

Appendix A

WEIGHTING METHODS

Actively and sustainably manage forests

For more information on the layers below see these notes: [WebEx Summary Notes Obj 2](#)

TOPIC	LAYER NAME	GIS ANALYSIS	EXPERT WEIGHTING	COMMENTS
Forest Productivity	Forest productivity	Ordinal scale data in 5 classes developed by DOR. Weighted mean (zonalmean) of raster cell counts of following categories: (100) Very High (84) High (68) Moderate (52) Low (36) Very Low (20) Non-Commercial (1) None	15%	
Forested areas with higher risk	Forested areas with higher risk: Ponderosa Pine and Douglas Fir	Percent of watershed based on acres of PP/DF(100) Watershed with highest number of acres <i>Continuous range to</i> (0) Watershed with lowest number of acres at risk	10%	
	Forested areas with higher risk: Lodgepole Pine	Percent of watershed based on acres of lodgepole pine (100) Watershed with highest number of acres at risk <i>Continuous range to</i> (0) Watershed with lowest number of acres at risk	8%	
Forest Stocking	Forest stocking	Ordinal scale data in 3 classes developed by DNRC. Weighted mean (zonalmean) of raster cell counts of following categories:	13%	

		(100) High - >=70% crown canopy (66) Med - 40% to 69% crown canopy (33) Low - 0% to 39% crown canopy		
Ownership - broad categories	Public land ownership	Weighted mean (zonalmean) of raster cell counts of following categories: Federal: (25) USFS - Lower score (53) BLM - High score (54) BIA and Tribal - High score (10) USFWS - Lowest score (20) OTHER federal State: (60) State trust - 7+ types - highest (60) Montana correctional - moderate (60) Montana Univ - lower (40) MDFWP - lower (50) HCP - Habitat Conservation Plans Private (59) Non - industrial (private, other, and land trusts) (70) Industrial (Plum Creek) Montana Legacy (55) Montana Legacy Lands (0) Wilderness, roadless, national parks, local govt, non forested	6%	
Burned probability map	Burned Area Probability Map	Continuous value of acres of crown fire probability on forested lands - using crown fire portion of this layer (100) Watershed with largest acreage of crown fire probability <i>Continuous range to</i> (0) Watershed with smallest	12%	

		acreage of crown fire probability		
Insect & Disease	Insect & disease for existing Bark Beetles	Continuous value of acres of Mountain Pine Beetle (100) Watershed with largest acreage of Bark Beetles <i>Continuous range to</i> (0) Watershed with smallest acreage of Bark Beetles	11%	
Insect & Disease	Insect & disease for the probability of Bark Beetle	Continuous value of acres of high probability areas predicted for Bark Beetle (100) Watershed with largest acreage of Bark Beetle <i>Continuous range to</i> (0) Watershed with smallest acreage of Bark Beetle	11%	
Tree Farms and Stewardship Plans	Tree Farms and Stewardship plans	tree_farm_points.shp (point centroids) treefarmpoly.shp (from Dan)	14%	

Assist communities in planning for and reducing wildfire risks

For more information on the layers below see these notes: [Webex Summary Notes Obj 3 and 7](#)

TOPIC	LAYER NAME	GIS ANALYSIS	EXPERT WEIGHTING	COMMENTS
Wildland-urban interface	Wildland Urban Interface	Percent of watershed with continuous value of acres of HFRA wildland urban interface (100) Watershed with largest acreage of wildland urban interface <i>Continuous range to</i> (0) Watershed with smallest acreage of wildland urban interface	20%	
Burned probability	Burned Area	Continuous value of acres of burned area probability on	27%	

