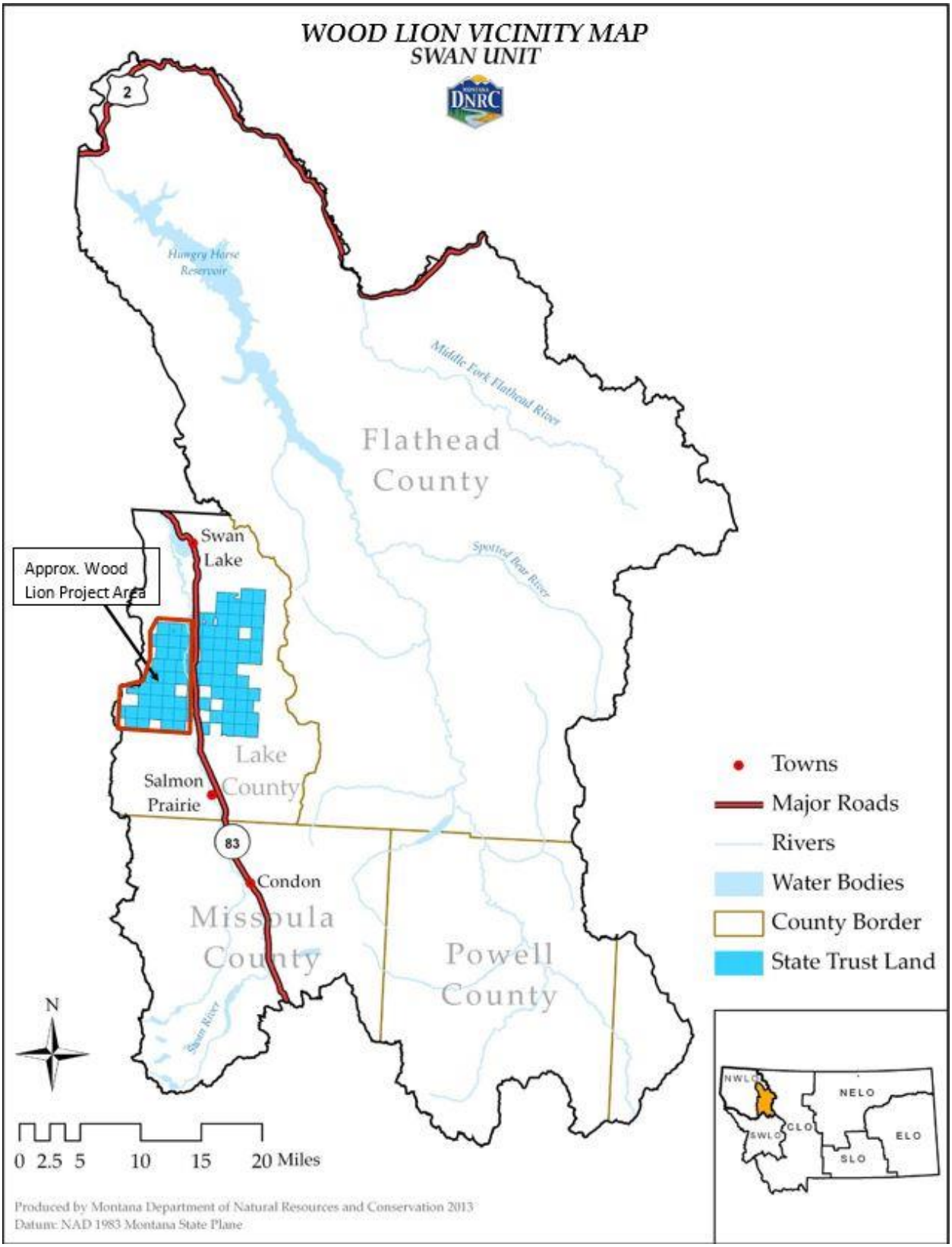
WOOD LION MULTIPLE TIMBER SALE PROJECT

SWAN RIVER STATE FOREST

Draft Environmental Impact Statement

July 2017

Department of Natural Resources and Conservation


WOOD LION VICINITY MAP
SWAN UNIT
DNRC
2
Hungry Horse Reservoir
Middle Fork Flathead River
Flathead County
Spotted Bear River
Swan Lake
Approx. Wood Lion Project Area
Lake County
Salmon Prairie
83
Condon
Missoula County
Powell County
Swan River
N
0 2.5 5 10 15 20 Miles
Towns
Major Roads
Rivers
Water Bodies
County Border
State Trust Land
NWLO
NELO
CLO
SWLO
ELO
SLO
Produced by Montana Department of Natural Resources and Conservation 2013
Datum: NAD 1983 Montana State Plane

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July 7, 2017

WOOD LION MULTIPLE TIMBER SALE PROJECT
DRAFT ENVIRONMENTAL IMPACT STATEMENT

Enclosed is a copy of the Wood Lion Multiple Timber Sale Project Draft Environmental Impact Statement (DEIS). I encourage you to carefully review the information presented in the DEIS and provide comments to Nick Aschenwald, Project Leader, Swan River State Forest, 34925 MT Highway 83, Swan Lake, Montana 59911. **Comments must be received by August 7, 2017**. Along with your comments, please be sure to include your name, address, telephone number, and the title of the DEIS for which you are providing comments.

The Department does not present a preferred alternative of the two action alternatives analyzed in the DEIS. The proposed harvest volumes range from 0 with No-Action Alternative A, 24.13 MMbf with Action Alternative B, and 23.42 MMbf with Action Alternative C.

This DEIS was designed to achieve the following objectives:

- Promote biodiversity by moving forest stands toward historic covertype conditions and species composition;
- Improve forest health and productivity by addressing insect and disease issues;
- Generate revenue to the Common School trust for funding K-12 public education and benefit local economies;
- Contribute sufficient volume towards DNRC's annual sustainable yield target of 56.9 Million Board Feet (MMbf) as required by state law (*77-5-221* through *223, MCA*) while incorporating and meeting important ecological commitments;
- Develop and improve the transportation system and infrastructure for long-term management, fire suppression, and public access;
- Improve water quality by removing and rehabilitating sediment-point sources, and meet *Best Management Practices* (BMPs) on all project roads, including haul routes to Highway 83; and
- Reduce fuel loads and wildfire hazards by decreasing ground and ladder fuel loads.
-

Chapter III-Existing Environment and Environmental Effects in the DEIS contains the bulk of the scientific analysis. I welcome your thoughts and comments.

Sincerely,

Greg Poncin
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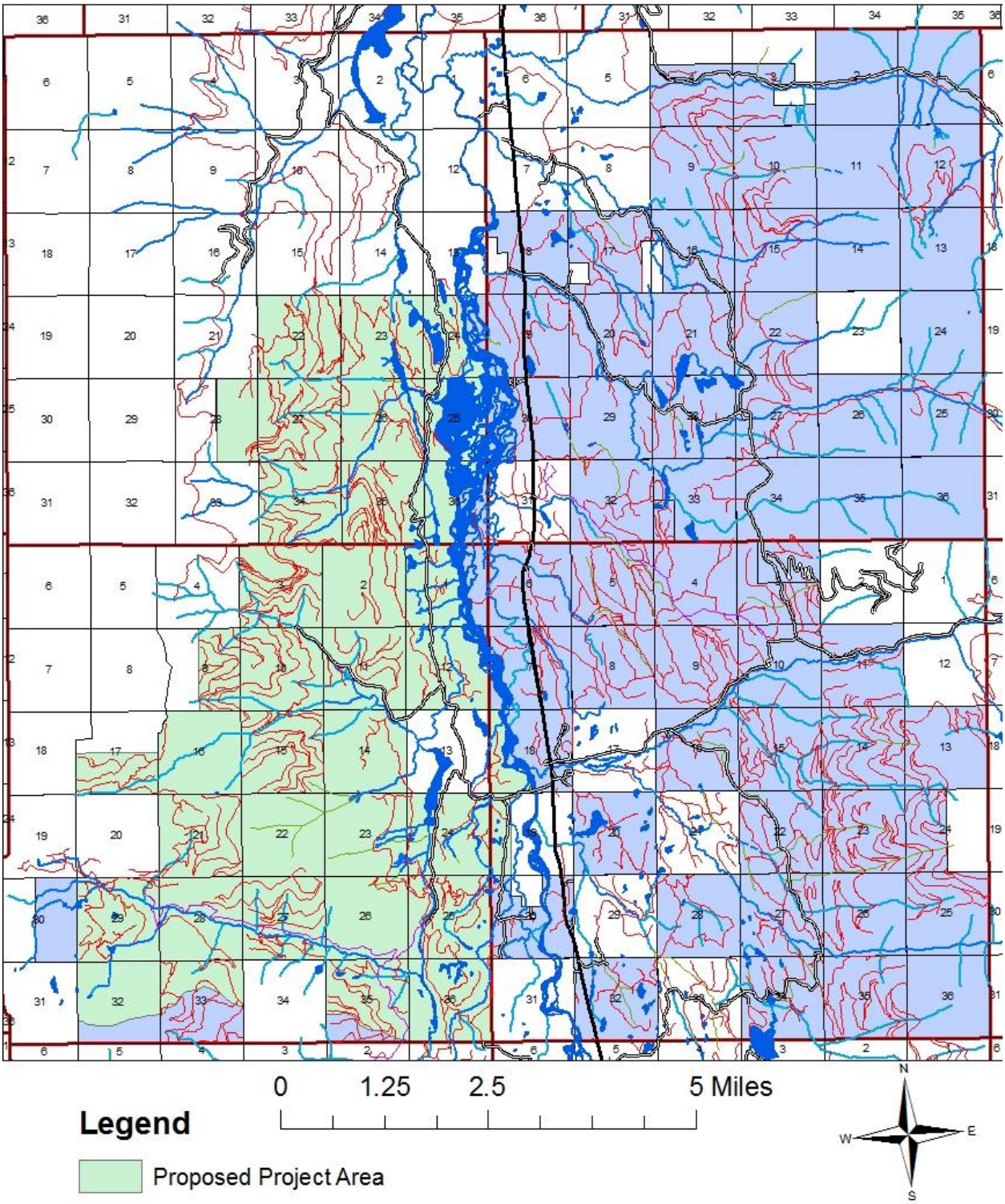
Wood Lion Proposed Project Area



Legend

Proposed Project Area

WOOD LION MULTIPLE TIMBER SALE PROJECT
DRAFT ENVIRONMENTAL IMPACT STATEMENT

PREFACE

This document has been designed and developed to provide the decisionmaker with sufficient information to make an informed, reasoned decision concerning the Wood Lion Multiple Timber Sale Project (proposed action) and to inform the interested public about this project so they may express their concerns to the project leader and decisionmaker.

The DEIS consists of the following sections:

- Chapter I – Purpose and Need
- Chapter II – Alternatives
- Chapter III – Existing Environment and Environmental Effects
- References
- Preparers and Contributors
- Scoping List and Respondents
- Stipulations and Specifications
- Glossary
- Acronyms and Abbreviations

CHAPTERS I and *II* offer a summary overview of the proposed action. These chapters have been written so nontechnical readers can easily understand the purpose and need of the proposed action, alternatives to the proposed action, and the potential environmental, economic, and social effects associated with the no-action and action alternatives.

CHAPTER I provides a brief description of the proposed action and explains key factors about the project, such as:

1) the purpose and need of the proposed action, which includes the project objectives;
2) the *Environmental Impact Statement* (*EIS*) process, which includes how scoping is done and the decisions made by the decisionmaker concerning this project;
3) the proposed schedule of activities;
4) the scope of this *Draft Environmental Impact Statement* (*DEIS*), which includes other relevant projects, issues studied in detail, and issues eliminated from further analysis, and
5) the relevant laws, regulations, and consultations with which DNRC must comply.

CHAPTER II provides detailed descriptions of the No-Action and the Action Alternatives. Included is a summary comparison of project activities associated with each alternative and a summary comparison of the predicted environmental effects of each alternative. These comparisons provide the decisionmaker a clear basis for choice between the No-Action and Action Alternatives.

CHAPTER III briefly describes the past and current conditions of the pertinent ecological and social resources in the project area that would be meaningfully affected, establishing a part of the baseline used for the comparison of the predicted effects of the alternatives. Chapter III also presents the detailed, analytic predictions of the potential direct, indirect, and cumulative effects associated with the No-Action and Action Alternatives.

REFERENCES lists the references utilized in the DEIS.

PREPARERS AND CONTRIBUTORS lists the preparers of the DEIS.

SCOPING LIST AND RESPONDENTS lists the persons, agencies, and organizations that are listed to receive scoping documents, newsletters, and public participation activities associated with the proposed action. This list also contains those individuals who submitted issues and concerns regarding the proposed action.

STIPULATIONS AND SPECIFICATIONS includes a list of measures designed to prevent or reduce the potential effects to the resources considered in this DEIS.

GLOSSARY defines the technical terms used throughout the document.

ACRONYMS AND ABBREVIATIONS lists the acronyms and abbreviations used throughout the document.

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CHAPTER I
PURPOSE AND NEED

LOCATION OF THE PROJECT

Swan River State Forest, Montana Department of Natural Resources and Conservation (DNRC), Trust Land Management Division, is proposing the Wood Lion Multiple Timber Sale Project. The project area is located approximately 7 air miles south of Swan Lake, Montana on Common School Trust Lands in the western portion of the Swan River State Forest. The project area is approximately 19,437 acres and includes all or portions of the following sections:

SECTIONS	TOWNSHIP	RANGE
22, 23, 24, 25, 26, 27, 28, 34, 35, and 36.	24N	18W
1, 2, 3, 9, 10, 11, 12, 14, 15, 16, 17, 21, 22, 23, 24, 25, 26, 27, 28, 29, 32, 33, 35, and 36.	23N	18W
18 and 19	23N	17W

The project area also includes existing and proposed roads needed to access the project area and support the proposed activities (refer to *VICINITY MAP* on back of front cover and *PROJECT AREA MAP* located in front of this document).

PURPOSE AND NEED

The project area has a variety of stands in differing stages of development. Some stands are young, vigorous, and healthy, while others are older with reduced vigor and multiple insect and disease issues. In many stands, the current forest cover type is moving away from, or no longer matches, DNRC's desired cover type for the site.

Forest-management activities would improve health, vigor, and development of desired future cover types, while also reducing the risk against losses from insects, diseases, and fire. Active forest management in the project area would produce revenue for the trust beneficiaries while encouraging the development of sustainable forest conditions consistent with programmatic goals of managing for healthy and biologically diverse forests.

The lands involved in the proposed action are held by the State of Montana for the support of the Common School Trust (*Enabling Act of February 22, 1889*). The *Board of Land Commissioners (Land Board)* and DNRC are required by law to administer these trust lands to produce the largest measure of reasonable and legitimate return over the long run for these beneficiary institutions (*1972 Montana Constitution, Article X, Section 11; Montana Code Annotated [MCA] 77-1-202*).

Management of the lands in the project area is guided by DNRC's *State Forest Land Management Plan* (*SFLMP*), *Forest Management Rules* (*Administrative Rules of Montana [ARM] 36.11.401* through *470*), and the *Montana DNRC Forested State Trust Lands Habitat Conservation Plan (HCP)*. The *SFLMP* has the following philosophy:

"Our premise is that the best way to produce long-term income for the trust is to manage intensively for healthy and biologically diverse forests. Our understanding is that a diverse forest is a stable forest that will produce the most reliable and highest long-term revenue stream. Healthy and biologically diverse forests would provide for sustained income from both timber and a variety of other uses. They would also help maintain stable trust income in the face of uncertainty regarding future resource values. In the foreseeable future, timber management will continue to be our primary tool for achieving biodiversity objectives." (DNRC 1996a: Record of Decision [ROD] 1 and 2)

PROJECT OBJECTIVES

DNRC has developed the following project objectives:

- Promote biodiversity by moving forest stands towards historic cover type conditions and species composition;
- Improve forest health and productivity by addressing insect and disease issues;
- Generate revenue to the Common School trust for funding K-12 public education and benefit local economies;
- Contribute sufficient volume towards DNRC's annual sustainable yield target of 56.9 Million Board Feet (MMbf) as required by state law (*77-5-221* through *223, MCA*) while incorporating and meeting important ecological commitments;
- Develop and improve the transportation system and infrastructure for long-term management, fire suppression, and public access;
- Improve water quality by removing and rehabilitating sediment-point sources, and meet *Best Management Practices* (BMPs) on all project roads, including haul routes to Highway 83; and
- Reduce fuel loads and wildfire hazards by decreasing ground and ladder fuel loads.

DNRC has developed 2 action alternatives designed to meet the proposed project objectives to varying degrees (see *CHAPTER II – ALTERNATIVES*).

DRAFT ENVIRONMENTAL IMPACT STATEMENT PROCESS

This section describes the process by which the *Interdisciplinary Team (ID Team)* developed this *DEIS*. The *DEIS* was developed in compliance with the *Montana Environmental Policy Act (MEPA)*; *MCA 75-1-101* through *75-1-324*, and DNRC *Procedural Rules (ARM 36.2.521* through *543*).

PUBLIC INVOLVEMENT

DNRC invited interested individuals, agencies, and organizations to identify issues and concerns associated with this proposed action. Public involvement activities included public scoping, field tours, and newsletters.

PUBLIC SCOPING

Public scoping occurs in the initial stages of the *EIS* process. Interested parties are informed that DNRC is proposing an action and invited to submit their comments related to the proposed action (*ARM 36.2.526*).

In February 2016, DNRC distributed the *Initial Proposal* and invited public comments. The initial proposal was also sent to the *Daily Inter Lake*, the *Flathead Beacon*, the *Missoulian*, the *Missoula Independent*, the *Bigfork Eagle*, and the Swan Valley's *Pathfinder* newspapers. The *Initial Proposal* was mailed to individuals, agencies, internal DNRC staff, industry representatives, and other organizations that had expressed interest in the Swan River State Forest management activities (see *SCOPING LIST AND RESPONDENTS*). The *Initial Proposal* included the objectives of the project, maps of the project area, and contact information. During the 30-day comment period, a total of 3 responses were received.

NEWSLETTERS

Newsletter 1

On July 13, 2016, the ID Team sent a newsletter to individuals/groups on the scoping list. The purpose of this newsletter was to:

- update the project development since the initial proposal scoping period;
- introduce the ID Team and decisionmaker to the public;
- summarize relevant issues identified up to that point;
- offer an opportunity at attend a public field tour; and
- allow further opportunities to comment on the project.

No comments were received.
Two parties were interested in attending a field tour.

Newsletter 2

On December 29, 2016, the ID Team sent a second newsletter out to individuals/groups on the scoping list to:

- update the project development since the first newsletter;
- summarize the proposed action alternatives;
- an update on the field tour, it will take place in the spring of 2017; and
- invite comments on the proposed action and alternatives.

No comments were received.

FIELD TOURS

Summer 2017

DNRC plans to host a field tour in July 2017. DNRC staff members and interested participants will visit stands in and adjacent to the proposed harvest units. Questions and concerns will be recorded.

DEVELOPMENT OF ISSUES AND ALTERNATIVES

ISSUES STUDIED IN DETAIL AND ISSUES ELIMINATED FROM FURTHER ANALYSIS

After reviewing the responses received during the scoping period and the other public participation events, the ID Team identified 92 issues related to the project (see *ISSUES STUDIED IN DETAIL AND ISSUES ELIMINATED FROM FURTHER ANALYSIS* under *SCOPE OF THIS DEIS* later in this chapter). These issues, issues raised by the ID Team, and requirements imposed by applicable rules, laws, and regulations provided the framework by

which the ID Team developed a range of alternatives. The ID Team designed the action alternatives to meet the project objectives to varying degrees and identified the direct, indirect, and cumulative impacts on relevant resources in the project area.

DRAFT ENVIRONMENTAL IMPACT STATEMENT

During winter of 2016, the ID Team prepared the *DEIS* for publication. A letter of notification was sent to individuals on the scoping list on July 7, 2017 (see *SCOPING LIST AND RESPONDENTS*), which initiated a 30-day comment period.

FINAL ENVIRONMENTAL IMPACT STATEMENT

After public comments are received, compiled, and addressed, DNRC will prepare a *Final Environmental Impact Statement* (*FEIS)* or adopt the *DEIS* as the *FEIS*. The *FEIS* would consist primarily of a revision of the *DEIS* that would incorporate new information based on public and internal comments. The *FEIS* would also include responses to substantive comments within the scope of the project that were received during the 30-day public review period of the *DEIS*.

NOTIFICATION OF DECISION

Following publication of the *FEIS*, the decisionmaker will review public comments, the *FEIS*, and information contained in the project file. No sooner than 15 days after the publication of the *FEIS*, the decisionmaker will consider and determine the following:

- Do the alternatives presented in the *FEIS* meet the project's purpose and objectives?
- Are the proposed mitigations adequate and feasible?
- Which alternative (or combination/modification of alternatives) should be implemented and why?

These determinations will be published and all interested parties will be notified. The decisions presented in the published document would become recommendations from DNRC to the *Montana Board of Land Commissioners* (Land Board). Ultimately, the Land Board will make the final decision to approve or not approve the project.

PROPOSED SCHEDULE OF ACTIVITIES

After the decision is published, and if an action alternative is selected, DNRC would prepare 6 to 9 sales from 0.5 to 6 MMbf each, approximately, over a 3 to 5 year operating period. The first timber sale contract package would tentatively be scheduled for presentation to the Land Board in the spring of 2018. If the Land Board approves the timber sale, the sale may be advertised that spring. The other contracts would subsequently be presented to the Land Board; upon approval, these sales would be advertised intermittently from the spring of 2018 through the winter of 2021. After each sale is sold, harvesting and roadwork activities would take place for 2 to 3 years. The anticipated end date of harvesting activities is March 2024. Post treatment activities, such as site preparation, planting, and hazard reduction, would follow harvesting activities.

SCOPE OF THIS DEIS

This section describes those factors that went into determining the scope (depth and breadth) of this environmental analysis.

RELEVANT PAST, PRESENT, AND REASONABLY FORESEEABLE ACTIONS

In order to adequately address the cumulative impacts of the proposed action on relevant resources, each analyst must account for the impacts of past, present, and reasonably foreseeable actions within a determined analysis area. The locations and sizes of the analysis areas vary by resource (watershed, soils, etc.) and species (bull trout, grizzly bear, etc.) and are further described by resource in *CHAPTER III – EXISTING ENVIRONMENT AND ENVIRONMENTAL IMPACTS*.

Past, present, and reasonably foreseeable actions on DNRC managed lands and adjacent land ownerships were considered for each analysis conducted for this *EIS*. DNRC often lacked data regarding actions on adjacent land ownerships; therefore, resource specialists were limited to qualitatively describing and considering, rather than quantifying, such actions for cumulative impacts.

The following list encompasses other relevant DNRC actions considered in this *DEIS*:

- Cilly Cliffs Timber Sale Project (Summer 2015 through Winter 2018)
  - 2,131 acres
  - Sections 1, 2, 3, 4, 9, 10, 11, 12, 13, 14, 15, 16, 17, 22, 27, 33, and 34 T24N, R17W and Section 3 T23N, R17W.
  - 22.6 MMbf
- Scout Lake Timber Sale Project (Summer 2012 through Fall 2016)
  - 2,009 acres
  - Sections 16, 18, 19, 20, 21, 27, 28, 29, 32, 33, 34, T23N, R17W; Sections 6, 8, 16, 18, 20, 22, 26, 28, 30, 34, T23N, R17W; and Section 36, T23N, R18W
  - 19.0 MMbf
- Three Creeks Timber Sale Project (Summer 2007 through Winter 2011)
  - 1,884 acres
  - Sections 1, 3, 4, 9, 10, 15, 16, 22, 25, and 27, T24N, R17W
  - 23.7 MMbf
- Winter Blowdown Salvage Timber Permit Project (Summer 2008)
  - 240 acres
  - Sections 16, 20, 30, 32, and 34, T23N, R17W
  - 200 thousand board feet (Mbf)
- Section 28 Salvage Permit (Summer 2009)
  - 80 acres
  - Section 28, T23N, R18W
  - 100 Mbf
- Woodward Pointed Face Precommercial Thinning Project (Summer/Fall 2010 through Summer 2011)

- 176 acres
- Sections 2 and 12, T23N, R18W and Section 34, T24N, R18W

- Luckow Lodgepole and Lodgepole 2 612s (Fall 2010 & Summer 2011)
  - 100 acres
  - Sections 18 and 32, T23N, R17W
  - 178 Mbf
- Shay and Shay 2 Post and Pole (Spring 2010 & Spring/Summer 2011)
  - 35 acres
  - Section 30, T23N, R17W
  - 3,959 lineal feet
- White Pine Pruning and Precommercial Thinning Projects (Summer 2011)
  - 225 acres pruned & 52 acres thinned
  - Sections 2, 12, and 14, T23N, R18W
  - Sections 19, 27, 29, and 30, T24N, R17W
  - Sections 23, 24, 26, 34, and 36, T24N, R18W
- Lost Creek Salvage (Summer/Fall 2012)
  - 25 acres
  - Section 1 T24N R7W
- White Porcupine Timber Sale Project (Summer 2009 through Fall 2014)
  - 1,492 acres
  - Sections 2, 16, 22, 23, 24, 26 T23N, R18W; Sections 22, 23, 26, 28, 34, T24N, R18W
  - 19.8 MMbf
- Westside Blowdown Salvage – (Summer 2012 through Spring 2014)
  - 1,000 acres
  - Sections 2, 10, 16, 26 T23N, R18W; Sections 22, 23 26, 28, 34, T24N, R18W
  - 2.0 MMbf
- Perry Squeezer 612 Permit – (Summer/Fall of 2014)
  - 30 acres
  - Section 16, T23N, R17W
  - 100 MBF
- Soup to Simmons PCT – (Summer/Fall of 2014)
  - 120 acres (estimated)
  - Section 18, T24N, R17W; Sections 8, 18, and 32, T23N, R17W; and Section 25, T23N, R18W
- Cilly Ridge Salvage – (Winter 2017)
  - 12 acres (estimated)
  - Section 15, T24N, R17W
- Soup Salvage – (Summer/Fall of 2014)
  - 14 acres (estimated)
  - Section 16, T24N, R17W
- Fatty Restoration – (Summer/Fall of 2014)

- 200 acres (estimated)
- Section 35, T23N, R118W;

- West side fir engraver salvage – (Summer/Fall of 2014)
  - 118 acres (estimated)
  - Section 2, T23N, R18W; Section 12, T23N, R18W; and Section 34, T24N, R18W
- Scout lake fire salvage – (Summer/Fall of 2014)
  - 55 acres (estimated)
  - Sections 6, 8, T23N, R18W

ISSUES STUDIED IN DETAIL AND ISSUES ELIMINATED FROM FURTHER ANALYSIS

Issues are statements of concern about the potential impacts the project may have on various resources. The ID Team identified 92 issues raised internally and by the public. Some issues were determined to be relevant and within the scope of the project. These were included in the impacts analyses and used to assist the ID Team in developing a reasonable range of alternatives (*TABLE I - 1 – ISSUES STUDIED IN DETAIL*). Issues that were eliminated from further analysis were those that were determined to not be relevant to the development of alternatives or were beyond the scope of the project, and were, therefore, not carried through the impacts analyses (*TABLE I - 2 – ISSUES ELIMINATED FROM FURTHER ANALYSIS*).

TABLE I-1 – ISSUES STUDIED IN DETAIL. *Issues studied in detail by resource area and where addressed in the DEIS.*

ISSUES STUDIED IN DETAIL	WHERE ADDRESSED IN DEIS
VEGETATION	
The proposed activities may affect forest cover types through species removal or changes in species composition.	Chapter III, Pages 5-10
The proposed activities may affect age classes through tree removal.	Chapter III, Pages 11-14
The proposed activities may affect forest old-growth amounts and quality through tree removal.	Chapter III, Pages 14-26
The proposed activities may affect patch size and shape through tree removal.	Chapter III, Pages 26-33
The proposed activities may affect forest fragmentation through tree removal.	Chapter III, Pages 33-35
The proposed activities may affect forest stand vigor through tree removal.	Chapter III, Pages 35-37
The proposed activities may affect forest stand structure through tree removal.	Chapter III, Pages 38-40
The proposed activities may affect forest crown cover through tree removal.	Chapter III, Pages 40-42
The proposed activities may affect forest insect and disease levels through tree removal (both suppressed/stressed and infested/infected).	Chapter III, Pages 42-51

The proposed activities may affect forest fire conditions, levels, and hazards through tree removal, increased public access, and/or fuel reduction.	Chapter III, Pages 51-56
The proposed activities may affect sensitive plant populations through ground disturbance.	Chapter III, Pages 56-57
The proposed activities may affect noxious weeds through ground disturbance.	Chapter III, Pages 57-58
GEOLOGY AND SOILS	
The proposed activities have the potential to compact and displace surface soils which reduces hydrologic function, macro-porosity, and soil function.	Chapter III, Pages 60-80
The proposed activities have the potential to increase erosion of productive surface soils off-site.	Chapter III, Pages 60-80
The proposed activities may cumulatively affect long term soil productivity.	Chapter III, Pages 60-80
The proposed activities have the potential to increase slope instability through increased water yields, road surface drainage concentration, and exceedance of resisting forces.	Chapter III, Pages 60-80
The proposed activities may remove large volumes of both coarse and fine woody material through timber harvest and may reduce the amount of organic matter and nutrients available for nutrient cycling possibly affecting the long-term productivity of the site.	Chapter III, Pages 60-80
WATERSHED AND HYDROLOGY	
The proposed activities may increase sediment delivery into streams/lakes and affect water quality.	Chapter III, Pages 82-102
The proposed activities have the potential to increase water yield, which in turn, may affect erosive power, in-stream sediment production, and stream-channel stability.	Chapter III, Pages 102-107
The proposed activities may adversely affect water quality by reducing shade and increasing stream temperature.	Chapter III, Pages 81-107
FISHERIES	
The proposed activities may affect fish populations' presence and genetics.	Chapter III, Pages 108-166
The proposed activities may affect fish habitat by modifying flow regime.	Chapter III, Pages 108-166
The proposed activities may affect fish habitat by modifying sediments.	Chapter III, Pages 108-166
The proposed activities may affect fish habitat by modifying channel forms.	Chapter III, Pages 108-166

The proposed activities may affect fish habitat by modifying riparian function.	Chapter III, Pages 108-166
The proposed activities may affect fish habitat by modifying amounts of large woody debris.	Chapter III, Pages 108-166
The proposed activities may affect fish habitat by modifying stream temperature.	Chapter III, Pages 108-166
The proposed activities may affect fish habitat by modifying stream nutrients.	Chapter III, Pages 108-166
The proposed activities may affect fish habitat by modifying stream connectivity.	Chapter III, Pages 108-166
WILDLIFE	
The proposed activities could result in changes in the distribution of different cover types on the landscape which could affect wildlife.	Chapter III, Pages 175-179
The proposed activities could alter the representation of stand age classes on the landscape which could affect wildlife.	Chapter III, Pages 179-181
The proposed activities could affect wildlife species associated with old-growth forests by reducing the acreage of available habitat and increasing fragmentation.	Chapter III, Pages 171-175
The proposed activities could result in disturbance or alteration of forested corridors and connectivity, which could inhibit wildlife movements.	Chapter III, Pages 181-188
The proposed activities could reduce forested cover which could adversely affect habitat linkage for wildlife.	Chapter III, Pages 189-195
The proposed activities could reduce bald eagle nesting and perching habitats and/ or disturb nesting bald eagles.	Chapter III, Page 193
The proposed activities could reduce the number and distribution of snags, which are an important component of wildlife habitat.	Chapter III, Pages 167-230
The proposed activities could reduce levels of coarse woody debris, which is an important component of wildlife habitat.	Chapter III, Pages 167-230
The proposed activities could reduce landscape connectivity and the availability of suitable Canada lynx habitat, reducing the capacity of the area to support Canada lynx.	Chapter III, Pages 196-200
The proposed activities could result in disturbance of wolves at denning or rendezvous sites, which could	Chapter III, Page 194

lead to pup abandonment and/or increased risk of mortality.	
The proposed activities could remove forest cover on important winter ranges, which could lower their capacity to support white-tailed deer and elk.	Chapter III, Pages 221-229
The proposed activities could result in increased human disturbance and potential for wolf-human conflicts that could alter wolf use of suitable habitats.	Chapter III, Page 194
The proposed activities could result in reduction of hiding cover important for grizzly bears, which could result in: 1) increased displacement of grizzly bears, 2) avoidance of otherwise suitable habitat, and or 3) increased risk of bear-human conflicts.	Chapter III, Pages 201-212
The proposed activities could result in an increase in density of roads, which could cause increased displacement of grizzly bears and increased risk of bear-human conflicts.	Chapter III, Pages 201-212
The proposed activities could result in a decrease in secure areas for grizzly bears, which could cause increased displacement of grizzly bears and increased risk of bear-human conflicts.	Chapter III, Pages 201-202
The proposed activities could reduce the availability and connectivity of suitable fisher habitat and increase human access, which could reduce habitat suitability and increase trapping mortality.	Chapter III, Pages 212-217
The proposed activities could alter the structure of flammulated owl preferred habitat, which could reduce habitat suitability for flammulated owls.	Chapter III, Page 194
The proposed activities could result in increased human disturbance that could alter wolverine use of suitable habitat, and may result in increased trapping mortality.	Chapter III, Page 195
The proposed activities could reduce tree density and alter the structure of mature forest stands, which could reduce habitat suitability for pileated woodpeckers.	Chapter III, Pages 217-221
The proposed activities could remove elk security cover, which could affect hunter opportunity and the quality of recreational hunting in the local area.	Chapter III, Pages 221-229
ECONOMICS	
The proposed activities may have economic impacts associated with generating revenue for the trust beneficiaries.	Chapter III, Pages 231-241

The proposed activities may have economic impacts associated with creating timber-related employment and stimulating the local economy.	Chapter III, Pages 231-241
The proposed activities may have economic impacts associated with non-market issues within the area.	Chapter III, Pages 231-241
AIR QUALITY	
The proposed activities may adversely affect local air quality through dust produced from harvest activities, road building and maintenance, and hauling.	Chapter III, Pages 242-246
The proposed activities may adversely affect local air quality through smoke produced from logging slash pile and prescribed burning.	Chapter III, Pages 242-246
RECREATION	
The proposed activities may affect public motorized use, non-motorized uses, and hunting.	Chapter III, Pages 247-254
The proposed activities may affect the revenue generated by recreational uses.	Chapter III, Pages 247-254
AESTHETICS	
The proposed activities may adversely affect local viewsheds and scenic vistas.	Chapter III, Pages 255-267
The proposed activities may increase local noise levels.	Chapter III, Pages 255-267
CULTURAL RESOURCES	
The proposed activities may affect local cultural resources.	Stipulations and Specifications pages 7

TABLE I-2 – ISSUES ELIMINATED FROM FURTHER ANALYSIS. *Issues eliminated from further analysis and accompanying rationale.*

ISSUES ELIMINATED FROM FURTHER ANALYSIS	RATIONALE
Why is this project area so large? How is logging such a large area in one project sustainable?	The initial proposal stated the project area covers approximately 19,540 acres. That has been reduced to 19,437 acres after further review of the original project area. One reason the project area is so large is because it encompasses the area within the Porcupine Woodward subunit in the (*Swan Valley Grizzly Bear Conservation Agreement* (SVGBCA), which is the active subunit from 2018 to 2020. Another reason for the large project area is because the project would involve multiple timber sales that would be sold and harvested over several years, and hence needs a larger project area to meet the objectives of this project. DNRC is only proposing harvesting on a portion of the project area. The proposed harvest is based on the Swan River State

	Forest's contribution towards DNRC's annual sustained yield of 56.9 MMBF, which was last calculated in 2015. When calculating the annual sustainable yield, all of DNRC's resource commitments as well as the growth and yield potential for forested parcels are considered to ensure that the amount harvested on an annual basis from forested state trust lands can be done so on a sustainable basis.
What has monitoring from Three Creeks and Scout Lake told you about your logging practices and how does that compare to assumptions made in those projects?	The monitoring generally used for past projects includes biodiversity field reviews, internal HCP audits, internal BMP audits, and statewide third-party BMP audits every two years. This monitoring is ongoing on these projects and that information will be adaptively used in future project design and implementation. Biodiversity field reviews have indicated that DNRC has been complying with measures in both the Montana Administrative Rules for Forest Management (Forest Management Rules) and the HCP. Statewide BMP audits published in 2012 showed that BMP application and effectiveness on DNRC sites was 99 percent. Four internal BMP audits of the Three Creeks and White Porcupine timber sale projects showed that BMP application and effectiveness was 97 percent. The Three Creeks project utilized regeneration harvest treatments on approximately 1,331 acres. To date, 942 acres have been planted. Survival surveys indicate that the average survival of the planted trees is greater than 80 percent. Additionally, natural regeneration is establishing throughout the Three Creeks project area.
How will climate change affect the growth and yield of these forests and how is DNRC planning to mitigate these effects?	Evidence of widespread climate change has been well-documented and reported (*Intergovernmental Panel on Climate Change 2013*). Over time, changes in tree species, their geographic distribution, and a decline in health and productivity may be expected within Montana forests (*EPA 1997*). Given possible changes in the amounts and types of trees and other plants observed in forests, unique vegetation community associations and new climax community types may also begin to appear in the future (*Fox 2007*). Understanding changes in tree species composition in forests, and the ability of various tree species to thrive under changing climate conditions, may take decades. Predicting possible effects of climate change in forests at local levels is also difficult due to large-scale variables at play, such as possible increases in global evaporation rates, and possible changes in global ocean currents and jet stream. Such outcomes could influence locally-

	observed precipitation amounts and possible influences on natural disturbance regimes (such as changing the average intensity, frequency and scale of fire events). Normal year to year variation in weather also confounds the ability to identify, understand, predict, and respond to influences of climate change. Given the many variables and difficulty in understanding the ramifications of changing climate, detailed assessment of possible direct, indirect, or cumulative effects of climate change in association with project activities described in this EIS is beyond the scope of this analysis. In the face of current uncertainty associated with climate change, DNRC is continuing to manage for biodiversity as guided under the SFLMP. Under the management philosophy of the SFLMP, DNRC will continue to manage for biodiversity using a coarse-filter approach that favors an appropriate mix of stand structures and compositions on state lands as described by *ARM 36.11.404*, while also working to understand relevant ecosystem changes as research findings and changes in climate evolve.
No new roads should be built. Road building associated with this project will increase the already too large road network on Swan River State Forest.	When planning transportation systems, DNRC is instructed to plan for the minimum number of road miles (*ARM 36.11.421[1]*). DNRC occasionally needs to construct additional roads in order to access timber stands for management. Obliterating all historical roads on the landscape would be cost-prohibitive. A historical road that is causing resource damage is prioritized for corrective actions to lessen or eliminate its negative impacts. The action alternatives in this *DEIS* contain different projected road amounts by alternative (see *DESCRIPTION OF ALTERNATIVES* in *CHAPTER II – ALTERNATIVES*). Both action alternatives attempt to minimize the miles of proposed road construction needed to meet project goals.
DNRC should identify all lands unsuitable for timber production from the timber base as they are identified.	This issue is more programmatic in nature and is beyond the scope of the project. DNRC does identify lands unsuitable for timber production and those areas are noted in its stand level inventory. Additionally, such lands are not included in and do not contribute to DNRC's annual sustainable yield. DNRC's annual sustainable yield is based only on commercial forest acres, which are those acres comprised of conifer species and having site productivity greater than 20 cubic feet per acre per year. Furthermore, although some sites may be viable for commercial timber management from a site productivity

	standpoint, other factors such as topography, wet areas, or lack of legal access, among others, preclude timber management. DNRC identifies such areas as 'deferred' from management, and those areas are not included in the sustainable yield calculation (SYC). The most recent SYC accounted for those factors. The analysis within an EIS is required to analyze the impacts on the human environment associated with the alternatives being considered; in this case, the no-action and action alternatives. An analysis of the economic suitability of various DNRC managed lands for various types of management would not provide a necessary and adequate assessment for meeting requirements of *MEPA* for the type of project that is being proposed. Foresters have also considered the whole project area, with scrutiny applied to the economics of harvesting and reforestation. The proposed action alternatives utilize conventional, cost-effective ground-based and skyline harvesting systems. The proposed reforestation activities are also common practice and are economically feasible on the areas proposed for harvesting.
What is the growth and yield of trees in the large clearcuts from Three Creeks and Scout Lake? The EIS should disclose the rate of growth from past cutting units and the number of times past logging units have been replanted.	Rather than regularly collect data on growth rates from previously harvested stands, DNRC utilizes the abundant ongoing research of forest growth and yield for similar forest types, as well as regional forest growth and yield models widely available in the region. Additionally, growth rates of current or previously harvested stands outside of the project area were not a primary consideration in developing objectives or selecting stands for treatment in the proposed project. DNRC uses planting when a natural seed source does not exist or when natural regeneration does not achieve adequate stocking levels following harvesting. The use of regeneration surveys required by *ARM 36.11.420*, in harvested stands ensure that DNRC monitors the effectiveness of silvicultural treatments and also identifies areas where planting may be needed. Because this project has no treatments proposed for recently planted stands in the project area, this request falls beyond the scope of the project and requires no further analysis. For more information on our programmatic planting accomplishments please see the *2011 Montana DNRC State Forest Land Management Plan, Implementation Monitoring Report* at the Swan River State Forest headquarters office.

Disclose the basis for the growth and yield calculation on Swan River State Forest.	This request is beyond the scope of this project and pertains to the sustainable yield calculation, which is a complex statewide project. DNRC's most recent SYC was completed by an independent consulting firm, Mason, Bruce, & Girard, in 2015. The SYC process included collecting and summarizing forest inventory data which was used to determine both the current forest conditions and the expected growth and yield associated with the range of management actions used by DNRC. The resulting growth and yield information was used in an optimization model that applied DNRC's management constraints to determine the annual sustainable yield. The forest inventory data used in the 2015 SYC was collected from state trust lands, including the Swan River State Forest, in 2014. Data does not exist to directly compare past project yield to current project yield. Measuring forest yield or growth takes decades if it is to be done for an individual site and is intended to compare a past project to the results of the next project. Tracking forest growth and yield is done by large-scale forest inventories. DNRC uses several sources, including periodic re-inventory of its lands, growth and yield modeling, and growth and volume estimates provided by the *USFS* and *Forest Inventory and Analysis* group to monitor changes in forest conditions and potential yield over time. The information provided by these inventories provides a means by which to observe forest-wide changes in yield over time. Many factors can increase yield rates, including replacing older, slower-growing stands with younger, faster-growing stands; planting harvest units with superior seed stock; and thinning younger stands for the purpose of reducing resource competition and increasing the growth rate for residual trees. For more information, the *2015 SYC Final Report* is available for download online at: *http://dnrc.mt.gov/divisions/trust/forest-management/sustainable-yield-calculation/announcements-and-stay-informed*
What data is collected and methodology used to figure the next sustained yield calculation?	This issue is programmatic in nature and beyond the scope of the proposed action. DNRC's most recent SYC was completed in 2015. A comprehensive description of the data and methods used in the SYC are available in the *2015 SYC Final Report* that can be downloaded online at: *http://dnrc.mt.gov/divisions/trust/forest-management/sustainable-yield-calculation/announcements-and-stay-informed*
Montana Environmental Policy Act (*MEPA*) alternatives must	As state trust land managers, DNRC is charged with the responsibility of generating the largest measure of reasonable

fully examine other viable economic options.	and legitimate revenue to the trust beneficiaries while protecting the revenue-generating capacity of state trust lands for future generations (*1972 Montana Constitution, Article X, Section 11; Montana Code Annotated [MCA] 77-1-202*). According to the SFLMP, DNRC has determined that the best way to produce long-term income for the trust beneficiaries from forested state trust lands is to manage those lands intensively for healthy and biologically diverse forests through the use of timber management activities. However, the SFLMP also states that DNRC would "pursue other income opportunities as guided by changing markets for new and traditional uses. These uses may replace timber production when their revenue exceeds long-term timber production revenue potential" (*DNRC 1996*). It is in the best interest of the trust beneficiaries for DNRC to consider other profitable revenue generating opportunities where appropriate, and DNRC has a long history of exploring and implementing a diversity of revenue generating uses and project types. At this time, DNRC has determined that forest management continues to be the best use of these project area lands in producing revenue over the long-term for the trust beneficiaries.
A short-term cash flow analysis is not adequate if DNRC must conduct another timber sale to clean up damage from past sales.	Cash flow analyses for timber sales and other trust land projects use a nominal interest rate of 5.4 percent which promotes a more long-term valuation of future cash flows as compared to private enterprise. Long-term project remediation costs are not commonly modeled, because they are not expected to occur. Appropriate development and maintenance improvements are contracted into DNRC timber sales at the time of sale, ensuring that any stand-alone timber sale project remain a value adding project for the trust beneficiaries.
DNRC must track the costs expended to plan and implement this timber sale.	Itemized cost accounting involves many unknown variables and is conducted at the programmatic level, rather than on a project-by-project basis. In this *DEIS* (see *ECONOMICS ANALYSIS* in *CHAPTER III – EXISTING ENVIRONMENT AND ENVIRONMENTAL IMPACTS*), project costs are estimated based on the most recent annual programmatic revenue to cost ratios. A more detailed review of programmatic costs is available in the *Trust Land Management Division Fiscal Year 2013 Return on Assets Report* and *DNRC FY 2012 Annual Report.*
Increase the utilization of biomass within the project area. Provide incentives and change policy to promote	Biomass utilization is an effort and issue beyond the scale or scope of analysis of any single timber sale project. Projects are designed to maximize utilization for existing markets and do not preclude utilization of biomass. Incentives to change policy

biomass utilization and infrastructure investment for this effort.	to promote biomass utilization are better analyzed and reviewed at the DNRC programmatic level, and Montana forest products industry scale.
DNRC should put existing old-growth stands on longer rotations so that old-growth is connected, existing old-growth must be put on longer rotation so that it is retained, other stands should be put on longer rotations so that they develop into old-growth and replace existing old-growth, and this project should designate an old-growth network to ensure it is maintained over the long term.	DNRC management decisions regarding old-growth at the project level follow *ARM 36.11.418(a)* and *(c).* When considering old-growth management at the project level, careful attention is given to many variables, including (but not limited to): cover types, stand locations, patch sizes, habitat connectivity, insect/disease risk, etc. This approach has allowed DNRC to evaluate conservation biology principles and tradeoffs at the landscape scale and have improved flexibility to address stand changes and economic losses brought about by natural-disturbance agents, such as insects, diseases, and wildfire. *DNRC* must also consider the requirements of *MCA 77-5-116*, which is a law that prohibits DNRC from establishing old-growth deferrals and set-asides without compensation to trust beneficiaries. For each timber sale project on Swan River State Forest, stand maps are produced to help evaluate management priorities and trade-offs necessary for informed decisionmaking. Old-growth stands receiving uneven-aged harvesting will be managed under a relatively long rotation with DNRC's current approach. Environmental impacts on old-growth are described in *OLD-GROWTH* under *VEGETATION ANALYSIS in CHAPTER III – EXISTING ENVIRONMENT AND ENVIRONMENTAL IMPACTS*. The estimated amounts of old-growth prior to this project and the amount of old-growth after this project (by alternative) are also disclosed.
DNRC must use the *Green et. al.* old-growth definition in its entirety instead of only the minimum number of large trees. Manipulating old-growth using the assumption that it will still be old-growth after logging is untested and not supported by science.	DNRC defines old-growth as a forest stand that meets or exceeds the minimum number, size, and age of those large trees as noted in "*Old-Growth Forest Types of the Northern Region," by Green et al.* (1992) [*ARM 36.11.403(49)*]. DNRC also uses the minimum criteria for stand basal area for each old-growth type described by Green *et al*. (1992, errata corrected 02/05, 12/07, 10/08, 12/11) as additional criteria for identifying potential old-growth stands. Descriptions within the various resource analyses presented in this document of old-growth forests on state trust lands are consistent with this definition. *Green et al*. (1992) state in their report that "old-growth is not necessarily 'virgin' or 'primeval'. Old-growth could develop following human disturbances." Additionally, there is a growing body of scientific literature addressing the use of silvicultural harvest treatments to retain and promote the

	development of old-growth forest attributes (*Larson et al. 2012, Bauhus et al. 2009, Raymond et al. 2009, Twedt and Somershoe 2009, Brewer et al. 2008, Fiedler et al. 2007, Keeton 2006, Beese et al. 2003, Latham and Tappeiner 2002, Fiedler 2000*). DNRC's management reflects and incorporates that research. *ARM 36.11.418* describes the types of silvicultural cutting treatments that may be used in old-growth stands on state trust lands. Two of those treatment types, old-growth maintenance and old-growth restoration, require that after harvesting the stand meets the minimum criteria presented by *Green et al.* (1992) to be defined as old-growth. When implementing such treatments, DNRC works to maintain to the extent practicable other attributes associated with old-growth forests, including multi-storied canopy structures, presence of snags and coarse woody debris. DNRC acknowledges that when treatments in old-growth stands occur, habitat attributes are altered and habitat quality for some associated species of wildlife may be reduced (*Jobes et al. 2004*). As such, because a logged old-growth stand may meet the *Green et al.* definition after treatment, does not indicate that it will provide high quality habitat for all old-growth associated species. Such stands following logging, however, will possess a definable threshold of very large, old trees that would otherwise take centuries to develop, and which provide important raw materials for other attributes found in most old-growth stands for years into the future (eg. large snags, large downed logs etc.).
DNRC's use of twenty-five foot stream buffers is not adequate to protect streams from increases in sediment and temperature nor do they provide for habitat complexity.	Any riparian timber harvesting conducted on state trust lands adjacent to fish-bearing streams must implement the *Streamside Management Zone Law* (*SMZ*) and *Rules* and *Forest Management Rules* that apply to *Riparian Management Zones* (*RMZ*), which include buffers with a minimum width of 50 feet.
What monitoring will be done for wildlife, fish, old-growth dependent wildlife, and sensitive plants and what monitoring has been done to determine if proposed treatments have the desired result?	Monitoring related to fisheries resources that has been performed in the project area includes: bull trout redd counts, McNeil core, substrate score, Wolman pebble count, fish presence/absence in unsurveyed streams, fish population estimates, snorkel surveys, bull trout and westslope cutthroat trout genetics, habitat inventories (feature location, area, volume and frequency), stream temperature, stream shading, woody debris frequency, macroinvertebrate richness, water chemistry, peak seasonal flow, total suspended sediment, riparian site potential tree height, riparian stand characteristics,

	and riparian tree planting survival. Monitoring results that are relevant or applicable to the assessment of fisheries resources potentially affected by the proposed actions can be found in the *FISHERIES RESOURCES ANALYSIS* section.
Ensure that biological diversity is maintained.	Under the *SFLMP* philosophy, DNRC believes that making efforts to emulate natural disturbance patterns, processes, and cover type distributions is a reasonable and responsible way to help ensure that ecosystem processes and endemic species that evolved with them are maintained. The *SFLMP* also encourages managers to explore new findings and adapt management accordingly.
When will DNRC develop conservation strategies for sensitive old-growth species?	DNRC currently addresses habitat for these species under the fine-filter approach and has *Forest Management Rules (ARMs 36.11.427* through *36.11.442)* that address various endangered, threatened, and sensitive species, such as, wolves, grizzly bears, and bald eagles.
Previous EISs have disclosed that prior logging projects have a negative impact on wildlife. DNRC must mitigate for these previous negative impacts.	DNRC mitigated for adverse effects to wildlife on previous timber sales according to the SVGBCA and *Forest Management Rules*. These mitigations are described in the *WILDLIFE ANALYSIS* within each FEIS.
DNRC needs to quantify what current habitat availability, local population monitoring, and the current status of species numbers indicate about current population health in this landscape.	DNRC attempts to promote biodiversity by taking a 'coarse-filter approach', which favors an appropriate mix of stand structures and compositions on state trust lands (*ARM 36.11.404*). Appropriate stand structures are based on ecological characteristics (e.g., landtype, habitat type, disturbance regime, unique characteristics). A coarse-filter approach assumes that if landscape patterns and processes are maintained similar to those with which the species evolved, the full complement of species would persist and biodiversity would be maintained. This coarse-filter approach supports diverse wildlife populations by managing for a variety of forest structures and compositions that approximate historic conditions across the landscape (*Lozensky 1997*). DNRC cannot assure that the coarse-filter approach will adequately address the full range of biodiversity; therefore, DNRC also employs a 'fine-filter' approach for threatened, endangered, and sensitive species (*ARM 36.11.406*). The fine-filter approach focuses on a single species' habitat requirements and considers the status for each listed species that may be affected. For each species or habitat issue, existing conditions of wildlife habitats are described and compared to the anticipated effects of the

	proposed no-action alternative and each action alternative to determine the foreseeable effects to associated wildlife habitats. If suitable habitat conditions for a particular species exist within any defined DNRC project area, that species is considered as present, thus, local population monitoring is typically not conducted.
What fine-filter monitoring for wildlife has been done? What are the results?	DNRC participates in or is a cooperator in a multitude of research and monitoring projects. Grizzly bear research and monitoring projects that DNRC supports or conducts include the Northern Divide Grizzly Bear DNA project (2001-2004), Fish, Wildlife and Parks *Northern Continental Divide Ecosystem* (NCDE) grizzly bear trend monitoring, Swan Valley grizzly bear monitoring (2001-2004), implementation monitoring in the Swan Valley annually for the SVGBCA, and the Grizzly Bear Ranger program in the Swan Valley. Results from these efforts indicate that the population of bears in the NCDE was at approximately 765 bears in 2004, population trends are increasing at approximately 3 percent per year, road closure effectiveness in ranges from 90 to 97 percent, and camper food storage compliance is approximately 93 percent. Additional projects include: Montana Bald Eagle Working Group monitoring and nest location efforts, Swan River State Forest fisher buffer track surveys (conducted by Northwest Connections and DNRC, 2008-2009), snag and coarse-woody-debris monitoring pre-and post-harvest on DNRC timber sales, and Swan River State Forest avian surveys in old-growth stands. Results from bald eagle monitoring have produced bald eagle productivity and distribution information. Track surveys indicated that deer and red squirrels, which were the most common species detected, were consistently found in greater numbers in unlogged retention areas than in adjacent logged sites. Snag and coarse-woody-debris monitoring results indicate that DNRC is meeting or exceeding retention requirements. Results from avian surveys to date indicate that the common birds detected in old-growth stands are pine siskins, Swainson's thrushes, chipping sparrows, and western tanagers.
The process of road obliteration does not immediately halt soil erosion from roads.	DNRC is not proposing any road obliteration of existing roads as part of this project. Potential sediment delivery to streams is disclosed in the *WATERSHED AND HYDROLOGY ANALYSIS*.
Now that DNRC owns the former Plum Creek lands the	Former Plum Creek lands that are under DNRC ownership have been inventoried by DNRC and added to its stand level

cumulative impacts of that logging must be analyzed.	inventory. The data collected reflects the current condition of that land, and that data was used in the analysis for this project.
DNRC must evaluate impacts of blowdown on forest structure; the large wind event in the Whitetail Porcupine project is an example of such a wind event.	Large scale natural weather events are out of the control of the DNRC and do not directly apply to the scope of this project and, thus, was eliminated from further analysis.
How will this project restore Goat Creek so that it is fully supporting beneficial uses?	The proposed project area is not surrounding Goat Creek and as such, was eliminated from further analysis.
This project must reduce fragmentation and edge effects and increase patch size and core areas. Large and small openings should be allowed to be created through natural processes rather than clearcut logging.	DNRC is required to mimic natural disturbances when selecting silvicultural prescriptions (*ARM 36.11.408*). Management of blocked ownership must take into account forest types and structures historically present on the landscape (*ARM 36.11.407*). All projects proposed under this DEIS are to adhere to these management rules. Patch size and core areas are analyzed in the *CHAPTER III- VEGETATION ANALYSIS, and WILDLIFE ANALYSIS.*
The current ARMs are outdated and do not reflect the best available science for fisher.	This does not directly relate to the scope of the project and has been removed from further analysis.
DNRC needs to quantify what current habitat availability, local population monitoring, and current status of species indicate about population health and relevance to population impacts.	This information was previously addressed in the Wood Lion Table 1-2.
Does DNRC have any width criteria for wildlife corridors?	This information can be found in the CHAPTER III- WILDLIFE ANALYSIS.
DNRC should disclose whether there have been sightings, nests, or dens of sensitive species in the Project Area and what is being done to protect these attributes.	This data is considered sensitive information and is not released to the public.
Has DNRC defined how much deer and elk winter range needs to be maintained over time on this landscape to	This does not directly relate to the scope of the project and has been removed from further analysis.

maintain stable big game populations? What limitation are there on habitat removal?	
Temporary roads have enduring impacts on aquatic resources.	Potential sediment delivery to aquatic resources is disclosed in the *HYDROLOGY ANALYSIS*.
Roads take acres out of the timber growing base.	When calculating the annual sustainable yield, acres that are not suitable for timber management are considered 'deferred' and, thus, removed from solution in the calculation. These roads are considered part of these 'deferred' acres.

RELEVANT AGREEMENTS, LAWS, PLANS, PERMITS, LICENSES, AND OTHER REQUIREMENTS

Management activities on the lands in the proposed project area must comply with the following agreements, laws, plans, permits, licenses, and other requirements.

ENABLING ACT (1889) AND 1972 MONTANA CONSTITUTION

By the *Enabling Act* approved February 22, 1889, the United States Congress granted certain lands to the State of Montana for the support of common schools and other public institutions. These lands are held in trust for the specific trust beneficiaries to which they were assigned and ultimately for the people of the State of Montana (*1972 Montana Constitution Article X, Section 11*). The lands involved in the proposed project area are designated to generate revenue for the Common School Trust. The Land Board and DNRC are required by law to administer these lands to produce the largest measure of reasonable and legitimate return over the long run for this beneficiary institution *(MCA 77-1-202).*

STATE FOREST LAND MANAGEMENT PLAN

DNRC developed the *SFLMP* to "provide field personnel with consistent policy, direction, and guidance for the management of state forested lands" (*DNRC 1996b: Executive Summary*). The *SFLMP* provides the philosophical basis, technical rationale, and direction for DNRC's forest-management program. The *SFLMP* is premised on the philosophy that the best way to produce long-term income for the trust is to manage intensively for healthy and biologically diverse forests. In the foreseeable future, timber management will continue to be the primary tool for achieving biodiversity objectives on Swan River State Forest and other DNRC-managed forested trust lands.

DNRC FOREST MANAGEMENT RULES

DNRC's *Forest Management Rules* (*ARM 36.11.401* through *456*) are the specific legal resource management standards and measures under which DNRC implements the *SFLMP* and subsequently its forest-management program. The *Forest Management Rules* were adopted in March 2003 and provide the legal framework for DNRC project-level decisions and provide field personnel with consistent policy and direction for managing forested state lands including Swan River State Forest. Project design considerations and mitigations developed for this project comply with the *Forest Management Rules*.

MONTANA FORESTED STATE TRUST LANDS HABITAT CONSERVATION PLAN

In December 2011, the Land Board approved the *Record of Decision* for the Montana DNRC Forested State Trust Lands HCP. Approval of the *Record of Decision* was followed by the issuance of an Incidental Take Permit by the *U.S. Department of Interior, Fish and Wildlife Service* (USFWS). The HCP is a required component of an application for a Permit which may be issued by the USFWS to state agencies or private citizens in situations where otherwise lawful activities might result in the incidental take of federally-listed species. The HCP is the plan under which DNRC conducts forest-management activities on select forested state trust lands while implementing specific mitigation requirements for managing the habitats of grizzly bear, Canada lynx, and three fish species: bull trout, westslope cutthroat trout, and Columbia redband trout. For grizzly bears, DNRC continues to manage its lands in accordance with the *SVGBCA*. In the event that the *SVGBCA* is terminated, the DNRC would implement HCP conservation strategies for grizzly bears as a pre-planned changed circumstance under the HCP.

SUSTAINABLE YIELD CALCULATION

DNRC is required to recalculate the annual sustainable yield for forested trust lands at least every 10 years (*MCA 77-5-221* through *223*). DNRC defines the *Annual Sustainable Yield* as:

> *"the quantity of timber that can be harvested from forested state lands each year in accordance with all applicable state and federal laws, including but not limited to the laws pertaining to wildlife, recreation and maintenance of watersheds and in compliance with water quality standards that protect fisheries and aquatic life and that are adopted under the provisions of Title 75, Chapter 5, taking into account the ability of state forests to generate replacement tree growth (MCA 77-5-221)."*

Programmatic environmental commitments related to biodiversity, forest health, threatened and endangered species, riparian buffers, old-growth, and desired species mix and cover types are incorporated into the calculation of the annual sustainable yield. The current annual sustainable yield is 56.9 MMbf statewide and was calculated and adopted by the Land Board in 2015. The long-term annual average contribution of the Swan River State Forest to the statewide total is approximately 8.0 MMbf.

MONTANA ENVIRONMENTAL POLICY ACT AND DNRC ADMINISTRATIVE RULES FOR MEPA

DNRC's management activities on state school trust lands are subject to the planning and environmental assessment requirements of *MEPA* (*MCA 75-1-101* through *324*). *MEPA* and its implementing rules (*ARM 36.2.521* through *543*) provide a public process that assures Montana's citizens that a deliberate effort is made to identify impacts before the state government decides to permit or implement an activity that could have significant impacts on the environment.

MEPA requires *DNRC* and other state agencies to inform the public and other interested parties about proposed projects, the potential environmental impacts associated with proposed projects, and alternative actions that could achieve the proposed project objectives.

SWAN VALLEY GRIZZLY BEAR CONSERVATION AGREEMENT

The *SVGBCA* is a cooperative agreement between *DNRC*, *Flathead National Forest*, and *USFWS.* The SVGBCA contains agreed-upon mitigations that are designed to reduce impacts to grizzly bears in the Swan Valley while allowing the cooperating parties to manage timber. As a cooperator, *DNRC* must abide by the terms and mitigations contained in the *SVGBCA*.

The philosophy of the *SVGBCA* is to concentrate management activities of the cooperators into specific areas called 'subunits' on a rotating basis. This provides bears areas that are relatively free of management for extended periods. Cooperators may manage in any subunit during the denning period (November 16 through March 31), but management during the nondenning period is only allowed in a subunit that is 'open' according to the rotating schedule. Open periods are 3 years, followed by a rest period of 6 years. The rotation schedule influences where DNRC schedules its management activities on Swan River State Forest.

The project area is entirely within the Porcupine/Woodward Subunit. According to the *SVGBCA* schedule, management during the nondenning period would be allowed in the Porcupine/Woodward Subunit from 2018 through 2020.

DNRC would prepare 6 to 10 timber sales ranging from 0.5 to 6 MMbf across the subunit. Rather than analyze each sale individually, this EIS has been developed to assess the impacts of all the sales.

MEMORANDUM OF UNDERSTANDING AND CONSERVATION AGREEMENT FOR WESTSLOPE CUTTHROAT TROUT AND YELLOWSTONE CUTTHROAT TROUT IN MONTANA

DNRC is a signatory to this 2007 statewide cooperative agreement along with 17 other agencies and organizations. The cutthroat trout management goals of the agreement include the long-term persistence of each of the subspecies across their historical ranges, maintenance of the genetic integrity, and diversity of nonintrogressed populations. Diversity of life histories represented by remaining cutthroat trout populations and protection of the ecological, recreational, and economic values associated with each subspecies are also management goals of this agreement.

RESTORATION PLAN FOR BULL TROUT IN THE CLARK FORK RIVER BASIN AND KOOTENAI RIVER BASIN, MONTANA

DNRC, along with 8 other agencies and organizations, is a signatory to this 2000 collaborative agreement. The goal of this management plan is the application of a framework of conservation strategies designed to reverse or halt the decline of bull trout throughout western Montana. The plan includes guidance for protecting existing stable populations and specific recommendations for restoring populations that have declined.

MONTANA BEST MANAGEMENT PRACTICES

DNRC's *BMPs* for forestry consist of forest stewardship practices that reduce forest-management impacts to water quality and forest soils. The implementation of *BMPs* by DNRC is required under *ARM 36.11.422*. Key forestry *BMP* elements include:

- streamside management;
- road design and planning;
- timber harvesting and site preparation;

- stream-crossing design and installation;
- winter logging; and
- storing, handling, and application of hazardous substances.

STREAM PRESERVATION ACT PERMIT

Department of Fish, Wildlife, and Parks, (DFWP) has jurisdiction over the management of fisheries and wildlife in the project area. A *Stream Preservation Act Permit (124 Permit)* is required for activities that may affect the natural shape and form of any stream or its banks or tributaries.

SHORT-TERM EXEMPTION FROM MONTANA'S WATER-QUALITY STANDARDS

Department of Environmental Quality (DEQ) has jurisdiction over water-quality standards in the project area. A *Short-Term Exemption from Montana Surface Water Quality and Fisheries Cooperative Program (318 Authorization)* may be required if temporary activities would introduce sediment above natural levels into streams or if *DFWP* deems a permit is necessary after reviewing the mitigation measures in the *124 Permit*.

MONTANA/IDAHO AIRSHED GROUP

DNRC is a member of the *Montana/Idaho Airshed Group*, which was formed to minimize or prevent smoke impacts while using fire to accomplish land-management objectives and/or fuel-hazard reduction (*Montana/Idaho Airshed Group 2006*). As a member, *DNRC* must submit a list of planned burns to the *Smoke Monitoring Unit* describing the type of burn in acres, and the location and elevation of each burn site. The *Smoke Monitoring Unit* provides timely restriction messages by airshed. *DNRC* is required to abide by those restrictions and burn only when conditions are conducive to good smoke dispersion.

AIR QUALITY MAJOR OPEN BURNING PERMIT

DEQ issues permits to entities that are classified as major open burners (*ARM 17.8.610*). *DNRC* is permitted to conduct prescribed wildland open burning activities in Montana that are either deliberately or naturally ignited. Planned prescribed burn descriptions must be submitted to *DEQ* and the *Smoke Monitoring Unit of the Montana/Idaho Airshed Group*. All burns must be conducted in accordance with the major open burning permit.

COOPERATIVE ROAD MAINTENANCE

DNRC currently shares a number of reciprocal road access agreements with *Flathead National Forest* and *The Nature Conservancy*.

CHAPTER II
ALTERNATIVES

INTRODUCTION

This chapter describes in detail the no-action alternative and 2 action alternatives of the proposed action. This chapter will focus on the:

- ID Team;
- development of the action alternatives;
- description of each alternative;
- summary comparison of project activities associated with each alternative;
- summary comparison of how each alternative achieved the proposed project objectives and summary comparison of the predicted environmental impacts of each alternative; and
- stipulations and specifications common to all action alternatives.

INTERDISCIPLINARY TEAM

An ID Team was formed to work on the proposed action in the spring of 2016. The ID Team consisted of a project leader and resource specialists from various disciplines, including fisheries, wildlife biology, hydrology, geology and soils, policy, economics, and forestry. The role of the ID Team was to summarize issues and concerns, develop alternatives of the proposed action in the project area, and analyze the potential environmental impacts of the alternatives on the human and natural environments.

The ID Team began reviewing resources in the proposed project area soon after the initial scoping period began. Field reviews were conducted and data was collected in the project area to aid in the analyses for affected resources, including vegetation, watersheds and hydrology, fisheries, wildlife, geology and soils, economics, air quality, recreation, and aesthetics. The ID Team conducted in-depth quantitative and qualitative analyses of the data to assess the existing environment for each affected resource and determine the potential environmental impacts of each alternative on the affected resources.

DEVELOPMENT OF ALTERNATIVES

Based on data collected from the field and issues received from the public and internally, the ID Team developed a range of alternatives designed to meet project objectives described under *PROJECT OBJECTIVES* in *CHAPTER I – PURPOSE AND NEED*. The action alternatives incorporate harvest unit design, prescriptions, mitigations, and road activities that allow DNRC to conduct forest-management activities consistent with direction contained in the *SFLMP*, *Forest Management Rules,* and the HCP.

The estimated timber volume produced by each alternative is based on ocular estimates obtained during stand reconnaissance and other available data used in the analysis. Advertised volumes may vary from the preliminary estimated volumes due to the increased statistical accuracy of measured data obtained during sale layout. While the estimated log volume may be different, the environmental impacts are based on acres treated and postharvest stand conditions.

DESCRIPTION OF ALTERNATIVES

This section describes No-Action Alternative A and Action Alternatives B and C. All alternatives are considered viable alternatives for selection (see *FIGURE II-1 – ACTION ALTERNATIVE B, FIGURE II-2 – ACTION ALTERNATIVE C,* and *TABLE II-1 – COMPARISON OF ACTIVITIES* - summarizes and compares project activities associated with each alternative.

PRESCRIPTIONS

For definitions of prescriptions see the *GLOSSARY*.

FIGURE II-1 – ACTION ALTERNATIVE B. *Proposed haul routes, units, and prescriptions.*

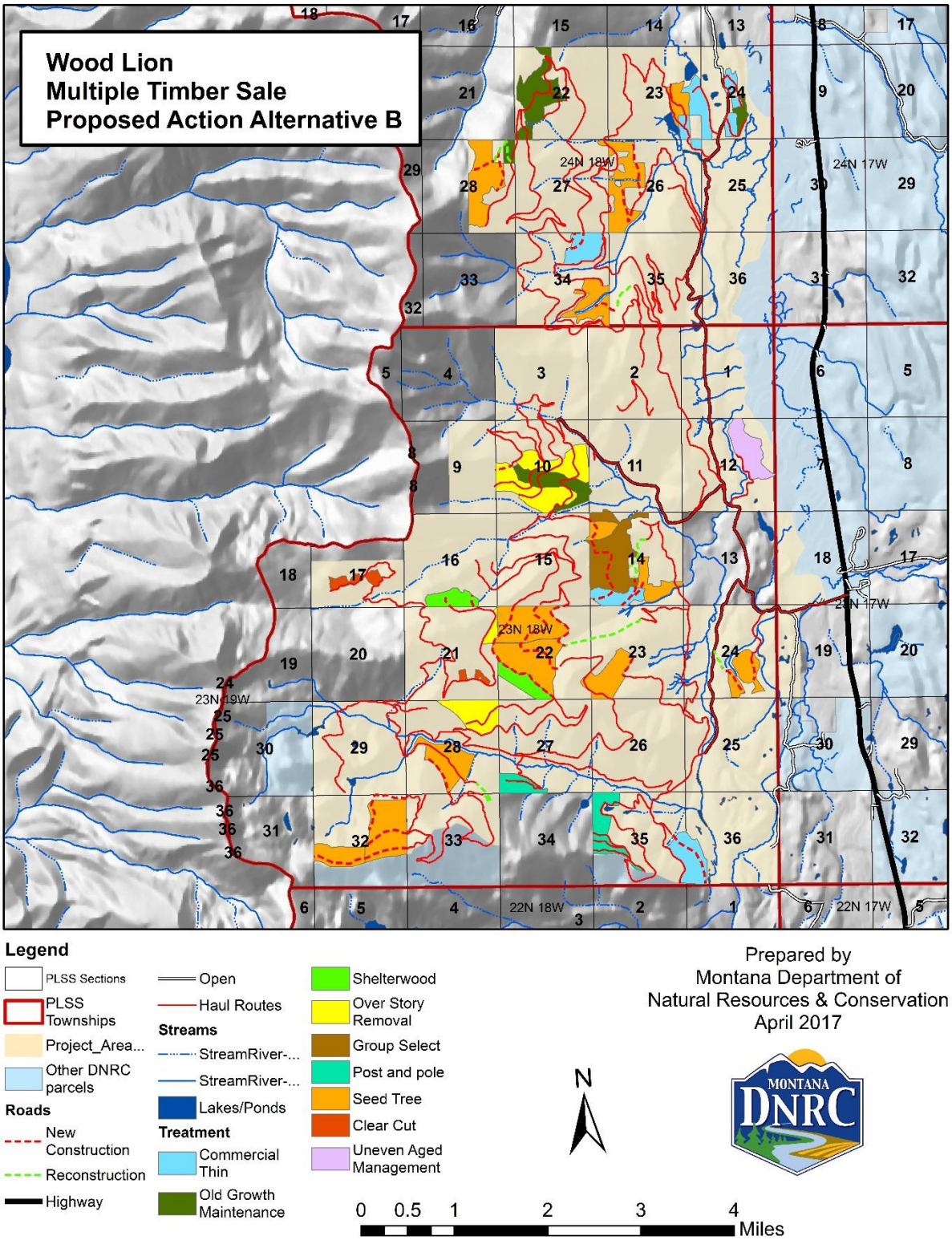
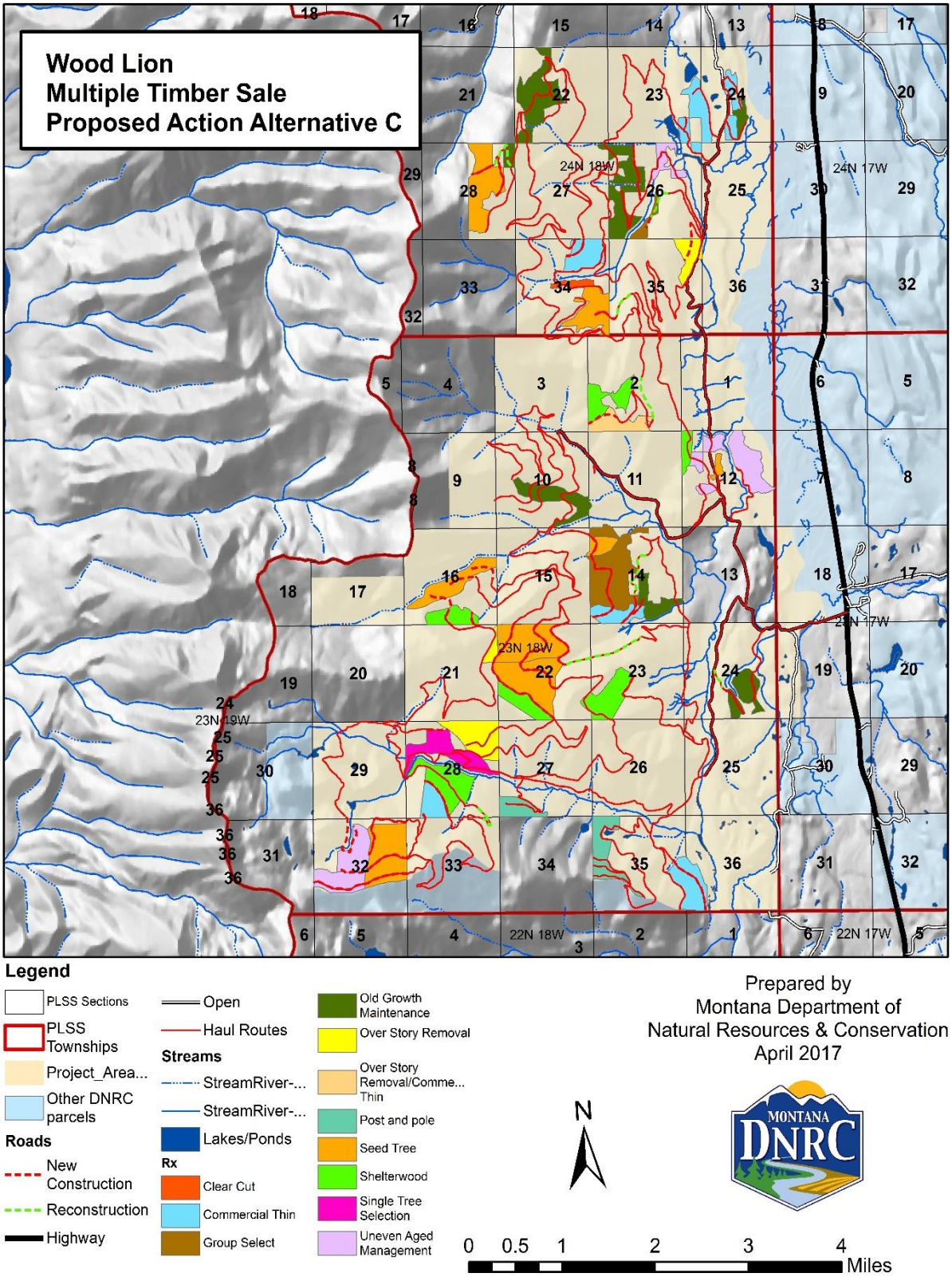


FIGURE II-2 – ACTION ALTERNATIVE C. *Proposed haul routes, units, and prescriptions.*



Prepared by
Montana Department of
Natural Resources & Conservation
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TABLE II-1 – COMPARISON OF ACTIVITIES. *Summary comparison of project activities of the no-action and action alternatives.*

ALTERNATIVE	VOLUME (MMbf)	TOTAL ACRES	OLD-GROWTH ACRES	SILVICULTURAL PRESCRIPTION (ACRES)	HARVEST METHOD	STREAM CROSSINGS	MILES OF ROADWORK	GRAVEL PITS
A	0	0	0	None	None	None	None	None
B	24.13	2,947	1168	Commercial Thin (365) Old-growth Maintenance (278) Overstory Removal (353) Seedtree (1,340) Shelterwood (111) Uneven aged Management (97) Group Select (208) Post and Pole (148) Clear Cut (47)	Ground-based yarding (2,236), Cable yarding (742)	2 stream crossing in the Whitetail Watershed 1 stream crossing in the Main Woodward Watershed 1 stream crossing in the South Woodward Watershed	92 miles of road maintenance 3 miles of road reconstruction 13 miles of new road construction 0 miles of temporary road construction	None
C	23.42	3,326	1349	Commercial Thin (412) Old-growth Maintenance (550) Overstory Removal/Commercial Thin (61) Overstory Removal (179) Seedtree (866) Shelterwood (416) Single-Tree Select (111) Clear Cut (20) Post and Pole (148) Uneven Aged Management (334) Group Select (229)	Ground-based yarding (2,406), Cable yarding (920),	2 stream crossing in the Whitetail Watershed 1 stream crossing in the Main Woodward Watershed 3 stream crossings in the South Woodward Watershed	97 miles of road maintenance 4 miles of road reconstruction 16 miles of new road construction 0 miles of temporary road construction	None

ACHIEVEMENT OF PROJECT OBJECTIVES

The following is a list of project objectives with brief identifiers that link the objectives to *TABLE II-2 – ACHIEVEMENT OF OBJECTIVES,* which summarizes how each alternative, would achieve the project objectives set forth under *PROJECT OBJECTIVES* in *CHAPTER I – PURPOSE AND NEED*. Listed after each objective is an indicator that will be used to measure how and to what extent each alternative meets or measures up to each project objective.

- **Biodiversity** – Promote biodiversity by moving forest stands towards historic cover type conditions and species composition.

  Indicator – Proportional change in cover type acres toward desired future conditions.

- **Insect and disease** – Improve forest health and productivity by addressing insect and disease issues.

  Indicator – Number of acres treated that are at moderate to high risk of insect and disease problems.

- **Revenue and sustained yield** – Generate revenue to the Common School trust for funding K-12 public education and benefit local economies. Contribute sufficient volume towards DNRC's annual sustained-yield target of 56.9 MMbf.

  Indicator – Volume harvested and revenue generated.

- **Transportation** – Develop and improve the transportation system and infrastructure for long-term management, fire suppression, and public access.

  Indicator – Miles of new road construction, reconstruction, and maintenance along with their associated development costs.

- **Water quality** – Improve water quality by removing and rehabilitating sediment-point sources, and meet BMPs on all project roads, including haul routes to Highway 83.

  Indicator – Miles of road reconstructed, improved, or maintained to reduce potential sediment delivery to streams.

- **Fuel loads** – Reduce fuel loads and wildfire hazards by decreasing ground and ladder fuel loads.

  Indicator – Acres treated with seedtree and shelterwood prescriptions in the project area. Additionally, treating stands adjacent to private landowners.

TABLE II-2 – ACHIEVEMENT OF OBJECTIVES. *Summary comparison of predicted achievement of project objectives for the no-action and action alternatives.*

PROJECT OBJECTIVES	ALTERNATIVES		
	A	B	C
Biodiversity (cover type) *change in acreage* percentages of increase or decrease by project area/Swan River State Forest	No changes in acreages from existing cover type.	Western larch/Douglas-fir *plus 720 acres* 3.9/1.3 percent increase Western white pine *plus 777 acres* 4.2/1.4 percent increase Lodgepole pine *Plus 83 acres* 0.4/0.2 percent increase Mixed Conifer *minus 1481 acres* 8.0/2.7 percent decrease Subalpine fir *minus 99 acres* 0.5/0.2percent decrease	Western larch/Douglas-fir *plus 699 acres* 3.8/1.3 percent increase Western white pine *plus 995 acres* 5.4/1.8 percent increase Lodgepole pine *plus 7 acres* 0.1/0.0 percent increase Mixed Conifer *minus 1567 acres* 8.4/2.9 percent decrease Subalpine fir *minus 134 acres* 0.7/0.2 percent decrease
Biodiversity (age class) *Change in acres* percentages of increase or decrease by project area/Swan River State Forest	No changes in acreages from existing age class.	No age *0 acres* 0 to 39 years *plus 1,741 acres* 8.9/3.1 percent increases 40 to 99 years *minus 215 acres*	No age *0 acres* 0 to 39 years *plus 1,062 acres* 5.7/1.9 percent increases 40 to 99 years *Minus 81 acres*

PROJECT OBJECTIVES	ALTERNATIVES		
	A	B	C
		1.1/0.4 percent decreases 100 to 149 *minus 597acres* 3.8/1.1 percent decreases 150-plus years *minus 156 acres* 0.8/0.3 percent decreases Old-growth *minus 773 acres* 4.2/1.4 percent decreases	0.4/0.1 percent increases 100 to 149 *minus 513 acres* 2.8/0.9 percent decreases 150-plus years *minus 73 acres* 0.4/0.2 percent decreases Old-growth *minus 395 acres* 2.1/0.7 percent decreases
Insect and disease	0 acres	2,357 acres of moderate to high levels of insect and disease problems treated	2,671 acres of moderate to high levels of insect and disease problems treated
Yield and trust revenue	0 MMbf and $0	24.13 MMbf and $2,482,990	23.42 MMbf and $2,410,133
Transportation	0 miles	16.0 miles of new road construction/reconstruction and 92 miles of maintenance.	20.0 miles of new road construction/reconstruction and 97 miles of maintenance.
Water Quality	0 replacements and improvements	Approximately 94.6 miles of road would be reconstructed, improved, or maintained to reduce potential sediment delivery.	Approximately 99.6 miles of road would be reconstructed, improved, or maintained to reduce potential sediment delivery.
Fuels loads	0 acres	1,451 acres treated with seedtree or shelterwood prescriptions followed by piling and burning of slash.	1,282 acres treated with seedtree or shelterwood prescriptions followed by piling and burning of slash.

TABLE II-3 -ALTERNATIVE COMPARISON OF ENVIRONMENTAL IMPACTS. *Summarizes the existing environment and the predicted environmental impacts of each alternative. The impacts are categorized by resource area and further subdivided by an abbreviated version of the issues listed in CHAPTER 1, TABLE I-1 – ISSUES STUDIED IN DETAIL.*

RESOURCE ISSUE	EXISTING ENVIRONMENT	DIRECT AND INDIRECT IMPACTS	CUMULATIVE IMPACTS
VEGETATION			
Cover type representation The proposed activities may affect forest cover types through species removal or changes in species composition.	Mixed-conifer stands are currently overrepresented compared to historic data and desired future conditions. Western larch/ Douglas-fir and western white pine cover types are currently underrepresented on Swan River State Forest.	***No-Action Alternative A***	
		No effects are anticipated.	Shade-tolerant species would continue to regenerate, leading to an increase in the mixed-conifer cover type and a gradual loss of the seral-dominated cover types, such as western larch/Douglas-fir and western white pine.
		Action Alternative B	
		In the project area, the most significant changes are the western larch/Douglas-fir cover type, which would increase from 17.8 to 21.7 percent, western white pine cover type would increase from 10.7 to 14.9 percent, and Lodgepole pine cover type would increase from 6.5 to 6.9 percent. The mixed-conifer cover type would decrease from 54.4 to 46.4 percent and the subalpine fir cover type would decrease from 7.9 to 7.4.	Cumulative effects would result in a trend of increasing seral cover types across areas where management has occurred.
		Action Alternative C	
		In the project area, the most significant changes are the	Cumulative effects would result in a trend of increasing seral cover types

		western larch/Douglas-fir cover type would increase from 17.8 to 21.6 percent, western white pine cover type would increase from 10.7 to 16.1 percent. The mixed-conifer cover type would decrease from 54.4 to 46 percent and the subalpine fir cover type would decrease from 7.9 to 7.2.	across areas where management has occurred.
Age class representation The proposed activities may affect forest age classes through tree removal.	Comparison of the current age class distribution across the entire Swan River State Forest to historical data for *Section M333C* demonstrates reduced acreage in the old stands age class and an overabundance in the poletimber age class. The acquisition of 14,612 acres of former Plum Creek lands in December 2012 has significantly altered this existing environment compared to previous EISs due to the increased acres and proportion of younger age classes on those lands.	***No-Action Alternative A***	
		No immediate change in the proportion of existing age classes is expected unless a large disturbance, such as wildfire, occurs.	There is a trend of increases in the 0 to 39 year age class and decreasing older age classes across areas where management occurs.
		Action Alternative B	
		Regeneration treatments and the subsequent planting or natural regeneration would increase the 0 to 39 year age class by 3.1 percent on Swan River State Forest and by 8.9 percent, or 1,741 acres, in the project area. The 150-year-plus and old-growth age class would be reduced by 1.6 percent on Swan River State Forest and by 5 percent, or 929 acres, in the project area.	Cumulative effects would result in a trend of reducing the acres in the older age classes while increasing the acres in the younger age classes.
		Action Alternative C	
		Regeneration treatments and the subsequent planting or natural regeneration would increase the 0	Cumulative effects would result in a trend of reducing the acres in the

		to 39 year age class by 1.9 percent on Swan River State Forest and by 5.7 percent, or 1,062 acres, in the project area. The 150-year-plus and old-growth age class would be reduced by 0.9 percent on Swan River State Forest and by 2.5 percent, or 468 acres, in the project area.	older age classes while increasing the acres in the younger age classes.
Old-growth representation The proposed activities may affect old-growth amounts and quality through tree removal.	Swan River State Forest currently has 8,310 acres of old-growth, which is equal to 15.3 percent of its total acreage. The project area contains 2,637 acres of old-growth, which is equal to 14.2 percent of the project area.	***No-Action Alternative A***	
		No immediate change in the amounts of old-growth is expected unless a large disturbance, such as wildfire, occurs. Over time, old-growth seral cover types (such as western larch/Douglas-fir) could shift to late-seral cover types (such as mixed conifer), old-growth risk rating could increase, and old-growth attributes (*Full Old-Growth Index* [*FOGI*] classification) could change.	Current levels of old-growth acres would not change in the short term. As stands continue to mature and large trees eventually die, some stands may no longer meet the old-growth definition.
		Action Alternative B	
		The old-growth amount on Swan River State Forest would decrease to 7,537 acres, which is equal to 13.9 percent of the total acreage. The project area would contain 1,864 acres of old-growth, which is equal to 10 percent of the project area.	Cumulative effects would result in a trend of reducing the acres in old-growth.

		Action Alternative C	
		The old-growth amount on Swan River State Forest would decrease to 7,915 acres, which is equal to 14.6 percent of the total acreage. The project area would contain 2,242 acres of old-growth, which is equal to 12.1 percent of the project area.	Cumulative effects would result in a trend of reducing the acres in old-growth.
Patch size and shape The proposed activities may affect patch size and shape through tree removal.		***No-Action Alternative A***	
		Age class, old-growth, and cover type patch sizes would not be immediately affected. Over time, the forest would tend to homogenize, leading to larger patches of older stands, especially in the absence of significant fires or disturbance events. Over time, the effects to the old-growth patch size would be uncertain. If existing large trees remain alive and new large trees develop in old-age stands, the mean patch size of old-growth would likely increase. If existing large trees continue to die and new large trees fail to develop, the mean patch size of old-growth would likely decrease. Over time, diversity of habitats in terms of cover type patches would likely be reduced through forest	Overall, age patches are reduced from historic conditions and active management has cumulatively increased the overall patch size of younger age classes. Old-growth patches are likely reduced from historic conditions as well. Cover type patch sizes have been reduced from historic conditions. Active management of forested lands suggests an increase in early seral species such as western larch and ponderosa pine. However, the result may also be the retention of a mixed-conifer cover type postharvest.

	Current project area mean patch sizes by age class: Nonforested - 60 acres 0 to 39 years - 63 acres 40 to 99 years - 182 acres 100 to old stand - 65 acres Old stand - 58 acres Overall - 90 acres Current project area mean old-growth patch size - 70 acres Current project area mean patch sizes by cover type: Douglas-fir - 59 acres Hardwood - 51 acres Lodgepole pine - 80 acres Mixed conifer - 348 acres Nonforested - 60 acres Nonstocked - 17 acres Ponderosa pine - 14 acres Subalpine fir - 244 acres Western larch/Douglas-fir - 89 acres Western white pine - 62 acres Overall - 132 acres	succession, resulting in an increase in mean size of patches dominated by shade-tolerant species.	
		Action Alternatives B and C	
		The mean old stand patch size would be reduced to 41 and 50 acres with Action Alternatives B and C, respectively. Other age patches would be only marginally affected except the 0 to 39-year-old class, where mean patches would be increased with each action alternative.	Overall, age class patches are reduced from historic conditions and active management has cumulatively increased the overall patch size of younger age classes. Old-growth patches and cover type patch sizes have been reduced from historic conditions. Active management of forested lands suggests an increase in early seral

			species such as western larch and ponderosa pine. However, the result may also be the retention of a mixed-conifer cover type postharvest.
Fragmentation The proposed activities may affect forest fragmentation through tree removal.	The majority of the project area is a matrix or mosaic of well-stocked stands interspersed with past regeneration harvesting activities. Some man-made patches in harvest units range from 10 to 640 acres, while some areas have not been previously entered and represent a continuous forest of stands uninfluenced by human activities, but of various stocking levels due to past insect infestation.	***No-Action Alternative A***	
		No direct effects to forest fragmentation would occur. A reduction in fragmentation would occur if additional harvesting is not imposed by management and existing patches of immature forest grow to maturity.	Cumulative effects would result in an increase in fragmentation in areas where regeneration harvest units occur and in a decrease in areas where regeneration harvest units do not occur and existing patches of immature forest grow to maturity.
		Action Alternatives B and C	
		For the areas proposed for seed tree, shelterwood, or salvage harvesting, the primary effects would be a reduction in mature forest. The areas proposed for other harvesting prescriptions would leave greater than 40-percent crown cover and would be more similar to adjacent mature stands of timber and would not contribute to fragmentation.	An overall increase in the size of younger age class patches and a decrease in the size of older age classes would occur where regeneration harvest units are proposed.
Stand Vigor The proposed activities may affect the vigor of forest stands through tree removal.	In terms of vigor classifications, the project area consists of 1,976 acres of full vigor (11 percent), 11,005 acres of good to average vigor (59 percent), 5,414 acres of just	***No-Action Alternative A***	
		No direct effects for stand vigor would occur. Vigor may decrease as insect infestations and disease infections continue to affect stands or if a large disturbance, such as a wildfire, occurs.	Current stand vigor would remain the same across the forest. Mortality and aging of trees or groups of trees would reduce vigor in localized areas. Large reductions in vigor

	below average to poor vigor (29 percent), and 195 acres of poor vigor (1 percent).		would occur if a large fire came through the area.
		Action Alternative B	
		Vigor classifications as a result of Action Alternative B would consist of 3,725 acres of full vigor (20 percent), 10,284 acres of good to average vigor (55 percent), 4,395 acres of just below average to poor vigor (24 percent), and 186 acres of poor vigor (1 percent).	Areas where harvesting has occurred would have increased vigor. Areas where harvesting has not occurred would have decreased vigor and the trees would no longer perform to their highest potential and would become susceptible to insects and diseases, etc.
		Action Alternative C	
		Vigor classifications as a result of Action Alternative C would consist of 3,360 acres of full vigor (18 percent), 10,379 acres of good to average vigor (56 percent), 4,684 acres of just below average to poor vigor (25 percent), and 166 acres of poor vigor (1 percent).	Areas where harvesting has occurred would have increased vigor. Areas where harvesting has not occurred would have decreased vigor and the trees would no longer perform to their highest potential and would become susceptible to insects and diseases, etc.
Stand structure The proposed activities may affect the forest stand structure through tree removal.	Current stand structure classifications and percentages in the project area: Single-storied - 15 percent	***No-Action Alternative A***	
		No immediate change in the proportion of stand structure is expected unless a large disturbance, such as wildfire, occurs.	The cumulative effects to stand-structure distributions due to previous activities are represented in descriptions of the current conditions. Those effects have been

	Two-storied - 32 percent Multistoried - 48 percent		to reduce the acres in multistoried stand structures while increasing the acres in the single-storied stand structure through even-aged management.
		Action Alternative B	
		The following stand structure proportions would change: The single-storied stand would increase 1,521 acres (23 percent), while the two-storied stand would decrease 586 acres (29 percent), and the multistoried stand would decrease 934 acres (43 percent).	The cumulative effects to stand-structure distributions due to previous activities are represented in descriptions of the current conditions. Those effects have been to reduce the acres in multistoried stand structures while increasing the acres in the single-storied stand structure through even-aged management.
		Action Alternative C	
		The following stand structure proportions would change: The single-storied stand would increase 1,142 acres (21 percent), while the two-storied stand would decrease 426 acres (30 percent), and the multistoried stand would decrease 716 acres (44 percent).	The cumulative effects to stand-structure distributions due to previous activities are represented in descriptions of the current conditions. Those effects have been to reduce the acres in multistoried stand structures while increasing the acres in the single-storied stand structure through even-aged management.
		No-Action Alternative A	

Crown Cover The proposed activities may affect the forest crown cover through tree removal.	In terms of overall crown cover in the project area, 12.5 percent of stands are well-stocked, 59.3 percent show medium stocking, 23.8 percent are poorly stocked, and 4.4 percent are nonforested.	Overall crown cover and stocking would likely increase over time in the absence of disturbances. Were large fires to occur, overall crown cover would be reduced. Ongoing insect and disease issues would reduce crown cover and sawtimber stocking in some areas prior to understory regeneration.	Current crown cover would remain the same across the forest. Over time, crown cover would be expected to increase in the absence of disturbance. Mortality of trees or groups of trees would reduce the crown cover in localized areas. Large reductions in crown cover would occur if a large fire came through the area.
		Action Alternative B	
		The project area would consist of approximately 4.3 percent well-stocked stands, 61.1percent medium-stocked stands, 30.2 percent poorly-stocked stands, and 4.4 percent nonforested stands.	Overall reductions of crown cover in well-stocked stands would be dispersed across the landscape. Representation of medium-stocked stands would increase following harvesting, as would poorly stocked stands. As stands regenerate, crown cover would increase.
		Action Alternative C	
		The project area would consist of approximately 5.3 percent well-stocked stands, 62.5 percent medium-stocked stands, 27.8 percent poorly-stocked stands, 4.4 percent nonforested stands.	Overall reductions of crown cover in well-stocked stands would be dispersed across the landscape. Representation of medium-stocked stands would increase following harvesting, as would poorly stocked stands. As stands regenerate, crown cover would increase.

Insects and diseases The proposed activities may affect forest insect and disease levels through tree removal (both suppressed/ stressed and infested/ infected).	The major forest insects and diseases currently affecting forest productivity on Swan River State Forest include Armillaria root disease, larch dwarf mistletoe, white pine blister rust, rust-red stringy rot, cedar laminated root and butt rot, red-brown butt rot, Douglas-fir bark beetle, fir engraver, mountain pine beetle, and western spruce budworm.	***No-Action Alternative A***	
		Sawlog volume, and the corresponding revenue, would continue to be lost from the project area due to insect and disease effects in inaccessible stands with large trees. Salvage harvesting would continue in areas where stands are accessible without building roads.	Some salvage harvesting of insect-infested and disease-infected trees would occur, but at a slower, less effective rate and not in association with this project. Forest stands would maintain dense stocking levels, which contribute to the spread of insects, diseases, and fuel loading, which could lead to high-intensity fires, unnatural forest structures, and overall poor stand health. Current forest conditions would continue.
		Action Alternatives B and C	
		Harvest treatments would remove trees affected by insects and diseases. Action Alternative B would treat stands with various levels of insect and disease risk: low risk 590 acres; moderate risk 1,460 acres; and high risk 897 acres. Action Alternative C would treat stands with various levels of insect and disease risk: low risk 655 acres; moderate risk 1,513 acres; and high risk 1,158 acres.	Timber-management activities generally implemented prescriptions that reduce losses and recover mortality due to insects and diseases. Stand-regeneration treatments are producing stands with species compositions more resilient to the impacts of forest insects and diseases. Thinning treatments have further reduced the percentage of infected or infested trees.
		No-Action Alternative A	

Fire effects The proposed activities may affect forest fire conditions, levels, and hazards through tree removal, increased public access, and/or fuel reduction.	The fire regime across Swan River State Forest is variable in frequency and intensity and is creating a mosaic pattern of age classes and cover types.	Wildfire hazards would not change substantially in the short term. With continued fuel accumulation from down woody debris, the potential for wildfire increases. Large-scale, stand-replacing fires may be the outcome.	The risk of wildfires would continue to increase as a result of long-term fire suppression.
		Action Alternatives B and C	
		Immediately following timber harvesting, the amount of fine fuels would increase. Hazards would be reduced through various fuel-treatment measures such as piling and burning.	Fuel loadings would be reduced in treated stands, decreasing wildfire risks in these specific areas.
Sensitive plants The proposed activities may affect sensitive plant populations through ground disturbance.	The majority of sensitive plants and their related habitat features were found in wet meadows, areas that are not normally classified as forest stands or considered for timber harvesting. The survey identified 14 species of special concern existing within a total of 24 separate populations (*Pierce and Barton 2003 and Montana Natural Heritage Program 2017*); one of these plant populations was found to be present in a proposed harvest unit	***No-Action Alternative A***	
		No effects are anticipated.	No effects are anticipated.
		Action Alternatives B and C	
		Minimal to no effects are expected to the single population of sensitive plants found to occur in one of the proposed harvest units. In alternative C, no effects are expected because no populations of sensitive plants occur within the proposed harvest units. Typically, these plants are located in such wet areas that activities would not occur within the plant habitat.	If changes occur in the water-yield or nutrient level, sensitive plant populations may, in turn, be affected. Given the level of the proposed and active harvesting on Swan River State Forest and other land in the project area, no measurable changes in water yield or nutrient levels are anticipated from any of the proposed action alternatives.