map	Probability Map	forested lands - using crown fire portion of this layer (100) Watershed with largest acreage of burned area probability <i>Continuous range to</i> (0) Watershed with smallest acreage of burned area probability		
Presence/Absence map of CWPP	CWPP	Expert assignment by county to a (100) Present (0) Absent After assignment this will be apportioned to watershed with a zonal mean value	3%	
Insect & Disease	Insect & disease for all species except Bark Beetles	Continuous value of acres of all insect and disease species except Bark Beetles (100) Watershed with largest acreage of all insect and disease except Bark Beetles <i>Continuous range to</i> (0) Watershed with smallest acreage of all insect and disease species except Bark Beetles	8%	
Insect & Disease	Insect & disease for existing Bark Beetles	Continuous value of acres of Bark Beetles (100) Watershed with largest acreage of Bark Beetles <i>Continuous range to</i> (0) Watershed with smallest acreage of Bark Beetles	10%	
Insect & Disease	Insect & disease for the probability of Bark Beetle	Continuous value of acres of high probability areas predicted for Bark Beetle (100) Watershed with largest acreage of Bark Beetle <i>Continuous range to</i> (0) Watershed with smallest	10%	

		acreage of Bark Beetle		
Temporary population	Overnight public recreation areas	Count of number of developed recreation point sites (100) Watershed with largest number of developed recreation point sites <i>Continuous range to</i> (0) Watershed with smallest number of developed recreation point sites	8%	
Temporary population	Day use recreation areas	Percent of watershed from continuous value of public day use areas (100) Watershed with largest acreage of public day use areas <i>Continuous range to</i> (0) Watershed with smallest acreage public day use areas	8%	
Temporary population	Private Overnight Recreation areas	Count of number of developed recreation point sites (100) Watershed with largest number of developed recreation point sites <i>Continuous range to</i> (0) Watershed with smallest number of developed recreation point sites	6%	

Connect people to trees and forests, and engage them in environmental stewardship activities

For more information on the layers below see these notes: [Webex Summary Notes Obj 10](#)

TOPIC	LAYER NAME	GIS ANALYSIS	EXPERT WEIGHTING	COMMENTS
Residential development	Cadastral centroid residential	Continuous value of count of cadastral centroid residential	9%	

likelihood	structures	structures (100) Watershed with highest number of cadastral centroid residential structures <i>Continuous range to</i> (0) Watershed with lowest number of cadastral centroid residential structures		
Green infrastructure composite	Residential annual growth rate 2009-2014	Continuous value of annual residential growth rate (100) Watershed with highest growth rate <i>Continuous range to</i> (0) Watershed with lowest growth rate	9%	
Forest Recreation	Dispersed forest recreation	Count of number of dispersed recreation point sites (100) Watershed with largest number of dispersed recreation point sites <i>Continuous range to</i> (0) Watershed with smallest number of dispersed recreation point sites	10%	Lump all motorized and non-motorized recreation point layers into one master layer. Include the following: Overnight public recreation areas Day use recreation areas State parks Ski areas Historic and cultural sites
Forest Recreation	Forest recreation in and near urban areas	Count of number of forest recreation point sites in and near urban areas (100) Watershed with largest number of recreation point sites <i>Continuous range to</i> (0) Watershed with smallest number of recreation point sites	22%	Those within 5 miles of an urban area <ul style="list-style-type: none"> • Include point count of points • Add 1 for each tree city arbor day event • Use CEORE tool to account for large open space lands areas (Msla, Helena, others? -

				do this in the WebEx follow up)
Theodore Roosevelt Conservation Partnership - Hunter and Angler Valued areas	Hunter and Angler Valued areas	Union all hunter and angler groups converted to a grid value with the number of groups interested in a given raster cell. Continuous value of number of hunter and angler groups (100) Watershed with highest number of hunter and angler groups <i>Continuous range to</i> (0) Watershed with lowest number of hunter and angler groups	10%	
Recreation Trails & Roads	Recreation and trail networks	Continuous value of total miles of all recreation and trail networks (100) Watershed with highest number of miles of recreation and trail networks <i>Continuous range to</i> (0) Watershed with lowest number of miles of recreation and trail networks	16%	Not complete coverage for the state, but use what we have. Cannot consistently differentiate between closed and open trails and roads for motorized use.
Public Water Supply-Drinking Water	Public water supply	Count of public water supply (PWS) points in the watershed (100) Watershed with the highest number of PWS points <i>Continuous range to</i> (0) Watershed with the lowest number of PWS points	16%	Assume we will use a simple count of PWS points or could weight the count by the number of persons served year round, or served on a temporary basis by a public water system.