		In alternative B, Prior to any harvest activity, in Section 10; T24N R18W, the harvest area would be resurveyed to locate and identify existing species population presence. If plant populations are found, the appropriate habitat areas would be excluded from the harvest unit.	
Noxious weeds The proposed activities may affect noxious weeds through ground disturbance.	Spotted knapweed, orange hawkweed, yellow hawkweed, Canada thistle, Bull thistle, oxeye daisy, and common St. John's-wort have become established along road edges in the project area.	***No-Action Alternative A***	
		Weed seed would continue to be introduced by recreational use of the forest, log hauling, and other logging activities on adjacent land ownerships. Swan River State Forest may initiate spot spraying to reduce noxious weed spread along its roads under the *Forest Improvement* (FI) program.	Current population levels would continue to exist and may increase over time.
		Action Alternative B and C	
		Log hauling and equipment movement would introduce seeds from other sites. Weed establishment and spread would be reduced by grass seeding new and disturbed roads and landings, spot spraying of new infestations, requiring contractors to wash and have machinery inspected prior to entering the	The action alternatives, together with other management and recreational activities on Swan River State Forest, would provide an opportunity for the transfer of weed seeds and increased establishment of noxious weeds. Preventative actions facilitated by the Lake County Weed Board and active weed-management activities performed by Swan River State Forest would

		project area, and roadside herbicide spraying.	reduce the spread and establishment of noxious weeds, as well as the impacts resulting from the replacement of native species.
GEOLOGY AND SOILS			
Physical Soil Properties	Up to 564 acres have been historically harvested within the proposed harvest units. Detrimental soil disturbance was estimated to occur on less than 5 percent of these acres. Low levels of existing impacts to physical soil properties occur within the analysis area.	***No-Action Alternative A***	
		No impact, improving trend.	
		Action Alternatives B and C	
		A high probability of low- to moderate-level impacts for moderate durations (stand rotation) would be expected.	Action Alternatives B and C present a low risk of moderate cumulative effects to soil physical properties that would be expected to ameliorate within a stand rotation. Action Alternative B presents more risk for cumulative effects to soil function than Alternative C.
Erosion	Soils are erosively stable with no rill or gully erosion observed outside of road prisms in the analysis area.	***No-Action Alternative A***	
		No impacts would be expected; the trend would remain stable.	
		Action Alternatives B and C	
		A moderate probability of low level effects to soil productivity resulting from off-site erosion is expected.	No cumulative effects from erosion within the analysis area are expected
		No-Action Alternative A	

Site Nutrients	Site nutrients vary spatially, dependent on aspect, elevation, habitat type, duff depth, and amount of fine woody debris. In general, no existing impacts from previous entries were identified within the analysis area.	No impacts would be expected; the trend would continue to increase.	
		Action Alternatives B and C	
		A low probability of low-level impacts would be expected for a short duration (15 to 20 years).	Actions within Action Alternatives B and C present a low probability of low level cumulative effects to site nutrients in the 564 and 476 acres proposed for re-entry, respectively.
Long-term Productivity	Soils are high in productivity due to ash-capped soils, climate, and high precipitation. No existing impacts were observed to long-term productivity from prior entries within the analysis area.	***No-Action Alternative A***	
		No impacts would be expected; the trend would continue to increase.	
		Action Alternatives B and C	
		A low probability of low-level impacts would occur for a short duration (15 to 20 years).	Actions within Action Alternatives B and C present a low probability of low level cumulative effects to soil productivity in the 564 and 476 acres proposed for re-entry, respectively.
Slope Stability	Both the *Flathead National Forest Land System Inventory* and DNRC soil surveys have identified one landtype (74) in the project area with an elevated risk of mass failure. During field review, small areas adjacent to locations of new road construction were identified as sensitive areas where management actions may affect slope equilibrium and the possibility of slope	***No-Action Alternative A***	
		No impacts would be expected; the trend would continue to increase.	
		Action Alternatives B and C	
		There would be a moderate risk for actions proposed under both action alternatives to increase the risk of slope instability during and after project implementation. This risk would be short in duration measured by the time it would take for a harvest unit and/or road cut or fill slope to revegetate.	No cumulative effects to slope stability are expected under either alternative within the project area.

	failure if not adequately mitigated.		
WATERSHED AND HYDROLOGY			
Timber harvesting and road construction has the potential to increase water yield, which, in turn, may affect erosive power, sediment production, and Stream-channel stability.	Existing annual water yields for watersheds in the Wood Lion Project Area: Whitetail Creek – 5.4 percent Woodward Creek – 5.9 percent South Woodward Creek – 2.9 percent	***No-Action Alternative A***	
		No direct or indirect increase in annual water yields would occur because no timber harvesting and road construction activities would occur.	No change in cumulative annual water yields would occur. The cumulative annual water yields would be the same as the existing annual water yields for each watershed. All watersheds would remain below the recommended threshold for annual water-yield increases.
		Action Alternative B	
		Direct and indirect increases to annual water yields in each watershed: Whitetail Creek – 2.8 percent Woodward Creek – 1.4 percent South Woodward Creek – 5.3 percent	All watersheds would remain at or below the recommended threshold for annual water-yield increases. Cumulative annual water-yield increases for each watershed: Whitetail Creek – 12.0 percent Woodward – 8.3 percent South Woodward Creek – 11.8 percent
		Action Alternative C	
		Direct and indirect increases to annual water yields in each watershed: Whitetail Creek – 2.7 percent Woodward Creek – 1.9 percent	All watersheds would remain at or below the recommended threshold for annual water-yield increases.

		South Woodward Creek – 5.1 percent	Cumulative annual water-yield increases for each watershed: Whitetail Creek – 11.9 percent Woodward Creek – 8.8 percent South Woodward Creek – 11.6 percent
Timber harvesting and road construction may increase sediment delivery into streams/lakes and affect water quality.	Sediment sources in each watershed and along the proposed haul route in each watershed were modeled using a procedure adapted from the *Washington Forest Practices Board*. The following list is the estimated potential tons per year sediment delivery into streams in each watershed in the project area (tons per year): Whitetail Creek – 2.24 Woodward Creek – 1.78 South Woodward Creek – 8.09	***No-Action Alternative A***	
		No direct or indirect increase or reduction in sediment delivery would occur as part of this project.	No change in cumulative sediment delivery would occur. The sediment delivery would change as funding for road maintenance is available.
		Action Alternative B	
		Road maintenance, reconstruction, and new road construction would result in the following net changes to the sediment delivery in each watershed: Whitetail Creek – 0.85 tons per year reduction Woodward Creek – 0.12 tons per year reduction South Woodward Creek – 5.04 tons per year reduction	Road maintenance, reconstruction, and new road construction would result in the following net post-project modeled potential cumulative sediment delivery from roads: Whitetail Creek – 1.39 tons per year Woodward Creek – 1.66 tons per year South Woodward Creek – 3.05 tons per year
		Action Alternative C	
		Road maintenance, reconstruction and new road construction would result in the following net changes to the	Road maintenance, reconstruction and new road construction would result in the following net post-project modeled potential

		sediment delivery in each watershed: Whitetail Creek – 0.87 tons per year reduction Woodward Creek – 0.09 tons per year reduction South Woodward Creek – 5.13 tons per year reduction	cumulative sediment delivery from roads: Whitetail Creek – 1.37 tons per year Woodward Creek – 1.69 tons per year South Woodward Creek – 2.96 tons per year
FISHERIES			
Populations	Existing impacts to native fisheries populations within each analysis area range from moderate to high.	***No-Action Alternative A***	
		No impacts would occur beyond those already described in EXISTING ENVIRONMENT.	See CUMULATIVE EFFECTS summary below.
		Action Alternative B	
		No direct or indirect impacts to fisheries populations (including species presence or absence and genetics) are expected to occur in any of the analysis areas as a result of the proposed actions.	See CUMULATIVE EFFECTS summary below.
		Action Alternative C	
		Same as Action Alternative B.	See CUMULATIVE EFFECTS summary below.
Flow regime	Low existing impacts due to water-yield increases occur in the Whitetail, Woodward and South Woodward analysis areas; existing impacts to seasonal peak flow volume, timing, and duration are also expected to be within the	***No-Action Alternative A***	
		No impacts would occur beyond those already described in *EXISTING ENVIRONMENT.*	See *CUMULATIVE EFFECTS* summary below.
		Action Alternative B	
		Additional impacts to water yield and seasonal peak flow volume, timing, and duration are expected	See *CUMULATIVE EFFECTS* summary below.

	range of natural variability. (Direct and indirect effects to flow regime are not assessed in the remaining analysis areas.)	to be low in the Whitetail (2.8% increase), Woodward (1.4% increase), and South Woodward (5.3% increase) creek analysis areas.	
		Action Alternative C	
		Additional impacts to water yield and seasonal peak flow volume, timing, and duration are expected to be low in the Whitetail (2.7% increase), Woodward (1.9% increase), and South Woodward (5.1% increase) creek analysis areas.	See *CUMULATIVE EFFECTS* summary below.
Sediment	Existing impacts to sediment are low in the Swan River, Whitetail, Woodward and South Woodward creek analysis areas, and negligible in the Cedar, Unnamed tributary to Swan River, Swan River face drainages, Upper Porcupine, and Unnamed tributary to Porcupine creek analysis areas.	***No-Action Alternative A***	
		No impacts would occur beyond those already described in *EXISTING ENVIRONMENT.*	See *CUMULATIVE EFFECTS* summary below.
		Action Alternative B	
		Low additional sediment impacts (short- and long-term) to fisheries resources are expected in all analysis areas. Implementation of BMPs is expected to reduce sediment in the following analysis areas; Whitetail; 0.85 ton reduction Woodward; 0.12 ton reduction South Woodward; 5.04 ton reduction	See *CUMULATIVE EFFECTS* summary below.

		Action Alternative C	
		Low additional sediment impacts (short- and long-term) to fisheries resources are expected in all analysis areas. Implementation of BMPs is expected to reduce sediment in the following analysis areas; Whitetail; 0.87 ton reduction Woodward; 0.09 ton reduction South Woodward; 5.13 ton reduction	See *CUMULATIVE EFFECTS* summary below.
Channel forms	Existing impacts to channel forms are low in the Whitetail and South Woodward creek analysis areas, low to moderate in the Woodward Creek analysis area, and negligible in the Swan River, Cedar, Unnamed tributary to Swan River, Swan River face drainages, Upper Porcupine, and Unnamed tributary to Porcupine creek analysis area.	***No-Action Alternative A***	
		No impacts would occur beyond those already described in *EXISTING ENVIRONMENT.*	See Cumulative Effects summary below.
		Action Alternative B	
		Negligible to low additional impacts to channel forms are expected in all analysis areas.	See *CUMULATIVE EFFECTS* summary below.
		Action Alternative C	
		Same as Action Alternative B.	See *CUMULATIVE EFFECTS* summary below.
Riparian condition	Existing impacts to riparian function are low in the Whitetail, Woodward, and South Woodward creek analysis areas, and negligible in the remaining analysis areas.	***No-Action Alternative A***	
		No impacts would occur beyond those already described in *EXISTING ENVIRONMENT.*	See *CUMULATIVE EFFECTS* summary below.
		Action Alternative B	
		Low additional impacts to riparian conditions are expected in the Unnamed tributary to	See *CUMULATIVE EFFECTS* summary below.

		Porcupine Creek analysis area, negligible impacts are expected in all other analysis areas.	
		Action Alternative C	
		Same as Action Alternative B.	See *CUMULATIVE EFFECTS* summary below.
Large woody debris	Existing impacts to large woody debris are low in the Whitetail, Woodward, and South Woodward creek analysis areas, and negligible in the remaining analysis areas.	***No-Action Alternative A***	
		No impacts would occur beyond those already described in *EXISTING ENVIRONMENT.*	See *CUMULATIVE EFFECTS* summary below.
		Action Alternative B	
		Low additional impacts to riparian conditions are expected in the Unnamed tributary to Porcupine Creek analysis area, negligible impacts are expected in all other analysis areas.	See *CUMULATIVE EFFECTS* summary below.
		Action Alternative C	
		Same as Action Alternative B.	See *CUMULATIVE EFFECTS* summary below.
Stream temperature	Existing impacts to stream temperature are low in the Whitetail, Woodward, and South Woodward creek analysis areas, and negligible in the remaining analysis areas.	***No-Action Alternative A***	
		No impacts would occur beyond those already described in *EXISTING ENVIRONMENT.*	See *CUMULATIVE EFFECTS* summary below.
		Action Alternative B	
		No impacts on stream temperature are expected in the Swan River and Cedar Creek analysis areas, negligible impacts are expected in the Unnamed tributary to Swan River, Swan	See *CUMULATIVE EFFECTS* summary below.

		River Face Drainages, and Upper Porcupine analysis areas, and low impacts are expected in Whitetail, Woodward, South Woodward, and Unnamed tributary to Porcupine Creek drainages.	
		Action Alternative C	
		Same as Action Alternative B.	See *CUMULATIVE EFFECTS* summary below.
Macroinvertebrate richness	Existing impacts to macroinvertebrate richness are negligible to low in all analysis areas.	***No-Action Alternative A***	
		No impacts would occur beyond those already described in *EXISTING ENVIRONMENT.*	See *CUMULATIVE EFFECTS* summary below.
		Action Alternative B	
		Negligible to very low additional impacts to macroinvertebrate richness are expected in all analysis areas.	See *CUMULATIVE EFFECTS* summary below.
		Action Alternative C	
		Same as Action Alternative B.	See *CUMULATIVE EFFECTS* summary below.
Connectivity	Existing moderate impacts to nonnative fisheries connectivity occur in the Whitetail and South Woodward creek analysis areas;	***No-Action Alternative A***	
		No impacts would occur beyond those already described in *EXISTING ENVIRONMENT.*	See *CUMULATIVE EFFECTS* summary below.
		Action Alternative B	
		Same as Action Alternative A.	See *CUMULATIVE EFFECTS* summary below.
		Action Alternative C	
		Same as Action Alternative A.	See *CUMULATIVE EFFECTS* summary below.

Cumulative effects to fisheries resources	A moderate to high cumulative impact occurs in all analysis areas. Although other contributing factors currently affect fisheries resources, this existing collective impact to fisheries is primarily a result of the adverse effects of nonnative fish populations on native fisheries.	***No-Action Alternative A***	
		Not applicable	Considering all impacts collectively, a moderate to high cumulative impact is expected to continue to occur (same as *EXISTING CONDITION*). Although the anticipated moderate to high cumulative effect is a function of all potentially related impacts, the elevated cumulative effect in the analysis areas is primarily due to adverse impacts from nonnative fish species.
		Action Alternative B	
		Not applicable	Using the cumulative effects described for No-Action Alternative A as a baseline, the anticipated collective direct and indirect effects due to implementing Action Alternative B is expected to contribute additional low impacts to fisheries resources. Consequently, moderate to high cumulative impacts to fisheries resources are expected in all analysis areas, which is fundamentally the same cumulative effect to fisheries resources described for No-Action Alternative A. Compared to the No-Action Alternative A, (1) low additional cumulative effects to

			fisheries resources would be expected, (2) the additional cumulative effects may be measureable or detectable but are not expected to be detrimental, (3) cumulative effects would remain elevated primarily due to the presence and consequent adverse impacts from nonnative fish species, and (4) the elevated cumulative effects would be expected to occur regardless of whether or not this Action Alternative is selected.
		Action Alternative C	
		Not applicable	Same as Action Alternative B.
WILDLIFE			
Cover type The proposed activities could result in changes in the distribution of cover types on the landscape, which could affect wildlife.	In the project area, mixed-conifer cover types exceed desired future conditions by 35.7 percent while western larch/Douglas-fir types are underrepresented by 20.6 percent and western white pine types are underrepresented by 19.7 percent. In the Cumulative Effects Analysis Area (CEAA), similar trends exist. Mixed-conifer cover types are overrepresented by 32.6	***No-Action Alternative A***	
		In the short term, minimal changes in cover types would be expected. In the long term and in the absences of natural disturbance, shade-tolerant trees would continue to replace shade-intolerant tree species. Wildlife species associated with shade-intolerant stands would be adversely affected and wildlife species associate with shade-tolerant forest conditions would benefit.	In the short term, minimal changes in cover types would be expected. In the long term and in the absences of natural disturbance, shade-tolerant trees would continue to replace shade-intolerant tree species. Adverse cumulative effects to wildlife more closely associated with open forest conditions and shade-intolerant tree species would be anticipated over time.
		Action Alternative B	

	percent while western larch/Douglas-fir and western white pine cover types are underrepresented by 20.4 percent and 18.9 percent, respectively.	Proposed activities would result in cover type conversions on 1,580 acres. The majority of these stands are mixed-conifer cover types that would be converted to western white pine and western larch/Douglas-fir cover types, resulting in positive effects for wildlife species associated with shade-intolerant cover types. Habitat quality would be adversely affected for species that use forest cover types dominated by shade-tolerant tree species.	The proposed activities would generally benefit endemic wildlife species that evolved under historic disturbance regimes. However, benefits would generally be realized in the longer term due to the necessary time required for cover type conversions to occur. Cumulative effects would tend to be positive for species that use shade-intolerant cover types at the possible expense of those that benefit from an abundance of shade-intolerant types on the landscape.
		Action Alternative C	
		Proposed activities would result in cover type conversions on 1,701 acres. The majority of these stands are mixed-conifer cover types that would be converted to western white pine and western larch/Douglas-fir cover types, resulting in positive effects for wildlife species associated with shade-intolerant cover types. Habitat quality would be adversely affected for species that use forest cover types dominated by shade-tolerant tree species.	The proposed activities would generally benefit endemic wildlife species that evolved under historic disturbance regimes. However, benefits would generally be realized in the longer term due to the necessary time required for cover type conversions to occur. Cumulative effects would tend to be positive for species that use shade-intolerant cover types at the possible expense of those that benefit from an abundance of shade-intolerant types on the landscape.
Age Class	In the project area, low proportions of the seedling-	***No-Action Alternative A***	
		In the short term, no effects to age class would be expected. Over	In the short term, no effects to age class would be expected. Over time

The proposed activities could alter the representation of stand age classes on the landscape, which could adversely affect wildlife.	sapling (0 to 39-year) age class, excess in the poletimber (40 to 99-year) age class, and a slight overabundance of mature (100-years-plus) age classes occur compared to historic conditions. In the CEAA, seedling-sapling stands are underrepresented while pole timber stands are overrepresented and mature stands slightly underrepresented compared to historic conditions.	time and in the absence of natural disturbance, proportions of older to younger stands would increase. This would lead to an increasing deviation from historic distributions of age classes, potentially promoting a reduction in the level of available habitat over time for species associated with young forest conditions. Conversely, wildlife species associated with mature forest would benefit.	and in the absence of natural disturbance, proportions of older to younger stands would increase. This would increase habitat availability for wildlife species associated with older stands, but could promote a cumulative reduction in the level of available habitat over time for species associated with young forest conditions.
		Action Alternative B	
		Regeneration harvests would convert older-aged stands to the youngest age class on 1,523 acres. Stands greater than 150 years old would decrease by 1,522 acres causing further departures from historic proportions of older stands. Reductions in habitat could cause adverse effects to wildlife species that prefer mature forest conditions. Wildlife species that use young forests would benefit.	The proposed harvest would increase the availability of younger age classes by 1,523 acres, while decreasing the availability of mature stands. Post-harvest, the availability of young age classes would be slightly above historical proportions while the availability of old age classes would be below historic proportions. Cumulative effects to wildlife species would be slightly negative to species associated with older forest stands, but positive for species that use younger age classes.
		Action Alternative C	
		Regeneration harvests would convert older-aged stands to the	The proposed harvest would increase the availability of younger

		youngest age class on 982 acres, increasing consistency with historic conditions. Stands greater than 100 years old would continue to be lower than historic proportions. Reductions in habitat could cause adverse effects to wildlife species that prefer mature forest conditions. Wildlife species that use young forests would benefit.	age classes by 982 acres, while decreasing the availability of mature stands. Post-harvest, the availability of young age classes would be slightly above historical proportions while the availability of old age classes would be below historic proportions. Cumulative effects to wildlife species would be slightly negative to species associated with older forest stands, but positive for species that use younger age classes.
Old-Growth The proposed activities could affect wildlife species associated with old-growth forests by reducing the acreage of available habitat and by	The project area contains 2,637 acres of old-growth, which represents about 13.6 percent of the project area. The average patch size in the project area is 71 acres and there are 14 old-growth	***No-Action Alternative A***	
		In the short term, no changes to the amounts, quality, or spatial arrangement of old-growth would occur. In the long term and in the absence of natural disturbance, the availability and connectivity of old-growth wildlife habitat may increase as stands mature. No adverse direct, indirect, or cumulative effects to old-growth-associated wildlife species would be anticipated.	
		Action Alternative B	

increasing fragmentation.	patches ≥80 acres. The CEAA contains 8,310 acres of old-growth, representing 14.8 percent of the CEAA. Average patch size in the CEAA is 58 acres and there are 27 old-growth patches ≥80 acres.	Approximately 1,169 acres (44.3 percent) of the existing old-growth in the project area would be affected by the proposed activities. Of these acres, 397 acres would continue to provide old-growth habitat, although stand density would be reduced. The remaining 772 acres would not provide old-growth habitat for wildlife post-harvest. Average patch size would decrease to 45 acres and the number of old-growth patches ≥80 acres would decrease to 10. Moderate adverse direct and indirect effects to old-growth-associated wildlife species would be anticipated.	Approximately 1,169 acres (14.1 percent) of the existing old-growth in the CEAA would be affected by the proposed activities. Of these acres, 397 acres would continue to provide old-growth habitat, although stand density would be reduced. The remaining 772 acres would not provide old-growth habitat for wildlife post-harvest. Average patch size would decrease to 58 acres and the number of old-growth patches ≥80 acres would decrease to 27. Minor adverse cumulative effects to old-growth-associated wildlife species would be anticipated.
		Action Alternative C	
		Approximately 1,349 acres (51.2 percent) of the existing old-growth in the project area would be affected by the proposed activities. Of these acres, 999 acres would continue to provide old-growth habitat, although stand density would be reduced. The remaining 395 acres would not provide old-growth habitat for wildlife post-harvest.	Approximately 1,349 acres (16.2 percent) of the existing old-growth in the CEAA would be affected by the proposed activities. Of these acres, 999 acres would continue to provide old-growth habitat, although stand density would be reduced. The remaining 395 acres would not provide old-growth habitat for wildlife post-harvest. Average patch size would decrease

		Average patch size would decrease to 59 acres and the number of old-growth patches ≥80 acres would decrease to 12. Minor adverse direct and indirect effects to old-growth-associated wildlife species would be anticipated.	to 63 acres and the number of old-growth patches ≥80 acres would decrease to 29. Minor adverse cumulative effects to old-growth-associated wildlife species would be anticipated.
Habitat Connectivity and Fragmentation The proposed activities could result in disturbance or alteration of forested corridors and connectivity, which could inhibit wildlife movements.	In the project area, existing patch connectivity is high and 9,979 acres provide habitat that would facilitate movement of wildlife. The average patch size is 169 acres and approximately 148 miles of edge are present. In the CEAA, 35,574 acres provide habitat that would facilitate movement of wildlife. The average patch size is 169 acres and approximately 522 miles of edge are present.	***No-Action Alternative A***	
		No changes from existing conditions regarding forest connectivity or habitat fragmentation would be anticipated.	
		Action Alternative B	
		Tree density would be reduced on 2,537 acres of connective forest resulting in a 16.8 percent reduction in forest acres that provide habitat connectivity. Average patch size would be reduced to 117 acres, representing a 30.8 percent reduction from existing conditions. Forest edge would increase by 1 miles (0.7 percent). A moderate degree of adverse effects to wildlife species associated with interior forest would be anticipated.	Forest connectivity would be maintained along major drainages, ridges and riparian areas in the CEAA. Tree density would be reduced in 2,537 acres of connective forest resulting in a 4.7 percent reduction in connective forest. Average patch size would be reduced to 152 acres representing a 10.1 percent reduction from existing conditions. Forest edge would increase by 2 miles (0.4 percent). A minor degree of adverse effects to wildlife species associated with interior forest would be anticipated.
		Action Alternative C	
		Tree density would be reduced on 3,103 acres of connective forest resulting in a 15.1 percent	Forest connectivity would be maintained along major drainages, ridges and riparian areas in the

		reduction in forest acres that provide habitat connectivity. Average patch size would be reduced to 116 acres, representing a 31.4 percent reduction from existing conditions. Forest edge would be increased by 2 miles (1.4 percent). A moderate degree of adverse effects to wildlife species associated with interior forest would be anticipated.	CEAA. Tree density would be reduced in 3,103 acres of connective forest resulting in a 4.2 percent reduction in connective forest. Average patch size would be reduced to 151 acres representing a 10.7-percent reduction from existing conditions. Forest edge would increase by 3 miles (0.6 percent). A minor degree of adverse effects to wildlife species associated with interior forest would be anticipated.
WILDLIFE (continued)			
Linkage The proposed activities could increase open road densities, increase human developments, and reduce forested cover, which could adversely affect linkage habitat for wildlife.	Project area lands contribute to high quality linkage habitat. In the project area, 14,066 acres (72.4 percent) of vegetative hiding cover exist. Open road density within the project area is 0.6 linear miles per square mile. The CEAA contains approximately 44,400 acres of vegetative hiding cover. Highway 83 bisects the CEAA, but the density of open roads in the CEAA is relatively low at 0.7 linear miles per square mile. Existing human development is low in this area. Riparian	***No-Action Alternative A***	
		No effects to important linkage attributes, or wildlife linkage habitat would be anticipated.	
		Action Alternative B	
		Open roads would not increase. Restricted roads would increase by 12.8 miles. No additional human development would occur. Cover would be reduced on 2,555 acres and 1,636 acres would not provide vegetative cover for linkage post-harvest (12.0 percent of the project area); however, 63.6 percent would remain across the project area and ample cover would be retained in riparian areas. Moderate short-term and minor long-term negative effects to	Open roads would not increase. Restricted roads would increase by 14.2 miles. No additional human development would occur. Cover would be reduced on 2,555 acres and 1,698 acres would not provide vegetative cover for linkage post-harvest (3.8 percent of the CEAA); however, 64.8 percent would remain across the CEAA and ample cover would be retained in riparian areas. Moderate short-term and minor long-term negative effects to linkage habitat would be anticipated.

	areas and hiding cover are abundant.	linkage habitat would be anticipated.	
		Action Alternative C	
		Open roads would not increase. Restricted roads would increase by 16.0 miles. No additional human development would occur. Cover would be reduced on 3,078 acres and 1,442 acres would not provide vegetative cover for linkage post-harvest (10.5 percent of the project area); however, 64.8 percent would remain across the project area and ample cover would be retained in riparian areas. Moderate short-term and minor long-term negative effects to linkage habitat would be anticipated.	Open roads would not increase. Restricted roads would increase by 16.0 miles. No additional human development would occur. Cover would be reduced on 3,078 acres and 1,1,481 acres would not provide vegetative cover for linkage post-harvest (3,3 percent of the CEAA); however, 65.2 percent would remain across the CEAA area and ample cover would be retained in riparian areas. Moderate short-term and minor long-term negative effects to linkage habitat would be anticipated.
Grizzly Bear The proposed activities could result in reduction of hiding cover important for grizzly bears, which could result in: 1) increased displacement of grizzly bears, 2) avoidance of otherwise	Hiding cover exists on 72.4 percent of the DNRC managed state lands in the project area. Presently, hiding cover is fairly abundant (>40 percent) in each of the subunits within the CEAA.	***No-Action Alternative A***	
		No effects on hiding cover would be anticipated.	
		Action Alternative B	
		The proposed harvesting would remove 1,468 acres of hiding cover from the existing 14,167 acres of hiding cover in the project area. Proposed seed tree harvest units would be laid out to ensure that no point in a harvest unit would be greater than 600	Proposed activities within the CEAA would reduce the amount of hiding cover in the Porcupine Woodward Grizzly Bear Subunit by up to 4.2 percent. Similarly, the amount of hiding cover across all cooperators within the affected subunit would be reduced to approximately 70.1

suitable habitat, and or 3) increased risk of bear-human conflicts.		feet to cover. Thus, moderate adverse direct and indirect effects would be anticipated.	percent, which would exceed the 40-percent minimum threshold required in the *SVGBCA*. Thus, minor adverse cumulative effects would be anticipated.
		Action Alternative C	
		The proposed harvesting would remove 1,266 acres of hiding cover from the existing 14,167 acres of hiding cover in the project area. Proposed seed tree harvest units would be laid out to ensure that no point in a harvest unit would be greater than 600 feet to cover. Thus, moderate adverse direct and indirect effects would be anticipated.	Proposed activities within the CEAA would reduce the amount of hiding cover in the South Fork Lost Soup Grizzly Bear Subunit by up to 3.6 percent. Similarly, the amount of hiding cover across all cooperators within the affected subunit would be reduced to approximately 71.4 percent, which would exceed the 40-percent minimum threshold required in the *SVGBCA*. Thus, minor adverse cumulative effects would be anticipated.
The proposed activities could result in an increase in the density of open roads, which could cause increased displacement of grizzly bears and increased risk of bear-human conflicts.	Presently, the project area has roughly 12.3 miles of open roads and 6.3 miles of seasonally open roads. At the larger scale, between 20 and 30 percent of the grizzly bear subunits within the CEAA have an open-road density greater than 1 mile per square mile of open road.	***No-Action Alternative A***	
		No effects would be anticipated.	
		Action Alternatives B and C	
		No new open roads would be constructed; thus, no changes in open-road densities would be anticipated.	No changes in open-road amounts or densities would be anticipated; thus, no changes in open-road densities would be anticipated.
The proposed activities could result in a	Secure habitat currently exists on approximately 7.2 percent	***No-Action Alternative A***	
		No effects would be anticipated.	
		Action Alternative B	

decrease in secure areas for grizzly bears, which could cause increased displacement of grizzly bears and increased risk of bear-human conflicts.	of the project area, much of which are included in larger blocks of secure habitats that extend beyond the project-area boundary. The Grizzly Bear Subunits included in the CEAA have between 27 and 58 percent in secure habitat. On the DNRC managed portions, between 79 and 96 percent of the subunits included in the CEAA exceed 2 miles per square mile of total-road density.	Approximately 922 acres of secure habitat would be removed and 12.8 miles of new restricted roads would be built. An increase in total road densities and disturbance levels associated with commercial timber harvesting would be anticipated. Harvesting would alter 1,039 acres of spring habitat in the linkage zone, although vegetation would be retained on 767 acres to provide adequate hiding cover. Harvesting would not occur during the spring period, which would limit potential disturbance to grizzly bears during this important time. Thus, moderate adverse direct and indirect effects would be anticipated.	Harvesting, road clearing and road building in the CEAA would reduce secure habitat within the Porcupine Woodward Grizzly Bear Subunit from 8.8 to 4.1 percent (DNRC managed lands only). Proposed road construction would increase the total road density in the affected subunit by 0.5 percent. Harvesting would alter 1,039 acres of spring habitat in the linkage zone, although vegetation would be retained on 767 acres to provide adequate hiding cover. Harvesting would not occur during the spring period, which would limit potential disturbance to grizzly bears during this important time. Thus, moderate adverse cumulative effects would be anticipated.
		Action Alternative C	
		Approximately 932 acres of secure habitat would be removed and 16.0 miles of new restricted roads would be built. An increase in total road densities and disturbance levels associated with commercial timber harvesting would be anticipated. Harvesting would alter 1,124 acres of spring habitat in the linkage zone, although vegetation	Harvesting and associated road building in the CEAA would reduce secure habitat within the Porcupine Woodward Grizzly Bear Subunit from 8.8 to 4.1 percent (DNRC managed lands only). Proposed road construction would increase the total road density in the affected subunit by 1.0 percent. Harvesting would alter 1,124 acres of spring habitat in the linkage zone, although

		would be retained on 901 acres to provide adequate hiding cover. Harvesting would not occur during the spring period, which would limit potential disturbance to grizzly bears during this important time. Thus, moderate adverse direct and indirect effects would be anticipated.	vegetation would be retained on 901 acres to provide adequate hiding cover. Harvesting would not occur during the spring period, which would limit potential disturbance to grizzly bears during this important time. Thus, moderate adverse cumulative effects would be anticipated.
Canada Lynx The proposed activities could reduce landscape connectivity and the availability of suitable Canada lynx habitat, reducing the capacity of the area to support Canada lynx.	Approximately 15.356 acres of Canada lynx habitat occur in the project area. Most this habitat is winter foraging habitat (53.8 percent of available habitat). Approximately 3,200 acres of temporarily unsuitable habitat occurs in the project area. Similar habitat trends occur in the Lynx CEAA, which contains 40,171 acres of suitable habitat 10,836 acres of temporarily unsuitable habitat.	***No-Action Alternative A***	
		Lynx habitat availability and habitat connectivity would not change in the short term. In the longer term, natural succession would increase the availability of winter foraging habitat and other suitable habitat; however, in the absence of natural disturbance, the availability of summer foraging habitat would decrease. Connectivity may also increase in the long term due to increasing canopy cover over time.	
		Action Alternative B	
		Proposed activities would affect 2,782 acres (18.1 percent) of suitable lynx habitat in the project area. Post-harvest, 1,855 of these acres would be temporarily unsuitable for lynx use until canopy cover in the understory and overstory develops. Approximately 27.2 percent of the project area would be temporarily unsuitable for lynx use post-harvest. Thus, minor adverse direct and indirect effects would be anticipated.	Proposed activities would affect 2,782 acres (6.3 percent) of suitable lynx habitat in the CEAA. Approximately 24.9 percent of the CEAA would be temporarily unsuitable for lynx use post-harvest. Landscape connectivity would remain high due to the retention of travel corridors. Thus, minor adverse cumulative effects would be anticipated.

		Action Alternative C	
		Proposed activities would affect 3,217 acres (20.9 percent) of suitable lynx habitat in the project area. Post-harvest, 1,565 of these acres would be temporarily unsuitable for lynx use until canopy cover in the understory and overstory develops. Approximately 25.6 percent of the project area would be temporarily unsuitable for lynx use post-harvest. Thus, minor adverse direct and indirect effects would be anticipated.	Proposed activities would affect 3,217 acres (7.3 percent) of suitable lynx habitat in the CEAA. Approximately 24.3 percent of the CEAA would be temporarily unsuitable for lynx use post-harvest. Landscape connectivity would remain high due to the retention of travel corridors. Thus, minor adverse cumulative effects would be anticipated.
Fisher The proposed activities could reduce the availability and connectivity of suitable fisher habitat and increase human access, which could reduce habitat suitability and increase trapping mortality.	The project area contains approximately 9,829 acres of suitable fisher habitat (50.6 percent of project area), including 832 acres of riparian fisher habitat. The CEAA contains approximately 18,094 acres of suitable fisher habitat (50.2 percent of CEAA), including 1,491 acres of riparian fisher habitat.	***No-Action Alternative A***	
		The level of motorized access would not change and no additional risk associated with trapping would be expected. Little change to fisher habitat availability or connectivity would be anticipated in the short term. In the long term and in the absence of natural disturbance, fisher habitat suitability and connectivity may increase as stands age, the availability of large-diameter at breast height (dbh) trees increases, and mature canopy cover increases.	
		Action Alternative B	
		Approximately 2,433 acres of fisher habitat would be affected. Of these acres 1,610 (16.4 percent) of habitat in the project area would not be suitable for fisher	The availability of fisher habitat on DNRC managed lands in the CEAA would be reduced by 8.5 percent and fisher riparian habitat would not be removed. Landscape connectivity

		use post-harvest. Fisher riparian habitat would not be reduced. Motorized public access would not change, but 12.8 miles of restricted roads would be constructed, increasing accessibility of the area. Thus, moderate adverse direct and indirect effects would be anticipated.	would be reduced, but riparian corridors would remain intact. Thus, minor adverse cumulative effects would be anticipated.
		Action Alternative C	
		Approximately 2,857 acres of fisher habitat would be affected. Of these acres 1,610 (8.5 percent) of habitat in the project area would not be suitable for fisher use post-harvest. Fisher riparian habitat would not be reduced. Motorized public access would not change, but 16.0 miles of restricted roads would be constructed, increasing accessibility of the area. Thus, moderate adverse direct and indirect effects would be anticipated.	The availability of fisher habitat on DNRC managed lands in the CEAA would be reduced by 7.3 percent and fisher riparian habitat would not be removed. Landscape connectivity would be reduced, but riparian corridors would remain intact. Thus, minor adverse cumulative effects would be anticipated.
Pileated Woodpecker The proposed activities could reduce tree	The project area contains approximately 2,399 acres of suitable pileated woodpecker	***No-Action Alternative A***	
		None of the proposed forest-management activities would occur. In the short term, no changes to pileated woodpecker habitat would be anticipated. However, in the long term and in the absence of natural	

density and alter the structure of mature forest stands, which could reduce habitat suitability for pileated woodpeckers	habitat (12.3 percent of the project area) and the CEAA contains approximately 11,094 acres of suitable pileated woodpecker habitat (29.5 percent of CEAA).	disturbance, pileated woodpecker habitat availability and connectivity may increase due to natural succession and aging of timber stands.	
		Action Alternative B	
		The proposed activities would affect 848 acres of pileated woodpecker habitat. Of these acres, 552 acres would not be suitable for pileated woodpecker use post-harvest (23.0 percent of pileated woodpecker habitat in the project area). Important habitat attributes including snags and coarse woody debris would be retained according to (*ARM 36.11.411*); Thus, moderate adverse direct and indirect effects would be anticipated.	Approximately 848 acres of pileated woodpecker habitat would be affected by timber harvest. Of these acres, 552 acres would not be suitable for pileated woodpecker use post-harvest (5.0 percent of pileated woodpecker habitat in the CEAA). Important habitat attributes including snags and coarse woody debris would be retained according to (*ARM 36.11.411*); Thus, minor adverse cumulative effects would be anticipated.
		Action Alternative C	
		The proposed activities would affect 1,005 acres of pileated woodpecker habitat. Of these acres, 487 acres would not be suitable for pileated woodpecker use post-harvest (20.3 percent of pileated woodpecker habitat in the project area). Important habitat attributes including snags and coarse woody debris would be retained according to (*ARM 36.11.411*); thus, moderate adverse direct and indirect effects would be anticipated.	Approximately 1,005 acres of pileated woodpecker habitat would be affected by timber harvest. Of these acres, 487 acres would not be suitable for pileated woodpecker use post-harvest (4.4 percent of pileated woodpecker habitat in the CEAA). Important habitat attributes including snags and coarse woody debris would be retained according to (*ARM 36.11.411*); thus, minor adverse cumulative effects would be anticipated.

Big Game Winter Range The proposed activities could remove forest cover on important winter ranges, which could lower their capacity to support elk, mule deer, and white-tailed deer.	In the project area, elk winter range occurs on 1,398 acres (7.2 percent of the project area) and white-tailed winter range occurs on 5,019 acres (25.8 percent of the project area). Mule deer winter range is not present. Dense, forest cover is present on 149 acres and 471 acres of elk and white-tailed deer winter range, respectively. In the CEAA, elk winter range occurs on 3,328 acres (8.8 percent of CEAA) and white-tailed deer winter range occurs on 9,287 acres (24.7 percent of CEAA). Dense, forest cover is present on 317 acres and 2,109 acres of elk and white-tailed deer winter range, respectively.	***No-Action Alternative A***	
		None of the proposed forest-management activities would occur. No changes in disturbance levels would occur. In the short term, no change in the availability of thermal cover would occur. In the long term and in the absence of natural disturbance, thermal cover may increase as stands age and canopy cover increases.	
		Action Alternative B	
		The availability of thermal cover in the project area would be reduced by 0 percent and 17.6 percent within elk and white-tailed deer winter ranges, respectively. Mature-forest cover patches would remain well connected. Traffic would increase on approximately 6 miles of elk and 24.1 miles white-tailed deer winter range roads during harvesting. Thus, moderate adverse direct and indirect effects would be anticipated.	The availability of thermal cover in the CEAA would be reduced by 0 percent and 3.9 percent within elk and white-tailed deer winter ranges, respectively Mature-forest cover patches would remain well connected. Traffic would increase on approximately 18.6 miles of elk and 41.2 miles white-tailed deer winter range roads during harvesting. Thus, minor adverse cumulative effects would be anticipated. anticipated.
		Action Alternative C	
		The availability of thermal cover in the project area would be reduced by 20.1 percent and 24.2 percent within elk and white-tailed deer winter ranges, respectively. Mature-forest cover patches would remain well connected. Traffic would increase on approximately 6.7 miles of elk and 25.1 miles white-	The availability of thermal cover in the CEAA would be reduced by 9.7 percent and 5.4 percent within elk and white-tailed deer winter ranges, respectively. Mature-forest cover patches would remain well connected. Traffic would increase on approximately 19.3 miles of elk and 42.3 miles white-tailed deer winter range roads during

		tailed deer winter range roads during harvesting. Thus, moderate adverse direct and indirect effects would be anticipated.	harvesting. Thus, minor adverse cumulative effects would be anticipated. anticipated.
WILDLIFE (continued)			
Elk Security Habitat The proposed activities could remove elk security cover, which could affect hunter opportunity and the quality of recreational hunting in the local area.	In the project area, 3,925 acres of security habitat are present (20.2 percent of project area), falling below the recommended 30 percent amount (*Hillis et al. 1991*). In the CEAA 9,534 acres of security habitat are present (25.3 percent of CEAA), which falls below the recommended amount (*Hillis et al. 1991*).	***No-Action Alternative A***	
		No changes in elk security cover would be expected. No changes to accessibility of the project area for hunters would occur. Existing cover would continue to provide security habitat. In the long term and in the absence of natural disturbance, elk security habitat availability may increase due to natural succession of timber stands.	
		Action Alternative B	
		Approximately 1,698 acres of security habitat would be affected by the proposed activities. Of these acres, 1,544 acres would not provide security habitat post-harvest, reducing security habitat availability in the project area from 21.5 percent to 13.6 percent, which is below the recommended 30 percent threshold. Approximately 12.8 miles of permanent restricted road would be constructed. Thus, high adverse direct and indirect effects would be anticipated.	Approximately 1,698 acres of security habitat would be affected by the proposed activities and 1,572 of these acres would not provide security habitat post-harvest. Security habitat availability in the CEAA would decrease from 25.3 percent to 21.1 percent, which would further decrease availability of security habitat below recommended levels. Approximately 12.8 miles of permanent restricted road would be constructed. Thus, moderate cumulative effects would be anticipated.
		Action Alternative C	
		Approximately 1,948 acres of security habitat would be affected	Approximately 1,948 acres of security habitat would be affected by

		by the proposed activities. Of these acres, 1,236 acres would not provide security habitat post-harvest, reducing security habitat availability in the project area from 21.5 percent to 15.2 percent, which is below the recommended 30 percent threshold. Approximately 16.0 miles of permanent restricted road would be constructed. Thus, high adverse direct and indirect effects would be anticipated.	the proposed activities and 1,264 of these acres would not provide security habitat post-harvest. Security habitat availability in the CEAA would decrease from 25.3 percent to 22.0 percent, which would further decrease availability of security habitat below recommended levels. Approximately 16.0 miles of permanent restricted road would be constructed. Thus, moderate cumulative effects would be anticipated.
ECONOMICS			
Income	Three-county area economy relies on income in the forestry, logging, and wood-product-manufacturing sectors. State forest timber sales generate approximately 10 percent of income in the statewide timber market as measured by volume supplied.	***No-Action Alternative A***	
		$0 total income earned.	Cumulative income effects are limited by the scale of the initial project. Measuring cumulative income effects with any certainty is difficult.
		Action Alternative B	
		$8,857,756 total income earned in log markets prior to manufacturing.	Cumulative income effects are limited by the scale of the initial project. Measuring cumulative income effects with any certainty is difficult.
		Action Alternative C	
		$8,597,849 total income earned in log markets prior to manufacturing.	Cumulative income effects are limited by the scale of the initial project. Measuring cumulative

			income effects with any certainty is difficult.
Employment	The 3-county area economy relies on employment in the forestry, logging, and wood-product-manufacturing sectors. State forest timber sales support approximately 10 percent of employment in the statewide timber and lumber market as measured by volume supplied. How many jobs available in these sectors in the 3-county area are unknown. State labor statistics identify over 2,618 jobs in the wood-product-manufacturing sector, and 679 jobs in the forestry and logging sector statewide.	***No-Action Alternative A***	
		0 annual jobs supported by the proposed alternative	Cumulative employment effects are limited as more timber sales in the region are required to maintain employment in the forestry, logging, and wood-products-manufacturing sectors.
		Action Alternative B	
		208 annual jobs supported by the proposed alternative.	Cumulative employment effects are limited as more timber sales in the region are required to maintain employment in the forestry, logging, and wood-products-manufacturing sectors.
		Action Alternative C	
		202 annual jobs supported by the proposed alternative.	Cumulative employment effects are limited as more timber sales in the region are required to maintain employment in the forestry, logging, and wood-products-manufacturing sectors.
AIR QUALITY			
The proposed activities may adversely affect local air quality through dust produced from harvest activities, road building and	Air quality in the analysis area is generally excellent and has limited local emission sources and consistent wind dispersion throughout most of the year. Emissions do not affect local population	***No-Action Alternative A***	
		No effects anticipated.	
		Action Alternatives B and C	
		Direct and indirect effects to air quality are expected to be localized to the roadways and areas directly adjacent to the	Cumulative effects to air quality are not expected to exceed *EPA* and *DEQ* standards.

maintenance, and hauling.	centers, impact zones, or class 1 Areas beyond *U.S. Environmental Protection Agency* (*EPA*) and *DEQ* standards.	roadways. Vegetative barriers and abatement measures are expected to greatly limit the dispersion of particulate matter beyond those areas.	
The proposed activities may adversely affect local air quality through smoke produced from logging slash pile and prescribed burning.		***No-Action Alternative A***	
		No effects anticipated.	
		Action Alternatives B and C	
		Burning days would be controlled and monitored by *DEQ* and the smoke monitoring unit of the *Montana/Idaho Airshed Group* and would meet *EPA* standards; thereby, the direct and indirect effects of burning activities would be minimized.	Cumulative effects to air quality are not expected to exceed *EPA* and *DEQ* standards.
RECREATION			
The proposed activities may affect public motorized use, non-motorized uses, and hunting. The proposed activities may affect the revenue generated by recreational uses.	Several miles of open, seasonally restricted, and closed to public motorized access exist throughout the area. Big game species are currently abundant throughout both analysis areas, affording many hunting opportunities. Ongoing forest-management activities temporarily displace recreationists to areas free of management. Revenue is generated by a number of	***No-Action Alternative A***	
		No effects anticipated.	
		Action Alternatives B and C	
		No changes in open roads or motorized access would occur. A 17.8- to 25.8- percent increase in road miles would be available for public nonmotorized recreation in the project area. No adverse direct or indirect effects to hunting are expected. As a result of forest-management activities, direct and indirect effects to recreationists during the work week are expected to be moderate	Cumulative effects would result in increases in nonmotorized public access and further displacement of recreationists from active harvesting areas during typical business hours. Adverse cumulative effects are expected to be minor since recreationists would continue to have recreational opportunities throughout inactive subunits.

	recreational licenses throughout the area.	to high, while direct and indirect effects to those who recreate during the weekend are expected to be minimal. No changes in revenue-producing recreational licenses are expected.	
AESTHETICS			
Views The proposed activities may adversely affect local viewsheds and scenic vistas.	Several acres previously harvested and road miles are potentially visible from specific observation points, yet currently are inhibited by existing vegetative barriers in the foreground. The existing landscape has various modifications of vegetative textures, forms, lines, and colors affecting the visual quality of the area.	***No-Action Alternative A***	
		No effects anticipated.	
		Action Alternatives B and C	
		Direct and indirect effects to views as a result of harvest units and roads associated with the action alternatives are expected to be minor.	The contribution of visible harvested acres and new road miles under each action alternative as seen from each observation point would be minor in comparison to what exists currently throughout the landscape.
Noise levels The proposed activities may increase local noise levels.	Traffic, harvesting operations, road building, rock blasting, and gravel crushing produce noise throughout the area. Noise generated from these activities coincides with the rotational schedule required under the SVGBCA.	***No-Action Alternative A***	
		No effects anticipated.	
		Action Alternatives B and C	
		Direct and indirect effects to noise levels as a result of harvesting operations, harvest-related traffic, and gravel-pit operations associated with the action alternatives are expected to be moderate during the work week and minor during the weekend.	Except during periods of rock blasting and gravel crushing, cumulative effects to noise would not be expected to increase beyond current levels found in the cumulative-effects analysis area.

CHAPTER III – EXISTING ENVIRONMENT AND ENVIRONMENTAL EFFECTS

INTRODUCTION

This chapter is a summary of resource conditions as they relate to the proposed Wood Lion Multiple Timber Sale Project. The current, or existing, condition can be viewed as a baseline to compare changes resulting from the selection of any alternative. How each alternative may affect the environment is also described. For more complete assessments and analyses related to the resources for both scientific and judicial review, refer to the appropriate section of this DEIS.

VEGETATION ANALYSIS

INTRODUCTION

This analysis describes current vegetative conditions on Swan River State Forest and discloses the potential direct, indirect, and cumulative environmental effects that may result under each alternative associated with the proposed action.

ISSUES AND MEASUREMENT CRITERIA

Issues regarding the effects of harvesting activities on the various vegetation components were identified through public and internal scoping. These issues are listed in *TABLE I-I – ISSUES STUDIED IN DETAIL* and are reiterated at the beginning of each topic section (cover type, age class, etc). Various measurement criteria were utilized to evaluate the effects of the alternatives, depending on the vegetative component. The criteria used for evaluation are described under *ANALYSIS AREAS* and *ANALYSIS METHODS*, below.

ANALYSIS AREAS

Direct and Indirect Effects

The analysis area for the direct and indirect effects was examined at the nested scales of the entire Swan River State Forest and the project area *(see PROJECT AREA MAP* located before *CHAPTER I – PURPOSE AND NEED)*.

Considering effects at each nested scale is important because activities within 1 scale can influence all scales and effects at 1 scale may be unapparent or misleading in representation of effects at another scale.

Cumulative Effects

The analysis area used to assess cumulative effects includes all ownerships within the perimeter of Swan River State Forest. Lands adjacent to or within the perimeter of Swan River State Forest, such as the USFS, DFWP, and private lands will be addressed to the extent possible. While *DNRC* does not have adequate data to quantitatively discuss conditions or ownership changes on other lands in the analysis area, DNRC acknowledges that management actions on these other lands can have ecological effects to resources on DNRC managed lands; thus, these effects will be discussed qualitatively.

ANALYSIS METHODS

Effects to forest vegetation are described and analyzed in terms of cover type representation, age class distributions, old-growth amounts and attribute levels, patch dynamics, forest fragmentation, stand structure and vigor, crown cover, fire effects, the role of insects and diseases, sensitive plants, and noxious weeds. Specific methods used to analyze each of those attributes are further described in the following effects analyses.

Direct and Indirect Effects

Direct and indirect effects analyses for both the entire Swan River State Forest and project-level analysis area are presented throughout the *DEIS*. Much of the analysis uses data from DNRC's *SLI*. The *SLI* quantifies stand characteristics for all forest stands in Swan River State Forest and is

incorporated into DNRC's *Geographic Information System (GIS).* The *SLI* is updated annually to account for harvesting activities and periodically through reinventory. This process provides *DNRC* foresters with current data for use in analyses of proposed management activities.

Cumulative Effects

Since ongoing and future timber sales have not undergone postharvest inventory, effects of these sales are estimated in order to address cumulative effects under each analysis section. The timber sales listed in *RELEVANT PAST, PRESENT, AND REASONABLY FORESEEABLE ACTIONS* under *SCOPE OF THIS EIS* in *CHAPTER I* were considered along with the *SLI* database.

Activities on adjacent lands, such as USFS, DFWP, and private land will also be addressed to the extent possible.

FOREST ECOLOGY AND PAST MANAGEMENT

PAST MANAGEMENT

The first known harvest in Swan River State Forest took place in the early 1900s. All residual signs of the activities indicate that the harvest was very minimal in scope and acreage. Timber harvesting on a larger scale began in and adjacent to the project area during the 1960s. Most of the harvesting in the 1960s were regeneration harvests. Seedtree and clearcut harvesting between 1970 and 1992 have created 10 to 380 acre openings with dense regeneration. Signs of individual tree-selection harvests, skid trails, and stumps from logging that took place in the era from the 1960s to the 1980s are scattered throughout many of the stands. Several salvage projects have taken place in the project area since the 1990s, with several permits having been completed in the areas immediately within and adjacent to the project area. The White Porcupine Multiple Timber Sale project during 2009 through 2012 was the latest large timber sale project in the project area. Most harvested stands have regenerated successfully, either naturally or by planting, and are dominated by seral species. USFS and other privately held lands adjacent to the project area have also had timber harvesting within the CEAA.

STAND DEVELOPMENT

Natural processes of stand development and disturbance are influenced by environmental conditions and site characteristics, including landform, soil type, aspect, elevation, growing season (climate), and moisture availability. The interaction of these factors determines, in part, the plant species assemblage, productivity, and the disturbance regimes affecting a site.

Forest stands typically follow a repeated pattern of development, known as succession, where stand structure and species composition change through time. For example, the development of even-aged stands can be described in 4 stages (*Oliver and Larson, 1996*), beginning with a disturbance that initiates the development of a new stand of trees that colonize the site for several years (stand initiation). Following stand initiation, the new stand will enter a stem-exclusion stage where existing individual trees and species begin to express dominance over other trees and species in terms of height and diameter growth and new trees do not readily establish in the stand. Eventually, understory plants and shrubs will appear underneath the main forest canopy, including tree species tolerant of growing in shaded conditions (understory

reinitiation). Following understory reinitiation, the forest eventually reaches a steady-state phase where some overstory trees die and create canopy gaps, allowing trees growing in the understory to advance into the main forest canopy. At any point in stand development, a disturbance, such as wildfire, insects and diseases, windthrow, or human-caused activities, such as timber harvesting, may modify the existing stand's structure and species composition, interrupting the progression of stand development and returning the stand to a previous stage. Disturbance generally creates conditions favorable to shade-intolerant species, such as western larch, and the absence of disturbance generally promotes shade-tolerant species such as grand fir, western red cedar, and western hemlock. As such, shade-intolerant species typically dominate the early stages of stand development; therefore, in the absence of disturbance, shade-tolerant species typically dominate the later stages of stand development.

Many of the stands proposed for harvesting in the project area follow this model of stand development and are in the understory reinitiation and steady-state phases. Proposed treatments would attempt to emulate naturally occurring disturbance patterns and, in most cases, would retain stands in or return stands to earlier stages of succession dominated by shade-intolerant species.

FOREST HABITAT TYPES

Similar sites will often share similar plant communities, succession, and disturbance patterns. Repeated patterns of similar site conditions and plant species assemblages have been used to develop classifications of forest habitat types (*Pfister et al.* 1977) that describe the potential vegetation communities, patterns of succession (stand development), and potential productivity of similar sites. Forest habitat types do not necessarily describe the current vegetation on a site because they describe the potential vegetation community that could develop and perpetuate itself on a site in the absence of disturbance. For that reason, the habitat type identified for a given site will not change following disturbance, including timber harvesting.

While minor differences in plant communities and site productivity exist among similar forest habitat types, many share similar naturally occurring disturbance patterns, such as the way fire behaves and affects those habitat types, and, as such, can be arranged into broad groups *(Fischer and Bradley 1987).* Swan River State Forest is dominated by warm and moist (approximately 65 percent) and cool and moist (approximately 20 percent), with significantly lesser amounts of the other groups. *TABLE III-1 ACRES BY HABITAT-TYPE GROUP* shows the distribution of habitat type groups across Swan River State Forest and within the project area.

TABLE III-1 – ACRES BY HABITAT-TYPE GROUP.

HABITAT TYPE GROUP	SWAN RIVER STATE FOREST		PROJECT AREA	
	ACRES	PERCENT OF TOTAL	ACRES	PERCENT OF TOTAL
Cold	90	0.2	0	0
Moderately warm and dry	3,006	5.5	11	0.0
Moderately cool and dry	346	0.6	20	0.1

Warm and moist	34,413	63.4	13,953	75.1
Cool and moist	11,668	21.5	3,700	19.9
Wet	1,192	2.2	215	1.2
Moderately cool and moist	686	1.3	169	0.9
Cool and moderately dry	2104	3.9	461	2.5
Cold and moderately dry	763	1.4	61	0.3
Totals	***54,267***	***100***	***18,589***	***100***
Non-forested	2,045	N/A	847	N/A

**numbers may not sum to total due to rounding*

ELEVATION AND ASPECT

Elevation and aspect interact to influence the moisture and temperature of a stand, and, therefore, the plant species capable of growing there. The project area ranges in elevation from 3,120 to 6,800 feet. The project area has a mix of steep and broken topography, as well as flat or gently rolling terrain; consequently, a wide range of sites of both moisture and temperature gradients (from wet to dry and cool to warm) are found in the project area. Cooler, wetter stands typically develop overstories of western white pine, western larch, Douglas-fir, grand fir, western red cedar, Engelmann spruce, lodgepole pine, and subalpine fir, while warmer and dryer sites are likely to have components of ponderosa pine, Douglas-fir, western larch, and lodgepole pine.

FOREST COVER TYPES AND DESIRED FUTURE CONDITIONS

Issue: The proposed activities may affect forest cover types through species removal or changes in species composition.

EXISTING ENVIRONMENT

Cover types describe the species composition of forest stands. Cover type representation often varies according to the frequency of disturbances. Some early seral species dominated types, such as ponderosa pine, reflect a frequent low-intensity disturbance that helps perpetuate the shade-intolerant ponderosa pine. Other cover types, such as mixed conifer, are indicative of infrequent and more severe disturbance regimes, and are typically found in the later stages of stand development.

The protocol used to assign cover types on DNRC managed forest lands, including Swan River State Forest, is explained in detail in *Forest Management Rules (36.11.401* through *406 ARM).* The methods used to analyze current and desired stand conditions are described below.

This cover type analysis compares current stand conditions and desired future conditions in terms of forest-species composition. Tracking expected changes in the amount of preharvest and

postharvest acreage in specific cover types helps to describe project effects to forest vegetation and track movement toward or away from desired future conditions.

Current conditions and desired future conditions are defined using DNRC's site-specific *SLI* (*SRSF_SLI_Final*). The DNRC site-specific model (*ARM 36.11.405*) was used to determine the characteristics of the desired future conditions and to evaluate potential direct, indirect, and cumulative effects. This model assigns a desired future condition in terms of cover type for each stand identified in the *SLI*. At the administrative unit level, the aggregate acreage of each desired future cover type describes a broad picture of the desired future conditions for that unit. This provides a basis for comparison of current and desired future conditions at both the project and landscape (administrative unit) levels. Field observations and tree data collected between the spring of 2015 through the fall of 2016 were used to verify and further refine descriptions of specific forest stand characteristics in the project area.

Compared to desired future conditions, the western larch/Douglas-fir and western white pine cover types are currently underrepresented on Swan River State Forest and within the project area. Western larch and Douglas-fir are preferred timber species that were often removed by partial or selective harvest methods that failed to provide suitable conditions for regenerating the species. Additionally, a lack of natural disturbances has prevented regeneration of western larch across much of Swan River State Forest, particularly in the dense old stands common throughout the project area, and has resulted in a shift in dominance from the shade-intolerant species like western larch and Douglas-fir toward the shade-tolerant species like grand fir and western red cedar.

Data for Swan River State Forest indicates that the extent of the western white pine cover type is considerably lower than that which occurred historically. White pine blister rust has drastically affected western white pine, reducing its representation to less than 10 percent of its historical range *(Fins et al. 2001).* The number of healthy western white pine that occupy the canopy as overstory dominants has been declined across its range for several decades despite multi-organization cooperative efforts to restore this species on the landscape.

TABLE III-2 - CURRENT COVER TYPE AND DESIRED FUTURE CONDITIONS FOR SWAN RIVER STATE FOREST AND THE PROJECT AREA.

COVER TYPE	SWAN RIVER STATE FOREST				
	CURRENT (ACRES)	PERCENT OF TOTAL	DESIRED FUTURE CONDITION (ACRES)	PERCENT OF TOTAL	*DIFFERENCE (PERCENT)*
Ponderosa pine	2,394	4.4	3,649	6.7	-2.3
Douglas-fir	2,485	4.6	1412	2.6	2
Western larch/ Douglas-fir	10,550	19.4	21,604	39.8	-20.4
Western white pine	3,405	6.3	13,652	25.2	-18.9

Lodgepole pine	2,377	4.4	2,154	4	0.4
Mixed conifer	26,940	49.6	9,232	17	32.6
Subalpine fir	5,450	10	2,431	4.5	5.6
Nonstocked	473	0.9	0	0.0	0.9
Hardwoods	194	0.4	134	0.2	0.1
Totals	***54,267***	***100.0***	***54,267***	***100.0***	N/A
Non-forested	2,045	N/A	2,045	N/A	N/A

**numbers may not sum to total due to rounding*

WOOD LION PROJECT AREA					
COVER TYPE	**CURRENT (ACRES)**	**PERCENT OF TOTAL**	**DESIRED FUTURE CONDITION (ACRES)**	**PERCENT OF TOTAL**	***DIFFERENCE (PERCENT)***
Ponderosa pine	42	0.2	18	0.1	0.1
Douglas-fir	295	1.6	254	1.4	0.2
Western larch/ Douglas-fir	3,316	17.8	7,146	38.5	-20.6
Western white pine	1,994	10.7	5,659	30.4	19.7
Lodgepole pine	1,204	6.5	1,204	6.5	0
Mixed conifer	10,101	54.4	3,459	18.6	35.7
Subalpine fir	1,466	7.9	769	4.1	3.8
Nonstocked	69	0.4	0	0.0	0.4
Hardwoods	101	0.5	80	0.4	0.1
Totals	***18,589***	***100.0***	***18,589***	***100.0***	**N/A**
Non-forested	847	N/A	847	N/A	N/A

**numbers may not sum to total due to rounding*

ENVIRONMENTAL EFFECTS

Direct and Indirect Effects

- ***Direct and Indirect Effects of No-Action Alternative A to Cover types***

The amount of western larch/Douglas-fir and western white pine cover types would remain lower than *DNRC's* identified desired future conditions amounts. Shade-tolerant species would continue to regenerate under closed-canopied forests. Over time, early seral-dominated cover types, such as western larch/Douglas-fir and western white pine, would be expected to decrease, and shade-tolerant cover types, such as mixed conifer, would increase.

Forest succession, driven by the impacts of forest insects and diseases when fires are being suppressed, would reduce the variability of cover types. As the forest ages and composition become more homogenous, biodiversity would be reduced.

- ***Direct and Indirect Effects of Action Alternative B to Cover types***

- This alternative proposes using the following silvicultural treatments:
  - commercial thin on 365 acres,
  - old-growth maintenance on 278 acres,
  - overstory removal on 353 acres,
  - clear cut on 47 acres,
  - group select on 208 acres,
  - seedtree on 1,340 acres,
  - shelterwood on 111 acres,
  - uneven aged management on 97 acres, and
  - post and pole on 148 acres.
- Approximately 1513 acres of the mixed-conifer cover type would be converted to the following cover types:
  - 721 acres of western larch/Douglas-fir,
  - 717 acres of western white pine, and
  - 75 acres of lodgepole pine.
- Approximately 130 acres of the western larch/Douglas-fir cover type would be converted to the following cover types:
  - 30 acres of lodgepole pine, and
  - 100 acres of western white pine.
- Approximately 99 acres of subalpine fir would be converted to western larch/Douglas-fir.
- Approximately 40 acres of the western white pine cover type would be converted to the following cover types:
  - 23 acres of mixed conifer, and
  - 17 acres of western larch/Douglas-fir.
- Approximately 22 acres of the lodgepole pine cover type would be converted to the following cover types:
  - 9 acres of mixed conifer, and
  - 13 acres of western larch/Douglas-fir.
- Other minor amounts (less than 5 acres) of cover type conversions would also occur.
- No change in cover type would be expected following harvesting on approximately:
  - 472 acres of western larch/Douglas-fir,
  - 259 acres of the mixed conifer,
  - 232 acres of subalpine fir,
  - 142 acres of the western white pine, and
  - 38 acres of lodgepole pine.

- ***Direct and Indirect Effects of Action Alternative C to Cover Types***

- This alternative proposes using the following silvicultural treatments:
  - commercial thin on 412 acres,
  - old-growth maintenance on 550 acres,
  - overstory removal/commercial thin on 61 acres,
  - over story removal on 179 acres,
  - clear cut on 20 acres,
  - seedtree on 866 acres,
  - shelterwood on 416 acres,
  - single-tree selection on 111 acres,
  - post and pole on 148 acres,
  - uneven aged management on 334 acres, and
  - group select on 229 acres.
- Approximately 1,633 acres of the mixed-conifer cover type would be converted to the following cover types:
  - 864 acres of western white pine,
  - 759 acres of western larch/Douglas-fir, and
  - 10 acres of lodgepole pine.
- Approximately 186 acres of the western larch/Douglas-fir cover type would be converted to the following cover types:
  - 175 acres of western white pine, and
  - 11 acres of lodgepole pine.
- Approximately 44 acres of the western white pine cover type would be converted to the following cover types:
  - 28 acres of mixed-conifer, and
  - 16 acres of western larch/Douglas-fir.
- Approximately 134 acres of the subalpine fir cover type would be converted to the following cover types:
  - 96 acres of western larch/Douglas-fir, and
  - 38 acres of mixed-conifer.
- Approximately 14 acres of lodgepole pine would be converted to western larch/Douglas-fir.
- Other minor amounts (less than 5 acres) of cover type conversions would also occur.
- No change in cover type would be expected following harvesting on approximately:
  - 501 acres of western larch/Douglas-fir,
  - 279 acres of the mixed conifer,
  - 309 acres of subalpine fir,
  - 37 acres of lodgepole pine,
  - 175 acres of the western white pine, and
  - 14 acres of Douglas-fir.

TABLE III-3 – COVER TYPE CHANGE BY ACTION ALTERNATIVES FOR THE PROJECT AREA AND SWAN RIVER STATE FOREST.

COVER TYPE	ACTION ALTERNATIVES					
	B			C		
	CHANGE IN ACREAGE	CHANGE IN PERCENT		CHANGE IN ACREAGE	CHANGE IN PERCENT	
		PROJECT AREA	SWAN RIVER STATE FOREST		PROJECT AREA	SWAN RIVER STATE FOREST
Western larch/Douglas-fir	720	3.9	1.3	699	3.8	1.3
Western white pine	777	4.2	1.4	995	5.4	1.8
Mixed Conifer	-1,481	-8.0	-2.7	-1,567	-8.4	-2.9
Lodgepole pine	83	0.4	0.2	7	0.1	0.0
Subalpine fir	-99	-0.5	-0.2	-134	-0.7	-0.2

**Change in percent for the project area and The Swan River State Forest were calculated using the forested acres.*

Cumulative Effects

- ***Cumulative Effects of No-Action Alternative A to Cover Types***

The cumulative effects of recent forest management on Swan River State Forest have resulted in a trend of increasing early seral cover types across areas where management has occurred. For example, planting in selective units on the Three Creeks, White Porcupine, and Scout Lake timber sale projects increased the western larch/Douglas-fir and western white pine cover types on Swan River State Forest. In areas where management has not occurred, proportions of shade-tolerant species and late-seral cover types tend to be increasing.

Timber sales in the Cilly Cliffs Multiple Timber Sale Project have been sold and are in the process of being harvested. These treatments will continue the trend of increasing seral cover types and decreasing late-successional cover types across areas where management occurred. The post-treatment cover types of these stands have been incorporated into the current cover type amounts.

Based on aerial-photograph interpretation on a landscape basis, the cumulative effects to cover type distributions trend typically is late seral species in old stands and a mosaic of early to late seral species in younger or treated stands, the results being dependent on the residual timber, harvest prescription, and postharvest treatments. Development plans on small, private landholdings could result in a decrease in cover types as forested land is converted to non-forested land.

- ***Cumulative Effects of Action Alternatives B and C to Cover Types***

The cumulative effects of the action alternatives would be similar to those seen in No-Action Alternative A; however, in general, the result would be a greater increase in early seral cover

types across areas where management occurs.

AGE CLASS

Issue: The proposed activities may affect forest age classes through tree removal.

EXISTING ENVIRONMENT

The distribution of forest age classes is another characteristic important for determining trends on a landscape level. Age class distributions both influence and are influenced by cover type representation and disturbance regimes, both of which vary over the landscape in relation to prevailing climatic conditions of temperature and moisture.

The climatically and physiographically defined "*Upper Flathead Section*" (*M333C*) of the larger, vegetation-defined "*Northern Rocky Mountain Forest-Steppe-Coniferous Forest–Alpine Meadow Province*" (*Province M333*) (*Bailey et al. 1994*) was utilized as a reference for the historical forest conditions in Swan River State Forest and the project area. Historic conditions of age classes and cover types were quantified by *Losensky (1997*), who used forest inventory data from the 1930s to estimate the historic proportion of age classes by forest cover type for Montana. This provided an estimate of age class distribution and stand composition prior to Euro/American settlement and the effects of fire suppression, selective logging, cattle and sheep grazing, and the full impact of white pine blister rust. Although the data was collected at a specific point in time, this data represents the best baseline available for assessing differences between the current and past age class distributions.

A comparison of the current age class distribution for the Swan River State Forest with the historical age class distribution of the *Upper Flathead Climatic Section* (*M333C*), is shown in *TABLE III-4 – HISTORIC, CURRENT, AND POSTHARVEST AGE CLASS DISTRIBUTIONS FOR SWAN RIVER STATE FOREST.* The Current seedling-sapling (0 to 39 year) age class compared to historic conditions, while the current poletimber (40 to 99 year) age class is greater compared to historic conditions. The mature (100 years plus) age classes are slightly less (46% vs. 51%) when compared to historic amounts for the climatic section(*TABLE III-4*).

TABLE III-4 – HISTORIC, CURRENT, AND POSTHARVEST AGE CLASS DISTRIBUTIONS FOR SWAN RIVER STATE FOREST.

	M333C (HISTORIC PERCENT)	CURRENT		ALTERNATIVE B (POSTHARVEST)		ALTERNATIVE C (POSTHARVEST)	
		ACRES	PERCENT	ACRES	PERCENT	ACRES	PERCENT
0 to 39	22	7,632	14.1	9,373	17.2	8,694	16
40 to 99	13	21,555	39.7	21,340	40.1	21,474	39.6
100 to 149	22	11,359	20.9	10,762	19.8	10,846	20
150 plus[1]	29	5,411	10	5,255	9.7	5,338	9.8
Old-growth[2]	N/A	8,310	15.3	7,537	13.9	7,915	14.6
Nonstocked	14	0	0	0	0	0	0
Totals	*100*	***54,267***	*100*	***54,267***	*100*	***54,267***	*100*
Non-forested	N/A	2,045	N/A	2,045	N/A	2,045	N/A

[1] *Losensky's (1997) report for Climatic Section M333C does not include 100 to 149 years, 150-years-plus, and old-growth categories, but instead categorizes mature stands in 2 categories: 100 year old stands and "old stands". Ponderosa pine, Douglas-fir, and western larch/Douglas-fir stands greater than 170 years, western white pine and mixed-conifer stands greater than 180 years, and lodgepole pine stands greater than 140 years were classified as "old stands".*

[2]*Current old-growth stands would be considered a subset of primarily the historical 150 plus age class, with small portions in the historical 100 to 149 age class.*

**numbers may not sum to total due to rounding*

Comparing the current distribution of age classes in the project area to the historical data for *Section M333C* demonstrates a lower proportion in the seedling-sapling (0 to 39 year) age class, a higher proportion in the poletimber (40 to 99 year) age class, and a lower proportion of mature (100 years plus) age classes (*TABLE III-5 – HISTORIC, CURRENT, AND POSTHARVEST AGE CLASS DISTRIBUTIONS FOR THE PROJECT AREA*). The difference between the project area and Swan River State Forest distributions is due to interaction of spatial scale and the acquisition of former Plum Creek lands that are predominantly in younger age classes. The acquisition of those lands increased the number of acres and proportion of Swan River State Forest that is in younger age classes, resulting in a corresponding decrease in the percentage of mature age classes on the forest.

TABLE III-5 – HISTORIC, CURRENT, AND POSTHARVEST AGE CLASS DISTRIBUTIONS FOR THE PROJECT AREA.

AGE CLASS	M333C (HISTORIC PERCENT)	CURRENT		ALTERNATIVE B (POSTHARVEST)		ALTERNATIVE C (POSTHARVEST)	
		ACRES	PERCENT	ACRES	PERCENT	ACRES	PERCENT
0 to 39	22	3,698	19.9	5,439	29.3	4,760	25.6
40 to 99	13	8,242	44.3	8,027	43.2	8,161	43.9
100 to 149	22	3,066	16.5	2,469	13.3	2,553	13.7
150 plus[1]	29	947	5.1	791	4.3	874	4.7
Old-growth[2]	N/A	2,637	14.2	1,864	10	2,242	12.1
Nonstocked	14	0	0	0	0	0	0
Totals	*100*	***18,589***	*100*	***18,589***	*100*	***18,589***	*100*
Nonforested	N/A	847	N/A	847	N/A	847	N/A

[1] *Losensky's (1997) report for Climatic Section M333C does not include 100 to 149 years, 150-years-plus, and old-growth categories, but instead categorizes mature stands in 2 categories: 100 year old stands and "old stands". Ponderosa pine, Douglas-fir, and western larch/Douglas-fir stands greater than 170 years, western white pine and mixed-conifer stands greater than 180 years, and lodgepole pine stands greater than 140 years were classified as "old stands".*

[2]*Current old-growth stands would be considered a subset of primarily the historical 150 plus age class, with small portions in the historical 100 to 149 age class.*

**numbers may not sum to total due to rounding*

ENVIRONMENTAL EFFECTS

Direct and Indirect Effects

- ***Direct and Indirect Effects of No-Action Alternative A to Age Classes***

No immediate change in the proportion of existing age classes is expected unless a large disturbance, such as a wildfire, occurs. Forest succession, driven by the impacts of forest insects

and diseases when fires are being suppressed, would reduce the variability of age classes. As the forest ages and its composition becomes more homogenous, biodiversity would be reduced.

- ***Direct and Indirect Effects of Action Alternative B to Age Classes***

The proposed seedtree, over story removal, and clearcut treatments with this alternative would regenerate approximately 1,741 acres, converting these acres to the 0 to 39 year age class. Of this, 773 acres would be converted from the old-growth age class, 156 acres from the 150 year plus age class, 597 acres from the 100 to 149 year age class, and 215 acres from the 40 to 99 year age class. These treatments and subsequent planting or natural regeneration would increase the proportion of the 0 to 39 year age class on Swan River State Forest by 3.1 percent and in the project area by 8.9 percent, or 1,741 acres. Older age classes (old-growth and 150 year plus) would decrease by 929 acres, or 1.6 percent on Swan River State Forest and 4.8 percent in the project area (*TABLE III-4* and *TABLE III-5*).

Of the other stands proposed for treatment under this alternative, approximately 395 acres would remain in the old-growth age class, 180 acres would remain in the 150 year plus age class, 211 acres would remain in the 100 to 149 year age class, 407 acres would remain in the 40 to 99 year age class, and 14 acres would retain the 0 to 39 year age class.

- ***Direct and Indirect Effects of Action Alternative C to Age Classes***

The proposed seedtree, over story removal, and clearcut treatments with this alternative would regenerate approximately 1,062 acres, converting these acres to the 0 to 39 year age class. Of this, 395 acres would be converted from the old-growth age class, 73 acres from the 150 year plus age class, 513 acres from the 100 to 149 year age class, and 81 acres from the 40 to 99 year age class. These treatments and subsequent planting or natural regeneration would increase the proportion of the 0 to 39 year age class on Swan River State Forest by 1.9 percent and in the project area by 5.7 percent, or 1,062 acres. Older age classes (old-growth and 150 year plus) would decrease by 468 acres, or 0.9 percent on Swan River State Forest and 2.5 percent in the project area (*TABLE III-4* and *TABLE III-5*).

Of the other stand proposed for treatment under this alternative, approximately 954 acres would remain in the old-growth age class, 212 acres would remain in the 150 year plus age class, 385 acres would remain in the 100 to 149 year age class, 695 acres would remain in the 40 to 99 year age class, and 15 acres would retain the 0 to 39 year age class.

Cumulative Effects

- ***Cumulative Effects of No-Action Alternative A to Age Classes***

The cumulative effects to age class distributions due to previous forest-management activities on Swan River State Forest are represented in descriptions of the current age class distribution. Generally speaking, those effects have reduced the proportion of older age classes while increasing the proportion in younger age classes, particularly the 0 to 39 year age class. For example, the Three Creeks, White Porcupine, and Scout Lake timber sale projects increased the 0 to 39 year age class on Swan River State Forest through timber harvesting and planting in selected units.

Timber sales in the Cilly Cliffs Multiple Timber Sale Project have been sold and are in the

process of being harvested. The post treatment age classes of these stands have been incorporated into the current age class amounts. These treatments will continue the trend of increasing the 0 to 39 year age class and decreasing older age classes across areas where management occurs.

Based on aerial-photograph interpretation on a landscape basis, the cumulative effects to age class distributions due to previous activities on USFS, DFWP, as well as privately held ground adjacent to Swan River State Forest, have been a reduction in the acres of the older age classes and an increase in the acres of the younger age classes. Although the condition appears to be mostly 0 to 39 year old and 40 to 99 year old age classes, a mix of older age classes is also apparent, mostly on the USFS lands and also on private lands in the floodplain of the Swan River.

- ***Cumulative Effects of Action Alternatives B and C to Age Classes***

The cumulative effects of the action alternatives would be similar to those seen under No-Action Alternative A; however, the result would be a greater increase in the 0 to 39year-old age class across areas where even-aged management would occur.

OLD-GROWTH

Issue: The proposed activities may affect old-growth amounts and quality through tree removal.

Old-Growth Definition

DNRC defines old-growth as stands that meet minimum criteria for number, size, and age of trees per acre for a given combination of cover type and forest habitat-type group. The definitions are adopted from those presented by *Green et al. (1992)*. DNRC's definition has evolved over the years; previous analysis may appear to contradict the analysis presented in this *DEIS* because of that evolution.

Historic Estimates of Old-Growth

Many previous efforts have been made to estimate the historical amounts of old-growth in Swan Valley. The following approaches have been used:

- DNRC estimated the quantity of old-growth that may have existed historically (*Montana DNRC 2000*). Results suggested that, given the definition used in the analysis, approximately 22 percent of Swan River State Forest represents the expected amount of naturally occurring old-growth.
- *FNF Plan Amendment 21 (1998)* estimated that 29 percent of low-elevation forests on the *Flathead National Forest* was old-growth, 8 percent of mid-elevation forest was old-growth, and none of the high-elevation forest was old-growth, as derived from historic surveys (*Ayers 1898, 1899*). Using various sources of information, the *FNF Amendment 21* also estimated that old-growth in *Flathead National Forest* had a historical range of variability from 15 to 60 percent. Using a computer modeling process, *Flathead National Forest e*stimated that approximately 36 percent of Swan Valley existed as late-seral forest; however, not all late-seral stands would qualify as old-growth.
- *Lesica (1996),* in an effort to use fire history to estimate the proportions of old-growth forests in Swan Valley, estimated that approximately 52 percent of the area was occupied by stands

that were 180 years or older. *Lesica* used stand age as a surrogate for old-growth in his mathematically derived estimations.

- Using cover type conditions and historical data from the 1930s (*Losensky 1997*), 29 percent of the forested acres in the *Upper Flathead Climatic Section* were estimated to have historically been occupied by stands 150 years and older and contained a minimum of 4 Mbf/acre (*South Fork Lost Creek FEIS, 1998*).
- *Hart (1989)* indicated that approximately 48 percent of the area represented in the 1930s stand data for the Seeley and Swan valleys had forests with a significant component of trees older than 200 years.

Therefore, using a wide variety of old-growth definitions, the estimates of the historic amount of old-growth on Swan River State Forest suggest a range from 15 to 60 percent. The estimates above are primarily age-based estimates that do not consider the other attributes, such as number of snags or coarse woody debris, often deemed necessary to call a stand old-growth. The lack of additional old-growth attributes in many of the old-growth definitions results in overestimated amounts of old-growth compared to other old-growth definitions that include additional attribute thresholds. For example, only DNRC's estimate has any criteria related to the size and number of large trees per acre, leading one to the conclusion that old-growth would necessarily be lower than the other estimates provided because not all old stands, late-seral stands, or modeled stands would have sufficient numbers of large live trees to meet DNRC's old-growth definition.

Estimates presented defined old-growth in a variety of ways and none of them represent estimates based on the *Green et al. (1992)* definition that DNRC currently uses; most provide estimates that are higher than they would be if they included additional attribute criteria.

Based on available estimates, the amount of old-growth on Swan River State Forest is currently within the historically-occurring range.

Relationship to the Sustainable Yield Calculation

State law directs the DNRC to sell a consistent amount of timber each year, as determined by a sustainable yield calculation. As defined in *77-5-221 MCA* and pursuant to *77-5-222* and *223 MCA*, DNRC, under the direction of the State Board of Land Commissioners (Land Board), is required to commission an independent third party to calculate the annual sustainable yield for forested trust lands at least once every 10 years. Sustainable yield is defined as "the quantity of timber that can be harvested from forested state trust lands each year in accordance with all applicable state and federal laws, including but not limited to the laws pertaining to wildlife, recreation, and maintenance of watersheds, and in compliance with water quality standards that protect fisheries and aquatic life and that are adopted under the provisions of Title 75, chapter 5, taking into account the ability of state forests to generate replacement tree growth." The most recent sustainable yield calculation was completed by the natural resources consulting firm Mason, Bruce, and Girard and approved by the Land Board in September 2015.

On forested Trust Lands, DNRC's management activities are guided by the standards and philosophy of the *SFLMP*, associated Administrative Rules (ARM), and DNRC's Forested State

Trust Lands Habitat Conservation Plan (HCP). In the context of calculating annual sustainable yield, the requirements set forth by SFLMP, ARM, and HCP were applied as management constraints in an optimization model used to calculate the annual sustainable yield. Constraints are limitations placed on the model that restrict when, where, which, and how often harvesting treatments may be applied. The 2015 calculation included constraints related to operability, wildlife habitat, water resources, and timber harvest and silviculture—including old-growth.

The old-growth constraint modeled in the 2015 calculation required that each administrative unit within the Northwestern and Southwestern Land Offices maintain at least 8% of their acres as old-growth (4% for units in the Central Land Office). The model was constrained in a manner that required units below the target old-growth percentage to be managed in a manner to meet the target percentage as soon as possible, and that units above the target percentage would remain above that target percentage over time. Units that currently have less than 8% old-growth were required to manage an amount of non-old-growth acres needed to reach 8% using management pathways that would facilitate their development into old-growth stands. The constraint prohibited the selection of existing old-growth stands for regeneration harvesting that would remove them from old-growth status until the administrative unit had at least 8% old-growth. In all units, regardless of whether they were above or below the 8% threshold, old-growth maintenance and restoration treatments that would maintain a stand's old-growth status could be used in existing old-growth stands. This method of constraining the model ensured that the intended old-growth amount for each unit was met as quickly as possible and then maintained over time.

At the current annual sustainable harvest level of 56.9 MMBF, the model indicates that meeting and maintaining these objectives for old-growth on state trust lands is achievable.

ANALYSIS METHODS

Old-Growth Distribution

The analysis of old-growth distribution relies on DNRC's *SLI* and ocular observations in the field. The *SLI* was queried to select stands meeting the age, DBH, and large-tree criteria for old-growth based on habitat-type groups (see *GLOSSARY* for *DNRC's* old-growth definition). Field surveys were employed to verify the old-growth status of selected stands and determine if additional stands meet the old-growth definition in the project area.

Old-Growth Attributes

Using the *SLI,* attribute levels in the old-growth stands are described and analyzed for preharvest and postharvest conditions. The diversity of old-growth definitions and the relative importance of old-growth as a specific stand condition led DNRC to develop a tool to analyze and understand the level of old-growth associated stand attributes occurring in a given stand. This tool, known as the Full Old-Growth Index (*FOGI*), assigns a point value to old-growth associated stand attributes contained in DNRC's *SLI* and then combines them to determine an overall index value that describes the overall level of attribute development relative to other stands. Index attributes and point assignments are shown in *TABLE III-6.*

The old-growth associated attributes used in the *FOGI* are:

- number of large live trees,
- amount of coarse woody debris,
- number of snags,
- amount of decadence,
- multistoried structures,
- gross volume, and
- crown cover.

Old-growth quality depends on the type of old-growth, associated wildlife species being considered, where old-growth exists on the landscape, and other factors that do not lend themselves to consistent or meaningful quantification. For the purposes of this analysis, DNRC is using attribute levels (*FOGI*) as an indicator of quality, but are also cognizant that quality is too nebulous a concept for a quantitative analysis. Using the *FOGI* provides a method to consistently describe the attributes of old-growth stands relative to other old-growth stands on state managed lands. *FOGI* could be construed as providing an indication of old-growth quality, but is more appropriately considered an indication of overall attribute levels. So, while the highest attribute levels may be high quality for some wildlife species and old-growth types (for example, mixed-conifer old-growth, which tends to exist in a dense and structurally diverse condition), other species and types are highest quality at relatively lower attribute levels (in particular, the ponderosa pine type, which tends to exist in a more open condition that is less structurally diverse). Therefore, the analysis focuses on quantitative or qualitative assessment of attribute levels rather than relying on the value-laden concept of quality.

TABLE III-6 - OLD-GROWTH INDEX ATTRIBUTES AND POINT ASSIGNMENTS.

ATTRIBUTES[1]	0	1	2	3	4	5	6	7
Number of large trees	None		Few		Some		Lots	
Coarse woody debris	None	Few	Some	Lots				
Number of snags	None	Few	Some	Lots				
Decadence	None	Little	Some	Lots				
Structure	Single-storied	Two-storied	Multistoried					
Gross Mbf	Less than 4	4 to 6	7 to 9	10 to 12	13 to 15	16 to 20	21 to 25	26+
Crown cover index (percent)	Poor (0 to 39)		Medium (40 to 69)		Well (70-plus)			

[1]*The blank spaces are not applicable; see OLD-GROWTH ATTRIBUTE ASSIGNMENTS at the end of this VEGETATION ANALYSIS for attribute assignments.*

EXISTING ENVIRONMENT, DIRECT, AND INDIRECT EFFECTS

Old-Growth Distribution

Existing Environment

Swan River State Forest currently has 8,310 acres of old-growth, which is equal to 15.3 percent of the total forested acreage (*TABLE III-7 – CURRENT OLD-GROWTH ACRES AND POSTHARVEST ACTION ALTERNATIVE EFFECTS BY FOREST COVER TYPE FOR SWAN RIVER STATE FOREST*). The project area contains 2,637 acres of old-growth, which is equal to 14.2 percent of the forested project area acreage (*TABLE III-8 – CURRENT OLD-GROWTH ACRES AND POSTHARVEST ACTION ALTERNATIVE EFFECTS BY FOREST COVER TYPE FOR THE PROJECT AREA)*. Old-growth acreages may change over time as field surveys are completed and the *SLI* database is updated.

The old-growth definitions used by DNRC are expressed in terms of cover type. Mixed conifer, western larch/Douglas-fir, subalpine fir, and western white pine (*TABLE III-7*) are currently the 4 dominant old-growth types on Swan River State Forest.

TABLE III-7 - CURRENT OLD-GROWTH ACRES AND POSTHARVEST ACTION ALTERNATIVE EFFECTS BY FOREST COVER TYPE FOR SWAN RIVER STATE FOREST.

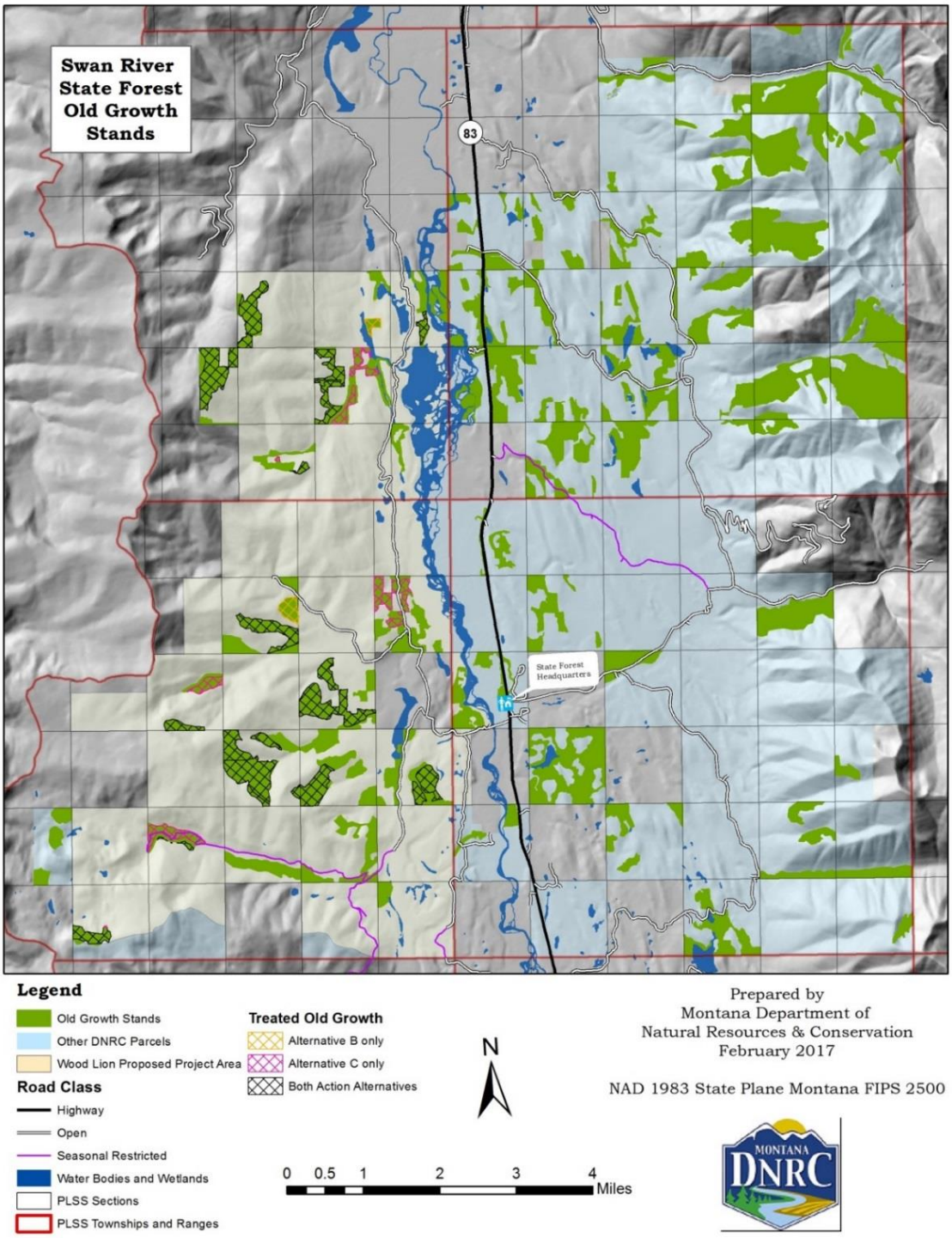
OLD-GROWTH TYPE	*OLD-GROWTH ACRES*	*POSTHARVEST ACTION ALTERNATIVE*	
		B	*C*
Douglas-fir	50	50	50
Western larch/ Douglas-fir	788	785	778
Western white pine	299	299	299
Mixed conifer	6,278	5,619	5,992
Subalpine fir	702	591	603
Lodgepole pine	57	57	57
Ponderosa pine	136	136	136
Totals	*8,310*	*7,537*	*7,915*

TABLE III-8 - CURRENT OLD-GROWTH ACRES AND POSTHARVEST ACTION ALTERNATIVE EFFECTS BY FOREST COVER TYPE FOR THE PROJECT AREA.

OLD-GROWTH TYPE	**OLD-GROWTH ACRES**	**POSTHARVEST ACTION ALTERNATIVE**	
		B	**C**
Douglas-fir	11	11	11
Western larch/ Douglas-fir	210	207	200
Western white pine	18	18	18
Mixed conifer	2,235	1,576	1,949
Subalpine fir	163	52	64
Lodgepole pine	0	0	0
Ponderosa pine	0	0	0
Totals	*2,637*	*1,864*	*2,242*

The current analysis also looks at the old-growth spatial distribution to analyze the effects of a proposed action.

FIGURE III-4 - CURRENT OLD-GROWTH STANDS ON SWAN RIVER STATE FOREST



Environmental Effects to Old-Growth Distribution

- ***Direct and Indirect Effects of No-Action Alternative A to Old-Growth Distribution***

Initially, the amount of old-growth in the project area and on Swan River State Forest would not change. However, mortality and increasing decadence of existing old-growth stands would over time cause some stands to no longer meet the requirements of the old-growth definition, reducing the amount of old-growth acreage. Some stands not currently classified as old-growth would, over time, attain sufficient numbers of large live trees that meet the diameter and age requirements to be classified as old-growth. The cover types of old-growth stands would be expected, over time, to shift toward increasing amounts of cover types dominated by shade-tolerant species, such as mixed conifer, with decreases in cover types dominated by shade-intolerant species (western larch/Douglas-fir, western white pine, and ponderosa pine). Old-growth stands dominated by shade-tolerant species would be likely to have high attribute levels (high numbers of snags and amount of coarse woody debris, multistoried canopy structure, dense crown cover, and increased decadence), but less longevity on the landscape than old-growth stands dominated by shade-intolerant species.

- ***Direct and Indirect Effects of Action Alternatives B and C to Old-Growth Distribution***

The main objectives for entering the majority of the old-growth stands are to treat current high to medium risk stands or prevent a future high risk status (see discussion of high risk old-growth below pg. 24) through removal of insect-infested and disease-infected trees, maintenance of historical cover types, and removal or reduction of shade-tolerant species. The old-growth maintenance units, group select units, shelterwood units, and uneven-aged management unit may be classified as old-growth following harvesting; postharvest data collection in particular stands would determine their classification. *TABLE III-9 – OLD-GROWTH ACRES TREATED BY HARVEST PRESCRIPTION AND POSTHARVEST OLD-GROWTH STATUS* shows old-growth acres treated by harvest prescription and their postharvest old-growth status for each alternative. *TABLE III-10 – OLD-GROWTH FOGI ATTRIBUTE CLASSIFICATION CHANGES PREHARVEST AND POSTHARVEST BY ALTERNATIVE* clearly outlines the pre-harvest and postharvest attributes of each unit proposed for treatment.

TABLE III-9 - OLD-GROWTH ACRES TREATED BY HARVEST PRESCRIPTION AND POSTHARVEST OLD-GROWTH STATUS.

	Old-Growth Postharvest Acres		
	Old-growth postharvest	**Not old-growth postharvest**	**Total old-growth treated**
Harvest Prescription	**Alternative B**		
Clear Cut	0	0	0
Commercial Thin	0	0	0
Group Select	124	0	124
Old-Growth Maintenance	229	0	229
Over Story Removal	0	40	40
Post and Pole	0	0	0
Seed Tree	0	733	733
Shelterwood	42	0	42
Uneven-Aged Management	0	0	0
Totals	395	773	1,168
Harvest Prescription	**Alternative C**		
Clear Cut	0	2	2
Commercial Thin	0	0	0
Group Select	145	0	145
Old-Growth Maintenance	453	0	453
Over Story Removal	0	0	0
Over Story Removal / Commercial Thin	0	0	0
Post and Pole	0	0	0
Seed Tree	0	393	393
Shelterwood	167	0	167
Single Tree Selection	53	0	53
Uneven-Aged Management	136	0	136
Totals	954	395	1,349

TABLE III-10 - OLD-GROWTH FOGI ATTRIBUTE CLASSIFICATION CHANGES PREHARVEST AND POSTHARVEST BY ALTERNATIVE.

CURRENT STAND NUMBER	OLD-GROWTH TYPE	ALTERNATIVE B HARVEST PRESCRIPTION	ALTERNATIVE C HARVEST PRESCRIPTION	STAND ACRES	PRE-HARVEST INDEX NUMBER	CURRENT FOGI CLASS	HIGH RISK	EFFECTS BY ACTION ALTERNATIVE					
								B			C		
								INDEX NUMBER	CLASS	OLD-GROWTH POSTHARVEST	INDEX NUMBER	CLASS	OLD-GROWTH POSTHARVEST
23181003	MC	OGM	OGM	89	19	Med	Yes	11	Low	Yes	11	Low	Yes
23181017	MC	OSR		40	19	Med	No			No			
23181207	WL/DF		UEA	23	22	High	Yes				14	Med	Yes
23181209	MC		UEA	12	12	Low	No				8	Low	Yes
23181211	MC		SW	29	4	Low	No				2	Low	Yes
23181212	WL/DF		UEA	16	22	High	Yes				14	Med	Yes
23181223	MC		ST	11	15	Med	No						No
23181408	MC-WL/DF	ST	OGM	55	15	Med	Yes			No	11	Low	Yes
23181421	MC-WL/DF	GS	GS	124	18	Med	Yes	10	Low	Yes	10	Low	Yes
23181604	SUB ALP		ST	33	8	Low	No						No
23181610	MC	SW	SW	30	21	High	Yes	11	Low	Yes	11	Low	Yes
23182213	MC-SUB ALP	ST	ST	141	14	Med	Yes			No			No
23182214	MC-SUB ALP	ST	ST	80	19	Med	Yes			No			No
23182215	MC	SW	SW	12	20	Med	No	12	Low	Yes	12	Low	Yes
23182307	MC	ST	SW	90	13	Med	Yes			No	9	Low	Yes
23182417	MC	ST	OGM	73	13	Med	No			No	9	Low	Yes
23182803	MC	ST	SW	6	6	Low	No			No	6	Low	Yes
23182807	MC		STS	53	15	Med	No				4	Low	Yes
23183209	SUB ALP		UEA	1	6	Low	No				4	Low	Yes
23183210	SUB ALP	ST	UEA	46	5	Low	No			No	3	Low	Yes
24182209	MC-WL/DF-WWP	OGM	OGM	100	14	Med	No	9	Low	Yes	9	Low	Yes
24182305	MC	ST		18	3	Low	No			No			
24182419	MC	OGM	OGM	21	16	Med	No	7	Low	Yes	7	Low	Yes
24182620	MC-WL/DF		UEA	38	13	Med	No				9	Low	Yes
24182621	WL/DF		GS	21	17	Med	Yes				12	Low	Yes
24182626	MC-WL/DF	ST	OGM	96	12	Low	Yes			No	9	Low	Yes
24182804	MC	OGM	OGM	19	13	Med	No	7	Low	Yes	7	Low	Yes
24182805	MC	ST	ST	118	17	Med	No			No			No
24183401	MC		CC	2	4	Low	No						No
24183411	MC	ST	ST	10	11	Low	Yes			No			No

Action Alternative B would harvest approximately 1,168 acres of old-growth. Following harvesting operations, 773 acres would no longer meet old-growth criteria, which would reduce the amount of old-growth acres in the project area by 4.2 percent. Following harvesting, 395 acres would remain classified as old-growth. The amount of old-growth remaining on Swan River State Forest would be 7,537 acres, and the proportion of acreage classified as old-growth would be 13.9 percent (*TABLE III-7*).

Action Alternative C would harvest approximately 1,349 acres of old-growth. Following harvesting operations, 395 acres would no longer meet old-growth criteria, which would reduce the amount of old-growth acres in the project area by 2.1 percent. Following harvesting, 954 acres would remain classified as old-growth. The amount of old-growth remaining on Swan River State Forest would be 7,915 acres and the proportion of acreage classified as old-growth would be 14.6 percent.

HIGH RISK OLD-GROWTH STANDS

Existing Environment

As time passes, various factors influencing stand development may cause stands currently defined as old-growth to no longer meet the requirements of the *Green et al. (1992)* old-growth definitions. Such factors include insect and disease outbreaks, drought, competition, etc. These factors can, gradually or suddenly, reduce the number of large, live trees below the minimum described in *Green et al. (1992)*. Stand vigor, insect and disease presence, and current mortality levels as determined by field reconnaissance and *SLI* data, can be used to estimate the risk of falling out of the old-growth status according to *Green et al*. Currently, 1,010 acres, or 38.3 percent, of the old-growth stands in the project area are classified as high risk (see *TABLE III-11 – CURRENT AND POSTHARVEST AMOUNT OF HIGH-RISK OLD-GROWTH STANDS IN THE PROJECT AREA).*

As shown by *TABLE III-11*, most treatments occurring in old-growth address stands with a high risk of losing the old-growth status. Focusing treatments in these stands allows *DNRC* to not only meet its objective of promoting healthy and biologically diverse forest in the project area and Swan River State Forest, but also captures value that would otherwise be lost to mortality. While many of these stands would no longer be classified as old-growth following treatment, a high likelihood is that in the near future, even without treatment, these stands would no longer be classified as old-growth.

TABLE III-11- CURRENT AND POSTHARVEST AMOUNT OF HIGH-RISK OLD-GROWTH STANDS IN THE PROJECT AREA.

	POSTHARVEST TREATMENT OLD-GROWTH STATUS			
	HIGH RISK OLD-GROWTH	**OTHER OLD-GROWTH**	**NOT OLD-GROWTH**	**TOTALS**
Current and No-Action Alternative A	1,010	1,627	0	2,367
Action Alternative B	538	1,326	773	2,367
Action Alternative C	779	1,463	395	2,367

Environmental Effects to Old-Growth Risk

- ***Direct and Indirect Effects of No-Action Alternative A to Old-Growth Risk***

Stands currently classified as high risk would be expected to remain as high-risk stands and, over time, fall out of old-growth status as large live trees die and fall below the threshold numbers identified by *Green et al (1992)* to be classified as old-growth. Other old-growth stands would, over the long term, see their risk rating increase as the stands age and become more decadent.

- ***Direct and Indirect Effects of Action Alternatives B and C to Old-Growth Risk***

With Action Alternative B, the amount of high-risk old-growth would be reduced by 472 acres through the use of various harvesting prescriptions. Approximately 538 acres would still be classified as high-risk old-growth. Approximately 301 acres of other old growth would no longer be classified as old growth, leaving 1,326 acres of old growth that is not in a high-risk status (see *TABLE III-11)*.

With Action Alternative C, the amount of high-risk old-growth would be reduced by 231 acres through the use of various harvesting prescriptions. Approximately 779 acres would still be classified as high-risk old-growth. Approximately 164 acres of other old growth would no longer be classified as old growth, leaving 1,463 acres of old growth that is not in a high-risk status (see *TABLE III-11)*.

OLD-GROWTH ATTRIBUTES

Existing Environment

The *FOGI* process assigns an index rating to each old-growth attribute that, when summed, indicates its total score, or old-growth index, for the stand. For analysis purposes, these scores can be grouped into low, medium, and high categories. This provides an indication of the condition of the stand in regards to attributes often associated with old-growth. These indices do not necessarily indicate old-growth quality, but can be used to compare and classify a collection of older stands across the landscape. Many of the attributes contributing to the FOGI rating relate to wildlife habitat and are discussed under *WILDLIFE ANALYSIS*. *TABLE III-12 – FOGI CLASSIFICATION FOR THE PROJECT AREA AND POSTHARVEST AMOUNTS* shows the current amounts of old-growth acres in each of the *FOGI* classifications and the effects of the action alternatives. See *OLD-GROWTH ATTRIBUTE ASSIGNMENTS* at

the end of this *VEGETATION ANALYSIS* for a greater explanation of *TABLE III-6 – OLD-GROWTH INDEX ATTRIBUTES AND POINT ASSIGNMENTS.*

TABLE III-12 - FOGI CLASSIFICATION FOR THE PROJECT AREA AND POSTHARVEST AMOUNTS.