Preservation, Wilderness, Roadless Land Use	Preservation, Wilderness, research/designate d land use and roadless areas	Percent of watershed from continuous value of acres of preservation, wilderness, research/designated land use (100) Watershed with largest acreage of preservation, wilderness, roadless land use <i>Continuous range to</i> (0) Watershed with smallest acreage of preservation, wilderness, roadless land use	8%	
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Identify and conserve high priority forest ecosystems and landscapes.

Special Note to Reviewers: We have split this objective into two components for the purpose of weighted modeling, differentiating between urban and rural forest environments. The reason for this is we are using residential growth rates to measure both. Higher growth rates were judged as positive for urban forest environments, and negative for forest ecosystems in rural environments. Using both in the same weighted sum GIS model would negate the influence of each other.

For more information on the layers below see these notes: [WebEx Summary Notes Obj 1](#)

Urban Forest Environment

TOPIC	LAYER NAME	GIS ANALYSIS	EXPERT WEIGHTING	COMMENTS
Green infrastructure composite	Urban forest program presence	Expert assignment by watershed (100) Urban forest program (0) No urban forest program	23%	
Green infrastructure composite	Urban forest canopy cover	Expert assignment by watershed - percent forested in urban area (100) Watershed with highest percent canopy cover <i>Continuous range to</i>	34%	

		(0) Watershed with lowest growth rate percent canopy cover		
Green infrastructure composite	Cadastral centroid residential structures	Continuous value of population (100) Watershed with highest number of cadastral centroid residential structures <i>Continuous range to</i> (0) Watershed with lowest number of cadastral centroid residential structures	23%	
Green infrastructure composite	Montana Urban Forest Towns Residential annual growth rate 2009-2014	Continuous value of annual residential growth rate (100) Watershed with highest growth rate <i>Continuous range to</i> (0) Watershed with lowest growth rate	20%	

Rural Forest Environment

TOPIC	LAYER NAME	GIS ANALYSIS	EXPERT WEIGHTING	COMMENTS
Community forests	Community forest	Expert assignment by watershed (100) Present (0) Absent	1%	
Forest fragmentation	SAP Forest patches	Percent of watershed based on count of raster cells for large forest patches (100) Watershed with highest number of large forest patch raster cells	12%	

		<p><i>Continuous range to</i> (0) Watershed with lowest number of large forest patch raster cells</p>		
Impractical Forest Operations	Impractical forest operations SAP undevelopable areas	<p>Percent of watershed based on count of raster cells impractical for forest operations (100) Watershed with lowest number of undevelopable raster cells <i>Continuous range to</i> (0) Watershed with highest number of undevelopable raster cells</p>	10%	
Protected areas	Public lands and conservation easements	<p>Percent of watershed based on acres (100) Watershed with highest number of forested public lands and easement acres <i>Continuous range to</i> (0) Watershed with lowest number of easement acres forested public lands and easement acres</p>	17%	
Forest Productivity	Forest productivity	<p>Ordinal scale data in 5 classes developed by DOR. Weighted mean (zonalmean) of raster cell counts of following categories: (100) Very High (84) High (68) Moderate (52) Low (36) Very Low (20) Non-Commercial (0) None</p>	18%	

Residential development likelihood	Residential annual growth rate 2009-2014	Continuous value of annual residential growth rate (100) Watershed with lowest growth rate <i>Continuous range to</i> (0) Watershed with highest growth rate	18%	
Residential development likelihood	Cadastral centroid residential structures	Continuous value of count of cadastral centroid residential structures (100) Watershed with lowest number of cadastral centroid residential structures <i>Continuous range to</i> (0) Watershed with highest number of cadastral centroid residential structures	19%	

Identify, manage and reduce threats to forest and ecosystem health

For more information on the layers below see these notes: [Webex Summary Notes Obj 4](#)

TOPIC	LAYER NAME	GIS ANALYSIS	EXPERT WEIGHTING	COMMENTS
Insect & Disease	Insect & disease for all species except Bark Beetles	Continuous value of acres of all insect and disease species except Bark Beetles (100) Watershed with largest acreage of all insect and disease except Bark Beetles <i>Continuous range to</i> (0) Watershed with smallest acreage of all insect and disease species except Bark	12%	

		Beetles		
Insect & Disease	Insect & disease for existing Bark Beetles	Continuous value of acres of Bark Beetles (100) Watershed with largest acreage of Bark Beetles <i>Continuous range to</i> (0) Watershed with smallest acreage of Bark Beetles	15%	
Insect & Disease	Insect & disease for the probability of Bark Beetle	Continuous value of acres of high probability areas predicted for Bark Beetle (100) Watershed with largest acreage of Bark Beetle <i>Continuous range to</i> (0) Watershed with smallest acreage of Bark Beetle	16%	
Insect & Disease	Crown Fire Probability	Continuous value of acres of high probability areas predicted for crown fire (100) Watershed with largest acreage of crown fire probability <i>Continuous range to</i> (0) Watershed with smallest acreage of crown fire probability	16%	
Specific Species	Whitebark pine forest health threats	Percent of watershed based on forest health threat to Whitebark pine (100) Watershed with highest number of threatened whitebark pine raster cells <i>Continuous range to</i> (0) Watershed with lowest number of threatened	12%	

		whitebark pine raster cells		
Noxious weeds	Noxious weeds	Expert assignment by watershed (100) Very High (75) High (50) Medium (25) Low (1) Very Low	7%	
Departure from Desired Vegetation Condition	Departure from Desired Vegetation Condition	Ordinal scale data in classes developed by USFS R1. Weighted mean (zonalmean) of raster cell counts of categories	22%	

Improve air quality and conserve energy

For more information on the layers below see these notes: [Webex Summary Notes Obj 6](#)

TOPIC	LAYER NAME	GIS ANALYSIS	EXPERT WEIGHTING	COMMENTS
Non -attainment areas	Air Quality Non-Attainment Areas	Percent of watershed based on count of of air quality non attainment areas (100) Watershed with 2 air quality non attainment areas (50) Watershed with 2 air quality non attainment areas (0) Watershed with the no air quality non attainment areas	19%	
Forest influence on urban areas	Forest influence on urban areas	Percent of watershed based on count of acres of forested lands within 1 miles of the urban areas (100) Watershed with the highest acres of forested land influencing the urban areas	14%	

		<i>Continuous range to</i> (0) Watershed with the lowest acres of forested land influencing the urban areas		
Historic fires near urban areas	Historic fires near urban areas	Weighted sum (zonal sum) of raster cell counts of historic fires in the last 10 years (100) Watershed with highest acreage of fires in the last 10 years <i>Continuous range to</i> (0) Watershed with lowest acreage of fires in the last 10 years	9%	
Residential development likelihood	Cadastral centroid residential structures	Continuous value of count of cadastral centroid residential structures (100) Watershed with highest number of cadastral centroid residential structures <i>Continuous range to</i> (0) Watershed with lowest number of cadastral centroid residential structures	13%	
Residential development likelihood	Residential annual growth rate 2009-2014	Continuous value of annual residential growth rate (100) Watershed with highest growth rate <i>Continuous range to</i> (0) Watershed with lowest growth rate	12%	
Impervious surfaces	Impervious surfaces	Percent of watershed based on count of raster cells of impervious surfaces (100) Watershed with lowest	8%	

		number of impervious surface raster cells <i>Continuous range to</i> (0) Watershed with highest number of impervious surface raster cells		
Urban Canopy cover	Urban forest canopy cover	Percent of watershed based on expert opinion of forested canopy cover in the urban influence area (100) Watershed with highest number of forested canopy cover <i>Continuous range to</i> (0) Watershed with lowest number of forested canopy cover	25%	

Maintain and enhance the economic benefits and values of trees and forests

For more information on the layers below see these notes: [Webex Summary Notes Obj 8](#)

TOPIC	LAYER NAME	GIS ANALYSIS	EXPERT WEIGHTING	COMMENTS
Biomass potential, site productivity	Forest productivity	Ordinal scale data in 5 classes developed by DOR. Weighted mean (zonalmean) of raster cell counts of following categories: (100) Very High (84) High (68) Moderate (52) Low (36) Very Low (20) Non-Commercial	27%	