FOGI CLASSIFICATION	CURRENT ACRES	ACTION ALTERNATIVE	
		B	C
Not Old Growth	0	773	395
Low	253	472	933
Medium	1,636	674	630
High	748	718	679
Totals	*2,637*	*2,637*	*2,637*

Direct and Indirect Effects to Old-Growth

- ***Direct and Indirect Effects of No-Action Alternative A to Old-Growth Attributes***

The current *FOGI* classification for old-growth stands would not change in the short term. Over time, as growth and decadence increases, stands in the low and medium class may progress to medium and high class, respectively. Conversely, stands may revert from the high and medium class to the medium and low class depending on the attributes affected by insects, diseases, forest succession, decay, etc. These changes would probably occur slowly over time due to the numerous factors that contribute to the *FOGI* classification.

- ***Direct and Indirect Effects of Action Alternatives B and C to Old-Growth Attributes***

Under action Alternative B, the following changes to the *FOGI* classification would occur: approximately 733 acres would no longer be classified as old-growth, stands classified as low would be increased by 219 acres, stands classified as medium would be reduced by 962 acres, and stands classified as high would be reduced by 30 acres. Detailed changes to FOGI classification changes can be found in *TABLE III-10*.

Under action Alternative C, the following changes to the *FOGI* classification would occur: approximately 395 acres would no longer be classified as old-growth, stands classified as low would be increased by 680 acres, stands classified as medium would be reduced by 1,006 acres, and stands classified as high would be reduced by 69 acres. Detailed changes to FOGI classification changes can be found in *TABLE III-10*.

Cumulative Effects to Old-Growth

- ***Cumulative Effects of No-Action Alternative A to Old-Growth***

Current levels of old-growth acres would not change in the short term. As stands continue to mature and large trees eventually die, some stands may no longer meet the old-growth definition. Ongoing data collection of stands may change the amount of acres classified as old-growth. The *Three Creeks Multiple Timber Sales, White Porcupine Multiple Timber Sales, Scout Lake Multiple Timber Sales,* and *Cilly Cliffs Multiple Timber Sales* contained old-growth stands and harvesting is either complete or on-going. The change in old-growth amounts and attribute levels from these projects was incorporated into the current condition on Swan River State Forest. It should be noted that timber

stands, whether harvesting occurs or not, may be reinventoried or reindexed in regard to adjustments of stand boundaries, and a more intensive inventory may change the old-growth status.

Past road construction, timber harvests, wildfires, and general site characteristics have led to the current amount of old-growth characteristics in the entire area. Future timber sales and thinning projects would likely continue to take place in the analysis area. If additional management projects were proposed, the *MEPA* process would be implemented. The cumulative effects to old-growth amounts and distributions due to previous activities on USFS as well as privately-held ground adjacent to Swan River State Forest and the project area, are difficult to quantify because little is known about the total amount of old-growth on these ownerships and old-growth stand approximations were not possible by analyzing aerial photographs. Old-growth appears to have been retained on some USFS ground. The stands of small, private landowners appear as a mosaic, which results in a variety of age classes and inexact amounts of old-growth amongst multiple ownerships.

- ***Cumulative Effects of Action Alternatives B and C to Old-Growth***

The cumulative effects of the action alternatives would be similar to those seen under No-Action Alternative A; however, they would reduce the proportion of old-growth on Swan River State Forest by approximately 1.4 (Action Alternative B) or 0.7 (Action Alternative C) percent. Old-growth attribute levels in harvested stands would generally decrease immediately following harvesting, but over time would be expected to increase.

AGE AND COVER TYPE PATCH SIZE

Issue: The proposed activities may affect patch size and shape through tree removal.

AGE PATCHES

Existing Environment

The size of patches of equivalent age is one way to assess effects of management activities to the forested landscape. Age class patches broadly reflect disturbance in the natural environment and the additional influence of harvesting and associated activities in the managed environment.

Forests change over time. Tracking the changes from historical to current conditions can indicate the effects of management and whether the direction of change is desirable. Assessing historic forest conditions is filled with challenges, such as a lack of actual data or, even when data is available, compatibility with current information. DNRC has maps of an inventory conducted in the 1930s that provide a general baseline for age (and cover type) patches for Swan River State Forest and the project area. The data does not provide for a seamless comparison between historic and current conditions due to differences in mapping procedures, primarily an 8-fold difference in minimum map unit size (40 acres historically and 5 acres currently). The reduced minimum map unit size results in many more patches of a smaller average size, even when applied to the same forest at the same point in time. However, the data does represent the best historic information available; therefore, the data is presented with the caveats mentioned in this

paragraph.

This analysis focuses on stand age classes. The oldest age class also encompasses all old-growth stands. However, old-growth would represent only a portion of all old age stands, as not all old stands would meet the large-tree requirements that are part of DNRC's old-growth definition. Reconstructing the historic data to quantify patch characteristics of old-growth is not possible, so comparisons between historic and current conditions are not made. An analysis of the current patch characteristics of old-growth and the effects of each action alternative are presented under *OLD-GROWTH PATCHES* further on in this analysis.

Historic data indicates that old stand patches were large in both Swan River State Forest and the project area. Historically, a single large old stand patch exceeding 14,000 acres dominated Swan River State Forest (previous DNRC analysis indicates that large stands would be divided into many additional polygons using today's mapping protocols, even in the absence of any harvest-related activities). Other age patches were variable in size between the project level and Swan River State Forest. The expectation is that the project area would naturally have smaller patch size means due to imposing the artificial project area boundary onto some existing patches. On average, current age class patches are much smaller than they were historically. Some of the decreases can be attributed to different map unit minimums, but the data likely reflects a real reduction in mean patch sizes, as harvesting and roads have broken up some previously intact patches.

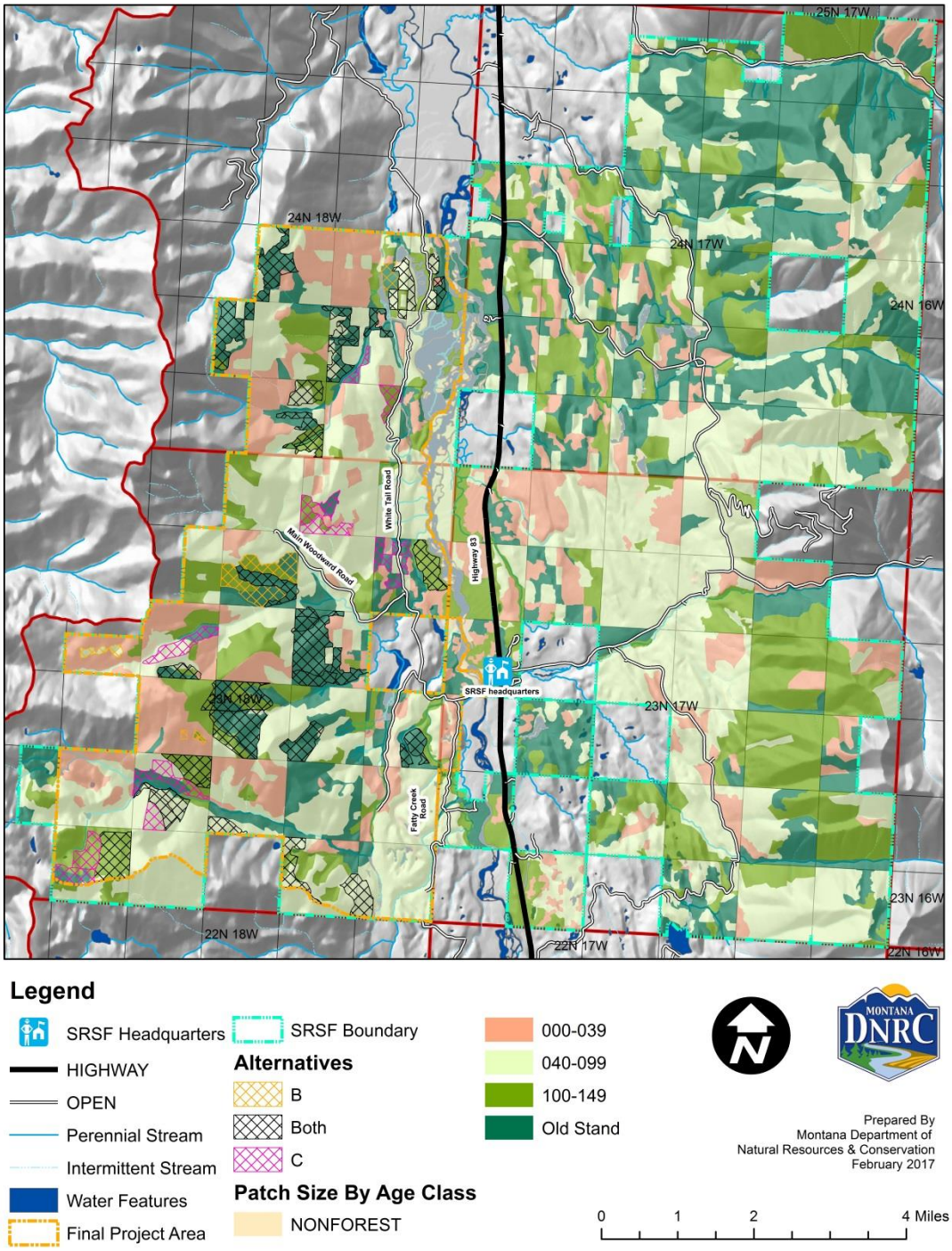
TABLE III-13 - HISTORIC AND CURRENT MEAN PATCH SIZES BY AGE CLASS FOR SWAN RIVER STATE FOREST AND THE PROJECT AREA.

AGE CLASS	SWAN RIVER STATE FOREST (56,312 ACRES)		PROJECT AREA (19,437 ACRES)	
	HISTORIC	CURRENT	HISTORIC	CURRENT
Nonforested	121	38	71	60
0 to 39 years	91	47	830	63
40 to 99 years	135	131	452	182
100 to old stand	76	77	301	65
Old stand[1]	665	56	1,346	58
Overall	280	73	670	90

[1]*The old stand age class represents the 150-199, 200 plus and old-growth age classes.*

Current old stand patches are smaller at the scale of the project area and Swan River State Forest than they were historically. Current Swan River State Forest old stand patches are approximately 8 percent of the Swan River State Forest historic mean, and the current project area old stand patches are approximately 5 percent of the project area historic mean. At scales of both the project area and Swan River State Forest, the general trend appears to be a current mean patch size of all age classes that is smaller than the historic mean (see *FIGURE III-5 – CURRENT PATCH SIZE AND LOCATION BY AGE CLASS ON SWAN RIVER STATE FOREST* for details).

FIGURE III-5 - CURRENT PATCH SIZE AND LOCATION BY AGE CLASS ON SWAN RIVER STATE FOREST.



ENVIRONMENTAL EFFECTS

Direct and Indirect Effects

- ***Direct and Indirect Effects of No-Action Alternative A on Age Patch Size***

Patch sizes would not be immediately affected. Over time, the forest would tend to homogenize, leading to larger patches of older stands, especially in the absence of significant fires or other disturbance events.

- ***Direct and Indirect Effects of Action Alternatives B and C on Age Patch Size***

In the project area, the mean old stand patch size would be reduced to 41 acres or 50 acres (a 29 or 14 percent reduction) with Action Alternatives B or C (*TABLE III-14 – CURRENT AND POSTHARVEST MEAN PATCH SIZES BY AGE CLASS FOR THE PROJECT AREA*). Other age patches would be only marginally affected, except the 0 to 39 year age class, where mean patches would be increased with each action alternative, reflecting the effort to group stand-replacement harvesting near other previously harvested areas.

Compared to current conditions, project level effects indicate that Action Alternatives B and C would slightly decrease the mean size of age patches.

TABLE III-14 – CURRENT AND POSTHARVEST MEAN PATCH SIZES BY AGE CLASS FOR THE PROJECT AREA.

AGE CLASS	CURRENT PROJECT AREA (ACRES)	POSTHARVEST ACTION ALTERNATIVES	
		B	C
		(ACRES)	
Nonforested	60	56	56
0 to 39 years	63	75	78
40 to 99 years	182	167	163
100 to old stand	65	53	57
Old stand	58	41	50
Overall	90	79	83

Cumulative Effects

- ***Cumulative Effects of All Alternatives on Age Patch Size***

The current age class patch condition reflects the effects of natural disturbances and succession and the cumulative effects of previous activities by DNRC and other land owners that have been completed and mapped. Overall, harvesting by DNRC and other landowners including the USFS, DFWP, and private landowners within the cumulative effects analysis area appears to be reducing the patch size of mature stands and increasing the patch size of younger (0-39 and 40-99 year old) stands.

OLD-GROWTH PATCHES

Existing Environment

Old-growth represents a subset of the old stand age class. Old stands must contain a specified number and size of 'large' live trees to meet the old-growth definition; those large trees must also meet or exceed minimum age requirements. This analysis displays

current patch size characteristics of old-growth and the effects of each alternative. This analysis does not present a corresponding analysis of historic old-growth patch characteristics because the data does not exist. Although it cannot be verified with observations of historic old-growth patch size, the reduction in patch size of old stands is expected to reflect a similar reduction in patch size of old-growth stands, but the absolute magnitude is unknown.

Currently, the mean patch size of old-growth stands on Swan River State Forest is 66 acres (*TABLE III-15 – CURRENT AND POSTHARVEST MEAN PATCH SIZES OF OLD-GROWTH ON SWAN RIVER STATE FOREST AND IN THE PROJECT AREA*). In the project area, the mean old-growth patch size is 70 acres. Old-growth patches are larger than the mean size of old stand patches in the project area. The disparity between patch sizes of old stands and old-growth reflects the addition of the large-tree number, size, and age requirements of DNRC's old-growth definition.

TABLE III-15 - CURRENT AND POSTHARVEST MEAN PATCH SIZES OF OLD-GROWTH ON SWAN RIVER STATE FOREST AND IN THE PROJECT AREA.

CURRENT SWAN RIVER STATE FOREST (ACRES)	SWAN RIVER STATE FOREST POST HARVEST ACTION ALTERNATIVES (ACRES)		CURRENT PROJECT AREA (ACRES)	PROJECT AREA POST HARVEST ACTION ALTERNATIVES (ACRES)	
	B	C		B	C
66	34	52	70	43	57

ENVIRONMENTAL EFFECTS

Direct and Indirect Effects

- ***Direct and Indirect Effects of No-Action Alternative A on Old-Growth Patches***

The patch size of old-growth stands would not be immediately affected. Over time, the effects to the old-growth patch size would be uncertain because the continued development of large live trees within old stands is unpredictable. If existing large live trees remain alive and new large trees develop in old-age stands, the mean patch size of old-growth would be expected to increase. Conversely, if existing large live trees continue to die from effects of insects, diseases, and other factors, causing the stand to no longer meet the old-growth requirements specified by *Green et al. (1992),* and new large trees fail to develop because of overly dense stands, the mean patch size of old-growth would be expected to decrease.

- ***Direct and Indirect Effects of Action Alternatives B and C on Old-Growth Patches***

At the project level, mean old-growth patch size would decrease with Action Alternative B or C, by 27 and 13 acres, respectively.

Cumulative Effects

- ***Cumulative Effects of All Alternatives on Old-Growth Patches***

At the cumulative-effects level, mean old-growth patch size would decrease to 34 acres under Action Alternative B and to 52 acres under Action Alternative C. A resulting decrease of 32 acres under Action Alternative B and decrease of 14 acres under Action

Alternative C would occur. The current old-growth patch condition reflects the effects of natural disturbance and succession and the cumulative effects of previous activities by DNRC that have been completed and mapped. Overall, old-growth patches for Swan River State Forest and the project area are reduced from historic to current conditions. Based on aerial-photograph interpretation on a landscape basis, the cumulative effects to old-growth patch size due to previous activities on USFS as well as on privately held ground adjacent to Swan River State Forest and the project area have been an overall decrease in old-growth patch size through timber management.

COVER TYPE PATCHES

Existing Environment

Historic data suggests mean cover type patch sizes are similar to age patch sizes, in part, due to large patches of old western larch/Douglas-fir and western white pine that dominated the forest and the project area. As with mean age class patch sizes, the differences in mapping protocols and, in particular, a different minimum map-unit size confound direct comparison and drawing clear conclusions. However, a real decrease in mean cover type patch size is expected due to the effects of timber harvesting. The effects of succession confound the results and are reflected in the increased patch size of shade- tolerant types (mixed conifer and subalpine fir).

Overall, current cover type patches on Swan River State Forest and the project area are about 48 and 23 percent the size of the historic mean, respectively (*TABLE III-16* and *TABLE III-17 - HISTORIC AND CURRENT MEAN PATCH SIZES BY COVER TYPE FOR THE PROJECT AREA*).

TABLE III-16 - HISTORIC AND CURRENT MEAN PATCH SIZES BY COVER TYPE FOR SWAN RIVER STATE FOREST.

COVER TYPE CLASS	HISTORIC ACRES	CURRENT ACRES
Douglas-fir	0	61
Hardwood	29	32
Lodgepole pine	95	59
Mixed conifer	119	313
Noncommercial	85	0
Nonforested	33	38
Nonstocked	0	28
Ponderosa pine	127	36
Subalpine fir	171	218
Water	26	0
Western larch/Douglas-fir	793	89
Western white pine	158	52
Overall	223	108

TABLE III-17 - HISTORIC AND CURRENT MEAN PATCH SIZES BY COVER TYPE FOR THE PROJECT AREA.

COVER TYPE CLASS	HISTORIC ACRES	CURRENT ACRES
Douglas-fir	0	59
Hardwood	58	51
Lodgepole pine	390	80
Mixed conifer	157	348
Nonforested	38	60
Nonstocked	0	17
Ponderosa pine	0	14
Subalpine fir	397	244
Western larch/ Douglas-fir	1,368	89
Western white pine	4,686	62
Overall	572	132

ENVIRONMENTAL EFFECTS

Direct and Indirect Effects

- ***Direct and Indirect Effects of No-Action Alternative A on Cover Type Patches***

The cover type patch sizes would not be immediately affected; however, over time, diversity of habitats in terms of cover type patches would likely be reduced through forest succession. The result would be an increase in the mean size of patches dominated by shade-tolerant species as shade-intolerant species are excluded.

- ***Direct and Indirect Effects of Action Alternatives B and C on Cover Type Patches***

Each action alternative would slightly reduce the overall average cover type patch size (*TABLE III-18 – PROJECT AREA POSTHARVEST MEAN PATCH SIZES BY COVER*

TYPE FOR EACH ALTERNATIVE). Action Alternative C would reduce the mean patch size the most at a decrease of 23 acres, Action Alternative B the least at 22 acres. The greatest changes in patch sizes would occur in the mixed-conifer cover type. The mixed-conifer cover type patches would be reduced in size with each action alternative; Action Alternative C the most at 159 acres and Action Alternative B the least at 157 acres. Subalpine fir patch size would also decrease by 17 in alternative B and increase by 23 acres in alternative C. Western larch/Douglas-fir patch size would increase by 17 and 11 acres with Action Alternatives B and C, respectively. Western white pine would also increase by 11 and 13 acres with Action Alternatives B and C, respectively. Other cover type patch sizes would be affected marginally or not at all by the project.

TABLE III-18 - PROJECT AREA POSTHARVEST MEAN PATCH SIZES BY COVER TYPE FOR EACH ALTERNATIVE.

COVER TYPE CLASS	CURRENT (ACRES)	ACTION ALTERNATIVE (ACRES)	
		B	C
Douglas-fir	59	59	65
Hardwood	51	51	51
Lodgepole pine	80	65	64
Mixed conifer	348	191	189
Nonforested	60	56	56
Nonstocked	17	17	17
Ponderosa pine	14	14	14
Subalpine fir	244	228	267
Western larch/ Douglas-fir	89	106	100
Western white pine	62	73	75
Overall	132	110	109

Cumulative Effects

- ***Cumulative Effects of All Alternatives on Cover Type Patches***

The current cover type patch condition reflects previous activities by DNRC and natural disturbances and succession that have been completed and mapped. Overall, cover type patch sizes have been reduced from historic to current conditions. Cumulative effects of past harvests have been incorporated into the project area. The effect of past management activities on USFS, DFWP, and other private land within the CEAA on cover type patches through aerial-photograph interpretation is difficult. Active management of forested lands suggests an increase in early seral species such as western larch and ponderosa pine.

FRAGMENTATION

Issue: The proposed activities may affect forest fragmentation through tree removal.

EXISTING ENVIRONMENT

Forest fragmentation refers to the breaking up of previously contiguous blocks of forest. Most often, the fragmentation is used in reference to the disruption of large contiguous blocks of mature forest caused by forest management activities such as road building and timber harvesting. In relation to fragmentation, management activities begin by putting holes in the natural forested landscape (i.e. portions of the forest are removed via harvesting, thus creating patches of immature forest within a background matrix of mature forest). As management continues and more harvesting takes place, the open patches created can become connected to other open patches, thus, severing the previously existing connections between patches of mature forest. While the appropriate level of fragmentation for any particular forest is unknown, forests fragmented by management activities generally do not resemble natural forest conditions.

Forest fragmentation was analyzed using aerial photographs of the project area in ArcMap and querying the *SLI*. Aerial photographs provided a visual of past harvesting and current stand appearances such as stocking density and stand boundaries. Queries in the *SLI* and other layers provided information on contiguous areas of stands in the same age class, stocking levels, and stand densities. Alternative effects on the patch size of old-growth stands were also analyzed. Field visits helped to verify this information to establish increases or decreases in a given patch size.

Historically, wildfires burned with varying intensities and return intervals and to different sizes across Swan River State Forest, which interacted with insect and disease activities and blowdown events to create a mosaic of forest cover types and age classes. Today, forest management is the primary agent influencing fragmentation. If intense fires were to occur during extreme fire seasons, they would influence fragmentation across the landscape, as would insect and disease activities and blowdown events.

The majority of the project area is a matrix, or mosaic, of well-stocked older stands interspersed with younger stands resulting from harvesting activities of past even-aged management; thus, the stands have been fragmented to some degree. Some man-made patches in harvest units range from 10 to 640 acres. However, some areas have not been entered previously and represent a continuous forest of stands uninfluenced by human activities, but of various stocking levels due to past insect infestations. Refer to *CONNECTIVITY ANALYSIS* in *WILDLIFE ANALYSIS* for an assessment of fragmentation effects on closed-canopied forests. Refer to the patch size of age classes, old-growth, and cover type in this analysis for additional indications of the effects of forest fragmentation.

ENVIRONMENTAL EFFECTS

Direct and Indirect Effects

- ***Direct and Indirect Effects of No-Action Alternative A to Fragmentation***

Forest fragmentation would not be directly affected by this alternative. Over time, and depending on an unknown future, indirect effects would include a reduction in fragmentation if additional harvesting is not imposed by management and existing

patches of immature forests grow to maturity. Insects, diseases, or fire, depending on the acreage involved and severity, could result in an increase in fragmentation as well.

- ***Direct and Indirect Effects of Action Alternatives B and C to Fragmentation***

In the stands designated for regeneration harvesting, the primary effects would be creating a larger area of younger stands with a corresponding reduction in mature forest stands. Stands designated for seed tree, shelterwood, clearcut, or overstory removal harvesting would contribute to the fragmentation of mature forests.

Stands designated for other harvesting prescriptions would maintain greater than 40 percent crown cover and would be more similar to adjacent mature stands of timber than would the regeneration harvest units and, therefore, would not contribute to fragmentation. These prescriptions may allow for openings in the canopy, the openings may resemble gaps created by small areas of crown torching that occur during low-intensity fires. However, these instances would not contribute to fragmentation.

Some regeneration harvest units are adjacent to past harvest areas and other proposed units, which would result in an enlargement of the younger age class patches. The end result would be more of a blended geometric shape of larger regeneration units. The large size of regeneration units would result in larger mature stands in the future, thus, reducing fragmentation. However, future timber harvesting would result in additional fragmentation if existing mature timber patches received a regeneration harvest. The actual net effect on fragmentation would depend on future timber harvesting.

Cumulative Effects

- ***Cumulative Effects of No-Action Alternative A to Fragmentation***

The on-going *Cilly Cliffs Multiple Timber Sales,* as well as previous management activities, such as the *Three Creeks, White Porcupine, and Scout Lake* multiple timber sales, have added to the fragmentation of the forest. The stands that primarily contributed to fragmentation are the regeneration units. Units that involve thinning treatments did not provide harsh breaks in the canopy, but a reduced crown cover. The aerial view shows the differences from one unit to the other from the point of stand density, but do not necessarily differ from the point of age class.

Based on aerial-photograph interpretation on a landscape basis, the cumulative effects to fragmentation due to previous activities on USFS, DFWP, as well as on privately held ground adjacent to Swan River State Forest and the project area, have been an overall increase in the size of younger age class patches through timber management.

- ***Cumulative Effects of Action Alternatives B and C to Fragmentation***

An overall increase in the patch size of younger age classes and a decrease in the patch size of older age classes would occur where regeneration harvest units are proposed. See the discussion on age classes for acres that would change by alternative.

STAND VIGOR

Issue: The proposed activities may affect the forest stand vigor through tree removal.

EXISTING ENVIRONMENT

Stand vigor, a qualitative assessment of stand health in relation to growth potential, is affected by a variety of factors such as stand age and density, insects, diseases, and weather. Insects and diseases are currently active in the project area, decreasing vigor, reducing growth, causing mortality, removing stands from the old-growth classification, and resulting in lost economic value. Elevated populations of Douglas-fir beetles, fir engravers, mistletoe, mountain pine beetles, white pine blister rust, and various heart rots exist throughout the project area. Indian paint fungus is common in grand fir and subalpine fir. The majority of tree species show effects from insect infestations and disease infections, causing value to be lost. Also, tree crowns appear sparse, yellowing, and/or fading in some stands, reflecting poor health and slow growth.

The *SLI* identifies stand vigor for each stand on Swan River State Forest in 1 of 4 categories. The 4 categories for vigor classification are:

- full,
- good to average,
- just below average to poor, and
- poor

The majority of the stands selected for harvesting fall in the *good to average and just below average to poor* category (*TABLE III-19 – CURRENT HARVEST UNIT VIGOR CLASSIFICATION (PERCENT) BY ACTION ALTERNATIVE)*.

TABLE III-19 – CURRENT HARVEST UNIT VIGOR CLASSIFICATION (PERCENT) BY ACTION ALTERNATIVE.

VIGOR	ACTION ALTERNATIVE	
	B	C
Full	3.9	3.2
Good to average	43.4	47.7
Just below average to poor	50.9	45.9
Poor	1.8	3.2

ENVIRONMENTAL EFFECTS

Direct and Indirect Effects

- ***Direct and Indirect Effects of No-Action Alternative A to Stand Vigor***

No immediate change in the proportion of existing stand vigor is expected unless a large disturbance, such as a wildfire, occurs (*TABLE III-19* and *TABLE III-20 – CURRENT AND POSTHARVEST PROJECT AREA VIGOR)*.

Forest succession, driven by the impacts of forest insects and diseases when fires are being suppressed, would continue to reduce stand vigor. As the forest ages and composition becomes more homogenous, vigor is expected to decrease.

- ***Direct and Indirect Effects of Action Alternative B to Stand Vigor***

Postharvest, *full* vigor would increase on approximately 1,749 acres, *good to average* vigor would decrease on approximately 720 acres, *just below average to poor* vigor would decrease on approximately 1,019 acres, and *poor* vigor would decrease on approximately 9 acres *(TABLE III-20)*.

TABLE III-20 - CURRENT AND POSTHARVEST PROJECT AREA VIGOR.

STAND VIGOR	CURRENT		ACTION ALTERNATIVE			
			B		C	
			POSTHARVEST			
	ACRES	PERCENT	ACRES	PERCENT	ACRES	PERCENT
Full	1,976	11	3,725	20	3,360	18
Good to average	11,005	59	10,284	55	10,379	56
Just below average to poor	5,414	29	4,395	24	4,684	25
Poor	195	1	186	1	166	1
Nonforested	847	N/A	847	N/A	847	N/A
Totals	*19,437*	*100*	*19,437*	*100*	*19,437*	*100*

- ***Direct and Indirect Effects of Action Alternative C to Stand Vigor***

Postharvest, *full* vigor would increase on approximately 1,384 acres, *good to average* vigor would decrease on approximately 625 acres, *just below average to poor* vigor would decrease on approximately 730 acres, and *poor* vigor would decrease on approximately 29 acres *(TABLE III-20)*.

Cumulative Effects

- ***Cumulative Effects of No-Action Alternative A to Stand Vigor***

Current stand vigor would remain the same across the forest. Over time, stand vigor would be expected to decrease in the absence of disturbance or management. Occurrences of mortality of trees or groups of trees would reduce the stand vigor in localized areas. Limited salvaging may increase the stand vigor in localized areas. Large reductions in stand vigor would occur if a large fire came through the area and salvage harvesting and regeneration or replanting attempts did not follow.

- ***Cumulative Effects of Action Alternatives B and C to Stand Vigor***

Cumulative effects would result in an increase in vigor in areas where harvesting has occurred and a decrease in vigor in areas where harvesting has not occurred. The trees no longer perform to their highest potential and become susceptible to insects and diseases, etc. Based on aerial-photograph interpretation on a landscape basis, the cumulative effects to stand vigor due to previous activities on USFS, DFWP, as well as privately held ground adjacent to Swan River State Forest and the project area, have typically been similar to those described for Swan River State Forest, above. Vigor typically increases as stands are harvested and regenerate postharvest; vigor typically decreases as a stand ages and remains in an unmanaged state.

STAND STRUCTURE

Issue: The proposed activities may affect the forest stand structure through tree removal.

EXISTING ENVIRONMENT

Stand structure indicates a characteristic of stand development and how the stand would continue to develop. The disturbance regime or most recent disturbance event can also be reflected. Stand structure is described by 3 categories that describe the number of distinct canopy layers present in a stand:

Single-storied: One distinct canopy layer is present; this condition is most commonly seen in young stands following disturbance or prior to regeneration establishment in mature stands that have been harvested with regeneration methods such as seedtree and shelterwood cutting.

Two-storied: Two distinct canopy layers are present; this condition is associated with recently harvested or burned stands that have a number of large, fire-resistant trees growing over established or advanced regeneration, or with the understory reinitiation stage of stand development where shade-tolerant trees establish beneath the existing overstory.

Multistoried: At least 3 distinct canopy levels are present; this condition is commonly associated with older stands that have entered the steady state stage of stand development, where understory trees are advancing into the overstory, or in uneven-aged stands. This condition is often indicative of a long period without disturbance.

TABLE III-21 – CURRENT AND POSTHARVEST STAND STRUCTURE (PERCENT) IN THE PROJECT AREA compares the current proportion of stands and the postharvest results by alternative in single-storied, two-storied, and multistoried stands in the project area.

TABLE III-21 – CURRENT AND POSTHARVEST STAND STRUCTURE (PERCENT) IN THE PROJECT AREA.

STAND STRUCTURE	CURRENT AMOUNTS	POSTHARVEST ACTION ALTERNATIVE	
		B	C
Single-storied	15	23	21
Two-storied	32	29	30
Multistoried	48	43	44
Nonforested	5	5	5

ENVIRONMENTAL EFFECTS

Direct and Indirect Effects

- ***Direct and Indirect Effects of No-Action Alternative A to Stand Structure***

No immediate change in the proportion of existing stand structure is expected unless a large disturbance, such as a wildfire, occurs (*TABLE III-21*).

Forest succession, driven by the impacts of insects and diseases when fires are being suppressed, would reduce the variability of stand structure. As the forest ages and composition become more homogenous, so would the stand type.

- ***Direct and Indirect Effects of Action Alternative B to Stand Structure***

The single-storied stand structure would increase approximately 1,521 acres; the two-storied stand structure would decrease approximately 586 acres; and the multistoried stand structure would decrease approximately 934 acres.

The proportion of single-storied stand structure in the project area would increase from 15 percent currently to 23 percent, the proportion of two-storied stand structure would decrease from 32 to 29 percent, and the proportion of multistoried stand structure would decrease from 48 to 43 percent (*TABLE III-21*).

- ***Direct and Indirect Effects of Action Alternative C to Stand Structure***

The single-storied stand structure would increase approximately 1,142 acres; the two-storied stand structure would decrease approximately 426 acres; and the multistoried stand structure would decrease approximately 716 acres.

The proportion of single-storied stand structure in the project area would increase from 15 percent currently to 21 percent, the proportion of two-storied stand structure would decrease from 32 percent to 30 percent, and the proportion of multistoried stand structure would decrease from 48 to 44 percent (*TABLE III-21*).

Cumulative Effects

- ***Cumulative Effects of No-Action Alternative A to Stand Structure***

The cumulative effects to stand structure distributions due to previous activities on Swan River State Forest are represented in the description of the current condition. Generally speaking, those effects have been to reduce the acres in multistoried stand structures while increasing the acres in the single-storied stand structure through even-aged management. However, as a whole, the forest contains a mosaic of structures that include single-storied, two-storied, and multistoried conditions.

Although harvesting has changed the proportion of stand structure distribution, the harvesting methods used emulate the range of disturbances, from stand-replacement fire to mixed severity and light underburns, which have historically occurred in Swan River State Forest. Seedtree and shelterwood harvests have shifted stands to a single-storied stand structure following harvesting, similar to the effects of stand-replacing fire. Old-growth maintenance, uneven aged management, and variable thinning treatments have left trees in multiple size classes, initially moving stands to a two-storied structure following harvesting that would, over time and in the absence of further harvesting activities or natural disturbance, develop into multistoried conditions. These treatments

emulate the effects of mixed and low-severity fires.

Barring natural disturbance, over time, untreated stands would gradually shift toward heterogeneous, multistoried, or classic uneven-aged stand structures. Treated stands would also gradually shift toward those stand structures through time.

Based on aerial-photograph interpretation on a landscape basis, the cumulative effects to stand structure distributions due to previous activities on USFS, DFWP, as well as on privately held ground adjacent to Swan River State Forest and the project area, have been variable. Actively managed areas tend to resemble a single-storied stand structure of a single age class, or rather, a stand very homogeneous in appearance. Areas that have not been actively managed can appear single-storied to multistoried due to variances in stand conditions and age classes. Exact stand structure assessments were not possible due to lack of field reconnaissance on non-DNRC managed ground.

- ***Cumulative Effects of Action Alternatives B and C to Stand Structure***

The cumulative effects of the action alternatives would be similar to those seen in No-Action Alternative A; however, across areas where management would occur, the result would be a greater increase in the single storied stand structures and, a greater decrease in the two-storied and multistoried stand structures.

CROWN COVER

Issue: The proposed activities may affect forest crown cover through tree removal.

EXISTING ENVIRONMENT

Crown cover, an estimate of the ratio between tree crown area and ground surface area, is usually expressed in terms of percent and is another measure of stand stocking and density. Categories used to describe crown cover include well-stocked (over 70 percent), medium-stocked (40 to 69 percent), poorly stocked (less than 39 percent), nonstocked, and nonforested.

The *SLI* database has a rating for overall crown cover. In terms of overall crown cover in the project area, 12.5 percent of stands are well stocked, 59.3 percent are medium stocked, 23.8 percent are poorly stocked, 4.4 percent are nonforested. The poorly stocked sawtimber category consists of 23.8 percent of the project area; the associated stands are typically in poor health or have high quantities of rock and/or brush. Timber in these stands is generally not of good merchantable quality, but in the instance of poor stand health, steps may be taken to address the issue. The nonforested category, associated with roads and water areas, is 4.4 percent.

ENVIRONMENTAL EFFECTS

Direct and Indirect Effects

- ***Direct and Indirect Effects of No-Action Alternative A to Crown Cover***

No-Action Alternative A would not change the crown cover in the short term. Over time, individuals and groups of trees would be removed from the canopy by insects, diseases, windthrow, or fires and this would result in variable changes to crown cover as canopy gaps are created and gradually filled. Patches of variable size currently exist where the Douglas-fir bark beetles and root rot have killed Douglas-fir, white pine

blister rust has killed western white pine, or significant windthrow occurred from storms passing through.

Overall, crown cover and stocking would likely increase over time in the absence of disturbances. Were large fires to occur, overall crown cover would be reduced. Ongoing insect and disease issues would reduce crown cover and sawtimber stocking in some areas prior to understory reinitiation.

- ***Direct and Indirect Effects of Action Alternatives B and C to Crown Cover***

The reduction in crown cover subsequent to harvest treatments would vary by action alternative and silvicultural prescription. In general, reduced crown cover affects stand growth and development in various ways. First, competition among the crowns of overstory trees is reduced, allowing accelerated volume growth and increased seed production. Second, competition for water and nutrients is reduced, thus, allowing trees to be more resistant to both drought and bark beetle attacks. Third, a more diverse and vigorous understory is able to establish. Finally, sunlight is allowed to reach the forest floor, which, along with seedbed preparation, is of particular importance to the successful regeneration of early seral species such as western larch and western white pine. For this analysis, the residual crown cover includes both the overstory and understory tree canopies that remain after harvesting, including both merchantable and submerchantable trees.

In areas with clear cut, overstory removal, and seedtree treatments, the final crown cover would be less than 40 percent. Final crown cover on all other harvesting prescriptions would be a minimum of 40 percent.

Under Action Alternative B, the project area would have approximately 4.3 percent well-stocked stands, approximately 61.1 percent medium-stocked stands, approximately 30.2 percent poorly-stocked stands, approximately 4.4 percent nonforested stands (see *TABLE III-22 – PERCENT OF PROJECT AREA CURRENT AND POSTHARVEST CROWN COVER BY ALTERNATIVE*).

Under Action Alternative C, the project area would have approximately 5.3 percent well-stocked stands, approximately 62.5 percent medium-stocked stands, approximately 27.8 percent poorly-stocked stands, approximately 4.4 percent nonforested stands (see *TABLE III-22*).

TABLE III-22 - PERCENT OF PROJECT AREA CURRENT AND POSTHARVEST CROWN COVER BY ALTERNATIVE.

CROWN COVER	CURRENT	POSTHARVEST ACTION ALTERNATIVE	
		B	C
Well stocked	12.5	4.3	5.3
Medium stocked	59.3	61.1	62.5
Poorly stocked	23.8	30.2	27.8
Nonforested	4.4	4.4	4.4

Riparian stands associated with perennial streams, namely Cedar creek, South Woodward creek, Swan River, Whitetail creek, and Woodward creek, would be minimally treated and could experience reduced crown cover down to a minimum of 50 percent. The riparian harvest prescription for Class 1 streams is a 50 foot wide, no harvest zone along with a supplemental 50 percent retention zone between 50 feet and 110 feet. Class 2 streams would retain a minimum of 50 percent crown cover for 50 feet or 100 foot buffer on slopes greater than 35 percent. Harvesting may occur adjacent to class 3 streams with remaining crown cover being the same as the adjacent harvest unit.

Crown cover would increase over time as regeneration replaces the harvested units that received seedtree, shelterwood, and variable thinning treatments. 15 to 20 years and 5 to 10 years would be needed to develop 70 to 100 percent crown cover in the regeneration and variable thinning harvest units, respectively.

Cumulative Effects

- ***Cumulative Effects of No-Action Alternative A to Crown Cover***

Current crown cover would remain the same across the forest. Over time, crown cover would be expected to increase in the absence of disturbance. Mortality of trees or groups of trees would reduce the crown cover in localized areas. Large reductions in crown cover would occur if a large fire came through the area.

- ***Cumulative Effects of Action Alternatives B and C to Crown Cover***

Overall, reductions of crown cover in well-stocked stands would be dispersed across the landscape. Representation of medium-stocked stands would increase following harvesting, as would poorly-stocked stands. As stands regenerate, crown cover would increase. Based on aerial-photograph interpretation on a landscape basis, the cumulative effects to crown cover due to previous activities on USFS, DFWP, as well as privately held ground adjacent to Swan River State Forest and the project area, have been similar to those described for Swan River State Forest. These properties are similar in that their stocking level typically increases as stands regenerate postharvest and all entities have created a mosaic of crown cover on the landscape. Exact crown cover assessments were not possible due to lack of field reconnaissance on non-DNRC managed ground.

INSECTS AND DISEASES

Issue: The proposed activities may affect forest insect and disease levels through tree removal (both suppressed/stressed and infested/infected).

EXISTING ENVIRONMENT

Planning for both the short and long-term management of forest insects and diseases is an important part of designing project level timber sales. Various forest species compositions and structures are more vulnerable to certain insects and diseases than others (*Byler and Hagle 2000*). Identifying vulnerable stands and developing suitable management plans can help alleviate future problems that may prevent achievement of long-term objectives for forest management.

Current insect activity is mapped annually during aerial-detection surveys carried out by the USDA Forest Service in cooperation with the Montana DNRC. New occurrences

and expansion of existing pockets, particularly of bark beetles and defoliators, are mapped and approximate acreages and locations are collected. Some disease data is collected during aerial surveys, but due to the cryptic nature of forest diseases it is not nearly as expansive as the data for insects. Field surveys identify areas with insect and disease activities for timber-harvesting opportunities. Maps of several successive years of flight surveys are available at the Swan River State Forest office.

The major forest insects and diseases currently affecting forest productivity include:

Diseases

- Armillaria root disease
- Larch dwarf mistletoe
- White pine blister rust
- Indian Paint Fungus
- Cedar laminated root and butt rot
- Red-brown butt rot

Insects

- Douglas-fir bark beetle
- Fir engraver
- Mountain pine beetle
- Western spruce budworm

Armillaria Root Disease

Armillaria root disease, caused by the fungus *Armillaria ostoyae,* is a common pathogen of conifers in western North America. Stands impacted by Armillaria root disease occur throughout the project area. While Armillaria root disease can affect all conifers, the most susceptible are Douglas-fir, grand fir, and subalpine fir. Silvicultural approaches that emphasize early seral species, natural regeneration, and reduction of root to root pathways between susceptible species are recommended for stands with Armillaria root disease (for example: *Filip and Goheen 1984; Hagle 2008; Morrison and Mallett 1996; Morrison et al. 2000; Morrison et al. 2000*).

Western Larch Dwarf Mistletoe

Western larch dwarf mistletoe, caused by *Arceuthobium laricis*, is considered the most important disease of western larch in the Inland Northwest (*Beatty et al. 1997*). Dwarf mistletoes are parasitic, seed-bearing plants that obtain moisture and nutrients from their hosts, resulting in a reduction in tree vigor and growth. Infections on western larch cause branches to form dense clumps of twigs known as "witches' brooms", which are prone to breakage under snow loads. Mistletoe infection can also exacerbate a tree's susceptibility to attack by wood borers (*Gibson 2004*).

The incidence and severity of western larch dwarf mistletoe appears to be highly variable across the project area. This likely reflects a complex history of mixed-severity and stand-replacing fires in these forests. Depending on the spatial distribution of mistletoe-infected, seed-bearing trees following fires, western larch regeneration might remain free of infection, have a substantial lag-time prior to infection, or become infected early in development. The earlier a tree becomes infected by dwarf mistletoe, the

greater the impacts (*Mathiasen 1998*).

Due to the seeding habit of dwarf mistletoes, spread and intensification are at their worst when an infected overstory exists over regeneration of the same tree species. Seedtree or shelterwood treatments can still be carried out in stands that have dwarf mistletoe infections in the overstory (*Mathiasen 1998*), but tree selection needs to discriminate against the most heavily-infected western larch and leave as many non or lightly-infected trees as possible (*Beatty et al. 1997*).

White Pine Blister Rust

Two five-needled pine species (western white pine and whitebark pine) have declined where they occurred historically on Swan River State Forest. The primary cause is white pine blister rust, a disease caused by the non-native fungus *Cronartium ribicola*, which can infect and kill western white pine and whitebark pine of all ages and sizes (*Keane and Arno 1993; Schwandt et al. 2013*).

Some western white pine and whitebark pine remain on Swan River State Forest because either they possess natural genetic resistance to the rust or have not been infected. Retention of such trees is encouraged to maintain genetic diversity and promote natural regeneration where possible (*Schwandt and Zack 1996*).

Management and restoration recommendations for western white pine emphasize planting rust-resistant western white pine seedlings, pruning the lower bole, and maintaining western white pine genetic diversity (*Fins et al. 2001*).

Current options for restoration of whitebark pine have recently been addressed (*Keane and Parsons 2010*). They include combinations of prescribed fire, thinning, selection cuttings, and fuel enhancement cuttings.

Indian Paint Fungus

Indian paint fungus, so called because Native Americans used the brick-red interior of the fruiting body in making pigment, is a true heartrot that very commonly infects true firs and hemlocks. This fungus is the predominant cause of heartrot and volume losses in these species in western North America (Hansen and Lewis 1997). True heartrots, generally confined to the heartwood of trees, consistently produce fruiting bodies or conks on the stems of living trees and do not rely on mechanical wounding as their principal infection court (Ethridge and Hunt 1978). Large-diameter grand fir with decay caused by Indian paint fungus are important habitat, both while standing and down, for various species of cavity-nesting birds and mammals (Bull et al. 1997).

Trees are infected with *Echinodontium tinctorium* spores via very small branchlet stubs. The spores germinate before the infection goes dormant after being overgrown by the tree, and can then stay dormant for decades (Maloy 1991). Heaviest infections tend to occur in advanced regeneration growing under an infected overstory. Growth of the fungus is reactivated when the tree is wounded either naturally or mechanically, develops frost cracks, or is otherwise physiologically altered. The fungus causes extensive decay of the heartwood and, over time, these trees become more susceptible to stem collapse. A rule of thumb is that one conk on the stem of a tree indicates approximately 16 feet of extensive heartwood decay in either direction, while several

conks on the stem of a tree indicate that the tree is a cull.

In the project area, Indian paint fungus is well distributed on both grand and subalpine firs. Stand exams and reconnaissance surveys reveal a 30 to 40 percent infection rate. Management recommendations to reduce losses from this pathogen include keeping rotation lengths of susceptible species to less than 150 years, early thinning, leaving vigorous nonwounded residual trees, and avoiding tree damage when conducting silvicultural treatments (*Filip et al. 1983; Filip et al. 2009*).

Cedar Laminated Root and Butt Rot

Cedar laminated root and butt rot is caused by the fungus *Phellinus weirii*. This disease is responsible for the majority of western cedar heartwood decay in the Inland Northwest (*Hagle 2006*). Little is known about the life cycle and infection processes of this fungus. Trees are rarely killed outright but can experience extensive decay extending into the butt log and down into the heartwood of roots. Cavity-nesting species often utilize decayed cedar. Management recommendations are to avoid wounds and to harvest at an age prior to the development of extensive decay (*Hagle 2006*).

Red-Brown Butt Rot

Red-brown butt rot, also known as Schweinitzii root and butt rot, is caused by the root-infecting fungal pathogen *Phaeolus schweinitzii* (*Hagle and Filip 2010*). Any conifer can be a host but infection is considered of primary importance in Douglas-fir. Red-brown butt rot infects trees via small roots and causes decay in the interior of the roots, which eventually extends into the butt log, making such trees susceptible to stem collapse. Instead of affecting trees in slowly-expanding groups due to the fungus growing from root system to root system at root contacts, as do root diseases such as Armillaria root disease, red-brown butt rot tends to affect trees on an individual basis (*Hansen and Lewis 1997*). Most damage occurs in stands more than 80 years of age. Management options are limited; rotations can be shortened to about 90 years in Douglas-fir to minimize loss due to decay and less-affected host species can be emphasized over Douglas-fir.

Douglas-Fir Bark Beetle

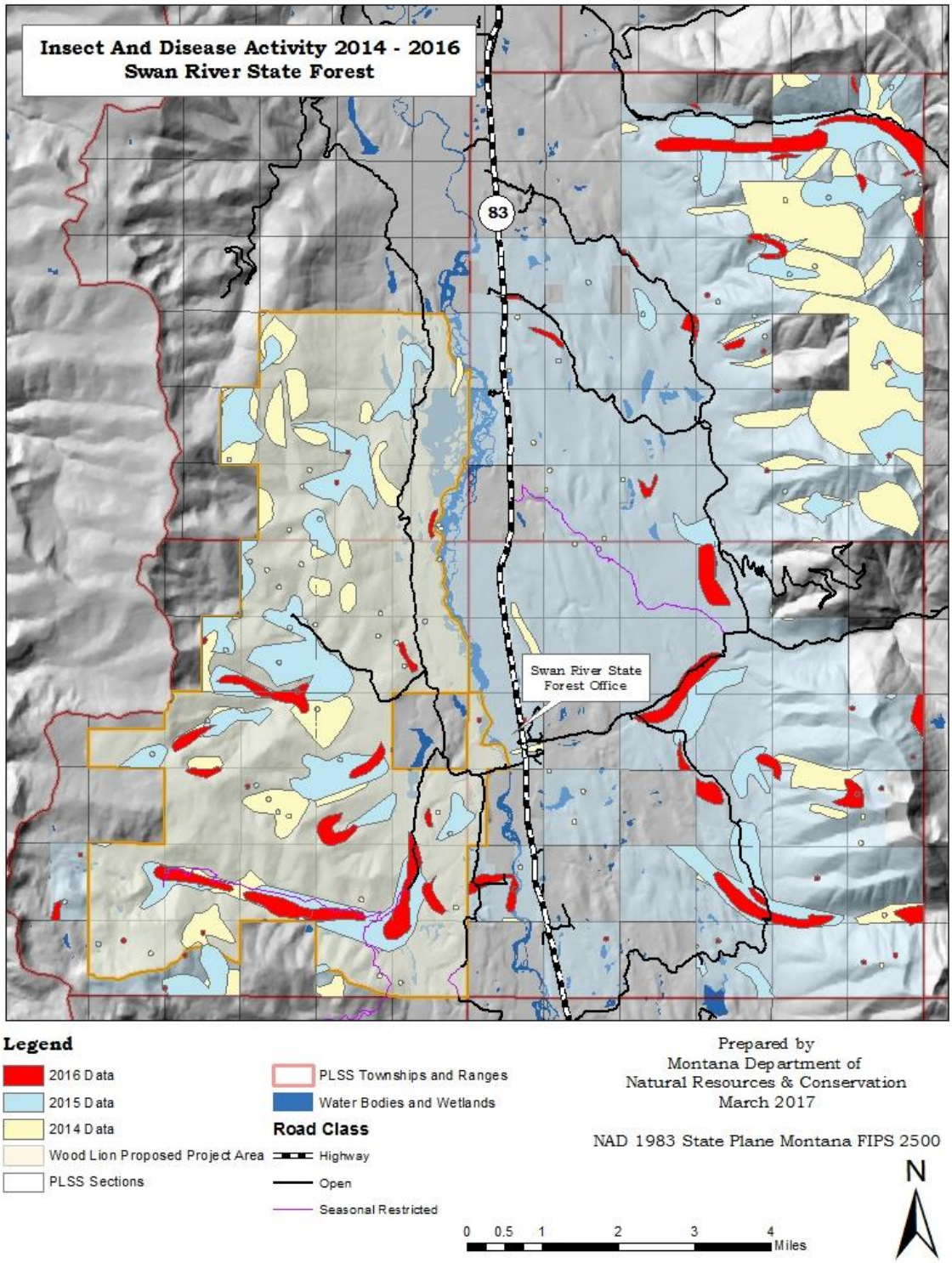
Douglas-fir bark beetle has been active in recent years on Swan River State Forest. The project area has an elevated incidence of the Douglas-fir bark beetle in areas proposed for harvesting. This is due, in part, to continual spread within the forest and active populations on adjacent lands. In general, stands that are at highest risk to attack by the Douglas-fir bark beetle are those with:

- basal areas greater than 250 square feet per acre;
- an average stand age greater than 120 years;
- an average dbh greater than 14 inches; and
- a stand composition greater than 50 percent Douglas-fir (*USDA Forest Service 1999)*.

Management of the Douglas-fir bark beetle should concentrate on the removal of wind-thrown Douglas-fir and the salvage of newly attacked trees before adult beetles can emerge (*Kegley 2011; Livingston 1999; Schmitz and Gibson 1996*).

Douglas-fir in most of the proposed harvest areas are at high risk of Douglas-fir bark beetle attack due to age, size, and stocking. Numerous pockets of infestations were located in the analysis area in 2015. Each spring, aerial surveys and light field reconnaissance by *DNRC* foresters were completed to determine the extent of infestations (see *FIGURE III-6 - INSECT ACTIVITY 2014 THROUGH 2016 IN THE PROJECT AREA, ALL ALTERNATIVES*). Currently, at least 1,440 acres of stands within the project area contain snags in varying levels of decay and low to moderate infestation levels of Douglas-fir bark beetles.

FIGURE III-6 – INSECT AND DISEASE ACTIVITY 2014 THROUGH 2016 IN THE PROJECT AREA, ALL ALTERNATIVES.



Fir Engraver

The fir engraver (*Scolytus ventralis*) has killed many grand and subalpine firs in the Swan Valley. Its primary host is grand fir (*Ferrell 1986*). Endemic populations of fir engraver

beetles are closely associated with root disease centers or other factors that stress its hosts; they rarely make successful attacks on vigorous grand fir (*Goheen and Hansen 1993*). Silvicultural practices that promote the vigor of grand fir stands (thinning, for example) and promote species less susceptible to root disease can reduce impacts from the fir engraver (*Ferrell 1986*). The fir engraver is present in approximately 5 to 10 percent of the project area; however, most of that area has been previously affected and only small patches in select stands are experiencing current activity. In 2014, a salvage project, Westside Fir Engraver Salvage, harvested 300 Mbf from 118 acres in the project area.

Mountain Pine Beetle

The mountain pine beetle (*Dendroctonus ponderosae*) is a native North American bark beetle; hosts include lodgepole pine, western white pine, whitebark pine, and ponderosa pine (*Amman et al. 1989; Gibson et al. 2009*). A mountain pine beetle attack is typically characterized by the presence of pitch tubes along the bole of the tree, although 'blind attacks' can occur in moisture-stressed trees with boring dust as the only indicator. Mountain pine beetles kill trees by girdling the cambium layer beneath the bark and introducing blue stain fungi that grow into the sapwood, both of which disrupt the flow of water and nutrients through the tree (*Gibson et al. 2009*). During an outbreak mountain pine beetles can kill extensive areas of host trees.

Numerous areas of mountain pine beetle infestations were located in the analysis area in 2010. The beetle was estimated to have caused lodgepole and ponderosa pine mortality on approximately 300 acres within the project area. Each spring, aerial surveys, as well as light field reconnaissance by DNRC foresters, were completed to determine the extent of the infestations (see *FIGURE III-6 - INSECT ACTIVITY 2014 THROUGH 2016 IN THE PROJECT AREA, ALL ALTERNATIVES*). In recent years mountain pine beetle population levels have decreased but they are still present and active.

Western Spruce Budworm

The western spruce budworm *(Choristoneura occidentalis)* has been active in recent years across Swan River State Forest. It is the most widely distributed and destructive defoliator in western North America (*Fellin and Dewey 1986*). Large populations can persist if stand conditions are favorable and hosts are available. Repeated defoliation over several years may result in decreased growth, increased susceptibility to bark beetles, and, though extremely rare in the Swan Valley, mortality *(USDA Forest Service 2011).* Within the project area, hosts include: Douglas-fir, Engelmann spruce, grand fir, subalpine fir, and western larch. Factors that influence outbreaks include:

- a large percentage of shade-tolerant species present;
- drier habitat types;
- stand overstocking;
- multi-storied stand structure;
- low tree vigor;
- increasing stand age; and
- continuous, stand cover types *(USDA Forest Service 1989).*

Management of the western spruce budworm should emphasize: even-aged

management, thinning from below, lower stand densities, and maintaining tree species diversity (*Fellin and Dewey 1986; USDA Forest Service 1989).*

Numerous pockets of infestations were located in the analysis area from 2014 to 2016. Each spring, aerial surveys and light field reconnaissance by *DNRC* foresters are completed to determine the extent of infestations (see *FIGURE III-6 - INSECT ACTIVITY 2014 THROUGH 2016 IN THE PROJECT AREA, ALL ALTERNATIVES*). Budworm was estimated to have been present on approximately 6,100 acres within the project area.

ENVIRONMENTAL EFFECTS

Direct and Indirect Effects

- ***Direct and Indirect Effects of No-Action Alternative A to Insects and Diseases***

Sawlog volume would continue to be lost from the project area due to insect and disease effects, especially from Douglas-fir bark beetle, Armillaria root disease, mountain pine beetle, and Indian paint fungus in inaccessible stands with large trees. Salvage logging would continue where stands are accessible without building roads.

If this alternative were implemented, seral and other shade-intolerant species, such as western larch and Douglas-fir, would continue to be lost from insect infestations and disease infections. The spread of the fir engraver would continue, causing mortality in grand and subalpine firs.

School trusts may lose long-term revenue due to:

- increasing mortality rates and sawlog defect that are caused by the ongoing presence of a variety of the aforementioned pathogens;
- reduced growth rates as old-growth stands continue to age and defects increase; and
- the non-regeneration of high-valued species such as western larch and western white pine.

- ***Direct Effects of Action Alternatives B and C to Insects and Diseases***

Harvest treatments would target those species or individual trees affected by insects and diseases, as well as salvage recently killed trees. Douglas-fir currently or recently infested by the Douglas-fir bark beetle, lodgepole pine currently or recently infested by the mountain pine beetle, and western white pine currently or recently infested by the mountain pine beetle would be removed when merchantable value exists. Western larch with moderate to severe infections of dwarf mistletoe would be harvested. Grand fir and subalpine fir would be removed if infected with Indian paint fungus. Western white pine currently infected or recently killed by white pine blister rust would be removed when merchantable value exists. Where possible, whitebark pine would be retained. Trees within *Armillaria* root disease pockets would be removed, particularly if conversion to early-seral species is possible. Engelmann spruce infected with western spruce budworm would be removed before loss of merchantable value occurs.

Harvest treatments would focus on leaving early-seral species, such as western larch, that are more resistant to insect and diseases than shade-tolerant species. Reserve trees left following harvesting would also provide a seed source for natural regeneration.

Insect and disease problems would be reduced following implementation of either action alternative. Action Alternative B would treat fewer acres within the project area but those acres would be treated more intensely. Regeneration type harvest prescriptions would favor the retention of early seral species that tend to be more resistant to insects and diseases. Action Alternative C treats more acres across the landscape but with a lighter touch. Potentially more individual trees with insect and disease issues would be removed. Although, most stands would retain shade-tolerant species that are prone to insect and disease activity.

- ***Direct Effects of Action Alternative B to Insects and Diseases***

The stands selected for this alternative are slightly more concentrated in the project area and have insect and disease activities occurring at all levels, from low to moderate to high levels. Emphasis would be placed on trees (groups or individuals) that are affected by insects or diseases, are at risk of infection, or, if dead, contain merchantable material.

The majority of the units would be treated with regeneration harvests, but some variable thinning would be applied. Regenerating species would be shade-intolerant species, such as western larch and blister rust-resistant western white pine, that are more resistant to many of the infecting agents currently present. This alternative treats stands with various levels of insect and disease risk: low 590 acres; moderate 1,460 acres; and high 897 acres.

- ***Direct Effects of Action Alternative C to Insects and Diseases***

The stands selected for this alternative are spread throughout the project area and have insect and disease activities occurring at all levels, from low to moderate to high levels. Emphasis would be placed on trees (groups or individuals) that are affected by insects or diseases, are at risk of infection, or, if dead, contain merchantable material. In units utilizing a regeneration harvest, seed trees would remain scattered throughout to provide a seed source; these seed trees would primarily be shade-intolerant species, such as western larch and blister rust-resistant western white pine, that have a higher tolerance to insects and diseases. This alternative treats stands with various levels of insect and disease risk: low 655 acres; moderate 1,513 acres; and high 1,158 acres.

- ***Indirect Effects of Action Alternatives B and C to Insects and Diseases***

Where shelterwood and variable-thin treatments are applied, an indirect effect would be increased vigor and growth rates of the remaining trees due to the availability of light, nutrients, and moisture. Following treatment, the species composition would be more resilient to damage by forest diseases and insects.

Rust-resistant western white pine, western larch, and, in some cases, ponderosa pine, Douglas-fir or Engelmann spruce would be planted in units utilizing seed tree harvest treatments. The western white pine seedlings would increase a declining component on Swan River State Forest. The planting of western larch would help reduce the likelihood of future insect and disease problems due to its lower susceptibility to many of the problems being addressed.

Action Alternative B proposes harvesting insect and disease-infected stands using site-intensive management treatments such as seed tree regeneration harvesting. This alternative would not treat as many acres across the landscape but would promote

establishment of early seral species which tend to be more resistant to insect and disease infection.

Action Alternative C would treat a greater number of stands at moderate risk due to insects and disease present throughout the project area. This alternative would treat the most acres but with a lighter touch through commercial thinning. Most stands would retain shade-tolerant species that are prone to insect and disease activity. Overall, this alternative may do less than Action Alternative B to address the insect and disease problems prevalent in the project area.

Cumulative Effects

- ***Cumulative Effects of No-Action Alternative A to Insects and Diseases***

No harvesting of live, dead, dying, or high-risk trees would occur. Some salvage harvesting of insect-infested and diseased trees would occur, but at a slower, less-effective rate and not as a result of this analysis or association with this project. Forest stands would maintain dense stocking levels; which contribute to the spread of insects, diseases, and fuel loading; which could lead to high-intensity fires, unnatural forest structures, and overall poor health of the stand.

- ***Cumulative Effects of Action Alternatives B and C to Insects and Diseases***

Timber management activities on Swan River State Forest, including those proposed to varying extents under each action alternative, have generally implemented prescriptions that would reduce losses and recover mortality due to heartrots, bark beetles, white pine blister rust, western larch dwarf mistletoe, blowdown, and other causes. Older stands are the most susceptible to many of the identified insect and disease problems in the project area due to lack of vigor, stand age, drought, and other factors. Stand regeneration treatments that would bring older stands to a 0 to 39 year age class are producing stands with species compositions more resilient to the impacts of forest insects and diseases and more in line with historic forest conditions. Thinning treatments have further reduced the percentage of infected or infested trees.

Activities on USFS as well as on small, private landholdings adjacent to Swan River State Forest and the project area have been mixed. Depending on land management objectives or other mandates, small private landowners or other government agencies may or may not currently employ prescriptions that aim to reduce insect and disease levels on their lands.

FIRE EFFECTS

Issue: The proposed activities may affect forest fire conditions, levels, and hazards through tree removal, increased public access, and/or fuel reduction.

EXISTING ENVIRONMENT

Swan River State Forest Fire History

Swan River State Forest displays a mosaic pattern of age classes and cover types that have developed due to variations in fire frequency and intensity. In areas that have experienced relatively frequent fires, Douglas-fir, western larch, and ponderosa pine cover types, with a component of lodgepole pine and western white pine, were

produced. As fire frequencies become longer in time, shade-tolerant species (grand fir, subalpine fir, Engelmann spruce, western red cedar) have a better chance to develop. Higher elevation sites in the forest have longer fire frequencies, and the resultant stands are multistoried with a dominant shade-tolerant cover type. Where fire frequencies were short, the stands are open, single-storied, and occasionally two-storied. As fire suppression began, cover types and fire frequencies were altered. Stands of ponderosa pine, western larch, and/or Douglas-fir have become multi-storied with shade-tolerant species. Ponderosa pine-dominated stands that were once open now have a thick understory of Douglas-fir and/or grand fir. Fires that do occur are generally kept small and natural fire effects are limited. If a larger scale fire were to start, many acres could be affected due to ladder fuels, heavy fuel accumulation, and other environmental factors.

Swan River State Forest has identified 119 fires that have burned 2553 acres over the last 36 years. On average, 3.4 fires per year occur. Over the last 36 years, 75 lightning fires have burned 193 acres, with the largest occurring in 2011 during a dry lightning storm; that fire burned 270 acres from western red cedar habitat types to the upper subalpine fir habitat types. Lightning causes approximately 63 percent of all fire starts on Swan River State Forest, and humans cause approximately 37 percent. Human-caused fires are typically started from campfires, debris burning, equipment, or incidents directly related to powerline sparks *(http://mine.mt.gov/f1000/reports.aspx:F1000 Reports*).

In or adjacent to the project area on the west side of Swan River, 36 fires burned 26 acres over the last 36 years. Lightning caused 27 out of 36, or 75 percent of the fires, and burned 4.1 acres *(F1000 reports).*

Past research of fire history in Swan Valley has been conducted. The following summaries describe the fire history and patterns these fires created on the landscape.

Hart (1989) summarized the historical data as follows:

> *Although most of the burns…were of stand-replacement intensity, many less intense fires had also crept over wide areas. The upper (southern) half of Swan valley had been extensively burned, and was blanketed by fallen trees. In this area, fires were moderate, thinning the forest. The lower (northern) Swan also was scarred by fires, but it had a great deal of older mixed forest; species typical of mesic sites were found in this region…*

Antos and Habeck (1981), working mostly in the northern portion of Swan Valley, emphasized the dominance of low-frequency, high-intensity fires (stand-replacement fires) in determining stand patterns:

> *During most summers, the occurrence of frequent rain makes intense fires unlikely; but in some years, dry summers set the stage for large crown fires. Most stands were initiated on large burns… An average frequency of replacement burns of between 100 and 200 years was characteristic… Stands over 300 years old do occur, and repeat burns less than 20 years apart have also occurred. In some forests initiated by replacement burns, ground fires have occurred after stand establishment, with variable effects on the overstory. Very wet sites, such as stream bottoms and lower north slopes, often experience partial burns when located within the perimeter of large replacement burns.*

The analysis of fire history indicates that the lower elevations of Swan Valley were burned frequently; in the drier southern half, the intervals were shorter than on the more moist northern part. Between the years of 1758 and 1905, the northern portion of the range had fire-free intervals of about 30 years, and the presence of western larch and even-aged lodgepole pine suggests the fires were of higher intensity. The remaining samples are from the southern end and these have a shorter interval of 17 years (*Freedman and Habeck, 1985*).

Historical data indicates that forests in Swan River State Forest and the project area were cooler and moister than the broad scale *Climatic Section* and western Montana averages. Forests were also considerably older with a far higher proportion of western larch/Douglas-fir cover types than at the broad scale. Although the forests of Swan River State Forest were old, the representation of shade-tolerant cover types was low, indicating disturbance was frequent or recent enough to prevent widespread cover type conversion through succession.

Fire Groups

The project area is primarily represented by 2 fire groups as classified by *Fischer and Bradley (1987)*. Fire Group 11 is found on warm, moist grand fir, western red cedar, and western hemlock habitat types (76.6 percent of the project area). Fire Group 9 is found on moist, lower subalpine habitat types (20.5 percent of the project area). Other fire groups represented in the project area include Fire Group 10 (cold, moist upper subalpine and timberline habitat types) representing 0.3 percent, Fire Group 8 (dry, lower subalpine habitat types) representing 2.5 percent, and Fire Group 6 (moist Douglas-fir habitat types) representing 0.1 percent of the project area. *TABLE III-23 – CHARACTERISTICS OF FIRE GROUPS OCCURRING IN THE PROJECT AREA (Fischer and Bradley, 1987)* describes the characteristics of the Fire Groups present in the project area.

TABLE III-23 – CHARACTERISTICS OF FIRE GROUPS OCCURRING IN THE PROJECT AREA (Fischer and Bradley, 1987).

	FIRE GROUP				
	6	**8**	**9**	**10**	**11**
Habitat type group	Moist Douglas-fir habitat types	Dry, lower subalpine habitat types	Moist, lower subalpine habitat types	Cold, moist upper subalpine and timberline types	Moist grand fir, western red cedar, and western hemlock habitat types
Percent of project area	0.1	2.5	20.5	0.3	76.6
Fire return interval/ severity	Frequent/ low to moderate	Frequent to infrequent/ low to moderate	Infrequent/ mixed (low to high)	Frequent to infrequent/ mixed (low to high)	Infrequent/ mixed (low to high)

Average fuel loading (tons/acre)	12	18	25	18	25
Postharvest fuel loading (tons/acre)	10 to 25	10 to 25	10 to 25	10 to 25	10 to 25

Stands in both Fire Groups 9 and 11 would typically experience infrequent fires of mixed severity ranging from stand-replacing during droughty conditions to minor ground fires under normal or excessively moist conditions. Fire free intervals typically range from 100 to 200 years between stand-replacing fires, but return intervals of 30 years have also been documented, particularly in the relatively drier grand fir habitat types that have a component of ponderosa pine. These fire groups have predominately moist conditions, which can allow these areas to serve as a fire break for low-intensity ground fires. These sites have high fuel loadings and high plant productivity that, when combined with drought conditions, can lead to severe and widespread fires. The effects of fire on these sites are dependent on severity, but generally create conditions favorable to early-seral, shade-intolerant species by killing shade-tolerant overstory trees and preparing mineral seedbeds for natural regeneration.

Fire Group 6 is characterized by frequent, low-severity fires. These sites are drier than those found on Fire Groups 9 and 11, and typically have significant components of ponderosa pine and Douglas-fir. On these sites, frequent, low-severity fire would kill most Douglas-fir and maintain forests dominated by ponderosa pine. A prolonged fire-free interval would allow the establishment and development of Douglas-fir. Fire Group 8 is characterized by variable frequency and severity fires with fuel loading and duff layers contributing significantly to overall fire hazard during dry conditions. On these sites, fire would kill most subalpine fir and Engelmann spruce, favoring Douglas-fir and lodgepole pine. Fire Group 10 is characterized by frequent to infrequent, mixed-severity fires that are heavily influenced by the climate and soil of these high-elevation sites *(Fischer and Bradley)*.

Hazards and Risks in the Project Area

The hazards and risks associated with wildfires include a potential loss of timber resources, effects to watersheds, and loss of property. The majority of timber stands being considered for harvesting are in the mature or older age classes in stands that have not burned since pre-European settlement. Fire hazards in these areas range from above- to near-natural levels with moderate to high accumulations of down and ladder fuels relative to stand densities. Some of the western larch/Douglas-fir stands have a dense understory of grand fir, creating a significant hazard due to its density and structure that increases the risk that a low-intensity ground fire could develop into a stand-replacing crown fire.

Many of the old-growth stands in the project area are relic stands. Stand-replacing fires have not occurred in the area for 200 or more years. As the stands continue to age and mortality occurs from various biotic and abiotic factors, fuels would accumulate. These

stands have an in-growth of shade-tolerant trees, which provide ground and ladder fuels, thus increasing their susceptibility to intense fires, especially during times of drought. Accessible stands have had salvage logging and firewood cutting that has reduced the larger-diameter down fuels in the area. The continued encroachment of shade-tolerant trees, accumulations of down woody debris, and mortality increases fire risks.

Increased recreational use in the area is another potential ignition source that may result in a hazardous condition due to fuel accumulation.

Nonindustrial forestland adjacent to the project area has a similar amount of fuel loading. Much of the adjacent *USFS* ownership has not been managed for several years. The resulting stands have a moderate to high risk of stand-replacement wildfires due to continued heavy fuel loadings.

ENVIRONMENTAL EFFECTS

Direct and Indirect Effects

- ***Direct and Indirect Effects of No-Action Alternative A to Fire Effects***

The wildfire hazard would not change substantially in the short term. With continued fuel accumulation from down woody debris, the potential for wildfires increases. Large-scale, stand-replacing fires may be the outcome. Eventually, due to the continuing accumulation of fine fuels, snags, ladder fuels, and deadwood components, the risk of stand-replacement fires would increase.

- ***Direct and Indirect Effects of Action Alternatives B and C to Fire Effects***

Immediately following timber harvesting, the amount of fine fuels would increase. Hazards would be reduced by scattering slash, cutting limbs and tops to within a maximum height to hasten decomposition, spot-piling by machine in openings created by harvesting, broadcast burning, and burning landing piles.

Clearcuts, seedtree, and shelterwood units would be treated by simultaneously piling slash and scarifying soil with an excavator, followed by burning slash piles. Scarification prepares seedbeds for natural regeneration.

The hazards of destructive wildfires in these stands would be reduced because larger, more fire-resistant species would be left at wider spacing. Grand fir, some Douglas-fir, western red cedar, and subalpine fir, which pose a higher crown-fire hazard because of their low-growing branches and combustible nature, would be removed. This would reduce the potential mortality from low- to moderate-intensity fires, but would not 'fireproof' the stands from the high-intensity stand-replacing fires brought on by drought and wind.

Clearcuts, seedtree, and shelterwood harvest treatments would reduce wildfire hazards. Regeneration harvests, where slash has been treated, but trees are still small, have proven to be fire resistant in many cases. However, contrary conclusions have been put forth wherein timber harvesting is believed to have increased the risk of wildfires, especially in the short term, where logging slash was not treated. Fire hazards would slowly increase over time as trees reach pole size, crown densities increase, and fuels

accumulate.

Immediately following timber harvest were partial cutting treatments (commercial thin, overstory removal, etc) would increase the amount of fine flashy fuels. Wildfire hazard would be reduced by scattering slash, cutting limbs and tops to lay low to the ground to hasten decomposition. Spot piling with an excavator in openings or areas of heavy concentrations, followed by burning of slash piles would reduce the fire hazard. Fire hazards would again slowly increase over time as crown densities increase and fuels accumulate.

Cumulative Effects

- ***Cumulative Effects of No-Action Alternative A on Fire Effects***

The risk of wildfires would continue to increase as a result of long-term fire suppression.

- ***Cumulative Effects of Action Alternatives B and C on Fire Effects***

Fuel loadings would be reduced in treated stands, decreasing wildfire risks in these specific areas.

The Scout Lake and Cilly Cliffs Multiple Timber Sales have a combination of broadcast burning and excavator piling, with burning to be completed from the fall of 2015 to the fall of 2021. Past and ongoing salvage sales across Swan River State Forest will also have excavator piling and burning associated with slash at the landings. The net cumulative effect would be a reduction in wildfire risks. The differing management techniques of *USFS* and small, private landowners may result in a slight, net cumulative reduction in wildfire risks.

SENSITIVE PLANTS

Issue: The proposed activities may affect sensitive plant populations through ground disturbance.

EXISTING ENVIRONMENT

The *Montana Natural Heritage Program* database (*http://mtnhp.org/*) was searched in May 2003 and January 2017 for plant species and the habitat that would support these plants in the vicinity of Swan River State Forest. Botanists were contracted in 2003 to perform a site-specific survey for sensitive plants on Swan River State Forest. Results of this search were compared to the location of proposed harvest sites for potential direct and indirect impacts and the need for mitigation measures was assessed.

The majority of sensitive plants and their related habitat features were found in wet meadows, areas that are not normally classified as forest stands or considered for timber harvesting. The survey identified 14 species of special concern existing within a total of 24 separate populations (*Pierce and Barton 2003 and Montana Natural Heritage Program 2017*); one of these plant populations was found to be present in a proposed harvest unit.

ENVIRONMENTAL EFFECTS

Direct and Indirect Effects

- ***Direct and Indirect Effects of Action Alternative B to Sensitive Plants***

Minimal to no effects are expected to the single population of sensitive plants found to occur in one of the proposed harvest units. The species, *Botrychium montanum*, mountain moonwort, has an established population presence in Section 10 Township 24 north, Range 18 west along the eastern section line. Prior to any harvest activity, this area would be resurveyed to locate and identify existing species population presence. If plant populations are found, the appropriate habitat areas would be excluded from the harvest unit. Typically, sensitive plants are located in such wet areas that activities would not occur within the plant habitat.

- ***Direct and Indirect Effects of Action Alternative C to Sensitive Plants***

No effects are expected because no populations of sensitive plants occur within the proposed harvest units. Typically, these plants are located in such wet areas that activities would not occur within the plant habitat.

Cumulative Effects

- ***Cumulative Effects of All Alternatives to Sensitive Plants***

If changes occur in the water yield or nutrient level, sensitive plant populations may, in turn, be affected. Given the level of the proposed and active harvesting on Swan River State Forest and other lands in the project area, no measurable changes in water yield or surface water levels are anticipated from the proposed action alternatives in Whitetail, Main Woodward, or South Woodward creeks. No change in nutrient levels would occur due to mitigation measures designed to prevent erosion and sediment delivery. USFS lands, other State managed lands, and private landholdings may have sensitive plant populations on their ownership, and various activities may impact those populations.

NOXIOUS WEEDS

Issue: Harvest activities may affect noxious weeds through ground disturbance.

EXISTING ENVIRONMENT

Spotted knapweed (*Centaurea mauclosa*), yellow hawkweed (*Hieracium caespitosum*), orange hawkweed (*Hieracium aurantiacum*), Canada thistle (*Cirsium arvense*), Bull thistle (*Cirsium vulgare*), oxeye daisy (*Chrysanthemum leucanthemum*), and common St. John's-wort (*Hypericum perforatum*) have become established along road edges in the project area. Swan River State Forest has an ongoing program to reduce the spread and occurrence of noxious weeds.

ENVIRONMENTAL EFFECTS

Direct and Indirect Effects

- ***Direct and Indirect Effects of No-Action Alternative A to Noxious Weeds***

Noxious weed populations would continue as they exist. Weed seed would continue to be introduced by recreational use of the forest and other forest management activities on adjacent ownerships. Swan River State Forest may initiate spot spraying to reduce

noxious weed spread along roads under the *FI* program.

- ***Direct and Indirect Effects of All Action Alternatives to Noxious Weeds***

Logging disturbance would provide opportunities for increased establishment of noxious weeds; log hauling and equipment movement would introduce weed seeds from other sites. The occurrence and spread of existing or new noxious weeds would be reduced by mitigation measures in the form of integrated weed-management techniques. Grass seeding of new and disturbed roads and landings and spot spraying of new infestations would reduce or prevent the establishment of new weed populations. Contractors would be required to wash and have machinery inspected prior to entering the project area to reduce the introduction of noxious weed seeds. Roadside herbicide spraying would reduce existing populations of noxious weeds. All herbicide applications would follow label directions, avoid introduction of chemicals into riparian systems, and target only the intended species of noxious weeds.

Cumulative Effects

- ***Cumulative Effects of No-Action Alternative A to Noxious Weeds***

Salvage logging on state-managed land and activities on adjacent lands would continue to provide opportunities for noxious weeds to become established. Current population levels would continue to exist and may increase over time.

- ***Cumulative Effects of All Action Alternatives to Noxious Weeds***

The action alternatives, together with other management and recreational activities on Swan River State Forest, would provide an opportunity for the transfer of weed seed and increased establishment of noxious weeds. Preventative actions facilitated by the *Lake County Weed Board* and the active weed-management activities performed by Swan River State Forest would reduce the spread and establishment of noxious weeds, as well as the impacts resulting from the replacement of native species. Swan River State Forest would continue to perform weed management through this action depending on funding levels. The US Forest Service works in conjunction with Swan River State Forest to treat noxious weeds; therefore, treatment of noxious weeds could be expected on adjacent parcels under their continued weed-management efforts. Private landowners may continue to transfer weed seed through vehicle travel and lack of weed management.

VEGETATION ANALYSIS ATTACHMENT 1
OLD-GROWTH ATTRIBUTE ASSIGNMENTS

LARGE LIVE TREES

Listing the number of trees in the (21 inches or greater dbh category), first, and the (17 inches or greater dbh category) second: all possible combinations are shown for each class.

Lots = (11, 11); (11, 3); (11, 6)

Some = (6, 11); (6, 6); (1, 11); (6, 1); (6, 3)

Few = (1, 6); (1, 1); (0, 11); (0, 6); (3, 3); (3, 1)

None = (0, 0); (0, 1)

LARGE COARSE WOODY DEBRIS

DWOODSM = number of small pieces (<16 inches dbh) of coarse woody debris within a 300-foot transect

DWOODLG = number of large pieces (>16 inches dbh) of coarse woody debris within a 300-foot transect

CWDNEW = DWOODSM + (3 * DWOODLG)

Lots = CWDNEW ³ 27

Some = CWDNEW ³ 14 and <27

Few = CWDNEW ³ 3 and <14

None = CWDNEW 0, 1, or 2

SNAGS

Lots = [6 snags at 21 inches or greater dbh] or [11 snags at 15 to 20 inch dbh] possible combinations: listing the 21 inches or greater dbh snag category), first and the (15- to 20-inch dbh snag category), second are (6,0), (6,1), (6, 3), (6,6), (6,11), (11,0), (11,1), (11,6), (11,11), (1,11), or (0,11)

Some = [1 snag at 21 inches or greater dbh] or [6 snags at 15 inches or greater dbh] possible combinations: listing the (21 inches or greater dbh snag category), first and the (15- to 20-inch dbh snag category), second are (3, 3), (3, 6), (1, 0), (1, 1), (1, 6), (1, 3), or (0, 6)

Few = [0 snags at 21 inches or greater dbh] or [1 to 5 snags at 15- to 20-inch dbh] possible combinations: listing the (21 inches or greater dbh snag category), first and the (15- to 20-inch dbh snag category), second are (0, 3) or (0, 1)

None = [0 snags at 21 inches or greater dbh and 0 snags at 15- to 20-inch dbh) possible combinations: listing the (21 inches or greater dbh snag category), first and the (15- to 20-inch dbh snag category), second are (0, 0)

DECADENCE

Lots = Stand mortality likely exceeds growth.

Some = Closed canopy with crown ratios less than 33 percent. Growth and mortality approximately equal.

GEOLOGY AND SOILS ANALYSIS

INTRODUCTION

The following document discloses the potential impacts to soils resources within the project area as defined in *CHAPTER 1 – PURPOSE AND NEED FOR ACTION* for each of the 2 alternatives outlined in *CHAPTER II – ALTERNATIVES*. Both action alternatives vary by the amount of new and temporary road construction, type and extent of logging system used, and silvicultural prescriptions. All of the variables mentioned above have been shown to result in a range of impacts to soil resources in both magnitude and spatial extent (*DNRC 2009, 2011*). The following document will analyze each alternative with respect to issues and concerns that were raised internally within DNRC and through public comment and public field tours as described in *CHAPTER 1 – PURPOSE AND NEED, SCOPE OF THIS EIS, ISSUES STUDIED IN DETAIL.*

ISSUES ANALYZED AND DISMISSED

The following bulleted issue statements listed below summarizes both internal and public concerns that were identified prior to field review and document development.

- Traditional ground-based harvest operations have the potential to compact and displace surface soils which can reduce hydrologic function, macro-porosity, and aggregate stability. This suite of processes is referred to as soil function.
- Areas of impacted soil function have the potential to increase rates of offsite erosion which may affect productive surface soils.
- Activities associated with the proposed actions such as timber harvest and road construction have the potential to affect slope stability through increased runoff response and road surface drainage concentration resulting in the exceedance of resisting forces on landslide prone hillslopes.
- The removal of large volumes of both coarse and fine woody material through timber harvest reduces the amount of organic matter and nutrients available for nutrient cycling possible affecting the long-term productivity of the site.
- Repeat entries into a forest stand with heavy equipment has the potential to reinforce existing detrimental soil impacts and cumulatively inhibit soil recovery and soil productivity.

MEASURMENT CRITERIA

Field reviews, professionally published soils surveys, geologic maps, landscape vegetation data and DNRC soil monitoring data guided data collection of measurement criteria for this analysis. The methods for how this information will be used to disclose impacts can be reviewed in the analysis methods section of this document. The measurement criteria that will be used to assess direct, indirect, and cumulative effects regarding the issues previously listed outlined below (*TABLE III-24)*.

TABLE III-24 - MEASUREMENT CRITERIA.

GENERALIZED ISSUES	MEASUREMENT CRITERIA	UNITS
Soil Physical Properties	Displacement, Rutting, and Compaction *(Howes et al. 1983)*	Percent (%) of area
Erosion	K Factor, Slope, Erosion Risk and Sediment Delivery Efficiency, Rainfall Intensity	K, %, Risk, in/day
Site Nutrients	Volume of coarse and fine woody debris	Tons/Acre
Long Term Productivity	Amount of acres proposed for re-entry, coarse and fine woody debris	Acres, Tons/Acre
Slope Stability	Area of existing and proposed new road construction on potentially unstable landtypes	Acres

ANALYSIS AREA

The project area consists of 19,437 acres located within Swan River State Forest (*FIGURE III-16*). While harvest within each alternative varies by location and intensity as well as by the type and extent of logging systems employed, the common analysis area for direct and indirect effects to soil physical properties, erosion, nutrient cycling and site productivity will include harvest units, log landings, and areas of new and temporary road construction.

Cumulative effects by definition are the collective impacts on the human environment of the proposed action(s) when considered in conjunction with other past, present, and future actions related to the proposed action by location or generic type. For an impact to soil resources to be cumulative they must overlap a least twice in both time and space. Considering this constraint, the cumulative effects analysis area for all proposed alternatives will be the same as that described for direct and indirect impacts above.

ANALYSIS METHODS

It has been displayed through DNRC soil monitoring (*DNR*C 2009, 2011) that past performance in harvest design, BMP design, and implementation and timber sale contract administration are good indicators of expected future results regarding impacts to soil resources. The following soil analysis was designed around this assumption which has been validated through 25 plus years of quantitative soil monitoring conducted by DNRC.

Soil disturbance within harvest units proposed for re-entry were evaluated for current levels of detrimental soil impacts in portions of harvest units with documented historic harvest. The level of existing impacts within these areas, as well as data from soil monitoring results, will be used to forecast potential effects of the proposed actions. Numerous efforts in past DNRC soil monitoring and environmental documents (*DNRC 2009, 2011*) have explored the natural amelioration rate of compacted soils similar to those found in the project area and this information will also assist in forecasting potential effects.

Erosion will be qualitatively assessed using variables of erosion K factors, erosion risk, sediment delivery efficiency, slope and probability of various rainfall intensities.

Forecasting effects to site nutrient pools will be guided by coarse and fine woody debris data collected throughout both the project area and Swan River State Forest (*Brown 197*4) in various habitat types and intensities of historic management. This data will be used in concert with scientific literature (*Harvey et al. 1987, Graham et al. 1994, Laiho* and *Prescott 1999, Harrison et al. 2011*) to not only forecast potential impacts but recommend effective mitigations.

All of the above listed measurement criteria are interconnected and support positive feedback mechanisms with soil biologics. The summation of all the above listed variables, physical, chemical and biological soil properties, create a suite of processes that together control soil productivity and ultimately controls forest productivity. The risk of impacts to each measurement criteria will be summarized and qualitatively assessed to forecast potential impacts to the soil resources long-term productivity.

Effective risk management requires assessment of inherently uncertain events and circumstances, typically addressing 2 dimensions: how likely the effect is to occur (probability), and the magnitude the effect would be if it happened (impact) (*Hillson and Hulett 2004*). This method of risk management and communication is employed for all issues throughout this document.

RELEVANT AGREEMENTS, LAWS, PLANS, RULES, AND REGULATIONS

Developed in 1996, the SFLMP is a programmatic plan that outlines the approach and philosophy guiding land-management activities on forested school trust lands throughout the state of Montana (*DNRC 1996*). Within this plan, detrimental soil disturbance is defined and recommends that projects implemented by DNRC should strive to maintain the long-term soil productivity of a site by limiting detrimental soil impacts to 20 percent or less of a harvest area and retain adequate levels of both coarse and fine woody material to facilitate nutrient retention and cycling.

To accomplish these goals and objectives contract stipulations and site specific BMPs are developed to provide protection for soil resources in a project area. The *Forest Management Rules [ARM 36.11.422 (2) (2) (a)]* state that appropriate BMPs shall be determined during project design and incorporated into implementation. *ARM's 36.11.410* thru *36.11.414* mandates that adequate coarse woody debris shall be left on site to facilitate nutrient conservation and cycling. To ensure the incorporated BMPs are implemented and site productivity maintained, specific requirements are incorporated into the DNRC timber sale contracts. The following are some general BMP's and mitigations that would be incorporated into the proposed action to ensure adequate soil protection and long-term productivity of the site.

- Limit equipment operations to periods when soils are relatively dry, (less than 20 percent soil moisture), frozen or snow covered (12 inches packed or 18 inches unconsolidated) to minimize soil compaction and rutting, and maintain drainage features.
- Ground-based logging equipment (tractors, skidders, and mechanical harvesters) is limited to slopes less than 45 percent on ridges, convex slopes; and to 40 percent or less on concave slopes without winter conditions.
- The Forest Officer shall approve a plan for felling, yarding and landings in each harvest unit prior to the start of operations in the unit. The locations and spacing of skid trails and landings shall be designated and approved by the Forest Officer prior to construction.
- Levels of coarse and fine woody material will be retained on site as prescribed by the Forest Officer and recommended by the project soil scientist using the best available science (*Graham et al. 1994*). 10 to 15 tons/acre of woody material and upwards of 25 tons/acre, in favorable habitat types or intense siliviculture prescriptions, is recommended for the Project Area. Upwards of 35 percent of this volume should be retained as fine woody material (1 to 3 inches) with as much fine needles retained on site as possible.

These general BMPs along with site specific mitigations designed during contract development have been monitored for effectiveness by DNRC since 1988 and have repeatedly been shown to be an effective measure to achieve objectives described in the SFLMP (DNRC *2009*, 2011).

EXISTING ENVIRONMENT

This section describes the current conditions and trends of the soil resources within the project area. These conditions, with respect to geology and soils, will serve as the baseline to which environmental effects of the alternatives will be compared.

CLIMATE

The climate of the Project Area is seasonal and highly variable. The average annual precipitation of 25 to 65 inches in the project area is directly correlated to elevation which ranges from 3,100 to 6,800 feet. Approximately 62 percent of this precipitation is received as snow in winter months from late November to early April although spring rains during May and June also comprise a large portion of annual precipitation. The table below (*TABLE III-25)* provides storm recurrence intervals for the project area along with the associated 24-hour precipitation totals and the probability of such a storm happening in any given calendar year.

TABLE III-25 – PRECIPITATION INTENSITY AND RECURRENCE.

RECURRANCE INTERVAL (YEARS)	24 HOUR PRECIPITATION (INCHES)	PROBABILITY OF OCCURANCE PER YEAR (%)
1	1.1	100%
2	1.3	50%
4	1.4	25%
5	1.5	20%
10	1.8	10%
20	2.2	5%
25	2.3	4%
50	2.4	2%

The probability of intense precipitation over short durations can be an analog to erosive events and can help highlight the probability of erosion during such events. It is assumed here that BMP effectiveness would be compromised to varying degrees during a storm with an event probability less than 4 percent.

GEOLOGY

The geology within the project area is dominated by the middle to upper stratigraphic sections of the Ravalli group and conformably above this sequence, the Piegan group, both Precambrian in age. The only formation within the Ravalli group exposed in the project area is the poorly exposed Spokane formation. This formation is thinly bedded to laminated, red to maroon-gray, coarse-grained argillite and siltites (*MBMG 2004*). The Spokane formation is relatively resistant to weathering and is a fair nutrient source for soils (*Johnson 2007*).

Basal sections of the Piegan group include the Helena Formation which dominates outcrops in higher elevations of the project area. This formation is characterized by cyclic bedding, forming bands of gray to black argillite or gray dolomitic silite that weathers to a tan color, alternating with dense limestone that weathers to orange-brown (*MBMG 2004*). Moderately resistant to weathering, the mineralogy of this formation makes for a poor source of soil nutrients required for tree growth (*Johnson 2007*).

During the Laramide orogeny, a period of mountain building in western North America, which started in the Late Cretaceous, 70 to 80 million years ago, and ended 35 to 55 million years ago, the Swan Valley was formed through block faulting along the Swan fault on the eastern margins of the valley. This period of uplift is responsible for the dramatic relief observed today along the Swan front and more gradual grades of the headwall dipping to the east in the southern Mission Mountains.

LANDFORMS AND SOILS

The landforms and valley morphology observed today in the Swan Valley are largely a result of glacial and fluvial processes working in concert to erode, transport and redeposit sediment. Two large scale continental glacial advances and recessions have helped to transport the massive glacial till deposits we observe today in the form of moraines, eskers, outwash plains and numerous other glacial features. Since the end of the Pinedale Glaciation, approximately 15,000 years ago, massive alpine glaciers had advanced and receded through the Swan Valley ultimately resulting in the numerous lakes and glacial outwash deposits at canyon mouths along the Swan and Mission mountains.

In general, the soils within the project area adjacent to the valley floor include deep alluvial and glacial deposits on low grades. Wetland or hydric soils have been identified adjacent to kettle lakes, areas consistently inundated by flood waters and areas influenced by beaver activity. Shallow bedrock and high rock content residual soils are found on glacial scoured ridges while valley hillslopes have moderate to deep glacial till deposits with cobble silt loam subsoils. In total, 16 individual landtypes have been mapped in the project area. For further discussion of the landtype attributes (*TABLE III-67)* and locations (*FIGURE III-16*) refer to end of this section.

Erosion and sediment delivery efficiency is based on slope and soil erosion K factor. The risk of erosion is described as slight, moderate, high, or severe (*Hansen 2004)*. A rating of low indicates that erosion is unlikely under ordinary climatic conditions; moderate indicates that some erosion is likely and that erosion-control measures may be needed; high indicates that erosion is very likely and that erosion control measures including revegetation of bare areas are advised; and severe indicates that substantial erosion is expected, loss of soil productivity and off-site damage are likely, and erosion–control measures are costly and generally impractical (Hansen 2004). Sediment delivery efficiency refers primarily to landform slope the map unit is located on and the proximity of the map unit with respect to water features. Soil map units associated with upland environments or on ridges are typically inefficient at transporting sediment to water features when compared to those associated with riparian or streambank map units. The table below (*TABLE III-26*) presents terrain slope within the project area as well as the individual alternatives. Only about 25% of the landscape in either alternative

is over 40% slope while the majority is within 20-40% slope. Steep, continuous hillslopes, while not numerous in the alternatives, have significant potential energy in terms of erosive power (*Carson and Kirby 1972*). These steep, mid to upper hillslope positions are typically considered areas of sediment production and transport regarding hillslope processes, but also employ the lowest impact harvest systems.

TABLE III-26 – SLOPE CLASS DISTRIBUTIONS.

SLOPE CATEGORY (%)	PROJECT AREA			ANALYSIS AREA - ALT. B			ANALYSIS AREA - ALT. C		
	ACRES	PROJECT AREA (%)	CUMULATIVE TOTAL (%)	ACRES	Alt B (%)	CUMULATIVE TOTAL (%)	ACRES	Alt C (%)	CUMULATIVE TOTAL (%)
0-10%	4,570	23.5%	23.5%	389	13.2%	13.2%	429	12.9%	12.9%
11-20%	3,894	20.0%	43.5%	556	18.9%	32.1%	654	19.7%	32.6%
21-30%	3,725	19.2%	62.7%	691	23.4%	55.5%	751	22.6%	55.1%
31-40%	3,448	17.7%	80.4%	623	21.1%	76.6%	659	19.8%	75.0%
41-50%	2,353	12.1%	92.6%	459	15.6%	92.2%	482	14.5%	89.4%
51-60%	921	4.7%	97.3%	169	5.7%	97.9%	216	6.5%	95.9%
>60%	526	2.7%	100.0%	61	2.1%	100.0%	135	4.1%	100.0%

A common feature to all soil map units within the project area, though spatially explicit, is the influence of volcanic ash. Volcanic ash from eruptions along the Pacific Northwest Cascade Range has significantly influenced forest soil productivity in the Inland Northwest (*Mullineaux 1996; Shipley 1983*) and particularly the project area. Soils influenced by volcanic ash have lower bulk densities, higher porosities, high cation exchange capacity and higher water infiltration and retention (*Shoji 1993*) as well as reduced stress to plant growth during droughty conditions. Very low bulk density values are consistent with ash influenced surface soils. Ash thickness in the project area has been observed to range from a few inches to 6 to 8 inches in favorable aspects.

HISTORIC HARVEST AND RELEVANT MANAGEMENT ACTIONS

Since the 1920's the Swan River State Forest has been actively managed for timber production. The majority of timber harvest in these early periods involved select cutting of only the most merchantable timber. Timber was typically hand felled and skidded with horses until mechanized equipment was employed. Impacts to soil resources prior to the late 1950s are assumed to be ameliorated except for the most heavily impacted skid trails, which comprise a very low percentage of the analysis area.

Accurate inventory and record keeping from the 1960s to the present enables a more analytical analysis of past soil resource impacts. As shown in *FIGURE III-10 – HISTORIC HARVEST*, four distinct and pronounced periods of timber harvest have occurred on the westside of the Swan River State Forest including the mid to late 1960s, the early 1980s and 1990's and the early 2000s. The most recent timber harvest occurred in 2014 with the completion of the Whitetail Porcupine timber sale projects.

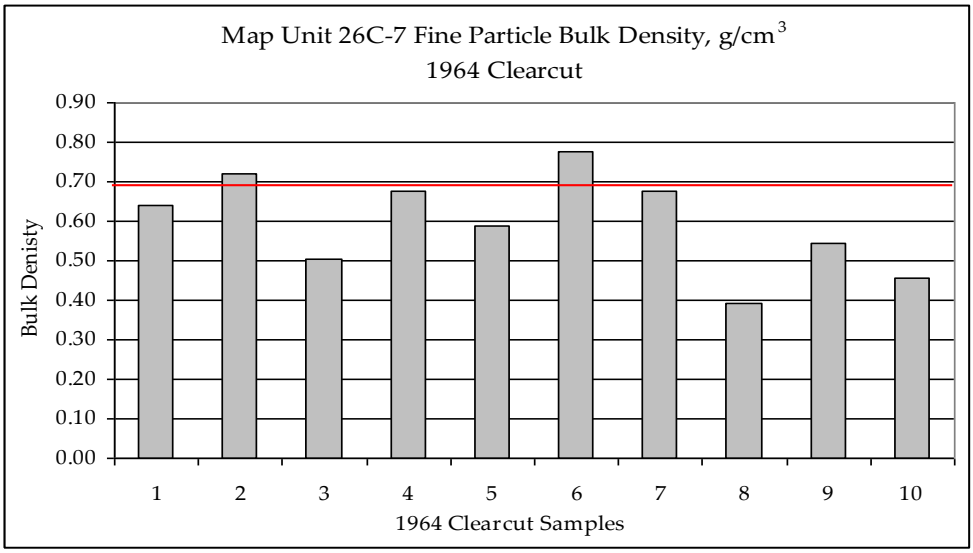
Much of the timber sale activity on the westside of the Swan River State Forest in a result of DNRC acquiring approximately 16,000 acres of formerly Plum Creek Timber Company land. These lands had been industrial forest lands even prior to Plum Creek

ownership and have been intensively managed for approximately the last 50 years. While harvest history data on these lands is hard compile, aerial photo interpretation shows that a large portion of these acquisition lands were harvested in the late 1980's and 1990's thus the resulting increase in harvest acres for these periods in *FIGURE III-10 – HISTORIC HARVEST*.

Soil samples were collected within a historic harvest unit representative of the stands that were harvested in the 1960's. Results show no pronounced differences between average bulk density values when compared to an un-entered stand on similar soils. From the results of these data presented below in *FIGURE III-8 – SOIL PHYSICAL PROPERTIES WITHIN A 1964 HARVEST UNIT* DNRC can infer that past soil resource impacts have naturally ameliorated within this harvest unit due to the moist climatic conditions found in the project area, long periods of freeze-thaw climatic conditions, and root penetration from ground vegetation and the regenerating stand.

DNRC can further extrapolate these point measurements to the whole harvest unit by examining random transects that were placed throughout the unit to monitor soil disturbance. Using 5 transects and 500 sample points, the level of compaction within this historic harvest unit was estimated at 1.6% of the 18.3 acre unit. Furthermore, it was estimated that on average 4.2% of the unit was considered detrimentally impacted by either displacement or compaction. No erosion was observed within this historic harvest unit. This information is critical when considering the temporal aspect of soil impacts from implementing the proposed actions of this project and will be referenced later in this document when considering environmental consequences.

FIGURE III-8 – SOIL PHYSICAL PROPERTIES WITHIN A 1964 HARVEST UNIT.

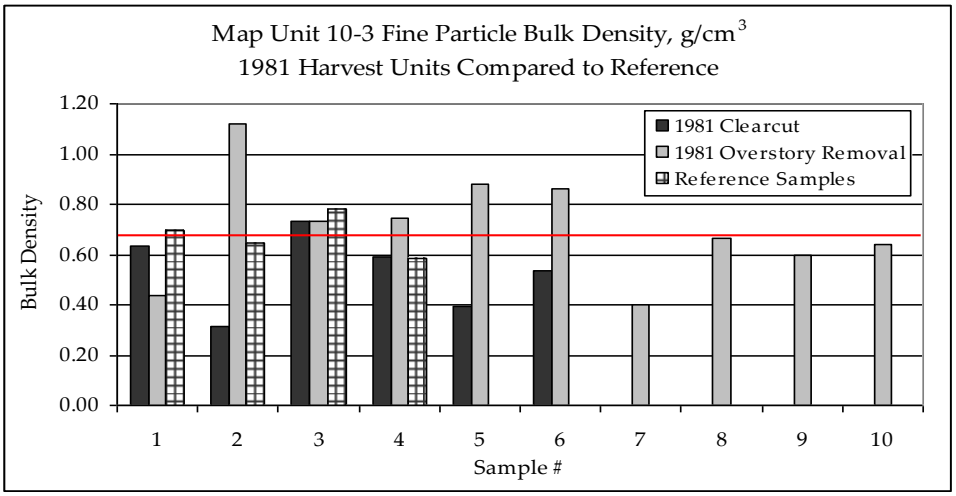


A similar methodology was employed on two sites that were harvested in 1981 by different silvicultural prescriptions. One unit was clearcut and one unit was prescribed an over-story removal treatment. Data from bulk density samples collected from each unit and their associated reference sample is presented below in *FIGURE III-8 – SOIL PHYSICAL PROPERTIES WITHIN A 1964 HARVEST UNIT*. The red line within the figure indicates the average bulk density values from reference soil samples of soil map unit 26C-7.

Impacts from historic harvests from 1981 can still be observed in the physical soil properties within the overstory removal harvest unit through slightly elevated bulk density values as shown below in *FIGURE III-9 - SOIL PHYSICAL PROPERTIES WITHIN A 1981 HARVEST UNIT*. Bulk density values within the clearcut are at or below average reference values (depicted by red line). The values presented below could be attributed to the site preparation methods used for the clearcut unit as compared to the overstory removal unit. In a regeneration harvest, it is common practice to scarify the forest floor to encourage natural regeneration of the stand. This was commonly accomplished with a brush rake attached to a skidder. This practice would have aided compacted areas to recover more rapidly when compared to the overstory removal unit where scarification was not an objective.

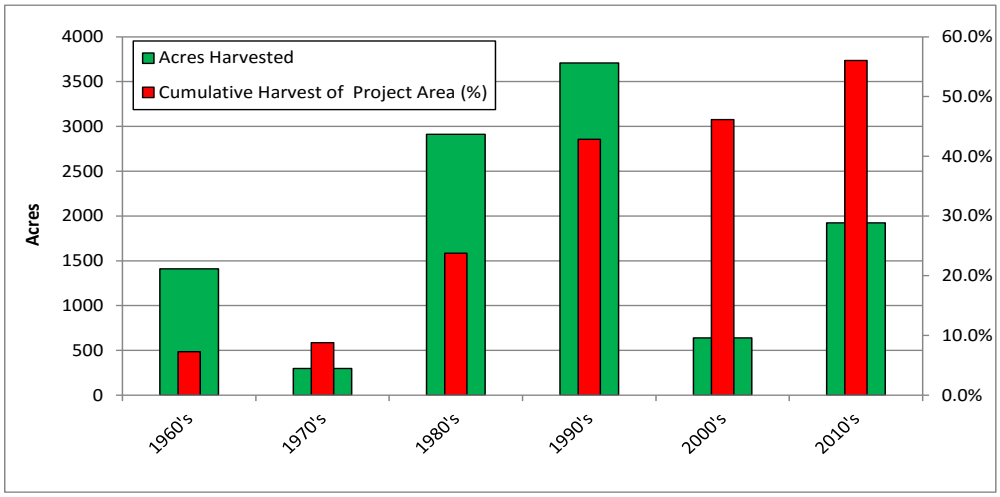
Extrapolating these point measurements to the 45 acre overstory removal harvest unit through randomly placed transects found disturbance levels slightly higher than those observed in the clearcut from 1964. Overall, 10.7% of the unit was observed to be compacted through knife probing. Displacement of surface soils was observed on an additional 3.7% of the unit totaling 14.4% of the unit recovering from detrimental soil impacts resulting from the 1981 harvest. Again, these data provide an excellent insight into natural recovery rates for soil impacts within the Project Area, are useful when describing the existing conditions of the soil resources and provide helpful insight for forecasting probable impacts for each Action Alternative.

FIGURE III -9 – SOIL PHYSICAL PROPERTIES WITHIN A 1981 HARVEST UNIT.



The most recent large timber sale within the westside of the Swan River State Forest was the Whitetail Porcupine timber sale projects. Soil monitoring was conducted three individual timber sales in the summer of 2012. The landtypes that soil monitoring was conducted on within this timber sale were similar to landtypes 27-7, 26C-8 and 26C-9 within the Wood Lion Project Area. Monitoring results showed total detrimental impacts to range from 12.0% to 17.2% of the site. No erosion was noted within the harvest unit. Compaction was not physically measured but was noted to be low except on main skid trails and landings. Harvest operations were conducted when soil moisture conditions were dry, slopes within the unit were moderate and no departures from BMP's were noted. These data help to show the effectiveness of DNRC contract administration process and site specific mitigation and BMP's that are incorporated into timber sale contract.

FIGURE III-10 – WOOD LION PROJECT AREA HISTORIC HARVEST.



Under Action Alternative B approximately 564 acres are proposed for re-entry and under Action Alternative C approximately 476 acres are proposed for re-entry. The stands in these previously harvested areas are fully stocked but have evidence of historic skid trails. It was estimated that less than 5 percent of these acres had detrimental soil conditions from previous entries.

NUTRIENT CYCLING AND SITE PRODUCTIVITY

Coarse and fine woody debris and the organic forest floor provide a critical role in all forested ecosystems through nutrient cycling, microbial habitat, moisture retention and protection of the forest floor and mineral soil from erosion (*Harmon et al. 1986*). Coarse woody debris decays at various rates and is largely dependant on local climatic conditions with the degree of decay directly related to the service it provides to the ecosystem. Coarse wood in advance stages of decay contains many nutrients (sulfur, phosphorous, and nitrogen), provides important sites for non-symbiotic nitrogen fixation (*Larson et al. 1978, Wicklow et al. 1973*) and can hold large volumes of moisture for vegetation during dry periods.

Forest management can affect the volumes of both fine and coarse woody debris through timber harvest resulting in changes (both positive and negative) to site nutrient pools necessary for the long-term nutrient demands of the forest, and, thus, long-term productivity of the site. The data presented below (*TABLE III-27*) was collected from 187 randomly oriented transects in previously managed stands with various siviculture prescription throughout Swan River State Forest. Similar to soil disturbance, as harvest intensity increases coarse and fine woody debris retention can decrease if not properly mitigated. This data helps to forecast proper woody debris retention mitigations in concert with proposed logging systems and prescriptions within each action alternative.

TABLE III-27 - COARSE WOODY DEBRIS VOLUMES BY PRESCRIPTION.
Swan River State Forest.

PRESCRIPTION	SAMPLE SIZE	PROPOSED ACRES (ALT B / ALT C)	AVERAGE (TONS/ACRE)	FWD RATIO*
Clearcut	61	0 / 0	11.7	0.39
Seedtree	35	1,173 / 1,324	11.7	0.36
Overstory Removal	34	333 / 201	15.2	0.37
Shelterwood	12	297 / 103	15.3	0.41
Commerical Thinning	19	128 / 92	17.5	0.44
Salvage	9	332 / 332	21.4	0.31
Select Cut	17	28 / 28	26.7	0.42

**FWD Ratio = FWD/Total Woody Material*

The data presented below (*TABLE III-28*) was also collected from the same transects but has been stratified by various habitat types within the Project Area. These results show that the volume of coarse woody debris in the project area are consistent with the

recommendations made by *Graham et al. (1994*) to support soil biologics and moisture retention objectives.

TABLE III-28 - COARSE WOODY DEBRIS VOLUMES BY HABITAT TYPE. *Wood Lion Project Area.*

HABITAT TYPE	SAMPLE SIZE	AVERAGE (TONS/ACRE)	GRAHAM ET AL. (1994) (TONS/ACRE)
Douglas-fir	1	6.8	12-24
Grand Fir	22	16.2	7-14
Spruce	1	18.3	n/a
Subalpine fir	24	20.8	11-23
Western Red Cedar	16	21.9	16-33

Prescriptions for nutrient and slash management for both action alternatives would use the data collected during field reconnaissance in concert with those recommended in the literature (*Graham et al. 1994*).

SLOPE STABILITY

Slope stability is the ability of material on a slope to remain in equilibrium (stable) and, therefore, represents some balance between driving forces (shear stress) and resisting forces (shear strength). Many variables, both natural and/or anthropogenic, may affect either driving or resisting forces. For a slope to be considered unstable driving forces and resisting forces must be close to unity. Factors affecting these forces include slope, parent material, vegetation, and precipitation. While landslides and mass movements are a dominant geomorphic agent and landscape evolution process in certain areas of the country, it is not a commonly observed process in northwest Montana.

Both the *Flathead National Forest Land System Inventory* and DNRC soil surveys have identified one landtype (74) in the project area with an elevated risk of mass failure. No operations are planned on this landtype under Alternative B while 70 acres of harvest and 1 acre of new road construction is planned under Alternative C. This comprises 2 percent of the total area under Alternative C. During field review, small areas adjacent to locations of new road construction were identified as sensitive areas where management actions may affect slope equilibrium and the possibility of slope failure if not adequately mitigated. These areas were avoided if possible and where avoidance was not possible, mitigation measures focused on the road construction practices were identified to reduce the risk of failure.

ENVIRONMENTAL EFFECTS

This section will disclose the direct, indirect, and cumulative effects of all proposed action alternatives. Direct and indirect environmental effects common to both

alternatives will be summarized and then followed by effects unique to each alternative. Cumulative effects will be summarized by alternative and will be presented in the section titled *CUMULATIVE EFFECTS BY ALTERNATIVE* immediately following direct and indirect effects.

OVERVIEW

Past soil monitoring projects of DNRC timber sales on soils similar to those found in the project area allows informed forecasting of potential effects to soils resource from the implementation of each action alternative. Presented below (*TABLE III-29)* are soil monitoring projects completed by DNRC since 1987 that were conducted within the boundaries of the *Flathead National Forest Land System Inventory* (*Martinson 1999*).

Soil monitoring of the Coal Creek Timber Sale in 1987 documented the highest level of soil disturbance on state lands and it should be noted that operations were conducted prior to BMP implementation. While these values are excessive, much was learned from these old practices and, thus, still relevant. The average value of total impacts from all projects will be used to forecast detrimental effects for tractor logging units within each alternative along with a potential range of impacts. The range of impacts will include values within one standard deviation of the sample mean.

TABLE III-29 - SOIL MONITORING PROJECTS RELAVANT TO THE PROJECT AREA.

PROJECT NAME	YEAR	MAP UNITS	AVERAGE SLOPE (%)	PRESCRIPTION	EQUIPMENT	SEASON	TOTAL DETRIMENTAL DISTRUBANCE (%)
Coal Creek; Unit 5	1987	26C-8*	23%	Seed Tree	Ground Based	Winter	19.1
Coal Creek; Units 8,9,10	1987	73	31%	Seed Tree	Ground Based	Summer/Fall	34.2
Goat Rot Hill; Unit 2	1989	26A-9*	15%	Clearcut	Ground Based	Summer	10.2
South Wood #2; Unit 2	1991	23-9	29%	Commercial Thin	Ground Based	Summer	8.1
Lower Stillwater #2; Units 2 & 6	1991	28-7, 26G-7	7%	Clearcut	Ground Based	Winter	7.7
Chicken Werner; Unit 10	2003	26C-8*	37%	Seed Tree	Ground Based	Summer	8.0
Dog Meadow North; Unit 9	2006	26C-8*	10%	Seed Tree	Ground Based	Summer/Fall	21.2
Shorts Meadows; Unit 6 & 9	2010	27-7	29%	Seed Tree	Ground Based	Summer	1.8
White Donut	2011	27-7	16%	Seed Tree	Ground Based	Summer/Fall	12.0
White Porcupine #1	2012	26C-9*	27%	Clear Cut	Ground Based	Summer/Fall	17.2
White Porcupine #2	2012	26C-8*	32%	Seed Tree	Ground Based	Summer	16.3
* Denotes map units within the Wood Lion analysis area							Average: 14.2 %

It has been shown that cable logging systems have less soil disturbance than ground based systems (*Allen 1999; Aulerich 1974; Cromack et al. 1978; DNRC 2009, 2011*). Due to these research findings, it would be inappropriate to apply a soil disturbance rate from ground based systems to cable or skyline systems. DNRC has conducted soil monitoring on seven harvest units that employed cable logging systems and found that ground disturbance values average 7.0 percent of the unit and range from 2.3 percent to 11.4 percent (*DNRC 2011)*. The results of these finding will be applied to all cable harvest units when predicting potential soil impacts. All cable harvest monitoring projects were completed after full implementation of BMP's and are assumed here to be

reflective of current forest practices. Due to this, the observed range of impacts will be used to forecast potential soil impacts and not the standard deviation as in ground based forecasts.

- ***Direct and Indirect Effects of No-Action Alternative***

Under No-Action Alternative A, timber harvesting or road construction would be deferred. No harvest units would be entered or re-entered resulting in no new detrimental soil impacts. Erosion and sediment production from proposed harvest units would continue to be stable and mimic natural base erosion rates. Nutrient pools would continue to accumulate with additional inputs from the surround forest stands. Data collected during project development, information gained from past DNRC soil monitoring projects and from the research community show that the soils within the project area will continue on a stable or increasing trend with regard to productivity and soil function. No adverse direct or indirect effects to soils resources would occur under this alternative.

- ***Direct and Indirect Effects Common to Both Action Alternatives***

EROSION

Under both action alternatives, the potential for upland erosion and transport within actual harvest unit boundaries would be moderate based on field observation of past projects, DNRC-monitoring data, moderate erosion rates and generally steep slopes in harvest units. Observed erosion is typically limited to compacted locations where organic matter, vegetative cover and surface soils have been most disturbed and the hydrologic function of the soil has been limited. These locations are usually found on main skid trails, cable corridors and at log landings. On these impacted sites the potential for erosion is a function of the soil texture, severity of impacts and rainfall intensity. Erosion risk and sediment delivery efficiency has been summarized by soil map unit can be found in *TABLE III-32 – SOIL MAP UNITS AND ATTRIBUTES*. In general, steep impacted sites are most prone to erosion and offsite transport. Due to the moderate risk of erosion and low probability of high rainfall intensity, impacted areas can be mitigated with standard erosion control measures. These include providing temporary vegetative cover with logging slash, installing drainage features on landings and main skid trails and mechanically ripping heavily impacts sites to assist the hydrologic recovery of compacted soils. Considering all these factors, a moderate probability of low level effects to soil productivity resulting from off-site erosion is expected as a result of implementing either action alternative. Immeasurable differences in sediment production and erosion exist between either action alternatives.

SLOPE STABILITY

There would be a moderate risk for actions proposed under both action alternatives to increase the risk of slope instability during and after project implementation. This risk would be short in duration measured by the time it would take for a harvest unit and/or road cut or fill slope to revegetate. Sensitive sites prone to mass failure identified during field review with harvest units would have silvicultural prescriptions designed to minimize the effect to slope stability by minimizing canopy removal and thus hydrologic response during precipitation events.

Cut and fill slopes of new road construction could potentially slough and be difficult to revegetate. Numerous mitigation measures as well as engineering and construction techniques such as increased site drainage, cut and fill slope stabilization, and full bench construction can be applied to potentially unstable slopes to achieve a stable road prism. These techniques would be incorporated as necessary into the timber sale contract. The mitigations and techniques mentioned above are very general in nature but provide the basic concepts that would be adapted into site specific designs. With mitigation measures applied, both action alternatives present a moderate risk of slope instability.

NUTRIENT CYCLING AND LONG-TERM SOIL PRODUCTIVITY

Both action alternatives would have a low probability of low level impacts for a short duration (15 to 20 yrs) to site nutrient pools and long-term soil productivity. The removal nitrogen, potassium, and sulfur along with other micro nutrients from the site through timber harvest would be mitigated by mimicking volumes of coarse and fine woody material found throughout the project area presented previously (*TABLE III-29*). The volume of coarse and fine woody material retained on site would vary by habitat type and sivilcultural prescription but would typically range from 10 to 25 tons per acre as recommended by *Graham et al. (1994)*.

- ***Direct and Indirect Effects Unique to Action Alternative B***

SOIL PHYSCIAL PROPERTIES

Under Action Alternative B approximately 2,948 acres would be harvested from the project area and 12.8 miles of road would be constructed. Tractor (75 percent) and cable (25 percent) yarding systems would be used to extract the timber. Permanent roads would change the land use of the affected area from forest products to transportation. The table below (*TABLE III-30*) presents the approximate amount of acres that would be disturbed and the expected range detrimental soil effects.

TABLE III-30 - SOIL DISTRUBANCE. *Action Alternative B.*

HARVEST SYSTEM	ACRES/MILES	SOIL IMPACT RATE		IMPACTED AREA	
		AVERAGE (%)	RANGE (%) **	AVERAGE (ACRES)	RANGE (ACRES)
Tractor	2,208	14.2	8.8 - 22.4	313.5	194.3 - 494.6
Cable	740	7.0	2.3 - 11.4	51.8	17.0 - 84.4
New Road Construction	12.8	100% *		62.1	62.1
Analysis Area; Acres of Expected Impacts		14.2%	9.2 - 19.1%**	427.4	276.2-575.4

** New road construction assumes a clearing limit average of 40 feet*

*** Range of impacts assumes one standard deviation of the average rate and summarized as a weighted average*

The level of soil disturbance forecasted from harvest activities are below that recommended within the SFLMP (*DNRC 1996*) and will result in less disturbance than Action Alternative C. In total, 14.2 percent of harvest units/roads and 2.2 percent of the land in the gross project area would have compromised soil function of varying degrees within the analysis area and the project area, respectively. Action Alternative B presents a high probability of low to moderate level impacts to soil physical properties within the analysis area for moderate durations (80 to 100 years). The long-term soil productivity is expected to be maintained at levels described in the existing conditions and within the SFLMP (*DNRC 1996*).

- ***Direct and Indirect Effects Unique to Action Alternative C***

SOIL PHYSICAL PROPERTIES

Under Action Alternative C approximately 3,326 acres would be harvested from the project area and 16.0 miles of road would be constructed. Tractor (71 percent) and cable (29 percent) yarding systems would be used to extract the timber. The table below (*TABLE III-31*) presents the approximate amount of acres that would be disturbed and the expected range detrimental soil effects.

TABLE III-31 – SOIL DISTRUBANCE RESULTING FROM ACTION ALTERNATIVE C.

HARVEST SYSTEM	ACRES/MILES	SOIL IMPACT RATE		IMPACTED AREA	
		AVERAGE (%)	RANGE (%) **	AVERAGE (ACRES)	RANGE (ACRES)
Tractor	2,360	14.2	8.8 - 22.4	335.1	207.7 - 528.6
Cable	966	7.0	2.3 - 11.4	67.6	22.2 - 110.1
New Road Construction	16.0	100% *		77.6	77.6
Analysis Area; Acres of Expected Impacts		14.1%	9.0 - 21.0%**	480.3	307.5 - 716.3

** New road construction assumes a clearing limit average of 40 feet*

*** Range of impacts assumes one standard deviation of the average rate and summarized as a weighted average*

The level of soil disturbance forecasted from harvest activities are below that

recommended within the SFLMP (*DNRC, 1996*) and would result in more disturbance than Action Alternative B. In total, 14.1 percent of harvest units/roads and 3.5 percent of the land in the gross project area would have compromised soil function of varying degrees within the analysis area and project area, respectively. Action Alternative C presents a high probability of low to moderate level impacts to soil physical properties within the analysis area and the long-term soil productivity is expected to be maintained at levels described in the existing conditions within the SFLMP (*DNRC 1996*).

CUMULATIVE EFFECTS BY ALTERNATIVE

A mentioned previously, for a proposed action to have cumulative effects to soil resources the action must overlap a previous or potential future action. The overlap refers to both the harvest unit in question and 2 points in time. The following summarizes cumulative effects by each alternative.

- ***No-Action Alternative A***

Under No-Action Alternative A, no timber harvesting or road construction would be implemented. No new impacts to the soils resources would be expected and soil productivity trends would continue on a stable to upward trend resulting from continual amelioration of past soil impacts within harvest units, but not permanent roads. Nutrient cycling would continue as both coarse and fine woody materials decay and are incorporated into the soil profile as organic matter and soil wood. Potential future actions to actively manage the stands selected in each alternative are foreseeable, but the design and objectives of future projects is impractical to predict. Small sanitation, salvage and firewood permits would continue to be offered within the project area under No-Action Alternative A. If stands are re-entered in potential future projects or permits, historic skid trails and landings would be reused and all relevant BMP's and mitigations would be included into project design to minimize the potential of cumulative effects.

- ***Action Alternative B***

Under Action Alternative B, a total of 564 acres would be re-entered that have had past-management activities since the 1960's. All observed impacts in these stands were solely isolated to historic skid trails and temporary roads, which was estimated at less than 2 percent of the area. These impacted locations would again be used under the proposed action and existing impacts would be reinforced, slowing natural amelioration rates. Additional impacts would also be expected, but with primary skid trails already established, cumulative soil impacts are expected to remain below 20 percent of the harvest area as recommended by the SFLMP. Assuming BMP's and general mitigations outlined in this document are applied, the long-term productivity of the site is expected to be maintained. Action Alternative B presents a low risk of moderate cumulative effects to soil physical properties that would be expected to ameliorate within a stand

rotation. Action Alternative B presents more risk for cumulative effects to soil function than Action Alternative C.

No harvest units proposed for re-entry under Action Alternative B were observed to contain areas of chronic erosion. All past impacted areas have revegetated naturally and have returned to their natural base erosion rates. No cumulative effects from erosion and slope stability within the analysis area are expected.

There would be a moderate probability of low level cumulative effects to nutrient pools within the re-entered stands under Action Alternative B. In general, stands currently contain adequate levels of both fine and coarse woody material. If a stand's nutrient retention levels were mismanaged in the past, the re-entry allows DNRC to better manage site nutrients through woody debris retention that mimics that found in similar habitat types and as recommended *Graham et al. (1994*).

In summary, actions within Action Alternative B present a low probability of low level cumulative effects to soil productivity in the 564 acres proposed for re-entry. In proposed harvest areas not previously entered, cumulative effects to soil productivity would be the same as those reported in the direct and indirect effects analysis.

- ***Action Alternative C***

Under Action Alternative C, a total of 476 acres would be re-entered that have had past-management activities since the 1960s. All observed impacts in these stands were solely isolated to historic skid trails and temporary roads, which was estimated at less than 2 percent of the area. These locations would be reused under the proposed action and existing impacts would be reinforced, slowing natural amelioration rates. Additional impacts would be expected, but with primary skid trails already established, cumulative soil impacts are expected to remain below 20 percent of the harvest area as recommended by the SFLMP. Assuming BMP's and general mitigations outlined in this document are applied, the long-term productivity of the site is expected to be maintained. Action Alternative C presents a low risk of moderate cumulative effects to soil physical properties that would be expected to ameliorate within a stand rotation. Action Alternative C presents less risk of cumulative effects to soil function than Action Alternative B.

No historically managed sites within the project area were observed to contain chronic erosion features. All past impacted areas have revegetated naturally and have returned to their natural base erosion rates. No cumulative effects from erosion and slope stability within the analysis area are expected.

There would be a high probability of low level cumulative effects to nutrient pools within the re-entered stands under Action Alternative C. In general, stands currently

contain adequate levels of both fine and coarse woody material averaging approximately 15.5 tons/acre. The variability observed within the dataset can largely be described by habitat type and to a lesser degree, siviculture prescription, with ranges from 1 to 32 tons/acre. If a site's nutrient retention levels were mismanaged in the past, the re-entry allows DNRC to better manage site nutrients through woody debris retention that mimics that found in similar habitat types and as recommended *Graham et al. (1994)*

In summary, actions within Action Alternative C present a low probability of low level cumulative effects to soil productivity in the 476 acres proposed for re-entry. In proposed harvest areas not previously entered, cumulative effects to soil productivity would be the same as those reported in the direct and indirect effects analysis.

FIGURE III-11 - WOOD LION PROJECT AREA AND SOIL MAP UNITS.

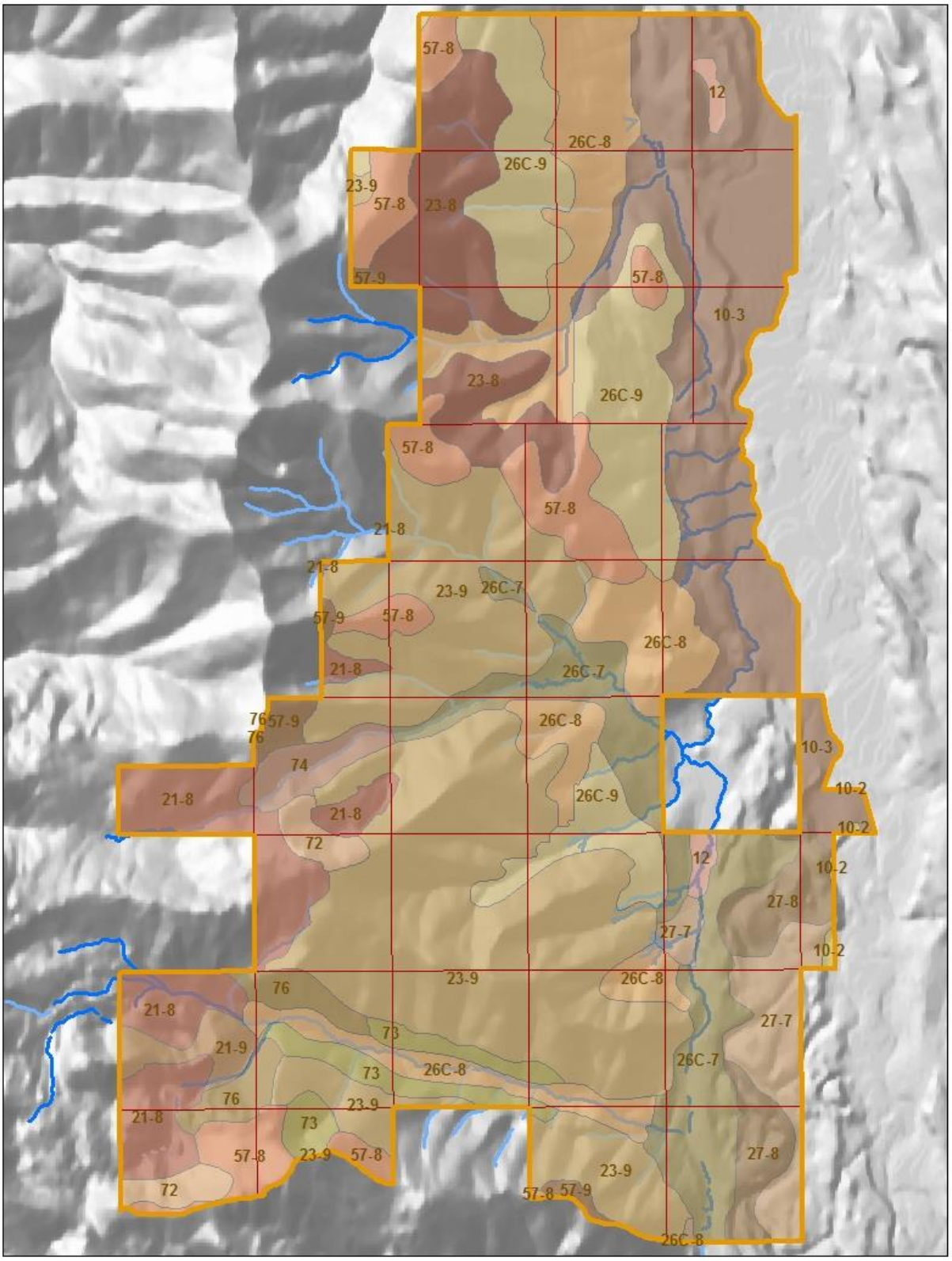


TABLE III-32 - SOIL MAP UNITS AND ATTRIBUTES.

MAP UNIT	ALT "B" HARVEST UNITS / NEW RD	ALT "C" HARVEST UNITS / NEW RD	K FACTOR (ROCK FREE)	MAP UNIT NAME	LANDFORM	EROSION & SEDIMENT DELIVERY HAZARD	COMPACTION / DISPLACEMENT HAZARD
10-3	302 / 0	369 / 1	0.32	Aquepts, Stream bottoms	Dominant slopes have gradients of 0-5%. Located in depressions on flood plains and often shallow ponds. Subject to flooding during spring snowmelt and have highly fluctuating water tables.	Severe, but SMZ laws would prohibit most operations	Moderate / Moderate
21-8	68 / 1	78 / 3	0.32	Andic Cryochrepts-Entic Cryandepts-Rock outcrop complex, cirque basins	Dominant slopes have gradients of 20-40%. Contains a complex pattern of glacial tills, residual soils and rockland located in high alpine glaciated basins generally on east or north aspects.	Moderate erosion hazard. Moderate sediment delivery efficiency.	Low/Moderate
21-9	0 / 0	1 / 0	0.32	Andic Cryochrepts-Entic Cryandepts-Rock outcrop complex, cirque basins, steep	Dominant slopes have gradients from 40-60%. Contains a complex pattern of glacial tills, residual soils and rockland located in high alpine glaciated basins generally on east or north aspects.	Moderate erosion hazard. Moderate sediment delivery efficiency.	Low/Moderate
23-8	180 / 0	181 / 0	0.32	Andeptic Cryoboralfs-Andic Cryochrepts complex, hilly.	Glaciated mountain slopes and ridges with dominant slopes from 20-60%. Typically mantled with glacial tills. Drainage is dentritic and widely spaced.	Skid Trails => Moderate Moderate sediment delivery efficiency.	Moderate / High
23-9	1157 / 15	1032 / 17	0.32	Andeptic Cryoboralfs-Andic Cryochrepts complex, steep.	Dominant steep slopes between 40-60%. Glaciated mountain slopes and ridges mantled with glacial tills.	Skid Trails => Moderate Moderate sediment delivery efficiency.	Moderate/ Moderate
26C-7	78 / 1	64 / 1	0.32	Andeptic Cryobralfs, silty till substratum, rolling	Dominant slopes have gradients from 10- 20%. Moraines are rolling glacial till deposits. They have deranged drainage patterns.	Moderate erosion hazard. Moderate sediment delivery efficiency.	Moderate/Moderate
26C-8	328 / 7	450 / 7	0.32	Andeptic Cryoboralfs, silty till substratum, hilly	Glaciated mountain slopes and ridges with dominant slopes from 20-60%. Typically mantled with glacial tills. The drainage pattern is dendritic and drainages are widely spaced.	Moderate erosion hazard. Moderate sediment delivery efficiency.	Moderate/Moderate
26C-9	194 / 3	233 / 4	0.32	Andeptic Cryoboralfs, silty till substratum, steep	Glaciated mountain slopes and ridges with dominant slopes from 40-60%. Typically mantled with glacial tills. The drainage pattern is dendritic and drainages are widely spaced.	Moderate erosion hazard. Moderate sediment delivery efficiency.	Moderate/Moderate
27-7	18 / 0	18 / 0	0.32	Dystric Eutrochrepts, till substratum	Dominant slopes and gradients of 10-20%. Kames and kettles are a complex pattern of knolls and depressions. The drainage pattern is deranged, terraces have a dendritic pattern of widely spaced drainages.	Moderate erosion hazard. Moderate sediment delivery efficiency.	Moderate/Low
27-8	63 / 2	63 / 2	0.32	Dystric Eutrochrepts, till substratum, steep	Dominant slopes and gradients of 20-40%. Kames and kettles are a complex pattern of knolls and depressions. The drainage pattern is deranged, terraces have a dendritic pattern of widely spaced drainages.	Moderate erosion hazard. Moderate sediment delivery efficiency.	Moderate/Low
57-8	308 / 6	400 / 6	0.32	Andic Cryochrepts, glaciated mountain ridges	Dominant slopes have gradients of 20-40%. Glaciated mountain ridges have smooth, rounded convex ridgetops.	Moderate erosion hazard. Low sediment delivery efficiency.	Low / Moderate
57-9	27 / 0	27 / 0	0.32	Andic Cryochrepts, glaciated mountain slopes	Dominant slopes have gradients of 40-60%. Glaciated mountain slopes have thin glacial till in places. Drainage pattern is dendritic and widely spaced.	Moderate erosion hazard. Moderate sediment delivery efficiency.	Low / Moderate
72	110 / 2	134 / 4	0.32	Cirqueland-Entic Cryandepts complex, very steep	Dominat slopes have gradients greater than 60% with rock outcrops comprising 50-70% of the landtype. Morphology consists of oversteepened cirque headwalls and narrow alpine ridges surrounding amphitheater-shaped basins at the head of glaciated valleys.	Low	Low/Low
73	99 / 0	123 / 0	0.32	Andic Cryochrepts-Andeptic Cryoboralfs association, glacial trough walls	This landform contains as association of soils formed in glacial till and residum on extremely steep concave valley walls that have been scoured by galcial ice.	High	Low/Moderate
74	0 / 0	70 / 1	0.20	Ochrepts, very steep	On stream breaklands. Stream breaklands consist of narrow V-shaped valley slopes along major streams. These are barren, rapidly eroding soils where streams are actively undercutting slopes.	High	Low / Moderate
76	16 / 1	83 / 2	0.20	Rock outcrop-Ochrepts complex, structural breaklands	Dominant slopes have gradients of 60-90%. These structural breaklands have slope shapes controlled by underlying bedrock. The dip of underlying rock strata is roughly perpendicular to slopes. The unit has common avalanche paths. The drainage pattern is dendritic or parallel and drainages are widely spaced and weakly incised.	Moderate to high erosion hazard though highly site specific. High sediment delivery efficiency.	Low / Moderate
Total Area of Operations (acres)	2948 / 39	3326 / 48					

WATERSHED AND HYDROLOGY ANALYSIS

INTRODUCTION

PROJECT AREA AND PROJECT ACTIVITIES

The gross project area (see *CHAPTER 1* for project area) includes 19,437 acres within the Swan River State Forest. Affected watersheds include the Whitetail Creek, Woodward Creek and South Woodward Creek watersheds in the Swan River drainage. Each of these watersheds includes land managed by the Flathead National Forest and the DNRC. There are also areas outside of the watersheds listed that are included in the proposed project area. The proposed action alternatives would include a combination of ground based and cable yarding methods to harvest timber on a range of acres from 2,948 to 3,326 within the project area. Infrastructure for the proposed action would involve the construction of between 12.8 and 16.0 miles of new temporary and permanent road to access proposed harvest areas. All proposed road construction would be done outside of the SMZs, except at up to 4 proposed new stream crossings.

RESOURCE DESCRIPTION

Water yield and sediment delivery will be assessed in this analysis. Annual water yield increases (WYI) and changes to timing and magnitude of peak flows can affect channel stability if dramatically altered, and sediment delivery from both in-channel and introduced sources is a primary component of overall water quality in a watershed.

ISSUES AND MEASUREMENT CRITERIA

The following issues encompass the specific issues and concerns raised through public and internal scoping of the proposed project. For a specific list of individual comments and concerns, please refer to the project file.

Sediment Delivery

Sediment delivery can be affected by timber harvesting and related activities, primarily through road construction. These activities can lead to water-quality impacts by increasing the production and delivery of fine sediment to streams. Construction of roads, skid trails, and landings can generate and transfer substantial amounts of sediment through the removal of vegetation and exposure of bare soil. In addition, removal of vegetation near stream channels reduces the sediment-filtering capacity and may reduce channel stability and the amounts of large woody material. Large woody debris is a very important component of stream dynamics, creating natural sediment traps and energy dissipaters to reduce the velocity and erosive power of stream flows. Other aspects of sediment analysis, such as sediment storage and transport, can also be found in the fisheries analysis portion of this document.

Measurement Criteria: Tons of sediment delivery per year using procedures adapted from the Washington Forest Practices (WFP) Board (*Callahan 200*0). Sediment from harvesting activities and vegetative removal will be analyzed qualitatively through data collected in the BMP audit process along with information found in the soils portion of this document.

Water Yield

Water yield can be affected by timber harvesting and road construction. These activities can affect the timing, distribution, and amount of water yield in a harvested watershed. Water yields tend to increase proportionately to the percentage of canopy removal (Haupt 1976), because removal of live trees reduces the amount of water transpired, leaving more water available for soil saturation and runoff. Canopy removal also decreases interception of rain and snow and alters snowpack distribution and snowmelt, which lead to further water-yield increases. Higher water yields may lead to increases in peak flows and peak-flow duration, which can result in accelerated streambank erosion and sediment deposition. Vegetation removal can also reduce peak flows by changing the timing of snowmelt. Openings will melt earlier in the spring with solar radiation and have less snow available in late spring when temperatures are warm. This effect can reduce the synchronization of snowmelt runoff and lower peak flows. Measurement criteria: Equivalent Clearcut Acres (ECA) and percent water yield increase (WYI). All past and proposed timber management activities are converted to ECA using procedures outlined in Forest Hydrology Part II (*Haupt 1976*). Peak flow duration and timing will be addressed qualitatively.

ANALYSIS AREA

Sediment Delivery

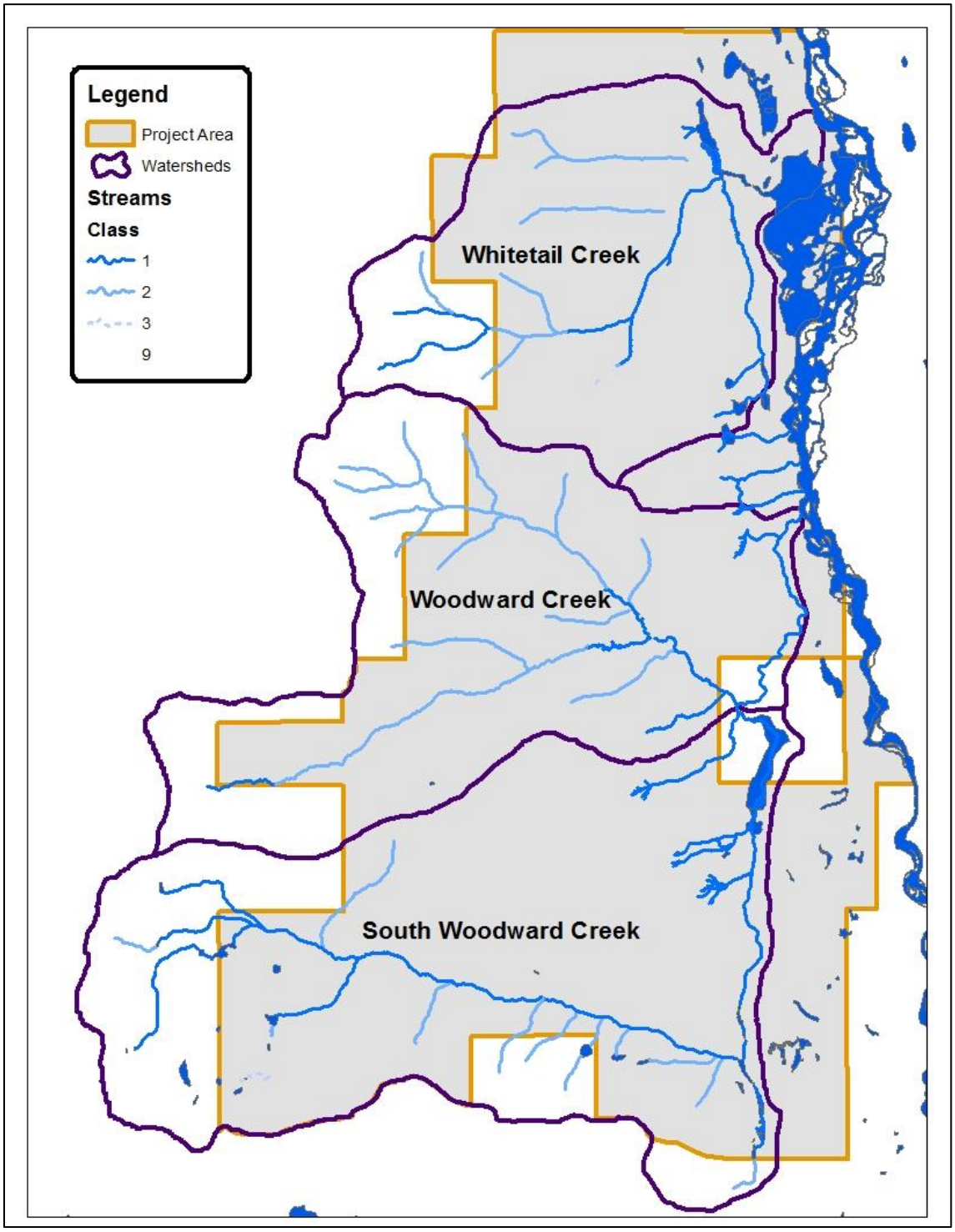
Direct, indirect and cumulative effects to sediment delivery will be analyzed in each of the three project area watersheds listed in the Project Area and Project Activities portion of this analysis. All existing and proposed road construction activities related to the Wood Lion project on all ownership within each project area watershed will be analyzed. These watersheds were chosen as an appropriate scale of analysis for the WFP method, and will effectively display the estimated impacts of proposed activities. Additional sites not located within the project area watershed boundaries will be assessed qualitatively for their potential to affect downstream waters.

Water Yield

Direct, indirect and cumulative effects to water yield will be analyzed in each of the three project area watersheds listed in the Project Area and Project Activities portion of this analysis. A map of the project area watersheds and their relation to the proposed project area is found below *(FIGURE III-12)*. All existing activities on all ownerships and

proposed activities related to the Wood Lion project, including road construction, within each project area watershed will be analyzed using the ECA method to estimate the changes in average annual water yield that may occur as a result of the proposed project. These watersheds were chosen as an appropriate scale of analysis for the ECA method, and will effectively display the estimated impacts of proposed activities. A qualitative assessment of water yield will be done for areas outside of the three watersheds listed in Project Area and Project Activities portion of this analysis.

FIGURE III-12 – PROJECT AREA WATERSHEDS.



ANALYSIS METHODS

Analysis methods for cumulative effects include all proposed DNRC activities and planned actions on other ownerships. However, potential future management on other ownerships was not considered due to the speculative nature of predicting the intentions of other landowners. For a complete list of past activities considered in this analysis, please refer to CHAPTER 1, SCOPE OF THE EIS – RELEVANT PAST, PRESENT, AND REASONABLY FORESEEABLE FUTURE ACTIONS. Each of the analyses below was conducted on a watershed basis, and included activities on all roads and acres, regardless of ownership.

Sediment Delivery

Analysis methods to assess sediment delivery consisted of a sediment-source inventory. All roads and stream crossings within project area watersheds were evaluated to determine sources of introduced sediment. Data was collected in 2013 to estimate quantities of sediment delivery from roads using procedures adapted from the WFP Board (*Callahan, 2000*). Proposed new roads and stream crossings were assessed using the same methodology based on all proposed new crossings meeting applicable BMPs. In addition, in-channel sources of sediment were identified using channel-stability rating methods developed by Pfankuch (*1975*) and through the conversion of stability rating to reach condition by stream type developed by Rosgen (*1996*). These analyses were conducted in 2004 by a DNRC hydrologist, and the results were verified in 2013 to ensure the validity of the results.

Water Yield

Analysis methods to assess the water-yield increase for the watersheds in the project area consisted of the ECA method as outlined in Forest Hydrology Part II (*Haupt 1976*). ECA is a function of total area roaded and harvested, percent of crown removal in harvesting, and amount of vegetative recovery that has occurred in harvest areas. This method equates area harvested and percent of crown removed with an equivalent amount of clearcut area. For example, if 100 acres had 60 percent crown removed, ECA would be approximately 60, or equivalent to a 60-acre clearcut. The relationship between crown removal and ECA is not a 1-to-1 ratio, so the percent ECA is not always the same as the percent canopy removal. As live trees are removed, the water they would have evaporated and transpired either saturates the soil, or is translated to runoff. This method also calculates the recovery of these increases as new trees begin to grow and move toward preharvest water use.

Analysis methods to evaluate the watershed risk of potential water-yield increase include establishing a threshold of concern. In order to determine a threshold of concern, acceptable risk level, resource value, and watershed sensitivity are evaluated according to Young (*1989*). The watershed sensitivity is evaluated using qualitative assessments, as well as procedures outlined in Forest Hydrology Part II (*Haupt 1976*). The stability of a stream channel is an important indicator of where a threshold of concern should be set. As water yields increase as a result of canopy removal, the amount of water flowing in a creek gradually increases. When these increases reach a certain level, the bed and banks may begin to erode. More stable streams will be able to handle larger increases in water yield before they begin to erode, while less stable streams will experience erosion at more moderate water-yield increases (*Rosgen 1996*).

Risk Assessment Criteria

Where risk is assessed in both sediment-delivery and water-yield analyses, the following definitions apply to the level of risk reported:

- low risk means that impacts are unlikely to result from proposed activities,
- moderate risk means that there is approximately a 50-percent chance of impacts resulting from proposed activities, and
- high risk means that impacts are likely to result from proposed activities.

Where levels or degrees of impacts are assessed in this analysis, the following definitions apply to the degree of impacts reported:

- very low impact means that impacts from proposed activities are unlikely to be measurable or detectable and are not likely to be detrimental to the water resource;
- low impact means that impacts from proposed activities would likely be measurable or detectable, but are not likely to be detrimental to the water resource;
- moderate impact means that impacts from proposed activities would likely be measurable or detectable, and may or may not be detrimental to the water resource;
- high impact means that impacts from proposed activities would likely be measurable or detectable, and are likely to have detrimental impacts to the water resource.

Montana Surface Water-Quality Standards

According to ARM 17.30.608 (1)(b)(i), the Swan River drainage, including Whitetail, Woodward, and South Woodward creeks, is classified as B-1. Among other criteria for B-1 waters, no increases are allowed above naturally occurring levels of sediment, and minimal increases over natural turbidity. "Naturally occurring," as defined by ARM 17.30.602 (19), includes conditions or materials present during runoff from developed land where all reasonable land, soil, and water conservation practices (commonly called Best Management Practices or BMPs) have been applied. Reasonable practices include methods, measures, or practices that protect present and reasonably anticipated beneficial uses. These practices include, but are not limited to, structural and nonstructural controls and operation and maintenance procedures. Appropriate practices may be applied before, during, or after completion of activities that could create impacts.

Designated beneficial water uses within the project area include cold-water fisheries and recreational use in the stream, wetlands, lake, and surrounding area. There are 2 existing surface water rights in the project for domestic use on Woodward Creek. Domestic use refers to water rights assigned to individual property owners for uses such as eating, drinking, laundering, bathing, lawn watering and watering a household garden.

Water-Quality-Limited Waterbodies

None of the streams in the proposed project area are currently listed as water-quality-limited waterbodies in the 2016 Montana 303(d) list. Swan Lake and Goat Creek are currently listed on the 2016 Montana 303(d) list. Each of the project area watersheds is a tributary to the Swan River, which is the primary inflow to Swan Lake. The 303(d) list is compiled by the Montana Department of Environmental Quality (DEQ) as required by Section 303(d) of the Federal Clean Water Act and the Environmental Protection Agency (EPA) Water Quality Planning and Management Regulations (*40 CFR, Part 130*). Under these laws, DEQ is required to identify waterbodies that do not fully meet water-quality standards, or where beneficial uses are threatened or impaired. These waterbodies are then characterized as "water quality limited" and thus targeted for Total Maximum Daily Load (TMDL) development. The TMDL process is used to determine the total allowable amount of pollutants in a waterbody of a watershed. Each contributing source is allocated a portion of the allowable limit. These allocations are designed to achieve water-quality standards.

The Montana Water Quality Act (*MCA 75-5-701 through 705*) also directs DEQ to assess the quality of State waters, ensure that sufficient and credible data exists to support a 303(d) listing, and develop TMDL for those waters identified as threatened or impaired. Under the Montana TMDL Law, new or expanded nonpoint source activities affecting a listed waterbody may commence and continue provided they are conducted in accordance with all reasonable land, soil, and water conservation practices. DNRC will comply with the TMDL Law and interim guidance developed by DEQ through implementation of all reasonable soil and water conservation practices, including BMPs and Forest Management Rules (*ARM 36.11.401 through 450*).

Swan Lake is currently listed as fully supporting for all beneficial uses. Goat Creek above the confluence with Squeezer Creek is listed as not supporting aquatic life. The current listed cause of impairment in Goat Creek is total suspended solids; the probable sources include silviculture harvesting, highways, roads, bridges, infrasturcture (new construction). Through the Swan Lake Watershed Group and its associated Swan Lake Technical Advisory Group, a water-quality restoration plan was developed for Swan Lake in June 2004. The Swan Lake Watershed Group and Technical Advisory Group are comprised of local stakeholders and include:

- the Swan Valley Connections, Flathead Lake Biological Station at Yellow Bay, and Friends of the Wild Swan;
- landowners, including the USDA Forest Service, Montana DNRC; and
- regulatory agencies, including DEQ and the U.S. Environmental Protection Agency (EPA).

The Water Quality Restoration Plan was approved by EPA in August 2004, and activities are ongoing to correct current sources and causes of sediment to Swan Lake and its tributaries. DNRC is an active partner and participant in this process. All proposed activities within the project area would implement activities to alleviate identified sources of sediment and comply fully with all TMDL requirements.

Montana SMZ Law

By the definition in ARM 36.11.312 (3), the majority of the stream reaches in the Whitetail, Woodward, and South Woodward Creek watersheds are class 1 streams. All of these streams and many of their tributaries have flow for more than 6 months each year. Many of these stream reaches also support fish. Some of the smaller first-order tributaries may be classified as class 2 or 3 based on site-specific conditions. A class 3 stream is defined as a stream that does not support fish; normally has surface flow during less than 6 months of the year; and rarely contributes surface flow to another

stream, lake or other body of water (*ARM 36.11.312 (5)*). According to ARM 36.11.312 (4), a class 2 stream is a portion of a stream that is not a class 1 or class 3 stream segment.

Forest Management Rules

In 2003, DNRC drafted Administrative Rules for Forest Management. The portion of those rules applicable to watershed and hydrology resources include ARM 36.11.422 through 426. All applicable rules will be implemented if they are relevant to activities proposed with this project.

EXISTING ENVIRONMENT

The existing environment was assessed in the watersheds in the proposed project area, and includes Whitetail, Woodward, and South Woodward Creeks. Each of these drainages lies on the east slope of the Mission Range, and form a portion of the western geologic boundary of the Swan Valley. Precipitation ranges from approximately 20 inches annually in the valley bottom to approximately 70 inches near ridge tops. Stream gauging data gathered since 1976 on project area streams show that peak discharge in streams on the west side of the Swan Valley is approximately double that of summer low flows. In comparison, streams on the east side of the valley gauged on the same dates show approximately a 5-fold increase from low flow to peak discharge. The result of these stable flows is generally high channel and bank stability. These and other attributes will be described in more detail in the following sections.

SEDIMENT DELIVERY

In-channel and out-of–channel sources of sediment delivery were assessed by DNRC hydrologists and fisheries biologists in 1998, 2007 and 2016 and by PBS&J Consulting in association with the development of the Swan Lake Water Quality Protection Plan and TMDL (DEQ 2005). The results of these assessments were used in the following sections of this analysis.

Whitetail Creek In-channel Sources

In-channel sources of sediment were evaluated in Whitetail Creek based on field reconnaissance from 1998-2000, 2007 and 2016. Stream reaches in the Whitetail Creek watershed were rated primarily in good condition. No reaches of Whitetail Creek were rated in poor condition.

Most reaches of Whitetail Creek were rated as B3 and B4 channels using a classification system developed by *Rosgen (1996)*. Channel types rated as "B" are typically in the 2- to 4-percent gradient range, and have a moderate degree of meander (sinuosity). Channel bed materials in B3 types are mainly cobble with some boulders and gravel, and bed

materials in B4 types are mainly gravel with some cobble and sand. No areas of down-cut channels were identified during field reconnaissance. Large woody debris was found in adequate supply to support channel form and function. Woody material in a stream provides traps for sediment storage and gradient breaks to reduce erosive energy and work as flow deflectors to reduce bank erosion. Large woody debris is also assessed for its ability to provide habitat for aquatic species. These issues are discussed further in the fisheries portion of this document. The lower reaches of the watershed flow through a series of wetlands and beaver ponds. The beaver dams can lead to changing water levels in the stream, but the wetlands and beaver ponds tend to moderate the high runoff periods and settle out sediment and channel bed materials that may be carried downstream during runoff. Little evidence of past SMZ harvesting was found, and, where past logging took place in the SMZ, no deficiency of existing or potential downed woody material was apparent in the streams.

Woodward Creek In-channel Sources

In-channel sources of sediment were evaluated in Woodward Creek based on field reconnaissance from 1998-2000, 2007 and 2016. Stream reaches in the Woodward Creek watershed were rated in good to fair condition (*Rosgen 1996*). Four reaches were rated in poor condition. These reaches were all moderate to moderately high gradient channels in gravel or sand substrate. Channels with dominant substrate sizes in the gravel and sand ranges have less resistance to erosive flows, especially in steeper gradient channels. These reaches represent approximately 25 percent of the total length of streams in the watershed and are located mainly on DNRC lands.

Stream reaches in the upper portions of the Woodward Creek watershed are mainly B4 channel types, with minor amounts of B5 and B6 channels using a classification system developed by *Rosgen* (*1996*). Channel types rated as "B" are typically in the 2- to 4-percent gradient range, and have a moderate degree of meander (sinuosity). Channel-bed materials in B4 and B5 types are mainly gravel or sand, respectively, and channel-bed materials in B6 types are mainly silt/clay. Stream reaches in the lower portions of the Woodward Creek watershed are mainly C4 and C5 channels. Channel types rated as "C" are typically in the 1- to 2-percent gradient range, and have a high degree of meander (sinuosity). Channel-bed materials in C4 and C5 channels are mostly gravel and coarse sand, respectively. Given the gravel and coarse sand beds and the gradient of these stream types, bed materials commonly move. No areas of down-cut channels were identified during field reconnaissance. Large woody debris was found in adequate supply to support channel form and function. Woody material in a stream provides traps for sediment storage and gradient breaks to reduce erosive energy and work as

flow deflectors to reduce bank erosion. Large woody debris is also assessed for its ability to provide habitat for aquatic species. Little evidence of past SMZ harvesting was found, and, where past logging took place in the SMZ, no deficiency of existing or potential downed woody material was apparent in the streams. These issues are discussed further in the fisheries portion of this document.

South Woodward Creek In-channel Sources

In-channel sources of sediment were evaluated in South Woodward Creek based on field reconnaissance from 1998-2000, 2007 and 2016. Stream reaches in the South Woodward Creek watershed are primarily in good to fair condition (*Rosgen 1996*). One reach was rated in poor condition and is located where the stream gradient changes dramatically. This reach becomes a depositional area where upstream sediment transport reaches deposit material. The reach represents less than 5 percent of the total length of streams in the watershed. Portions of the proposed project area are found upstream from this reach, but most of the proposed project area is located downstream from this reach.

Most reaches of South Woodward Creek were rated as B2 and B3 channels, and many of the perennial tributaries to South Woodward Creek were rated as B4 using a classification system developed by *Rosgen* (*1996*). Channel types rated as "B" are typically in the 2- to 4-percent gradient range, and have a moderate degree of meander (sinuosity). Channel-bed materials in B2 and B3 types are mainly boulder and cobble, respectively, and channel-bed materials in B4 types are mainly gravel. Given the cobble and gravel content and the gradient of these stream types, bed materials commonly move. Gravel bars have formed on point bars in these reaches (point bars are areas of natural deposition found on the inside of a meander bend). No areas of down-cut channels were identified during field reconnaissance. Large woody debris was found in adequate supply to support channel form and function. Woody material in a stream provides traps for sediment storage and gradient breaks to reduce erosive energy and work as flow deflectors to reduce bank erosion. Large woody debris is also assessed for its ability to provide habitat for aquatic species. These issues are discussed further in the fisheries portion of this document. Little evidence of past SMZ harvesting was found, and where past logging took place in the SMZ, no deficiency of existing or potential downed woody material to support hydrologic function was apparent in the streams. The fisheries analysis has a more in-depth analysis of large woody debris, including a discussion of reference stream conditions.

Road System

The existing road system located within and leading to the proposed project area was reviewed in 2016 for existing and potential sources of sediment. Based on the sediment-source review, several existing sources of sediment were identified on the existing road system. Each of the sources identified in this analysis are either found on DNRC ownership or are associated with roads that are under a Cost-Share Agreement entered into by DNRC and FNF. Most of the delivery sites are located at stream crossings. The total estimated sediment delivery from roads in the project area to Whitetail, Woodward, and South Woodward creeks are displayed below *(TABLE III-33)*. These sediment-delivery values are estimates based on procedures outlined above and are not measured values. Portions of the proposed haul routes lie outside of these project area watersheds, and include road segments in the East Porcupine Creek and Cedar Creek watersheds. These roads were assessed qualitatively and were found to have applicable BMPs in place. Most of this road system has had recent BMP improvements installed through the White Porcupine analysis and its associated timber sales, so nothing other than minor maintenance would be needed to maintain functioning BMPs.

TABLE III-33 - CURRENT SEDIMENT DELIVERY. *Current estimated sediment delivery to project area streams from existing road system.*

	WHITETAIL CREEK	WOODWARD CREEK	SOUTH WOODWARD CREEK
Existing tons per year	2.24	1.78	8.09

Estimated sediment delivery from the road system occurs primarily at stream crossings, and sediment comes from a variety of sources. Identified sources of sediment delivery found during the inventory are minor and located on sites needing additional road surface drainage and BMP upgrades. These sites are found mainly on older roads that were constructed before the adoption of forest management BMPs. Some sites have BMPs in place, but are not functioning as designed due to maintenance. These sites are also responsible for some of the smaller delivery sources.

An existing source of sediment exists in the Whitetail Creek watershed on an intermittent class 3 stream that does not contribute flow to Whitetail Creek. This source is an active slump and mass movement of soil. The slump is a natural occurrence that was likely exacerbated by construction of a road across it. This road was built in the

1950s or 1960s. In the past 15 years, the slump has become active and has become a chronic source of sediment to the intermittent class 3 stream. Multiple attempts have been made to repair and stabilize the slump where the existing road crosses it, but these efforts have not been successful. This site is described in greater detail in the Soils and Geology portion of this analysis.

Much of the existing road system in the proposed project area meets applicable BMPs. Surface drainage and erosion control features were installed on the road systems in most of the Whitetail, Woodward and South Woodward creek watersheds through recent past project work.

WATER YIELD

According to ARM 36.11.423, allowable WYI values were set at levels to ensure compliance with all water-quality standards, protect beneficial uses, and exhibit a low degree of risk. This means that the allowable level is a point below which water yields are unlikely to cause any measurable or detectable changes in channel stability. The allowable WYI for the Whitetail Creek watershed has been set at 12 percent based on channel-stability evaluations, watershed sensitivity, and acceptable risk. This WYI would be reached approximately when the ECA level in Whitetail Creek reaches the estimated level of 1,517 acres. The allowable WYI for the Woodward Creek watershed has been set at 12 percent based on channel-stability evaluations, watershed sensitivity, and acceptable risk. This WYI would be reached approximately when the ECA level in Woodward Creek reaches the estimated level of 2,038 acres. The allowable WYI for the South Woodward Creek watershed has been set at 12 percent based on channel-stability evaluations, watershed sensitivity, and acceptable risk. This WYI would be reached approximately when the ECA level in South Woodward Creek reaches the estimated level of 2,758 acres. Based on review of 1966 aerial photography and DNRC section records in the project area, timber-harvesting and associated road-construction activities have taken place in the Whitetail, Woodward and South Woodward creek watersheds since the early 1950s. Harvest activities may have occurred prior to the 1950s, but no records of activities were found. Any timber management taking place prior to the 1950s is assumed to have returned to pre-activity levels of transpiration and snowpack distribution (*Haupt 1976*). Timber management history on land administered by the Flathead National Forest (FNF) was also included for each of the project area watersheds. These activities, combined with the vegetative recovery that has occurred, have led to an estimated 9.2 percent WYI over a fully forested condition in the Whitetail Creek watershed, 6.9 percent over a fully forested condition in Woodward Creek and 6.5 percent over a fully forested condition in South Woodward Creek. Existing conditions for water yield and the associated ECA levels in the project area watersheds are

summarized below *(TABLE III-34)*. Estimated water yield and ECA levels are well below established thresholds in all project area watersheds.

TABLE III-34 – CURRENT WATER YIELD. *Water yield and ECA increases in project area watersheds.*

	Whitetail Creek	**Woodward Creek**	**South Woodward Creek**
Existing % WYI	9.2	6.9	6.5
Allowable % WYI	12.0	12.0	12.0
Existing ECA	927	985	1,332
Allowable ECA	1,517	2,038	2,758

ENVIRONMENTAL EFFECTS

SEDIMENT DELIVERY

- ***Direct and Indirect Effects of No-Action Alternative A to Sediment Delivery***

No-Action Alternative A would have no direct effects to sediment delivery beyond those currently occurring. Existing sources of sediment, both in-channel and out of channel would continue to recover or degrade based on natural or preexisting conditions.

Indirect effects of No-Action Alternative A would be an increased risk of sediment delivery to streams from crossings that do not meet applicable BMPs. These sites would continue to pose a moderate risk of sediment delivery to streams until other funding became available to repair them.

- ***Direct and Indirect Effects to Sediment Delivery Common to All Action Alternatives***

Direct and indirect effects to sediment delivery common to both action alternatives relate to the repair and rehabilitation of an existing slump and mass movement of soil in the Whitetail Creek watershed. This site is proposed to be stabilized through an outside source of funding secured by the Technical Advisory Group of the Swan Lake Watershed Group, of which DNRC is an active participant. The proposal is to decommission the portion of the road that crosses the slump and rehabilitate and stabilize the site to encourage re-vegetation. This would likely lead to reductions in sediment delivery to the unnamed class 3 stream affected by this slump.

- ***Direct and Indirect Effects of Action Alternative B to Sediment Delivery***

Direct and indirect effects of Action Alternative B to sediment delivery would include the maintenance or improvement of BMPs at several stream crossings. Erosion control and BMPs would be improved on up to 95 miles of existing road. This work would:

- reduce the estimated sediment load to Whitetail Creek by approximately 0.85 tons of sediment per year;
- reduce the estimated sediment load to Woodward Creek by approximately 0.12 tons per year; and
- reduce the estimated sediment load to South Woodward Creek by approximately 5.04 tons per year.

These projected sediment reductions are net values for each watershed. These values include the projected increases in sediment delivery from new stream crossings and new road construction, as well as projected sediment reductions from BMP improvements and road and stream-crossing improvement activity. A more detailed summary of sediment delivery estimates is found below *(TABLE III-35, TABLE III-36, TABLE III-37)*.

Action Alternative B would also construct approximately 12.8 miles of new road to access proposed harvest units. The impacts of proposed new roads are primarily associated with new stream crossings. These impacts are discussed below and in *TABLE III-35*, *TABLE III-36*, and *TABLE III-37*. The remainder of the impacts of new road construction is related to the risk of erosion resulting from exposure of bare soil. The risk of sediment delivery from new permanent roads is low where these roads are located away from stream crossings. As cut slopes and fill slopes revegetate, this risk would decrease. Installation of surface drainage and the implementation of other BMPs and Forest Management Rules would further reduce the risk of erosion or sediment delivery from new roads by routing road surface drainage through adequate filtration zones prior to entering a stream.

There is a high risk of low impacts to project area streams from construction of new stream crossings with Action Alternative B. This alternative would propose to construct 3 new stream crossing; 1 in the Whitetail Creek watershed, 1 in the Woodward Creek watershed and 1 in the South Woodward Creek watershed. The high risks of low impacts are related mainly to the exposure of bare soil on cut and fill slopes on and around the proposed crossings. As these sites re-vegetate in two to three years, these sites would become a low risk of low impacts to sediment delivery.

There is a low risk of low impacts to streams outside the proposed project area as a result of hauling timber on existing roads. Portions of roads proposed as haul routes

with Action Alternative B are located in the East Porcupine Creek watershed to the north of the proposed project area and in the Cedar Creek watershed to the south of the proposed project area. These roads already have applicable BMPs installed and BMPs would be maintained or improved with this project.

Action Alternative B would have a low risk of sediment delivery to streams as a result of proposed timber-harvesting activities. The SMZ law, Administrative Rules for Forest Management, applicable BMPs and DNRC's Habitat Conservation Plan (HCP) would be applied to all harvesting activities, which would minimize the risk of sediment delivery to draws and streams. The Montana BMP audit process has been used to evaluate the application and effectiveness of forest-management BMPs since 1990; this process has also been used to evaluate the application and effectiveness of the SMZ Law since 1996. During that time, evaluation of ground-based-skidding practices near riparian areas has been rated 92-percent effective, and these same practices have been found effective over 99 percent of the time from 1998 to present (*DNRC 1990 through 2016*). Since 1996, effectiveness of the SMZ width has been rated over 99 percent (*DNRC 1990 through 2016*). As a result, with the application of BMPs and the SMZ Law, proposed activities are expected to have a low risk of low impacts to sediment delivery. Up to 13 acres of harvest are proposed within the riparian management zone (RMZ) of a class 1 stream in the proposed project area with Action Alternative B. According to AQ-RM1 of DNRC's HCP, these 13 acres lie between the 50-foot no-cut buffer and the 120-foot RMZ boundary. None of this proposed RMZ harvesting would occur within 50 feet of a stream. No other SMZ harvesting is proposed with this alternative. None of the proposed SMZ harvesting would involve ground based equipment. Since none of these proposed activities within RMZs or SMZs would involve ground based equipment operation within 50 feet of a stream and would occur on gentle to moderate slopes, there is a low risk of low impacts to sediment delivery from these activities.

- ***Direct and Indirect Effects of Action Alternative C to Sediment Delivery***

Direct and indirect effects of Action Alternative C to sediment delivery would include the maintenance or improvement of BMPs at several stream crossings. Erosion control and BMPs would be improved on up to 81 miles of existing road. This work would:

- reduce the estimated sediment load to Whitetail Creek by approximately 0.87 tons of sediment per year;
- reduce the estimated sediment load to Woodward Creek by approximately 0.09 tons per year; and
- reduce the estimated sediment load to South Woodward Creek by approximately 5.13 tons per year.

These projected sediment reductions are net values for each watershed. These values include the projected increases in sediment delivery from new stream crossings and new road construction, as well as projected sediment reductions from BMP improvements and road and stream-crossing improvement activity. A more detailed summary of sediment delivery estimates is found below *(TABLE III-35, TABLE III-36, TABLE III-37)*.

Action Alternative C would also construct approximately 16.0 miles of new road to access proposed harvest units. The impacts of proposed new roads are primarily associated with new stream crossings. These impacts are discussed below and in *TABLE III-35, TABLE III-36,* and *TABLE III-37*. The remainder of the impacts of new road construction is related to the risk of erosion resulting from exposure of bare soil. The risk of sediment delivery from new permanent roads is low where these roads are located away from stream crossings. As cut slopes and fill slopes revegetate, this risk would decrease. Installation of surface drainage and the implementation of other BMPs and Forest Management Rules would further reduce the risk of erosion or sediment delivery from new roads.

There is a high risk of low impacts to project area streams from construction of new stream crossings with Action Alternative C. This alternative would propose to construct 4 new stream crossing; 1 in the Whitetail Creek watershed, 1 in the Woodward Creek watershed and 1 in the South Woodward Creek watershed. The high risks of low impacts are related mainly to the exposure of bare soil on cut and fill slopes on and around the proposed crossings. As these sites re-vegetate in two to three years, these sites would become a low risk of low impacts to sediment delivery.

There is a low risk of low impacts to streams outside the proposed project area as a result of hauling timber on existing roads. Portions of roads proposed as haul routes with Action Alternative C are located in the East Porcupine Creek watershed to the north of the proposed project area and in the Cedar Creek watershed to the south of the proposed project area. These roads already have applicable BMPs installed and BMPs would be maintained or improved with this project.

Action Alternative C would have a low risk of sediment delivery to streams as a result of proposed timber-harvesting activities. The SMZ law, Administrative Rules for Forest Management, applicable BMPs and DNRC's HCP would be applied to all harvesting activities, which would minimize the risk of sediment delivery to draws and streams. The Montana BMP audit process has been used to evaluate the application and effectiveness of forest-management BMPs since 1990; this process has also been used to evaluate the application and effectiveness of the SMZ Law since 1996. During that time,

evaluation of ground-based-skidding practices near riparian areas has been rated 92-percent effective, and these same practices have been found effective over 99 percent of the time from 1998 to present (DNRC 1990 through 2016). Since 1996, effectiveness of the SMZ width has been rated over 99 percent (DNRC 1990 through 2016). As a result, with the application of BMPs and the SMZ Law, proposed activities are expected to have a low risk of low impacts to sediment delivery. Up to 7 acres of harvest are proposed within the riparian management zone (RMZ) of a class 1 stream in the proposed project area with Action Alternative C. According to AQ-RM1 of DNRC's HCP, these 7 acres lie between the 50-foot no-cut buffer and the 120-foot RMZ boundary. None of this proposed RMZ harvesting would occur within 50 feet of a stream. No other SMZ harvesting is proposed with this alternative. None of the proposed SMZ harvesting would involve ground based equipment. Since none of these proposed activities within RMZs or SMZs would involve ground based equipment operation within 50 feet of a stream, there is a low risk of low impacts to sediment delivery from these activities.

Cumulative Effects

- ***Cumulative Effects of No-Action Alternative A to Sediment Delivery***

The cumulative effects would be very similar to those described in the existing conditions portion of this analysis. All existing sources of sediment would continue to recover or degrade as dictated by natural and preexisting conditions until a source of funding became available to repair them. Sediment loads would remain at or near present levels.

- ***Cumulative Effects of Action Alternative B to Sediment Delivery***

Cumulative effects to sediment delivery from Action Alternative B would be primarily related to roadwork and stream-crossing replacements. Sediment generated from the replacement of existing culverts would increase the total sediment load in streams flowing through the project area and proposed haul routes for the duration of activity. These increases would not exceed any State water-quality laws and would follow all applicable recommendations given in the 124 and 318 permits. In the long term, the cumulative effects to sediment delivery would be a reduction from approximately 2.24 tons of sediment per year to approximately 1.39 tons of sediment per year in Whitetail Creek, reduced from 1.78 tons per year to approximately 1.66 tons per year in Woodward Creek, and reduced from 8.09 tons per year to 3.05 tons per year in South Woodward Creek. These values include projected increases from new road and stream-crossing construction, potential increases from the replacement of existing stream-crossing structures, and the projected reductions in sediment delivery from upgrading surface drainage, erosion control, and BMPs on existing roads. A summary of sediment-

delivery estimates is found in *TABLE III-35, TABLE III-36,* and *TABLE III-37.* As the sites stabilize and revegetate, sediment levels resulting from BMP improvement sites would decrease further from projected levels as work sites are closed and bare soil re-vegetates and stabilizes. Over the long term, cumulative sediment loads would be reduced due to improvement of surface drainage and erosion control BMPs at crossing sites.

The construction of new roads and stream crossings and installation and improvement of erosion-control and surface-drainage features on existing roads associated with Alternative B would also affect the cumulative sediment delivery to Whitetail, Woodward, and South Woodward creeks as described above (*Burroughs and King 1989*). In the short term, new road construction and the installation and improvement of surface drainage features would expose bare soil. This would increase the risk of short-term sediment delivery to the streams in and around the proposed project area. The application of all applicable BMPs during this work would minimize the risk of potential short-term sediment loading to downstream waters. Over the long term, cumulative sediment delivery to Whitetail, Woodward, and South Woodward creeks is projected to be lower than existing conditions. Projected increases in sediment delivery from new road and stream-crossing construction would be less than the sediment-delivery decreases expected with the installation of more effective surface drainage and erosion control features on the existing road system. The net long-term effect to sediment delivery from this alternative is expected to be a cumulative decrease from pre-project levels.

Action Alternative B would have an overall low risk of adverse cumulative impacts to sediment yield in project-area watersheds and presents a low risk to adversely affect downstream beneficial uses. Although risk is elevated at site specific locations, overall risk of adverse cumulative effects to sediment loading is low. Implementation of BMPs, the SMZ Law, and Forest Management Rules would ensure low risk of increased sediment delivery, and improvements to the existing road system would substantially reduce cumulative levels of sedimentation compared to current levels. All activities would comply with applicable laws, rules, and regulations.

- ***Cumulative Effects of Action Alternative C to Sediment Delivery***

Cumulative effects to sediment delivery from Action Alternative C would be primarily related to roadwork and stream-crossing replacements. Sediment generated from the replacement of existing culverts would increase the total sediment load in streams flowing through the project area and proposed haul routes for the duration of activity. These increases would not exceed any State water-quality laws and would follow all applicable recommendations given in the 124 and 318 permits. In the long term, the

cumulative effects to sediment delivery would be a reduction from approximately 2.24 tons of sediment per year to approximately 1.37 tons of sediment per year in Whitetail Creek, reduced from 1.78 tons per year to approximately 1.69 tons per year in Woodward Creek, and reduced from 8.09 tons per year to 2.96 tons per year in South Woodward Creek. These values include projected increases from new road and stream-crossing construction, potential increases from the replacement of existing stream-crossing structures, and the projected reductions in sediment delivery from upgrading surface drainage, erosion control, and BMPs on existing roads. A summary of sediment-delivery estimates is found in *TABLE III-35, TABLE III-36,* and *TABLE III-37*. As the sites stabilize and revegetate, sediment levels resulting from BMP improvement sites would decrease further from projected levels as work sites are closed and bare soil re-vegetates and stabilizes. Over the long term, cumulative sediment loads would be reduced due to improvement of surface drainage and erosion control BMPs at crossing sites.

The construction of new roads and stream crossings and installation and improvement of erosion-control and surface-drainage features on existing roads associated with Alternative C would also affect the cumulative sediment delivery to Whitetail, Woodward, and South Woodward creeks as described above. In the short term, new road construction and the installation and improvement of surface drainage features would expose bare soil. This would increase the risk of short-term sediment delivery to the streams in and around the proposed project area. The application of all applicable BMPs during this work would minimize the risk of potential short-term sediment loading to downstream waters. Over the long term, cumulative sediment delivery to Whitetail, Woodward, and South Woodward creeks are projected to be lower than existing conditions. Projected increases in sediment delivery from new road and stream-crossing construction would be less than the sediment-delivery decreases expected with the installation of more effective surface drainage and erosion control features on the existing road system. The net long-term effect to sediment delivery from this alternative is expected to be a cumulative decrease from pre-project levels.

Action Alternative C would have an overall low risk of adverse cumulative impacts to sediment yield in project-area watersheds and presents a low risk to adversely affect downstream beneficial uses. Although risk is elevated at site specific locations, overall risk of adverse cumulative effects to sediment loading is low. Implementation of BMPs, the SMZ Law, and Forest Management Rules would ensure low risk of increased sediment delivery, and improvements to the existing road system would substantially reduce cumulative levels of sedimentation compared to current levels. All activities would comply with applicable laws, rules, and regulations.

TABLE III-35 – WHITETAIL CREEK DELIVERY. *Estimates of sediment delivery in the Whitetail Creek watershed.*

	ALTERNATIVE		
	A	**B**	**C**
Existing delivery (tons/year)[1]	2.24	2.24	2.24
Estimated reduction[2]	0.0	0.89	0.91
Estimated increase[3]	0.0	0.04	0.04
Post-project delivery (tons/year)	2.24	1.39	1.37
Reduction (tons/year)[1]	0	0.85	0.87
Percent reduction[4]	0	38%	39%

TABLE III-36 – WOODWARD CREEK DELIVERY. *Estimates of sediment delivery in the Woodward Creek watershed.*

	ALTERNATIVE		
	A	**B**	**C**
Existing delivery (tons/year)[1]	1.78	1.78	1.78
Estimated reduction[2]	0.0	0.16	0.13
Estimated increase[3]	0.0	0.04	0.04
Post-project delivery (tons/year)	1.78	1.66	1.69
Reduction (tons/year)[1]	0	0.12	0.09
Percent reduction[4]	0	7%	5%

TABLE III-37 – SOUTH WOODWARD CREEK DELIVERY. *Estimates of sediment delivery in the South Woodward Creek watershed.*

	ALTERNATIVE		
	A	**B**	**C**
Existing delivery (tons/year)[1]	8.09	8.09	8.09
Estimated reduction[2]	0.0	5.08	5.21
Estimated increase[3]	0.0	0.04	0.08
Post-project delivery (tons/year)	8.09	3.05	2.96
Reduction (tons/year)[3]	0	5.04	5.13
Percent reduction[4]	0	62%	63%

[1]*These sediment-delivery values are estimates based on procedures outlined in Analysis Methods, and are not measured values.*
[2]*Includes projected decreases from rehabilitation and BMP work on existing roads and crossings.*
[3]*Includes projected increases from construction of new roads and new stream crossings.*
[4]*Percent reduction values are estimates based on procedures outlined in Analysis Methods, not on measured values.*

WATER YIELD

Direct and Indirect Effects

- ***Direct and Indirect Effects of No-Action Alternative A to Water Yield***

No-Action Alternative A would have no direct or indirect effects on water yield. Water quantity would not be changed from present levels and the harvest units would continue to return to fully forested conditions as areas of historic timber-harvests regenerate.

- ***Direct and Indirect Effects of Action Alternative B to Water Yield***

Direct and indirect effects of Action Alternative B to water yield include a 2.8% increase in annual water yield in the Whitetail Creek watershed, a 1.4% increase in annual water yield in the Woodward Creek watershed and a 5.3% increase in annual water yield in the South Woodward Creek watershed. These levels of projected water-yield increase are incremental values that refer only to water yield generated by this action alternative and do not include water yield increases from past activities. The cumulative water-yield increase will assess the impacts of the proposed action alternative when added to the impacts of past and planned future activities; this will be discussed in Cumulative Effects portion of this analysis. These levels of water-yield increases would produce a

low risk of creating unstable channels in any of the project-area streams. Peak flow volume and duration may be elevated, and the timing of peak flows may be slightly earlier as a result of the proposed harvest activities. These changes have a low risk of low impacts to the stream channels in each of the watersheds listed above.

- ***Direct and Indirect Effects of Action Alternative C to Water Yield***

Direct and indirect effects of Action Alternative C to water yield include a 2.7% increase in annual water yield in the Whitetail Creek watershed, a 1.9% increase in annual water yield in the Woodward Creek watershed and a 5.1% increase in annual water yield in the South Woodward Creek watershed. These levels of projected water-yield increase are incremental values that refer only to water yield generated by this action alternative and do not include water yield increases from past activities. The cumulative water-yield increase will assess the impacts of the proposed action alternative when added to the impacts of past and planned future activities; this will be discussed in Cumulative Effects portion of this analysis. These levels of water-yield increases would produce a low risk of creating unstable channels in any of the project-area streams. Peak flow volume and duration may be elevated, and the timing of peak flows may be slightly earlier as a result of the proposed harvest activities. These changes have a low risk of low impacts to the stream channels in each of the watersheds listed above.

Cumulative Effects

- ***Cumulative Effects of No-Action Alternative A on Water Yield***

No cumulative effects on water yield are expected as a result of this alternative. Existing timber-harvest units would continue to revegetate and move closer to pre-management levels of water use and snowpack distribution.

- ***Cumulative Effects of Action Alternative B on Water Yield***

Cumulative effects of Action Alternative B on water yield include removal of trees that would increase the annual water yield in the Whitetail Creek watershed from its current level of approximately 9.2 percent over a fully forested condition to an estimated 12.0 percent. This water-yield increase, and its associated ECA level, includes the impacts of all past management activity, existing and proposed roads, proposed timber harvesting, and vegetative hydrologic recovery in the Whitetail Creek watershed. The water-yield increase expected from this alternative leaves the watershed at the established threshold of concern reported in the existing conditions portion of this analysis. This cumulative level of water-yield increase would produce a low risk of creating unstable channels in Whitetail Creek or its tributaries.

Cumulative effects of Action Alternative B on water yield include removal of trees that would increase the annual water yield in the Woodward Creek watershed from its current level of approximately 6.9 percent over a fully forested condition to an estimated 8.3 percent. This water-yield increase, and its associated ECA level, includes the impacts of all past management activity, existing and proposed roads, proposed timber harvesting, and vegetative hydrologic recovery in the Woodward Creek watershed. The water-yield increase expected from this alternative leaves the watershed well below the established threshold of concern reported in the existing conditions portion of this analysis. This cumulative level of water-yield increase would produce a low risk of creating unstable channels in Woodward Creek or its tributaries.

Cumulative effects of Action Alternative B on water yield include removal of trees that would increase the annual water yield in the South Woodward Creek watershed from its current level of approximately 6.5 percent over a fully forested condition to an estimated 11.8 percent. This water-yield increase, and its associated ECA level, includes the impacts of all past management activity, existing and proposed roads, proposed timber harvesting, and vegetative hydrologic recovery in the South Woodward Creek watershed. The water-yield increase expected from this alternative leaves the watershed below the established threshold of concern reported in the existing conditions portion of this analysis. This cumulative level of water-yield increase would produce a low risk of creating unstable channels in South Woodward Creek or its tributaries.

Action Alternative B is expected to have a low risk of cumulative impacts to water yield as a result of the proposed timber harvesting in Whitetail Creek, Woodward Creek and in South Woodward Creek. A summary of the anticipated water-yield impacts of Action Alternative B to the Whitetail, Woodward and South Woodward creek drainages is found in *TABLE III-38*, *TABLE III-39*, and *TABLE III-40.*

- ***Cumulative Effects of Action Alternative C on Water Yield***

Cumulative effects of Action Alternative C on water yield include removal of trees that would increase the annual water yield in the Whitetail Creek watershed from its current level of approximately 9.2 percent over a fully forested condition to an estimated 11.9 percent. This water-yield increase, and its associated ECA level, includes the impacts of all past management activity, existing and proposed roads, proposed timber harvesting, and vegetative hydrologic recovery in the Whitetail Creek watershed. The water-yield increase expected from this alternative leaves the watershed below the established threshold of concern reported in the existing conditions portion of this analysis. This cumulative level of water-yield increase would produce a low risk of creating unstable channels in Whitetail Creek or its tributaries.

Cumulative effects of Action Alternative C on water yield include removal of trees that would increase the annual water yield in the Woodward Creek watershed from its current level of approximately 6.9 percent over a fully forested condition to an estimated 8.8 percent. This water-yield increase, and its associated ECA level, includes the impacts of all past management activity, existing and proposed roads, proposed timber harvesting, and vegetative hydrologic recovery in the Woodward Creek watershed. The water-yield increase expected from this alternative leaves the watershed well below the established threshold of concern reported in the existing conditions portion of this analysis. This cumulative level of water-yield increase would produce a low risk of creating unstable channels in Woodward Creek or its tributaries.

Cumulative effects of Action Alternative C on water yield include removal of trees that would increase the annual water yield in the South Woodward Creek watershed from its current level of approximately 6.5 percent over a fully forested condition to an estimated 11.6 percent. This water-yield increase, and its associated ECA level, includes the impacts of all past management activity, existing and proposed roads, proposed timber harvesting, and vegetative hydrologic recovery in the South Woodward Creek watershed. The water-yield increase expected from this alternative leaves the watershed below the established threshold of concern reported in the existing conditions portion of this analysis. This cumulative level of water-yield increase would produce a low risk of creating unstable channels in South Woodward Creek or its tributaries.

Action Alternative C is expected to have a low risk of cumulative impacts to water yield as a result of the proposed timber harvesting. A summary of the anticipated water-yield impacts of Action Alternative B to the Whitetail, Woodward and South Woodward creek drainages is found in *TABLE III-38, TABLE III-39,* and *TABLE III-40).*

TABLE III-38 – WHITETAIL WATER YIELD. *ECA and percent WYI results for the Whitetail Creek watershed.*

	ALTERNATIVE		
	A	**B**	**C**
Allowable water-yield increase	12%	12%	12%
Percent water-yield increase	9.2	12.0	11.9
Acres harvested[1]	0	548	668

Miles of new road[1]	0	2.3	2.8
ECA generated	0	400	333
Total ECA	927	1,327	1,260
Allowable ECA	1,517	1,517	1,517

TABLE III-39 - WOODWARD WATER YIELD. *ECA and percent WYI results for the Woodward Creek watershed.*

	ALTERNATIVE		
	A	**B**	**C**
Allowable water-yield increase	12%	12%	12%
Percent water-yield increase	6.9	8.3	8.8
Acres harvested[1]	0	683	700
Miles of new road[1]	0	1.6	3.1
ECA generated	0	275	367
Total ECA	985	1,260	1,352
Allowable ECA	2,038	2,038	2,038

TABLE III-40 – SOUTH WOODWARD WATER YIELD. *ECA and percent WYI results for the South Woodward Creek watershed.*

	ALTERNATIVE		
	A	**B**	**C**
Allowable water-yield increase	12%	12%	12%
Percent water-yield increase	6.5	11.8	11.6
Acres harvested[1]	0	1,289	1,524

Miles of new road[1]	0	8.0	9.3
ECA generated	0	997	969
Total ECA	1332	2329	2301
Allowable ECA	2,758	2,758	2,758

[1] *Does not include acres or road segments located outside of watershed boundary*

FISHERIES RESOURCES ANALYSIS

INTRODUCTION

The purpose of this analysis is to assess potential impacts to fisheries resources in the proposed project area (see *CHAPTER I-PURPOSE AND NEED*) as a result of implementing one of the project alternatives (see *CHAPTER II-ALTERNATIVES*).

The project area is entirely within the Swan River watershed (Fifth Code HUC: *1701021103*). Proposed actions under analysis include; up to 3,326 acres of total harvest, up to 16.0 miles of new permanent road construction in the project area.

Native cold-water species known, or presumed, to be present in the project area include:

- bull trout (*Salvelinus confluentus*)
- westslope cutthroat trout (*Oncorhynchus clarki lewisi*)
- mountain whitefish (*Prosopium williamsoni*)
- largescale sucker (*Catostomous macrocheilus*)
- longnose sucker (*Catostomous catostomous*)
- northern pikeminnow (*Ptychocheilus oregonensis*)
- longnose dace (*Rhinichtys cataractae*)
- peamouth (*Mylocheilus caurinus*)
- redside shiner (*Richardsonius balteatus*)
- slimy sculpin (*Cottus cognatus*)
- brook stickleback (*Culaea inconstans*)
- Nonnative species known, or presumed, to be present in the project area include:
- eastern brook trout (*Salvelinus fontinalis*)
- rainbow trout (*Oncorhynchus mykiss*)
- lake trout (*Salvelinus namaycush*)
- kokanee (*Oncorhynchus nerka*)

The remainder of this introduction will focus on a brief review of the life history and ecology of bull trout and westslope cutthroat trout. These species will be the focus of the following *EFFECTS ANALYSIS* (see *ANALYSIS METHODS*).

Both bull trout and westslope cutthroat trout exhibit life history plasticity which includes resident, fluvial, and adfluvial forms. Fish species exhibiting resident life histories typically spend juvenile and adult periods in natal, or nearby connected, low order habitats. Fluvial and adfluvial life histories typically spend 1-3 years in natal streams before migrating downstream to higher order rivers or lake systems to mature (*Shepard et al. 1984, Fraley and Shepard 1989*).

Following maturation, fluvial and adfluvial fish will return to headwater tributaries to spawn. Fluvial and adfluvial life forms of bull trout and westslope cutthroat trout are typically larger than resident forms, and bull trout have been observed returning to upstream reaches in successive or alternating years to spawn (*Fraley and Shepard 1989*). Overall, the life forms and stages of bull trout and westslope cutthroat trout are highly coevolved (*Nakano et al. 1992, Pratt 1984, Shepard et al. 1984*).

Historically, bull trout were found throughout the Columbia River Basin in the northwestern United States. The species was listed as threatened under the Endangered Species Act in 1999 (*USFWS 1999; 64 FR 58910*), with a recovery plan completed in 2015 (*USFWS 2015a*). The recovery plan identified six recovery units including the Columbia Headwaters Recovery Unit which encompasses the upper Clark Fork, Flathead, Kootenai, Lower Clark Fork and Coeur d'Alene rivers (*USFWS 2015b*).

Fluvial and adfluvial bull trout generally mature at ages 5 to 6 years, begin upstream spawning migrations in April, and spawn between September and October in response to a temperature regime decline below 9–10° Celsius (*C; Fraley and Shepard 1989*). Spawning bull trout construct redds in close association with upwelling groundwater and proximity to overhanging or instream cover (*Fraley and Shepard 1989*). Naturally occurring stream temperature regimes and substrate compositions having low levels of fine material are closely related to embryo and juvenile survival (*Pratt 1984, Weaver and Fraley 1991, MBTSG 1998*).

Bull trout have been found inhabiting streams with wetted width as low as 1.0 meter and gradients as high as 15.6 percent (*Rich et al. 2003*), while observed average measures have ranged from 3.1 to 12.4 meters for wetted width and 1.6 to 5.6 percent stream gradient (*Dunham and Chandler 2001, Rich et al. 2003*). Bull trout appear to prefer average maximum seasonal stream temperatures ranging from approximately 14.0–16.0° C (*Rieman and Chandler 1999, Sauter et al. 2001, Garnett 2002, Rich et al. 2003*). Laboratory studies have indicated maximum juvenile growth occurs at temperatures between 10.9 and 15.4° C (*Selong et al. 2001*).

Historically, westslope cutthroat trout were found in the headwaters of the Clark Fork, Missouri, and Saskatchewan rivers in Montana (*Behnke 1992*). The species occupies habitat ranging from first-order and larger streams and rivers, with the historical distribution likely defined by thermal regimes (*Behnke 1992, McIntyre and Rieman 1995*).

Resident westslope cutthroat trout have been observed maturing at ages 3 to 5 years (*Downs et al. 1997*), and all life forms are known to spawn during May and June (*Shepard et al. 1984*). Naturally occurring stream temperature regimes and substrate compositions having low levels

of fine material are closely related to westslope cutthroat trout embryo and juvenile survival (*Pratt 1984*). Spawning typically occurs in water depths of 12.9 cm with substrate size ranging from 6 to 110 mm (*Schmetterling 2000*). Thermal tolerance of westslope cutthroat trout has been reported to be 19.6° C, with optimal juvenile growth occurring at 13.6° C (*Bear et al. 2007*).

RELEVANT AGREEMENTS, LAWS, PLANS, RULES, AND REGULATIONS

Bull trout are currently listed as threatened under the Endangered Species Act (*USFWS 1999*). This project area falls into the Columbia Headwaters Recovery Unit which includes the Swan River drainage. Both bull trout and westslope cutthroat trout are listed as S2 Montana Animals Species of Concern. Species in this classification are considered at risk because of very limited and/or potentially declining populations, range, and/or habitat, making the species vulnerable to global extinction or extirpation in the state (*MTDFWP, Montana Natural Heritage Program, Montana Chapter of the American Fisheries Society*). DNRC has also identified both bull trout and westslope cutthroat trout as sensitive species (*ARM 36.11.436*).

DNRC is a cooperator and signatory on the following agreements:

- Restoration Plan for Bull Trout in the Clark Fork River Basin and Kootenai River Basin, Montana (2000)
- Memorandum of Understanding for the Swan Valley Bull Trout Work Group (2005)
- Memorandum of Understanding for Westslope Cutthroat Trout and Yellowstone Cutthroat Trout in Montana (2007)

All three agreements contain land management conservation strategies or action items utilized by DNRC as decision-making tools.

None of the streams in the fisheries analysis areas are individually identified on the list of *303(d)* impaired streams in Montana (*MTDEQ 2005, MTDEQ 2016*). Swan Lake is identified in the 2016 *303(d)* list. Each of the project area watersheds is a tributary to Swan River, the primary inflow to Swan Lake. The *303(d)* list is compiled by DEQ as required by the Federal Clean Water Act and the EPA Water Quality Planning and Management Regulations (*40 CFR, Part 130*). For further detail, refer to the WATERSHED AND HYDROLOGY ANALYSIS.

All waterbodies in the fisheries analysis areas are classified as B-1 in the Montana Surface Water Quality Standards (*ARM 17.30.608 [b][i]*). The B-1 classification is for multiple beneficial-use waters, including the growth and propagation of cold-water fisheries and associated aquatic life. Among other criteria for B-1 waters, a 1° Fahrenheit (F) maximum increase above naturally occurring water temperature is allowed within the range of 32–66° F (0–18° Celsius [C]), and no increases are allowed above naturally occurring concentrations of sediment or suspended

sediment that will harm or prove detrimental to fish or wildlife. In regard to sediment, naturally occurring includes conditions or materials present from runoff or percolation from developed land where all reasonable land, soil, and water conservation practices have been applied (*ARM 17.30.602 [17]*). Reasonable land, soil, and water conservation practices include methods, measures, or practices that protect present and reasonably anticipated beneficial uses (*ARM 17.30.602 [23]*). The State has adopted Best Management Practices (BMPs) through the Nonpoint Source Management Plan as the principle means of controlling nonpoint source pollution from silvicultural activities (*MTDEQ 2012*).

Fisheries specific forest management ARMs (*36.11.425 and 36.11.427*), the Streamside Management Zone Law and Rules (*MCA 77.5.301–307*), and other site specific prescriptions would be implemented as part of any action alternative.

ISSUES AND MEASUREMENT CRITERIA

Eight detailed concerns and issues regarding fisheries resources were raised through public participation during the scoping process. These concerns and issues are contained in a separate document (*see PROJECT FILE: FISHERIES ISSUE STATEMENTS*). Each detailed concern and issue is identified and followed with a statement describing how the concern and issue will be addressed by this analysis.

The broad issues raised internally and through public comment during the scoping process are that proposed actions may adversely affect fisheries populations and fisheries habitat features, including flow regime (or annual flow characteristics), sediment, channel forms, riparian condition, large woody debris, and stream temperature, in fish bearing streams in the project area. The following brief rationales describe why these issues are important fisheries resource concerns:

- Population: Provides the status and distribution of fish species in the project area
- Flow Regime: Affects species migration, spawning, and embryo survival and is a direct contributor to the function of other features such as; sediment transport, channel form, and stream temperature.
- Sediment: Major habitat feature which can affect fish embryo survival, and the quality and quantity of channel form features.
- Channel Forms: Descriptor of the quantity of various fish habitat types
- Riparian Condition: Primary terrestrial feature affecting channel form and function through incorporation of large woody debris and stream shading which affects water temperature

- Large Woody Debris: Major contributing factor in the quality and quantity of channel form and feature.
- Stream Temperature: Major habitat factor affecting the distribution of a fish assemblage in a waterbody, and subsequently the abundance and survival of fish species in a waterbody.
- Macroinvertebrate richness: Indicator of water quality, nutrients, and stream productivity.
- Connectivity: Describes the potential for fish to migrate within and between available habitats.

Depending on the type and extent of the proposed actions, these issues will (or will not) be addressed separately for each analysis area under the EXISTING ENVIRONMENT AND ENVIRONMENTAL EFFECTS sections.

Issue variables, normal effect mechanisms, potential effects mechanisms and measurement criteria establish the foundation of analysis for each of the broad fisheries issues. Those descriptors are outlined in *TABLE III-41*, for each of the broad fisheries issues. The broad issues include those variables that have potentially measurable or detectable criteria and are expected to support the development of meaningful effects analysis.

For the purposes of this analysis, issue variables are primary factors that contribute to a broad environmental issue. Normal effect mechanisms describe the typical physical or biological processes that determine how issue variables are expressed in the environment. Potential effect mechanisms describe the processes through which the proposed actions may affect normal effect mechanisms and, consequently, issue variables.

FISHERIES RESOURCE ANALYSIS AREAS

In order to evaluate the existing environment and potential environmental effects to fisheries resources within the project area, 9 analysis areas that contain distinct fisheries distributions were identified (*FIGURE III-13*). Seven of the analysis areas include the contributing area watersheds of one or more stream drainages; the Swan River and Cedar Creek analysis areas contains stream reaches, but not contributing area watersheds. The analysis areas were chosen because they include:

- The watershed or reaches of known or potential fish-bearing streams or lakes, and;
- The proposed harvest units and/or associated roads that could have foreseeable measurable or detectable impacts to those fish-bearing streams or lakes.

In certain instances analysis areas are evaluated as one unit, this was done in occasions where fisheries populations or effect mechanisms were similar. The analysis areas of contributing area watersheds are delineated using sixth code HUC scale or smaller watershed boundaries.

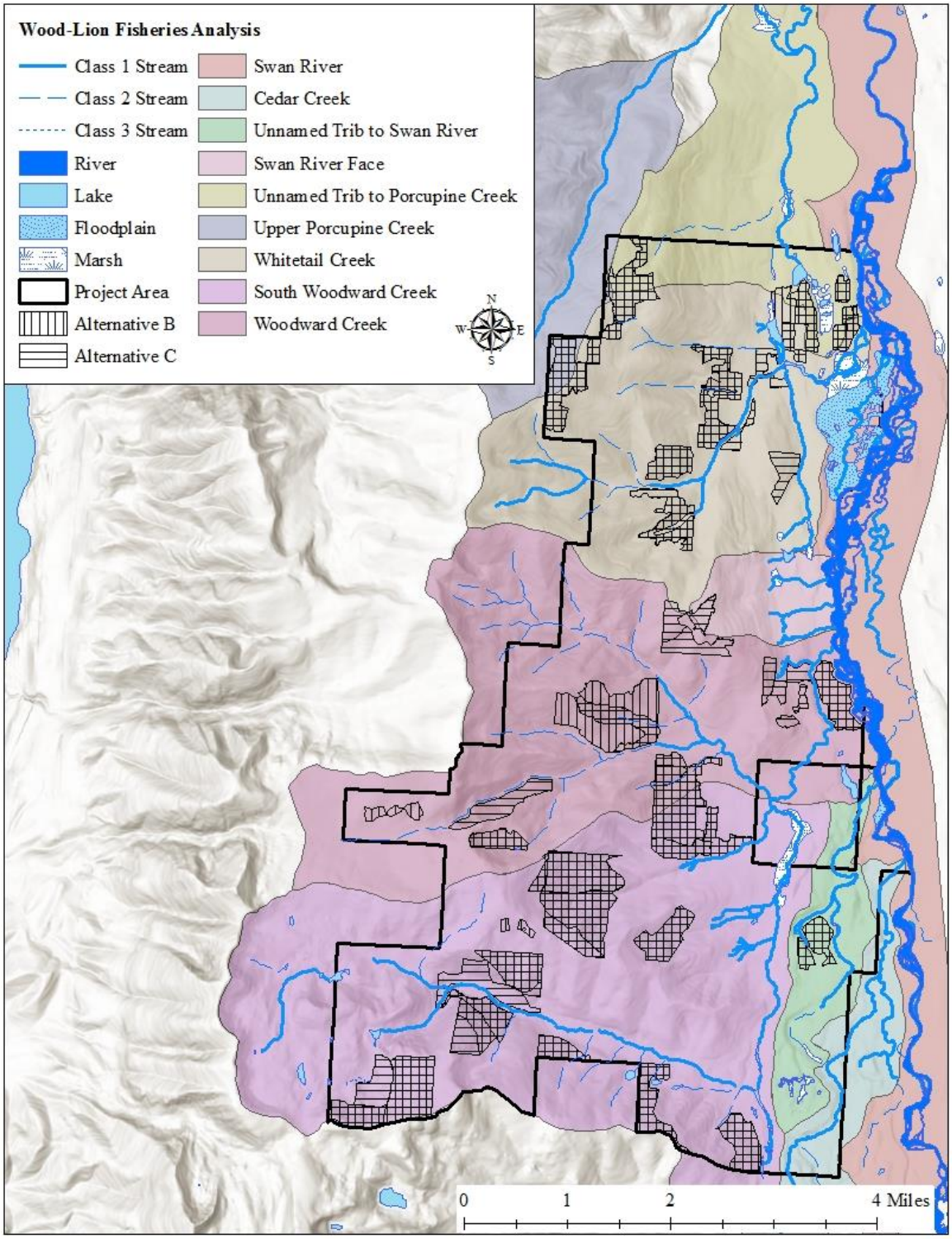
TABLE III-41 –METHODS FOR EVALUATING EXISTING CONDTIONS.