		(0) None		
Existing or planned mills and other forestry infrastructure	Forest industry infrastructure	Continuous value of proximity to forest infrastructure following transportation routes, measured by weighted mean (zonalmean) of raster cells per watershed. (100) Watershed with shortest average distance (closest proximity) to forest mills and infrastructure <i>Continuous range to</i> (0) Watershed with highest average distance (farthest proximity) to forest mills and infrastructure	31%	
Municipal water supply intakes	Public water supply	Continuous value of count of public water supply intake point locations (100) Watershed with highest population <i>Continuous range to</i> (0) Watershed with lowest population	21%	
Forest Economic characteristics	Forest Economic characteristics using the surrogate layer below at this point until further data is available Public land ownership	Weighted mean (zonalmean) of raster cell counts of following categories: Federal: (25) USFS - Lower score (55) BLM - High score (55) BIA - High score (10) USFWS - Lowest score (20) OTHER federal State: (60) State trust - 7+ types - highest (60) Montana correctional - moderate	21%	

		(60) Montana Univ - lower (40) MDFWP - lower (50) HCP - Habitat Conservation Plans Private (60) Non - industrial (70) Industrial Montana Legacy (55) Montana Legacy Lands (1) Wilderness, roadless, national parks, non forested		
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Manage and restore trees and forests to mitigate and adapt to global climate change

For more information on the layers below see these notes: [Webex Summary Notes Obj 11](#)

TOPIC	LAYER NAME	GIS ANALYSIS	EXPERT WEIGHTING	COMMENTS
Species with accelerated effects from climate change	Species with accelerated effects from climate change: Dry forest types	Percent of watershed based on acres of selected species (100) Watershed with highest number of dry forest type acres <i>Continuous range to</i> (0) Watershed with lowest number of dry forest type acres	28%	This layer is recommended to be weighted lower than whitebark pine but higher than lodgepole. Use mtdryforest from Landfire grid where USFS lands are. Fill in the other areas with Landfire Cover type for DF/PP.
Species with accelerated effects from climate change	Species with accelerated effects from climate change: Whitebark Pine	Percent of watershed based on acres of selected species (100) Watershed with highest number of whitebark pine acres <i>Continuous range to</i> (0) Watershed with lowest number of whitebark pine	22%	This layer is recommended to be weighted higher since it is a survivability of species situation. Bob Keanne layer for Whitebark pine.

		acres		
Species with accelerated effects from climate change	Species with accelerated effects from climate change: Lodgepole pine	Percent of watershed based on acres of selected species (100) Watershed with highest number of selected species acres <i>Continuous range to</i> (0) Watershed with lowest number of selected species acres	13%	This layer is recommended to be weighted lower. Landfire Cover type for Lodgepole pine
Roadless Wildfire	Roadless Wildfire	Weighted average (zonalmean) of watershed based on acres of forested roadless wildfire areas split into those areas burned since 1988 and those not burned recently. (100) Areas in watershed with recently unburned forested roadless acres (50) Areas in watershed with recently burned forested roadless acres (0) Areas in watershed with no roadless forested areas	10%	Recommend weighting this layer lower than others in this list. Areas where mechanical operations not possible, wildfire is the primary tool for management Preservation, Wilderness, research/designated land use and roadless areas can be used as the source for this
High Hazard Fire Potential	Highest fire hazard areas	Percent of watershed based on acres of high hazard fire potential exacerbated by climate change. Assume this will be continuous, but may be divided into ordinal scales (high through low) with subsequent weighted mean value (100) Watershed with highest number of selected acres <i>Continuous range to</i> (0) Watershed with lowest	27%	

		number of selected acres		
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Protect and enhance water quality and quantity

For more information on the layers below see these notes: [Webex Summary Notes Obj 5](#)

TOPIC	LAYER NAME	GIS ANALYSIS	EXPERT WEIGHTING	COMMENTS
Priority watersheds	Priority watersheds	Continuous value of percent acreage of impaired 6th code watersheds within each 5th code. (100) Watershed with the highest percent acreage of impaired 6th code watersheds <i>Continuous range to</i> (0) Watershed with the lowest percent acreage of impaired 6th code watersheds	23%	
Priority watersheds	Abandoned Mines	Count of abandoned mines within each 5th code watershed. (100) Watershed with the highest number of abandoned mines <i>Continuous range to</i> (0) Watershed with the lowest number of abandoned mines	8%	
Priority HUCS R1 water quality	USFS Priority HUCS for water quality	Need more information on structure of this database	12%	
Public Water Supply-Drinking Water	Public water supply	Count of public water supply (PWS) points in the watershed	25%	