Variable	Normal Effect Mechanism	Potential Effect Mechanism	Measurement Criteria
Species presence or absence	Historic range of native species, range of nonnative species, species status	Species introduction, suppression, or removal	Species presence or absence, species density, and trend
Genetics	Species migration, species isolation	Species introduction, suppression, or removal	Pure genetics, genetic introgression, or hybridization
Gross annual flow volume	Precipitation + equivalent clearcut area (ECA)[1] + watershed area + elevation + climate	Increase in ECA[1]	Annual water yield[2]
Peak seasonal flow volume	Precipitation + equivalent clearcut area (ECA)1 + watershed area + elevation + climate	Increase in ECA1	Peak seasonal flow volume
Peak seasonal flow time	Precipitation + equivalent clearcut area (ECA)1 + watershed area + elevation + climate	Increase in ECA1	Peak seasonal flow time
Peak seasonal flow duration	Precipitation + equivalent clearcut area (ECA)1 + watershed area + elevation + climate	Increase in ECA1	Peak seasonal flow duration
Fine sediment	Flow regime + sediment budget	Sedimentation from 1) road-stream crossing structure, 2) adjacent roads, 3) RMZ disturbance	Percent fine sediment

Embeddedness (*Sylte and Fischenich 2002*)	Flow regime + sediment budget	Sedimentation from 1) road-stream crossing structure, 2) adjacent raods, 3) RMZ disturbance	Substrate score (*Weaver and Fraley 1991 citing others)*
Surface substrate size-class distribution	Flow regime + sediment budget	Sedimentation from 1) road-stream crossing structure, 2) adjacent roads, 3) RMZ disturbance	Relative percent of size classes per Rosgen channel type (*Rosgen 1996*)
Channel type	Flow regime + sediment + LWD + stream gradient + stream confinement	Change in flow regime and/or sediment	*Rosgen* (1996), *Montgomery* and *Buffington* channel types (*Montgomery and Buffington 1997*)
Fast/slow fish habitat frequency	Flow regime + sediment + LWD + stream gradient + stream confinement	Change in flow regime, sediment, and/or LWD (if applicable)	Percent of slow habitats per stream reach
Fast/slow fish habitat volume	Flow regime + sediment + LWD + stream gradient + stream confinement	Change in flow regime, sediment, and/or LWD (if applicable)	Total volume of slow habitats per stream reach
Channel bank stability (*Overton et al 1997 citing others*)	Flow regime + sediment + LWD + stream gradient + stream confinement	Change in flow regime and/or sediment	Percent of stable channel bank per stream reach
Riparian stand characteristics	Precipitation + physiographic location + elevation + soils/geology	RMZ Timber Harvest	Average trees per acre, average quadratic mean diameter, average basal area per acre, average height of site index trees at 100 years
Riparian habitat type (climax)	Precipitation + physiographic location + elevation + soils/geology	RMZ Timber Harvest	Riparian habitat type (climax)

Riparian habitat type (regional functionality)	Precipitation + physiographic location + elevation + soils/geology + wind events	RMZ Timber Harvest	Riparian habitat type (regional functionality)
Rate of riparian tree blowdown	Precipitation + physiographic location + elevation + soils/geology	RMZ Timber Harvest	Average rate of riparian tree blowdown
Stream shading	Precipitation + physiographic location + elevation + soils/geology	RMZ Timber Harvest	Average angular canopy density in July and August
In-stream LWD frequency	Riparian condition	RMZ Timber Harvest	In-stream LWD frequency per 1,000 linear stream feet
In-stream temperature rate of change	Flow regime + channel forms + riparian condition	Change in flow regime, and/or channel forms, RMZ timber harvest	Change in mean weekly maximum temperature per stream reach
DEQ macroinvertebrate indicies (MMI[3], RIVPACS[4])	Flow regime + sediment + riparian condition + nutrients	Change in flow regime and/or sediment, RMZ timber harvest	MMI[3] index, RIVPACS[4] index, DEQ impairment class
Historic macroinvertebrate index (MVFP[5])	Flow regime + sediment + riparian condition + nutrients	Change in flow regime and/or sediment, RMZ timber harvest	MVFP[5] index, MVFP[5] impairment class
Accessible fish habitat (adult fish)	Natural migration barriers, road-stream crossing structure	Road-stream crossing structure installation or removal	Miles of accessible fish habitat (adult fish)
Accessible habitat (juvenile fish)	Natural migration barriers, road-stream crossing structure	Road-stream crossing structure installation or removal	Miles of accessible fish habitat (juvenile fish)

FIGURE III13 –WOOD LION FISHERIES ANALYSIS AREA.



The fisheries analysis areas closely coincide with the analysis areas for the WATERSHED AND HYDROLOGY and SOILS analyses of this document.

ANALYSIS METHODS

The environmental analysis contained in this document will focus primarily on the populations and habitat variables affecting bull trout and westslope cutthroat trout, as these native species are the primary focus of fisheries related comments developed for this project as a result of public and internal scoping. Furthermore, bull trout and westslope cutthroat trout are also the focus of many sensitive species listings and interagency agreements (see RELEVANT AGREEMENTS, LAWS, PLANS, RULES, AND REGULATIONS), which indicates that these species have high intrinsic ecological and social value. The additional nine native species known, or presumed to be in the project area are not listed as endangered, threatened, or sensitive species (*MNHP 2016*). Although each of these species contributes to a properly functioning aquatic ecosystem within the project area, any foreseeable issues or concerns regarding these species' populations or habitat variables can be adequately addressed through an effects analysis for bull trout and westslope cutthroat trout. Eastern brook trout, rainbow trout, lake trout and kokanee are nonnative species, and to a large degree are invasive species which are not an historical component of the regional biodiversity, however, any foreseeable issues or concerns regarding these species populations or habitat variables can also be addressed through an effects analysis of relevant fisheries resources related to bull trout and westslope cutthroat trout.

The existing environment and (if possible) the ranges of existing conditions of bull trout and westslope cutthroat trout populations and habitat variables will be described in the EXISTING ENVIRONMENT section of this analysis. The analysis methods for evaluation of existing conditions are detailed in WOOD-LION FISHERIES ANALYSIS–METHODS FOR EVALUATING ENVIRONMENTAL IMPACTS (ENVIRONMENTAL EFFECTS), which can be found in the project file.

Depending on the type and extent of the proposed actions, issues will (or will not) be carried through the analysis methods in each analysis area. The analysis methods detailed in WOOD-LION FISHERIES ANALYSIS–METHODS FOR EVALUATING EXISTING CONDITIONS (EXISTING ENVIRONMENT) and WOOD-LION FISHERIES ANALYSIS–METHODS FOR EVALUATING ENVIRONMENTAL IMPACTS (ENVIRONMENTAL EFFECTS) include the general methodologies considered for analysis throughout the project area; however, the actual relevance and degree of fisheries resource information that is assessed in each analysis area is a function of the scope and type of the proposed actions in each analysis area.

Throughout the EXISTING ENVIRONMENT AND ENVIRONMENTAL EFFECTS section, the risk of a particular impact to fisheries resources is described. All impacts described in ENVIRONMENTAL EFFECTS are short term (1–5 year duration) unless otherwise noted as long term. Positive impacts to fisheries resources will also be described, if applicable, using information on impact extent and duration.

- Very low impact: Unlikely to be detectable or measurable, and not likely to be detrimental to the resource.
- Low impact: Likely to be detectable or measurable, but not likely to be detrimental to the resource.
- Moderate impact: Likely to be detectable or measurable, and likely to be moderately detrimental to the resource.
- High impact: Likely to be detectable or measurable, and likely to be highly detrimental to the resource.

Cumulative impacts are those collective impacts on the human environment (e.g. fisheries resources) of the proposed action when considered in conjunction with other past, present, and future actions relative to the proposed action by location or generic type (*MCA 75.1.220*). The potential cumulative impacts to fisheries in the analysis areas are determined by assessing the collective anticipated direct and indirect impacts, other related existing actions, and foreseeable future actions affecting the fish-bearing streams.

Existing road density and road stream-crossing density are other variables that have been indirectly correlated to native fish population trends across large regional areas (*Quigley and Arbelbide 1997*). The mechanisms through which road density and road stream-crossing density affect native fish populations include; sedimentation, fishing access, poaching, recreational access, timber harvest access, and grazing and agriculture (*Quigley and Arbelbide 1997, Baxter et al. 1999*). As road density and road stream-crossing density are very broad surrogates of multiple potential actions, these variables are tools to describe potential cumulative effects to fisheries. In the absence of site-specific fisheries data to describe the existing conditions of the project area, road density and road stream-crossing density could be considered simple, viable measures of potential cumulative effects. However, the level of detailed, project-specific fisheries population and habitat data to be utilized throughout a fisheries analysis is expected to provide a much more accurate and precise baseline for the cumulative-effects analysis of fisheries in the project area. Therefore, road density and road stream-crossing density will not be used as a measure of potential cumulative effects in this analysis.

EXISTING ENVIRONMENT AND ENVIRONMENTAL EFFECTS

The existing environment assessment for each analysis area includes: affected fish species, potential actions that may affect fisheries resources, fisheries resources (issues and variables) that may be affected by potential actions, existing conditions of potentially affected fisheries resources, and other existing information needed for the assessment of cumulative effects.

The environmental effects assessment for each analysis area includes: analysis of potential impacts to affected fisheries resources, comparison of potential impacts to existing conditions, and cumulative effects assessment of anticipated collective impacts. The effects assessment for each analysis area will be conducted for all alternatives.

SWAN RIVER AND CEDAR CREEK ANALYSIS AREA

The proposed actions affecting fisheries resources in the Swan River and Cedar Creek Analysis Area include;

- Use of a major haul route for timber and equipment transportation
- Minor road surface maintenance.

The point-source mechanism through which fisheries resources are affected by the proposed actions is sediment delivery to fish habitats at single road-stream crossings of both the Swan River and Cedar Creek (*FIGURE III-14*). For analysis in this document, sediment is the only measureable or detectable fisheries resource variable expected to be potentially affected by the proposed actions.

EXISTING ENVIRONMENT

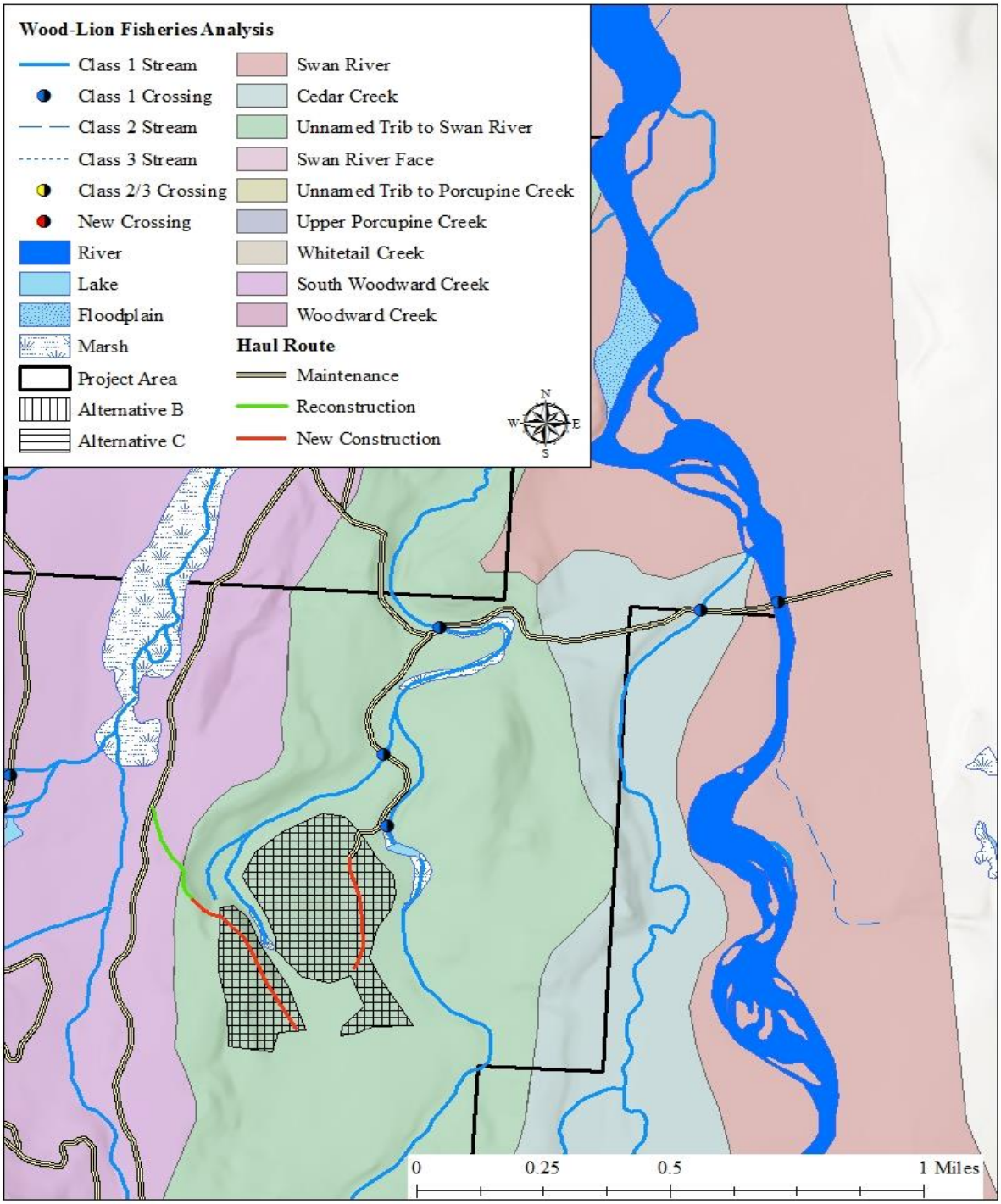
Affected fishes in the Swan River and Cedar Creek Analysis Areas are detailed in *TABLE III-42* (*MFISH 2017*).

Quantitative data of percent fine sediment (McNeil core) or embeddedness (substrate score) are not available for the reach of the Swan River adjacent to the proposed road-stream crossing site. The existing structure is an elevated concrete bridge with concrete abutments. The structure is at low risk of failure during high-flow events. Based on qualitative field surveys, a low impact to sediment is likely occurring in the Swan River, but the existing condition in likely within the range of variability found in the reach.

Quantitative data of percent fine sediment or embeddedness are not available for the reach of Cedar Creek adjacent to the proposed road-stream crossing site. Surface substrate size-class distribution indicates fine sediment (0 to 8 mm) comprises 8 percent of streambed surface substrates (*Koopal 2002a*), which is less than the expected average of 27 percent for the C4

channel type (*Rosgen 1996*). Data from other stream reaches on the Swan River State Forest with similar channel type and valley locations indicate a range of fine sediment from 6 to 100

FIGURE III-14 – SWAN RIVER, CEDAR CREEK, AND UNNAMED TRIBUTARY TO THE SWAN RIVER ANALYSIS AREAS.



percent, with an overall average of 44 percent (*Koopal 2001, Koopal 2002b, Koopal 2002d, Sawtelle 2006*). Cedar Creek is composed of C (67.6% total habitat) and B (32.4% total habitat) channel types. Slow water habitats made up 22.8% of the total volume and 10.7% of the total area in C channel types and 29.8% of the volume and 13.9% of the area in B channel types (*Koopal 2002a*).

Road-stream crossing structures on the Swan River and Cedar Creek are elevated concrete bridges with concrete abutments, which are at a very low risk of failure during high-flow events. A qualitative field survey indicated an existing low risk of sediment delivery at the Swan River bridge, and low risk of sediment delivery at the Cedar Creek bridge. Based on this information, a low impact to sediment is likely occurring in the Swan River and Cedar Creek, but the existing condition is also likely to be within the range of natural variability found in the stream reach.

Other past and present factors affecting the Swan River and Cedar Creek Analysis Area include those actions described under RELEVANT PAST, PRESENT, AND REASONABLY FORESEEABLE FUTURE ACTIONS in CHAPTER 1 – PURPOSE AND NEED. These other factors include adverse impacts on native species by nonnative species, minor riparian harvest, low to moderate levels of upland harvest, timber and equipment hauling by other landowners, and other publicly open road-stream crossing sites. These factors, in conjunction with those site-specific existing conditions assessed above, contribute an existing moderate collective impact to the Swan River and Cedar Creek Analysis Areas.

ENVIRONMENTAL EFFECTS

- ***Direct and Indirect Effects of the No-Action Alternative A on the Swan River and Cedar Creek Analysis Areas***

No Direct or Indirect impacts would occur to the affected fish species or other affected resources beyond those described in *EXISTING ENVIRONMENT.*

- ***Direct and Indirect Effects of Action Alternatives B and C on the Swan River and Cedar Creek Analysis Areas***

No direct or indirect effects to fisheries populations (presence/absence, genetic purity) are expected to occur in this analysis area under either action alternative. Adverse impacts of nonnative species will continue to occur at the same levels as described under *EXISTING ENVIRONMENT*.

TABLE III-42 – AFFECTED FISH SPECIES IN THE WOOD-LION FISHERIES ANALYSIS AREAS.

Species		Analysis Area								
		Swan River	Cedar Creek	Unnamed tributary to Swan River	Swan River Face Drainages	Upper Porcupine Creek	Unnamed tributary to Porcupine Creek	Whitetail Creek	South Woodward Creek	Woodward Creek
Native	Bull Trout	X	X					X	X	X
	Westslope Cutthroat Trout	X	X		X			X	X	X
	Mountain Whitefish	X								X
	Largescale Sucker	X								
	Longnose Sucker	X	X							
	Longnose Dace	X								
	Redside Shiner	X								
	Northern Pikeminnow	X								
	Slimy Sculpin	X								
	Peamouth	X								
	Brook Stickleback	X								
Non-native	Brook Trout	X	X	X	X	X	X	X	X	X
	Rainbow Trout	X	X							X
	Lake Trout	X								
	Kokanee	X								

The erosion of road surfaces and potential delivery of fine sediment to the stream channel are a function of the application of forestry BMPs including, road design, road surface material, maintenance, and traffic. Through the implementation of project specific BMPs and road maintenance, sediment delivery to the Swan River and Cedar Creek is expected to be reduced if either action alternative is selected.

Increased truck traffic can also accelerate the mobilization and erosion of roadbed material at road-stream crossings (*Reid and Dunne 1984, Bilby et al. 1989, Coker et al. 1993, Luce and Black 2001*). The total number of project related crossings at the Swan River and Cedar Creek road-stream crossings are: 5,921 (Alternative B) and 5,740 (Alternative C). The average timber load per truck is 4.5 Mbf (*N. Aschenwald , DNRC, personal communication*), and one support vehicle entering the project area for every 10 log trucks.

Alternatives B and C propose to harvest 24.1 MMbf and 23.4 MMbf respectively. The road-stream crossings on the Swan River and Cedar Creek were designed to route most mobilized sediment away from the waterways and filter eroded material through roadside vegetation, which is expected to reduce the amount of fine sediment delivery resulting from the proposed levels of project related traffic at both sites. Considering a positive impact due to the implementation of project-specific BMPs and road maintenance, but a risk of fine sediment delivery to the Swan River and Cedar Creek from increased project-specific traffic, a net low risk of low impacts to fisheries resources (sediment) is expected.

- ***Cumulative Effects of No-Action Alternative A on the Swan River and Cedar Creek Analysis Areas***

The other related past and present factors and site specific existing conditions described in *Existing Environment* would continue to occur. Other future actions include those under RELEVANT PAST, PRESENT, AND REASONABLY FORESEEABLE FUTURE ACTIONS in CHAPTER 1 – PURPOSE AND NEED and the potential conversion of forest timberlands to residential use; these actions are expected to have a low risk of low impacts to fisheries resources. Considering all of the impacts collectively, a moderate risk of moderate impacts is expected to occur. Although the anticipated moderate cumulative effect is a function of all potential related impacts, the elevated cumulative effects in the analysis area is primarily due to adverse impacts from non-native fish species.

- ***Cumulative Effects of Action Alternatives B and C on the Swan River and Cedar Creek Analysis Areas***

Using the cumulative effects described for the No-Action Alternative A as a baseline, the anticipated level of direct and indirect effects resulting from implementation of either Alternative B or C additional low impacts to fisheries resources are expected. Compared to Alternative A, both action alternatives would result in:

- No impact on: fish species presence/absence, native species genetics, fisheries connectivity
- Low additional risk of impacts to: sediment

The continued presence of several nonnative species in the analysis areas results in a moderate to high cumulative impact to fisheries resources in these analysis areas. These elevated effects will continue to persist if any of the proposed alternatives are selected.

UNNAMED TRIBUTARY TO SWAN RIVER ANALYSIS AREA

The proposed actions affecting fisheries resources in the Unnamed Tributary to Swan River Analysis Area include;

- Use of a major haul route for timber and equipment transportation
- Road-surface maintenance
- Road construction
- Upland harvest

The point-source mechanism through which fisheries resources are affected by the proposed actions is sediment delivery to fish habitats at three road-stream crossings (*FIGURE III-14*). Non-point sources affecting fisheries resources include; modification of flow regime from upland harvest, and sediment delivery from road construction and maintenance. For analysis in this document, flow regime, sediment, and channel form are the only measureable or detectable fisheries resource variable expected to be potentially affected by the proposed actions.

EXISTING ENVIRONMENT

The Unnamed tributary to Swan River is a seasonally intermittent, relatively warm stream. Affected fishes in the Unnamed tributary to the Swan River are detailed in (*TABLE III-42*) (*MFISH 2017*).

Quantitative data of percent fine sediment (McNeil core), and embeddedness (substrate score), or surface substrate size-class distribution are not available for the stream reach adjacent to the existing road-stream crossings. Qualitative assessments of the existing structures indicated that all are low risk of failure during high-flow events. The assessment indicated an existing low risk of sediment delivery to the stream at these crossing sites. Based on this information, a low impact to sediment is likely occurring in the Unnamed Tributary to Swan River, and the existing condition is likely within the historic range of variability for this waterbody.

Other past and present factors affecting the Unnamed Tributary to the Swan River Analysis Area include those actions described under *RELEVANT PAST, PRESENT, AND REASONABLY FORESEEABLE FUTURE ACTIONS* in *CHAPTER 1-PURPOSE AND NEED.* These other factors include nonnative fish species, low levels of upland harvest, and timber and equipment hauling by other landowners. These other factors, in conjunction with those site-specific existing conditions assessed above contribute an existing low to moderate impact on the Unnamed Tributary to the Swan River Analysis Area.

ENVIRONMENTAL EFFECTS

- ***Direct and Indirect Effects of the No-Action Alternative A on the Unnamed tributary to the Swan River Analysis Area***

No Direct or Indirect impacts would occur to the affected fish species or other affected resources beyond those described in *EXISTING ENVIRONMENT.*

- ***Direct and Indirect Effects of Action Alternatives B and C on the Unnamed tributary to the Swan River Analysis Area***

No direct or indirect effects to fisheries populations (presence/absence, genetic purity) are expected to occur in this analysis area under either action alternative. Currently, no native species are known to occupy the streams in this analysis area. Adverse impacts of nonnative species will continue to occur at the same levels as described under

EXISTING ENVIRONMENT

The annual water yield in the analysis area would increase above existing condition under both proposed alternatives. Water yield increase would be higher under Alternative B than Alternative C. Peak seasonal flow volumes may increase over existing conditions, peak flow timing may occur at an earlier date, and the peak flow duration may occur over a longer period of time. Due to the low elevation and low gradient of the stream reach adjacent to and downstream from the proposed harvest unit, alterations to the flow regime are expected to be minimal, however, these alterations may have a detectable effect to fisheries resources including channel form, stream temperature, and nutrients in the Unnamed Tributary to Swan River Analysis Area, and are representative of a moderate risk of low impact to the flow regime.

Increased traffic related to project activities will occur under both action alternatives. This increase may accelerate mobilization and erosion of road surface material at road-stream crossings (*Reid and Dunne 1984, Bilby et al. 1989, Coker et al. 1993, Luce and Black 2001*). The foreseeable number of vehicle passes by project related traffic at 2 minor haul route road-stream crossings are 288 under Alternative B, and 144 under Alternative C. Both structures are low risk of delivery of fines sediments. In addition to the 2 minor haul route crossings, one major haul route road-stream crossing will be utilized for all project related traffic under both action alternatives. This structure is at low risk of contributing fine sediment to the Unnamed Tributary to Swan River. The foreseeable number of vehicle passes by project related traffic at this crossing are 5,886 under Alternative B, and 5,722 under Alternative C. Through implementation of project specific BMPs and road maintenance, the applicable road-stream crossing sites would be expected to deliver most mobilized sediment away from the stream and road surface

and filter eroded material through roadside vegetation. These actions are expected to offset the risk of sedimentation due to project related traffic.

The erosion of forest road surfaces and potential delivery of fine material to stream channels are a function of the application of forestry BMPs including; road design, road traffic, road surface composition, and road maintenance. Through the implementation of project specific BMPs and road maintenance, sediment delivery to Unnamed Tributary to Swan River is expected to be reduced under both alternatives. Under both alternatives, approximately 1,200 feet of new road would be constructed within 300 feet of perennial streams, with an additional 500 feet of road being reconstructed. Due to the implementation of BMPs and road maintenance, although the new road construction occurs relatively close to perennial streams, road surface contribution of fine sediments is expected to present a low risk of low impacts to sediments in this analysis area.

Adjacent to all fish bearing and non-fish bearing class 1 streams, an equipment exclusion zone would be established between 50 feet and 100 feet from the ordinary high water mark. This is expected to reduce potential sediment delivery from ground disturbance related to upland harvest (*Davies and Nelson 1994, Castelle and Johnson 2000, Parker 2005, Rashin et al. 2006, Sweeney and Newbold 2014*). Additionally, 50 foot equipment restriction zones would be established adjacent to all class 2 and 3 streams. Application of the SMZ Law is expected to reduce potential sediment delivery related to ground disturbance associated with upland harvest adjacent to perennial and intermittent streams in the analysis area.

The primary considerations for impacts to sediments in this analysis include; 1) implementation of BMPs and road maintenance, 2) low impacts over both the short- and long-term associated with fine sediment delivery due to project related traffic and new road construction, and 3) delivery of sediments related to upland timber harvest. Based on positive impacts of BMPs and maintenance offsetting a portion of the potential impacts of increased traffic, road construction, and upland harvest, a low risk of low impacts is expected in this analysis area under both action alternatives.

Potential impacts to channel form under both proposed alternatives are primarily a function of long-term alterations to the flow regime in the analysis area and sediment conditions associated with road-stream crossings, road construction, and upland harvest. Based on the factors described from flow regime and sediment above, a low risk of very low impact to channel form is expected in this analysis area.

No riparian harvest is proposed in this analysis area, as such, negligible impacts are anticipated to riparian function, large woody debris, and stream temperature under both action alternatives.

Macroinvertebrate richness may decrease slightly due to potential alterations to the flow regime and sediment (*Herlihy et al. 2005, VanDusen et al. 2005*). Applications of no harvest zones and the SMZ Law in the analysis areas are expected to reduce impacts to macroinvertebrate richness (*Sweeney and Newbold 2014*). Based the anticipated level of impacts on flow regime, sediment, and riparian condition, negligible impacts are anticipated for macroinvertebrate richness in all analysis areas.

No new road-stream crossings are proposed in this analysis area. At this time, all 3 existing road-stream crossing allow passage by at least a portion of adult fish, however, juvenile passage is limited. Due to the presence of brook trout in this stream, alterations or replacement of these structures is a low priority as it would not benefit native fish species.

- ***Cumulative Effects of No-Action Alternative A on the Unnamed tributary to the Swan River Analysis Area***

The other related past and present factors and site-specific existing conditions described in *EXISTING ENVIRONMENT* would continue to occur. Other future, related actions include those described in CHAPTER 1-PURPOSE AND NEED under *RELEVANT PAST, PRESENT, AND REASONABLY FORESEEABLE FUTURE ACTIONS*. These related actions include moderate levels of timber harvest and associated road use on private lands and potential conversion of forest timberlands to residential use; these actions may have low impacts to fisheries resources. Considering all of these impacts collectively, moderate to high cumulative effects is a function of all potentially related impacts, the elevated cumulative impact to fisheries resources in the analysis area is primarily due to nonnative fish species.

- ***Cumulative Effects of Action Alternatives B and C on the Unnamed tributary to the Swan River Analysis Area***

Using the cumulative effects described for the No-Action Alternative A as a baseline, the anticipated level of direct and indirect effects resulting from implementation of either Alternative B or C additional low impacts to fisheries resources are expected. Compared to Alternative A, both action alternatives would result in:

- No impact on: fish species presence/absence, native fish species genetics, fisheries connectivity

- Negligible impacts on: riparian function, large woody debris, stream temperature, and macroinvertebrate richness;
- Low additional risk of impacts to fisheries resources including; flow regime, sediment, and channel form.

Continued presence of several nonnative species in the analysis areas results in a moderate to high cumulative impact to fisheries resources in these analysis areas. These elevated effects will continue to persist if any of the proposed alternatives are selected.

SWAN RIVER FACE DRAINAGES ANALYSIS AREAS

The proposed actions affecting fisheries resources in the Swan River Face Drainages Analysis Area include;

- Use of a major haul route for timber and equipment transportation
- Road-surface maintenance
- Minor upland harvest

The primary point-source mechanism through which fisheries resources are affected by the proposed actions are through sediment delivery at three road-stream crossings (*FIGURE III-15*). The primary nonpoint-source mechanisms through which fisheries resources are affects by the proposed actions are through modifications to the flow regime from upland harvest and sediment delivery from adjacent forest road use and maintenance. For analysis in this EIS, flow regime, sediment, and channel form are the resources expected to be potentially affected by the proposed actions.

EXISTING ENVIRONMENT

Currently all streams in the analysis area are occupied by eastern brook trout. Historically, these streams likely supported populations of westslope cutthroat trout (*TABLE III-42*; *MFISH 2017*).

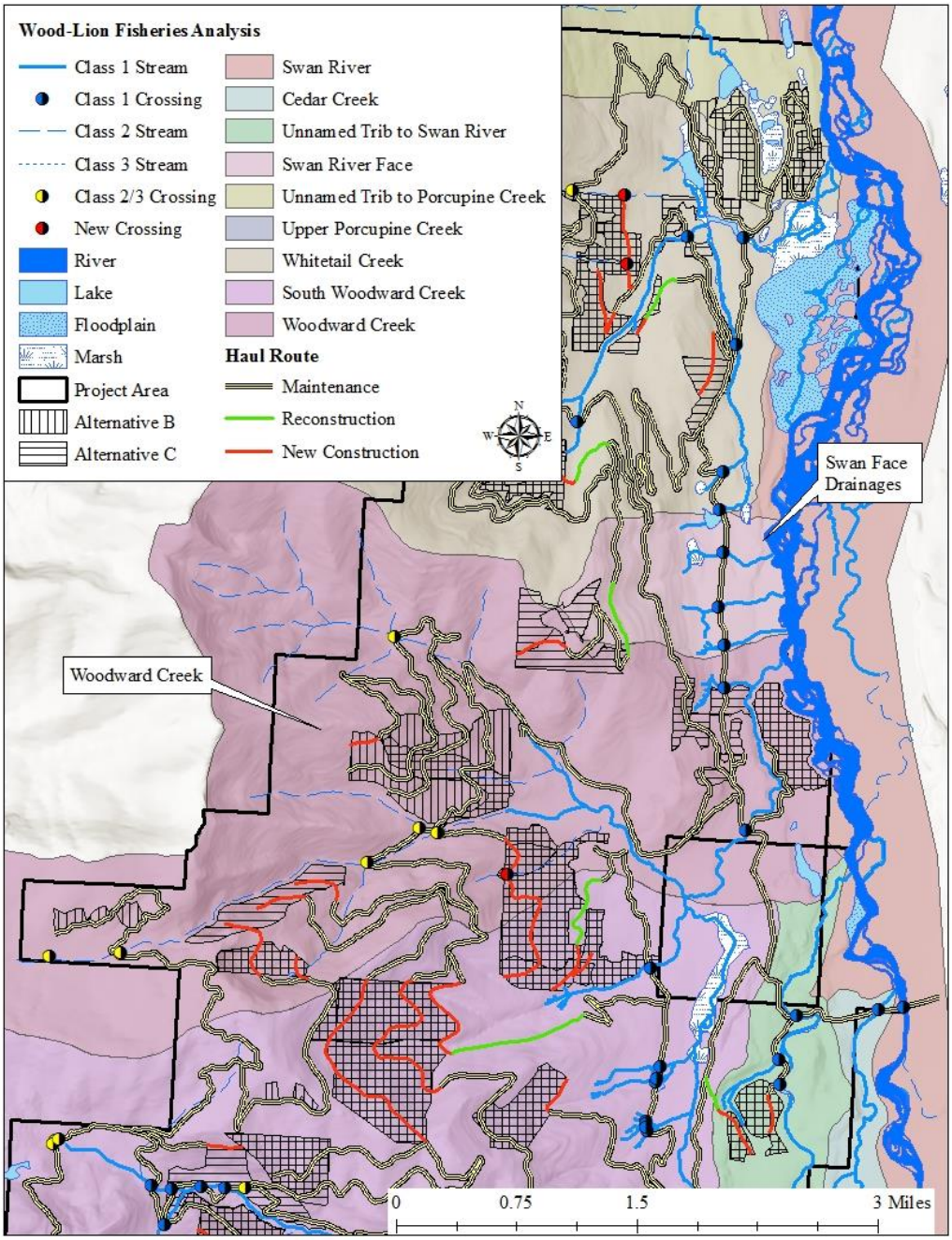
The three streams in the analysis area were characterized in previous environmental assessments (*DNRC 2009*), and exhibit A4, C4/C5, and B4/B5 characteristics from north to south respectively (*Rosgen 1996*). A4 stream types are characterized by gradients from 4-10%, low sinuosity, and gravel substrate. C4/C5 streams are characterized by low gradient (1-2%), moderate to high sinuosity, and gravel/sand substrate. B4/B5 streams are characterized by moderate gradient (2-4%), moderate sinuosity, and gravel/sand substrate. Sediment conditions in these streams are likely within the range of natural conditions for these stream types.

Quantitative data related to percent fine sediment (McNeil core), embeddedness (substrate score), or surface substrate size-class distribution are not available for any of

the road-stream crossings in this analysis unit. The existing road-stream crossings in this unit are all metal culverts, all of which are at low risk of failure during high-flow events. Qualitative assessments of the crossing structures in the *HYDROLOGY ANALYSIS* indicate a low level of fine sediment is delivered to streams in the analysis area from all three crossing sites. Based on these assessments, a low impact to sediment is likely occurring at all crossing sites, however, the existing condition is also likely to be within the natural range of variability for this stream type.

The existing structures at all three road-stream crossings in the analysis area are metal culverts. Qualitative surveys of these structures for the *HYDROLOGY ANALYSIS* indicate a low level of risk of failure under high flow events. Low levels of fine sediment are being delivered to streams at each of the structures. Based on this information, a low impact to sediment is currently occurring in these stream reaches, but is likely within the natural range of variability.

FIGURE III-15 – SWAN RIVER FACE DRAINAGES AND WOODWARD CREEK FISHERIES ANALYSIS UNITS.



ENVIRONMENTAL EFFECTS

- ***Direct and Indirect Effects of the No-Action Alternative A on the Swan River Face Drainages Analysis Areas***

No Direct or Indirect impacts would occur to the affected fish species or other affected resources beyond those described in *EXISTING ENVIRONMENT.*

- ***Direct and Indirect Effects of Action Alternative B on the Swan River Face Drainages Analysis Areas***

No direct or indirect effects to fisheries populations (presence/absence, genetic purity) are expected to occur in this analysis area under Alternative B. Currently, nonnative brook trout are the only species known to occupy streams in the analysis area. Adverse impacts of nonnative species will continue to occur at the same levels as described under *EXISTING ENVIRONMENT*.

The annual water yield in the analysis area would not be altered as a result of upland timber harvest or road construction under Alternative B. Existing departure from natural conditions in annual water yield related to past timber harvest would continue to occur in this analysis area as described under *EXISTING ENVIRONMENT.*

Increased traffic related to project activities will occur under Alternative B. This increase may accelerate mobilization and erosion of road surface material at road-stream crossings (*Reid and Dunne 1984, Bilby et al. 1989, Coker et al. 1993, Luce and Black 2001*). Three road-stream crossing structures will be utilized for timber and equipment hauling in this analysis area. All structures are metal culverts and are at low risk of contributing fine sediments to streams in the analysis area. The foreseeable number of vehicle passes by project related traffic at these 3 road-stream crossings is 3,636 under Alternative B. Through implementation of project specific BMPs and road maintenance, the applicable road-stream crossing sites would be expected to deliver most mobilized sediment away from the stream and road surface and filter eroded material through roadside vegetation. These actions are expected to offset the risk of sedimentation due to project related traffic.

The erosion of forest road surfaces and potential delivery of fine material to stream channels are a function of the application of forestry BMPs including; road design, road traffic, road surface composition, and road maintenance. Through the implementation of project specific BMPs and road maintenance, sediment delivery to any of the streams in the analysis area is expected to be reduced under both alternatives. No new road construction within 300 feet of any perennial or intermittent stream is proposed under Alternative B. Due to the implementation of BMPs and road maintenance, road surface contribution of fine sediments is expected to present a low risk of low impacts to sediments in this analysis area.

The primary considerations for impacts to sediments in this analysis include; 1) implementation of BMPs and road maintenance, and 2) low impacts over both the short- and long-term associated with fine sediment delivery due to project related traffic and new road construction. Based on positive impacts of BMPs and maintenance offsetting a

portion of the potential impacts of increased traffic, road construction, and upland harvest, a moderate risk of low impacts is expected in this analysis area under both action alternatives.

Potential impacts to channel form under both proposed alternatives are primarily a function of long-term alterations to the flow regime in the analysis area and sediment conditions associated with road-stream crossings, road construction, and upland harvest. Based on the factors described from flow regime and sediment above, a low risk of very low impact to channel form is expected in this analysis area.

No riparian harvest is proposed in this analysis area, as such, negligible impacts are anticipated to riparian function, large woody debris, and stream temperature under Alternative B.

Macroinvertebrate richness may decrease slightly due to potential alterations sediment (*Herlihy et al. 2005, VanDusen et al. 2005*). Applications of no harvest zones and the SMZ Law in the analysis areas are expected to reduce impacts to macroinvertebrate richness (Sweeney and Newbold 2014). Based the anticipated level of impacts to sediment and riparian condition, negligible impacts are anticipated for macroinvertebrate richness in this analysis area.

No new road-stream crossings are proposed in this analysis area. At this time 1 existing road-stream crossing is known to block fish passage by all life stages. Passage at the remaining 2 structures is not known at this time. Due to the presence of brook trout in this stream, alterations or replacement of these structures is a low priority as it would not benefit native fish species. In the event that benefits to native species were perceived in replacement of these structures, those actions would be pursued.

- ***Direct and Indirect Effects of Action Alternative C on the Swan River Face Drainages Analysis Areas***

No direct or indirect effects to fisheries populations (presence/absence, genetic purity) are expected to occur in this analysis area under Alternative C. Currently, nonnative brook trout are the only species known to occupy streams in the analysis area. Adverse impacts of nonnative species will continue to occur at the same levels as described under *EXISTING ENVIRONMENT*.

The annual water yield in the analysis area may increase as a result of upland harvest proposed in Alternative C. Anticipated increases are minimal, as the affected portion of the analysis area is approximately 3.5% of the total watershed area. Peak seasonal flow volumes may increase, peak seasonal timing may be altered, and peak seasonal flow

duration may be longer. These departures may have detectable or otherwise measurable effects to fisheries resources in the 3 drainages in the analysis area, due to the magnitude of harvest these effects would likely be low risk of very low impact to flow regime.

Increased traffic related to project activities will occur under Alternative B. This increase may accelerate mobilization and erosion of road surface material at road-stream crossings (*Reid and Dunne 1984, Bilby et al. 1989, Coker et al. 1993, Luce and Black 2001*). Three road-stream crossing structures will be utilized for timber and equipment hauling in this analysis area. All structures are metal culverts and are at low risk of contributing fine sediments to streams in the analysis area. The foreseeable number of vehicle passes by project related traffic at these 3 road-stream crossings is 3,110 under Alternative C. Through implementation of project specific BMPs and road maintenance, the applicable road-stream crossing sites would be expected to deliver most mobilized sediment away from the stream and road surface and filter eroded material through roadside vegetation. These actions are expected to offset the risk of sedimentation due to project related traffic.

The erosion of forest road surfaces and potential delivery of fine material to stream channels are a function of the application of forestry BMPs including; road design, road traffic, road surface composition, and road maintenance. Through the implementation of project specific BMPs and road maintenance, sediment delivery to any of the streams in the analysis area is expected to be reduced under both alternatives. No new road construction within 300 feet of any perennial or intermittent stream is proposed under Alternative C. Due to the implementation of BMPs and road maintenance, road surface contribution of fine sediments is expected to present a low risk of low impacts to sediments in this analysis area.

Adjacent to all fish bearing and non-fish bearing class 1 streams, an equipment exclusion zone would be established between 50 feet and 100 feet from the ordinary high water mark. This is expected to reduce potential sediment delivery from ground disturbance related to upland harvest (*Davies and Nelson 1994, Castelle and Johnson 2000, Parker 2005, Rashin et al. 2006*). Additionally, 50 foot equipment restriction zones would be established adjacent to all class 2 and 3 streams. Application of the SMZ Law is expected to reduce potential sediment delivery related to ground disturbance associated with upland harvest adjacent to perennial and intermittent streams in the analysis area.

The primary considerations for impacts to sediments in this analysis include; 1) implementation of BMPs and road maintenance, 2) low impacts over both the short- and long-term associated with fine sediment delivery due to project related traffic and new

road construction, and 3) limited upland harvest. Based on positive impacts of BMPs and maintenance offsetting a portion of the potential impacts of increased traffic, road construction, and upland harvest, a moderate risk of low impacts is expected in this analysis area under both action alternatives.

Potential impacts to channel form under both proposed alternatives are primarily a function of long-term alterations to the flow regime in the analysis area and sediment conditions associated with road-stream crossings, road construction, and upland harvest. Based on the factors described from flow regime and sediment above, a low risk of very low impact to channel form is expected in this analysis area.

No riparian harvest is proposed in this analysis area, as such, negligible impacts are anticipated to riparian function, large woody debris, and stream temperature under Alternative C.

Macroinvertebrate richness may decrease slightly due to potential alterations to flow regime and sediment (*Herlihy et al. 2005, VanDusen et al. 2005*). Applications of no harvest zones and the SMZ Law in the analysis areas are expected to reduce impacts to macroinvertebrate richness (*Sweeney and Newbold 2014)*. Based the anticipated level of impacts to flow regime, sediment, and riparian condition, negligible impacts are anticipated for macroinvertebrate richness in this analysis areas.

No new road-stream crossings are proposed in this analysis area. At this time 1 existing road-stream crossing is known to block fish passage by all life stages. Passage at the remaining 2 structures is not known at this time. Due to the presence of brook trout in this stream, alterations or replacement of these structures is a low priority as it would not benefit native fish species. In the event that benefits to native species were perceived in replacement of these structures, those actions would be pursued.

- ***Cumulative Effects of No-Action Alternative A on the Swan River Face Drainages Analysis Areas***

The other related past and present factors and site-specific existing conditions described in *EXISTING ENVIRONMENT* would continue to occur. Other future, related actions include those described in *CHAPTER 1-PURPOSE AND NEED* under *RELEVANT PAST, PRESENT, AND REASONABLY FORESEEABLE FUTURE ACTIONS*. These related actions include moderate levels of timber harvest and associated road use on private lands and potential conversion of forest timberlands to residential use; these actions may have low impacts to fisheries resources. Considering all of these impacts collectively, moderate to high cumulative effects is a function of all potentially related impacts, the

elevated cumulative impact to fisheries resources in the analysis area is primarily due to nonnative fish species.

- ***Cumulative Effects of Action Alternatives B and C on the Swan River Face Drainages Analysis Areas***

Using the cumulative effects described for the No-Action Alternative A as a baseline, the anticipated level of direct and indirect effects resulting from implementation of either Alternative B or C additional low impacts to fisheries resources are expected. Compared to Alternative A, both action alternatives would result in:

- No impact on: fish species presence/absence, native species genetics, fisheries connectivity
- Negligible impacts on: riparian function, large woody debris, stream temperature, and macroinvertebrate richness;
- Low additional risk of impacts to fisheries resources including; flow regime, sediment, and channel form.

Consequently, the continued presence of several nonnative species in the analysis areas results in a moderate to high cumulative impact to fisheries resources in these analysis areas. These elevated effects will continue to persist if any of the proposed alternatives are selected.

UNNAMED TRIBUTARY TO PORCUPINE CREEK ANALYSIS AREA

The proposed actions affecting fisheries resources in the Unnamed Tributary to Porcupine Creek Analysis Area include;

- Use of a secondary haul route for timber and equipment transportation
- Road-surface maintenance
- Upland harvest
- Riparian harvest

No point source mechanisms which would affect fisheries resources in this analysis area. Nonpoint source mechanisms which may affect fisheries resources in this analysis area are altered flow regime from upland harvest and sediment delivery from adjacent forest road use and maintenance (*FIGURE III-15*). For analysis in this EIS, flow regime, and sediment are the resources expected to be potentially affected by the proposed actions.

EXISTING ENVIRONMENT

Affected fishes in the Unnamed Tributary to Porcupine Creek Analysis Area are detailed in *TABLE III-42* (*MFISH 2017*). The presence of eastern brook trout in this analysis area is inferred from DFWP surveys in Porcupine and Gildart creeks, both of which are over

30 years old (*MFISH 2017*). The fish population in this analysis area has not been confirmed by DNRC personnel.

Quantitative analysis of hydrologic conditions in this analysis area was not completed. Based on previous analysis (*DNRC 2009*), this analysis area likely has an increase in water yield above naturally occurring condition by 6-8%, which is primarily a result of past forest-crown removal from timber harvesting. The variables of existing peak seasonal flow volume, time, and duration are expected to be within the range of natural variability.

Quantitative assessment of percent fine sediment (McNeil core), embeddedness (substrate score), or surface substrate size class distribution are not available for this analysis area. The perennial stream reach in the analysis area begins approximately 800 feet downslope from harvest unit 24-04. The shortest distance between a perennial stream and a road used as a part of the project is greater than 1,500 feet, while the distance between intermittent streams and project roads is greater than 300 feet. Based on this information, impacts to sediment in this analysis area are negligible to low.

Based on the assessment of existing conditions, low existing impacts to flow regime may occur. Other past and present factors affecting the Unnamed Tributary to Porcupine Creek Analysis Area include those actions described under *RELEVANT PAST, PRESENT, AND REASONABLY FORESEEABLE FUTURE ACTIONS* in *CHAPTER 1- PURPOSE AND NEED.* These factors include adverse impacts from nonnative fish species, low levels of riparian harvest, moderate levels of upland harvest, and timber and equipment hauling by other landowners. These factors, in conjunction with those site-specific existing conditions assessed above contribute to an existing low collective impact to the Unnamed Tributary to Porcupine Creek Analysis Area.

ENVIRONMENTAL EFFECTS

- ***Direct and Indirect Effects of the No-Action Alternative A on the Unnamed Tributary to Porcupine Creek Analysis Area***

No Direct or Indirect impacts would occur to the affected fish species or other affected resources beyond those described in *EXISTING ENVIRONMENT.*

- ***Direct and Indirect Effects of Action Alternatives B and C on the Unnamed Tributary to Porcupine Creek Analysis Area***

No direct or indirect effects to fisheries populations (presence/absence, genetic purity) are expected to occur in this analysis area under either action alternative. Currently, no native species are known to occupy the streams in this analysis area. Adverse impacts of

nonnative species will continue to occur at the same levels as described under *EXISTING ENVIRONMENT*.

The annual water yield in the analysis area would increase above existing condition under both proposed alternatives. Water yield increase may be slightly higher under Alternative B than Alternative C. The total harvest area under Alternatives B and C are similar, 5.8% and 5.3% of the watershed area respectively. Peak seasonal flow volumes may increase over existing conditions, peak flow timing may occur at an earlier date, and the peak flow duration may occur over a longer period of time. Alterations to the flow regime may have a detectable effect to fisheries resources including channel form, stream temperature, and nutrients in the analysis area, and are representative of a moderate risk of low impact to the flow regime.

No road-stream crossings will be utilized on any perennial or intermittent streams under either proposed alternative in this analysis area.

No new road construction or reconstruction of existing road would occur under the proposed alternatives. Due to the implementation of BMPs, road maintenance, and filtration of any road surface runoff through greater than 300 feet of vegetation, road surface contribution of fine sediments is expected to be a negligible impact to sediments in this analysis area.

Adjacent to all fish bearing and non-fish bearing class 1 streams, an equipment exclusion zone would be established between 50 feet from the ordinary high water mark. This is expected to reduce potential sediment delivery from ground disturbance related to upland harvest (*Davies and Nelson 1994, Castelle and Johnson 2000, Parker 2005, Rashin et al. 2006*). Additionally, 50 foot equipment restriction zones would be established adjacent to all class 2 and 3 streams. Application of the SMZ Law is expected to reduce potential sediment delivery related to ground disturbance associated with upland harvest adjacent to perennial and intermittent streams in the analysis area.

Riparian harvest is proposed under Alternative B (6 acres) and Alternative C (5 acres). Harvest areas account for 2.0% and 1.7% of the total riparian zone in this analysis area respectively. Harvest would only occur between the 50 foot no harvest zone and the boundary of the riparian management zone which occurs 120 feet away from any waterbody. Application of the 50 foot no harvest zone is expected to minimize effects of riparian harvest to sediments, riparian condition, large woody debris and stream temperature. The proposed level of harvest is anticipated to have low risk of low impacts to riparian condition in these analysis areas.

The primary considerations for impacts to sediments in this analysis include; 1) implementation of BMPs and road maintenance, 2) delivery of sediments related to upland timber harvest, and 3) delivery of sediment from riparian harvest. Based on positive impacts of BMPs and maintenance offsetting a portion of the potential impacts of increased traffic and upland harvest, low risk of low impacts to sediment is expected in this analysis area under both action alternatives.

Potential impacts to channel form under both proposed alternatives are primarily a function of long-term alterations to the flow regime in the analysis area and sediment conditions associated with upland harvest. Based on the factors described from flow regime and sediment above, a low risk of very low impact to channel form is expected in this analysis area.

Macroinvertebrate richness may decrease slightly due to potential alterations to the flow regime and sediment (*Herlihy et al. 2005, VanDusen et al. 2005*). Applications of no harvest zones and the SMZ Law in the analysis areas are expected to reduce impacts to macroinvertebrate richness (*Sweeney and Newbold 2014*). Based the anticipated level of impacts on flow regime, sediment, and riparian condition, negligible impacts are anticipated for macroinvertebrate richness in all analysis areas.

No new road-stream crossings are proposed in this analysis area. No impacts to stream connectivity are associated with either proposed alternative.

- ***Cumulative Effects of No-Action Alternative A on the Unnamed Tributary to Porcupine Creek Analysis Area***

The other related past and present factors and site-specific existing conditions described in *EXISTING ENVIRONMENT* would continue to occur. Other future, related actions include those described in CHAPTER 1-PURPOSE AND NEED under *RELEVANT PAST, PRESENT, AND REASONABLY FORESEEABLE FUTURE ACTIONS*. These related actions include moderate levels of timber harvest and associated road use on private lands and potential conversion of forest timberlands to residential use; these actions may have low impacts to fisheries resources. Considering all of these impacts collectively, moderate to high cumulative effects is a function of all potentially related impacts, the elevated cumulative impact to fisheries resources in the analysis area is primarily due to nonnative fish species.

- ***Cumulative Effects of Action Alternatives B and C on the Unnamed Tributary to Porcupine Creek Analysis Area***

Using the cumulative effects described for the No-Action Alternative A as a baseline, the anticipated level of direct and indirect effects resulting from implementation of either

Alternative B or C additional low impacts to fisheries resources are expected. Compared to Alternative A, both action alternatives would result in:

- No impact on: fish species presence/absence, native species genetics, fisheries connectivity
- Low additional risk of impacts to fisheries resources including; flow regime, sediment, channel form, riparian condition, large woody debris, stream temperature, and macroinvertebrate richness

Continued presence of several nonnative species in the analysis areas results in a moderate to high cumulative impact to fisheries resources in these analysis areas. These elevated effects will continue to persist if any of the proposed alternatives are selected.

UPPER PORCUPINE CREEK ANALYSIS AREA

The proposed actions affecting fisheries resources in the Upper Porcupine Creek Analysis Area include;

- Use of a minor haul road for timber and equipment transportation
- Road construction
- Upland harvest

No point source mechanisms which would affect fisheries resources in this analysis area. Nonpoint source mechanisms which may affect fisheries resources in this analysis area are altered flow regime from upland harvest and sediment delivery from adjacent forest road construction, use, and maintenance (*FIGURE III-15*).

EXISTING ENVIRONMENT

Affected fishes in the Upper Porcupine Creek Analysis Areas are detailed in *TABLE III-42* (*MFISH 2017*). The presence of eastern brook trout in this analysis area is inferred from DFWP surveys in Porcupine and Gildart creeks, both of which are over 30 years old (*MFISH 2017*). The fish population in this analysis area has not been confirmed by DNRC personnel.

No perennial or intermittent streams are found near the proposed harvest units for in this project area. Consequently, quantitative analysis of existing hydrologic conditions in this analysis area was not completed.

Quantitative measures of fine sediment (McNeil core), embeddedness (substrate score), and surface substrate size-class distribution are not available for this analysis area.

ENVIRONMENTAL EFFECTS

- ***Direct and Indirect Effects of the No-Action Alternative A on the Upper Porcupine Creek Analysis Areas***

No direct or indirect impacts would occur to the affected fish species or other affected resources beyond those described in *EXISTING ENVIRONMENT.*

- ***Direct and Indirect Effects of Action Alternatives B and C on the Upper Porcupine Creek Analysis Areas***

No direct or indirect effects to fisheries populations (presence/absence, genetic purity) are expected to occur in this analysis area under either action alternative. Currently, no native species are known to occupy streams in this analysis area. Adverse impacts of nonnative species will continue to occur at the same levels as described under *EXISTING ENVIRONMENT*.

The annual water yield in the analysis area would increase above existing condition under both proposed alternatives. The total harvest area under Alternatives B and C is 2.1% of the watershed area. Peak seasonal flow volumes may increase over existing conditions, peak flow timing may occur at an earlier date, and the peak flow duration may occur over a longer period of time. Alterations to the flow regime may have a detectable effect to fisheries resources including channel form, stream temperature, and nutrients in the analysis area, and are representative of a low risk of very low impact to the flow regime.

No road-stream crossings will be utilized on any perennial or intermittent streams under either proposed alternative in this analysis area.

No new road construction or reconstruction of existing road would occur under the proposed alternatives. Due to the implementation of BMPs, road maintenance, and filtration of any road surface runoff through greater than 300 feet of vegetation, road surface contribution of fine sediments is expected to be a negligible impact to sediments in this analysis area.

The primary considerations for impacts to sediments in this analysis include; 1) implementation of BMPs and road maintenance, and 2) delivery of sediments related to upland timber harvest. Based on positive impacts of BMPs and maintenance offsetting a portion of the potential impacts of increased traffic and upland harvest, a low risk of very low impacts to sediment is expected in this analysis area under both action alternatives.

Potential impacts to channel form under both proposed alternatives are primarily a function of long-term alterations to the flow regime in the analysis area and sediment

conditions associated with upland harvest. Based on the factors described from flow regime and sediment above, a low risk of very low impact to channel form is expected in this analysis area.

No riparian harvest is proposed in this analysis area, as such, negligible impacts are anticipated to riparian function, large woody debris, and stream temperature under both action alternatives.

Macroinvertebrate richness may decrease slightly due to potential alterations to the flow regime and sediment (*Herlihy et al. 2005, VanDusen et al. 2005*). Applications of no harvest zones and the SMZ Law in the analysis areas are expected to reduce impacts to macroinvertebrate richness (*Sweeney and Newbold 2014*). Based the anticipated level of impacts on flow regime, sediment, and riparian condition, negligible impacts are anticipated for macroinvertebrate richness in all analysis areas.

No new road-stream crossings are proposed in this analysis area. No impacts to stream connectivity are associated with either proposed alternative.

- ***Cumulative Effects of No-Action Alternative A on the Upper Porcupine Creek Analysis Areas***

The other related past and present factors and site-specific existing conditions described in *EXISTING ENVIRONMENT* would continue to occur. Other future, related actions include those described in CHAPTER 1-PURPOSE AND NEED under *RELEVANT PAST, PRESENT, AND REASONABLY FORESEEABLE FUTURE ACTIONS*. These related actions include moderate levels of timber harvest and associated road use on private lands and potential conversion of forest timberlands to residential use; these actions may have low impacts to fisheries resources. Considering all of these impacts collectively, moderate to high cumulative effects is a function of all potentially related impacts, the elevated cumulative impact to fisheries resources in the analysis area is primarily due to nonnative fish species.

- ***Cumulative Effects of Action Alternatives B and C on the Upper Porcupine Creek Analysis Areas***

Using the cumulative effects described for the No-Action Alternative A as a baseline, the anticipated level of direct and indirect effects resulting from implementation of either Alternative B or C additional very low impacts to fisheries resources are expected. Compared to Alternative A, both action alternatives would result in:

- No impact on: fish species presence/absence, native species genetics, fisheries connectivity

- Negligible impacts on: riparian function, large woody debris, stream temperature, and macroinvertebrate richness;
- Very low additional risk of impacts to fisheries resources including; flow regime, sediment, and channel form.

Consequently, the continued presence of several nonnative species in the analysis areas results in a moderate to high cumulative impact to fisheries resources in these analysis areas. These elevated effects will continue to persist if any of the proposed alternatives are selected.

WHITETAIL CREEK

The proposed actions affecting fisheries resources in the Whitetail Creek Analysis Area include;

- Use of a major haul route for timber and equipment transportation
- Road-surface maintenance
- Road construction
- Upland harvest
- Riparian harvest

The primary point-source mechanism through which fisheries resources are affected by the proposed actions is through sediment delivery at 7 existing road-stream crossings of perennial stream reaches, and 7 road-stream crossings on intermittent stream reaches (*FIGURE III-15*). The primary non-point source mechanisms through which fisheries resources may be affected by the proposed actions include: 1) modification of the flow regime due to upland harvest, 2) increased sediment from road construction, road maintenance, and timber hauling, 3) increased stream temperature resulting from upland harvest and associated changes to the flow regime, and 4) riparian harvest. For analysis in this EIS, flow regime, sediment, channel form, and stream temperature are the measureable or detectable fisheries resources expected to be potentially affected by the proposed actions.

EXISTING ENVIRONMENT

Affected fishes in the Whitetail Creek Analysis Area are detailed in *TABLE III-42* (*MFISH 2017*). Whitetail Creek currently supports a population of pure westslope cutthroat trout upstream of one artificial barrier and one natural barrier. The artificial barrier is an elevated culvert, which flows on to a concrete splash pad to maintain shallow, high velocity laminar flow preventing upstream fish movement. The structure was constructed due to concerns with the integrity of the natural barrier approximately 800 feet upstream which is a debris jam of unknown stability. There is a small

population of brook trout between the two barriers which have been the focus of ongoing mechanical removal to minimize potential migration into the reach upstream of the natural barrier should it fail. The population of westslope cutthroat upstream from the natural barrier is very small, estimated at 140-150 fish occupying approximately 0.5 miles of stream. Currently, the largest threat to native species in the analysis area is primarily caused by the presence and increasing distribution and abundance of nonnative species. The mechanisms by which westslope cutthroat trout are impacted by nonnative species include hybridization with rainbow trout, competition for resources during all life stages with rainbow and brook trout, and predation on all life stages by brook trout. Downstream from the artificial barrier, Whitetail Creek likely historically supported populations of westslope cutthroat, bull trout, and sculpin. Brook trout have displaced these species downstream of the artificial fish barrier. Due to displacement of native fish species in the analysis area by brook trout, the impact to native species population presence is high.

The analysis of hydrologic data for Whitetail Creek indicates that the existing average departure in water yield is approximately 9.2% above the range of naturally occurring conditions (see *HYDROLOGY ANALYSIS*), which is primarily a result of past forest-crown removal from timber harvesting. The variables of existing peak seasonal flow volume, flow time, and flow duration are expected to be within the range of natural variability. .

McNeil core samples were also collected in Whitetail Creek from 2006-2010 to monitor spawning conditions for westslope cutthroat trout. During that time period the percent fine sediment was relatively stable and in the low to moderate risk range for westslope cutthroat spawning (36.1%; range = 34.1◎38.1%). Stream habitat types in Whitetail Creek are composed of B (57.5% total habitat) and C (42.5% total habitat) channel types (*Sawtelle 2006*). Slow water habitat features made up 23.4% of the volume and 15.1% of the area in B channel types and 93.0% of the volume and 84.1% of the area in C channel types in the surveyed reaches. Large woody debris counts in Whitetail Creek found an average of 123.2 and 58.7 pieces/1,000 feet of stream in B and C channel types respectively (*Sawtelle 2006*). Assessment of streambank stability found over 99% to be in stable condtion (*Overton et al. 1997, Sawtelle 2006*). Channel form characteristics are within the range of other observations in undisturbed stream reaches in the Swan State Forest.

Stream temperature is a function of flow regime, channel form, and riparian condition (*Poff et al. 1997*). Alterations to flow regime (*Haupt 1976*), channel form, and riparian condition (*Naiman and Decamps 1997, Sweeney and Newbold 2014*) may occur as a result of

upland and riparian timber harvest, ultimately impacting stream temperature. Streams in the project area are typically groundwater dominated systems with moderated high flow periods associated with snowmelt and episodic precipitation events. Critical periods for westslope cutthroat trout ecology related to stream temperature include juvenile rearing and overall survival. Stream temperature data are presented for Whitetail Creek from 2007-2009. Optimal growth temperature and thermal tolerance for westslope cutthroat trout in Whitetail Creek was compared to the mean weekly average temperature and the mean weekly maximum temperature, respectively. These metrics are calculated as the running mean of three days prior to, and three days following an observed mean or maximum temperature. The warmest maximum temperature observed in Whitetail Creek during the period of deployment was 10.2°C in 2009 (*FIGURE III-16*). Average temperatures did not exceed 9.2°C during the period of deployment, and were significantly lower than westslope cutthroat trout optimal growth temperature (*FIGURE III-16*). Stream temperatures observed in Whitetail Creek are within the expected range of variability for streams in the Swan River drainage.

The existing road-stream crossing structures at the 7 locations in the Whitetail Creek Analysis Area include 3 bridges and 4 culverts. Two of the bridges are at low risk of failure under high flow events, the remaining structure is at moderate risk of contributing fine sediments to Whitetail Creek. Two of the metal culverts are at low risk of failure during high flow events, one of the culverts is the fish barrier on Whitetail Creek, which is a velocity and leap barrier preventing brook trout movement upstream. The remaining 2 metal culverts are at moderate risk of failure under high flow events. Based on this information a moderate impact to sediment is likely occurring in Whitetail Creek, but the existing condition is likely to be within the expected range of variability found in the stream. Current sediment delivery from the road system in Whitetail Creek is 2.24 tons per year (see *HYDROLOGY ANALYSIS*).

ENVIRONMENTAL EFFECTS

- ***Direct and Indirect Effects of the No-Action Alternative A on the Whitetail Creek Analysis Areas***

No direct or indirect impacts would occur to the affected fish species or other affected resources beyond those described in *EXISTING ENVIRONMENT.*

- ***Direct and Indirect Effects of Action Alternative B on the Whitetail Creek Analysis Areas***

No direct or indirect effects to fisheries populations (presence/absence, genetic purity) are expected to occur in this analysis area as a result of proposed actions in Alternative

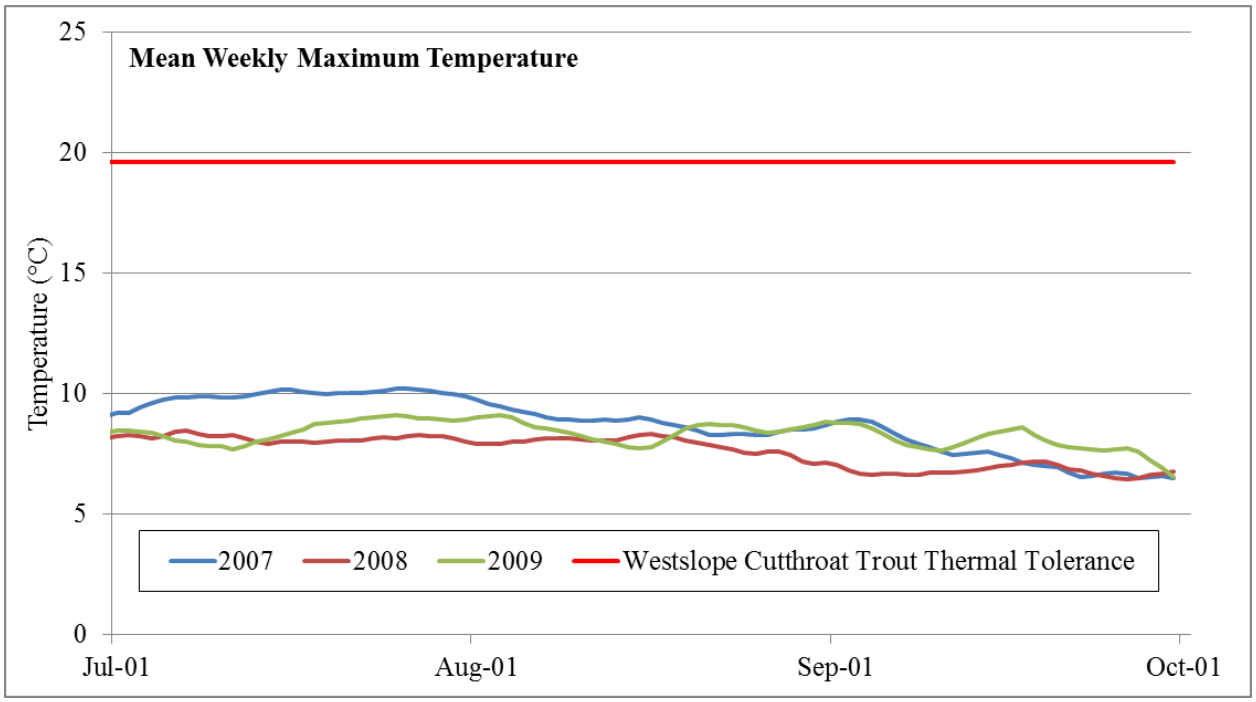
B. Adverse impacts of nonnative species will continue to occur at the same levels as described under *EXISTING ENVIRONMENT*.

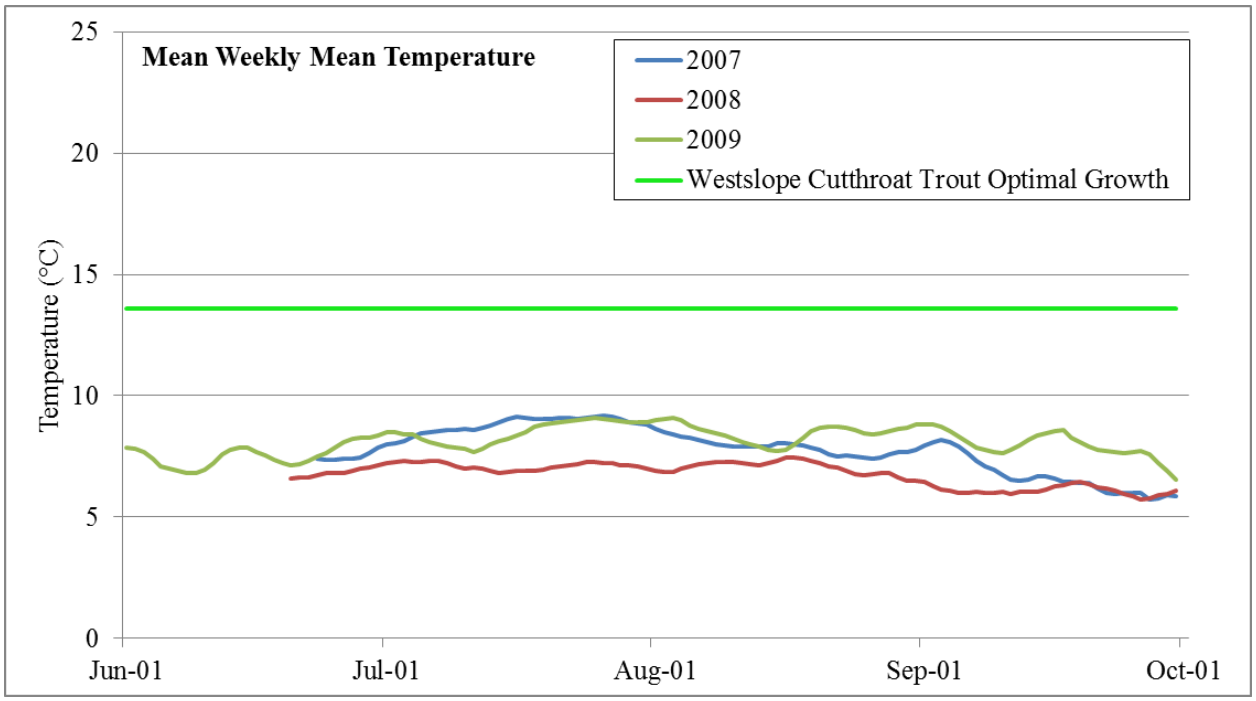
The annual water yield in the analysis area would increase above existing condition under Alternative B. The expected increase in water yield is 2.8% above the existing condition, which would result in a cumulative water yield of 12.0%. Peak seasonal flow volumes may increase over existing conditions, peak flow timing may occur at an earlier date, and the peak flow duration may occur over a longer period of time. These alterations to flow regime and timing may have a detectable effect to fisheries resources including channel form, stream temperature, and nutrients in the Whitetail Creek Analysis Area, and are representative of a moderate risk of low impacts to the flow regime.

Increased traffic related to project activities will occur under both action alternatives. This increase may accelerate mobilization and erosion of road surface material at road-stream crossings (*Reid and Dunne 1984, Bilby et al. 1989, Coker et al. 1993, Luce and Black 2001*). Road-stream crossings associated with the proposed actions in Alternative B include 7 road-stream crossings on class 1 streams, including 3 bridges and 4 metal culverts. Four of the structures are at low risk of fine sediment delivery to class 1 streams in the analysis area, and 3 of the structures are at moderate risk of fine sediment delivery. The foreseeable number of vehicle passes by project related traffic at class 1 stream crossings is 4,686. Additionally, 7 road-stream crossings on class 2 streams will be used as a part of this alternative. All crossing structures are metal culverts, 5 are at low risk of fine sediment delivery, and 2 structures are at moderate risk of fine sediment delivery to class 2 streams in the analysis area. Two new road-stream crossings would be installed on class 2 streams in the analysis area. The foreseeable number of vehicle passes by project related traffic at these crossings is 4,045 under Alternative B. Under Alternative B a total of 8,731 passes will be made at road-stream crossings on class 1 and class 2 streams. Through implementation of project specific BMPs and road maintenance, the applicable road-stream crossing sites would be expected to deliver most mobilized sediment away from the stream and road surface and filter eroded material through roadside vegetation. These actions are expected to offset the risk of sedimentation due to project related traffic.

The erosion of forest road surfaces and potential delivery of fine material to stream channels are a function of the application of forestry BMPs including; road design, road traffic, road surface composition, and road maintenance. Through the implementation of project specific BMPs and road maintenance, sediment delivery to streams in the Whitetail Creek Analysis Area is expected to be reduced under both this alternative.

FIGURE III-16: MEAN WEEKLY MAXIMUM AND AVERAGE STREAM TEMPERATURE (°C) OBSERVED IN WHITETAIL CREEK BETWEEN JULY 1 AND SEPTEMBER 30. *Constant green line reflects the optimal growth rate temperature for Westslope Cutthroat Trout as identified in laboratory studies.*





Approximately 1,500 feet of new road would be constructed within 300 feet of class 1 and class 2 streams in the analysis area. Implementation of BMPs and erosion control work would reduce estimated sediment loads to Whitetail Creek by 0.86 tons of sediment per year (see *HYDROLOGY ANALYSIS*). Due to the implementation of BMPs and road maintenance, although the new road construction occurs relatively close to perennial streams, road surface contribution of fine sediments is expected to present a low risk of low impacts to sediments in this analysis area.

Adjacent to all fish bearing and non-fish bearing class 1 streams, an equipment exclusion zone would be established between 50 feet and 120 feet from the ordinary high water mark. This is expected to reduce potential sediment delivery from ground disturbance related to upland harvest (*Davies and Nelson 1994, Castelle and Johnson 2000, Parker 2005, Rashin et al. 2006*). Additionally, 50 foot equipment restriction zones would be established adjacent to all class 2 streams. Application of the SMZ Law is expected to reduce potential sediment delivery related to ground disturbance associated with upland harvest adjacent to perennial and intermittent streams in the analysis area.

Seven acres of riparian harvest is proposed under Alternative B, accounting for approximately 1.1% of the total riparian zone in this analysis area. Harvest would only occur between the 50 foot no harvest zone and the boundary of the riparian management zone which occurs 120 feet away from any waterbody. Application of the 50 foot no harvest zone is expected to minimize effects of riparian harvest to sediments, riparian condition, large woody debris and stream temperature. The proposed level of harvest is anticipated to have low risk of very low impacts to riparian condition in these analysis areas.

The primary considerations for impacts to sediments in this analysis include; 1) implementation of BMPs and road maintenance, 2) low impacts over both the short- and long-term associated with fine sediment delivery due to project related traffic and new road construction, 3) delivery of sediments related to upland timber harvest, and 4) delivery of sediments from riparian harvest. Based on positive impacts of BMPs and maintenance offsetting a portion of the potential impacts of increased traffic, road construction, and upland harvest, a moderate risk of low impacts is expected in this analysis area under both action alternatives.

Potential impacts to channel form under both proposed alternatives are primarily a function of long-term alterations to the flow regime in the analysis area and sediment conditions associated with road-stream crossings, road construction, and upland

harvest. Based on the factors described from flow regime and sediment above, a low risk of low impact to channel form is expected in this analysis area.

Macroinvertebrate richness may decrease slightly due to potential alterations to the flow regime and sediment (*Herlihy et al. 2005, VanDusen et al. 2005*). Applications of no harvest zones and the SMZ Law in the analysis areas are expected to reduce impacts to macroinvertebrate richness (*Sweeney and Newbold 2014*). Based the anticipated level of impacts on flow regime, sediment, and riparian condition, low risk of very low impacts are anticipated for macroinvertebrate richness in all analysis areas.

No new road-stream crossings are proposed on fish bearing streams in this analysis area. Of the crossings on perennial streams, 1 is a conservation barrier preventing upstream passage of brook trout protecting a pure population of westslope cutthroat trout. The remaining crossings either allow fish passage of all life stages or the status of fish passage is unknown. No impact is expected to alter fish distribution or stream connectivity under Alternative B.

- ***Direct and Indirect Effects of Action Alternative C on the Whitetail Creek Analysis Areas***

No direct or indirect effects to fisheries populations (presence/absence, genetic purity) are expected to occur in this analysis area as a result of proposed actions in Alternative C. Adverse impacts of nonnative species will continue to occur at the same levels as described under EXISTING ENVIRONMENT.

The annual water yield in the analysis area would increase above existing condition under Alternative C. The expected increase in water yield is 2.7% above the existing condition, which would result in a cumulative water yield of 11.9%. Peak seasonal flow volumes may increase over existing conditions, peak flow timing may occur at an earlier date, and the peak flow duration may occur over a longer period of time. These alterations to flow regime and timing may have a detectable effect to fisheries resources including channel form, stream temperature, and nutrients in the Whitetail Creek Analysis Area, and are representative of a moderate risk of low impacts to the flow regime.

Increased traffic related to project activities will occur under both action alternatives. This increase may accelerate mobilization and erosion of road surface material at road-stream crossings (*Reid and Dunne 1984, Bilby et al. 1989, Coker et al. 1993, Luce and Black 2001*). Road-stream crossings associated with the proposed actions in Alternative B include 7 road-stream crossings on class 1 streams, including 3 bridges and 4 metal culverts. Four of the structures are at low risk of fine sediment delivery to class 1

streams in the analysis area, and 3 of the structures are at moderate risk of fine sediment delivery. The foreseeable number of vehicle passes by project related traffic at class 1 stream crossings is 4,031. Additionally, 7 road-stream crossings on class 2 streams will be used as a part of this alternative. All crossing structures are metal culverts, 5 are at low risk of fine sediment delivery, and 2 structures are at moderate risk of fine sediment delivery to class 2 streams in the analysis area. Two new road-stream crossings would be installed on class 2 streams in the analysis area. The foreseeable number of vehicle passes by project related traffic at these crossings is 3,488 under Alternative B. Under Alternative C a total of 7,519 passes will be made at road-stream crossings on class 1 and class 2 streams. Through implementation of project specific BMPs and road maintenance, the applicable road-stream crossing sites would be expected to deliver most mobilized sediment away from the stream and road surface and filter eroded material through roadside vegetation. These actions are expected to offset the risk of sedimentation due to project related traffic.

The erosion of forest road surfaces and potential delivery of fine material to stream channels are a function of the application of forestry BMPs including; road design, road traffic, road surface composition, and road maintenance. Through the implementation of project specific BMPs and road maintenance, sediment delivery to streams in the Whitetail Creek Analysis Area is expected to be reduced under both this alternative. Approximately 2,000 feet of new road would be constructed within 300 feet of class 1 and class 2 streams in the analysis area. Implementation of BMPs and erosion control work would reduce estimated sediment loads to Whitetail Creek by 0.87 tons of sediment per year (see *HYDROLOGY ANALYSIS*). Due to the implementation of BMPs and road maintenance, although the new road construction occurs relatively close to perennial streams, road surface contribution of fine sediments is expected to present a low risk of low impacts to sediments in this analysis area.

Adjacent to all fish bearing and non-fish bearing class 1 streams, an equipment exclusion zone would be established between 50 feet and 120 feet from the ordinary high water mark. This is expected to reduce potential sediment delivery from ground disturbance related to upland harvest (*Davies and Nelson 1994, Castelle and Johnson 2000, Parker 2005, Rashin et al. 2006*). Additionally, 50 foot equipment restriction zones would be established adjacent to all class 2 streams. Application of the SMZ Law is expected to reduce potential sediment delivery related to ground disturbance associated with upland harvest adjacent to perennial and intermittent streams in the analysis area.

Two acres of riparian harvest is proposed under Alternative C, accounting for approximately 0.3% of the total riparian zone in this analysis area. Harvest would only

occur between the 50 foot no harvest zone and the boundary of the riparian management zone which occurs 120 feet away from any waterbody. Application of the 50 foot no harvest zone is expected to minimize effects of riparian harvest to sediments, riparian condition, large woody debris and stream temperature. The proposed level of harvest is anticipated to have negligible impacts to riparian condition in this analysis area.

The primary considerations for impacts to sediments in this analysis include; 1) implementation of BMPs and road maintenance, 2) low impacts over both the short- and long-term associated with fine sediment delivery due to project related traffic and new road construction, and 3) delivery of sediments related to upland timber harvest. Based on positive impacts of BMPs and maintenance offsetting a portion of the potential impacts of increased traffic, road construction, and upland harvest, a moderate risk of low impacts is expected in this analysis area under both action alternatives.

Potential impacts to channel form under both proposed alternatives are primarily a function of long-term alterations to the flow regime in the analysis area and sediment conditions associated with road-stream crossings, road construction, and upland harvest. Based on the factors described from flow regime and sediment above, a low risk of low impact to channel form is expected in this analysis area.

No riparian harvest is proposed in this analysis area, as such, negligible impacts are anticipated to riparian function, large woody debris, and stream temperature under both action alternatives.

Macroinvertebrate richness may decrease slightly due to potential alterations to the flow regime and sediment (*Herlihy et al. 2005, VanDusen et al. 2005*). Applications of no harvest zones and the SMZ Law in the analysis areas are expected to reduce impacts to macroinvertebrate richness (*Sweeney and Newbold 2014*). Based the anticipated level of impacts on flow regime, sediment, and riparian condition, low risk of very low impacts are anticipated for macroinvertebrate richness in all analysis areas.

No new road-stream crossings are proposed on fish bearing streams in this analysis area. Of the crossings on perennial streams, 1 is a conservation barrier preventing upstream passage of brook trout protecting a pure population of westslope cutthroat trout. The remaining crossings either allow fish passage of all life stages or the status of fish passage is unknown. No impact is expected to alter fish distribution or stream connectivity under Alternative B.

- ***Cumulative Effects of No-Action Alternative A on the Whitetail Creek Analysis Areas***

The other related past and present factors and site-specific existing conditions described in *EXISTING ENVIRONMENT* would continue to occur. Other future, related actions include those described in CHAPTER 1-PURPOSE AND NEED under *RELEVANT PAST, PRESENT, AND REASONABLY FORESEEABLE FUTURE ACTIONS*. These related actions include moderate levels of timber harvest and associated road use on private lands and potential conversion of forest timberlands to residential use; these actions may have low impacts to fisheries resources. Considering all of these impacts collectively, moderate to high cumulative effects is a function of all potentially related impacts, the elevated cumulative impact to fisheries resources in the analysis area is primarily due to nonnative fish species.

- ***Cumulative Effects of Action Alternatives B and C on Whitetail Creek Analysis Areas***

Using the cumulative effects described for the No-Action Alternative A as a baseline, the anticipated level of direct and indirect effects resulting from implementation of either Alternative B or C additional low impacts to fisheries resources are expected. Compared to Alternative A, both action alternatives would result in:

- No impact on: fish species presence/absence, native species genetics, fisheries connectivity
- Negligible impacts on: riparian function and large woody debris;
- Low additional risk of impacts to fisheries resources including; flow regime, sediment, channel form, stream temperature, and macroinvertebrate richness

Consequently, the continued presence of several nonnative species in the analysis areas results in a moderate to high cumulative impact to fisheries resources in these analysis areas. These elevated effects will continue to persist if any of the proposed alternatives are selected.

SOUTH WOODWARD CREEK AND WOODWARD CREEK ANALYSIS AREAS

Due to similarities in the proposed actions and fisheries resources in South Woodward and Woodward creeks, these analysis areas are presented together in this EIS. The proposed actions affecting fisheries resources in the South Woodward Creek and Woodward Creek Analysis Areas include;

- Use of a major haul route for timber and equipment transportation
- Road-surface maintenance
- Road construction
- Upland harvest

The primary point-source mechanism through which fisheries resources are affected by the proposed actions is sediment delivery to fish habitats at 18 existing road-stream crossings of perennial stream reaches, and 10 road-stream crossings of intermittent stream reaches (*FIGURES III-15 and III-17*). The primary non-point source mechanisms through which fisheries resources are affected by the proposed actions are modification to the 1) flow regime from upland timber harvest, 2) increased sediment from road construction, road maintenance, and timber hauling, 3) alterations to channel form due to upland harvest, and 4) increased stream temperature resulting from upland harvest. For analysis in this EIS, flow regime, sediment, channel form, and stream temperature are the measurable or detectable fisheries resource expected to be potentially affected by the proposed actions.

EXISTING ENVIRONMENT

Affected fishes in the South Woodward Creek and Woodward Creek Analysis Areas are detailed in *TABLE III-42* (*MFISH 2017*). South Woodward and Woodward creeks are both considered bull trout core areas (*MBTSG 1996*) and were identified in the final designation of bull trout critical habitat (*USFWS 2010*). Currently, the largest threat to native species in the project area is primarily caused by the presence and increasing distribution and abundance of nonnative species. The mechanisms by which bull trout are impacted by nonnative species include hybridization with brook trout, competition for resources in rearing habitats during juvenile life stages, and competition and predation on all life stages by lake trout in Swan Lake.

The majority of bull trout spawning occurs in the lower reaches of both Woodward and South Woodward creeks in September and October, with redd count surveys conducted by DFWP annually since 1996. Redd count surveys include portions of both South Woodward and Woodward creeks and have averaged 74.2 redds/year (*FIGURE III-18*; 65.8 – 82.6; 95% C.I.) considerably higher that the basin average of 54.9 redds/year (*DFWP, unpublished data*). The proportion of the bull trout redds in the Swan River basin from South Woodward and Woodard creeks has increased since 2011, indicating the strong contribution of these streams to the fluvial population. From 1996 through 2010, these streams accounted for approximately 13.4% of the total number of redds observed during basin-wide redd counts. From 2011 through 2016 that proportion increased to 25.4% of the total number of redds observed (*FIGURE III-18*). Approximately 3.75 miles upstream from the mouth of South Woodward Creek, a perched road-stream crossing is an artificial barrier preventing upstream fish passage to the upper 3.0 miles of the stream. In the upper reach, genetically pure westslope cutthroat trout are the only species present.

Analysis of hydrologic data includes the assessment of water yield. Detailed existing conditions of water yield can be found in the *HYDROLOGY ANALYSIS*. Water yield typically is affected through timber harvest and road construction, increasing proportionally with canopy removal (*Haupt 1976*). Increased water yield can alter channel form through increased streambank erosion and sedimentation. Additionally, changes in timing of peak flow and peak flow duration can affect spring spawning fishes through alteration of spawn timing, substrate scouring, or sediment deposition on spawning areas (*Bunn and Arthington 2002, Lytle and Poff 2004*). Existing increases in water yield incorporates historic timber harvest and road construction activities on a watershed basis. Current conditions in South Woodward, and Woodward creeks are 6.5% and 6.9% respectively. While these increases represent a change in condition due to timber harvest, the values are likely within the range of natural variability which would have occurred historically due to natural disturbance. Consequently, this analysis indicates negligible existing impacts to the fisheries resources in these three analysis areas. The variables of existing peak flow volume, timing and duration are expected to be within the natural range of variability (see *HYDROLOGY ANALYSIS*).

Quantitative assessments of percent fine sediment (McNeil core) and embeddedness (substrate score) have been collected annually in Swan River tributaries within reaches important to bull trout and westslope cutthroat trout. McNeil core measurement provides a metric related to spawning substrate quality and is measured as the percent of sediments in a sample less than 6.35 mm. Values greater than 35% indicate moderate threats to embryo survival, with increasing values correlated with decreasing survival, embryo survival approaches 0% when values are greater than or equal to 50% (*Weaver and Fraley 1991*). Substrate score provides a metrics to evaluate rearing conditions for bull trout, with juvenile abundance typically declining when substrate scores are less than 9, with good quality rearing rated at 11 or higher (*Shepard et al. 1984*). McNeil core (1996-2015) and substrate scores (1996-2016) have been collected annually in South Woodward and Woodward creeks. Both streams exhibit low to moderate risk for spawning conditions, Woodward Creek averaged 36.4% (range: 32.8-41.7%) and South Woodward Creek averaged 29.7% (range: 24.9-35.4%) (*FIGURE III-19*; *DFWP, unpublished data*). Substrate score in Woodward Creek averaged 10.3 (range: 9.3 – 10.9) indicating that rearing conditions were adequate. Similar scores were observed in South Woodward Creek with an average score of 10.3 (range: 9.0-11.8; *FIGURE III-19*). Substrate scores in South Woodward Creek have been greater than 11 during 6 of the last 8 samples collected. McNeil core measures indicate a generally stable, and favorable, spawning environment for bull trout in South Woodward and Woodward creeks.

Substrate scores indicate average to good rearing conditions for bull trout in South Woodward and Woodward creeks.

FIGURE III-17–SOUTH WOODWARD CREEK FISHERIES ANALYSIS UNIT.

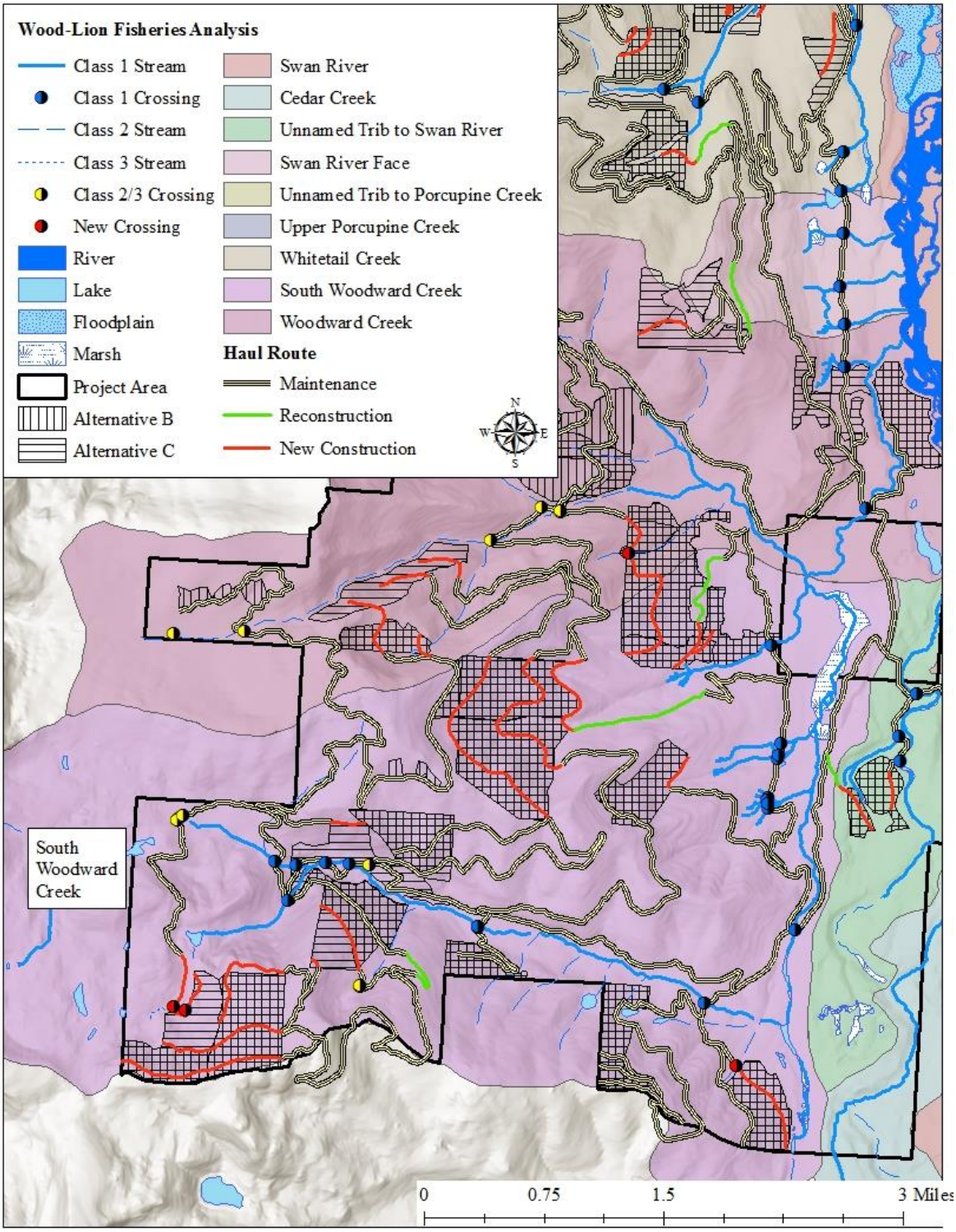
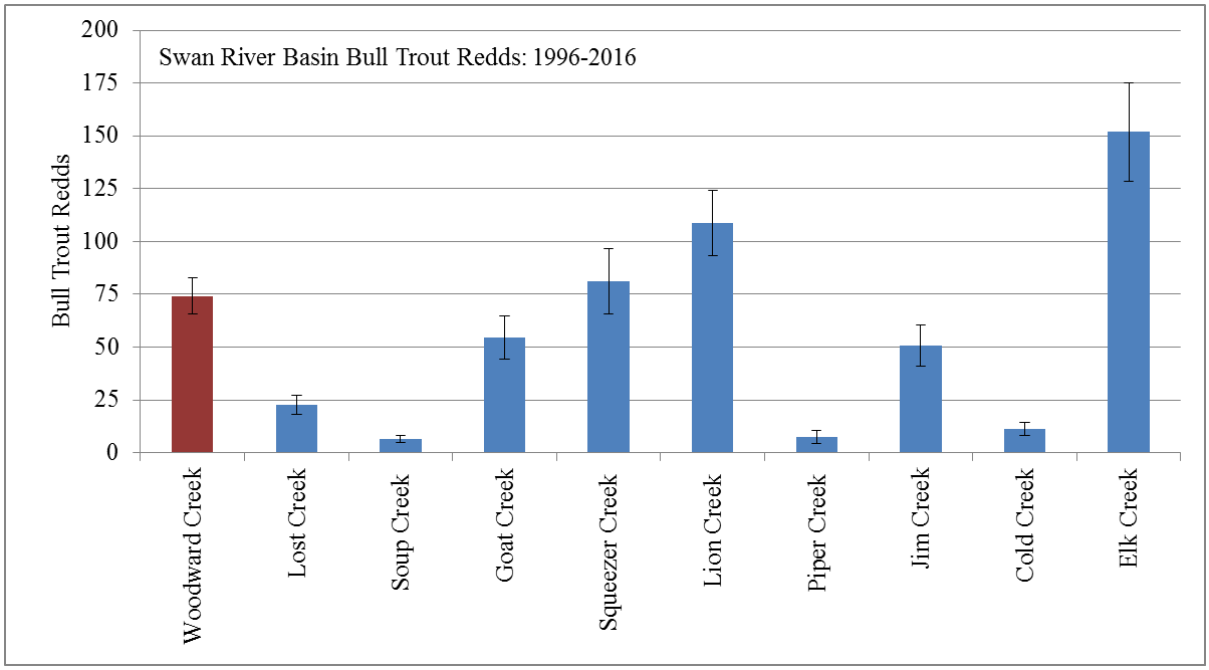


FIGURE III-18 - BULL TROUT REDD COUNTS CONDUCTED IN THE SWAN RIVER BASIN FROM 1996 TO 2016. *Bars indicate mean redd count, error bars indicate 2 S.E. a close approximation of a 95% confidence interval. Blue line represents the contribution to the total number of bull trout redds in the Swan River basin red line represents the long-term average.*



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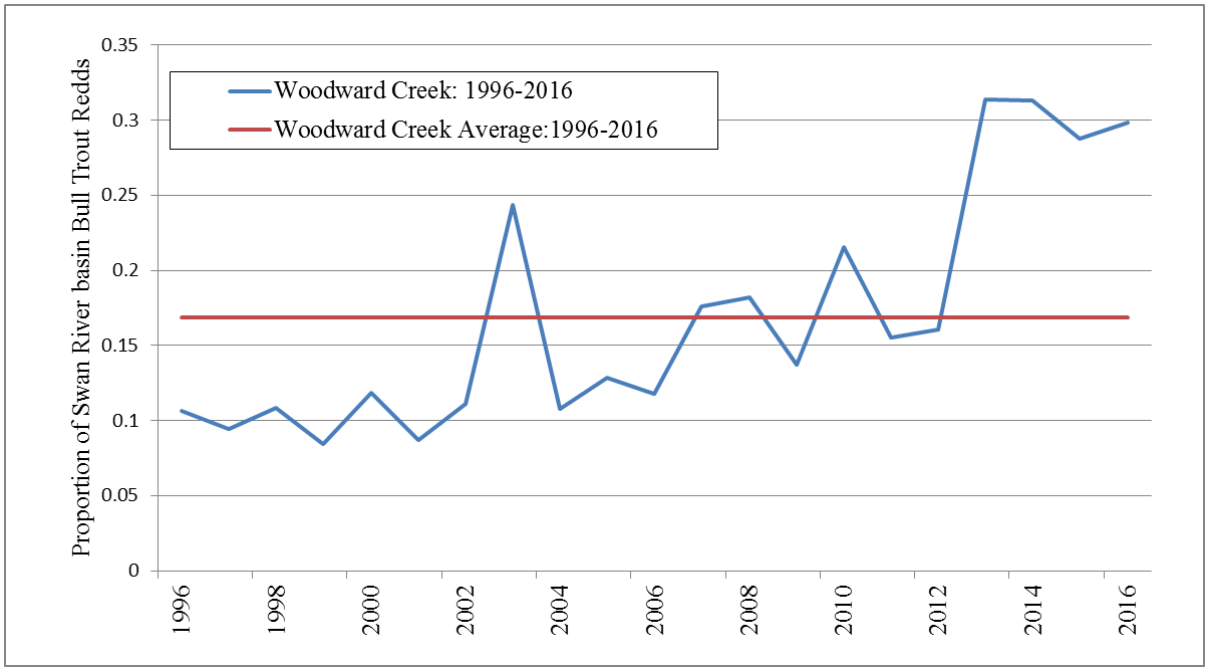
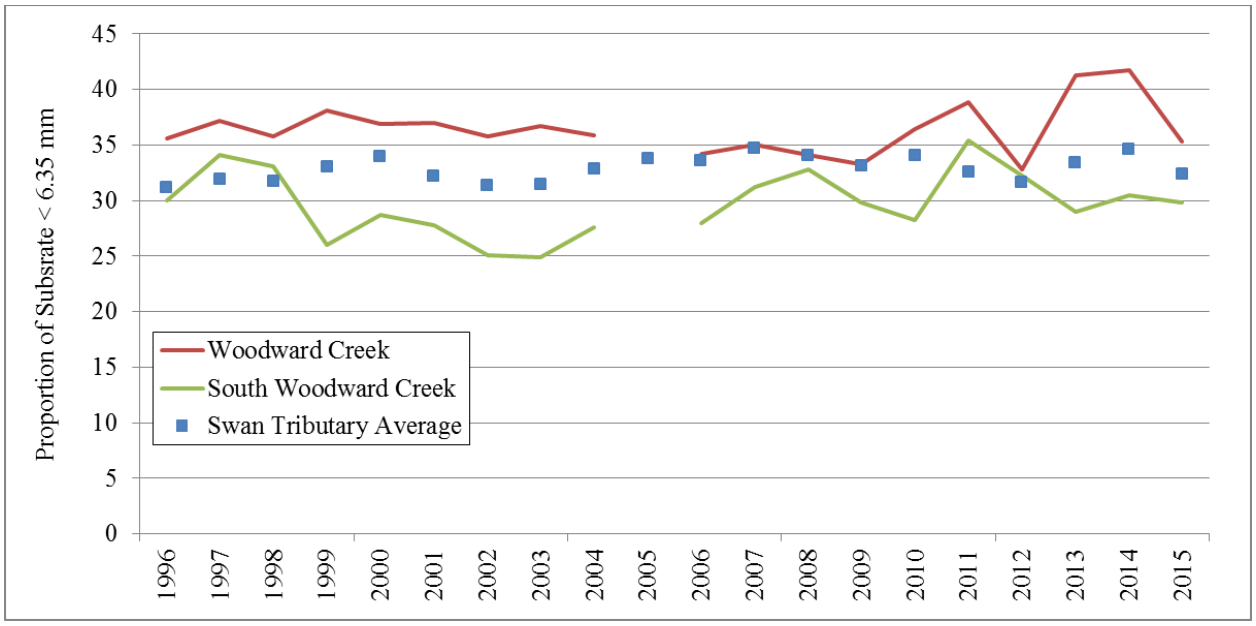
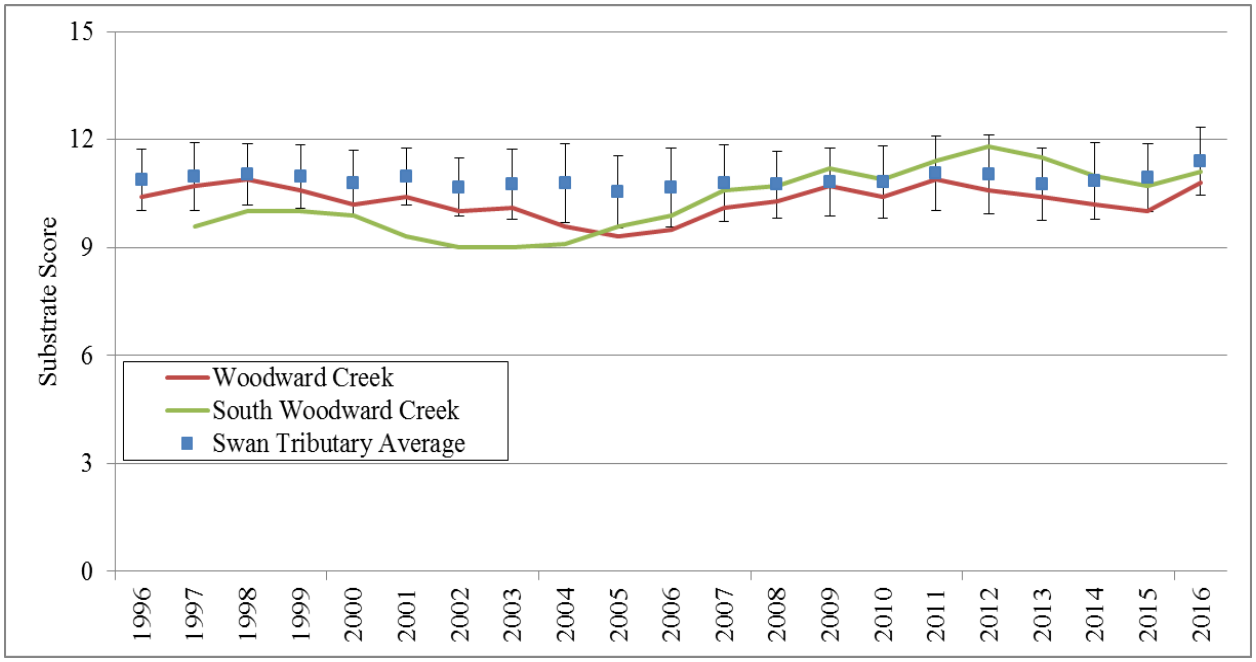


Stream habitat types in South Woodward Creek vary among A (11.5% total habitat), B (18.6% total habitat), and C (69.9% total habitat) channel types (*Rosgen 1996; Koopal 2002*). Slow water habitat features (*Overton et al. 1997*) made up 29.6% of the volume and 20.5% of the area in A channel type reaches, 7.9% of the volume and 5.1% of the area in B channel type reaches, and 7.1% of the volume and 4.8% of the area in C channel type reaches (*Koopal 2002*). Large woody debris (LWD) surveys found an average of 106.3, 103.7, and 69.1 pieces/1,000 feet of stream for A, B, and C channel types respectively. Stream habitat in Woodward Creek is primarily composed of C channel type (80.0% total habitat) with a smaller portion of B channel type (20.0% total habitat). Slow water habitat features made up 21.8% of the volume and 13.9% of the area in C channel types, and 4.5% of the volume and 3.4% of the area in B channel types (Koopal 2001). Large woody debris counts found an average of 49.3 and 88.7 pieces/1,000 feet of stream in C and B channel types respectively.

Stream temperature is a function of flow regime, channel form, and riparian condition (*Poff et al. 1997*). Alterations to flow regime (*Haupt 1976*), channel form, and riparian condition (*Naiman and Decamps 1997, Sweeney and Newbold 2014*) may occur as a result of upland and riparian timber harvest, ultimately impacting stream temperature.

FIGURE III-19 - MCNEIL SEDIMENT CORE SAMPLES AND SUBSTRATE SCORE SURVEYS IN WOODWARD AND SOUTH WOODWARD CREEKS FROM 1996 TO 2016. *Dotted blue line indicates the average substrate score for the remaining Bull trout streams surveyed in the Swan River basin.*





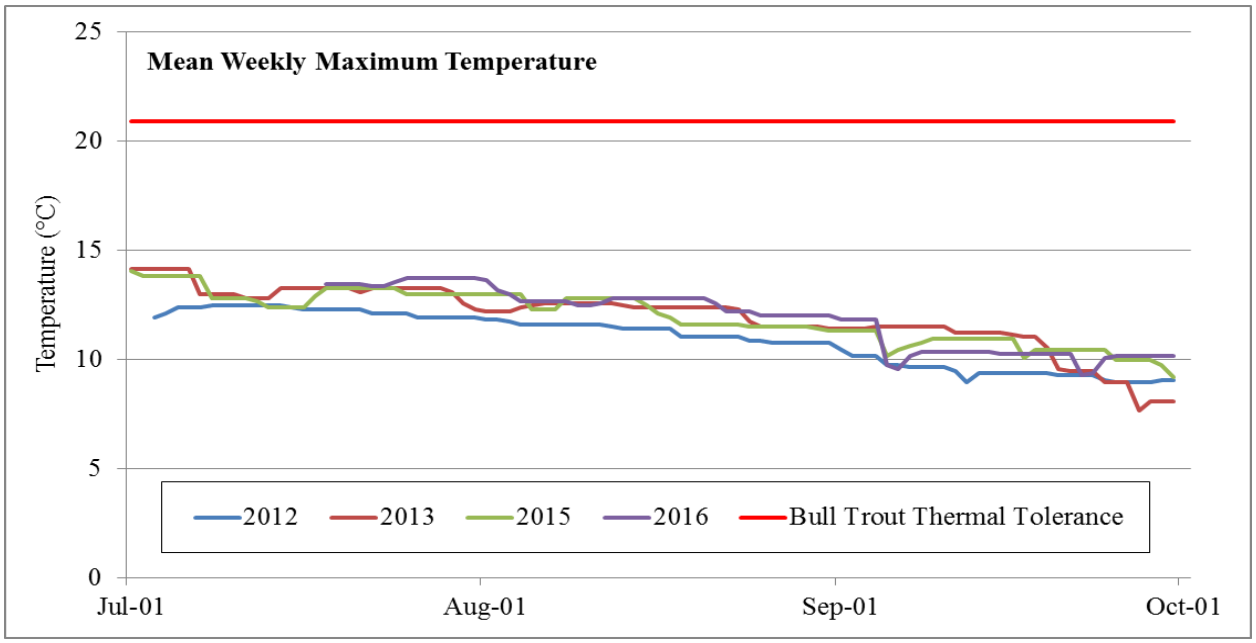
Streams in the project area are typically groundwater dominated systems with moderated high flow periods associated with snowmelt and episodic precipitation events. Critical periods for bull trout ecology related to stream temperature include juvenile rearing and overall survival. Stream temperature data are presented for Woodward Creek from 2012-2016 (excluding 2014). Optimal growth temperature and thermal tolerance for bull trout in Woodward Creek was compared to the mean weekly average temperature and the mean weekly maximum temperature, respectively. These metrics are calculated as the running mean of three days prior to, and three days following an observed mean or maximum temperature. The warmest maximum temperature observed in Woodward Creek during the period of deployment was 14.1°C in 2013 (*FIGURE III-20*). Average temperatures did not exceed 10.4°C during the period of deployment, and were significantly lower than bull trout optimal growth temperature (*FIGURE III-20*). Stream temperatures observed in Woodward Creek are within the expected range of variability for streams in the Swan River drainage.

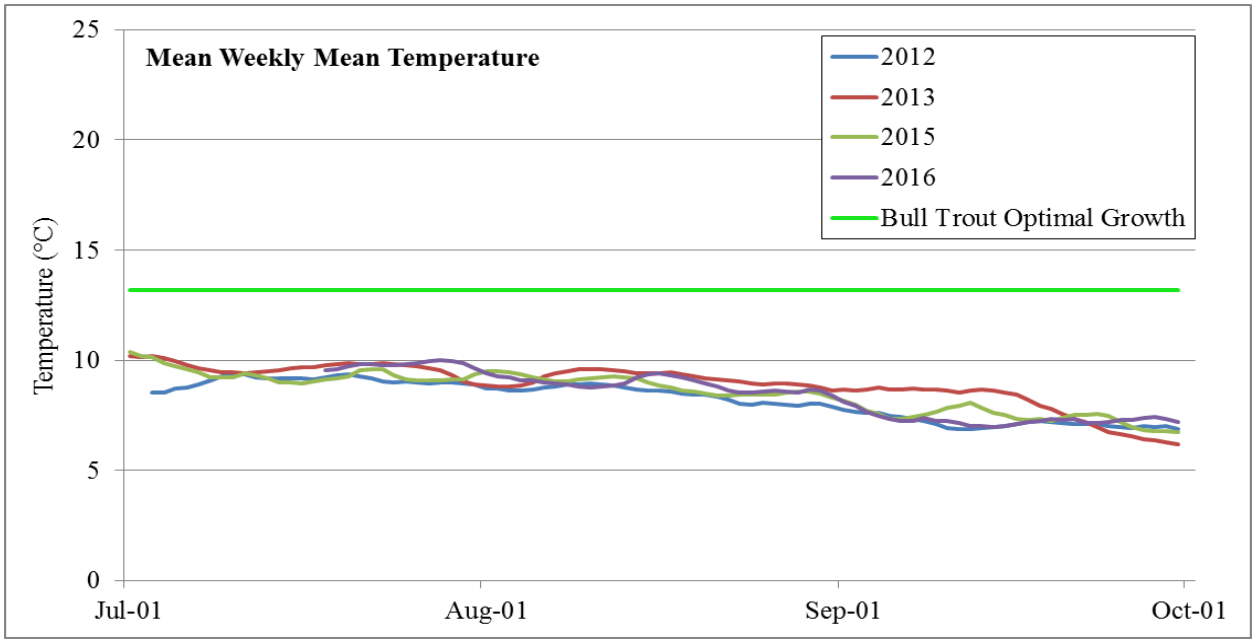
The existing road-stream crossing structures at the 2 crossing locations in the Woodward Creek Analysis Area include one concrete bridge and one metal culvert. Both structures are at low risk of contributing fine sediments to perennial streams. In the South Woodward Creek Analysis Area there are a total of 14 road-stream crossings including 3 bridges and 11 metal culverts. All bridges and 9 of the metal culverts in the Analysis Area are at low risk of contributing fine sediment to perennial streams. One of the metal culverts is at a moderate risk of contributing fine sediment to the stream, and one structure is at high risk of contributing fine sediment to the stream. Based on this

information, a low to moderate impact to sediment is likely occurring in the Woodward and South Woodward Creek Analysis Areas, but the existing condition is likely within the expected range of variability found in the stream reach. Current sediment delivery from the road system in South Woodward Creek and Woodward Creek are 8.09 and 1.78 tons of sediment delivered per year respectively (see *HYDROLOGY ANALYSIS*).

Other past and present factors affecting the South Woodward Creek and Woodward Creek Analysis Aras include those actions described under *RELEVEANT PAST, PRESENT, AND REASONABLY FORESSEABLE FUTURE ACITONS* in *CHAPTER 1-PURPOSE AND NEED.* These factors include adverse impacts from nonnative fish species in both analysis areas, moderate levels of riparian and upland harvest, timber and equipment hauling by other landowners, and travel on open road-stream crossing sites. These factors in conjunction with those site-specific existing conditions assessed above, contribute to an existing moderate collective impact to the South Woodward Creek and Woodward Creek Analysis Areas.

FIGURE III-20: Mean weekly maximum and mean weekly average stream temperature (°C) observed in Woodward Creek between July 1 and September 30. *Constant red line reflects the upper incipient lethal temperature tolerated by Bull Trout as identified in laboratory studies.*





ENVIRONMENTAL EFFECTS

- ***Direct and Indirect Effects of the No-Action Alternative A on the South Woodward Creek and Woodward Creek Analysis Areas***

No Direct or Indirect impacts would occur to the affected fish species or other affected resources beyond those described in *EXISTING ENVIRONMENT.*

- ***Direct and Indirect Effects of Action Alternative B on the South Woodward Creek and Woodward Creek Analysis Areas***

Potential effect mechanisms in the South Woodward Creek and Woodward Creek Analysis Areas which may affect fisheries resources including flow regime, sediment, channel form, and stream temperature are outlined in *TABLE III-43*.

No direct or indirect effects to fisheries populations (presence/absence, genetic purity) are expected to occur in this analysis area as a result of proposed actions in Alternative B. Adverse impacts of nonnative species will continue to occur at the same levels as described under *EXISTING ENVIRONMENT*.

The annual water yield in the analysis areas would increase above existing condition under Alternative B. The expected increases in water yield are 5.3% and 1.4% above the existing condition for South Woodward Creek and Woodward Creek Analysis Areas. These increases would result in a cumulative water yield of 11.8% and 8.3% for the respective areas. Peak seasonal flow volumes may increase over existing conditions, peak flow timing may occur at an earlier date, and the peak flow duration may occur over a longer period of time. These alterations to flow regime and timing may have a detectable effect to fisheries resources including channel form, stream temperature, and

nutrients in the both analysis areas, and are representative of a moderate risk of low impacts to the flow regime.

Increased traffic related to project activities will occur under both action alternatives. This increase may accelerate mobilization and erosion of road surface material at road-stream crossings (*Reid and Dunne 1984, Bilby et al. 1989, Coker et al. 1993, Luce and Black 2001*). Road-stream crossings associated with the proposed actions in Alternative B include 16 and 2 road- areas respectively. Of these 18 crossing structures, 14 are at low risk, 1 structure is at moderate risk, and 1 is at high risk of fine sediment delivery to class 1 streams in the analysis area. The foreseeable number of vehicle passes by project related traffic at all stream crossings is found in *TABLE-43* Additionally, 10 road-stream crossings on class 2 and 3 streams will be used as a part of this alternative. All crossing structures are metal culverts, and are at low risk of fine sediment delivery. Two new road-stream crossings would be installed on class 2 streams in the analysis areas.

TABLE III-43 –POTENTIAL FISHERIES RESOURCES EFFECTS MECHANISMS IN SOUTH WOODWARD CREEK AND WOODWARD CREEK ANALYSIS AREAS UNDER ALTERNATIVE B.

Alternative B		
	Analysis Area	
	South Woodward Creek	Woodward Creek
Percent existing increase in annual water yield	6.5	6.9
Percent new increase in annual water yield	5.3	1.4
Miles of existing road within 300 feet of all streams	7.0	5.0
Miles of new road construction within 300 feet of all streams	0.2	0.1
Total Number of Road-Stream Crossings	21	7
Perennial Road-Stream Crossings	16	2
Intermittent Road-Stream Crossings	5	5
Number of new crossings installed	1	1
Total Number of Project Related vehicle crossings	16,043	4,779
Reduction in sediment delivery through BMP implementation	5.04	0.13
Riparian Harvest Acres	0	0

Through implementation of project specific BMPs and road maintenance, the applicable road-stream crossing sites would be expected to deliver most mobilized sediment away from the stream and road surface and filter eroded material through roadside vegetation. These actions are expected to offset the risk of sedimentation due to project related traffic.

- ***Stream Crossings on Class I Streams in South Woodward Creek and Woodward Creek Analysis***

The erosion of forest road surfaces and potential delivery of fine material to stream channels are a function of the application of forestry BMPs including; road design, road traffic, road surface composition, and road maintenance. Through the implementation of project specific BMPs and road maintenance, sediment delivery to streams in the South Woodward Creek and Woodward Creek Analysis Areas is expected to be reduced by 5.04 and 0.13 tons per year under this alternative, respectively. New road construction would occur in both analysis areas (*TABLE III-43*). Due to the implementation of BMPs and road maintenance, although the new road construction occurs relatively close to perennial streams, road surface contribution of fine sediments is expected to present a low risk of low impacts to sediments in this analysis area.

Adjacent to all fish bearing and non-fish bearing class 1 streams, an equipment exclusion zone would be established between 50 feet and 150 feet from the ordinary high water mark. A 110-150 foot wide no-harvest zone would be established along all fish-bearing streams in the analysis area. This is expected to reduce potential sediment delivery from ground disturbance related to upland harvest (*Davies and Nelson 1994, Castelle and Johnson 2000, Parker 2005, Rashin et al. 2006*). Additionally, 50 foot equipment restriction zones would be established adjacent to all class 2 and 3 streams. Application of the SMZ Law is expected to reduce potential sediment delivery related to ground disturbance associated with upland harvest adjacent to perennial and intermittent streams in the analysis area.

The primary considerations for impacts to sediments in this analysis include; 1) implementation of BMPs and road maintenance, 2) low impacts over both the short- and long-term associated with fine sediment delivery due to project related traffic and new road construction, and 3) delivery of sediments related to upland timber harvest. Based on positive impacts of BMPs and maintenance offsetting a portion of the potential impacts of increased traffic, road construction, and upland harvest, a moderate risk of low impacts is expected in this analysis area under both action alternatives.

Potential impacts to channel form under both proposed alternatives are primarily a function of long-term alterations to the flow regime in the analysis area and sediment conditions associated with road-stream crossings, road construction, and upland harvest. Based on the factors described from flow regime and sediment above, a low risk of low impact to channel form is expected in this analysis area.

No riparian harvest is proposed in this analysis area, as such, negligible impacts are anticipated to riparian function, large woody debris, and stream temperature proposed actions in Alternative B.

Stream temperature may increase slightly as a result of potential alterations to flow regime, channel form, and sediment. Implementation of a 110-150 foot wide no harvest zone along fish bearing streams in these analysis areas should reduce potential effects and changes to stream temperature (*Beschta et al. 1987, Brosofske et al. 1997, Wilkerson et al. 2006, Sweeney and Newbold 2014*). Application of the SMZ Law along non-fish bearing streams in the analysis areas is expected to offset potential impacts to stream temperature in class 1, 2, and 3 streams. A low risk of very low impacts to stream temperature is expected under the proposed actions in Alternative B.

Macroinvertebrate richness may decrease slightly due to potential alterations to the flow regime and sediment (*Herlihy et al. 2005, VanDusen et al. 2005*). Applications of no harvest zones and the SMZ Law in the analysis areas are expected to reduce impacts to macroinvertebrate richness (*Sweeney and Newbold 2014*). Based the anticipated level of impacts on flow regime, sediment, and riparian condition, low risk of very low impacts are anticipated for macroinvertebrate richness in all analysis areas.

No new road-stream crossings are proposed on fish bearing streams in this analysis area. Of the crossings on perennial streams, 1 is a conservation barrier preventing upstream passage of brook trout protecting a pure population of westslope cutthroat trout. The proposed actions in Alternative B are anticipated to have no impact to stream habitat connectivity in these analysis areas.

- ***Direct and Indirect Effects of Action Alternative C on the South Woodward Creek and Woodward Creek Analysis Areas***

TABLE III-44 outlines potential effect mechanisms in the South Woodward Creek and Woodward Creek Analysis Areas which may affect fisheries resources including flow regime, sediment, channel form, and stream temperature.

No direct or indirect effects to fisheries populations (presence/absence, genetic purity) are expected to occur in this analysis area under either action alternative. Currently, no native species are known to occupy the streams in this analysis area. Adverse impacts of nonnative species will continue to occur at the same levels as described under *EXISTING ENVIRONMENT*.

TABLE III-44 –POTENTIAL FISHERIES RESOURCES EFFECTS MECHANISMS IN SOUTH WOODWARD CREEK AND WOODWARD CREEK ANALYSIS AREAS UNDER ALTERNATIVE C.

Alternative C		
	Analysis Area	
	South Woodward Creek	Woodward Creek
Percent existing increase in annual water yield	6.5	6.9
Percent new increase in annual water yield	5.1	1.9
Miles of existing road within 300 feet of all streams	7.2	5.1
Miles of new road construction within 300 feet of all streams	0.6	0.2
Total Number of Road-Stream Crossings	21	6
Perennial Road-Stream Crossings	16	2
Intermittent Road-Stream Crossings	5	4
Number of new crossings installed	3	1
Total Number of Project Related vehicle crossings	14,639	4,908
Reduction in sediment delivery through BMP implementation	5.14	0.09
Riparian Harvest Acres	0	0

The annual water yield in the analysis areas would increase above existing condition under Alternative C. Expected increases in water yield are 5.1% and 1.9% above the existing condition for South Woodward Creek and Woodward Creek Analysis Areas. These increases would result in a cumulative water yield of 11.6% and 8.8% for the respective areas. Peak seasonal flow volumes may increase over existing conditions, peak flow timing may occur at an earlier date, and the peak flow duration may occur over a longer period of time. These alterations may have a detectable effect to fisheries resources including channel form, stream temperature, and nutrients in the Unnamed Tributary to Swan River Analysis Area, and are representative of a moderate risk of low impact to the flow regime.

Increased traffic related to project activities will occur under both action alternatives. This increase may accelerate mobilization and erosion of road surface material at road-stream crossings (*Reid and Dunne 1984, Bilby et al. 1989, Coker et al. 1993, Luce and Black 2001*). Road-stream crossings associated with the proposed actions in Alternative C include 16 and 2 road-stream crossings on class 1 streams in South Woodward Creek and Woodward Creek Analysis Areas respectively. Of these 18 crossing structures, 14 are at low risk, 1 structure is at moderate risk, and 1 is at high risk of fine sediment delivery to class 1 streams in the analysis area. The foreseeable number of vehicle passes by project related traffic at all stream crossings is found in *TABLE III-44*. Additionally, 9 road-stream crossings on class 2 and 3 streams will be used as a part of this alternative. All crossing structures are metal culverts, and are at low risk of fine sediment delivery.

New road-stream crossings would be installed in 4 locations on class 2 and 3 streams in the analysis areas. Due to the separation between these class 2 and 3 reaches and any fish bearing reaches in the analysis areas, the installations pose a short term low risk of low impact to fisheries resources. Through implementation of project specific BMPs and road maintenance, the applicable road-stream crossing sites would be expected to deliver most mobilized sediment away from the stream and road surface and filter eroded material through roadside vegetation. These actions are expected to offset the risk of sedimentation due to project related traffic.

The erosion of forest road surfaces and potential delivery of fine material to stream channels are a function of the application of forestry BMPs including; road design, road traffic, road surface composition, and road maintenance. Through the implementation of project specific BMPs and road maintenance, sediment delivery to streams in the South Woodward Creek and Woodward Creek Analysis Areas is expected to be reduced by 5.14 and 0.09 tons per year under this alternative, respectively. New road construction would occur in both analysis areas (*TABLE III-44*). Due to the implementation of BMPs and road maintenance, although the new road construction occurs relatively close to perennial streams, road surface contribution of fine sediments is expected to present a low risk of low impacts to sediments in this analysis area.

Adjacent to all fish bearing and non-fish bearing class 1 streams, an equipment exclusion zone would be established between 50 feet and 150 feet from the ordinary high water mark. A 110-150 foot wide no-harvest zone would be established along all fish-bearing streams in the analysis area. This is expected to reduce potential sediment delivery from ground disturbance related to upland harvest (*Davies and Nelson 1994, Castelle and Johnson 2000, Parker 2005, Rashin et al. 2006*). Additionally, 50 foot equipment restriction zones would be established adjacent to all class 2 streams. Application of the SMZ Law is expected to reduce potential sediment delivery related to ground disturbance associated with upland harvest adjacent to perennial and intermittent streams in the analysis area.

The primary considerations for impacts to sediments in this analysis include; 1) implementation of BMPs and road maintenance, 2) low impacts over both the short- and long-term associated with fine sediment delivery due to project related traffic and new road construction, and 3) delivery of sediments related to upland timber harvest. Based on positive impacts of BMPs and maintenance offsetting a portion of the potential impacts of increased traffic, road construction, and upland harvest, a moderate risk of low impacts is expected in this analysis area under both action alternatives.

Potential impacts to channel form under both proposed alternatives are primarily a function of long-term alterations to the flow regime in the analysis area and sediment conditions associated with road-stream crossings, road construction, and upland harvest. Based on the factors described from flow regime and sediment above, a low risk of low impact to channel form is expected in this analysis area.

No riparian harvest is proposed in this analysis area, as such, negligible impacts are anticipated to riparian function, and large woody debris in Alternative C.

Stream temperature may increase slightly as a result of potential alterations to flow regime, channel form, and sediment. Implementation of a 110-150 foot wide no harvest zone along fish bearing streams in these analysis areas should reduce potential effects and changes to stream temperature (*Beschta et al. 1987, Brosofske et al. 1997, Wilkerson et al. 2006, Sweeney and Newbold 2014*). Application of the SMZ Law along non-fish bearing streams in the analysis areas is expected to offset potential impacts to stream temperature in class 1, 2, and 3 streams. A low risk of very low impacts to stream temperature is expected under the proposed actions in Alternative C.

Macroinvertebrate richness may decrease slightly due to potential alterations to the flow regime and sediment (*Herlihy et al. 2005, VanDusen et al. 2005*). Applications of no harvest zones and the SMZ Law in the analysis areas are expected to reduce impacts to macroinvertebrate richness (*Sweeney and Newbold 2014*). Based the anticipated level of impacts on flow regime, sediment, and riparian condition, low risk of very low impacts are anticipated for macroinvertebrate richness in all analysis areas.

No new road-stream crossings are proposed on fish bearing streams in this analysis area. Of the crossings on perennial streams, 1 is a conservation barrier preventing upstream passage of brook trout protecting a pure population of westslope cutthroat trout. The proposed actions in Alternative C are anticipated to have no impact to stream habitat connectivity in these analysis areas.

- ***Cumulative Effects of No-Action Alternative A on the South Woodward Creek and Woodward Creek Analysis Areas***

The other related past and present factors and site-specific existing conditions described in *EXISTING ENVIRONMENT* would continue to occur. Other future, related actions include those described in CHAPTER 1-PURPOSE AND NEED under *RELEVANT PAST, PRESENT, AND REASONABLY FORESEEABLE FUTURE ACTIONS*. These related actions include moderate levels of timber harvest and associated road use on private lands and potential conversion of forest timberlands to residential use; these actions may have low impacts to fisheries resources. Considering all of these impacts

collectively, moderate to high cumulative effects is a function of all potentially related impacts, the elevated cumulative impact to fisheries resources in the analysis area is primarily due to nonnative fish species.

- ***Cumulative Effects of Action Alternatives B and C on the South Woodward Creek and Woodward Creek Analysis Areas***

Using the cumulative effects described for the No-Action Alternative A as a baseline, the anticipated level of direct and indirect effects resulting from implementation of either Alternative B or C additional low impacts to fisheries resources are expected. Compared to Alternative A, both action alternatives would result in:

- No impact on: fish species presence/absence, native species genetics, fisheries connectivity
- Negligible impacts on: riparian function and large woody debris;
- Low additional risk of impacts to fisheries resources including; flow regime, sediment, channel form, stream temperature, and macroinvertebrate richness

Consequently, the continued presence of several nonnative species in the analysis areas results in a moderate to high cumulative impact to fisheries resources in these analysis areas. These elevated effects will continue to persist if any of the proposed alternatives are selected.

WILDLIFE ANALYSIS

INTRODUCTION

The wildlife analysis is designed to disclose the existing condition of wildlife resources and the anticipated direct, indirect, and cumulative effects that may result from implementing the No-action and action alternatives.

ISSUES AND MEASUREMENT CRITERIA

Wildlife-related issues were identified through public and internal scoping and are listed in *TABLE I–1 – ISSUES STUDIED IN DETAIL* (*CHAPTER I*). The issues carried forward in this analysis are reiterated at the beginning of each applicable subsection. Differing measurement criteria were used to evaluate the effects of the alternatives, depending on the resource or habitat attribute analyzed. Quantifiable metrics were selected to describe the scope and scale of effects to a target species, habitat, or habitat parameter. The metrics used for evaluations are described in *ANALYSIS METHODS* under each issue topic.

ANALYSIS AREAS

DIRECT AND INDIRECT EFFECTS

The direct and indirect effects of the proposed activities on all species/habitat parameters were analyzed within the Project Area (*TABLE III-45, FIGURE III-21*).

CUMULATIVE EFFECTS

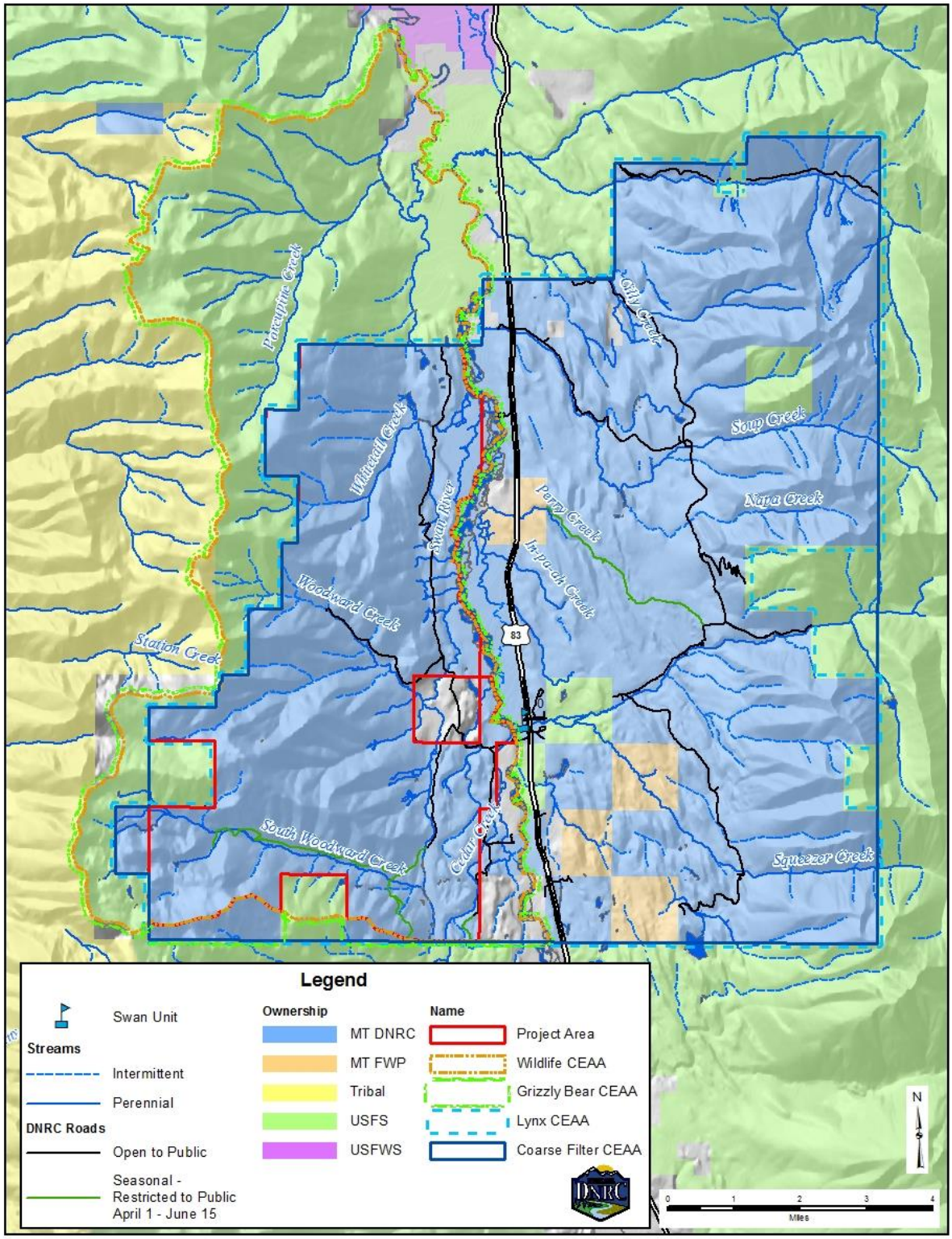
The cumulative effects of the proposed activities on all species/habitat parameters were analyzed at broad surrounding landscape scales that vary according to the issue being discussed. Cumulative effects analysis areas (CEAAs) are summarized in *TABLE III-45* and depicted in *FIGURE III-21*. CEAAs include the Project Area as well as lands managed by other agencies and private landowners. Detailed descriptions of each analysis area are in the *EXISTING ENVIRONMENT* section for each habitat parameter or species evaluated.

TABLE III-45 – ANALYSIS AREAS. *Descriptions of the Project Area and CEAAs.*

ANALYSIS AREA NAME	DESCRIPTION	TOTAL ACRES	ISSUE(S)/SPECIES ANALYZED
Project Area	Portions of DNRC-managed lands in T24N, R18W, Sections 22-28 and 34-36; T23N, R18W Sections 1-3, 9-12, 14-17, 21-29, 32, 33, 35, and 36; and T23N, R17W Sections 18 and 19.	19,437	direct and indirect effects for all issues/species

Wildlife CEAA	The *Porcupine-Woodward Grizzly Bear Management Subunit*. The CEAA is managed primarily by DNRC (54%) and the USFS (41%).	37,666	fishers, pileated woodpeckers, big game
Grizzly Bear CEAA	The *Porcupine-Woodward Grizzly Bear Management Subunit* plus an additional 652 acres of DNRC-managed lands in the *Piper Creek Grizzly Bear Management Subunit* where increased traffic may affect bears	38,318	grizzly bears
Lynx CEAA	The *Swan Lynx Management Area*	63,273	Canada lynx
Coarse Filter CEAA	Swan River State Forest including non-DNRC checkerboard lands. The CEAA is managed primarily by the DNRC (85.3%) and the USFS (7.9%).	65,853	cover types, age class, old-growth, habitat connectivity and fragmentation, and linkage

FIGURE III-21 –ANALYSIS AREAS. *Project Area and wildlife cumulative effects analysis areas for the Wood Lion Multiple Timber Sale Project.*



ANALYSIS METHODS

Analysis methods are based on the DNRC State Forest Land Management Plan, which is designed to promote biodiversity. The primary basis for this analysis includes information obtained by: field visits, review of scientific literature, Montana Natural Heritage Program (MNHP) data queries, DNRC Stand Level Inventory (SLI) data analysis, aerial photograph analysis, and consultation with professionals. The coarse-filter wildlife analysis section includes analyses of the direct, indirect, and cumulative effects of the proposed alternatives on forest cover types, age class, old-growth forest, habitat connectivity and fragmentation, and linkage.

In the fine-filter analysis, individual species of concern are evaluated. These species include wildlife species federally listed under the Endangered Species Act, species listed as sensitive by DNRC, and species managed as big game by the Montana Department of Fish Wildlife and Parks (DFWP).

Cumulative effects analyses account for known past and current activities, as well as planned future agency actions. See *CHAPTER I - PURPOSE AND NEED* for a comprehensive listing of past DNRC projects involving vegetation management on the Swan River State Forest. Changes to forest structure resulting from all completed and ongoing DNRC projects have been accounted for in SLI data used for this analysis through routine timber sale updating procedures. Ongoing timber sales occurring in the Project Area and CEAAs are listed in *TABLE III-46*. Timber sales that occurred on private lands and USFS lands are accounted for in analyses of aerial photographs. DNRC is not proposing additional timber sales and is not aware of any proposed or ongoing activities on other ownerships at this time(*USFS 2017*).

TABLE III-46 – ONGOING PROJECTS. *Acreage of ongoing timber sales occurring in the Project Area and CEAAs.*

SALE NAME	*PROJECT AREA*	*WILDLFE CEAA*	*GRIZZLY BEAR CEAA*	*LYNX CEAA*	*COARSE FILTER*
Cilly 349	0	0	0	285	285
Cilly Graves	0	0	0	221	221
Cilly Napa	0	0	0	190	190
Cilly North Soup	0	0	0	200	200

Cilly Sanitation	0	0	0	178	177
Total	*0*	*0*	*0*	*1,074*	*1,074*

RELEVANT AGREEMENTS, LAWS, PLANS, RULES, AND REGULATIONS

The following plans, rules, and practices have guided this project's planning and/or will be implemented during project activities: *DNRC Forest Management Rules (ARMs)*, *DNRC Forested Trust Lands Final Environmental Impact Statement and Habitat Conservation Plan (USFWS and DNRC 2010)*, *SVGBCA*, *Endangered Species Act*, *Migratory Bird Treaty Act*, and *Bald and Golden Eagle Protection Act*.

COARSE FILTER WILDLIFE ANALYSIS

OLD-GROWTH

Issue: The proposed activities could affect wildlife species associated with old-growth forests by reducing the acreage of available habitat and increasing fragmentation.

Introduction

Old-growth forest stands typically contain various combinations of large old trees, abundant snags and downed logs, and multiple canopy layers, which are typically not found in young forests. These attributes provide structures used by a diversity of wildlife species. The diversity of species and the complexity of interactions between them can be different than in earlier successional stages (*Warren 1990*). Thus, old-growth forests provide habitat and functions important for maintaining biological diversity. Of the 48 old-growth associated species occurring in the Northern Rockies, about 60 percent may require stands larger than 80 acres (*Harger 1978*). Smaller patches may be unsuitable for wildlife species with large home ranges. Additionally, small, less-mobile species may be at greater risk of local extinction in small patches. Timber harvest can affect the size, availability, and spatial juxtaposition of old-growth stands, which in turn may cause displacement of old-growth associated species. Additionally, local extinction of small, less-mobile old-growth associated wildlife species may occur at the stand-level scale.

Analysis Areas

The analysis area for direct and indirect effects is the 19,437-acre Project Area. Cumulative effects were analyzed at the landscape scale of the 65,853-acre Coarse Filter CEAA to provide an appropriate expanded scale comprised predominantly of DNRC-managed lands, and to provide consistency with the discussion in *VEGETATION ANALYSIS*. The analysis areas are described in *TABLE III-45* and depicted in *FIGURE III-21*.

Analysis Methods

Old-growth forest patches were identified using tree size, age, and patch size as described in the *OLD-GROWTH* section of the *VEGETATION ANALYSIS.* Changes in the total acres of old-growth, as well as the number of patches greater than 80 acres, were assessed in the Project Area and the Coarse Filter CEAA. Factors considered in the analysis include: 1) the level of harvesting, 2) the abundance of old-growth, and 3) the abundance of patches ≥80 acres.

Existing Environment

The Project Area contains 2,637 acres of old-growth (13.6 percent of Project Area; 14.2 percent of forested stands) (*TABLE III-47*; see No-Action Alternative A for *EXISTING CONDITIONS*). The majority of old-growth is concentrated between the Main Woodward and South Woodward drainages with other small patches scattered across the Project Area. However, many of the old-growth patches in the Project Area share some of their boundaries with mature, dense forests. In these cases, the effective patch size for old-growth associated species is likely larger than for patches surrounded by younger-aged forest stands. These old-growth stands are primarily mixed conifer stands (2,235 acres).

The Coarse Filter CEAA contains 8,310 acres of old-growth on DNRC-managed lands (14.8 percent of DNRC-managed lands within the Coarse Filter CEAA; 15.3 percent of total DNRC-managed forested acreage) (*TABLE III-47;* see No-Action Alternative A for *EXISTING CONDITIONS*). Overall, the amount of old-growth in the Coarse Filter CEAA is difficult to quantify because little is known as to the potential amounts of old-growth on other ownerships, and approximations of very old age classes were not possible with aerial-photograph analysis. Various landowners have had differing approaches to the management of old-growth in the Coarse Filter CEAA, which has affected its abundance and spatial distribution. In general, the USFS has retained much of the old-growth acreages on its lands.

TABLE III-47 – OLD-GROWTH CHARACTERISTICS. *Estimated acreage and average patch size of old-growth stands that would remain post-harvest on DNRC-managed lands in the Project Area and the Coarse Filter CEAA.*

OLD-GROWTH ATTRIBUTE	*PROJECT AREA*			*COARSE FILTER CEAA*		
	NO-ACTION	*ACTION*		*NO-ACTION*	*ACTION*	
	A	*B*	*C*	*A*	*B*	*C*
Total acres of old-growth	2,637	1,865	2,242	8,310	7,538	7,915
Number of old-growth patches	37	41	38	125	130	126
Average patch size	71	45	59	67	58	63
Number of patches ≥80 acres	14	10	12	31	27	29
Average size of patches ≥80 acres	136	109	127	193	192	193

Maximum patch size	220	191	220	725	725	725

Environmental Effects

- ***Direct and Indirect Effects of No-Action Alternative A to Old-Growth***

None of the proposed forest management activities would occur. In the short term, no changes to the amounts, quality, or spatial arrangement of old-growth would occur. In the long term and in the absence of natural disturbance, the availability and connectivity of old-growth wildlife habitat may increase as stands mature. Thus, no adverse direct or indirect effects to old-growth associated wildlife would be anticipated as a result of No-Action Alternative A.

- ***Direct and Indirect Effects of Action Alternative B to Old-Growth***

Approximately 1,169 acres (44.3 percent) of the existing 2,637 acres of old-growth available in the Project Area would be harvested under Action Alternative B. Approximately 397 of these acres of old-growth would be treated with old-growth maintenance, group select, and shelterwood treatments. Overall, some old-growth structural attributes would be maintained in these stands, and they would continue to exceed the minimum threshold old-growth definitions described by Green et al. (*1992*) (see *VEGETATION ANALYSIS*). However, habitat quality would be reduced for wildlife species that prefer dense old-growth stands. The remaining 772 acres proposed for harvest would be treated with seed tree, overstory removal, and commercial thin treatments and these stands would not be considered old-growth post-harvest due to the low density of large-diameter trees; thus, 772 acres of old-growth habitat would be removed (*TABLE III-47*). Average patch size of old-growth stands would decrease from 71 acres to 45 acres (*TABLE III-47*). The number of old-growth patches ≥80 acres would decrease from 14 to 10 and the average size of these patches would decrease. Thus, since: 1) the abundance of old-growth would be reduced by 772 acres (29.3 percent of existing old-growth stands available in the Project Area); 2) stand density would decrease on 397 acres (15.1 percent of existing old-growth stands in the Project Area), which may adversely affect wildlife species that prefer dense old-growth stands; and 3) the abundance of patches ≥80 acres would be reduced by 4 patches and the average size of these patches would decrease by 27 acres; moderate adverse direct and indirect effects to old-growth associated wildlife species would be anticipated as a result of the Action Alternative B.

- ***Direct and Indirect Effects of Action Alternative C to Old-Growth***

Approximately 1,349 acres (51.2 percent) of the existing 2,637 acres of old-growth available in the Project Area would be harvested under Action Alternative C. A relatively small proportion of treated acres (395 acres) would not meet DNRC's old-growth definitions. Under Alternative C, old-growth maintenance (999 acres) would be emphasized and treated stands would have improved resiliency and sustainability for several decades following treatment, resulting in moderate beneficial effects. These acres would continue to exceed the minimum threshold old-growth definitions

described by Green et al. (*1992*) (see *VEGETATION ANALYSIS*). Average patch size would decrease from 71 acres to 59 acres (*TABLE III-47*). The number of old-growth patches ≥80 acres would decrease from 14 to 12 and the average size of these large patches would decrease. Thus, since: 1) the abundance of old-growth would be reduced by 395 acres (14.9 percent of existing old-growth stands available in the Project Area); 2) stand density would decrease on an additional 999 acres treated with maintenance treatments, increasing stand resiliency in these acres (37.8 percent of existing old-growth stands) and 3) the abundance of patches ≥80 acres would be reduced by 2 patches and the average size of these patches would decrease by 9 acres; minor adverse direct and indirect effects to old-growth associated wildlife species would be anticipated as a result of the Action Alternative C.

- ***Cumulative Effects of No-Action Alternative A to Old-Growth***

None of the proposed forest management activities would occur. In the short term, no changes to the amounts, quality, or spatial arrangement of old-growth would occur. In the long term and in the absence of natural disturbance, the availability and connectivity of old-growth wildlife habitat may increase as stands mature. Thus, no adverse cumulative effects to old-growth associated wildlife would be anticipated as a result of No-Action Alternative A.

- ***Cumulative Effects of Action Alternative B to Old-Growth***

Approximately 1,169 acres (14.1 percent) of the existing 8,310 acres of old-growth available in the Coarse Filter CEAA would be harvested under Action Alternative B. Approximately 397 of these acres of old-growth would be treated with old-growth maintenance, group select, and shelterwood treatments; old-growth structural attributes would be maintained in these stands, and they would continue to exceed the minimum threshold old-growth definitions described by *Green et al. (1992*) (see *VEGETATION ANALYSIS*). However, habitat quality would be reduced for wildlife species that prefer dense old-growth in these stands. The remaining 772 acres proposed for harvest would be treated with seed tree, overstory removal, and commercial thin treatments and would not be considered old-growth post-harvest due to the low density of large-diameter trees; thus, habitat would be removed where old-growth-associated wildlife species could successfully live and reproduce. Average patch size would decrease from 67 acres to 58 acres (*TABLE III-47*). The number of old-growth patches ≥80 acres would decrease by 4 patches and the average size of these large patches would decrease by 1 acre. Overall, approximately 7,538 acres of old-growth (13.4 percent of DNRC-managed lands in the Coarse Filter CEAA) would be retained across the Swan River State Forest (*TABLE III-47*). The proposed activities would be additive to completed and ongoing activities in the Coarse Filter CEAA (see *RELEVANT PAST, PRESENT, AND REASONABLY FORESEEABLE ACTIONS* in *CHAPTER I- PURPOSE AND NEED* for a complete list of DNRC projects and *TABLE III-2* for acreage of ongoing timber sales). The effects of these activities have been accounted for in this analysis. DNRC is not aware of any proposed or ongoing activities on other ownerships (*USFS 2017*). Thus, since: 1) the abundance of old-growth would be reduced by 772 acres (9.3 percent of existing old-growth stands

available in the Coarse Filter CEAA); 2) stand density would decrease on 397 acres (4.8 percent of existing old-growth stands), which may affect wildlife species that prefer dense old-growth stands; 3) the abundance of patches ≥80 acres would be reduced by 4 patches; and 4) old-growth would be retained on 13.4 percent of DNRC-managed lands in the Coarse Filter CEAA; minor adverse cumulative effects to old-growth associated wildlife species would be anticipated as a result of the Action Alternative B.

- ***Cumulative Effects of Action Alternative C to Old-Growth***

Approximately 1,349 acres (16.2 percent) of the existing 8,310 acres of old-growth available in the CEAA would be harvested under Action Alternative C. Approximately 999 of these acres of old-growth would be treated with old-growth maintenance and shelterwood treatments and these acres would continue to exceed the minimum threshold old-growth definitions described by *Green et al. (1992*) (see *VEGETATION ANALYSIS*). Stands treated with maintenance treatments would be expected to have improved resiliency and sustainability. However, habitat quality would be reduced for wildlife species that prefer dense old-growth stands. The remaining 395 acres of old-growth proposed for harvest would be treated with seed tree and clearcut treatments and these stands would not be considered old-growth post-harvest due to the low density of large-diameter trees; thus, habitat would be temporarily removed where old-growth-associated wildlife species could successfully live and reproduce in these stands. Average patch size would decrease from 67 acres to 63 acres (*TABLE III-3*). The number of old-growth patches ≥80 acres would decrease by 2 patches, but the average size of these large patches would not be affected. Overall, approximately 7,915 acres of old-growth (14.1 percent of DNRC-managed lands in the Coarse Filter CEAA) would be retained across the Swan River State Forest (*TABLE III-3*). The proposed activities would be additive to completed and ongoing activities in the Coarse Filter CEAA (see *RELEVANT PAST, PRESENT, AND REASONABLY FORESEEABLE ACTIONS* in *CHAPTER I- PURPOSE AND NEED* for a complete list of DNRC projects and *TABLE III-46* for acreage of ongoing timber sales). The effects of these activities have been accounted for in this analysis. DNRC is not aware of any proposed or ongoing activities on other ownerships (*USFS 2017*). Thus, since: 1) the abundance of old-growth would be reduced by 395 acres (4.7 percent of existing old-growth stands available in the Coarse Filter CEAA); 2) stand density would decrease on 999 acres (12.0 percent of existing old-growth stands in the Coarse Filter CEAA), increasing stand resiliency in these acres; 3) the abundance of patches ≥80 acres would be reduced by 2 patches; and 4) old-growth would be retained on 14.1 percent of DNRC-managed lands in the Coarse Filter CEAA; minor adverse cumulative effects to old-growth associated wildlife species would be anticipated as a result of the Action Alternative C.

COVER TYPES

Issue: The proposed activities could result in changes in the distribution of cover types on the landscape, which could affect wildlife.

Introduction

Forest cover types provide important habitat attributes for some wildlife species. While some wildlife species are relatively unaffected by cover type (e.g., coyote), others are strongly associated with specific cover types (e.g., flammulated owl). Preferences by some species for specific cover types may reflect a direct relationship between the wildlife species and the vegetation, but often the relationship results from the preference for characteristics associated with the cover type. For example, drier cover types, such as ponderosa pine, are typically associated with a more-open, grassy understory that may provide important foraging areas for wintering ungulates or open hunting areas for species such as the flammulated owl (*Linkhart and McCallum 2013*). In contrast, subalpine fir and spruce forests typically support a dense understory structure that is favored by snowshoe hares and Canada lynx (*Hodges 2000, Squires et al. 2010*). Forest management considerations for wildlife include providing an appropriate diversity of cover types similar to proportions historically present on the Swan River State Forest (*ARM 36.11.405*).

Analysis Areas

The analysis area for direct and indirect effects is the 19,437-acre Project Area (*FIGURE III-21*). To provide an appropriate, expanded biological scale and consistency with the discussion in *VEGETATION ANALYSIS*, cumulative effects were analyzed within the 65,853-acre Coarse Filter CEAA. The analysis areas are described in *TABLE III-45* and depicted in *FIGURE III-21*.

Analysis Methods

The percentage of each major cover type in the Project Area was assessed using *SLI* data (see *COVER TYPE* in the *VEGETATION ANALYSIS* for additional information). On other ownerships in the Coarse Filter CEAA, USFS *Vmap v12* (*2012*) stand data were used to estimate acreage of dominant cover types. Factors considered in the analysis include: 1) the level of harvesting, and 2) resulting changes in cover types.

Existing Environment

Cover type distributions within the Project Area continue to be skewed from desired future conditions and what would have been expected before European settlement of the area due to the effects of fire suppression, logging, white-pine blister rust, and grazing (*Upper Flathead Climatic Section M333C*, *Losensky 1997*). Currently, mixed-conifer shade-tolerant forest types are overrepresented by 35.7 percent, while western larch/Douglas-fir and western white pine are underrepresented by 20.6 percent and 19.7 percent, respectively (see *COVER TYPE* tables in *VEGETATION ANALYSIS*). This variation from desired future conditions may benefit species such as lynx, which prefer

shade-tolerant forest types, but results in reduced habitat availability for species like flammulated owls that prefer open stands of seral tree species.

Within DNRC-managed lands in the Coarse Filter CEAA, cover type distributions are also out of proportion compared to desired future conditions based on historic cover types (see also *COVER TYPE* tables in *VEGETATION ANALYSIS*). At the forest-wide scale, mixed-conifer cover types are overrepresented by 32.6 percent, while western larch/Douglas-fir and western white pine cover types are underrepresented by 20.4 percent and 18.9 percent, respectively. These conditions likely lead to increased habitat availability and quality for species that use dense stands that include a variety of shade-tolerant and shade-intolerant tree species, while providing less habitat for species that use open stands dominated by shade-intolerant tree species. On lands managed by other land owners in the CEAA, forest stands are dominated by Douglas-fir, lodgepole pine, and western larch (*USFS Vmap data, 2012*).

Environmental Effects

- ***Direct and Indirect Effects of No-Action Alternative A to Cover Types***

In the short term, minimal changes in cover types would be expected. However, over the next several decades, shade-intolerant trees may be replaced by shade-tolerant species, which would lead to an increasing deviation from desired future conditions. Over time, this could lead to a reduction in habitat for species associated with cover types dominated by shade-intolerant tree species. For example, shade-intolerant western larch trees are preferred nest trees for pileated woodpeckers (*Bull and Jackson 2011*). Conversely, species that are associated with shade-tolerant habitat types would benefit from increased habitat availability. Therefore, the effects of this alternative in the absence of natural disturbances could result in localized adverse effects to wildlife species that are closely associated with shade-intolerant cover types.

- ***Direct and Indirect Effects of Action Alternatives B and C to Cover Types***

Action Alternatives B and C would involve cover type conversions on 1,580 and 1,701 acres in the Project Area, respectively (see *COVER TYPE* in the *VEGETATION ANALYSIS* section). The majority of these stands are currently mixed-conifer cover types that would be converted to western larch/Douglas-fir and western white pine cover types, increasing the similarity of cover type proportions in the Project Area to desired future conditions based on historic conditions. Action Alternative B would increase the availability of western larch/Douglas-fir and western white pine cover types in the Project Area by 3.9 percent and 4.2 percent, respectively, while Action Alternative C would increase the availability of these cover types by 3.8 percent and 5.4 percent, respectively. Both action alternatives would improve and maintain habitat quality for species associated with shade-intolerant cover types, although stand density may be too low for some wildlife species in stands treated with regeneration treatments. However, species associated with shade-tolerant cover types would be adversely affected by

habitat loss. Thus, since: 1) wildlife species associated with shade-tolerant cover types would be adversely affected, while species associated with shade-intolerant cover types would be positively affected by both alternatives; and 2) both alternatives would move cover type proportions in the Project Area toward desired future conditions, which is an important aspect of maintaining biodiversity; minor beneficial direct and indirect effects associated with cover type availability for wildlife habitat would be anticipated as a result of Action Alternatives B and C.

- ***Cumulative Effects of No-Action Alternative A to Cover Types***

In the short term, changes in cover type would not occur and proportions of mixed-conifer cover types would remain high on DNRC-managed lands in the Coarse Filter CEAA. Over time and in the absence of severe natural disturbances, gradual cumulative increases in the proportion of shade-tolerant cover types would occur on DNRC-managed lands in the Coarse Filter CEAA, skewing cover type proportions further from desired future conditions. Wildlife species associated with shade-intolerant species may be adversely affected. Conversely, species that are associated with shade-tolerant habitat types would benefit from increased habitat availability. Such cumulative shifts could be additive to similar changes occurring on neighboring ownerships.

- ***Cumulative Effects of Action Alternatives B and C to Cover Types***

The proposed activities would address deviations from desired future conditions based on historic cover type proportions in the Coarse Filter CEAA by increasing the availability of western larch/Douglas-fir and western white pine cover types by 1.3 percent and 1.4 percent, respectively, under Action Alternative B or 1.3 percent and 1.8 percent, respectively, under Action Alternative C. These cover types are currently underrepresented across the CEAA. Forest management activities that have occurred over the last several decades within the Coarse Filter CEAA have contributed to a cumulative increasing trend in the abundance of seral forest cover types, although these cover types are still underrepresented compared to historic conditions. Anticipated shifts in cover type abundance associated with any of the action alternatives would be additive to past actions that have occurred in the Coarse Filter CEAA, including those recently managed as corporate timberlands. The proposed activities would be additive to past and ongoing activities in the Coarse Filter CEAA (see *RELEVANT PAST, PRESENT, AND REASONABLY FORESEEABLE ACTIONS* in *CHAPTER I- PURPOSE AND NEED* for a complete list of projects and *TABLE III-2* for acreage of ongoing DNRC timber sales). All changes to cover types resulting from DNRC activities have been accounted for in this analysis. The USFS has no plans in the foreseeable future to manage timber in the Coarse Filter CEAA and DNRC is unaware of any activities on neighboring ownerships (*USFS 2017*). In general, wildlife species that evolved under historic disturbance regimes would benefit from the changes in cover type distributions to a similar degree under both action alternatives. Thus, since: 1) wildlife species associated with shade-tolerant cover types would be adversely affected, while species associated with shade-intolerant cover types would be positively affected by both

alternatives; and 2) both alternatives would move cover type proportions in the CEAA toward desired future conditions, which is an important aspect of maintaining biodiversity; minor beneficial cumulative effects associated with cover type availability for wildlife habitat would be anticipated as a result of Action Alternatives B and C.

AGE CLASS

Issue: The proposed activities could alter the representation of stand age classes on the landscape, which could adversely affect wildlife.

Introduction

Forest stand age class is an important component of wildlife habitat that enhances ecological complexity and biodiversity. Old stands often contain large decaying trees that provide a substrate for nesting, resting, and roosting sites for birds and mammals. For example, brown creepers (*Certhia americana*) nest under the bark of large Douglas-fir and ponderosa pine trees (*Poulin et al. 2013*). However, young stands provide access to a high availability of nutritious browse plants for a variety of species. Some wildlife species, such as the snowshoe hare, can be found in younger stands of regenerating trees, as well as mature forest stands with dense structure, but are not typically found in mid-successional stands with open forest understory vegetation (*Hodges 2000*).

Analysis Areas

The analysis area for direct and indirect effects is the 19,437-acre Project Area. Cumulative effects were analyzed at the scale of the 65,853-acre Coarse Filter CEAA to provide an appropriate, expanded biological scale for analysis and consistency with the discussion in *VEGETATION ANALYSIS*. The analysis areas are described in *TABLE III-45* and depicted in *FIGURE III-21*.

Analysis Methods

To provide an appropriate diversity of forest stands to support wildlife species, DNRC considers historic proportions and distributions of age classes (*ARM 36.11.404*). For this analysis, SLI data was used to categorize stands as seedling-sapling (0 to 39 years), poletimber (40 to 99 years), and mature stands (100 to 149 years and 150 years and greater) (see *AGE CLASSES* in *VEGETATION ANALYSIS* for additional information). To estimate age class categories on these on other ownerships, tree size class data from USFS *Vmap v12* (*2012*) stand data was examined. Factors considered in the analysis include: 1) proposed treatment types, and 2) the change in acreage of forest age classes.

Existing Environment

Compared to the historical distribution of age classes for the *Upper Flathead Climatic Section* (*M333C, Losensky 1997*), stands in the seedling-sapling age class are underrepresented by 2.1 percent, and stands in the poletimber age class are

overrepresented by 31.3 percent. Stands in the 100- to 149-year age class are slightly underrepresented compared to historic conditions by 5.5 percent, and old forests greater than 150 years are underrepresented by approximately 9.7 percent (see *AGE CLASSES* in the *VEGETATION ANALYSIS*). Skewed age class distributions are due in part to the high proportion of recently acquired Plum Creek Timber Company lands, which typically contain younger age classes, in the Project Area.

DNRC manages the majority of the Coarse Filter CEAA (85.3 percent), with the USFS (7.9 percent), DFWP (3.4 percent) and private landowners (3.5 percent) managing the remaining acres. Age class distributions in the Coarse Filter CEAA indicates that there is a low proportion of the seedling-sapling (0-to-39-year) age class, excess in the poletimber (40-to-99-year) age class, and mature (100-years-plus) age classes are underrepresented (see *AGE CLASSES* in the *VEGETATION ANALYSIS*). Stands in the seedling-sapling age class are underrepresented by 7.9 percent, and stands in the poletimber age class are overrepresented by 26.7 percent. Stands in the 100- to 149-year age class are slightly underrepresented compared to historic conditions by 1.1 percent and old forests greater than 150 years old are underrepresented by approximately 3.7 percent. On other ownerships in the Coarse Filter CEAA, approximately 3,298 acres consist of stands that are ≥10-inches dbh and may be ≥100 years old (*USFS Vmap data, 2012*). The remaining 6,406 acres on other ownerships consist of relatively young stands (≤9.9-inches dbh), and stands that are dominated by shrubs or herbaceous plants, deciduous stands, and sparsely vegetated stands.

Environmental Effects

- ***Direct and Indirect Effects of No-Action Alternative A to Age Class***

In the short term, no effects on age class proportions would be expected. In the long term and in the absence of natural disturbances, the proportion of older to younger stands would increase, closely resembling the historic age class distribution for several decades. However, as forest stands would continue to age through time, younger age classes would become absent without some form of disturbance to regenerate them. Thus, after an extended period, wildlife species associated with young forest conditions would likely experience localized reductions in habitat availability. Conversely, wildlife species associated with mature forest would benefit from increased habitat availability and connectivity.

- ***Direct and Indirect Effects of Action Alternatives B and C to Age Class***

Action Alternatives B and C would involve regeneration harvests that would convert older-aged stands to the seedling-sapling age class. Harvest would increase the availability of seedling-sapling stands by 1,523 acres or 982 acres, increasing the percentage of this age class across the Project Area by 8.2 percent or 5.3 percent under Action Alternatives B and C, respectively (see AGE *CLASSES* in the *VEGETATION ANALYSIS*). Under both alternatives, the percentage of older stands (≥150 years) in the

Project Area would decrease by 5.0 percent and 2.5 percent under Action Alternatives B and C, respectively. The proposed treatments could cause adverse effects for 30 to 50 years to wildlife species that prefer mature forest conditions, while wildlife species that use early successional forests would benefit from an increase in habitat availability for approximately 30 years. Thus, since: 1) the availability of young age classes would increase by 1,729 acres (to 72.4 percent of the Project Area) or 1,063 acres (to 69.5 percent of the Project Area) under Alternatives B and C, respectively; and 2) the availability of older age classes (≥150 years) would decrease by 1,522 acres (to 27.6 percent of the Project Area) or 983 acres (to 30.5 percent of the Project Area) under Action Alternatives B and C, respectively, causing further departures from historic proportions of older stands; moderate adverse direct or indirect effects associated with age class distributions and wildlife habitat would be anticipated under Action Alternatives B and C with Action Alternative B having a greater level of adverse effects.

- ***Cumulative Effects of No-Action Alternative A to Age Class***

In the short term, no cumulative effects associated with age class would occur. Over the long term (i.e., several decades) as forest stands age and succession continues, adverse effects to wildlife species associated with younger age classes could occur and beneficial effects to wildlife associated with older age classes could occur. However, natural disturbance, if it occurs, may mitigate these adverse effects.

- ***Cumulative Effects of Action Alternatives B and C to Age Class***

Both action alternatives would increase the proportion of younger age classes, while decreasing the proportion of existing mature to old stands causing further deviations from historic age class distributions. These effects would be additive to completed and ongoing activities (see *RELEVANT PAST, PRESENT, AND REASONABLY FORESEEABLE ACTIONS* in *CHAPTER I- PURPOSE AND NEED* for a complete list of DNRC projects and *TABLE III-2* for acreage of ongoing timber sales). DNRC is unaware of any proposed or ongoing projects on other ownerships (*USFS 2017*). Thus, since 1) the availability of young age classes would increase above historical age class distributions by 1,523 acres or (to 56.5 percent of the Coarse Filter CEAA) or 982 acres (to 55.6 percent of the Coarse Filter CEAA) under Action Alternatives B and C respectively; and 2) the availability of older age classes (≥150 years) would decrease below historic proportions by 1,522 acres (to 43.4 percent of the Coarse Filter CEAA) or 983 acres (to 44.4 percent of the Coarse Filter CEAA) under Action Alternatives B and C respectively; minor adverse cumulative effects associated with age class distributions and wildlife habitat would be anticipated under Action Alternatives B and C.

HABITAT CONNECTIVITY AND FRAGMENTATION

Issue: The proposed activities could result in disturbance or alteration of forested corridors and connectivity, which could inhibit wildlife movements.

Introduction

Connectivity of forest cover between adjacent patches is important for promoting movements of species that are hesitant to cross nonforested expanses. Effective corridors tend to be relatively wide, unfragmented, diverse, and associated with riparian areas or ridges (*Fischer and Fischenich 2000*). In general, wider corridors are more effective and provide connectivity for more wildlife species than a narrower corridor. Narrow corridors can provide some connectivity, particularly for small mammals and amphibians; however, they can also act as funnels that increase predator efficiency (*Groom et al. 1999*). Wildlife movement may be adversely affected when habitat fragmentation, a landscape-level process in which a specific habitat is progressively subdivided into smaller and more isolated patches occurs (*McGarigal and Cushman 2002*). Historically, wildfires were the primary disturbance factor that shaped the forests of western Montana (*Fischer and Bradley 1987, Arno et al. 1995, Losensky 1997*). Thus, substantial portions of forested landscapes were fragmented naturally by young forests or nonforested habitat (*Gruell 1983, Hart 1994*), and many species native to Montana evolved under conditions where habitat occurred in relatively small, isolated patches. Timber harvest can also fragment dense forested habitat and decrease patch size and shape. Forest management considerations to mitigate adverse effects to habitat connectivity include limiting the creation of small habitat islands that may cause localized extinctions of small subpopulations, treating and retaining fewer larger patches rather than many small patches, and reducing edge (boundary between habitats perceived by an organism to be different from one another) to reduce potential for nest parasitism and predation associated with edge habitat.

Analysis Areas

The analysis area for direct and indirect effects is the 19,437-acre Project Area. Cumulative effects were analyzed at the scale of the 65,853-acre Coarse Filter CEAA to provide consistency with the discussion in *VEGETATION ANALYSIS*. The analysis areas are described in *TABLE III-45* and depicted in *FIGURE III-21*.

Analysis Methods

Connective forest was identified using current DNRC *SLI* data, *USDA USFS VMap 2012 data*, and *National Agriculture Imagery Program (NAIP)* aerial imagery. Connective forest was defined as pole and sawtimber stands with moderate to closed canopies (40- to 100-percent canopy cover) greater than 300 feet wide (*ARM 36.11.403(20)(b)*). Stands meeting these requirements were assumed to provide conditions that would facilitate movement of wildlife species in the area. Factors considered in the analysis include: 1) the level of harvesting, 2) the availability of connected forest, 3) average patch size, 4) and forest edge.

Existing Environment

The Project Area contains 9,979 acres of connective forest habitat that would facilitate movement for forest-associated wildlife (*TABLE III-4;* see No-Action Alternative A for *EXISTING CONDITIONS)*. Very few of these acres occur as isolated patches and

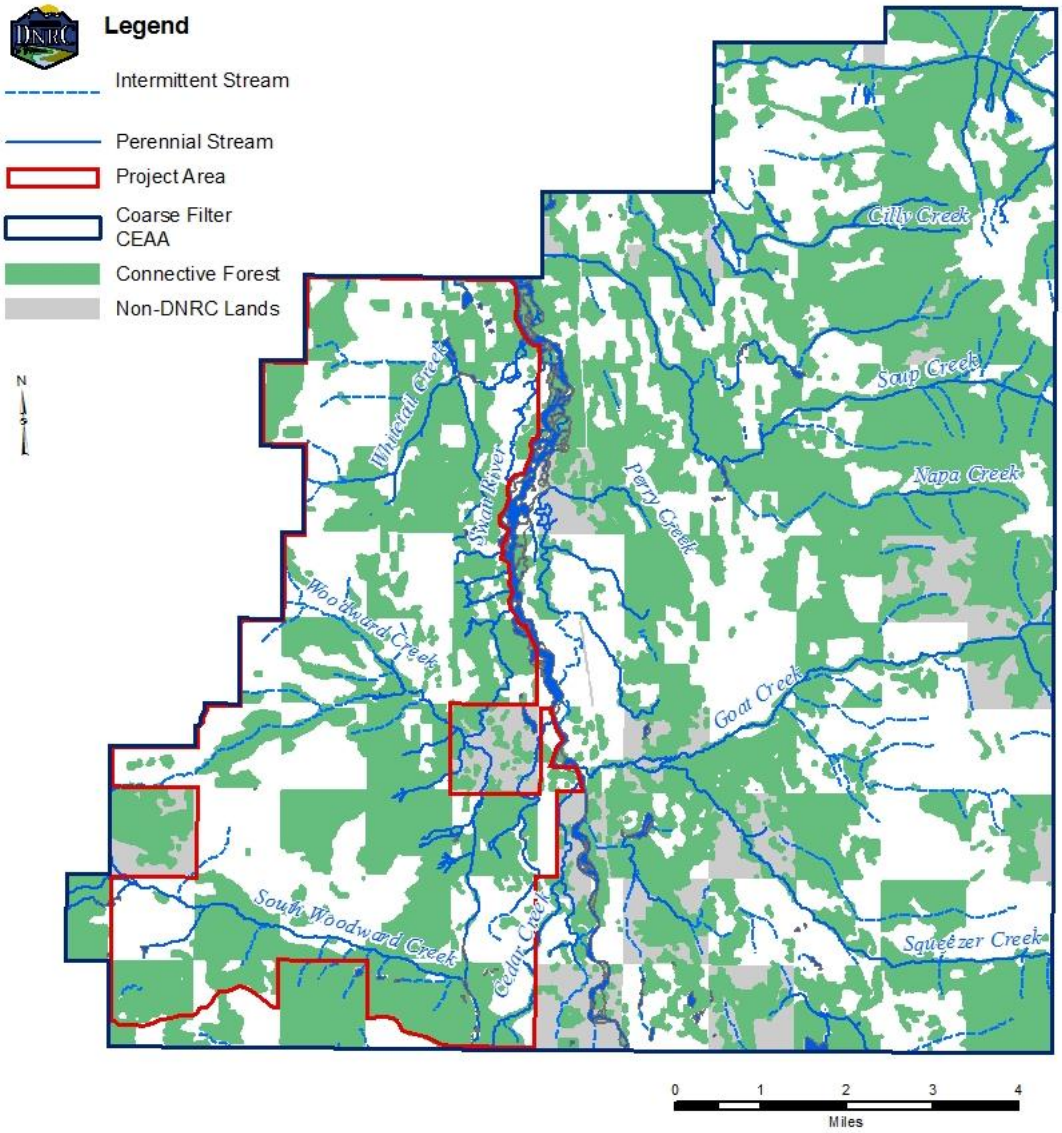
connectivity throughout the major drainages and across DNRC-managed lands on the Swan River State Forest is relatively high, although connective forest availability is low on lands that were formerly private industrial timberland (*FIGURE III-12*). There are also several gaps in connective forest habitat along creeks in the Project Area due to the presence of many wet meadows.

The Coarse Filter CEAA contains approximately 35,574 acres of connective forest that would facilitate movement of forest-associated wildlife (*TABLE III-48;* see No-Action Alternative A for *EXISTING CONDITIONS)*. Throughout the Coarse Filter CEAA, connectivity of mature forest has been diminished in places due largely to the scattered ownership patterns where private industrial timberlands with large harvest units are interspersed with DNRC-managed and USFS lands (*FIGURE III-22*). Additional gaps occur where natural openings (wet meadows, brush fields, and avalanche chutes) reduce patch width below 300 feet. In most cases, these openings contain at least some horizontal cover from shrubs or regenerating trees, thereby providing some structure usable by some species of wildlife.

TABLE III-48 – CONNECTIVE FOREST. *Changes in connective forest habitat, patch size, and forest edge length in the Project Area and the Coarse Filter CEAA. The connective forest removed statistic accounts for direct removal of cover as well as stands that would not meet the 300-foot minimum patch width requirement post-harvest.*

CONNECTIVE FOREST PARAMETER	PROJECT AREA			COARSE FILTER CEAA		
	NO-ACTION	ACTION		NO-ACTION	ACTION	
	A	B	C	A	B	C
Connective forest habitat affected (percent of available habitat)	0 (0.0)	2,537 (25.4)	3,103 (31.1)	0 (0.0)	2,537 (7.1)	3,103 (8.7)
Connective forest removed (percent of available habitat)	0 (0.0)	1,680 (16.8)	1,503 (15.1)	0 (0.0)	1,686 (4.7)	1,508 (4.2)
Average patch size (percent decrease in patch size)	169 (0.0)	117 (30.8)	116 (31.4)	176 (0.0)	152 (13.6)	151 (14.2)
Miles of edge (percent change in edge habitat)	148 (0.0)	149 (0.7)	150 (1.4)	522 (0.0)	524 (0.4)	525 (0.6)
Total connective forest habitat post-harvest (percent of analysis area)	9,979 (51.3)	8,299 (*42.7*)	*8,476* (*43.6*)	35,574 (54.0)	*33,888* (*51.5*)	*34,066* (*51.7*)

FIGURE III-22. NO-ACTION ALTERNATIVE A CONNECTIVITY. *Existing patches of forest cover that provide connectivity for wildlife species in the Project Area and Coarse Filter CEAA. Non-cover areas on non-DNRC-managed lands are shaded gray.*



Environmental Effects

- ***Direct and Indirect Effects of No-Action Alternative A to Habitat Connectivity and Fragmentation***

None of the proposed forest management activities would occur. In the short-term, no changes to forest connectivity or habitat fragmentation would occur. In the long term

and in the absence of natural disturbance, connectivity would increase and fragmentation would decrease as stands mature.

- ***Direct and Indirect Effects of Action Alternatives B and C to Habitat Connectivity and Fragmentation***

Approximately 2,537 or 3,103 acres of connective forest would be harvested under Action Alternatives B and C, respectively (*TABLE III-48*). Post-harvest a portion of these acres would retain a minimum of 40 percent canopy cover and would continue providing connective forest habitat. Approximately 1,607 acres (Alternative B) or 1,448 acres (Alternative C) would retain less than 40 percent canopy cover, which in turn would cause additional acres (1,680 acres total Alternative B; 1,503 acres total Alternative C) to no longer meet the 300-foot minimum width requirement. Overall, Action Alternative B would have slightly greater adverse effects to connective forest due to a higher level of removal of connective forest. Following logging, 8,299 acres (42.7 percent of the Project Area) or 8,476 acres (43.6 percent of the Project Area) of forest patches meeting the minimum connective patch criteria would be retained (*TABLE III-48*). Average patch size of connective forest would decrease by 30.8 to 31.4 percent and total edge would slightly increase (*TABLE III-48*). After harvest, forest patches in the Project Area would continue to have variable tree density and would continue to provide a mosaic of habitat conditions, and moderate to dense patches of mature forest cover would generally remain well-represented and connected (*FIGURES III-23 and III-48*). However, proposed reductions in the amount of moderate to dense forest and reduced patch sizes would be expected to inhibit movements of interior forest species in some localized areas in the Project Area. Thus, since: 1) connectivity would be maintained along the major drainages and along ridgelines where cover is available; 2) connective forest habitat would be reduced by 1,680 acres (Alternative B, 16.8 percent of existing connective forest in the Project Area) or 1,503 acres (Alternative C, 15.1 percent of existing connective forest in the Project Area); 3) connective forest would remain in 42.7 percent (Alternative B) or 43.6 percent (Alternative C) of the Project Area; 4) average patch size would be reduced by 30.8 percent (Alternative B) or 31.4 percent (Alternative C); and 5) forest edge would increase by 0.7 percent (Alternative B) or 1.4 percent (Alternative C); moderate adverse direct and indirect effects to wildlife habitat connectivity or fragmentation would be anticipated. These effects would be associated with reductions in habitat quality and potential for impeded movements across the Project Area associated with reduced levels of cover, smaller patch sizes, and patch fragmentation in localized areas.

FIGURE III-23 – ACTION ALTERNATIVE B CONNECTIVITY. *Patches of forest cover that would provide habitat connectivity for wildlife in the Project Area and Coarse Filter CEAA following implementation of Action Alternative B. Non-cover areas on non-DNRC-managed-lands are shaded gray.*

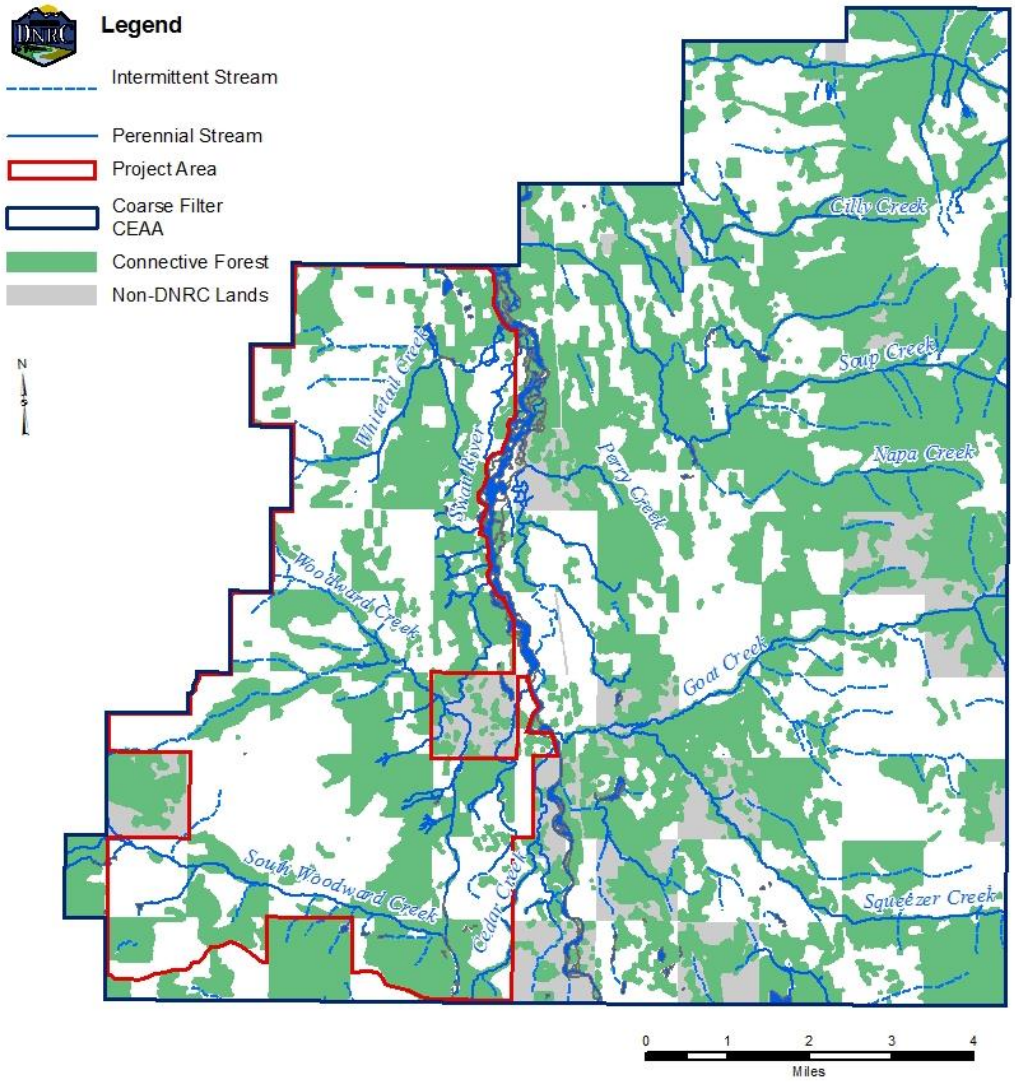
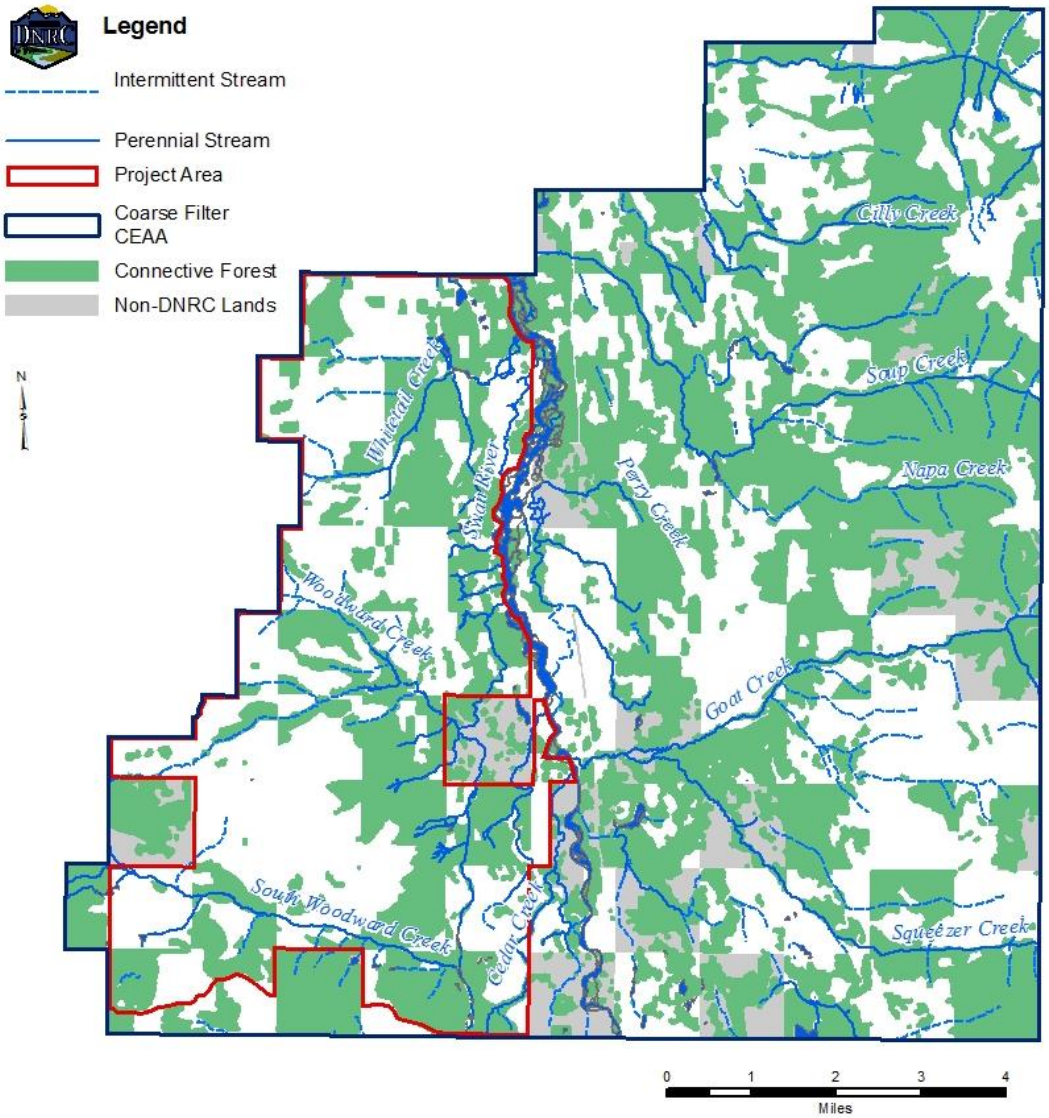


FIGURE III-24 – ACTION ALTERNATIVE C CONNECTIVITY. *Patches of forest cover that would provide habitat connectivity for wildlife in the Project Area and CEAA following implementation of Action Alternative C. Non-cover areas on non-DNRC-managed lands are shaded gray.*



- ***Cumulative Effects of No-Action Alternative A to Habitat Connectivity and Fragmentation***

None of the proposed forest management activities would occur on DNRC-managed lands. In the short term, no changes in forest connectivity or habitat fragmentation would be expected as no harvesting would occur. In the long term, connectivity of forest habitat would improve in the absence of natural disturbance or forest management activities on other ownerships.

- ***Cumulative Effects of Action Alternatives B and C to Habitat Connectivity and Fragmentation***

Approximately 2,537 or 3,103 acres of connective forest would be harvested under Action Alternatives B and C, respectively (*TABLE III-48*). Of these acres, post-harvest approximately 1,607 acres (Alternative B) or 1,448 acres (Alternative C) would retain less than 40 percent canopy cover, which in turn would cause additional acres (1,686 acres total Alternative B; 1,508 acres total Alternative C) to no longer meet the 300-foot minimum width requirement. The remaining acres proposed for harvest would continue providing connective forest habitat, albeit at a reduced stand density. Overall, Action Alternative B would have slightly greater adverse effects to connective forest due to a higher level of removal of connective forest. Following logging, 33,888 acres (51.5-percent of the CEAA) or 34,066 acres (51.7 percent of the CEAA) of forest patches meeting the minimum connective patch criteria would be retained (*TABLE III-48*). Average patch size of connective forest would decrease by 13.6 to 14.2 percent and total edge would slightly increase (*TABLE III-48*). After harvest, forest patches in the CEAA would continue to have variable tree density and would continue to provide a mosaic of habitat conditions, and moderate to dense patches of mature forest cover would generally remain well-represented and connected (*FIGURES III-23 and III-24*). However, proposed reductions in the amount of moderate to dense forest and reduced patch sizes would be expected to inhibit movements of interior forest species in portions of the CEAA. The proposed activities would be additive to completed and ongoing activities in the Coarse Filter CEAA (see *RELEVANT PAST, PRESENT, AND REASONABLY FORESEEABLE ACTIONS* in *CHAPTER I- PURPOSE AND NEED* for a complete list of DNRC projects and *TABLE III-2* for acreage of ongoing timber sales). The effects of these activities have been accounted for in this analysis. DNRC is not aware of any proposed or ongoing activities on other ownerships (*USFS 2017*). Thus, since: 1) connectivity would be maintained along the major drainages and along ridgelines where cover is available; 2) connective forest habitat would be reduced by 1,686 acres (Alternative B, 4.7 percent reduction of existing connective forest in the CEAA) or 1,508 acres (Alternative B, 4.2 percent reduction of existing connective forest in the CEAA); 3) connective forest would remain in 51.5 percent (Alternative B) or 51.7 percent (Alternative C) of the Project Area; 4) average patch size would be reduced by 13.6 percent (Alternative B) or 14.2 percent (Alternative C); and 5) forest edge would increase by 0.4 percent (Alternative B) or 0.6 percent (Alternative C); minor adverse cumulative effects to wildlife habitat connectivity or fragmentation would be anticipated. These effects would be associated with reductions in habitat quality and potential for impeded movements across the CEAA associated with reduced levels of cover, smaller patch sizes, and patch fragmentation in localized areas.

LINKAGE

Issue: The proposed activities could increase open road densities, increase human developments, and reduce forested cover, which could adversely affect linkage habitat for wildlife.

Introduction

Linkage zones are defined as 'the area between larger blocks of habitat where animals can live at certain seasons and where they can find the security they need to successfully move between these larger habitat blocks' (*Servheen et al. 2003*). Linkage zones differ from corridors in that the area is not just used for travel. Areas appropriate for linkage zones can occur at different spatial scales, particularly when considering the species of concern. For example, a linkage zone for a stream-breeding salamander may be the upland habitat between two first-order streams, whereas the linkage zone for a grizzly bear may be the large valley bottom between two mountain ranges. Increased linkage potential is found in areas with lower road densities, low densities of human-developed sites, higher vegetative hiding cover, and abundant riparian areas (*Servheen et al. 2003*). In this analysis, linkage is discussed in terms of factors that would allow linkage for a variety of small, medium, and large wide-ranging terrestrial wildlife species, including grizzly bears.

Analysis Areas

The analysis area for direct and indirect effects is the 19,437-acre Project Area (*TABLE III-45, FIGURE III-21*). Because large terrestrial species were used as focal species for determining the effects of the proposed project to linkage, the 65,853-acre Coarse Filter CEAA was used to analyze cumulative effects of the proposed alternatives. The CEAA provides linkage between the Mission Mountains to the west and the Swan Valley bottom to the east as described in the *SVGBCA (1995)*.

Analysis Methods

Three measurement criteria were used to assess existing and predicted future-linkage potential under each alternative: 1) open-road densities (calculated using simple linear miles per square mile), 2) a qualitative assessment of human development, and 3) vegetative cover in the analysis areas and within grizzly bear linkage zones as described in the *SVGBCA (1995)*. Vegetative hiding cover was considered vegetation patches capable of hiding 90 percent or more of a large mammal at 200 feet and had to be at least 300 feet wide (*DNRC 2015*). On non-DNRC-managed lands a conservative measure of mature or pole-sized connective forest with ≥40 percent crown closure was considered to provide hiding cover.

Existing Environment

The Project Area contains 14,066 acres of vegetative cover, a portion of which is located in grizzly bear linkage zone habitat as identified in the *SVGBCA (1995)* (72.4 percent of the Project Area; *TABLE III-49*). Approximately 47.1 percent (9,157 acres) of the Project Area lies within the grizzly bear linkage zone located in the Whitetail Creek and

Woodward Creek drainages; special protective measures to limit disturbance in spring are in place in this area. In general, lands in the Project Area currently contribute to high-quality linkage habitat, as open-road densities in the Project Area are relatively low (0.6 miles per square mile), and human developments are relatively absent, which presents few hindrances to linkage. Additionally, riparian areas are abundant and heavily vegetated.

In the CEAA, linkage values are also high, though some existing features reduce linkage potential. The CEAA contains approximately 44,400 acres of vegetative cover, a portion of which is in linkage zones as identified in the *SVGBCA (1995)* (67.4 percent of the CEAA; *TABLE III-49*). Approximately 50.3 percent (33,185 acres) of the CEAA is in grizzly bear linkage zone habitat and most the CEAA, 56,149 acres (85.3 percent), is managed by DNRC. Highway 83, a narrow two-lane road with a 70-mph speed limit bisects the CEAA; this highway affects linkage potential as some species may be hesitant to cross a busy roadway and forest openings. Vehicle-related wildlife mortalities associated with Highway 83 in Swan Valley are common (particularly white-tailed deer). Open roads can degrade linkage value; however, open-road densities in the CEAA are relatively low at 0.7 miles per square mile. Human development is also relatively low in the CEAA, and most scattered homes and other buildings are located within 0.5 miles of Highway 83. Riparian areas are also abundant in the CEAA and are protected in accordance with the *SVGBCA, DNRC HCP*, and other state and federal regulations. Vegetative cover is also regulated by the *SVGBCA* and must remain at 40 percent or more in each grizzly bear subunit on cooperators' lands. Cover amounts have been influenced by logging over the last several decades on state, USFS, and previously-owned Plum Creek Timber Company lands. However, both the Project Area and the CEAA currently provide desirable linkage attributes for a variety of small, medium, and large wildlife species.

TABLE III-49 – LINKAGE HABITAT. *Changes in vegetative cover in the Project Area and the Coarse Filter CEAA. The "vegetative cover removed" parameter accounts for direct removal of cover as well as for stands that would not meet the 300-foot minimum patch width requirement post-harvest. Total vegetative cover remaining in linkage zones as described in the SVGBCA (1995) in each analysis area is also considered below.*

LINKAGE HABITAT PARAMETER	PROJECT AREA			COARSE FILTER CEAA		
	NO-ACTION	ACTION		NO-ACTION	ACTION	
	A	B	C	A	B	C
Vegetative cover affected (percent of available habitat)	0 (0.0)	2,555 (18.2)	3,078 (21.9)	0 (0.0)	2,555 (5.8)	3,078 (6.9)
Vegetative cover removed (percent of available habitat)	0 (0.0)	1,692 (12.0)	1,477 (10.5)	0 (0.0)	1,698 (3.8)	1,481 (3.3)
Total vegetative cover within linkage zones	6,155 (*67.2*)	5,712 (*62.4*)	*5,772* (*63.0*)	22,571 (*68.1*)	*22,126* (*66.7*)	*22,187* (*66.9*)

(percent of linkage zone in analysis area)						
Total vegetative cover post-harvest (percent of analysis area)	14,066 (72.4)	12,374 (*63.6*)	*12,589* (*64.8*)	44,400 (67.4)	*42,702* (*64.8*)	*42,919* (*65.2*)

Environmental Effects

- ***Direct and Indirect Effects of No-Action Alternative A to Habitat Linkage***

None of the proposed forest management activities would occur and road densities would not change. No changes in human development would occur in the Project Area, and forest vegetation would not be affected in the short term. In the long term and in the absence of natural disturbance, linkage may improve as vegetative cover matures.

- ***Direct and Indirect Effects of Action Alternatives B and C to Linkage***

Open road density would not change under both action alternatives. However, 12.8 or 16.0 miles of permanent restricted roads would be built in the Project Area under Action Alternatives B or C, respectively. Restricted roads do not allow motorized use by the public, but do permit administrative use and non-motorized public use. No additional human development would occur under either action alternative; thus, no additional effects to linkage associated with development would be anticipated. No harvest of riparian habitat is proposed under either action alternative and these areas would continue to provide important travel corridors. Vegetative cover would be affected on 2,555 acres (Action Alternative B) or 3,078 acres (Action Alternative C), which could deter movement or habitat use for species that prefer dense cover (*TABLE III-49)*. Of these acres, 1,636 acres or 1,442 acres would retain less than 40 percent canopy cover post-harvest under Action Alternatives B and C, respectively, and these acres would not provide vegetative cover post-harvest. The removal of these acres would cause some patches to become smaller than 300 feet wide and thus, post-harvest a total of 12,374 acres or 12,589 acres would continue providing vegetative cover under Action Alternatives B and C, respectively. Within the linkage zone, 5,712 (Alternative B) or 5,772 (Alternative C) acres of cover (approximately 62.4 to 63.0 percent of linkage zone within the Project Area) would remain after harvesting under Action Alternatives B and C. Thus, because: 1) long-term open-road densities would not increase, but road usage would temporarily increase along the haul route for 5 to 7 years; 2) no additional human dwellings would be developed under this proposal; 3) vegetative cover would decrease by 12.0 percent (Alternative B) or 10.5 percent (Alternative C) overall and 4.8 percent (Alternative B) or 4.2 percent (Alternative C) inside the linkage zone within the Project Area; moderate short-term and minor long-term negative effects to linkage habitat would be anticipated under either of the action alternatives considered.

- ***Cumulative Effects of No-Action Alternative A to Linkage***

None of the proposed activities would occur and no changes in road densities, human developments, or forest cover would occur on DNRC-managed lands in the CEAA.

Thus, no cumulative effects to wildlife linkage habitat would be anticipated. In the short term, no changes to linkage habitat would occur. In the long term and in the absence of natural disturbance or activity on other ownerships, linkage habitat may improve as stands mature and more cover develops over time.

- ***Cumulative Effects to Linkage Common to Action Alternatives B and C***

Under both action alternatives, long-term open-road densities would not increase in the CEAA. However, 12.8 or 16.0 miles of permanent restricted roads would be constructed with Action Alternatives B or C, respectively. Use of restricted roads would be expected to increase with both the administrative and commercial uses associated with both proposed action alternatives. No additional human development would occur under either action alternative; thus, no additional cumulative effects to linkage associated with development would be anticipated. Harvesting under these alternatives would have minimal effects to cover associated with riparian areas considering that no harvest of riparian habitat is proposed. Cover would be affected on 2,555 acres (Action Alternative B) or 3,078 acres (Action Alternative C) (*TABLE III-49)*. Of these acres, 1,636 acres (Action Alternative B) or 1,442 acres (Action Alternative C) of cover would retain less than 40 percent canopy cover and would no longer provide vegetative cover. Removal of these stands would cause additional areas not to meet the 300-foot width requirement so that post-harvest 42,702 acres (Alternative B) or 42,919 acres (Alternative C) of vegetative cover would remain post-harvest. Within the linkage zone inside the CEAA, approximately 22,126 acres (Alternative B) or 22,187 acres (Alternative B) of vegetative cover (66.7 to 66.9 percent of linkage zone within the CEAA) would remain post-harvest. Thus, because: 1) long-term open-road densities would not increase, but road usage would temporarily increase for 5 to 7 years, 2) no additional human dwellings would be developed under this proposal, 3) vegetative cover would decrease by 3.8 percent (Alternative B) or 3.3 percent (Alternative B) and 1.4 percent or 1.2 percent inside linkage zones within the CEAA, moderate short-term and minor long-term adverse effects to linkage habitat would be anticipated under either of the action alternatives considered.

FINE-FILTER WILDLIFE ANALYSIS

In the fine-filter analysis, individual species of concern are evaluated. These species include those listed as threatened or endangered under the Endangered Species Act of 1973, species listed as sensitive by DNRC, and animals managed as big game by Montana DFWP. *TABLE III-50* provides an analysis of the anticipated effects for each species.

TABLE III-50 – FINE-FILTER. *Anticipated effects of the Wood Lion Timber Sale on wildlife species.*

SPECIES/HABITAT	[Y/N] Potential Impacts and Mitigation Measures N = Not Present or No Impact is Likely to Occur Y = Impacts May Occur (Explain Below)
THREATENED AND ENDANGERED SPECIES	
Canada lynx (*Felis lynx*) Habitat: Subalpine fir habitat types, dense sapling, old forest, deep snow zones	**[Y]** The Project Area contains 15,356 acres of suitable lynx habitat.
Grizzly bear (*Ursus arctos*) Habitat: Recovery areas, security from human activity	**[Y]** The Project Area is located in the Porcupine-Woodward Grizzly Bear Subunit of recovery zone habitat associated with the *Northern Continental Divide Ecosystem (NCDE)* (*USFWS 1993*).
SENSITIVE SPECIES	
Bald eagles (*Haliaeetus leucocephalus*) Habitat: Late-successional forest less than 1 mile from open water	**[N]** The Project Area contains multiple streams including Woodward Creek, Whitetail Creek, the Swan River as well as others. However, nesting bald eagles have not been documented on these creeks or within 2.5 miles of the Project Area. Thus, negligible direct, indirect, or cumulative effects to bald eagles would be anticipated.
Black-backed woodpeckers (*Picoides arcticus*) Habitat: Mature to old burned or beetle-infested forest	**[N]** No recently (<5 years) burned areas occur within 0.25 miles of the Project Area. Thus, no direct, indirect, or cumulative effects to black-backed woodpeckers would be expected to occur as a result of the alternatives.
Coeur d'Alene salamanders (*Plethodon idahoensis*) Habitat: Waterfall spray zones, talus near cascading streams	**[N]** Potentially suitable moist talus or streamside talus habitat may occur in the Project Area; however, these habitat types do not occur in the vicinity of the proposed harvest units. Thus, no direct, indirect, or cumulative effects to Coeur d'Alene salamanders would be expected to occur as a result of the alternatives.
Columbian sharp-tailed grouse (*Tympanuchus Phasianellus columbianus*) Habitat: Grassland, shrubland, riparian, agriculture	**[N]** No suitable grassland communities occur in the Project Area. Thus, no direct, indirect, or cumulative effects to Columbian sharp-tailed grouse would be expected to occur as a result of the alternatives.

Common loons (*Gavia immer*) Habitat: Cold mountain lakes, nest in emergent vegetation	**[N]** No suitable lake habitat occurs within 500 feet of the Project Area. Thus, no direct, indirect, or cumulative effects to common loons would be expected to occur as a result of the alternatives.
Fishers (*Pekania pennanti*) Habitat: Dense mature to old forest less than 6,000 feet in elevation and riparian	**[Y]** Approximately 9,829 acres of suitable fisher habitat occur within the Project Area.
Flammulated owls (*Otus flammeolus*) Habitat: Late-successional ponderosa pine and Douglas-fir forest	**[N]** No suitable flammulated owl habitat types occur in the Project Area. Thus, no direct, indirect, or cumulative effects to flammulated owls would be expected to occur as a result of the alternatives.
Gray wolves (*Canis lupus*) Habitat: Ample big game populations, security from human activities	**[N]** Wolves may use habitat in the vicinity of the Project Area. Disturbance associated with timber sales at den and rendezvous locations can adversely affect wolves; however, timing restrictions would apply if den or rendezvous sites are documented (*ARM 33.11.430(1)(a)(b)*). Thus, negligible adverse direct, indirect or cumulative effects to gray wolves would be anticipated.
Harlequin ducks (*Histrionicus histrionicus*) Habitat: White-water streams, boulder and cobble substrates	**[N]** Potentially suitable high-gradient stream habitat does not occur within 0.5 miles of the Project Area. Additionally, harlequin ducks have not been observed in the Project Area (*Montana Natural Heritage Program data, Dec. 8, 2016*). Thus, no direct, indirect, or cumulative effects to harlequin ducks would be anticipated.
Northern bog lemmings (*Synaptomys borealis*) Habitat: Sphagnum meadows, bogs, fens with thick moss mats	**[N]** Potentially suitable wetlands exist in the Project Area; however, harvest and heavy-equipment restrictions would apply (*ARM 36.11.436*) and such areas would be avoided. Thus, negligible direct, indirect, or cumulative effects to northern bog lemmings would be expected to occur as a result of the alternatives.

Peregrine falcons (*Falco peregrinus*) Habitat: Cliff features near open foraging areas and/or wetlands	**[N]** Suitable cliffs/rock outcrops for nest sites were observed in the Project Area, particularly in the South Woodward Drainage. However, peregrine eyries have not been documented in the vicinity of the Project Area (*Montana Natural Heritage Program data, Dec. 8, 2016*). Thus, no direct, indirect, or cumulative effects to peregrine falcons would be anticipated as a result of the alternatives.
Pileated woodpeckers (*Dryocopus pileatus*) Habitat: Late-successional ponderosa pine and larch-fir forest	**[Y]** Approximately 2,399 acres of pileated woodpecker habitat occur in the Project Area.
Townsend's big-eared bats (*Plecotus townsendii*) Habitat: Caves, caverns, old mines	**[N]** No suitable caves or mine tunnels are known to occur in the Project Area. Thus, no direct, indirect, or cumulative effects to Townsend's big-eared bats would be expected to occur as a result of the alternatives.
Wolverine (*Gulo gulo*) Habitat: Alpine tundra and high-elevation boreal and coniferous forests that maintain deep persistent snow into late spring	**[N]** Potentially suitable wolverine habitat exists within the proposed Project Area. Wolverine tracks have been observed in the Project Area in the past (*Montana Natural Heritage Program data, Dec. 8, 2016; Southwestern Crown Carnivore Monitoring Team 2014*) and occasional use of the area by wolverines is possible. Timber harvest may occur in approximately 530 acres or 579 acres that retain persistent spring snowpack under Action Alternatives B and C, respectively per USFS data (*Copeland et al. 2010*). During the non-denning season, minor short-term displacement associated with logging disturbance could occur if wolverines are in the area. Given the large home range area wolverines occupy (average 150 plus square miles), the long distances wolverines typically cover during their movements, and that the proposed activities would occur after the end of the wolverine's reproductive denning period (February through May), the proposed activities are not expected to measurably affect use of the area by wolverines. Thus, negligible adverse direct, indirect, or cumulative effects to wolverines would be expected to occur as a result of either Action Alternative.
BIG GAME	
Elk (*Cervus canadensis*)	**[Y]** The Project Area contains potential elk and white-tailed deer winter range habitat as identified by DFWP
Mule Deer (*Odocoileus hemionus*)	

White-tailed Deer (*Odocoileus virginianus*)	(*DFWP 2008*). Elk security habitat also occurs in the Project Area .

THREATENED AND ENDANGERED SPECIES

- ***Canada Lynx***

Issue: The proposed activities could reduce landscape connectivity and the availability of suitable Canada lynx habitat, reducing the capacity of the area to support Canada lynx.

Introduction

Canada lynx are medium-size felines that are federally listed as a threatened species (*Ruediger et al. 2000*). Lynx foraging habitat in western Montana consists of a mosaic of young and mature forested stands of lodgepole pine, Engelmann spruce, and subalpine fir with high levels of canopy cover (*Squires et al. 2010, Squires et al. 2013, Holbrook et al. 2017*). Stand with these characteristics are likely to support snowshoe hare populations, which are the primary prey of Canada lynx. Retaining habitat connectivity of both summer and winter lynx foraging habitat is important since winter corridors may provide local connectivity while summer corridors are more likely to facilitate long-distance dispersal (*Squires et al. 2013*). Forest management considerations for lynx include providing a mosaic of well-connected young and mature lynx habitat patches containing high horizontal cover.

Analysis Areas

The analysis area for direct and indirect effects is the 19,437-acre Project Area (*FIGURE III-21*). The analysis area for cumulative effects is the 63,273-acre Lynx CEAA described in *TABLE III-45* and depicted in *FIGURE III-21*. The Lynx CEAA is the *Swan Lynx Management Area*, which is a designated portion of DNRC-managed land where resident lynx populations are known to occur or where there is a high probability of periodic lynx occupancy over time (*USFWS and DNRC 2010*).

Measurement Criteria

Factors considered in the analysis include: 1) the level of harvesting, 2) the availability of suitable lynx habitat classes, and 3) landscape connectivity. Suitable lynx habitat was subdivided into the following lynx habitat classes: 1) winter foraging, 2) summer foraging, 3) other suitable, and 4) temporary non-habitat. Other suitable lynx habitat is defined as habitat that has the potential to provide connectivity and lower quality foraging habitat, but does not contain the necessary attributes to be classified as winter or summer foraging habitat classes. The temporary non-habitat category consists of forested stands that are not expected to be used by lynx until suitable horizontal cover develops. All habitat classes were identified according to DNRC's lynx habitat mapping protocols (*USFWS and DNRC 2010*). On non-DNRC lands stands with ≥40 percent canopy cover provided by trees >9 inches dbh on average was queried to estimate suitable lynx habitat, although availability of habitat is likely higher on these lands

considering that stands providing 40 percent of total conifer cover of any size class may provide lynx habitat.

Existing Environment

The Project Area contains 15,356 acres of suitable lynx habitat (82.8 percent of the Project Area; *TABLE III-52;* see No-Action Alternative A for *EXISTING CONDITIONS*). The remaining acres in the Project Area consists of 3,203 acres of stands that do not contain suitable structure for lynx use, as well as approximately 878 acres of stands that are xeric cover types that are not likely to be used by lynx. Forested ridgelines and creeks including Woodward, South Woodward, and Whitetail creeks likely facilitate landscape connectivity in the Project Area (see *MATURE FORESTED COVER* and *CONNECTIVITY* in the coarse filter analysis section for further information).