		(100) Watershed with the highest number of PWS points <i>Continuous range to</i> (50) Watershed with the lowest number of PWS points (0) Watershed with no PWS points		
Insect & Disease	Insect & disease for existing Bark Beetles	Continuous value of acres of Mountain Pine Beetle (100) Watershed with largest acreage of Mountain Pine Beetle <i>Continuous range to</i> (0) Watershed with smallest acreage of Mountain Pine Beetle	9%	
Insect & Disease	Insect & disease for the probability of Bark Beetle	Continuous value of acres of high probability areas predicted for Bark Beetle (100) Watershed with largest acreage of Bark Beetle <i>Continuous range to</i> (0) Watershed with smallest acreage of Bark Beetle	9%	
Insect & Disease	Crown Fire Probability	Continuous value of acres of high probability areas predicted for crown fire (100) Watershed with largest acreage of crown fire <i>Continuous range to</i> (0) Watershed with smallest acreage of crown fire	14%	

Protect, conserve, and enhance wildlife and fish habitat

For more information on the layers below see these notes: [Webex Summary Notes Obj 9](#)

TOPIC	LAYER NAME	GIS ANALYSIS	EXPERT WEIGHTING	COMMENTS
MDFWP Crucial Areas	Aquatic resources	All of these layers are still unknown in terms of the attribution and number of classes. They will include percent of HUC based on acreage if they are binary or weighted average acreage if they are in multiple nominal classes <i>(100) Watershed with highest value or weight</i> <i>Continuous range to</i> <i>(0) Watershed with lowest value or weight</i>	26%	
MDFWP Crucial Areas	Terrestrial Wildlife	All of these layers are still unknown in terms of the attribution and number of classes. They will include percent of HUC based on acreage if they are binary or weighted average acreage if they are in multiple nominal classes <i>(100) Watershed with highest value or weight</i> <i>Continuous range to</i> <i>(0) Watershed with lowest value or weight</i>	28%	Terrestrial game species Terrestrial species of concern Terrestrial species habitat associations Landscape metrics - intact native landscapes Wetlands Riparian areas
DNRC Conservation Priority areas	DNRC HCP	Percent of watershed based on count of acreage of DNRC HCP areas <i>(100) Watershed with highest</i>	15%	Double check with Donna - doesn't include Eastern MT lands - should be

		number of acreage of DNRC HCP areas <i>Continuous range to</i> (0) Watershed with lowest number of acreage of DNRC HCP areas		recognized by final model users if this is correct we need a note in the metadata
Theodore Roosevelt Conservation Partnership - Hunter and Angler Valued areas	Hunter and angler valued areas	Union all hunter and angler groups converted to a grid value with the number of groups interested in a given raster cell. Weighted average (zonalmean) of number of hunter and angler groups (100) Watershed with highest number of miles of hunter and angler groups <i>Continuous range to</i> (0) Watershed with lowest number of hunter and angler groups	15%	
Priority HUCS R1 water quality and fish	USFS Priority HUCS for fish	Need to know more about the data and data structure	16%	

Restore fire-adapted lands and reduce risk of wildfire impacts

For more information on the layers below see these notes:

[Webex Summary Notes Obj 3 and 7](#)

TOPIC	LAYER NAME	GIS ANALYSIS	EXPERT WEIGHTING	COMMENTS
Burned probability map	Burned Area Probability Map and combination of either of the	Continuous value of acres of burned area probability on forested lands - using crown fire portion of this layer	31%	