The Lynx CEAA contains a total of 40,171 acres of suitable lynx habitat on DNRC-managed lands (78.8 percent of DNRC-managed portions of the Lynx CEAA) (*TABLE III-52;* see No-Action Alternative A for *EXISTING CONDITIONS*). The remaining acres in the Lynx CEAA that are managed by DNRC consist of approximately 10,836 acres of stands that do not contain suitable structure for lynx use and 5,305 acres of stands that are not preferred lynx cover types. On other ownerships in the Lynx CEAA, there are approximately 3,992 acres of connected forest habitat (≥40-percent canopy cover below 6,000 feet elevation) that are likely to provide suitable lynx habitat. Specific use of the CEAA by lynx is unknown; however, scattered lynx tracks have been documented in the Swan River State Forest during carnivore survey efforts (*Southwestern Crown Carnivore Monitoring Team 2014*; *USFS, unpublished data, Jan. 2017*). This evidence indicates that lynx use of the CEAA occurs, but is not extensive compared to habitat use observed in the Seeley Lake area. However, modeling indicates that suitable lynx habitat is available and lynx may use or travel through the CEAA at any time (*Squires et al. 2013*).

TABLE III-51 – LYNX HABITAT. *Estimated acreage of lynx habitat that would be affected and removed in the Project Area and Lynx CEAA under the proposed alternatives. Values in parentheses refer to the percentage of the total existing suitable lynx habitat, which includes potentially suitable habitat on non-DNRC lands.*

LYNX HABITAT CATEGORY	PROJECT AREA			LYNX CEAA		
	NO-ACTION	ACTION		NO-ACTION	ACTION	
	A	B	C	A	B	C
Suitable Habitat Affected by Harvest	0 (0.0)	2,782 (18.1)	3,217 (20.9)	0 (0.0)	2,782 (6.3)	3,217 (7.3)
Suitable Habitat Removed by Harvest	0 (0.0)	1,855 (12.1)	1,565 (10.8)	0 (0.0)	1,855 (4.2)	1,565 (3.5)

TABLE III-52 – LYNX HABITAT CLASSES. *Estimated acreage of lynx habitat by habitat class that would remain in the Project Area and Lynx CEAA post-harvest on DNRC-managed lands under the proposed alternatives. Values in parentheses refer to the percentage of the total potential lynx habitat[a] on DNRC-managed lands that each lynx habitat class represents.*

LYNX HABITAT CATEGORY	PROJECT AREA			LYNX CEAA		
	NO-ACTION	ACTION		NO-ACTION	ACTION	
	A	B	C	A	B	C
Summer Foraging	3,014 (16.2)	2,896 (15.6)	2,896 (15.6)	7,966 (15.6)	7,848 (15.4)	7,848 (15.4)
Winter Foraging	9,991 (53.8)	8,475 (45.6)	8,781 (47.3)	27,404 (53.7)	25,888 (50.8)	26,194 (51.4)
Other Suitable	2,352 (12.7)	2,131 (11.5)	2,125 (11.5)	4,800 (9.4)	4,579 (9.0)	4,573 (9.0)
Temporary non-habitat	3,200 (17.2)	5,055 (27.2)	4,756 (25.6)	10,836 (21.2)	12,691 (24.9)	12,392 (24.3)
Grand Total Suitable Lynx Habitat[b] Post-harvest	15,356 (82.8)	13,502 (72.8)	13,802 (74.4)	40,171 (78.8)	38,317 (75.1)	38,617 (75.7)

[a]Total potential lynx habitat describes all stands that are appropriate habitat types for lynx (i.e., sum of summer forage, winter forage, other suitable, and temporary non-suitable lynx habitat classes).
[b]Total suitable lynx habitat describes all lynx habitat categories that contain structural attributes necessary for lynx use (i.e., sum of summer forage, winter forage, other suitable lynx habitat classes).

Environmental Effects

- ***Direct and Indirect Effects of No-Action Alternative A to Canada Lynx***

None of the proposed forest management activities would occur. In the short term, lynx habitat availability and connectivity would not change. In the long term and in the absence of natural disturbance, winter foraging habitat availability would increase due to natural forest succession while summer foraging habitat availability would decrease due to the lack of new regenerating stands. Connectivity may also increase in the long term due to increasing canopy cover over time.

- ***Direct and Indirect Effects of the Action Alternatives B and C to Canada Lynx***

The proposed activities would occur in 2,782 acres (18.1 percent) or 3,217 acres (20.9 percent) of suitable lynx habitat in the Project Area under Action Alternatives B and C, respectively (*TABLE III-51*). Action Alternative B would convert 290 more acres (1,855 acres) of suitable lynx habitat to temporary non-suitable habitat post-harvest than Action Alternative C (1,565 acres) (*TABLE III-51*). These acres would be considered temporarily unsuitable for lynx use post-harvest due to lack of canopy cover in the

understory and overstory. The remaining 927 acres or 1,652 acres of suitable lynx habitat proposed for harvest under Action Alternatives B and C, respectively, would be expected to retain adequate understory and overstory canopy cover, allowing these acres to continue to meet the structural conditions suitable for lynx use. To ensure that forest structural attributes preferred by snowshoe hares remain following harvest, dense patches of advanced regeneration would be retained where possible, especially within lynx winter foraging habitat. Additionally, coarse woody debris would be retained in accordance with DNRC *Forest Management Rules* (*ARM 36.11.414)* and retention of downed logs ≥15-inch diameter would be emphasized. Lynx habitat connectivity would be reduced under both action alternatives, but would differ according to the location of clear cut, seed tree, shelterwood, overstory removal, and post and pole harvest treatments, which are not likely to retain suitable habitat characteristics for lynx use post-harvest. Action Alternative B would have greater adverse effects on connectivity and result in more fragmentation of lynx habitat in the Whitetail and Main Woodward drainages (Sections 26 and 10). Action Alternative C would result in more fragmentation of lynx habitat near Main Woodward Creek (Section 2) and the unnamed drainage between Main and South Woodward. However, both action alternatives would retain 300-foot wide corridors along major creeks and prominent ridgelines. Overall, suitable lynx habitat would remain continuous under both Action Alternatives. Additionally, as seedlings grow, harvested areas would likely become suitable as lynx summer foraging habitat in approximately 10 to 20 years. If present near the Project Area, lynx could be temporarily displaced by forest management activities for approximately a 5- to 7-year period, including 5 to 6 years of timber harvest and one year of site preparation, which is a lower intensity disturbance. Disturbance would generally occur for brief high-intensity periods, followed by inactivity throughout this 5- to 7-year period. Thus, since: 1) lynx suitable habitat availability in the Project Area would be reduced by 1,855 acres (12.1 percent) or 1,565 acres (10.8 percent) under Action Alternatives B and C, respectively; 2) habitat quality would be reduced within an additional 927 or 1,652 acres of suitable lynx habitat under Action Alternatives B and C, respectively; 3) patches of advanced regeneration would be retained where feasible, particularly in winter foraging habitat; and 4) landscape connectivity would be reduced, but potential travel corridors would be retained along creeks and major ridgelines; moderate adverse direct and indirect effects to Canada lynx associated with landscape connectivity and availability of suitable habitat would be anticipated as a result of the Action Alternatives B and C.

- ***Cumulative Effects of No-Action Alternative A to Canada Lynx***

None of the proposed forest management activities would occur. In the short term, no changes to lynx habitat would be anticipated. However, in the long term and in the absence of natural disturbance, winter foraging habitat would become more prevalent over time due to natural forest succession while summer foraging habitat would become less prevalent due to the absence of regenerating stands. Connectivity may also increase due to increasing canopy cover in the understory and overstory.

- ***Cumulative Effects of Action Alternatives B and C to Canada Lynx***

Action Alternatives B and C would affect 2,782 acres (6.3 percent) and 3,217 acres (7.3 percent), respectively, of potentially suitable lynx habitat in the Lynx CEAA (*TABLE III-51*). Action Alternative B would convert 290 more acres of currently suitable lynx habitat to temporary non-suitable habitat post-harvest than Action Alternative C (*TABLE III-51*). Advanced regeneration would be retained within lynx winter foraging habitat and coarse woody debris would be retained in accordance with DNRC *Forest Management Rules* (*ARM 36.11.414)* with an emphasis on the retention of downed logs ≥15-inch diameter. Both Action Alternatives would remove a large patch of suitable habitat in the drainage between Main and South Woodward. However, connectivity would remain along a ridgeline in the area. Alternative B would have a greater impact on habitat connectivity due to more acres of habitat removal with more fragmentation located in the Whitetail Drainage (Section 26) and the Main Woodward Drainage (Section 10). Alternative C would have less adverse effects on connectivity, but would have a greater impact in the unnamed drainage (Section 16) and near Main Woodward Creek (Section 2). Connectivity corridors would be retained along prominent ridgelines and creeks under both alternatives. The proposed activities would be additive to past and ongoing activities in the Lynx CEAA (see *RELEVANT PAST, PRESENT, AND REASONABLY FORESEEABLE ACTIONS* in *CHAPTER I- PURPOSE AND NEED* for a complete list of DNRC projects and *TABLE III-46* for acreage of ongoing timber sales). The Cilly Cliffs Multiple Timber Sales are ongoing in the Lynx CEAA; however, the effects of these activities on lynx habitat have been accounted for in this analysis and DNRC is not aware of any proposed or ongoing activities on other ownerships (*USFS 2017*). Disturbance associated with Wood Lion timber sales could adversely affect Canada lynx for approximately a 5- to 7-year timber period, including 5 to 6 years of timber harvest and one year of site preparation, which is a lower intensity disturbance. Disturbance would generally occur for brief high-intensity periods, followed by inactivity throughout this 5- to 7-year time-period. Disturbance associated with Wood Lion would be additive to disturbance associated with other ongoing DNRC timber sales. Thus, since: 1) lynx suitable habitat availability in the Lynx CEAA would be reduced 1,855 acres (4.2 percent) or 1,565 acres (3.5 percent),under Alternatives B and C, respectively; 2) habitat quality would be reduced within an additional 927 or 1,652 acres of suitable lynx habitat under Action Alternatives B and C, respectively; 3) patches of advanced regeneration and shade-tolerant understory trees would be retained where feasible, particularly in winter forage habitat; and 4) landscape connectivity would be reduced under both action alternatives, but overall connectivity would remain high; minor adverse cumulative effects to Canada lynx associated with landscape connectivity and suitable habitat type availability would be anticipated as a result of the Action Alternatives B and C.

- **Grizzly Bear**

ISSUES

Hiding Cover

The proposed activities could result in reduction of hiding cover important for grizzly bears, which could result in: 1) increased displacement of grizzly bears, 2) avoidance of otherwise suitable habitat, and or 3) increased risk of bear-human conflicts.

Open Road Density

The proposed activities could result in an increase in density of open roads, which could cause increased displacement of grizzly bears and increased risk of bear-human conflicts.

Secure Habitat

The proposed activities could result in a decrease in secure areas for grizzly bears, which could cause increased displacement of grizzly bears and increased risk of bear-human conflicts.

Introduction

Grizzly bears are native generalist omnivores that use a diversity of habitats found in western Montana and they are currently federally listed as 'threatened' under the *Endangered Species Act*. Preferred grizzly bear habitats are meadows, riparian zones, avalanche chutes, subalpine forests, and big game winter ranges, all of which provide seasonal food sources. In the Project Area, primary habitat components include meadows, riparian areas, and big game winter ranges. Primary threats to grizzly bears are related to human-bear conflicts, habituation to unnatural foods near high-risk areas, and long-term habitat loss associated with human development (*Mace and Waller 1997, Roberts and Costello 2016).* Forest management activities may affect grizzly bears by altering cover and/or by increasing human access into secure areas by creating roads (*Mace et al. 1997*). These actions could lead to the displacement of grizzly bears from preferred areas and/or result in an increased risk of human-caused mortality by bringing humans and bears closer together and/or making bears more detectable, which can increase their risk of being shot illegally. Displacing bears from preferred areas may increase their energetic costs, which may in turn lower their ability to survive and/or reproduce successfully. The grizzly bear population of the Northern Continental Divide Ecosystem (NCDE), which includes the Swan Valley, continues to remain healthy and increase annually (*Costello et al. 2016*). Given our understanding of bears in the Swan Valley based on a recent radio-collared sub sample of bears, population linkage has been successful between the Mission Range and the Swan Range, and bears commonly use active and inactive subunits during all seasons of the non-denning period (*Hicks et al. 2010*).

Analysis Areas

Direct and indirect effects were analyzed for activities conducted in the Project Area. Cumulative effects were analyzed on the Grizzly Bear CEAA, which contains the entire Project Area. This CEAA includes the entire *Porcupine Woodward Grizzly Bear Subunit*

and approximately 652 acres of DNRC lands within the *Piper Creek Grizzly Bear Subunit*. DNRC lands within the *Piper Creek Grizzly Bear Subunit* were included for analysis due to the potential for increased use of some restricted DNRC roads within the proposed action alternatives. Grizzly bear subunits approximate the annual home range size of a female grizzly bear (*USFS 1995, Mace and Roberts 2011*). The CEAA contains a variety of habitats preferred by grizzly bears, from low-elevation riparian areas to high-elevation avalanche chutes. The analysis areas are described in *TABLE III-45* and depicted in *FIGURE III-21*.

ANALYSIS METHODS

Hiding Cover

To assess hiding cover, DNRC's *SLI* data was used to map stands that would serve as hiding cover (*DNRC 2006*). Hiding cover for bears was defined as vegetation blocks capable of obscuring a bear from human view at 200 feet. Hiding cover blocks had to be at least 300 feet wide to be considered in the analysis. Factors considered in the analysis include the amount of hiding cover available in the affected grizzly bear subunit(s).

Open Road Density

A moving-windows analysis (*Ake 1994*) was conducted to determine open-road densities in the Piper Creek and Porcupine Woodward Grizzly Bear Subunits. Results were provided for the amount of area that exceeded an open-road density of 1 mile per square mile. Factors considered in the analysis include the percentage of the area with open-road densities greater than 1 mile per square mile.

Secure Habitat

Secure habitat is defined as areas free of motorized human access greater than 0.3 miles (500 meters) from any open, restricted, or high-use roads and trails (*IGBC 1998*). A moving-windows analysis was conducted to determine areas that provide secure habitats and areas that exceed a total road density of 2 miles per square mile (*Ake 1994*). Open and gated roads were buffered by 0.3 miles (500 meters), and the resultant area was removed from the subunit to obtain the amount of potential secure habitat in the CEAA.

The presence and maintenance of restricted roads produces a long-term potential for additional disturbance to grizzly bears and increased risk of human-caused mortality when compared to areas without roads. Since both open and restricted roads pose a risk to grizzly bears, total road density estimates were used as a surrogate for that amount of the area potentially receiving more motorized and nonmotorized use than areas without roads. Spring habitat in linkage zones provides connectivity and relatively undisturbed areas during the spring period. Factors considered in the analysis include amount of available secure habitat, amount of the area with a total road density greater than 2 miles per square mile, and amount of habitat affected in two grizzly bear linkage zones within the Swan River State Forest (SRSF). One linkage zone extends across a broad northerly portion of the SRSF and the other overlaps only small portions of several DNRC sections at the very southern end of the SRSF.

Existing Environment

Hiding Cover

Past timber harvesting in Swan Valley on all ownerships has resulted in an obvious patchwork comprised of variously shaped forest stands that exist at differing stages of successional development. Hiding cover on DNRC-managed lands is abundant and is present on 72.4 percent of the Project Area.

Some of the ongoing and recently completed forest management activities have altered hiding cover (e.g. *White Porcupine Timber Sale Project*), while others (e.g. *Westside Blowdown Salvage*) have not appreciably altered hiding cover due to the nature of the salvaged material. Hiding cover is present on 75.0 percent of the DNRC and USFS-managed lands within the *Porcupine Woodward Grizzly Bear Subunit*. Currently, no other DNRC or USFS projects that would alter grizzly bear hiding cover are proposed within the CEAA (*USDA Forest Service 2017)*. Within the CEAA, timber management activities on privately owned lands are possible and could alter hiding cover in the future. However, only 4.6 percent of the CEAA is comprised of private lands.

Open Road Density

Extensive road systems that have been required over the years to facilitate timber management are evident in the valley. These road systems now provide a number of access routes into otherwise remote areas. Presently, the Project Area has approximately 12.3 miles of open roads and 6.3 miles of seasonally open roads. At the larger scale, the Piper Creek and Porcupine Woodward subunits that are entirely within or partially inside the CEAA have open-road densities greater than 1 mile per square mile on between 20 and 30 percent of their individual areas respectively *(TABLE III- 53– EXISTING GRIZZLY BEAR HABITAT PARAMETERS – CUMULATIVE EFFECTS ANALYSIS AREA*). The CEAA contains approximately 42.2 miles of open/seasonally open roads, which includes approximately 9.9 miles of private/residential access roads. No proposed or ongoing DNRC projects that would alter long-term open-road densities are occurring in the CEAA. Currently, no activities are planned in the near term on USFS lands within the CEAA that would appreciably affect open-road densities or road use (*USDA Forest Service 2017*).

Secure Habitat

Secure habitat currently exists on approximately 7.2 percent of the Project Area, about half of which is included in large blocks that extend beyond the Project Area boundary. The Porcupine Woodward and Piper Creek subunits within the CEAA currently contain 27 and 58 percent secure habitat respectively (*TABLE III-51).* Much of the existing secure habitat on DNRC lands within the Project Area and CEAA consists of area where existing roads have revegetated with trees and shrubs to a point that they are not currently passible with a motorized vehicle. On the DNRC portions of the Piper Creek and Porcupine Woodward subunits within the CEAA, 79 and 96 percent of the subunit areas respectively exceed 2 miles per square mile of total road density (*TABLE III-53).* Additionally, secure habitat during the spring is provided for grizzly bears by limiting

all management activities during the spring period in identified linkage zones below 5,200 feet of elevation. Approximately 9,157 acres (47.1 percent) of the Project Area and 13,492 acres (35.2 percent) of the CEAA is in Linkage Zones. Harvesting in the Project Area within the last 15 years has altered approximately 1,385 acres of Linkage Zone habitat.

Timber harvesting in the past, including the most recent White Porcupine Multiple Timber Sale Project, has altered some secure habitat, total road densities, and spring habitat in linkage zones within the Project Area and CEAA in the last decade. No other DNRC or USFS projects are currently proposed in the CEAA that would alter grizzly bear secure habitat, total road densities, or spring habitat in the related linkage zones (*USDA Forest Service 2017*). Within the CEAA, timber management could occur on private lands; however, these lands do not currently contain secure habitat for grizzly bears and make up approximately 4.6 percent of the CEAA.

TABLE III-53 – EXISTING GRIZZLY BEAR HABITAT PARAMETERS – CUMULATIVE EFFECTS ANALYSIS AREA. *Open-road density (>1 mile/sq. mile), total-road density (>2 mile/sq. mile), and secure habitat percentages by land ownership within each of the 2 grizzly bear subunits included in the cumulative effects analysis area. Values for the entire subunit are shown, although the cumulative effects analysis area contains only a small portion of the Piper Creek subunit.*

	Open Road Density		Total Road Density		Secure Habitat	
	Entire Subunit	DNRC	Entire Subunit	DNRC	Entire Subunit	DNRC
Porcupine Woodward	30	36	76	96	27	9
Piper Creek	20	15	45	79	58	19

Environmental Effects

- ***Direct and Indirect Effects of No-Action Alternative A to Grizzly Bears***

Hiding Cover

No vegetation modification would occur in the Project Area; therefore, no changes to existing hiding cover would be anticipated. Thus, no direct and indirect effects to grizzly bear hiding cover or associated impacts to bears involving displacement, avoidance of habitat, or increased risk of bear-human conflicts would be anticipated.

Open Road Density

No changes to the open-road status, open-road densities, or risk of grizzly bear displacement or bear-human conflicts caused by vehicular noise or human access would occur. Thus, no additional direct or indirect effects to grizzly bears associated with open-road densities in the Project Area would be anticipated.

Secure Habitat

No alteration of habitat attributes or increased human presence would occur. No changes to total road densities or spring grizzly bear habitat in linkage zones would occur. Therefore, no changes in grizzly bear secure habitat, increased displacement, or risk of human-caused mortality in the Project Area would be expected under this alternative.

- ***Direct and Indirect Effects of Action Alternatives B and C to Grizzly Bears***

Hiding Cover

The proposed harvesting would alter 2,555 (Action Alternative B) to 3,078 acres (Action Alternative C) of hiding cover from the existing 14,067 acres of hiding cover in the Project Area. Approximately 1,468 acres (10.4 percent) to 1,267 acres (9.0 percent) of hiding cover would be effectively removed by harvest treatments, with the greatest reduction in hiding cover occurring under Action Alternative B (*TABLE III-54– PROJECT AREA GRIZZLY BEAR HABITAT PARAMETERS*). Under either action alternative, harvesting in the Project Area would affect hiding cover only within the *Porcupine Woodward Grizzly Bear Subunit*. To reduce the long-term avoidance of harvest units by grizzly bears and provide mitigation to offer some retained security, the proposed seed tree and clearcut harvest units would be designed to ensure that no point in a harvest unit would be greater than 600 feet to cover. Visual screening cover would also be retained between any proposed harvest units and open roads. Proposed road construction would alter cover in several riparian areas; however, these areas are outside of the linkage zone, and the road construction was designed to minimize riparian habitat loss. The proposed activities would be additive to altered hiding due to past harvesting, most recently the White Porcupine Multiple Timber Sale Project. Thus, minor adverse direct and indirect effects to hiding cover that would affect grizzly bears in the Project Area would be anticipated since: 1) hiding cover would be reduced across a portion of the Project Area, but considerable hiding cover would remain in the Project Area (12,599 [64.8 percent] to 12,800 [65.9 percent] acres remaining), and 2) additional mitigations would ensure that no point in a proposed seed tree or clearcut unit is more than 600 feet to cover, and 3) that greater than 40 percent of DNRC-managed lands would meet the definitions for hiding cover, which would maintain ample cover for bears in the Project Area.

Open Road Density

Under either action alternative, no new open roads would be constructed. However, proposed harvesting activities and associated road use could result in short-term displacement effects; while the construction of new restricted roads could result in both short- and long-term displacement effects (see analysis regarding *SECURE HABITAT* below for more detail). As all newly constructed roads would be managed as restricted, the amount of open roads and associated open-road densities would not change (*TABLE III-53*). All newly constructed roads would be behind closure devices or berms, which would allow for future administrative and commercial uses. Thus, since open-road densities would not change, negligible direct and indirect effects associated with open-

road densities would be anticipated that would affect grizzly bears in the Project Area for the foreseeable future.

Secure Habitat

Under either action alternative, harvesting and road construction would affect secure habitat within the Project Area. Although no changes in open roads would be anticipated, reductions in secure habitat on 922 acres under Alternative B or 932 acres under Alternative C (65.8 percent or 66.5 percent of existing secure habitat, respectively) would be anticipated in the Project Area, with the greater reduction being associated with Action Alternative C (*TABLE III-54)*. Between 12.8 (7.8 percent) and 16.0 (9.8 percent) miles of new permanent restricted roads under Alternatives B and C respectively, would be constructed adding to the existing 163 miles in the Project Area, with the greatest amounts constructed under Action Alternative C (*TABLE III-54*). An increase in total road densities and disturbance levels associated with commercial timber harvesting would be anticipated, with the greater increase associated with Action Alternative C (*TABLE III-54*). Additionally, the action alternatives would remove some secure habitat in the Project Area by clearing existing roads that are currently inaccessible to motorized use due to thick brush and debris. Collectively, the increases in total road density, accessibility of existing roads that would be reconstructed, and the decrease in secure habitat could result in increased disturbance of grizzly bears via nonmotorized dispersed recreation, administrative activities (including motorized), salvage harvests during inactive periods, and commercial forest management activities during active periods. The increases in total road density and decreases in secure habitat could result in increased risks of avoidance of suitable habitat and bear-human conflicts. Continued use of the Project Area by grizzly bears would be expected, although bears would likely avoid areas where active harvesting and road use/construction would occur for up to 3 years. Additional motorized administrative activities associated with post-harvest site preparation would pose a minor risk of displacement for another 1 to 2 years. However, stipulations placed on contractors and DNRC personnel that restrict carrying firearms reduce the risk of additional mortality associated with commercial and administrative use. The availability of newly constructed roads, as well as the improvements made to existing roads, could increase long-term nonmotorized use in the Project Area, with slightly more impacts associated with Action Alternative C (*TABLE III-54– GRIZZLY BEAR HABITAT PARAMETERS – CUMULATIVE EFFECTS ANALYSIS AREA*). This nonmotorized recreational use would be expected to increase proportionally with proposed increases in road densities; the number of user days would likely be similar to other restricted road systems in the Swan Valley. Therefore, the risk to bears associated with nonmotorized use would be moderate in the short term and decrease over time as lesser-used restricted roads fill in with brush and deadfall.

Timber harvesting in proposed units could make grizzly bears more visible; however, maintaining new and existing roads as restricted, incorporating 600 feet to cover requirements, maintaining visual screening along open roads, and prohibiting

contractors from carrying firearms while on duty would minimize the risk of human-caused mortality. Harvesting would alter 1,038 acres (12.1 - Action Alternative B) to 1,124 acres (13.1 percent - Action Alternative C) of spring habitat within the linkage zone; however, silvicultural prescriptions would retain adequate hiding cover on 767 (Action Alternative B) to 901 (Action Alternative C) of those acres. Thus, approximately 5,584 acres to 5,625 acres of the existing 5,824 acres of cover within spring habitat would remain sufficiently dense to provide hiding cover. Harvesting would not occur during the spring period (April 1 through June 15). This seasonal restriction would limit the potential for disturbance to grizzly bears during the spring period when they are more susceptible to disturbance. Action Alternative C, with the larger reduction in secure habitat and more new road construction, and higher amounts of spring habitat in linkage zone affected would be expected to have slightly more adverse effects to grizzly bears than Action Alternative B. However, Action Alternative B would harvest more acres where hiding cover would be completely removed by clearcut or seed tree prescriptions.

Collectively, moderate adverse direct and indirect effects to grizzly bear secure habitat and subsequent displacement, and bear-human conflict effects would be anticipated in the Project Area since: 1) secure habitat would be reduced by 4.7 to 4.8 percent; 2) total road densities would increase in the Project Area with the addition of 12.8 to 16.0 miles of new, restricted roads; 3) new restricted roads in previously secure habitat would increase long-term risk of displacement and human-bear conflicts associated with nonmotorized recreational use and motorized administrative use; 4) some increases in disturbance caused by commercial harvesting/post-harvest site preparation could occur during the nondenning period for 3 to 5 years and 5) spring habitat within the linkage zone would be altered across 1,039 acres to 1,124 acres.

TABLE III-54– PROJECT AREA GRIZZLY BEAR HABITAT PARAMETERS.
Proposed amounts of hiding cover removed, as well as hiding cover retained; linear miles of permanent road, miles of open and restricted road construction; resultant miles of open and restricted roads expected under each alternative; and acres of spring habitat altered within the linkage zone in the Project Area.

PARAMETER	ALTERNATIVES		
	NO ACTION	ACTION	
	A	B	C
Acres of hiding cover removed (percent of existing hiding cover removed)	0	1,468 (10.4)	1,267 (9.0)
Acres of hiding cover retained in the Project Area after implementation of each alternative (percent of Project Area)	14,067 (72.4)	12,599 (64.8)	12,800 (65.9)
Linear miles of new permanent, restricted road constructed	0	12.8	16.0
	163.4	176.2	179.4

Linear miles of permanent restricted road (percent increase)	(0.0)	(7.8)	(9.8)
Miles of new permanent open road constructed	0	0	0
Miles of permanent open road (percent increase)	18.6 (0.0)	18.6 (0.0)	18.6 (0.0)
Acres of secure habitat in the Project Area after implementation of each alternative (percent of Project Area providing secure habitat)	1,401 (7.2)	479 (2.5)	469 (2.4)
Acres of spring habitat in the linkage zone modified (percent of harvest unit acreage in Project Area)	0 (0.0)	1,039 (35.2)	1,124 (33.8)
Acres of spring habitat in the linkage zone in the Project Area that would not be altered (percent reduction)	8,591 (0.0)	7,553 (12.1)	7,468 (13.1)

- ***Cumulative Effects of No-Action Alternative A to Grizzly Bears***

Hiding Cover

No vegetation modification would occur; therefore, no changes to existing hiding cover would be anticipated in the CEAA *(TABLE III-54)*. Vegetation in the Project Area and CEAA that are providing hiding cover would be expected to continue providing this attribute for the foreseeable future. Recent and ongoing projects affecting grizzly bear hiding cover within the CEAA would continue (see *TABLE III-46)*. Thus, no further cumulative effects to hiding cover or associated impacts to bears involving displacement or avoidance of habitat would be anticipated that would affect grizzly bears in the CEAA (see *TABLE III-53*).

Open Road Density

No changes in open road amounts or open-road density would be anticipated. On DNRC-managed lands, the 20.2 to 30.1 percent of the Piper Creek and Porcupine Woodward subunits (respectively) inside the CEAA with an open-road density greater than 1 mile per square mile would not change *(TABLE III-54)*. Thus, no further cumulative effects to grizzly bears associated with open-road densities or increased risk of bear-human conflicts would be anticipated in the CEAA for the foreseeable future.

Secure Habitat

No changes to open roads, grizzly bear secure habitat, total road densities, amount of spring habitat altered in the linkage zone, or increased potential for displacement or bear-human conflicts would be anticipated. No changes would be anticipated to the percentage of DNRC-managed lands in the CEAA that are currently providing secure habitat *(TABLE III-54)*. Likewise, the percentage of the CEAA with total road density exceeding 2 miles per square mile would not change. No further changes to spring habitat in the linkage zone would occur. Thus, no further cumulative effects would be

anticipated to secure habitat that would affect grizzly bears in the CEAA for the foreseeable future.

- ***Cumulative Effects to Grizzly Bears Common to Action Alternatives B and C***
  Hiding Cover

Proposed activities would reduce the amount of hiding cover in the *Porcupine Woodward Grizzly Bear Subunit* by 6.3 to 7.2 percent *(TABLE III-55)*. An additional 7 to 12 acres (<0.1 percent of the subunit) of hiding cover would be affected within the *Piper Creek Grizzly Bear Subunit*. Proposed road construction would alter hiding cover in several riparian areas; however, the proposed road construction would be designed to minimize riparian habitat loss. Vegetation elsewhere in the Project Area and CEAA that is providing hiding cover would be expected to continue providing this attribute for the foreseeable future. Ongoing harvesting and thinning on DNRC-managed lands, as well as lands on other ownerships would continue altering grizzly bear hiding cover (see *TABLE III-46)*. Thus, reductions in hiding cover associated with these alternatives would be additive to ongoing and recently completed projects that would alter, or have altered, grizzly bear hiding cover. Reductions in hiding cover associated with timber harvesting and thinning are short lived (10 to 20 years) and recovery of hiding cover in the vicinity of the CEAA is fairly rapid. The proposed harvesting would reduce the amount of hiding cover on DNRC-managed lands in the *Porcupine Woodward Grizzly Bear Subunit* from 71.9 percent to 64.7 (Alternative B) or 65.6 percent (Alternative C) following proposed logging treatments *(TABLE III-53)*. Collectively, Action Alternative B would remove more hiding cover; therefore, a slightly lower degree of adverse effect would be anticipated under Action Alternative C. Thus, minor adverse cumulative effects to hiding cover that would influence grizzly bear displacement, avoidance of habitat, or increased risk of bear-human conflicts in the CEAA would be anticipated since: 1) hiding cover would be reduced by a measurable level on DNRC-managed lands; but 2) adequate hiding cover exceeding 40 percent would persist on all the affected subunits within the CEAA.

Open Road Density

No changes in open-road amounts, open-road densities or the associated potential for human-caused mortality would be anticipated. No ongoing or proposed salvage/sanitation or pre-commercial thinning on DNRC-managed lands would alter open-road densities. Any activities that could occur on other ownerships in the CEAA could alter total road densities, but changes to open roads would not be expected. Approximately 30.1 percent of the *Porcupine Woodward Grizzly Bear Subunit* would continue to have an open road density greater than one mile per a square mile (*TABLE III-53*). Thus, no further cumulative effects involving open-road densities and grizzly bears would be anticipated in the CEAA for the foreseeable future.

Secure Habitat

Under either action alternative, harvesting would primarily affect secure habitat within the *Porcupine Woodward Grizzly Bear Subunit.* However, new road construction and road clearing near the border of the *Porcupine Woodward Grizzly Bear Subunit*, as well as some

commercial use (log and gravel hauling) of existing roads within the *Piper Creek Grizzly Bear Subunit* could create additional disturbance in the Piper Creek portion of the CEAA. Secure habitat on DNRC-managed lands would be reduced in the *Porcupine Woodward Grizzly Bear Subunit* from 8.8 percent to 4.1 percent (both Action Alternatives). New road construction under both Action Alternatives would increase total road densities, however all of these new roads would remain restricted to the public. Proposed road construction would increase the percent of the area with a total-road density greater than 2 miles per square mile within the *Porcupine Woodward Grizzly Bear Subunit* from an existing level of 76.4 percent to 76.9 (Action Alternative B) or 77.4 percent (Action Alternatives C), with a slightly larger increase associated with Action Alternative C (*TABLE III-55*). Use of the restricted roads in the *Porcupine Woodward Grizzly Bear Subunit* and select restricted roads within the *Piper Creek Grizzly Bear Subunit* (1.6 miles) would increase substantially during the 3-year active period and then revert to lower levels similar to current levels for another inactive 6-year period. Proposed harvesting would alter 1,039 acres (Alternative B) or 1,124 acres (Alternative C) of spring habitat in the linkage zone within the *Porcupine Woodward Grizzly Bear Subunit*, however harvest prescriptions would only completely remove 272 acres (Action Alternative B) or 223 acres (Action Alternative C) depending upon the selection of an action alternative (*TABLE III-55*). Approximately 6,420 acres to 6,457 acres of hiding cover in spring habitat would remain within the CEAA. Collectively, the increases in total-road density, accessibility of existing roads that would be reconstructed, and the decrease in secure habitat could result in increased disturbance of grizzly bears via nonmotorized dispersed recreation, administrative activities (including motorized), salvage harvests during inactive periods, and commercial forest management activities during active periods. The increases in total-road density and decreases in secure habitat could result in increased risks of avoidance of suitable habitat and bear-human conflicts. Nonmotorized recreational use associated with new restricted roads would be expected to increase proportionally with proposed increases in road densities; the number of user days would likely be similar to other restricted road systems in the Swan Valley. Therefore, the risk to bears associated with nonmotorized use would be moderate in the short term and decrease over time as lesser-used restricted roads fill in with brush and deadfall. Continued use of the CEAA by grizzly bears would be expected, although bears would likely avoid areas where active harvesting and road use/construction would occur for up to 3 years. Additional motorized administrative activities associated with post-harvest site preparation and tree planting would pose a minor risk of displacement for another 1 to 2 years. However, stipulations placed on contractors and DNRC personnel that restrict carrying firearms reduce the risk of additional mortality associated with commercial and administrative use. The availability of newly constructed roads, as well as the improvements made to 82 to 89 miles of existing restricted roads, could increase long-term nonmotorized use in the CEAA, with slightly more access associated with Action Alternative C (*TABLE III-55*). However, this nonmotorized use would not be expected to increase substantially; therefore, the risk to bears associated with nonmotorized use would be minor.

Reductions in habitat quality and quantity would be additive to losses associated with past and current harvesting on all ownerships in the CEAA. Additionally, reductions of forest cover in spring habitat would be additive to the recent activities on DNRC-managed lands as well as any ongoing harvest activities on private lands within spring habitat. An increase in grizzly bear disturbance levels associated with the proposed activities would be additive to any existing disturbance mechanisms in the CEAA. However, only the *Porcupine Woodward Grizzly Bear Subunit* would be active under either action alternative, limiting potential disturbance to grizzly bears, with the exception of a small portion of the *Piper Creek Grizzly Bear Subunit* used for timber hauling and ongoing recreational use of the areas and other permitted activities (including road maintenance, limited salvage harvesting, etc.) within the CEAA. Comparatively, Action Alternative B removes more hiding cover, whereas Action Alternative C constructs more new restricted road, uses more road miles to complete proposed operations, and affects higher amounts of spring habitat in the linkage zone (*TABLE III-53*). Overall, adverse effects on grizzly bears would be anticipated to be similar between the two alternatives. Thus, moderate adverse cumulative effects to secure habitat for grizzly bears would be anticipated in the CEAA since: 1) secure habitat would be reduced by 4.7 percent within the *Porcupine Woodward Grizzly Bear Subunit*; 2) portions of the affected subunit with greater than 2 miles per square mile total-road density would increase to either 0.5 percent (Alternative B) or 1.0 percent (Alternative C), 3) new restricted roads in previously secure habitat would increase long-term risk of displacement and human-bear conflicts associated with nonmotorized recreational use and motorized administrative use, 4) increased disturbance caused by commercial activities would occur for up to 3 years during the nondenning period and would be additive to other sources of disturbance within the CEAA, 5) some administrative motorized activities would also occur for up to 2 additional years during the nondenning period and would be additive to other sources of disturbance within the CEAA, and 6) forest vegetation in spring habitat within the linkage zone would be altered on up to 8.3 percent of the linkage zone area within the CEAA

TABLE III-55– CUMULATIVE EFFECTS ANALYSIS AREA GRIZZLY BEAR HABITAT PARAMETERS. *Anticipated changes to open-road densities, hiding cover, restricted roads, total-road densities, secure habitat, and spring habitat in the linkage zone under each alternative. Parameters reported below are for the Porcupine Woodward Grizzly Bear Subunit. Parameters for the Piper Creek subunit were not included because no changes from existing vegetation conditions would be expected and only a small amount of restricted road (1.6 miles) would be used under either action alternative.*

HABITAT PARAMETER	ALTERNATIVE		
	NO ACTION	ACTION	
	A	B	C

Percent of the subunit on DNRC-managed lands with an open-road density greater than 1 mile per square mile.	36.1	36.1	36.1
Percent of the subunit under all *SVGBCA* cooperator-managed lands with an open-road density greater than 1 mile per square mile.	30.1	30.1	30.1
Percent of hiding cover retained on DNRC-managed lands (percent of subunit changed).	71.9 (0)	64.7 (7.2)	65.6 (6.3)
Linear miles of restricted roads.	200.8	213.8	216.8
Percent of the subunit with a total-road density greater than 2 miles per square mile (percent change).	76.4 (0)	76.9 (0.5)	77.4 (1.0)
Percent of secure habitat on DNRC-managed lands remaining after implementation of each alternative (percent reduction).	8.8 (0)	4.1 (4.7)	4.1 (4.7)
Altered acres of spring habitat in linkage zone.	0.0	1,038.5	1,123.7
Acres of spring habitats in linkage zone within CEAA that would not be altered on all ownerships.	9,977	8,938	8,853

SENSITIVE SPECIES

- ***Fishers***

Issue: The proposed activities could reduce the availability and connectivity of suitable fisher habitat and increase human access, which could reduce habitat suitability and increase trapping mortality.

Introduction

In the Rocky Mountains, fisher home ranges typically consist of mesic late-successional forests with complex vertical and horizontal structure, large-diameter trees, and >50 percent canopy cover of mature forested stands (*Raley et al. 2012, Schwartz et al. 2013, Olson et al. 2014, Sauder and Rachlow 2014*). Fishers typically avoid ponderosa pine and lodgepole pine stands, and large openings such as clearcuts; however, frequently used areas within home ranges contain high habitat heterogeneity (*Schwartz et al. 2013, Sauder and Rachlow 2015*). Fishers prey upon snowshoe hares, ungulate carrion, porcupines, birds, and small mammals as well as seasonally available fruits and berries. Fisher resting and denning sites are found in cavities of live trees and snags, downed logs, brush piles, mistletoe brooms, squirrel and raptor nests, and holes in the ground. Forest-management considerations for fishers include retaining large trees and snags for resting and denning habitat, maintaining a network of travel corridors, and reducing trapping risk associated with motorized access.

Analysis Areas

The analysis area for direct and indirect effects is the 19,437-acre Project Area (*FIGURE III-21*). The analysis area for cumulative effects is the 37,666-acre Wildlife CEAA described in *TABLE III-45* and depicted in *FIGURE III-21* CEAA (per *ARM 36.11.440(1)(a)*). The Wildlife CEAA consists of the *Porcupine-Woodward Grizzly Bear Management Subunit* and is defined by geographic features, which are likely to influence movements of fishers near the Project Area. The CEAA is also potentially large enough to support a population of fishers (*Olson et al. 2014*), thus providing a reasonable analysis area for fishers that could be influenced by project-related activities.

Measurement Criteria

Analysis methods include field evaluations, aerial photograph interpretation, and GIS analysis of travel corridors, preferred fisher cover types (*ARM 36.11.403(60)*), and habitat structure. Stands were considered appropriate for fisher use if they were appropriate cover types and contained 40 to 100 percent stocking density of sawtimber size class trees (≥9-inches dbh). Additional fisher habitat classifications considered in the analysis include: 1) upland fisher habitat, and 2) riparian fisher habitat, which are defined according to proximity of the stand to streams. Riparian fisher habitat is located within 100 feet of class 1 streams or within 50 feet of class 2 streams (*ARM 36.11.440(b)*). Potential fisher habitat (upland, riparian) on other ownerships was identified by examining moderate to densely stocked mature forest habitat (≥40-percent canopy cover) below 6,000 feet elevation and the proximity of closed-canopy forested habitat to perennial and intermittent streams. Factors considered in the analysis include: 1) the degree of harvesting, 2) availability and structure of preferred fisher habitats (upland, riparian), 3) landscape connectivity, and 4) human access.

Existing Environment

Approximately 9,829 acres (50.6 percent of Project Area) in the Project Area are considered suitable fisher habitat (i.e., stands in appropriate cover types, sawtimber size class ≥9-inches dbh, with 40 to 100-percent canopy cover) (*TABLE III-56*). These stands are likely to provide features necessary for use as fisher resting and denning sites, and serve to maintain landscape connectivity. Approximately 832 acres of suitable fisher riparian habitat occurs in the Project Area. The remaining acres in the Project Area consist of approximately 4,030 acres of young stands, 4,264 acres of xeric forest types that are typically avoided by fishers, and 1,314 acres of poorly-stocked sawtimber stands. The density of open and seasonally open roads is 0.6 miles/square mile and total road density is 6.0 miles/square mile, thus, there is moderate to high level of access that could facilitate trapping.

The Wildlife CEAA contains approximately 18,904 acres of fisher habitat (50.2 percent of the analysis area), including 10,272 acres of suitable fisher habitat on DNRC-managed lands (*TABLE III-56*) and an additional 8,632 acres of forested habitat on other ownerships located below 6,000 feet elevation, which are likely to provide suitable fisher habitat. Of these acres of potential fisher habitat, approximately 1,491 acres are riparian

fisher habitat including 926 acres of DNRC-managed fisher riparian habitat and approximately 565 acres of fisher riparian habitat on other ownerships. DNRC manages preferred fisher cover types across grizzly bear subunits (i.e., the Wildlife CEAA) such that, within 100 feet of class 1 streams and 50 feet of class 2 streams, at least 75 percent of the acreage (trust lands only) is in the sawtimber size class in moderate to well-stocked density (*ARM 36.11.440[1][b][i]*). Currently 926 acres of potential riparian fisher habitat (83.5 percent of preferred riparian fisher cover types on DNRC-managed lands) contain suitable stand structure for fisher use. The remaining 18,762 acres in the Wildlife CEAA consist of young stands or poorly-stocked stands that are unsuitable for fisher use, as well as stands that are not appropriate cover types. Fisher habitat is continuous in the northern portion of the Wildlife CEAA and near Woodward Creek where large stands of moist cover types occur and is more fragmented in the remainder of the Wildlife CEAA, particularly in vicinity of parcels previously owned by Plum Creek Timber Company. According to trapping records, fishers have been documented in the Wildlife CEAA as recently as the 1980s (*Montana Natural Heritage Program data, January 23, 2017*); however, fishers were not detected in winter carnivore surveys of the Swan Valley conducted in the winter of 2012-2016 (*Southwestern Crown Carnivore Monitoring Team 2014; USFS unpublished data Jan. 2017*). The density of open and seasonally restricted roads is 0.8 miles/square mile and total road density is 4.1 miles/square mile; thus, there is a moderate level of access that could facilitate trapping at this scale.

TABLE III-56– FISHER HABITAT. *Changes in fisher habitat under each alternative in the Project Area and the Wildlife CEAA; estimates include potential fisher habitat on non-DNRC lands.*

FISHER HABITAT PARAMETER	***PROJECT AREA***			***WILDLIFE CEAA***		
	NO-ACTION	***ACTION***		***NO-ACTION***	***ACTION***	
	A	***B***	***C***	***A***	***B***	***C***
Riparian habitat affected by harvest (percent of available habitat)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Habitat affected by harvest (percent of available habitat)	0 (0.0)	2,433 (24.8)	2,857 (29.1)	0 (0.0)	2,433 (12.9)	2,857 (15.1)
Habitat Removed by harvest (percent of available habitat)	*0 (0.0)*	1,610 (16.4)	*1,374 (14.0)*	0 (0.0)	1,610 *(8.5)*	*1,374 (7.3)*
Total fisher riparian habitat post-harvest (percent of analysis area)	*832 (4.3)*	832 *(4.3)*	*832 (4.3)*	*1,491 (4.0)*	*1,491 (4.0)*	*1,491 (4.0)*
Total fisher habitat post-harvest (percent of analysis area)	*9,829 (50.6)*	8,219 *(42.3)*	*8,455 (43.5)*	*18,904 (50.2)*	17,294 *(45.9)*	*17,530 (46.5)*

Environmental Effects

- ***Direct and Indirect Effects of No-Action Alternative A to Fishers***

None of the proposed forest management activities would occur. The level of motorized access would not change and no additional risk associated with trapping would be expected. In the short term, no changes to fisher habitat availability or connectivity would occur in the Project Area. In the long term and in the absence of natural disturbance, fisher habitat suitability and connectivity would increase as stands age, availability of large-dbh trees increases, and mature canopy cover increases.

- ***Direct and Indirect Effects of Action Alternatives B and C to Fishers***

Overall, Action Alternative B is anticipated to have slightly greater adverse effects on fisher habitat due to the greater amount of habitat removed, although Alternative C would affect more acres of fisher habitat. The proposed activities would affect 2,433 acres (24.8 percent) or 2,857 acres (29.1 percent) of the 9,829 acres of suitable fisher habitat present in the Project Area under Action Alternatives B and C, respectively (*TABLE III-56*). Stands proposed for clear cut, seed tree, shelterwood treatments, overstory removal, and post and pole treatments would not retain suitable canopy cover for fisher use post-harvest, reducing the availability of suitable fisher habitat. Approximately 1,610 or 1,374 acres of fisher habitat would be removed under Action Alternatives B and C, respectively. The remaining acres of fisher habitat proposed for harvest would retain 40-percent mature canopy cover post-harvest and these stands would remain suitable for fisher use post-harvest, although these stands may be of lower habitat quality due to lower stand density. The availability of some important habitat characteristics (i.e., snags, coarse woody debris) could be reduced by harvest activities; although retention of dead-woody material and live snag recruitment trees would meet DNRC *Forest Management Rules* (*ARM 36.11.411, ARM 36.11.414*), which would maintain a source of large legacy woody material across the local landscape. Habitat within 100 feet of Class 1 streams and 50 feet of Class 2 streams would not be harvested and connectivity would remain intact due to vegetation retention requirements (see *HABITAT CONNECTIVITY AND FRAGMENTATION* in this analysis). No roads open to public motorized use are planned for construction; however, 12.8 and 16.0 miles of restricted roads are proposed for construction under Action Alternatives B and C, respectively. Motorized administrative use and non-motorized public use would be permitted on these roads. Thus, trapping risk associated with motorized human access would not increase, although non-motorized access routes would increase, particularly in the unroaded Sections 22 and 32 located near South Woodward Creek. If present near the Project Area, fishers could be temporarily displaced by forest management activities associated with Wood Lion Multiple Timber Sales for a 5 to 7-year operating period, including 5 to 6 years of timber harvest and one year of site preparation, which is a lower intensity disturbance. Disturbance would generally occur for brief high-intensity periods, followed by inactivity throughout this 5 to 7-year period. Thus, since: 1) approximately 2,433 acres (24.8 percent) or 2,857 acres (29.1 percent) of suitable fisher habitat in the Project Area would be affected by harvest under

Action Alternatives B and C, respectively; 2) 1,610 acres (16.4 percent) or 1,374 acres (14.0 percent) of suitable fisher habitat in the Project Area would be removed by the proposed activities under Action Alternatives B and C, respectively; 3) riparian fisher habitat would not be affected by either alternative; 4) landscape connectivity would be reduced, but riparian travel corridors would remain intact; and 5) 12.8 and 16.0 miles of restricted roads would be constructed under Action Alternatives B and C, respectively, but open road density would not change; moderate adverse direct and indirect effects to fisher associated with habitat suitability and trapping risk would be anticipated as a result of Action Alternatives B and C.

- ***Cumulative Effects of No-Action Alternative A to Fishers***

None of the proposed forest management activities would occur. In the short term, no changes to fisher habitat availability or connectivity associated with the Wood Lion Multiple Timber Sales would occur. In the long term and in the absence of natural disturbance, fisher habitat suitability and connectivity may increase as stands age, the availability of large-dbh trees increases, and mature canopy cover increases.

- ***Cumulative Effects of Action Alternatives B and C to Fishers***

The proposed activities would affect 2,433 acres (12.9 percent) or 2,857 acres (15.1 percent) of the 18,094 acres of potential fisher habitat in the Wildlife CEAA. A portion of these acres would be treated with regeneration treatments and would not be suitable for fisher use post-harvest (*TABLE III-56*). Overall, Action Alternative B is anticipated to have slightly greater adverse effects on fisher habitat than Action Alternative C due to greater amounts of fisher habitat removed, although Alternative C would affect more acres of habitat overall. Action Alternative C would construct more restricted roads (motorized administrative and non-motorized public permitted) than Action Alternative B (16.0 versus 12.8 miles of restricted road) possibly increasing trapping risk, although open road density would not change. Within all harvest units, snags, snag recruits, and coarse woody debris, which are important fisher habitat elements, would be retained according to DNRC *Forest Management Rules* (*ARM 36.11.411, ARM 36.11.414*). However, some snags would be removed and overall snag density would be reduced post-harvest. Riparian habitat is not proposed for harvest and connectivity would remain intact due to vegetation retention requirements. The proposed activities would be additive to past activities in the Wildlife CEAA (see *RELEVANT PAST, PRESENT, AND REASONABLY FORESEEABLE ACTIONS* in *CHAPTER I- PURPOSE AND NEED* for a complete list of DNRC projects and *TABLE III-2* for acreage of ongoing timber sales). DNRC is not aware of any proposed or ongoing activities on other ownerships (*USFS 2013*). Fishers could be temporarily displaced by forest management activities associated with the proposed Wood Lion Multiple Timber Sales for a 5 to 7-year timber period, including 5 to 6 years of timber harvest (some occurring during the winter period to comply with subunit rest requirements of the SVGBCA) and one year of site preparation, which is a lower intensity disturbance. Disturbance would generally occur for brief high-intensity periods, followed by inactivity throughout this 5 to 7-year time-period. Thus, since: 1) approximately 2,433 acres (12.9 percent) or 2,857 acres (15.1

percent) of potential fisher habitat in the Wildlife CEAA would be affected by harvest under Action Alternatives B and C, respectively; 2) 1,610 acres (8.5 percent) or 1,374 acres (7.3 percent) of potential fisher habitat in the Wildlife CEAA would be removed by the proposed activities under Action Alternatives B and C, respectively; 3) riparian fisher habitat would not be affected by either action alternative; 4) landscape connectivity would be reduced, but riparian travel corridors would remain intact; and 5) 12.8 and 16.0 miles of restricted roads would be constructed under Action Alternatives B and C, respectively, but open road density would not change; minor adverse cumulative effects to fisher associated with habitat suitability and trapping risk would be anticipated as a result of Action Alternatives B and C.

- ***Pileated Woodpecker***

Issue: The proposed activities could reduce tree density and alter the structure of mature forest stands, which could reduce habitat suitability for pileated woodpeckers.

Introduction

Pileated woodpeckers play an important role in mature forests because they excavate large cavities that are often used in subsequent years by a variety of wildlife species for nesting, roosting, and as rest sites. Pileated woodpeckers require mature forest stands with large-diameter (≥20 inch dbh) dead or defective trees for nesting and foraging, and the density of pileated woodpeckers is positively correlated with the amount of dead and dying wood in a stand (*McClelland 1979*). Timber harvest may remove large-diameter trees necessary for nesting, and fragmentation of mature forest stands can make birds more vulnerable to predation as they travel between habitat patches (*Poulin et al. 2013*). Forest management considerations for pileated woodpeckers include retaining dense patches of old and mature coniferous forest with abundant large snags and coarse-woody debris for foraging, roosting, and nesting.

Analysis Areas

The analysis area for direct and indirect effects is the 19,437-acre Project Area (*FIGURE III-21*). The analysis area for cumulative effects is the 37,666-acre Wildlife CEAA described in *TABLE III-45* and depicted in *FIGURE III-21*. The Wildlife CEAA is centered on the Project Area and defined according to geographic features (i.e., ridgelines) and provides a reasonable analysis area for pileated woodpeckers that could be influenced by project-related activities. This scale provides a sufficient area to support multiple pairs of pileated woodpeckers (*Poulin et al. 2013*).

Measurement Criteria

Factors considered in the analysis include: 1) the degree of harvesting and 2) the structure of pileated woodpecker preferred habitat types. On DNRC-managed lands, sawtimber stands ≥100 years old within preferred pileated cover types (*ARM 36.11.403(58)*) with ≥40 percent canopy closure were considered potential pileated woodpecker habitat. On non-DNRC lands, the stands considered potential pileated woodpecker habitat were mature forest stands (≥40 percent canopy cover, >9 inches dbh average) below 6,000 feet elevation.

Existing Environment

The Project Area contains 2,399 acres (12.3 percent of the Project Area) of suitable pileated woodpecker habitat. This habitat is composed primarily of old-growth Douglas-fir-western larch stands. Many these stands are located between the Woodward and South Woodward drainages with smaller suitable stands scattered throughout the Project Area. The remaining acres in the Project Area consist primarily of relatively young stands <100 years in age (11,939 acres, 61.4 percent of the Project Area), poorly stocked stands or nonforested areas (1,607 acres; 8.3 percent of the Project Area), as well as stands such as subalpine fir and western red cedar stands that are less suitable cover types for pileated woodpecker use. Snag availability in the Project Area is high at 17.2 snags per acre ≥8-inches dbh and coarse woody debris was moderate at 18.7 tons per acre. These existing attributes likely facilitate use of existing habitat in the Project Area for pileated woodpecker nesting and foraging. Additionally, pileated woodpeckers were seen and heard in the Project Area while conducting field reviews, and many foraging sites were observed.

The Wildlife CEAA contains 11,094 acres (29.5 percent of the CEAA) of potential pileated woodpecker habitat, which includes 2,462 acres of DNRC-managed pileated woodpecker habitat and an additional 8,632 acres of mature forested habitat (<6,000 feet elevation) on other ownerships. These habitat patches are scattered throughout the CEAA. Overall, road density in the Wildlife CEAA is moderate (0.8 miles per square mile open and seasonally restricted road density, 4.1 miles per square mile total road density) and provides a low level of accessibility for firewood cutting due to the low density of open roads. Additionally, the Wildlife CEAA is managed primarily by state and federal agencies (94.9 percent of the CEAA), which have retention guidelines for snags and coarse woody debris. Considering the low open road density and land ownership patterns, snags and coarse woody debris likely occur in ample amounts for pileated woodpeckers nesting and foraging in the Wildlife CEAA.

TABLE III-57 – PILEATED WOODPECKER. *Changes in pileated woodpecker habitat under each alternative in the Project Area and the Wildlife CEAA. Estimates include potential habitat on other ownerships.*

PILEATED WOODPECKER HABITAT	*PROJECT AREA*			*WILDLIFE CEAA*		
	NO-ACTION	*ACTION*		*NO-ACTION*	*ACTION*	
	A	*B*	*C*	*A*	*B*	*C*
Habitat affected by harvest (percent of available habitat)	0 (0)	848 (35.3)	1,005 (41.9)	0 (0)	848 (7.6)	1,005 (9.1)
Habitat removed by harvest	0 (0)	552 (23.0)	487 (20.3)	0 (0)	552 (5.0)	487 (4.4)

(percent of available habitat)						
Total habitat post-harvest (percent of analysis area)	*2,399 (12.3)*	*1,847 (9.5)*	*1,912 (9.8)*	*11,094 (29.5)*	*10,542 (28.0)*	*10,607 (28.2)*

Environmental Effects

- ***Direct and Indirect Effects of No-Action Alternative A to Pileated Woodpeckers***

None of the proposed forest management activities would occur. In the short term, no changes to pileated woodpecker habitat would be anticipated. However, in the long term and in the absence of natural disturbance, pileated woodpecker habitat availability and habitat patch size may increase due to natural succession and aging of timber stands.

- ***Direct and Indirect Effects of Action Alternatives B and C to Pileated Woodpeckers***

Overall, Action Alternative B is anticipated to have greater adverse effects on pileated woodpecker habitat than Action Alternative C because more acres of habitat would be removed. However, Alternative C would impact more acres of pileated woodpecker habitat than Alternative B. The proposed activities would affect 848 acres (35.3 percent) or 1,005 acres (41.9 percent) of pileated woodpecker habitat in the Project Area under Action Alternatives B or C, respectively (*TABLE III-57*). Of these acres, approximately 552 or 487 acres proposed for harvest under Action Alternatives B or C, respectively, would be treated with shelterwood, seed tree, overstory removal, or clearcut treatments, which would retain stand densities too low for pileated woodpecker use post-harvest (*TABLE III-57*). However, in the long term, seral tree species preferred by pileated woodpeckers would be recruited, creating future pileated woodpecker habitat in these stands and other stands proposed for treatment. The remaining 296 acres or 518 acres proposed for harvest under Action Alternatives B and C, respectively, would retain suitable stand characteristics for pileated woodpecker use, albeit at a reduced habitat quality due to reduced stand density. Proposed harvesting would remove pileated woodpecker habitat for 30 to 100 years, depending on the density and growth rate of trees in the stand. Snags would be removed by the proposed harvest, but at least 2 large snags and 2 large snag recruitment trees per acre (>21-inches dbh) would be retained (*ARM 36.11.411*). Disturbance associated with the proposed harvesting could adversely affect pileated woodpeckers in different portions of the Project Area for approximately 5 to 7 years, should they be present in the Project Area. Timber harvest is anticipated to occur over a 5 to 6-year time period and site preparation, which is a lower intensity disturbance, may occur for 1 additional year. Thus, since: 1) stand density and habitat quality would be reduced within 296 acres (12.3 percent) or 518 acres (21.6 percent) of pileated woodpecker habitat in the Project Area under Action Alternatives B and C, respectively; 2) harvesting would reduce suitable pileated woodpecker habitat

availability by 552 acres (23.0 percent) or 487 acres (20.3 percent) within the Project Area; and 3) important habitat attributes including snags and coarse woody debris would be retained according to (*ARM 36.11.411*); moderate adverse direct and indirect effects to pileated woodpecker habitat suitability in the Project Area would be anticipated as a result of Action Alternatives B and C.

- ***Cumulative Effects of No-Action Alternative A to Pileated Woodpeckers***

None of the proposed forest management activities would occur. In the short term, no changes to pileated woodpecker habitat would be anticipated. However, in the long term and in the absence of natural disturbance, pileated woodpecker habitat availability and habitat patch size may increase due to natural succession and aging of timber stands.

- ***Cumulative Effects of Action Alternatives B and C to Pileated Woodpeckers***

The proposed activities would occur in 848 acres (7.6 percent) or 1,005 acres (9.1 percent) of potential pileated woodpecker habitat in the Wildlife CEAA under Action Alternatives B or C, respectively (*TABLE III-57*). However, Action Alternative B is anticipated to have greater adverse effects on pileated woodpeckers due to the amount of habitat removed. The proposed activities would open stands to 5- to 20-percent residual mature canopy cover in 552 (Alternative B) or 487 acres (Alternative C) of current habitat, causing habitat structure to become unsuitable for pileated woodpecker use post-harvest in these stands. However, seral trees species preferred by pileated woodpeckers would be promoted in these stands as well as other stands proposed for treatment. The remaining acres proposed for harvest would retain stand structure required for suitable pileated woodpecker habitat post-harvest, albeit at a lower stand density resulting in reduced habitat quality. However, at least 2 large snags and 2 large snag recruitment trees per acre (>21-inches dbh) would be retained (*ARM 36.11.411*) in addition to coarse woody debris (*ARM 36.11.414*). Changes in pileated woodpecker habitat suitability would be additive to completed activities in the Wildlife CEAA (see *RELEVANT PAST, PRESENT, AND REASONABLY FORESEEABLE ACTIONS* in *CHAPTER I- PURPOSE AND NEED* for a complete list of DNRC projects and *TABLE III-2* for acreage of ongoing timber sales). Currently there are not any ongoing timber sales on DNRC lands in the Wildlife CEAA and DNRC is not aware of any proposed or ongoing activities on other ownerships (*USFS 2017*). Disturbance associated with the proposed activities could adversely affect pileated woodpeckers for a 5 to 7-year timber period, including 5 to 6 years of timber harvest and one year of site preparation, which is a lower intensity disturbance. Disturbance would generally occur for brief high-intensity periods, followed by inactivity throughout this 5 to 7-year period. Thus, since: 1) stand density and habitat quality would be reduced within 296 acres (2.7 percent) or 518 acres (4.7 percent) of pileated woodpecker habitat in the Wildlife CEAA under Action Alternatives B and C, respectively; 2) harvesting would reduce pileated woodpecker habitat availability by 552 acres (5.0 percent of exiting habitat) or 487 acres (4.4 percent of existing habitat) within the Wildlife CEAA; and 3) important habitat attributes including snags and coarse woody debris would be retained according to

(*ARM 36.11.411* and *36.11.414*); minor adverse cumulative effects to pileated woodpecker habitat suitability would be anticipated as a result of the Action Alternatives B and C.

BIG GAME

Issues:

Big Game Winter Range

The proposed activities could remove forest cover on important winter ranges, which could lower their capacity to support elk, mule deer, and white-tailed deer.

Elk Security Habitat

The proposed activities could remove elk security cover, which could affect hunter opportunity and the quality of recreational hunting in the local area.

BIG GAME WINTER RANGE

Introduction

Elk, mule deer, and white-tailed deer require areas with adequate amounts of cover and forage at lower elevations during winter. Effective big game winter range contains ample mid-story and overstory cover, which can ameliorate severe winter conditions by reducing wind velocity, enhancing thermoregulation, and intercepting snow, which improves access to forage with less energy expenditure. Ample mature cover on winter ranges enhances the ability of deer and elk to survive harsh winter weather conditions and enables their movements across the landscape. Forest management considerations for deer and elk include providing adequate hiding cover and ample overstory, which reduce the effects of harsh winter weather conditions.

Analysis Areas

The analysis area for direct and indirect effects is the 19,437-acre Project Area (*FIGURE III-21*). The analysis area for cumulative effects is the 37,666-acre Wildlife CEAA described in *TABLE III-45* and depicted in *FIGURE III-21*. The CEAA is centered on the Project Area, defined according to geographic features, and provides a reasonable analysis area for wintering big game that could be influenced by project-related activities.

Measurement Criteria

Factors considered in the analysis include: 1) the degree of timber harvesting, 2) the availability and structure of cover on DFWP-defined big game winter range, and 3) the level of disturbance associated with timber harvest. Forested habitat (≥60 percent canopy cover, >9 inch dbh average) was considered capable of providing thermal cover for big game.

Existing Environment

The Project Area provides potential elk and white-tailed deer winter range (*TABLE III-58*) with most of the winter range located along the Swan River, Cedar Creek, and the low-elevation portions Whitetail Creek. The Project Area is a part of a larger winter range extending east into the Swan Valley and the west facing slopes of the Flathead

Range with white-tailed deer winter range typically restricted to lower elevations. Desirable winter range habitat attributes found in the Project Area include low elevation riparian habitat, some south-facing aspects, and appreciable amounts of canopy cover. Thermal cover availability varies spatially according to the location of primary wintering areas for each big game species (*TABLE III-59*).

The Wildlife CEAA contains elk and white-tailed deer winter range (*TABLE III-58*). Elk winter range occurs primarily along the Swan River in the Wildlife CEAA and extends into west-facing slopes of the Flathead Range outside of the CEAA. White-tailed deer winter range also occurs primarily along the Swan River, but extends north into the Porcupine Creek Drainage in the CEAA. Patches of thermal cover comprised of dense, mature forest (i.e., greater than 60-percent canopy cover) are scattered along the Swan River, but are typically connected by less dense mature stands with at least 40-percent canopy cover (*TABLE III-59*). Most of the winter range in the CEAA occurs on DNRC and USFS lands. Across all ownerships, past timber-harvesting activities, human development, and road construction in big game winter range areas have likely lowered the carrying capacity to some degree (see *TABLE III-60* under *NO-ACTION ALTERNATIVE A -EXISTING CONDITION*).

TABLE III-58 – EXISTING WINTER RANGE. *Existing big game winter range in the Project Area and Wildlife CEAA as identified by DFWP (2008).*

BIG GAME SPECIES	***PROJECT AREA***	***WILDLIFE CEAA***
Elk (percent of analysis area)	1,398 (7.2)	3,328 (8.8)
White-tailed deer (percent of analysis area)	5,019 (25.8)	9,287 (24.7)

TABLE III-59 – THERMAL COVER. *The acreage of thermal cover under DNRC Wood Lion Timber Sale alternatives in the Project Area and Wildlife CEAA.*

BIG GAME SPECIES	***PROJECT AREA***			***WILDLIFE CEAA***		
	NO-ACTION	***ACTION***		***NO-ACTION***	***ACTION***	
	A	***B***	***C***	***A***	***B***	***C***
Elk (percent of winter range)	149 (10.7)	149 (10.7)	118 (8.4)	317 (9.5)	317 (9.5)	286 (8.6)
White-tailed deer (percent of winter range)	471 (9.4)	388 (7.7)	357 (7.1)	2,109 (22.8)	2,026 (21.8)	1,995 (21.5)

TABLE III-60 –WINTER RANGE ROAD DENSITY. *Changes in total road density (miles per square mile) within big game winter range habitat under DNRC Wood Lion Multiple Timber Sale alternatives in the Project Area and Wildlife CEAA.*

BIG GAME SPECIES	PROJECT AREA			WILDLIFE CEAA		
	NO-ACTION	ACTION		NO-ACTION	ACTION	
	A	B	C	A	B	C
Elk	4.7	4.7	4.7	4.6	4.6	4.6
White-tailed deer	5.1	5.3	5.3	4.1	4.2	4.2

TABLE III-61 – WINTER RANGE ACTIVE ROADS. *Miles of active system roads (open, seasonally open, and restricted roads included in the haul route; miles per square mile) for each alternative of the DNRC Wood Lion Multiple Timber Sale.*

BIG GAME SPECIES	PROJECT AREA			WILDLIFE CEAA		
	NO-ACTION	ACTION		NO-ACTION	ACTION	
	A	B	C	A	B	C
Elk	4.3 (2.0)	6.0 (2.7)	6.7 (3.1)	16.8 (3.2)	18.6 (3.5)	19.3 (3.7)
White-tailed deer	11.2 (1.4)	24.1 (3.1)	25.1 (3.2)	28.2 (1.9)	41.2 (2.8)	42.3 (2.9)

Environmental Effects

- ***Direct and Indirect Effects of No-Action Alternative A to Big Game Winter Range***

None of the proposed forest management activities would occur. No changes in disturbance levels would occur. In the short term, no change in the availability of thermal cover would occur. In the long term and in the absence of natural disturbance, thermal cover may increase as stands age and canopy cover increases.

- ***Direct and Indirect Effects of Action Alternatives B and C to Big Game Winter Range***

The availability of thermal cover in the Project Area would be reduced under Action Alternatives B and C, respectively, with Action Alternative C affecting slightly more acres of thermal cover than Action Alternative C (*TABLE III-59*). The amount of thermal cover affected by the proposed harvest varies according to the big game species. Under Action Alternative B, the availability of thermal cover in the Project Area would be reduced by 83 acres (17.6 percent of available thermal cover) within white-tailed deer winter range; the availability of thermal cover in elk winter range would not be affected. Action Alternative C would reduce the availability of thermal cover in the Project Area by 31 acres (20.1 percent of available thermal cover) and 114 acres (24.2 percent of available thermal cover) within elk and white-tailed deer winter ranges, respectively.

Following logging, forest patches in the Project Area would continue to provide a mosaic of habitat conditions. Mature forest stands in the Project Area would generally remain well connected and provide a suitable network of cover capable of facilitating movement of wintering animals across the local landscape, particularly along riparian areas. New forest openings created by logging could provide minor benefits for elk and deer for foraging during mild winters and early and late portions of each winter. Minor positive, short-term benefits would be anticipated during harvest operations as deer and elk may feed on felled tree tops, limbs, and slash piles. However, these benefits would be offset by disturbance effects to wintering deer and elk. Open roads would not be constructed, but both Action Alternatives B and C propose to construct new restricted roads that would be open to motorized administrative use and non-motorized use by the public (*TABLE III-60*). Additionally, traffic would increase on roads used in conjunction with logging activities for the duration of the project (up to 5 to 7 years) (*TABLE III-61*). Action Alternative C would increase traffic on slightly more roads located in winter range than Action Alternative B (*TABLE III-61*). Disturbance would generally occur for high-intensity periods, followed by inactivity throughout this 5 to 7-year period. Thus, since: 1) thermal cover availability would be reduced by 0 percent to 24.2 percent on big game winter range in the Project Area influencing no more than 114 acres; 2) the proposed harvest could occur during winter, potentially displacing wintering big game; 3) open roads would not be constructed, but restricted roads would be constructed increasing total road density in white-tailed deer winter range from 5.1 miles per square mile to 5.3 miles per square mile, 4) activity would increase on haul roads in winter range under Action Alternatives B and C, respectively potentially displacing big game; and 5) remaining patches of mature forest cover would generally remain well connected across the Project Area (including considerable acreage possessing 40 to 60-percent canopy cover), moderate direct and indirect effects to big game winter range habitat suitability would be anticipated as a result of Action Alternatives B and C.

- ***Cumulative Effects of No-Action Alternative A to Big Game Winter Range***

None of the proposed forest management activities would occur. In the short term, no change in the availability of thermal cover associated with the Wood Lion Multiple Timber Sales would occur. In the long term and in the absence of natural disturbance, thermal cover would increase as stands age and canopy cover increases.

- ***Cumulative Effects of Action Alternatives B and C to Big Game Winter Range***

Overall, Action Alternative C would reduce the availability of thermal cover in the Wildlife CEAA slightly more than Action Alternative C (*TABLE III-59*). Under Action Alternative B, the availability of thermal cover in the Wildlife CEAA would be reduced by 83 acres (3.9 percent of available thermal cover) within white-tailed deer winter range; the availability of thermal cover in elk winter range would not be affected. Under Action Alternative C, the availability of thermal cover in the Wildlife CEAA would be reduced by 31 acres (9.7 percent of available thermal cover) and 114 acres (5.4 percent of available thermal cover) within elk and white-tailed deer winter ranges, respectively.

Mature forest stands in the Wildlife CEAA would generally remain well connected and provide a suitable network of cover capable of facilitating movements of wintering animals across the local landscape, particularly along riparian areas. Slash, tree tops, and limbs associated with harvest units may increase short-term forage availability during harvest operations. However, wintering deer and elk may be either attracted to this food source or displaced by disturbance depending upon tolerance for disturbance and the availability of food in the vicinity. New roads open to public motorized use would not be constructed; however, roads that allow administrative use and non-motorized public use would be constructed under both Action Alternatives B and C increasing total road density in white-tailed deer winter range from 4.1 miles per square mile to 4.2 miles per square mile under both alternatives (*TABLE III-60*). No road construction would occur in elk winter range. Additionally, traffic would increase temporarily (up to 5 to 7 years) on roads used in conjunction with timber harvest for the duration of the project, with Alternative C increasing traffic on more miles of road located in winter range than Alternative B (*TABLE III-61*). Changes in winter range habitat suitability would be additive to previous timber sales in the Wildlife CEAA (see *RELEVANT PAST, PRESENT, AND REASONABLY FORESEEABLE ACTIONS* in *CHAPTER I- PURPOSE AND NEED* for a complete list of DNRC projects and *TABLE III-40* for acreage of ongoing timber sales). However, no DNRC projects are active in the Wildlife CEAA and DNRC is not aware of any proposed or ongoing activities on other ownerships (*USFS 2017*). Thus, since: 1) thermal cover availability would be reduced by 0 percent to 9.7 percent on big game winter range in the Wildlife CEAA influencing no more than 114 acres; 2) the proposed harvest could occur during winter, potentially displacing wintering big game and displacement would be additive to any ongoing activities in the Wildlife CEAA; 3) open roads would not be constructed, increasing road density in white-tailed deer winter range from 4.1 to 4.2 miles per square mile; 4) activity would increase on haul roads in winter range under Action Alternatives B and C, respectively potentially displacing big game; and 5) remaining patches of mature forest cover would generally remain well connected across the Project Area (including considerable acreage possessing 40 to 60-percent canopy cover), minor adverse cumulative effects to big game winter range habitat suitability would be anticipated as a result of Action Alternatives B and C.

ELK SECURITY HABITAT

Introduction

Elk security habitat provides hiding areas during hunting season by reducing visibility and accessibility in forested landscapes, reducing the likelihood that an animal will be observed and harvested (*Hillis et al. 1991*). Because the female segments of the elk populations are normally carefully regulated during hunting seasons, primary concerns are related to a substantial reduction of the male population and subsequent decrease in hunter opportunity. Open road density is of concern because it is well documented that elk avoid areas adjacent to open roads and that elk survival rates in areas adjacent to open roads is much lower that for elk using unroaded habitats (*McCorquodale 2013*).

Forest management considerations for elk security habitat include providing adequate cover and restricting motorized access.

Analysis Areas

The analysis area for direct and indirect effects is the 19,437-acre Project Area (*FIGURE III-21*). The analysis area for cumulative effects is the 37,666-acre Wildlife CEAA described in *TABLE III-45* and depicted in *FIGURE III-21*. The CEAA is centered on the Project Area, defined according to geographic features, and provides a reasonable analysis area for big game that could be influenced by project-related activities. The Wildlife CEAA would provide enough area for a local elk herd to avoid hunting pressure during the general hunting season.

Measurement Criteria

Factors considered in the analysis include: 1) the degree of timber harvesting, 2) the availability and density of mature forest cover patches, and 3) changes to open road and restricted road density. Big game security habitat was defined as forest habitat (≥40-percent canopy cover) that is ≥250 acres and located >0.5 miles from open roads (*Hillis et al. 1991*).

Existing Environment

Approximately 3,925 acres (20.2 percent of the Project Area) of security habitat occur in the Project Area (*TABLE III-62*). This amount of security habitat falls below the 30-percent minimum suggested for retention to reduce bull elk vulnerability (*Hillis et al. 1991*). The remaining acres in the Project Area consist primarily of areas that are too close to open roads to provide security habitat, as well as stands that are too open to provide security. Approximately 6,104 acres in the Project Area were recently acquired by DNRC that were previously owned by Plum Creek Timber Company, which was not subject to the same retention requirements as DNRC. Thus, mature forest cover is generally lower in these sections. The density of open and seasonally open roads is 0.6 miles per square mile and total road density is 6.0 miles per square mile, thus, there is moderate level of access that could provide access for hunters.

The Wildlife CEAA is in hunting district 130 and is a part of the Bob Marshall Elk Management Unit (EMU) (*DFWP 2004*). The EMU is currently under objective for elk numbers and was estimated to contain 108 animals in 2016 (*DFWP 2016*). Approximately 9,534 acres (25.3 percent of the Wildlife CEAA) meet the distance, cover, and size requirements of elk security habitat (*TABLE III-62*). This amount of security habitat falls below the suggested level for retention necessary to limit bull elk vulnerability (*Hillis et al. 1991*). However, DFWP (*2004*) describes the EMU as exceeding objectives for maintaining elk security habitat due in part to road closures implemented for grizzly bears and the inclusion of the wilderness area in the EMU. An additional 11,401 acres of forested habitat occur in the CEAA, but do not meet the size or distance from roads requirements to be considered security habitat. Hunter access in the Wildlife CEAA is moderate, with several open roads and considerable non-motorized access on

closed roads. The density of open and seasonally open roads is 0.8 miles per square mile and total road density is 4.1 miles per square mile.

TABLE III-62– ELK SECURITY. *The effect of the DNRC Wood Lion Multiple Timber Sale alternatives on elk security habitat in the Project Area and Wildlife CEAA. The security habitat removed statistic accounts for direct removal of cover as well as for stands that would not meet the 250-acre minimum patch size requirement post-harvest.*

SECURITY HABITAT PARAMETER	PROJECT AREA			WILDLIFE CEAA		
	NO-ACTION	ACTION		NO-ACTION	ACTION	
	A	B	C	A	B	C
Total road density (miles per square mile)	6.0	6.2	6.3	4.1	4.3	4.3
Security habitat affected (percent of available habitat)	0 (0.0)	1,698 (40.5)	1,948 (46.5)	0 (0.0)	1,698 (17.8)	1,948 (20.4)
Security habitat removed (percent of available habitat)	0 (0.0)	1,544 (36.9)	1,236 (29.5)	0 (0.0)	1,572 (16.5)	1,264 (13.3)
Total security habitat post-harvest (percent of analysis area)	4,188 (21.5)	2,644 *(13.6)*	2,952 *(15.2)*	*9,534 (25.3)*	*7,962 (21.1)*	*8,270 (22.0)*

Environmental Effects

- ***Direct and Indirect Effects of No-Action Alternative A to Elk Security Habitat***

No changes in elk security cover would be expected. No changes to accessibility of the Project Area for hunters would occur. Existing cover would continue to provide security habitat. In the long term and in the absence of natural disturbance, elk security habitat availability would likely increase due to natural succession of timber stands.

- ***Direct and Indirect Effects of Action Alternatives B and C to Elk Security Habitat***

Approximately 1,698 acres or 1,948 acres of elk security habitat in the Project Area would be harvested under Action Alternatives B and C, respectively (*TABLE III-62*). Post-harvest a total of 1,544 (Action Alternative B) or 1,236 (Action Alternative C) of acres of security habitat would not retain adequate canopy cover or would fall below the 250-acre minimum patch size requirement. Harvested acres would not provide security habitat for at least 20 to 30 years until trees and shrubs provide screening cover. However, layout of shelterwood and seed tree harvest units must meet 600 feet to cover requirements for grizzly bear mitigations (no point in a unit can be >600 feet to hiding cover; see *HIDING COVER* under *GRIZZLY BEAR* in this analysis). Both action alternatives would further reduce security habitat below the 30-percent threshold recommended by *Hillis et al. (1991)*. No changes in roads open to motorized public access would occur under either action alternative. However, restricted roads which are

open to administrative use and non-motorized public use are proposed for construction. Action Alternative C proposes more construction of restricted roads than Action Alternative B (16.0 versus 12.8 miles). Overall, Action Alternative C affects the least amount of security habitat and would be expected to have proportionally less adverse effects to elk security than Action Alternative B. Thus, since: 1) no changes in open roads or motorized access for the general public would be anticipated that would increase hunter access; 2) increases in non-motorized access could increase hunter access on 12.8 or 16.0 miles of new restricted roads under Action Alternative B and C, respectively; 3) high amounts of elk security habitat would be affected (40.5 percent or 46.5 percent of habitat available in the Project Area under Action Alternatives B and C, respectively); 4) approximately 36.9 percent or 29.5 percent of available elk security habitat available in the Project Area would be removed under Action Alternative B and C, respectively; and 5) reductions in elk security habitat would be temporary and last approximately 20 to 30 years; high adverse direct and indirect effects associated with elk vulnerability and security habitat would be anticipated under Action Alternatives B and moderate adverse direct and indirect effects would be anticipated under Action Alternative C.

- ***Cumulative Effects of No-Action Alternative A to Elk Security Habitat***

None of the proposed forest management activities would occur. No changes to accessibility of the Project Area for hunters would occur. Existing cover would continue to provide security habitat. In the long term and in the absence of natural disturbance, elk security habitat availability would likely increase due to natural succession of timber stands.

- ***Cumulative Effects of Action Alternatives B and C to Elk Security Habitat***

The proposed activities would occur in 1,698 acres (17.8 percent) or 1,948 acres (20.4 percent) of elk security habitat in the Wildlife CEAA under Action Alternatives B or C, respectively. The acreage affected in the Wildlife CEAA is greater than the acreage affected in the Project Area due to the location of large security habitat patches just outside of the Project Area no longer meeting the minimum 250-acre patch size. Action Alternative C affects a greater amount of security habitat; however Alternative B is anticipated to have greater adverse effects on elk security due the amount of security habitat that would be removed by timber harvest (*TABLE III-62*). Increased sight distances could reduce elk survival in the Wildlife CEAA and proposed road construction could facilitate an increase in public non-motorized use (12.8 or 16.0 miles under Action Alternatives B and C, respectively). However, DNRC would be required to lay out seed tree and shelterwood units such that no point is more than 600 feet to cover, which would have some benefits to big game by minimizing distances to escape cover. Changes in elk vulnerability and security habitat would be additive to completed activities in the Wildlife CEAA (see *RELEVANT PAST, PRESENT, AND REASONABLY FORESEEABLE ACTIONS* in *CHAPTER I- PURPOSE AND NEED* for a complete list of DNRC projects and *TABLE III-46* for acreage of ongoing timber sales). Estimates of security habitat post-harvest account for habitat that has been removed by other

projects. DNRC is not aware of any proposed or ongoing activities on other ownerships (*USFS 2017*). Post-harvest 21.1 percent (Action Alternative B) or 22.0 percent (Action Alternative C) of the Wildlife CEAA would provide elk security habitat, which would continue to fall below the 30-percent minimum threshold recommended by Hillis et al. (*1991*); however, the Bob Marshall Wilderness is a part of the EMU, and its presence would likely ameliorate reductions of security habitat on DNRC lands. Thus, since: 1) no changes in open roads or motorized access for the general public would be anticipated that would increase hunter access; 2) increases in non-motorized access could increase hunter access on 12.8 or 16.0 miles of new restricted roads under Action Alternatives B and C, respectively; 3) moderate amounts of elk security habitat would be affected (17.8 percent or 20.4 percent of habitat available in the Wildlife CEAA under Action Alternatives B and C, respectively); 4) approximately 16.5 percent or 13.3 percent of available elk security habitat available in the Wildlife CEAA would be removed under Action Alternatives B and C, respectively; 5) low amounts of elk security habitat (25.3 percent of Wildlife CEAA) are currently available; and 6) reductions in elk security habitat would be temporary and last approximately 20 to 30 years; moderate adverse cumulative effects associated with elk vulnerability and security habitat would be anticipated under Action Alternatives B and C.

LIST OF MITIGATIONS

- If a threatened or endangered species is encountered, a DNRC biologist would be consulted immediately, and an appropriate course of action would be developed and applied. Similarly, if undocumented nesting raptors or wolf dens are encountered within ½ mile of the Project Area a DNRC biologist would be immediately contacted to determine an appropriate course of action.
- Prohibit contractors and purchasers conducting contract operations from carrying firearms while on duty as per *ARM 36.11.444(2)* and *GB-PR2* (*USFWS* and *DNRC 2010)*.
- Contractors will adhere to food storage and sanitation requirements as described in the timber sale contract. Ensure that all attractants such as food, garbage, and petroleum products are stored in a bear-resistant manner.
- Restrict public access at all times on restricted roads that are opened for harvesting activities. Effectively close all restricted roads and skid trails following harvest completion.
- Within Canada lynx winter foraging habitat, retain up to 10 percent of the stand area in patches of advanced regeneration of shade-tolerant trees (grand fir, subalpine fir, and spruce) as per *LY-HB4* (*USFWS* and *DNRC 2010)*.
- Retention of patches of advanced regeneration of shade-tolerant trees in proposed units, where feasible, to break-up site distances, and provide some horizontal cover and forest structural attributes preferred by snowshoe hares and lynx
- Use a combination of topography, group retention, and roadside vegetation along

open roads to reduce sight distances within harvest units where feasible.

- Vegetation screening would be retained within a 100-foot buffer along open roads where regeneration units would be located adjacent to the open roads.
- Design seed tree units so that no point within the proposed unit is more than 600 feet to cover.
- Minimize potential disturbance to grizzly bears during the spring period by restricting activities in spring habitat from April 1 through June 15.
- Retain 2 large snags and 2 large snag recruitment trees per acre (>21-inches dbh) particularly favoring western larch, ponderosa pine, western white pine, and Douglas-fir. Clumps of existing snags may be maintained where they occur to offset areas without sufficient snags.
- Retain coarse woody debris amounts consistent with *Graham et al. (1994)* and emphasize the retention of downed logs ≥15-inches dbh where they occur as per *LY-HB2* (*USFWS* and *DNRC 2010)* aiming for at least one 20-foot-long piece per acre.
- Maintain connectivity for fisher, Canada lynx, grizzly bears, and other wildlife species by maintaining corridors of unharvested and/or lighter harvested areas along riparian areas, ridgetops, and saddles.

ECONOMIC ANALYSIS

INTRODUCTION

This analysis describes current economic conditions surrounding the Swan River State Forest and discloses the potential direct, indirect, and cumulative economic and trust fiduciary effects that may result under each alternative associated with the proposed action of the Wood Lion Timber Sale.

ISSUES AND MEASUREMENT CRITERIA

The following issue statement was crafted to account for concerns of the economic benefits of the Wood Lion Timber Sale and guide the analysis of this section:

> *The proposed action may directly affect private income and employment in the regional economy. Potential economic benefits from this sale may also include additional revenues for state trust beneficiaries, infrastructure development, and other forest improvements on state trust forestlands.*

The following measurement criteria were selected to describe the existing economic environment in the area and to 'measure' the extent of the potential direct, indirect, and cumulative economic effects under each alternative: For income, the measurement criterion is dollars distributed to the Common School Trust, FI program, and generated in the regional economy. For employment, the measurement criterion is the number of timber-related jobs provided.

- *For all income, revenues, and prices the measurement criterion is current U.S. dollars.*
- *For employment, the measurement criterion is full-time jobs sustained for one year.*

ANALYSIS AREAS

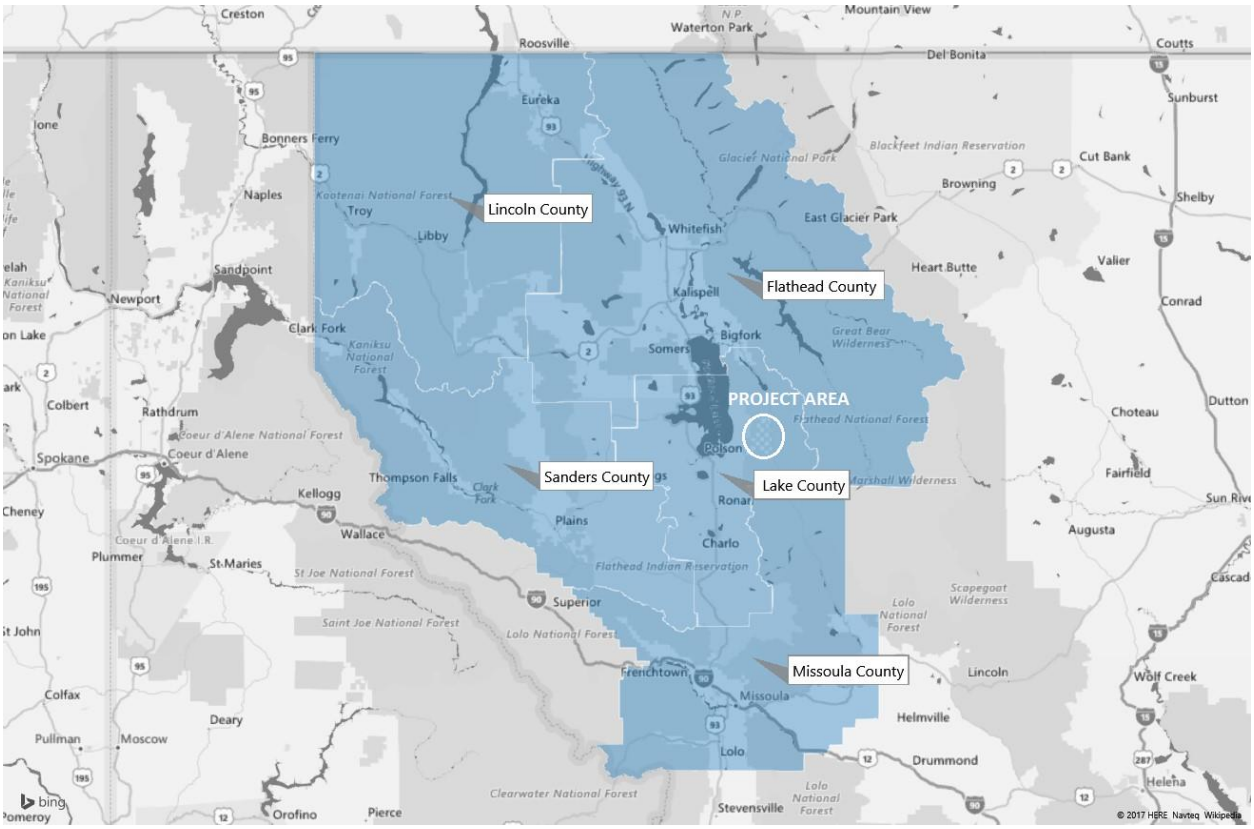
All Effects

The analysis area for the direct, indirect, and cumulative economic effects includes a multi-county area connected through commuting, business and trade to the Swan River State Forest and the project area (see *FIGURE III-25*).

The counties selected for the analysis area include Missoula, Flathead, Sanders, Lake, and Lincoln County. This five county area represents the project area's functioning economic region and provides the closest markets for labor, products, and information in forestry, forest products, and a wide array of other industries.

Economic effects are considered geographically at the county-level and temporally over the duration of the proposed action. County-level is the appropriate scale to observe economic effects because industry job and income data are publicly reported and more accurate at this level.

FIGURE III-25 – ECONOMIC ANALYSIS AREA.



ANALYSIS METHODS

This economic analysis of proposed timber sales is limited to the estimation of direct and indirect, income and employment opportunities occurring as a result of the proposed action, including income opportunities for the trust beneficiaries, directly.

Project generated income, from stages of the proposed action up to the point of industrial processing, is estimated by multiplying reported regional gate prices[1] (the delivered log price paid by industrial wood processors) by the total harvest volume expected in the proposed timber sale. Stumpage prices, the contractual price paid for standing timber, are estimated using a transaction evidence appraisal to determine the portion of this total income earned by the trust beneficiaries. Stumpage prices are estimated through transaction evidence from comparable timber sales, highlighting unique characteristics of the proposed sale (i.e. species mix, wood quality, density and diameter, terrain, development requirements, and proximity to

[1] Surveyed gate prices are reported quarterly by the Bureau of Business and Economic Research, an industry research organization at the University of Montana.

markets). State trust management expenses are estimated from annual cash-flow records from DNRC's *TLMD* forest-management program.

Direct and indirect employment opportunities, as well as direct labor income are estimated using employment and income multipliers published by the *University of Montana's Bureau of Business and Economic Research*. Additionally, data sources for the economic analysis include DNRC's *TLMD*, U.S. Department of Commerce, U.S. Department of Labor, the *Department of Labor and Industry*, *Research and Analysis Bureau*, *Western Wood Products Association* and *Random Lengths*.

AFFECTED ENVIRONMENT

The proposed action would take place in Swan River State Forest located on the eastern side of Lake County. Timber sales in this area typically supply lumber, pulp and other forest product industrial processors in Lake, Missoula, and Flathead counties, but occasionally timber sales in this area can involve labor, business and commodity trades into Sanders and Lincoln County. Closest to the project area, Flathead, Lake and Missoula County stretch from the Canadian border to the top end of the Bitterroot Valley. The most likely processing locations for Swan Valley timber exist in these three counties. Summary county level economic data, for all five counties, are provided in *TABLE III-63 – ECONOMIC REGION SUMMARY*.

TABLE III-63 – ANALYSIS AREA ECONOMY PROFILE.[2]

2015, 2014 U.S. data	**Flathead County, MT**	**Missoula County, MT**	**Lake County, MT**	**Lincoln County, MT**	**Sanders County, MT**	**Analysis Area**
Population, 2015	96,165	114,181	29,457	19,052	11,336	270,191
Population % change, 1970-2015	142.1%	95.3%	101.9%	5.5%	59.4%	95.9%
Employment % change, 1970-2015	301.0%	219.5%	197.7%	21.4%	91.5%	208.8%
Personal Income % change, 1970-2015	350.8%	265.3%	301.1%	62.2%	190.6%	263.9%
Unemployment rate, 2015	5.7%	3.9%	4.9%	10.0%	8.2%	5.1%

[2] U.S. Department of Commerce. 2016. Bureau of Economic Analysis, Regional Economic Accounts, Washington, D.C.

Average earnings per job, 2015 (2016 $s)	$40,443	$42,756	$32,686	$33,392	$30,945	$40,247
Per capita income, 2015 (2016 $s)	$40,932	$41,333	$32,886	$32,678	$32,677	$39,296
Non-Labor % of total personal income, 2015	44.1%	42.4%	55.6%	58.1%	57.7%	45.7%
Services % of total employment, 2015	74.2%	75.2%	55.9%	63.4%	58.4%	72.2%
Government % of total employment, 2015	8.6%	14.0%	22.1%	14.3%	13.1%	12.6%
Timber % of total private employment, 2014	3.5%	1.1%	1.8%	5.2%	6.7%	2.3%
Mining % of total private employment, 2014	0.1%	0.1%	0.0%	3.6%	1.0%	0.2%
Fossil fuels (oil, gas, & coal), 2014	0.0%	0.1%	0.0%	0.2%	0.1%	0.0%
Other mining, 2014	0.0%	0.1%	0.0%	3.8%	0.9%	0.2%
Agriculture % of total employment, 2015	1.7%	0.8%	8.3%	3.8%	9.2%	2.1%
Travel & Tourism % of total private employment, 2014	19.6%	19.6%	17.2%	20.7%	21.2%	19.6%

The total population across the analysis area is estimated around 270 thousand. A majority of this population resides in Flathead and Missoula County. Reflecting a portion of the eligible labor population, unemployment rates are highest in the Lincoln, Sanders, and Flathead County where a greater percentage of private employment and overall economy is supported by timber related industries. Timber sales are especially important to these three counties due to the greater presence of processing and harvesting industries. Overall, timber industries are most important in this economic region of Montana. Across the State, more than 85 percent of

forestry and logging firms and 75 percent of wood-product manufacturing firms are located in these counties.[3]

TABLE III-64–TIMBER INDUSTRY EMPLOYMENT PROFILE provides a more detailed account of timber industry employment across counties in the analysis area, as of 2014. The majority of industry jobs are located in Flathead and Missoula County, although Lincoln and Sanders County have proportionally higher employment in timber industries. Employment opportunities supported directly, or indirectly to timber sales in the project area may occur in any of these counties.

TABLE III-64 –TIMBER INDUSTRY EMPLOYMENT PROFILE.[4]

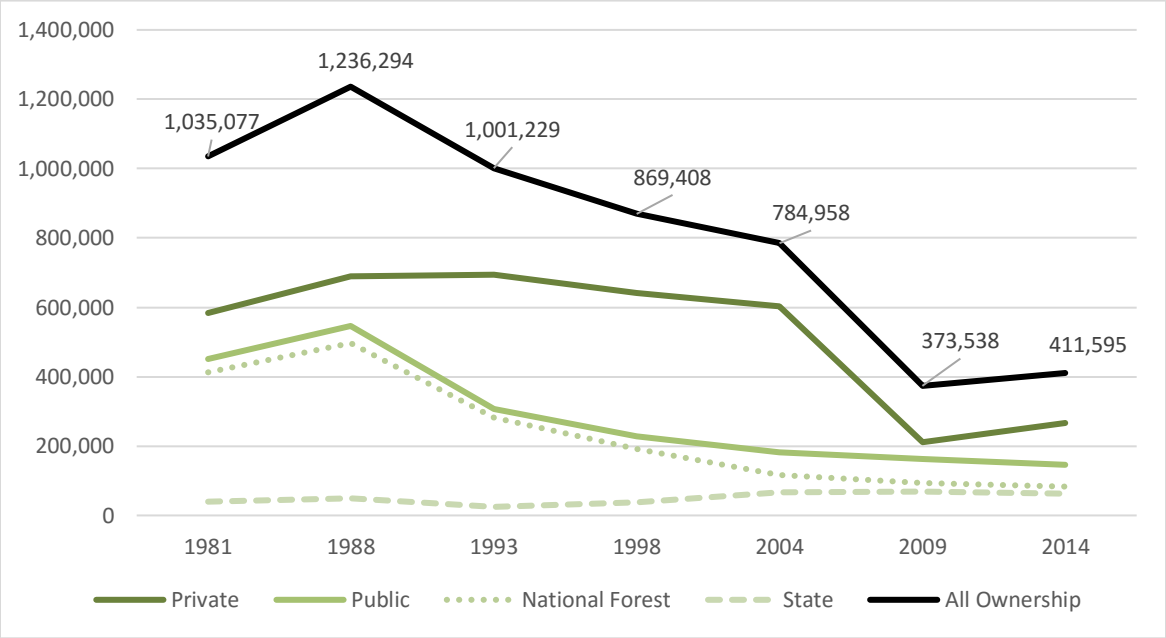
2014 U.S. employment data	Flathead County, MT	Missoula County, MT	Lake County, MT	Lincoln County, MT	Sanders County, MT	Analysis Area
Total Private Employment	35,041	49,006	5,357	3,850	1,978	95,232
Timber	1,213	537	96	201	132	2,179
Growing & Harvesting	164	126	23	121	37	471
Forestry & Logging	161	102	20	106	36	425
Support Activities for Forestry	3	24	3	15	1	46
Sawmills & Paper Mills	949	316	14	36	88	1,403
Sawmills & Wood Preservation	278	165	14	34	76	567
Pulp, Paper, & Paperboard Mills	0	0	0	0	0	0
Engineered Wood	671	151	0	2	12	836
Wood Products Manufacturing	100	95	59	44	7	305

[3] Montana Department of Labor and Industry, Bureau of Research and Analysis 2016.
[4] U.S. Department of Commerce. 2016. Census Bureau, County Business Patterns, Washington, D.C.

Other Wood Product Mfg.	93	95	59	44	7	298
Converted Paper Product Mfg.	0	0	0	0	0	0
Non-Timber	33,828	48,469	5,261	3,649	1,846	93,053

Regional commodity markets are another important perspective to consider for projects such as the proposed action. Overall, Montana timber and lumber markets have declined over recent history. *FIGURE III-26 – MONTANA TIMBER HARVEST BY OWNERSHIP, SELECT YEARS* shows this long run decline in Montana's timber supply since the 1980s. Aggregate timber supply in Montana has been affected by both changes in Federal policy and supply competition from Canada and the Pacific Northwest. Aggregate timber supply in Montana peaked in 1987 near 1.3 billion board feet and were recovering to over 400 million board feet in 2014. During this period in Montana, only state forests have continued to supply similar or increasing volumes year over year. As a result, supply of timber from state forests has increased as a percentage of aggregate supply, from approximately 3 to close to 15 percent. Over the past 10 years, state forests have supplied markets with an average of approximately 52 MMbf.

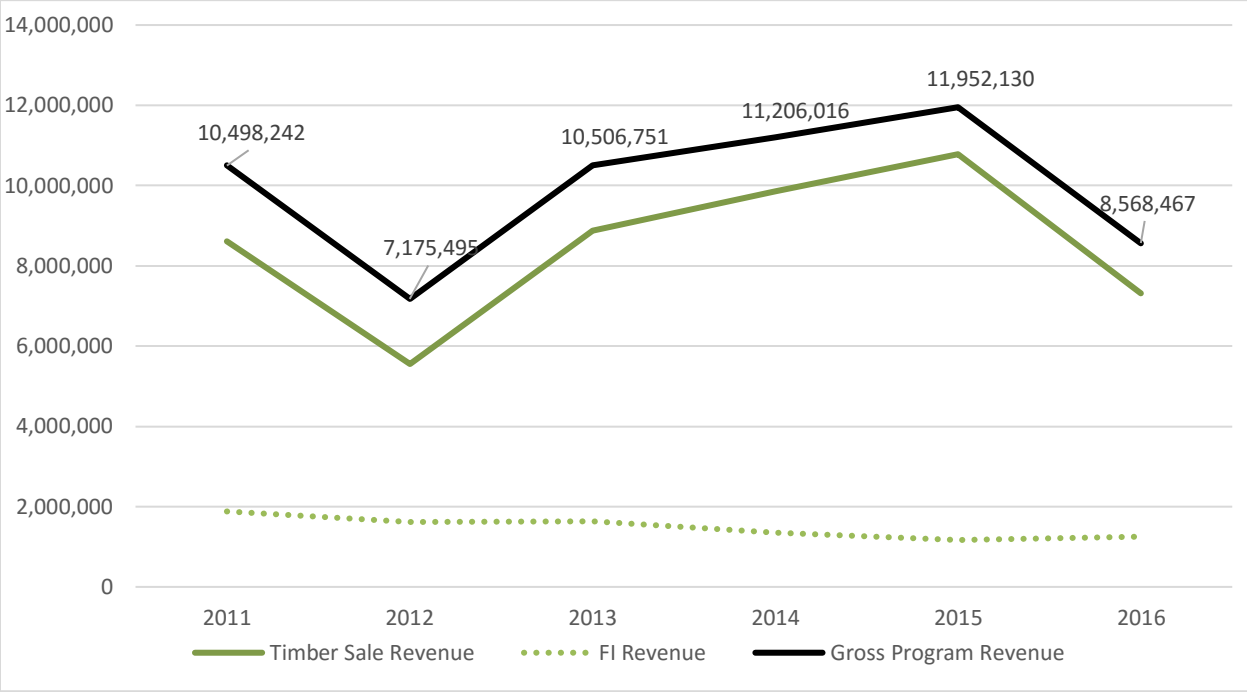
FIGURE III-26– MONTANA TIMBER HARVEST BY OWNERSHIP, SELECT YEARS.[5]



[5] Bureau of Business and Economic Research. 2016. University of Montana, Missoula.

In addition to supplying timber, state forests generate revenue for state trust beneficiaries. Revenue from state forests fluctuates due in part to fluctuating timber prices and other market conditions. *FIGURE III-27– TLMD GROSS FOREST MANAGEMENT REVENUE, 6 YEARS* charts state forest gross revenue, which includes both timber sale and FI revenue. Revenues for trust beneficiaries declined in the most recent fiscal year, though expectations are for revenue growth in future years. The proposed action would contribute a significant portion of revenue to the overall forest management program.

FIGURE III-27– TLMD GROSS FOREST MANAGEMENT REVENUE, 6 YEARS.



Forest improvement (FI) revenues are a component of gross revenues earned from state forest timber sales, and are used to finance projects that improve the health, productivity, and value of forested trust lands. FI investments are similar to capital improvements, as they can increase the asset value of forest lands and help yield future returns. FI activities may include the piling and disposal of logging slash, reforestation, thinning, prescribed burning, site preparation, noxious-weed control, seed collection, acquiring access and maintaining roads necessary for timber harvesting, and monitoring.

ECONOMIC EFFECTS

Direct economic effects include changes to income and employment in the timber related industries including forestry, logging, transportation, and wood-product manufacturing. Indirect economic effects include changes to other industries and sectors within the analysis area. Cumulative economic effects include any effect of the proposed action that may contribute to long-term changes in any part of the economy.

All economic effects are methodologically related to the scale and type of timber harvested and sold. *TABLE III 65– ALT B. ESTIMATED HARVEST VOLUMES BY SALE, and TABLE III-66 – ALT C. ESTIMATED HARVEST VOLUMES BY SALE* tabulate the expected harvest volumes by individual sale within the proposed action for both alternatives. Between the two alternatives, alternative B is expected to yield greater harvest volume across all proposed sales.

TABLE III-65 – ALT B. ESTIMATED HARVEST VOLUMES BY SALE.

Sale Name	Acres	MBF Cut	MBF Total	Percent Harvested
Bottom Wood	205	795	1,629	49%
Fatwood	343	4,089	5,530	74%
High Lion	203	1,205	1,860	65%
Low Lion	266	1,361	2,812	48%
Lower Woodward	350	3,180	5,288	60%
Swan Wood	492	5,536	7,727	72%
Ten Lions	327	2,527	4,751	53%
Top Wood	312	2,740	5,860	47%
White Lion	301	2,548	3,673	69%
Woodlion	148	148	148	100%
Total	**2,948**	**24,129**	**39,278**	**61%**

TABLE III-66– ALT C. ESTIMATED HARVEST VOLUMES BY SALE.

Sale Name	Acres	MBF Cut	MBF Total	Percent Harvested
Bottom Wood	301	812	2,789	29%
Fatwood	348	3,643	5,933	61%
Honey Wood	74	296	887	33%
Lion Cliffs	95	1,139	1,804	63%

Lower Lion	97	388	969	40%
Lower Woodward	350	2,794	5,288	53%
Swan Wood	561	5,275	7,638	69%
Ten Lions	92	922	1,567	59%
Top Wood	312	2,740	5,860	47%
Uneven Lions	62	276	639	43%
White Lion	189	1,258	1,996	63%
Whitetailed Lion	22	215	215	100%
Whitetailed Swan	38	422	728	58%
Woodlion	575	2,681	6,093	44%
WoodLion Recut	211	560	1,986	28%
Total	**3326**	**23,421**	**44,392**	**53%**

ENVIRONMENTAL EFFECTS

- ***Direct and Indirect Effects of No-Action Alternative A to Economics***

Information organized in *TABLE III-67– ESTIMATED DIRECT AND INDIRECT ECONOMIC EFFECTS* shows that under No-Action Alternative A, income effects from the project area would not be realized at this time. However, if timber from this project is not sold, equivalent volumes would need to come from sales on other trust forestlands in the State, lending to income and employment effects of an unknown scale to occur elsewhere. Local mills may not be able to substitute the potential loss of delivered logs from their regional resource supply chain. Negative economic effects can also occur from a no-action alternative concerning salvage condition trees where a particular forest stand is left unmanaged in a dead or dying state. Unmanaged dead stands can produce negative externalities and extend economic losses by promoting unwanted sylvicultural conditions and slowing down the rate at which a replacement stand matures. These effects are not quantified in this analysis, but do represent an increase in the total economic opportunity costs for a no-action alternative decision concerning salvage or overgrown stands.

- ***Direct and Indirect Effects of Action Alternatives B and C to Economics***

TABLE III- 67– ESTIMATED DIRECT AND INDIRECT ECONOMIC EFFECTS shows an estimated total direct state revenue of $4,684,887 or $4,547,421 with a total delivered value of $8,857,756 or $8,597,849 would be created in the harvest and delivery of logs from Action Alternative B and C, respectively. A portion of this value represents the margin for operators to harvest, load, and haul the logs to mill locations. The other portion includes revenue for state trust beneficiaries, infrastructure development, and other forest improvements on state forest. The estimated net revenue generated and distributed to trust beneficiaries is $2,482,990 or $2,410,133 for Alternative B and C, respectively. Management expenses are estimated using an average program revenue/cost ratio from annual accounting records highlighted and footnoted in *TABLE III- 67– ESTIMATED DIRECT AND INDIRECT ECONOMIC EFFECTS.*

State income effects reported are based on a preliminary appraised timber sale contract value which references sawlog prices reported from the University of Montana Bureau of Business and Economic 2016 Fourth Quarter Report. The estimated value in this EIS is preliminary and does not reflect the actual appraised sale values associated with any sale contract package. At the time of an actual sale, appraised values are expected to change with reported sawlog prices and other data refreshed in the timber sale contract package.

Direct labor income from harvesting and processing of timber in the proposed action is estimated at $6,938,941 or $6,735,336, for Alternative B and C, respectively.

Estimated direct and indirect employment effects include the contribution to 208 or 202 full-time jobs for one year for alternatives B and C, respectively. The level of employment sustained by these alternatives is estimated using industry research by the *Bureau of Business and Economic Research*.

TABLE III-67 – ESTIMATED DIRECT AND INDIRECT ECONOMIC EFFECTS.

Measurable Effect	**Formula**	***Alternative***		
		A	**B**	**C**
Total harvest volume	[a]	0	24,129	23,421
Delivered log price[16]/Mbf	[b]	0	$367.10	$367.10
Total delivered log value	[a] x [b]	0	$8,857,756	$8,597,849
Timber sale revenue/Mbf	[c]	0	$169.03	$169.03
FI revenue/Mbf	[d]	0	$25.13	$25.13

[6] Estimated using species mix and current Bureau of Business and Economic Research market price for delivered sawlogs in the Western Montana regions.

Direct state revenue	[a] x ([c] + [d])	0	$4,684,887	$4,547,421
Direct trust revenue[27]	[a] x ([c] + [d]) x (.53)	0	$2,482,990	$2,410,133
Estimated direct harvesting and processing employment[8]	[e]	0	135	131
Estimated direct harvesting and processing labor income[9]	[e]*51,353	0	$6,938,941	$6,735,336
Estimated indirect employment	[e]*(0.54)	0	73	71

Indirect and induced income effects are not quantified in this analysis, but they represent additional benefits to the economy as income earned in timber industries from the proposed action is recycled within the analysis area buying other goods and services.

Finally, cumulative effects have been considered and though they cannot be quantified in respect to alternatives B and C, collectively include the minor role the proposed action has in supporting and making whole, long term capital investments made by forest product manufactures and other timber companies in the analysis area. The infrastructure in these industries guarantees not only jobs and income in the analysis area, but also helps guarantee resource and land value for owners, public and private, of forested lands in Western Montana.

Other cumulative effects of the proposed action may include limited effects to regional and national timber and lumber markets, including the potential offsetting, or substitution, of imported timber or wood products.

[7] State management expenses estimated with the revenue and cost summary in the 2010 SFLMP Monitoring Report. The 0.53 proportion is the 2010 operating profit margin of timber sales in the NWLO.

[8] Sorenson, et al. 2015. Employment and Wage Impacts of Timber Harvesting and Processing in the United States. 2015. BBER University of Montana.

[9] U.S. Department of Labor. 2016. Bureau of Labor Statistics, Quarterly Census of Employment and Wages, Washington, D.C.

AIR QUALITY ANALYSIS

INTRODUCTION

This analysis describes the existing air quality and discloses the potential direct, indirect, and cumulative environmental effects the proposed action (see *CHAPTER I – PURPOSE AND NEED*) may have on air quality throughout the area.

ISSUES AND MEASUREMENT CRITERIA

ISSUES

The following issues concerning air quality were raised during internal and external scoping and will be analyzed in further detail in this analysis:

- Smoke produced from prescribed burning associated with the proposed actions may adversely affect local air quality.
- Dust produced from road construction, road maintenance, harvest-related traffic, and gravel pit operations associated with the proposed action may adversely affect local air quality.

MEASUREMENT CRITERIA

Quantitative and qualitative changes to the following measurement criteria are intended to measure the extent of the potential direct, indirect, and cumulative environmental effects that the proposed action may have on existing air quality in the area.

- To determine the impacts from smoke, the measurement criteria include: the amount, location, timing (including season), and duration of prescribed burning.
- To determine the impacts from dust, the measurement criteria include: the amount, location, timing (including season), and duration of road construction and maintenance, harvest-related traffic, and gravel pit operation.

ANALYSIS AREA

The analysis area used to determine direct, indirect, and cumulative environmental effects of the proposed action on air quality includes all of the Swan River Subbasin (fourth-level hydrologic unit) and all lands within a 5-mile buffer distance outside the boundary of the subbasin.

ANALYSIS METHODS

The methodologies used to determine the environmental effects of the proposed action on air quality in the project and surrounding areas include considering the amount, location, timing, and duration of smoke and dust generated by activities associated with the proposed action. Cumulative effects include consideration of other actions indicated under *RELEVANT PAST, PRESENT, AND REASONABLY FORESEEABLE ACTIONS* under *SCOPE OF THIS EIS* in *CHAPTER I*.

RELEVANT LAWS, PERMITS, AGREEMENTS, PLANS, LICENSES, AND OTHER REQUIREMENTS

CLEAN AIR ACT OF MONTANA

MCA 75-2-101 through *429* is known as the *Clean Air Act of Montana* and requires the State of Montana to provide for a coordinated statewide program to prevent, abate, and control air pollution while balancing the interest of the public.

MONTANA/IDAHO AIRSHED GROUP

DNRC is a member of the *Montana/Idaho Airshed Group*, which was formed to minimize or prevent smoke impacts while using fire to accomplish land-management objectives and/or fuel hazard reduction (*Montana/Idaho Airshed Group 2010*). The *Montana/Idaho Airshed Group* determines the delineation of airsheds and impact zones throughout Idaho and Montana. As a member, DNRC must submit burn plans to the smoke-monitoring unit that describe the type of burn to be conducted, the size of the burn in total acres, and the location and elevation of each burn site. The smoke-monitoring unit provides timely restriction messages by airshed. DNRC and other cooperators are required to abide by those restrictions and burn only when conditions are conducive to good smoke dispersion.

AIR QUALITY MAJOR OPEN-BURNING PERMIT

DEQ issues permits to entities that are classified as major open burners (*ARM 17.8.610).* DNRC is permitted to conduct prescribed wildland open-burning activities that are either deliberately or naturally ignited. Planned prescribed burn descriptions must be submitted to *DEQ* and the smoke-monitoring unit of the *Montana/Idaho Airshed Group*. All burns must be conducted in accordance with the major open-burning permit.

AFFECTED/EXISTING ENVIRONMENT

The analysis area is located within Montana Airshed 2, which encompasses the entire Flathead and Lake counties, most of Sanders County, and the smaller, northernmost portions of Missoula, Mineral, and Powell counties. The project area (see *CHAPTER I –PURPOSE AND NEED*) is located 5 miles from the 2 nearest population centers on either of its ends, which are Swan Lake and Salmon Prairie. Condon, the nearest population center after those, is 14 miles. The analysis area occurs outside of designated 'impact zones' that refer to areas the *Montana/Idaho Airshed Group* or affiliated local program identifies as smoke sensitive and/or having an existing air quality problem. Within the periphery of the analysis area are 3 'Class I Areas', which include the Mission Mountain and Bob Marshall wilderness areas and the Flathead Indian Reservation. Both wilderness areas are considered Mandatory Federal Class I Areas, which refer to areas specified as Class I by the *1977 Clean Air Act* and include international and national parks greater than 6,000 acres and national wilderness areas greater than 5,000 acres that existed on August 7, 1977. The Flathead Indian Reservation is considered a non-Federal Class I Area, yet still receives recognition and protection under the *1977 Clean Air Act*.

Air quality in the analysis area is generally excellent and has limited local emission sources and consistent wind dispersion throughout most of the year. Existing emission sources include residential wood-burning stoves, private homeowner debris burns, road dust created by

recreational or forest-management activities, and periodic wildland fires and prescribed burns on federal, private, state, and tribal forested lands. Prevailing winds typically blow from west to east; thus, emissions from activities in the western portion of the analysis area tend to drift into the valley bottom, particularly during the late afternoon and evening. Currently, emissions do not affect local population centers, impact zones, or Class I Areas beyond *EPA* and *DEQ* standards. All burning activities by major burners comply with emission levels authorized by the *Montana/Idaho Airshed Group*.

ENVIRONMENTAL EFFECTS

- ***Direct and Indirect Effects of No-Action Alternative A to Air Quality***

No prescribed burning, road construction and maintenance, harvest-related traffic, or gravel pit operation would occur. Therefore, direct and indirect effects to air quality as a result of this alternative would not be expected.

- ***Direct and Indirect Effects of Action Alternatives B and C to Air Quality***

Some differences between the 2 action alternatives do exist. Action Alternative C includes slightly more road miles than Action Alternative B. Despite this, the amount of particulate matter released into the analysis area is expected to be indistinguishable between alternatives. The only distinguishable difference between alternatives occurs in the location of emission sources. Sources associated with Action Alternative B would include a greater concentration of harvesting activity, and, therefore, the associated road construction and burning, between the Woodward Creek Drainage and the South Woodward Creek Drainage. Those activities associated with Action Alternative C would include a greater concentration between the Whitetail Creek Drainage and the Woodward Creek Drainage.

PRESCRIBED BURNING

Under each action alternative, DNRC would conduct prescribed burning following harvesting activities in order to remove residual logging waste and fine fuels. These burning activities would subsequently reduce fire risk in the area and prepare site conditions conducive to tree regeneration. Starting in the spring of 2019, 100 to 150 piles of slash and/or variable-sized broadcast units would be burned each fall over a period of approximately 7 years. Burning, which would vary by location under either action alternative, depending on weather conditions and which piles and/or units are ready to burn, would likely occur during the months of September and November. Burning would be done only during conditions that are conducive to good smoke dispersion. Actual burning days would be controlled and monitored by *DEQ* and the smoke monitoring unit of the *Montana/Idaho Airshed Group* and would meet *EPA* standards, which would further minimize the direct and indirect effects of burning activities.

ROAD CONSTRUCTION AND MAINTENANCE

Under each action alternative, operators conducting new road construction and road maintenance on existing roads are expected to produce particulate matter (*TABLE III-68 –MILES OF ROAD CONSTRUCTION AND MAINTENANCE BY ALTERNATIVE*).

Over the 7 year operating period, 6 to 9 timber sales are expected to be implemented. Varying levels of road construction and maintenance would typically occur prior to each sale and during

drier conditions to avoid damaging road-drainage features. Depending on the size and location of each sale and on the alternative implemented, 12.8 to 16.1 miles of new road construction, 3 to 5 miles of temporary road construction, 2.8 to 3.7 miles of road renovation, and 91.8 to 95.9 miles maintenance would occur over the 4 year project period during the months of June through November, conditions permitting. Depending on the season and conditions of the road, DNRC would require that purchasers apply dust abatement to segments of roads in order to reduce particulate emissions.

Direct and indirect effects to air quality as a result of road construction and maintenance are expected to be localized to the roadways and areas directly adjacent to the roadways. Vegetative barriers along the roadside and dust-abatement mitigations are expected to greatly limit the dispersion of particulate matter beyond these areas. Thus, direct and indirect effects to air quality throughout the analysis area as a result of road construction and maintenance are expected to be minor.

TABLE III-68 - MILES OF ROAD CONSTRUCTION AND MAINTENANCE BY ALTERNATIVE.

ACTION ALTERNATIVE	MAINTENANCE	RECONSTRUCTION	NEW CONSTRUCTION	TOTAL ROAD MILES
B	91.8	2.8	12.8	107.4
C	95.9	3.7	16.1	115.7

HARVEST-RELATED TRAFFIC

Under each action alternative, harvest-related traffic on gravel roads would be expected to produce particulate matter. According to the analysis conducted in the *RECREATION ANALYSIS*, approximately 4,887 to 8,954 harvest-related trips would be expected per year over the 4 to 7 year operating period (see *TABLE III-71 – HARVEST-RELATED TRAFFIC*). Traffic on designated restricted roads would be limited to 9 months due to restrictions during the grizzly bear denning period (April 1 through June 15) that are enforced under the *SVGBCA*. Traffic along open roads would likely continue during the denning period, but at rates lower than those expected outside of the denning period.

Dust production on roads during the dry summer and fall months would likely be higher than during the late fall, winter, and early spring months when frozen ground conditions and/or higher levels of moisture are expected to abate particulate production. During the dry months, log, rock, and equipment-hauling traffic would be expected to produce more particulate matter than the other harvest-related traffic due to the size and weight of the vehicles.

Half to two-thirds of the harvest operations would occur during the late-spring and winter months, while the other remaining proportion would occur during drier months. During the drier months, and depending on the condition of the roads, DNRC would require that harvest operators apply dust abatement to segments of roads used for hauling and other harvest-related traffic in order to reduce particulate emissions.

Direct and indirect effects to air quality as a result of harvest-related traffic are expected to be localized to the roadways and areas directly adjacent to the roadways. Vegetative barriers

along the roadside and dust abatement mitigations are expected to greatly limit the dispersion of particulate matter beyond these areas. Thus, direct and indirect effects to air quality throughout the analysis area as a result of harvest-related traffic are expected to be minor.

GRAVEL-PIT OPERATIONS

Under each action alternative, DNRC would utilize gravel pit resources from 2 different pits. These would be the existing Goat Creek Pit (Section 16, T23N, R17W) and the existing South Woodward Pit (Section 24, T23N, R18W). Contractors are required to hold a *Montana Air Quality Permit* for Portable Sources and abide by air-quality regulations set forth by *DEQ* under this permit. Operators regularly apply water during crushing and loading operations and wet stockpiles in order to reduce particulate emissions. Crushing would occur in the South Woodward Pit and is planned for the summer of 2019, though other crushing may occur as needed.

Direct and indirect effects of the gravel pits are expected to be localized to the South Woodward Drainage. Both gravel pits are at a greater distance than a mile from the primary travel route through the area, Highway 83, and vegetative barriers adjacent to the gravel pit and abatement measures are expected to greatly limit the dispersion of particulate matter beyond their immediate surroundings. Thus, direct and indirect effects to air quality throughout the analysis area as a result of gravel pit operations are expected to be minor.

- ***Cumulative Effect of No-Action Alternative A to Air Quality***

Cumulative effects to air quality as a result of this alternative would not be expected.

- ***Cumulative Effects of Action Alternatives B and C to Air Quality***

Actions on adjacent properties and ongoing DNRC timber sales in the analysis area would continue. Burning, road construction, road maintenance, and gravel crushing and hauling associated with ongoing and foreseeable actions on DNRC, federal, private, and tribal forested lands would produce particulate matter. Existing emission sources from residential wood-burning stoves, private homeowner debris burning, road dust created by recreational activities, and periodic wildland fires would continue. Nearby residential areas and towns in the analysis area would experience reductions in air quality during peak burning periods. All burning activities by major burners would continue to comply with emission levels authorized by *DEQ, Montana/Idaho Airshed Group*, and *EPA*.

All above-mentioned emissions in conjunction with expected particulate production from the proposed action would occur at higher levels than currently expected. Providing that dust abatement would be used during dry conditions and gravel operations, half of the harvesting operations would occur during frozen and/or wetter conditions, construction activities would be short in duration, and emissions produced from burning would be appropriately controlled and monitored, the cumulative effects to air quality are not expected to exceed *EPA* and *DEQ* standards.

RECREATION ANALYSIS

INTRODUCTION

Many residents and nonresidents of Montana enjoy recreational opportunities in and around the Swan River State Forest. Over 56,312 acres of mostly forested, legally accessible land are available for various recreational activities such as berry and mushroom picking, snowmobiling, cross-country skiing, horseback riding, bicycling, fishing, hiking, and hunting. This analysis describes the existing environment of recreational uses in the project area and surrounding areas and discloses the potential environmental effects the proposed action may have on those uses (see *CHAPTER I – PURPOSE AND NEED*).

ISSUES AND MEASUREMENTS CRITERIA

ISSUES

Two concerns were raised during the scoping period regarding potential impacts the proposed action may have on recreation throughout the area. The following issue statements summarize those concerns and ultimately guides this analysis:

- The proposed activities may affect public motorized use, non-motorized uses, and hunting.
- The proposed activities may affect the revenue generated by recreational uses.

MEASUREMENT CRITERIA

The following measurement criteria were used to help assess the extent of any potential direct, indirect, and cumulative environmental effects the proposed action may have on existing recreational uses in the project area:

- miles of roads where motorized and nonmotorized recreational access are allowed;
- big game use of the area;
- amount, duration, and location of forest-management activities in the area; and
- recreation revenue generated from 4 categories: *General Recreational Use*, *Special Recreational Use, Conservation*, and *Land Use* licenses.

PROJECT AND ANALYSIS AREAS

Direct and indirect environmental effects of the proposed action on recreational uses will be analyzed within the project area.

Cumulative environmental effects of the proposed action on recreational uses will be analyzed within an area that includes all legally accessible state, federal, and private lands within the perimeter of Swan River State Forest, as well as the roads used to access those lands. This analysis area will herein be referred to as the cumulative effects analysis area.

ANALYSIS METHODS

To assess the environmental effects of the proposed action on recreational uses in the project and cumulative effects analysis areas DNRC: 1) determined the amounts and types of existing recreational uses, 2) estimated and established the existing condition with regard to each measurement criterion, and 3) estimated any likely changes associated with the measurement criteria that may result under each alternative. When possible, project related and recreation related activities were quantified using metrics such as number of vehicle trips, license sales, and revenues generated. The cumulative effects analysis includes consideration of other actions indicated in *RELEVANT PAST, PRESENT, AND REASONABLY FORESEEABLE ACTIONS* under *SCOPE OF THIS EIS* in *CHAPTER I – PURPOSE AND NEED.*

DNRC developed the following calculations to determine how many project related traffic trips would result from each action alternative. A trip refers to travel in one direction. That is, a trip *to* the harvest site is counted as one event while the trip *from* the harvest site is counted as a separate event.

- Trips associated with road, harvesting and postharvest operations = 20 days per month times 9 months of operation per year for 4 to 7 years of operation for 4 to 5 vehicles times 2 trips (20 x 9 x [4 to 7] x [4 to 5] x 2)
- Trips associated with gravel hauling = 12,000 to 15,000 cubic yards of gravel hauled divided by 12 cubic yards per load times 2 trips ([12,000 to 15,000] / 12 x 2)
- Trips associated with timber sale and postharvest contract administration = 10 to 16 days per month times 9 months of operation per year for 4 to 7 years of operation for 1 vehicle times 2 trips ([10 to 16] x 9 x [4 to 7] x 1 x 2)
- Trips associated with log hauling = Volume in MMbf divided by 4.5 Mbf, plus 33 percent more trips for cull and pulp material times 2 trips (to and from the site) ([19.5 to 24.13 MMbf/4.5 Mbf] +(.33 [19.5 to 24.13 MMbf/4.5 Mbf]) x 2)
- Trips associated with sale preparation = 12 to 16 days per month times 9 months of marking times 1 to 2 vehicles times 2 trips for 4 to 5 years of operations ([12 to 16] x 9 x [1 to 2] x 2 x [4 to 5])

RELEVANT AGREEMENTS, LAWS, PLANS, PERMITS, LICENSES, AND OTHER REQUIREMENTS

DNRC RECREATION USE RULES

DNRC *Recreational Use Rules* (*ARM 36.25.146 though 162*) regulate and provide for the reasonable recreational use of legally accessible school trust lands. Recreational use is divided into 2 categories and, subsequently, requires 2 different types of recreational licenses for those wishing to engage in recreational activities on school trust lands. These include the "general recreational use license," and the "special recreational use license" types.

GENERAL RECREATIONAL USE LICENSE

A general recreational use license is a license issued to individuals for participation in recreational activities on state trust lands that are nonconcentrated and noncommercial in nature. Examples of permitted activities under this license type include snowmobiling, hiking,

bicycling, hunting, motorized use, horseback riding, and berry picking. Any person over the age of 12 who wishes to engage in activities that pertain to general recreational uses is required to obtain a 12 month *General Recreational Use License* from a state license provider or DFWP. For recreationists younger than 17 or older than 60, the license is $5. For recreationists between the ages of 17 and 60, the license is $10. All license holders are required to abide by current restrictions, closures, and regulations.

SPECIAL RECREATIONAL USE LICENSE

A *Special Recreational Use License* is required for trapping, commercial recreational use (such as outfitting), and concentrated (group) use. It is also required for uses outside of the restrictions applicable to general recreational use. For example, overnight horseback use or overnight use (camping) more than 200 feet from a customary access point or for more than two days on leased/licensed state trust lands. Any person who wishes to engage in activities that pertain to special recreational uses is required to obtain a *Special Recreational Use License* from DNRC. The cost of the license is determined by DNRC and is assessed at what is considered to be the full market value of that use.

MEMORANDUM OF AGREEMENT AFFECTING RECREATIONAL USE OF STATE SCHOOL TRUST LANDS

A *General Recreational Use License* is not required when using state trust lands for hunting and fishing because a $2.00 fee is included in the Montana Conservation License for use of these lands. This agreement entered into by DFWP and DNRC, requires DFWP to reimburse DNRC $2 for every wildlife conservation license and certain game animal licenses sold in accordance with *MCA 87-2-202, 505, 510,* and *511*.

LAND USE LICENSE

DNRC *Surface Management Rules* (*ARM 36.25.102[14]*) define and allow for uses of state lands other than those for which the land was originally classified. Such uses are allowed for a specific fee and a term not to exceed 10 years (*ARM 36.25.106[2]*). An example of a *Land Use License* on the Swan River State Forest is the Sprunger-Whitney Nature Trail by Point Pleasant Campground.

SWAN VALLEY GRIZZLY BEAR CONSERVATION AGREEMENT

As a cooperator of the *SVGBCA (1997)*, DNRC has agreed to a number of mitigations that restrict motorized use of roads in the project and surrounding areas. Recreational motorized road use is limited to those roads that are open year-round and seasonally to the public (this includes wintertime snowmobile access on otherwise restricted roads).

EXISTING ENVIRONMENT

MOTORIZED AND NONMOTORIZED RECREATIONAL ACCESS

The project and cumulative effects analysis areas both receive moderate recreational use throughout the year by anyone holding a *General Recreational Use License*. Current uses include berry and mushroom picking, snowmobiling, cross-country skiing, horseback riding, bicycling, fishing, hiking, and hunting. These activities primarily occur on or adjacent to roads that are open, seasonally restricted, or closed. Sixty-five road miles are available for recreational

opportunities throughout the project area, while 515 miles are available throughout the cumulative effects analysis area (*TABLE III-69-RECREATIONAL ROAD ACCESS*).

While only a limited amount of the existing roads are available for motorized activities, all roads throughout both analysis areas are open year-round to nonmotorized activities, including hiking, horseback riding, bicycling, hunting, and other similar activities that do not require a motorized vehicle.

TABLE III-69 – RECREATIONAL ROAD ACCESS. *Existing miles of road by closure status on the project area and Cumulative Effects Analysis Area*

ANALYSIS AREA	OPEN YEAR-ROUND TO PUBLIC MOTORIZED ACCESS	SEASONALLY RESTRICTED TO PUBLIC MOTORIZED ACCESS*	CLOSED YEAR-ROUND TO PUBLIC MOTORIZED ACCESS	TOTALS
	MILES			
Project Area	12.4	6.3	163.1	*181.8*
Cumulative Effects Analysis Area [1]	51.6	10.4	412.7	*474.7*

**As cooperators of the SVGBCA, DNRC, and Flathead National Forest restricts public motorized use on designated seasonally restricted roads during the grizzly bear spring period (April 1 through June 15).*
[1]Total road miles in the cumulative-effects analysis area include road miles in the project area.

BIG GAME USE

As indicated in *EXISTING ENVIRONMENT* and *ENVIRONMENTAL EFFECTS* under *WILDLIFE ANALYSIS*, a number of threatened, sensitive, and other wildlife species persist throughout the area. Of those, big game species are perhaps the most important to many recreationists who use the area. According to the wildlife analyses for this and prior proposed actions, big game species are currently abundant throughout both analysis areas, affording many hunting opportunities. Species commonly hunted in the valley include elk, mule deer and white-tailed deer.

FOREST MANAGEMENT ACTIVITIES

A great portion of the land available to recreationists throughout both analysis areas has undergone levels of forest management in the past, is undergoing forest management currently, or is expected to be managed at some point in the future. Therefore, any recreationists who frequent the area are most likely accustomed to forest-management activities and are adept at shifting their use based on the location and duration of those activities.

Activities that may displace recreationists include harvest-related traffic and temporary area closures during active harvesting. Displacement of recreationists from areas of active harvesting and logging traffic during the summer and fall months generally coincides with the rotational schedule required under the *SVGBCA*. Under the *SVGBCA* subunits are deemed 'inactive' for at least a 3 year period (typically 6 years), thereby greatly limiting the amount of forest management activities occurring in the area at those times. By default, these inactive subunits provide recreationists large areas that are relatively free of active harvesting and

harvest-related traffic except for occasional administrative uses and small-scale salvage or sanitation sales. Recreationists are free to take part in motorized and nonmotorized activities in active and inactive subunits as road restrictions allow under the *SVGBCA*. Public motorized use of closed roads in inactive subunits is not allowed.

REVENUE FROM GENERAL RECREATION USE, SPECIAL RECREATION USE, CONSERVATION, AND LAND USE LICENSES

Recreationists wanting to engage in hunting and fishing activities on state trust lands must obtain the appropriate licenses, including a *Conservation License*, which contains the *General Recreational Use License*, which permits these uses on state trust lands. This license covers a purchaser for other general recreational activities as well. However, individuals who do not purchase hunting or fishing license, a *General Recreational Use License* must still be obtained by an authorized license provider. Additional revenue produced from recreation comes from *Special Recreational Use* and *Land Use* licenses. The sales of *General Use*, *Conservation*, and *Special Recreation Use* licenses for FY 2016 generated gross annual revenue of $1,143,699. Gross revenue generated from all licenses per acre of state trust lands for FY 2016 was $0.22 per acre (*Department of Natural Resource and Conservation Trust Land Management Division Fiscal Year 2013 Annual Report*). Applying this gross average per acre to both the project area and cumulative effects analysis area, estimated gross annual revenue of $4,276.14 and $12,388.64 was generated by each, respectively, in FY 2016. In FY 2017, the estimated revenue that would be produced from recreation in the cumulative-effects analysis area would primarily come from *Special Recreational Use* and *Land Use* licenses and would generate a total of approximately $6,500 for the trust beneficiaries (*TABLE III-70 – SPECIAL RECREATIONAL USE AND LAND USE LICENSES*).

TABLE III-70 – ESTIMATED FY 2017 SPECIAL RECREATIONAL AND LAND LICENSES. *Number of recreation licenses issued and estimated revenue for activities conducted in the cumulative effects analysis area.*

LICENSE TYPE	NUMBER OF LICENSES ISSUED	REVENUE GENERATED PER LICENSE TYPE	TOTAL REVENUE GENERATED BY LICENSE TYPE
Special Recreational Use License			
Bobcat, beaver, marten, mink, otter, and weasel trapping	1	0	0
Adventure Cycling	1	$200	$200
Spring bear and big game outfitting	2	$2,000	$4,000
Fishing outfitting (average)	4	$400	$1,600
Land Use License			
Nature trail	1	$500	$500
Point Pleasant camping	1	$200	$200
Total			*$6,500*

ENVIRONMENTAL EFFECTS

- ***Direct and Indirect Effects of No-Action Alternative A to Recreation***

No appreciable changes to motorized and nonmotorized access, big game use, forest-management activities, or revenue generated by *General Recreational Use*, *Special Recreation Use*, *Conservation*, and *Land Use* licenses would occur. Therefore, direct and indirect effects to recreational use and revenue as a result of No-Action Alternative A would not be expected.

- ***Direct and Indirect Effects of Action Alternatives B and C to Recreation***

While some differences occur in harvest amounts and road miles between the 2 action alternatives, the effects to recreation are expected to be indistinguishable between these alternatives. For recreational purposes the only distinguishable differences between alternatives occurs in the harvest prescription and location of some harvesting activities. Activities associated with both action alternatives would be spread throughout the project area. Action Alternative B would have a slightly higher amount of harvest unit acreage.

Motorized and Nonmotorized Recreational Access

Under each action alternative, all newly constructed road miles would be closed year-round to public motorized use with the exception of snowmobile use during grizzly bear denning, yet remain open to public nonmotorized use. Approximately 12.8 miles of road would be constructed under Action Alternative B and 16.1 miles under Action Alternative C. Thus, the action alternatives would lead to a 17.8- to 25.8- percent increase in road miles available for public nonmotorized and denning period snowmobile recreation in the project area.

Big Game Use

According to *EXISTING ENVIRONMENT* and *ENVIRONMENTAL EFFECTS* in *WILDLIFE ANALYSIS*, negative impacts to big game use in the project area are expected to be moderate under each action alternative. Therefore, adverse direct and indirect effects to hunting and wildlife-viewing opportunities are expected to be moderate as well.

Forest Management Activities

Under each action alternative, active harvesting and harvest-related traffic would occur up to 9 months per year over the 4 to 7 year operating period. Operators would continue to recognize restrictions in place under the *SVGBCA* and concentrate management activities outside of the grizzly bear spring habitat for the period (April 1 through June 15).

Harvesting operations and associated traffic would mostly occur during the typical business workweek (Monday through Friday) and cease each day by early evening except for the occasional operator. Some limited use of campgrounds by contractors would also likely occur.

Harvest-related traffic under each action alternative is expected to be considerable, resulting in approximately 3,000 traffic trips during the shoulder years of the 4 to 7 year operating period. Up to 11,000 traffic trips per year during peak years of the operation period could occur along

designated haul routes depending on the total number of trips and total operating trips (*TABLE III-71*). Forty-five to sixty-six percent of those trips would be completed by large trucks.

TABLE III-71 - HARVEST-RELATED TRAFFIC. *Project-related traffic trips by type expected within the project area and cumulative effects analysis area during the 4 to 7 year operating period.*

HARVEST-RELATED TRIPS	ACTION ALTERNATIVE	
	B	C
Road/harvesting operations	5,760 to 12,600	
Gravel hauling	2,000 to 2,500	
Sale administration	720 to 2,016	
Log hauling	8,901 to 14,263	
Sale preparation	864 to 2,880	
Totals	*18,245 to 34,259*	

Direct and indirect effects to recreational use as a result of forest-management activities are expected to be localized to harvest units and harvest-related roads (see *CHAPTER II-ALTERNATIVES, FIGURE II-1* and *FIGURE II-2*). Those who choose to recreate in the area during the workweek daytime hours would likely meet harvest-related traffic on designated haul routes and operators in designated harvest units; thus, direct and indirect effects on these recreationists are expected to be moderate to high. Those who choose to recreate in the area on the weekend or during the workweek evenings would likely meet minimal harvest-related traffic and harvesting operations, except for occasional operators; thus, direct and indirect effects to these recreationists are expected to be minimal. Those who choose to recreate by nonmotorized or denning period snowmobile use on restricted roads would experience an increase in accessible lands following project completion due to the construction of 12.8 miles of new restricted roads constructed under Action Alternative B, or 16.1 miles of new restricted roads constructed under Action Alternative C. Thus, direct and indirect effects on these recreationists are expected to be moderate to high during the 4 to 7 year operating period.

Revenue from General Recreational Use, Special Recreational Use, Conservation, and Land Use Licenses

No changes in revenue produced from *General Recreational Use*, *Special Recreational Use*, *Conservation*, and *Land Use* licenses are expected to occur under the action alternatives. Forest management activities in the area may temporarily displace some license holders in some local areas during varied pulses of activity for up to 7 years, while the project is active.

- ***Cumulative Effects of No-Action Alternative A to Recreation***

No appreciable changes to motorized and nonmotorized access, big game use, forest-management activities, or revenue generated by *General Recreational Use*, *Special Recreation Use*, *Conservation*, and *Land Use* licenses would occur. Thus, cumulative effects to recreational use and revenue would not be expected.

- ***Cumulative Effects of Action Alternatives B and C to Recreation***

New, permanent road construction under each action alternative would lead to increases in public nonmotorized and snowmobile access. As required under the *SVGBCA*, any new road miles built by cooperators would be closed to motorized public access other than snowmobile use during grizzly bear denning periods. Traffic increases from project-related activities under each action alternative would temporarily displace recreationists from areas during the workweek. Those who plan to recreate during the weekend would likely meet minimal harvest-related traffic except for occasional weekend operators and homeowners in the area. Additionally, ongoing projects and proposed future actions would displace recreationists, especially winter recreationists in inactive subunits. Activities related to the Scout Lake Multiple Timber Sale project are ongoing in the Porcupine Woodward, Goat Creek, and South Fork Lost Soup subunits during the denning period, as allowed under the *SVCBCA*.

Thus, cumulative effects would result in increases in roads available for nonmotorized public access and further displacement of recreationists from active harvest areas during typical business hours. Adverse cumulative effects are expected to be minor within the cumulative effects analysis area since recreationists would continue to have recreational opportunities in the South Fork Lost Soup, Goat Creek, and Lion Creek subunit.

AESTHETICS ANALYSIS

INTRODUCTION

This analysis describes the existing visual quality and noise levels throughout the area and discloses the potential environmental effects the proposed action may have on those attributes.

ISSUES AND MEASUREMENT CRITERIA

Issues

The following issues concerning visual quality and noise levels were raised during internal and external scoping and will be analyzed in further detail in this analysis:

- The proposed activities may adversely affect local viewsheds and scenic vistas.
- The proposed activities may increase local noise levels.

Measurement Criteria

Quantitative and qualitative changes to the measurement criteria are intended to 'measure' the extent of the potential direct, indirect, and cumulative environmental effects the proposed action may have on existing visual quality and noise levels in the area. Following are the measurement criteria:

- The number of harvest-unit acres and associated roads visible from specific viewpoints.
- The quality of views from specific observation points in terms of texture, form, line, and color as viewed in the foreground, middleground, and background.
- The magnitude, timing, and type of activities that produce noise in the area.

ANALYSIS AREAS

Direct and Indirect Effects

The analysis area used to determine direct and indirect environmental effects of the proposed action on the visual quality and noise levels will be the project area.

Cumulative Effects

The analysis area used to assess cumulative environmental effects of the proposed action on visual quality and noise levels will include all state, federal, and private lands within the perimeter of Swan River State Forest. This analysis area will herein be referred to as the cumulative effects analysis area.

ANALYSIS METHODS

VISUAL QUALITY

The methodologies used to portray the existing environment and determine the environmental effects of the proposed action on the visual quality in the *project area* and *cumulative effects analysis area* include using *GIS* and methods adapted from the *Landscape Visibility* section of the *USFS Scenery Management System (USFS 1995)*.

Using a *GIS* viewshed analysis, historical harvest data, and analysis of digital air photos, DNRC calculated past, present, and future DNRC managed acres of harvest units and associated roads visible from specific viewpoints for both the *EXISTING ENVIRONMENT* and *ENVIRONMENTAL EFFECTS* sections of this analysis. Harvest history on newly-acquired sections of the *SRSF* was not always available. In order to estimate the amount of land that was previously harvested in these sections, SLI analyses were cross referenced with digital air photos.

DNRC selected viewpoints that were determined to be important areas of concentrated public-viewing use. These viewpoints are the Wildlife Viewing area south of Swan Lake, Napa Point Trailhead, Swan Peak Overview, and a portion of Highway 83 within the perimeter of the project and cumulative effects area.

Unit acres and associated roads visible from these viewpoints do not account for existing or potential obstructions, such as trees and other vegetation, in the foreground (0 to 0.5 mile), middleground (0.5 to 4.0 miles), and background (4 miles and beyond). As a result, reported visible unit acres and associated roads are likely to be overestimations of what would currently or potentially be visible from each viewpoint.

Methods adapted from the *USFS Scenery Management System* were used to account for obstructions in the visibility ranges and describe existing form, lines, textures, colors and potential changes to those attributes as proposed under the action alternatives. Harvest units associated with the action alternatives were displayed by prescription type to more accurately disclose the potential visual quality of harvest units expected under each alternative.

NOISE LEVELS

The methodologies used to portray the existing environment and determine the environmental effects of the proposed action on the noise levels in the project area and cumulative effects analysis area include estimating the magnitude, timing, and type of activities that produce noise.

Cumulative effects analyses for both visual quality and noise levels include consideration of other actions indicated in *RELEVANT PAST, PRESENT, AND REASONABLY FORESEEABLE ACTIONS* under *SCOPE OF THIS EIS* in *CHAPTER I – PURPOSE AND NEED.*

EXISTING ENVIRONMENT

Visual Quality

Most visible harvested acres currently occur in the middleground and background of the viewpoints. The *SVGBCA* and the *HCP* requires vegetative visual screening along open roads. As a result, many foreground views along such roads are inhibited by a barrier of standing trees. Depending on visual screening characteristics and topography, harvest stands further away from all viewpoints may be more visible than those nearby.

Due to the evolution of forest management practices and the diversity of previous ownerships in both analysis areas, the existing landscape has various modifications of vegetative textures,

forms, lines, and colors affecting the visual quality of the area. Hard, distinctive lines exist where different sections meet, making for a 'checkerboard' appearance when viewed from the viewpoints. The historical development of small harvest units in some areas has created a relatively patchy-looking landscape. The presence of roads creates additional distinctive lines on the landscape. Such characteristics have also led to a multitude of different colors dotting the landscape. Areas that have undergone more intensive treatments (i.e., clearcut, seedtree) often appear lighter in color than those that have undergone less intensive treatments (i.e. commercial thinning).

As stands have regenerated, so has the scenic integrity (degree of intactness) of the forested landscape. Most DNRC managed stands harvested prior to 1986 have regenerated to the point that the units and associated roads have blended in with adjacent unharvested areas, while stands harvested after 1986 are more evident. These newer stands appear lighter in color, are more distinctive in form, and have harder perimeter lines and visible road prisms. For analysis purposes, stands harvested prior to 1986 and that appear to have "blended" into landscape and unharvested units will be considered "unharvested". "Harvested" acres will be considered acres that have been harvested post 1986 or currently have a visual impact at the landscape scale.

Harvest Units and Associated Roads

Data describing forest management activities on the Swan River State Forest date back beyond 1935; the current *SLI* denotes harvesting activity dating back to 1970. According to the *SLI*, approximately 31 percent of the *Swan River State Forest* has been harvested since 1970. By cross-referencing aerial photos with the SLI analyses, it was determined that approximately 38 percent of the *Swan River State Forest* has been harvested to date; this includes newly acquired lands.

According to the viewshed analysis, not all of the acres within the *Cumulative Effects Analysis Area* are visible from the selected viewpoints. Total visible acres in this area are currently 5% at the wildlife viewing area, 21% at the Swan Peak overview, 48% at the Napa Point Trailhead, and 54% along the highway 83 corridor. Total visible harvested acres are 2% at the wildlife viewing area, 8% at the Swan Peak Overview, 17% at the Napa Point Trailhead, and 18% along the Highway 83 corridor. (*TABLE III-72 – EXISTING VISUAL ENVIRONMENT – ACRES).*

According to the viewshed analysis, not all of the acres within the *Project Area* are visible from the selected viewpoints. Total acres visible in this area are currently 14% at the wildlife viewing area, 29% at the Swan Peak overview, 76% at the Napa Point Trailhead, and 73% along the highway 83 corridor. Total visible harvested acres are 6% at the wildlife viewing area, 12% at the Swan Peak Overview, 28% at the Napa Point Trailhead, and 28% along the Highway 83 corridor. (*TABLE III-72 – EXISTING VISUAL ENVIRONMENT – ACRES).*

TABLE III-72 – EXISTING VISUAL ENVIRONMENT – ACRES. *Existing harvested and unharvested acres visible in the project area and cumulative effects analysis area.*

CUMULATIVE EFFECTS ANALYSIS AREA (60,898 Acres)	**Viewpoints**			
	Wildlife Area	**Swan Peak Overview**	**Napa Point Trailhead**	**Hwy 83**
Harvested Acres Visible from viewpoint	1,148 (2%)	5,143 (8%)	10,621 (17%)	11,385 (19%)
Unharvested Acres Visible from viewpoint	1,717 (3%)	7,495 (12%)	18,562 (31%)	21,266 (36%)
Total Acres Visible From Viewpoint	2,865 (5%)	12,638 (20%)	29,183 (48%)	32,651 (54%)

PROJECT AREA ANALYSIS (19,437 Acres)	**Viewpoints**			
	Wildlife Area	**Swan Peak Overview**	**Napa Point Trailhead**	**Hwy 83**
Harvested Acres Visible from viewpoint	1,133 (6%)	2,275 (12%)	5,433 (28%)	5,375 (28%)
Unharvested Acres Visible from viewpoint	1,631 (8%)	3,439 (17%)	9,392 (48%)	8,761 (45%)
Total Acres Visible From Viewpoint	2,746 (14%)	5,714 (29%)	14,825 (76%)	14,136 (73%)

Approximately 506 miles of highway, open, closed, and seasonally restricted roads occur throughout the *cumulative-effects analysis area*. Roads introduce hard distinctive lines that are very lightcolored in comparison to adjacent forested and harvested areas. According to the viewshed analysis, road miles visible at each viewpoint are approximately 6% at the wildlife area, 26% at the swan peak overview, 49% at the Napa Point Trailhead and 56% percent along the Highway 83 corridor. (*TABLE III-73 – EXISTING VISUAL ENVIRONMENT - ROADS*).

There are approximately 195 miles of highway, open, closed, and seasonally restricted roads occur throughout the *Project Area*. According to the viewshed analysis, road miles visible at

each viewpoint are approximately 15% at the wildlife area, 33% at the swan peak overview, 74% at the Napa Point Trailhead and 75% percent along the Highway 83 corridor (*TABLE III-73 – EXISTING VISUAL ENVIRONMENT - ROADS*).

TABLE III-73 – EXISTING VISUAL ENVIRONMENT – ROADS. *Existing road miles visible the project area and cumulative-effects analysis area by viewpoints and road type.*

CUMULATIVE EFFECTS ANALYSIS AREA (~506 Miles)	**Viewpoints**			
	Wildlife Area	**Swan Peak Overview**	**Napa Point Trailhead**	**Hwy 83**
Road Miles Visible from viewpoint	31 (6%)	132 (26%)	253 (50%)	288 (57%)

PROJECT AREA ANALYSIS (~195 Miles)	**Viewpoints**			
	Wildlife Area	**Swan Peak Overview**	**Napa Point Trailhead**	**Hwy 83**
Road Miles Visible from viewpoint	29 (15%)	64 (33%)	145 (74%)	146 (75%)

Noise Levels

Activities that generate noise within the project and cumulative effects analysis areas include:

- traffic associated with harvesting, road building, motorized recreation, and administrative use;
- harvesting operations; and
- rock blasting and gravel crushing

Noise generation from forest management activities coincides with the rotational schedule required under the *SVGBCA* and *HCP*. Under this agreement, subunits are deemed 'inactive' for at least a 6 year period, thereby, greatly limiting the amount of forest management activities occurring in the area. By default, these inactive subunits are relatively free of forest management activities except for occasional administrative use and small-scale salvage or sanitation sales. The project area resides in the 4th and 5th Subunits that are active from first harvest activity attached to this EIS on a three-year rotation. Noise generated by management activities occurs daily within the active subunit and relatively infrequently within the inactive subunits. Noise created by motorized public use continues to be frequent throughout both areas.

ENVIRONMENTAL EFFECTS

Direct and Indirect Effects (Project Area)

- ***Direct and Indirect Effects of No-Action Alternative A to Aesthetics***

No harvest-related activities would occur; therefore, no direct and indirect effects to visual quality and noise levels would be expected.

- ***Direct and Indirect Effects of Action Alternatives B and C to Aesthetics***

The anticipated effects to visual quality and noise levels are expected to be somewhat distinguishable between alternatives. The difference between the alternatives occurs in the location of visible harvest units, noise levels, and types of harvest being implemented. Effects associated with Action Alternative C would be greater than Action Alternative B because there are a greater number of new road miles and harvest units in the higher elevations in the Woodward point and South Woodward drainages that are more readily seen from viewpoints.

Visual Quality

Harvest Units and Associated Roads

Viewers at the viewpoints would tend to see more harvest unit acres and associated road miles under Action Alternative C than Action Alternative B. Action Alternative B would result in an increase in visible harvested acres of 1% at the Wildlife Area, 6% at the Swan Peak Overview, 10% at the Napa Point Trailhead, and 9% along the Highway 83 Corridor. Action alternative C would result in an increase in visible harvest units of 2% at the Wildlife Area, 5% at the Swan Peak Overview, 12% at the Napa Point Trailhead, and 11% along the Highway 83 Corridor (*TABLE III-74 – VISUAL ENVIRONMENTAL EFFECTS – ACRES).* See also *FIGURE III-28 – ACTION ALTERNATIVE B – VIEWPOINTS* and *FIGURE III -29- ACTION ALTERNATIVE C - VIEWPOINTS* at the end of this analysis.

TABLE III-74 – VISUAL ENVIRONMENTAL EFFECTS – ACRES. *Proposed harvested acres visible and not visible within the project area by action alternative and viewpoints.*

PROJECT AREA ANALYSIS	Viewpoints			
	Wildlife Area	**Swan Peak Overview**	**Napa Point Trailhead**	**Hwy 83**
Existing Environment				
Existing Harvested Unit Acres Visible from Viewpoints	1,133 (6%)	2,275 (12%)	5,433 (28%)	5,375 (28%)
Existing Road Miles Visible From Viewpoints	29 (15%)	64 (33%)	145 (74%)	146 (75%)
Alternative B				
Post Wood Lion Harvested Unit Acres Visible From Viewpoints	1,414 (7%)	3,166 (16%)	7,417 (38%)	7,235 (37%)
Post Wood Lion Road Miles Visible from Viewpoints	31 (16%)	70 (35%)	159 (81%)	159 (81%)
Alternative C				
Post Wood Lion Harvested Unit Acres Visible From Viewpoints	1,488 (8%)	3,312 (17%)	7,726 (40%)	7,595 (39%)
Post Wood Lion Road Miles Visible from Viewpoints	32 (16%)	71 (36%)	162 (83%)	162 (83%)

The vast majority of visible harvest units and associated roads would occur within the middleground and background of the viewpoints. Due to visual barriers mentioned in *EXISTING ENVIRONMENT*, views of harvest units and roads in the immediate foreground would likely continue to be partially obstructed, while views of harvest units and roads in the distance may be more apparent under each action alternative.

Various types of prescriptions associated with each action alternative would result in various types of textures, forms, lines, and colors.

- Seedtree prescriptions would result in stands with approximately 10 percent canopy cover. Stands undergoing this type of treatment are expected to appear very light in color, distinctive in form, and have hard perimeter lines where the stand meets adjacent

regenerating or unharvested stands. Approximately 6 to 8 of the larger, best available trees per acre would be left along with varying amounts of small submerchantable trees. Seedtree stands would be most apparent compared to the other prescription types.

- Salvage and shelterwood prescriptions would result in stands with approximately 20 percent canopy cover. Stands undergoing this type of treatment are expected to have similar qualities to seedtree stands, only to a lesser degree. Approximately 12 to 16 trees per acre would be left along with varying amounts of small submerchantable trees. These stands would be only slightly less apparent than seedtree stands.
- All other harvest prescriptions would result in stands with a minimum of 40 percent canopy cover. Stands undergoing this type of treatment are expected to be darker in color, less distinctive in form, and have softer perimeter lines than stands undergoing any of the other prescriptions.

All harvesting types would be visible, with seedtree and shelterwood treatments resulting in stand conditions that appear relatively stark in contrast when adjacent to regenerating or unharvested stands. When feasible, these lines would be 'softened' by tapering or feathering stand perimeters and rounding hard stand corners. Associated roads would also appear as distinctive lines. Over time, these stands are expected to become less apparent and darker in color while the road appearances will become less distinctive and buffered by the regeneration, thereby blending with adjacent unharvested and regenerating stands and associated roads in the project area.

Direct and indirect effects to visual quality as a result of seedtree and shelterwood harvest prescriptions are expected to minor if viewed from the immediate foreground due to visual barriers and moderate if viewed from a distance or where visual barriers don't exist.

Noise Levels

Under each action alternative, noise would be generated by harvesting operations, harvest-related traffic, road construction, and gravel pit activity, including rock blasting and gravel crushing.

Under each action alternative, harvesting activities, harvest-related traffic, and road construction would occur up to 9 months per year of the 3 to 7 year operating period. Operators would continue to recognize restrictions in place under the *SVGBCA* or *HCP* and concentrate most management activities outside of the grizzly bear spring period (April 1 through June 15).

Activities would mostly occur during the typical business workweek (Monday through Friday) and cease each day by early evening except for occasional operators and the use of the campgrounds by contractors.

According to *RECREATION ANALYSIS* in *CHAPTER III*, 21,193 to 32,022 harvest-related trips would be expected to occur per year over the 3 to 7 year operating period along designated haul routes (see *RECREATION ANALYSIS, TABLE III-69).* Traffic associated with gravel hauling,

road and harvesting operations and log hauling is expected to be louder than other harvest-related traffic. This louder traffic would constitute 45 to 66 percent of the traffic trips expected under each action alternative.

Rock development would occur in existing pits and coincide with gravel needs for ongoing road construction and maintenance work. Rock blasting and gravel crushing would produce high levels of noise.

Direct and indirect effects to noise levels as a result of harvesting operations, harvest-related traffic, and gravel pit activity associated with the action alternatives are expected to be moderate during the workweek and minor during the weekend.

Cumulative Effects

- ***Cumulative Effects of No-Action Alternative A to Aesthetics***

No harvest-related activities would occur; therefore, no cumulative effects to visual quality and noise levels would be expected.

- ***Cumulative Effects of Action Alternatives B and C to Aesthetics***

Current and foreseeable scheduled activities on DNRC managed and adjacent properties would continue. These activities, in conjunction with those proposed under each action alternative, would result in an increase of total harvested acres visible from each observation point and a minor increase in noise levels.

Visual Quality

The contribution of visible harvested acres under each action alternative as seen from each viewpoint would be minor in comparison to what exists currently throughout the landscape (*TABLE III-75).* Visual barriers along open roads would continue to be in place, thereby, obstructing foreground views from the viewpoints. Depending on type and amount of forest management planned on adjacent land ownerships, lands throughout the cumulative-effects analysis area would likely continue to experience similar forms, lines, textures, and colors. Older harvest units would continue to regenerate, blending lines, textures, forms, and colors, while newer harvest units would continue to introduce new attributes in sharper contrast to regenerating stands.

TABLE III-75 – VISUAL ENVIRONMENTAL EFFECTS – ACRES. *Proposed harvested acres visible and not visible within the cumulative effects analysis area by action alternative and viewpoints.*

CUMULATIVE EFFECTS ANALYSIS AREA	Viewpoints			
	Wildlife Area	Swan Peak Overview	Napa Point Trailhead	Hwy 83
Existing Environment				
Existing Harvested Unit Acres Visible from Viewpoints	1,148 (2%)	5,143 (8%)	10,621 (17%)	11,385 (19%)
Existing Road Miles Visible From Viewpoints	31 (6%)	132 (26%)	253 (50%)	288 (57%)
Alternative B				
Post Wood Lion Harvested Unit Acres Visible From Viewpoints	1,429 (2%)	6,034 (10%)	12,605 (21%)	13,245 (22%)
Post Wood Lion Road Miles Visible from Viewpoints	33 (7%)	138 (27%)	267 (53%)	301 (59%)
Alternative C				
Post Wood Lion Harvested Unit Acres Visible From Viewpoints	1,503 (2%)	6,180 (10%)	12,911 (21%)	13,605 (22%)
Post Wood Lion Road Miles Visible from Viewpoints	34 (7%)	139 (27%)	269 (53%)	304 (60%)

Noise Levels

The cumulative effects to noise would result in a minor increase beyond the current levels found in the cumulative effects analysis area. Rather, noise generated by forest-management activities would be concentrated in the 4th and 5th Subunits during the active period until 2021. Noise generated by motorized public use would continue throughout the area on designated roads.

FIGURE III–28- ACTION ALTERNATIVE B – VIEWPOINTS.

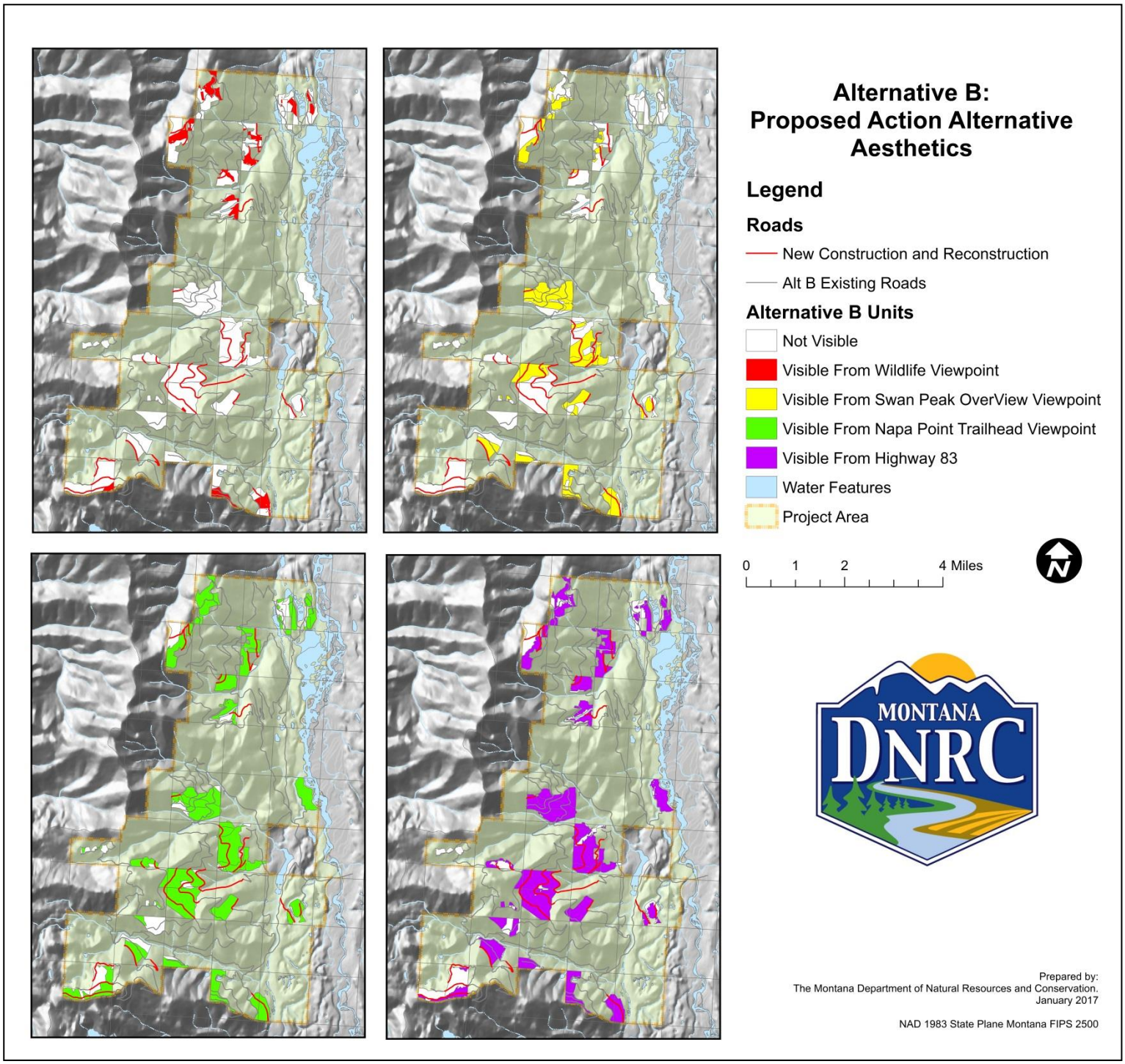


FIGURE III–29 - ACTION ALTERNATIVE C – VIEWPOINTS.

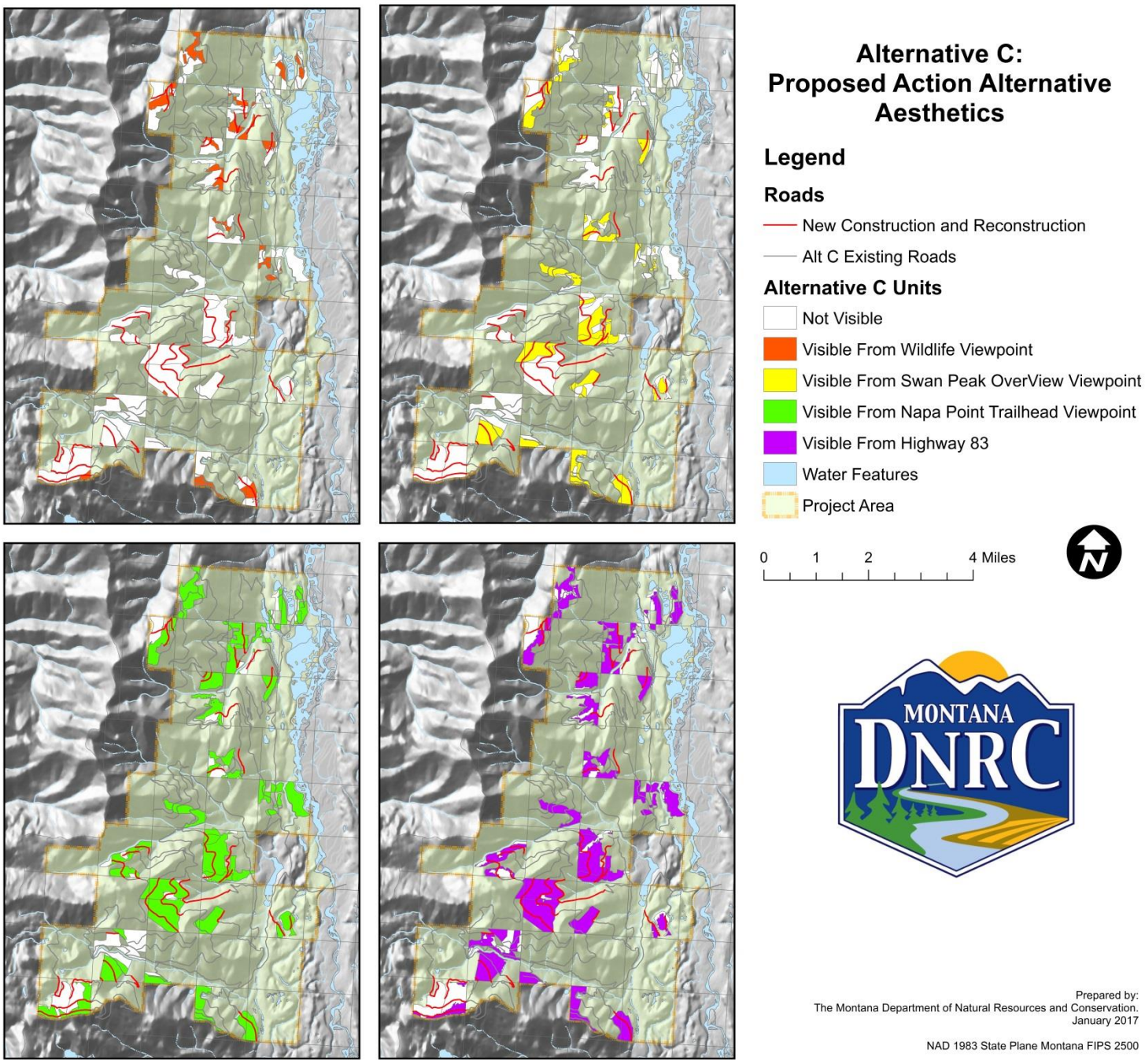
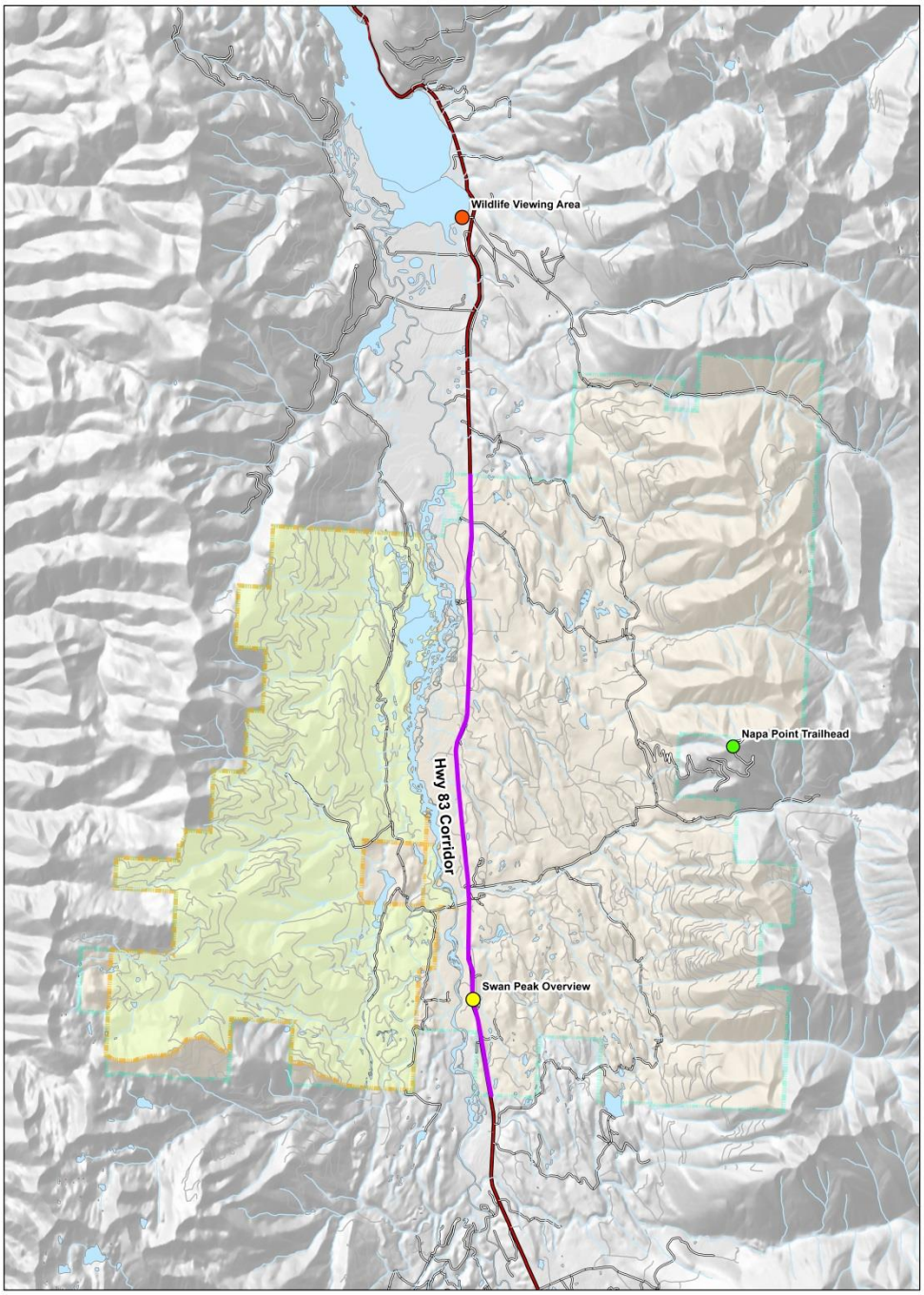


FIGURE III–30 – ALTERNATIVE B AND C VIEWPOINTS.



Wood Lion Aesthetics: Viewpoints

Legend

Viewpoints

- Wildlife Viewing Area
- Swan Peak Overview
- Napa Point Trailhead
- Highway 83 Corridor
- Hydro Features
- Hydro Features

Roads

- Highway
- Open
- Restricted
- Project Area
- Cumulative Effects Area

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IRRETRIEVABLE

A resource that has been irretrievably committed is lost for a period of time. Many timber stands in the project area are mature; some individual trees are more than 150 years old. Any of the timber harvesting alternatives would cause live trees to be irretrievably lost; they would no longer contribute to future snag recruitment, stand structure and compositional diversity, aesthetics, wildlife habitat, the nutrient-recycling process, or any other important ecosystem functions.

Areas converted from timber production to permanent roads would be lost from timber production and would not function as forested lands for a period of time.

IRREVERSIBLE

A resource that has been irreversibly committed cannot be reversed or replaced. The initial loss of trees due to timber harvesting would not be irreversible. Natural regeneration combined with site preparation and artificial regeneration would promote the establishment of new trees. If management decisions allowed for the continued growth of established trees, they would ultimately become equivalent in size to the irretrievably harvested trees.

Areas that are initially lost to timber production through road construction could, over time, be reclaimed and once again produce timber and function as forested land.

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STIPULATIONS AND SPECIFICATION

The stipulations and specifications for the action alternatives were identified or designed to prevent or reduce the potential effects to the resources considered in this analysis. These measures are derived from issues raised internally and by the public, *Forest Management Rules*, and other requirements with which forest-management activities must comply, as listed under *RELEVANT AGREEMENTS, LAWS, PLANS, PERMITS, LICENSES, AND OTHER REQUIREMENTS* in *CHAPTER I – PURPOSE AND NEED*.

Stipulations and specifications that apply to harvesting or road-building operations are incorporated into the *State of Montana Timber Sale Contract*. As such, they are binding and enforceable. Project administrators will enforce stipulations and specifications relating to activities that may occur during or after the contract period, such as site preparation or hazard reduction.

The following stipulations and specifications will be incorporated to mitigate effects on the resources involved with the action alternatives considered in this proposal. Each section is organized by resource.

VEGETATION

SENSITIVE PLANTS

Appropriate measures will prevent the disturbance of sensitive plant populations. Riparian areas near harvest units will be marked to protect SMZs and isolated wetlands. No harvesting will take place in wetlands or near springs on localized features. If sensitive plant populations are found, the appropriate habitat area will be excluded from the harvest units.

NOXIOUS WEED MANAGEMENT

To further limit the possibility of spreading noxious weeds, the following weed-management mitigation measures will be implemented:

- All tracked and wheeled equipment will be cleaned of noxious weeds prior to beginning project operations. The Forest Officer will inspect equipment periodically during project implementation.
- Surface blading on roads affected by the proposal may result in required weed removal before the seed-set state.
- Disturbed roadside sites will be promptly reseeded with an approved grass mix. Roads used and closed as part of this proposal will be reshaped and seeded.
- Herbicide application, as designated by the Forest Officer, may be used to control weeds along roads that access the timber sale area. To reduce risk to aquatic and terrestrial resources, the following will be required:
    - All herbicides will be applied by licensed applicators in accordance with laws, rules, and regulations of the State of Montana and Lake County Weed District.
    - All applications will adhere to BMPs and the herbicides' specific label guidelines.

- Herbicide applications will not be general, but site-specific to areas along roads where noxious weeds grow. No spray areas will be designated on the ground before applications begin.
- Herbicides will not be applied to areas where relief may contribute runoff directly into surface water.
- Herbicides will be applied on calm days free of rain to limit drift and the possibility of the herbicide moving off the road prisms.

WATERSHED AND FISHERIES

- Planned erosion-control measures and BMPs include:
    - installing grade breaks on roads,
    - installing water-diverting mechanisms on roads,
    - installing slash-filter windrows, and
    - grass seeding.
- All road stream crossings will be monitored for sedimentation and the deterioration of the road prism.
- Equipment traffic will be allowed at road-stream crossings only where road prisms have an adequate load-bearing capacity.
- Culvert sizing for all new road construction projects will be as recommended by the DNRC hydrologist for a 50 year flood period. New road stream crossing structures will ensure fish passage.
- Stream crossings, where culvert or bridge removals and installations are planned, will have the following requirements, as needed, to meet the intent of water-quality permits and BMPs and protect water quality:
    - diversion channels will be constructed and lined with plastic to divert stream flow prior to any in-channel operations,
    - slash-filter windrows will be constructed on the base of fill slopes,
    - silt fences will be installed along the stream banks prior to and following excavation at crossing sites,
    - filter-fabric fences will be in place downstream prior to and during culvert installation, and
    - stream work will be limited to periods approved by permitting agencies to minimize potential impacts to fish species present.
- Brush will be removed from existing road prisms to allow effective maintenance. Improved road maintenance will reduce sediment delivery.
- The contractor will be responsible for the immediate cleanup of any spills that may affect water quality (fuel, oil, dirt, etc.).
- Equipment that is leaking fluids will not be permitted to operate in stream crossing construction sites.

- The project proposal will include the following pertinent recommendations of the *Flathead Basin Forest Practices, Water Quality and Fisheries Cooperative Program Final Report, June 1991.* (The following numbers correspond to the numbering of recommendation items contained within the aforementioned document, included in pages 154 through 162 of the *Final Report*.)

  1. BMPs are incorporated into the project design and operations.

  2. Riparian indicators would be considered in the harvest unit layout.

  3. Management standards of the *SMZ Law (75-5-301 MCA)* are used in conjunction with the recommendations of the study.

  4. The BMP audit process will continue. This sale would likely be reviewed in an internal audit and may be randomly chosen as a statewide audit sale.

  7. SMZs will be evaluated as a part of the audit process.

  12. Watershed-level planning and analysis are completed. Logging plans of other agencies and private companies are used.

  15. DNRC would use the best available methods for logging and road building for this project.

  16A. Existing roads are fully utilized for this proposal.

  16B. DNRC utilizes BMPs, transportation planning, and logging-system design to minimize new road construction.

  17. DNRC contracts with DFWP to obtain species composition, spawning inventory, and spawning habitat quality. DNRC's mitigation plan for roads fits all recommendations for 'impaired streams'. Using 'worst-case scenario' criteria provides for conservative operations in this proposal.

  18. Provisions that address BMPs are in the *State of Montana Timber Sale Contract* and would be enforced.

  20. Long-term water quality and fisheries resource monitoring is planned for streams on Swan River State Forest.

  29-34. DNRC plans to cooperate with DFWP to continue fisheries work. DNRC would continue to support fisheries-monitoring efforts in the future as funding allows.

- SMZs and RMZs will be defined along those streams that are in or adjacent to harvest units; all applicable BMPs, Rules and HCP conservation strategies for fisheries' Riparian Management Zones adjacent to fish-bearing streams will be followed.

- A 110 foot no-harvest zone would be implemented immediately adjacent to all fish-bearing streams within the South Fork Lost Creek drainage to provide shade and recruitable woody debris.

- The *SMZ law* and *Forest Management Rules* will be applied to all non-fishbearing streams in the project area.
- *McNeil* core and substrate scores are expected to be continued to be monitored in bull trout spawning reaches in Soup and South Fork Lost creeks.

WILDLIFE

- If a threatened, endangered, or sensitive species of concern are encountered, consult a DNRC biologist and develop additional mitigations that are consistent with the *Forest Management Rules* for managing threatened and endangered species (*ARM 36.11.428* through *36.11.435*).
- Prohibit contractors and purchasers conducting contract operations from carrying firearms while on duty as per *ARM 36.11.444(2)* and *GB-PR2* (*USFWS and DNRC 2010).*
- Contractors will adhere to food storage and sanitation requirements as per *GB-PR3* (*USFWS* and *DNRC 2010*).
- Public access would be restricted at all times on restricted roads that are opened for harvesting activities; signs will be used during active periods and a physical closure (gate, barriers, equipment, etc.) will be used during inactive periods (nights, weekends, etc.).
- Roads and skid trails that are opened with the proposed activities would be reclosed to reduce the potential for unauthorized motor vehicle use.
- Within Canada lynx winter foraging habitat, retain up to 10 percent of the stand area in patches of advanced regeneration of shade-tolerant trees (grand fir, subalpine fir, and spruce) as per *LY-HB4* (*USFWS and DNRC 2010)*.
- Retention of patches of advanced regeneration of shade-tolerant trees in proposed units, where feasible, would provide some break-up site distances, horizontal cover, and forest structural attributes preferred by snowshoe hares and lynx
- Use a combination of topography, group retention, and roadside vegetation along open roads to reduce sight distances within harvest units where feasible.
- Vegetation screening would be retained within a 100 foot buffer along open roads where regeneration units would be adjacent to the open roads.
- Proposed seedtree units would be laid out so that no point within the proposed unit is more than 600 feet to cover.
- Minimize potential disturbance to grizzly bears during the spring period by restricting activities in spring habitat from April 1 through June 15.
- Prohibit timber harvest activities from November 16 to June 15 in potential grizzly bear denning habitat (slopes greater than 45 percent above 6,300 feet in elevation).
- Retention of visual screening adjacent to *RMZs* would reduce detection of grizzly bears near these important habitats.

- Minimize mechanized activity within 0.25 miles of burned forested stands in the project area between April 15 through July 1st to minimize disturbance to black-backed woodpeckers.
- Retain 2 large snags and 2 large snag recruitment trees per acre (>21 inches dbh) particularly favoring western larch, ponderosa pine, western white pine, and Douglas-fir. Clumps of existing snags could be maintained where they exist to offset areas without sufficient snags.
- Retain coarse woody debris amounts consistent with *Graham et al. (1994*) and emphasize the retention of downed logs ≥15 inches dbh where they occur as per *LY-HB2* (*USFWS* and *DNRC 2010).*
- Connectivity for fisher, Canada lynx, grizzly bears, and a host of other species would be provided by maintaining corridors of unharvested and/or lighter harvested areas along riparian areas, ridgetops, and saddles

SOILS

COMPACTION

- Logging equipment will not operate off forest roads unless:
    - soil moisture is less than 20 percent,
    - soil is frozen to a depth of 4 inches or a depth that will support machine operations (whichever is greater), or
    - soil is snow covered to a depth of 18 inches or a depth that will prevent compaction, rutting, or displacement (whichever is greater).
- Existing skid trails and landings will be used when their design is consistent with prescribed treatments and current *BMP* guidelines are met.
- The harvest project foreman and sale administrator will agree to a skidding plan prior to operating equipment.
- To reduce the number of skid trails and the potential for erosion, designated skid trails will be required where moist soils or short steep pitches (less than 300 feet) will not allow access by other logging systems.
- The density of skid trails in a harvest area will not exceed 20 percent of the total area in the cutting unit.

DISPLACEMENT

- Groundbased logging equipment (tractors, skidders, and mechanical harvesters) is limited to slopes less than 45 percent on ridges, convex slopes; and to 40 percent or less on concave slopes without winter conditions.
- Slash piling and scarification will be completed with a dozer where slopes are gentle enough to permit (less than 35 percent). Slash treatment and site preparation will be done with an excavator in areas where soils are wet or slopes are steeper (up to 55 percent). Broadcast burning may also be utilized.

EROSION

- Ground skidding machinery will be equipped with a winchline to limit equipment operation on steeper slopes.
- Roads used by the purchaser will be reshaped and the ditches redefined to reduce surface erosion prior to and following use.
- Drain dips, open-topped culverts, and gravel will be installed on roads as needed to improve road drainage and reduce erosion and maintenance needs.
- Some road sections will be repaired to upgrade the roads to design standards that will reduce the potential for erosion and maintenance needs.
- Certified weed-free grass seed and fertilizer will be applied promptly to newly constructed road surfaces, cutslopes, and fillslopes. These applications will also be done on existing disturbed cutslopes, fillslopes, and landings immediately adjacent to open roads. These applications, which will stabilize soils and reduce or prevent the establishment of noxious weeds, would include:
    - seeding all road cuts and fills concurrently with construction,
    - applying 'quick cover' seed mix within 1 day of work completion at culvert-installation sites, and
    - seeding all road surfaces and reseeding culvert installation sites when the final blading is completed for each specified road segment.
- Based on ground and weather conditions and as directed by the Forest Officer, water bars, logging-slash barriers, and, in some cases, temporary culverts will be installed on skid trails where erosion is anticipated. These erosion-control features would be periodically inspected and maintained throughout the Timber Sale Contract period or extensions thereof.

AIR QUALITY

- To prevent individual or cumulative effects and provide for burning during acceptable ventilation and dispersion conditions during burning operations, burning will be done in compliance with the *Montana Idaho Airshed Group* reporting regulations and any burning restrictions imposed in Airshed 2.
- Excavator, landing, and roadwork debris will be piled clean to allow easy ignition during fall and spring when ventilation is good and surrounding fuels are wet. The Forest Officer may require that piles be covered to reduce dispersed smoke and allow the piles to ignite more easily, burn hotter, and extinguish more quickly.
- The number of piles to burn will be reduced by leaving large wood debris in the harvest units.
- Depending on the season of harvest and level of public traffic, dust abatement may be applied on some segments of the roads that will be used during hauling.

AESTHETICS

- Damaged submerchantable residual vegetation will be slashed.
- Landings will be limited in size and number and located away from main roads when possible.
- Disturbed sites directly adjacent to roads will be grass seeded.
- When possible, healthy trees not big enough to be harvest will be retained.
- When possible, techniques such as feathering, which involves marking additional timber along the harvest boundary lines, or rounding, which involves eliminating abrupt edges such as those found at property corners, will be implemented to reduce the appearance of straight boundary lines along harvest units.

CULTURAL RESOURCES AND ARCHAEOLOGY

- A review of the project area was conducted by a DNRC archaeologist and local Native American tribal organization.
- A contract clause provides for suspending operations if cultural resources are discovered, and only resuming operations when directed by the Forest Officer.

ROADS

- Information about road reconstruction activities and road use associated with road construction activities will be relayed to the general public.
- Signs will be placed on restricted roads to prohibit public access while harvesting operations are in progress; these roads will be physically restricted during inactive periods (nights, weekends, holidays, shutdowns).
- BMPs will be incorporated into all planned road construction.

GLOSSARY

Acre-foot
A measure of water or sediment volume equal to an amount of material that would cover 1 acre to a depth of 1 foot.

Action alternative
One of several ways of moving toward the project objectives.

Adfluvial
A fish that out migrates to a lake as a juvenile to sexually mature and returns to natal stream to spawn.

Administrative road use
Road use that is restricted to DNRC personnel and contractors for purposes such as monitoring, forest improvement, fire control, hazard reduction, etc.

Airshed
An area defined by a certain set of air conditions; typically, a mountain valley where air movement is constrained by natural conditions such as topography.

Ameliorate
To make better; improve.

Appropriate conditions
Describes the set of forest conditions determined by DNRC to best meet the SFLMP objectives. The 4 main components useful for describing an appropriate mix of conditions are cover-type proportions, age class distributions, stand-structure characteristics, and the spatial relationships of stands (size, shape, location, etc.); all are assessed across the landscape.

Background view
Views of distant horizons, mountain ranges, or valleys from roads or trails.

Best Management Practices (BMPs)
Guidelines to direct forest activities, such as logging and road construction, for the protection of soils and water quality.

Biodiversity
The variety of life and its processes, including the variety of living organisms, the genetic differences among them, and the communities and ecosystems where they occur.

Board foot
144 cubic inches of wood that is equivalent to a piece of lumber 1-inch thick by 1 foot wide by 1 foot long.

Canopy
The upper level of a forest consisting of branches and leaves of the taller trees.

Canopy closure
The percentage of a given area covered by the crowns, or canopies, of trees.

Cavity
A hollow excavated in trees by birds or other animals. Cavities are used for roosting and reproduction by many birds and mammals.

Centimeter
A distance equal to 0.3937 inch.

Commercial-thin
A cultural treatment made to reduce stand density of merchantable trees primarily to improve growth, enhance forest health, or to recover potential mortality. For the purposes of this project, commercial thinning will leave approximately 70 to 110 trees per acre and greater than 40 percent canopy coverage will be retained.

Compaction
The increase in soil density caused by force exerted at the soil surface, modifying aeration and nutrient availability.

Connectivity
The quality, extent, or state of being joined; unity; the opposite of fragmentation.

Core area
See Security Habitat (grizzly bears).

Cover
See HIDING COVER and/or THERMAL COVER.

Coarse down woody material
Dead trees within a forest stand that have fallen and begun decomposing on the forest floor.

Crown cover or crown closure
The percentage of a given area covered by the crowns of trees.

Cull
A tree of such poor quality that it has no merchantable value in terms of the product being cut and manufactured.

Cumulative effect
The impact on the environment that results from the incremental impact of the action when added to other actions. Cumulative impacts can also result from individually minor actions, but collectively they may compound the effect of the actions.

Direct effect
Effects on the environment that occur at the same time and place as the initial cause or action.

Ditch relief
A method of draining water from roads using ditches and a corrugated metal pipe. The pipe is placed just under the road surface.

Dominant tree
Those trees within a forest stand that extend their crowns above surrounding trees and capture sunlight from above and around the crown.

Drain dip
A graded depression built into a road to divert water and prevent soil erosion.

Ecosystem
An interacting system of living organisms and the land and water that make up their environment; the home place of all living things, including humans.

Embeddeness
Embeddedness refers to the degree of armor or the tight consolidation of substrate.

Environmental effects
The impacts or effects of a project on the natural and human environment.

Equivalent clearcut area (ECA)
The total area within a watershed where timber has been harvested, including clearcuts, partial cuts, roads, and burns.

Allowable ECA - The estimated number of acres that can be clearcut before stream-channel stability is affected.

Existing ECA - The number of acres that have been previously harvested taking into account the degree of hydrologic recovery that has occurred due to revegetation.

Remaining ECA -The calculated amount of harvesting that may occur without substantially increasing the risk of causing detrimental effects to stream-channel stability.

Excavator piling
The piling of logging residue (slash) using an excavator.

Fire regimes
Describes the frequency, type, and severity of wildfires. Examples include: frequent, nonlethal underburns; mixed-severity fires; and stand-replacement or lethal burns.

Fluvial
A fish that outmigrates to a river from its natal stream as a juvenile to sexually mature in the river, and returns to its natal stream to spawn.

Forage
All browse and nonwoody plants available to wildlife for grazing.

Foreground view
The view immediately adjacent to a road or trail.

Forest improvement (FI)
The establishment and growing of trees after a site has been harvested. Associated activities include:

- site preparation, planting, survival checks, regeneration surveys, and stand thinnings;
- road maintenance;
- resource monitoring;
- noxious weed management; and
- right-of-way acquisition on a State forest.

Fragmentation (forest)
A reduction of connectivity and an increase in sharp stand edges resulting when large contiguous areas of forest with similar age and structural characteristics are interrupted through disturbances, such as stand-replacement fires and timber stand harvesting.

Geomorphological processes
The observed proportions of habitat types for each reach are within the broad ranges of expected conditions.

Habitat
The place where a plant or animal naturally or normally lives and grows.

Habitat type
Land areas that would produce similar plant communities if left undisturbed for a long period of time.

Harvest units
Areas of timber proposed for harvesting.

Hazard reduction
The abatement of a fire hazard by processing logging residue with methods such as separation, removal, scattering, lopping, crushing, piling and burning, broadcast burning, burying, and chipping.

Hiding cover
Vegetation capable of hiding 90 percent of a standing adult mammal from human view at a distance of 200 feet.

Historical forest condition
The condition of the forest prior to settlement by Europeans.

Indirect effects
Secondary effects that occur in locations other than the initial action or significantly later in time.

Intermediate trees
Characteristics of certain tree species that allow them to survive in relatively low-light conditions, although they may not thrive.

Interdisciplinary team (ID Team)
A team of resource specialists brought together to analyze the effects of a project on the environment.

K factor
The soil erodibility factor which represents both susceptibility of soil to erosion and the rate of runoff, as measured under the standard unit plot condition.

Landscape
An area of land with interacting ecosystems.

Macroinvertebrate richness
The relative abundance and diversity of insects and worms found throughout a streambed.

Macroporosity
The gaseous portion of a soil profile typically containing pores on the order of 3 to 100mm in diameter and are interconnected to varying degrees; thus, they can allow water to bypass the soil matrix and move rapidly to a basal saturated zone and/or move downslope as pipe flow at speeds greater than predicted by Darcy's Law.

McNeil Coring
McNeil coring is a method used to determine the size range of material in streambed spawning sites.

Meter
A distance equal to 39.37 inches.

Middleground view
The view that is 200 to 1,000 feet from a road or trail, usually consisting of hillsides and drainages.

Millimeter
A distance equal to 0.03937 inch.

Mitigation measure
An action or policy designed to reduce or prevent detrimental effects.

Multistoried stands
Timber stands with 2 or more distinct stories.

Nest site area (bald eagle)
The area in which human activity or development may stimulate the abandonment of the breeding area, affect successful completion of the nesting cycle, or reduce productivity. It is either mapped for a specific

nest, based on field data, or, if that is impossible, is defined as the area within a ¼-mile radius of all nest sites in the breeding area that have been active within the past 5 years.

No-action alternative
The option of maintaining the status quo and continuing present management activities by not implementing the proposed project.

Nonforested area
A naturally occurring area, (such as a bog, natural meadow, avalanche chute, and alpine areas) where trees do not establish over the long term.

Old-growth
Working definition - Old-growth as defined by *Green et al*.

Conceptual definition - The term old-growth is sometimes used to describe the later, or older, stages of natural development of forest stands. Characteristics associated with old-growth generally include relatively large old trees that contain a wide variation in tree sizes, exhibit some degree of a multi-storied structure, have signs of decadence, such as rot and spike-topped structure, and contain standing large snags and large down logs.

Old-growth maintenance
Silvicultural treatments in old-growth stands designed to retain old-growth attributes, including large live trees, snags, and coarse woody debris, but that would remove encroaching shade-tolerant species, create small canopy gaps generally less than one acre in size, and encourage regeneration of shade-intolerant species. This type of treatment is applicable on sites that historically would be characterized by mixed severity fire regimes, either relatively frequent or infrequent.

Old-growth network
A collection of timber stands that are selected to meet a management strategy that would retain and recruit 150+-year-old stands over the long term (biodiversity, wildlife, the spatial arrangement of stands and their relationship to landscape patterns and processes) are elements that are considered in the selection of stands.

Overstory
The level of the forest canopy that include the crowns of dominant, codominant, and intermediate trees.

Overstory removal
The cutting of trees comprising an upper canopy layer in order to release trees or other vegetation in an understory.

Patch
A discrete (individually distinct) area of forest connected to other discrete forest areas by relatively narrow corridors; an ecosystem element (such as vegetation) that is relatively homogeneous internally, but differs from what surrounds it.

Poletimber
Trees 4.1 inches to 8.9 inches in dbh.

Potential nesting habitat (bald eagle)
Sometimes referred to as 'suitable nesting habitat', areas that have no history of occupancy by breeding bald eagles, but contain potential to do so.

Project file
A public record of the analysis process, including all documents that form the basis for the project analysis. The project file for the Wood Lion Multiple Timber Sale Project EIS is located at the Swan River State Forest headquarters office at Goat Creek.

Redds
The spawning ground or nest of various fish species.

Regeneration
The replacement of one forest stand by another as a result of natural seeding, sprouting, planting, or other methods.

Reinitiation
The first phase of the process of stand development.

Resident
Pertaining to fish, resides and reproduces in natal stream.

Residual stand
Trees that remain standing following any cutting operation.

Road-construction
Cutting and filling of earthen material that results in a travel-way for wheeled vehicles.

Road maintenance
Maintenance and repair of existing roads that are accessible to motorized use, including but not limited to:

- blading;
- reshaping; or
- resurfacing the road to its original condition;
- cleaning culverts;
- restoring and perpetuating road surface drainage features; and
- clearing the roadside of brush.

Road reconstruction
Modifying a road to a higher standard to accommodate proposed use.

Salvage
The removal of dead trees or trees being damaged or dying due to injurious agents other than competition to recover value that would otherwise be lost.

Sanitation
The removal of trees to improve stand health by stopping or reducing actual or anticipated spread of insects and disease.

Saplings
Trees 1.0 inches to 4.0 inches in dbh.

Sawtimber trees
Trees with a minimum dbh of 9 inches.

Scarification
The mechanized gouging and ripping of surface vegetation and litter to expose mineral soil and enhance the establishment of natural regeneration.

Scoping
The process of determining the extent of the environmental assessment task. Scoping includes public involvement to learn which issues and concerns should be addressed and the depth of the assessment that will be required. It also includes a review of other factors such as laws, policies, actions by other landowners, and jurisdictions of other agencies that may affect the extent of assessment needed.

Security
For wild animals, the freedom from the likelihood of displacement or mortality due to human disturbance or confrontation.

Security habitat (grizzly bears)
An area of a minimum of 2,500 acres that is at least 0.3 miles from trails or roads with motorized travel and high-intensity, nonmotorized use during the nondenning period.

Sediment
Solid material, mineral or organic, that is suspended and transported or deposited in bodies of water.

Seedlings
Live trees less than 1.0 inch dbh.

Seedtree
An even-aged regeneration method in which a new age class develops from seeds that germinate in fully exposed microenvironments after removal of all the previous stand except a small number of trees left to provide seed. Seed trees are removed after regeneration is established. For the purposes of this project, 6 to 12 seed-bearing trees per acre will be retained to provide a seed source for stand regeneration.

Sediment yield
The amount of sediment that is carried to streams.

Seral
Refers to a biotic community that is in a developmental, transitional stage in ecological succession.

Shade intolerant
Describes tree species that generally can only reproduce and grow in the open or where the overstory is broken and allows sufficient sunlight to penetrate. Often these are seral species that get replaced by more shade-tolerant species during succession. In Swan River State Forest, shade-intolerant species generally include ponderosa pine, western larch, Douglas-fir, western white pine, and lodgepole pine.

Shade tolerant
Describes tree species that can reproduce and grow under the canopy in poor sunlight conditions. These species replace less shade-tolerant species during succession. In Swan River State Forest, shade-tolerant species generally include subalpine fir, grand fir, Douglas-fir, Engelmann spruce, western hemlock, and western red cedar.

Shelterwood
A method of regenerating an even-aged stand in which a new age class develops beneath the moderated microenvironment provided by the residual trees. A removal cut to release established regeneration from competition of the overwood would occur after regeneration is established. For the purposes of this project, 12 to 22 trees per acre will be retained to provide a seed source and shelter for stand regeneration.

Single-tree selection
A method of creating new age classes in uneven-aged stands in which individual trees of all size classes are removed more-or-less uniformly throughout the stand to achieve desired stand structural characteristics.

Sight distance
The distance at which 90 percent of an animal is hidden from view by vegetation.

Silviculture
The art and science of managing the establishment, composition, and growth of forests to accomplish specific objectives.

Site Preparation
A hand or mechanized manipulation of a harvested site to enhance the success of regeneration. Treatments are intended to modify the soil, litter, and vegetation to create microclimate conditions conducive to the establishment and growth of desired species.

Slash
Branches, tops, and cull trees left on the ground following harvesting.

Snag
A standing dead tree or the portion of a broken-off tree. Snags may provide feeding and/or nesting sites for wildlife.

Spur roads
Low-standard roads that are constructed to meet minimum requirements for harvesting-related traffic.

Stand
An aggregation of trees that are sufficiently uniform in composition, age, arrangement, and condition and occupy a specific area that is distinguishable from the adjoining forest.

Stand density
Number of trees per acre.

Stocking
The area of a piece of land that is now covered by trees is compared to what could ideally grow on that same area. The comparison is usually expressed as a percent.

Stream gradient
The slope of a stream along its course, usually expressed in percentage, indicating the amount of drop per 100 feet.

Stumpage
The value of standing trees in the forest. Sometimes used to mean the commercial value of standing trees.

Substrate scoring
Rating of streambed particle sizes.

Succession
The natural series of replacement of one plant (and animal) community by another over time in the absence of disturbance.

Suppressed
The condition of a tree characterized by a low-growth rate and low vigor due to overcrowding competition with overtopping trees.

Texture
A term used in visual assessments indicating distinctive or identifying features of the landscape depending on distance.

Thermal cover
For white-tailed deer, thermal cover has 70 percent or more coniferous canopy closure at least 20 feet above the ground, generally requiring trees to be 40 feet or taller. For elk and mule deer, thermal cover has 50 percent or more coniferous canopy closure at least 20 feet above the ground, generally requiring trees to be 40 feet or taller.

Timber harvesting activities

In general, all the activities conducted to facilitate timber removal before, during, and after the timber is removed. These activities may include any or all of the following:

- felling standing trees and bucking them into logs
- skidding logs to a landing
- processing, sorting, and loading logs at the landing
- hauling logs to a mill
- slashing and sanitizing residual vegetation damaged during logging
- machine piling logging slash
- burning logging slash
- scarifying, preparing the site as a seedbed
- planting trees

Understory
The trees and other woody species growing under a, more less, continuous cover of branches and foliage formed collectively by the overstory of adjacent trees and other woody growth.

Uneven-aged stand
Various ages and sizes of trees growing together on a uniform site.

Ungulates
Hoofed mammals, such as mule deer, white-tailed deer, elk, and moose, that are mostly herbivorous and many are horned or antlered.

Vigor
The degree of health and growth of a tree or stand.

Visual screening
The vegetation that obscures or reduces the length of view of an animal.

Watershed
The region or area drained by a river or other body of water.

Water yield
The average annual runoff for a particular watershed expressed in acre-feet.

Water yield increase
An increase in average annual runoff over natural conditions due to forest canopy removal.

ACRONYMS

ARM	Administrative Rules of Montana
BMP	Best Management Practices
dbh	diameter at breast height
DEIS	Draft Environmental Impact Statement
DEQ	Department of Environmental Quality
DFWP	Montana Department of Fish, Wildlife, and Parks
DNRC	Department of Natural Resources and Conservation
ECA	Equivalent Clearcut Acres
EIS	Environmental Impact Statement
EPA	Environmental Protection Agency
FEIS	Final Environmental Impact Statement
FI	Forest Improvement
FNF	Flathead National Forest
FY	Fiscal Year (July 1 – June 30)
FOGI	Full Old-Growth Index
GIS	Geographic Information System
HCP	Habitat Conservation Plan
ID Team	Interdisciplinary Team
Land Board	Board of Land Commissioners
LWD	large woody debris
MCA	Montana Code Annotated
MEPA	Montana Environmental Policy Act
MBF	Thousand Board Feet
MMBF	Million Board Feet
MNHP	Montana Natural Heritage Program
NAIP	National Aerial Imagery Program
NWLO	Northwestern Land Office
Plum Creek	Plum Creek Timber Company
RMZ	Riparian Management Zone
ROD	Record of Decision
SFLMP	State Forest Land Management Plan
SLI	Stand-level Inventory
SMZ	Streamside Management Zone
SVGBCA	Swan Valley Grizzly Bear Conservation Agreement
SYC	Sustainable Yield Calculation
TMDL	Total Maximum Daily Load
USFS	United States Forest Service
USFWS	United States Fish and Wildlife Service
124 Permit	Stream Preservation Act Permit
318 Permit	A short-term exemption from Montana's Surface Water Quality and Fisheries Cooperative Program

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