	layers below National Map (Finney)- if completed in time or Ponderosa Pine and Douglas Fir Landfire Refresh Existing Vegetation Type	(100) Watershed with largest acreage of burned area probability <i>Continuous range to</i> (0) Watershed with smallest acreage of burned area probability		
Presence/Absence map of CWPP	CWPP	Expert assignment by watershed (100) Present (0) Absent	1%	
Departure from Desired Vegetation Condition	Departure from Desired Vegetation Condition	Ordinal scale data in classes developed by USFS R1. Weighted mean (zonalmean) of raster cell counts of categories @DOuble check on this process after looking at Chip's layer	28%	
Insect & Disease	Insect & disease for all species except Bark Beetles	Continuous value of acres of all insect and disease species except Bark Beetles (100) Watershed with largest acreage of all insect and disease species except Bark Beetles <i>Continuous range to</i> (0) Watershed with smallest acreage of all insect and disease species except Bark Beetles	11%	
Insect & Disease	Insect & disease	Continuous value of acres of	15%	

	for existing Bark Beetles	Bark Beetle(100) Watershed with largest acreage of Bark Beetles <i>Continuous range to</i> (0) Watershed with smallest acreage of Bark Beetles		
Insect & Disease	Insect & disease for the probability of Bark Beetle	Continuous value of acres of high probability areas predicted for Bark Beetle (100) Watershed with largest acreage of Bark Beetle <i>Continuous range to</i> (0) Watershed with smallest acreage of Bark Beetle	14%	

Appendix B

Abandoned Mines

SUMMARY (Short overview of the data layer)

Abandoned mines from the Montana Dept. of Environmental Quality (DEQ), Mine Waste Clean Up Bureau, Abandoned Mines Section database. Coordinates were derived from map interpolated Lat/Longs and quarter/quarter/quarter section descriptions.

SAWG DOCUMENTATION (Put metadata on processing here)

1. Delete mines that fall outside of the Montana state boundary
 2. Convert abdmine.shp to Raster
 - Conversion Tools > To Raster > Polygon to Raster
 - Input Features: abdmine.shp
 - Value Field: ID
 - Output: abdmminerast
 - Cell assignment: CELL_CENTER
 - Priority Field: NONE
 - Cellsize: 30
 3. Zonal Statistics
 - Spatial Analyst Tools > Zonal > Zonal Statistics
 - Input raster or feature zone data: SAWG_units_KB
 - Zone field: Huc_10
 - Input value raster: abdmminerast
 - Output: abdmine_tbl.dbf
 - Statistics type: MEAN
 - Join output table to zone layer
 - Ignore NoData
 4. Populate ABDMINE Attribute Field
 - Add ABDMINE field (Short Int) to SAWG_units_KB.shp
 - <NULL> = 0
 - Calculate ABDMINE field (abdmine_tbl.COUNT/242)*100
 - Remove table join
-

METADATA FROM OTHER SOURCES (Upload files and paste document file names here)

http://nris.mt.gov/nsdi/nris/deq_abandoned_mines.html

GENERAL NOTES

Add abandoned mines to this analysis based on 12-07-09 WebEx review session

No consideration possible in the current process for levels of cost for reclamation, but consider in future.

Air Quality Non-Attainment Areas

SUMMARY (Short overview of the data layer)

A “nonattainment area” is a defined geographic area that has been designated by EPA, and within which concentrations of a given air pollutant either are, or have been, higher than the national standards.

SAWG DOCUMENTATION (Put metadata on processing here)

1. Create airqnaa.shp from 8 non-attainment layers listed below

NON ATTAINMENT LAYERS	NOTE
CO_Limited_Maint_Plans.shp	3 polygons - Missoula, Billings, Great Falls
CO_SIP_Call_Nonattainment.shp	1 point in Kalispell
Fed_PM10__Nonattainment.shp	5 polygons total, 2 in Polson, 2 in Ronan, 1 in lame Deer
Lead_NonAttainment.shp	1 polygon
SO2_Nonattainment.shp	2 polygons - East Helena and Laurel
SO2_SIP_Call_Nonattainment.shp	1 point in Billings
State 10 Micron Particulate Nonattainment Areas - PM10_NA.shp	7 polygons - Libby, Whitefish, Columbia Falls, Kalispell, Thompson Falls, Missoula, Butte
State 2-5 Micron Particulate Nonattainment Area - PM25_NA.shp	1 polygons in Libby

- place point in each watershed for each non-attainment layer

2. Spatial join to HUC layer

3. Summarize on HUC for count of points: airqnaa_tbl.dbf

4. Join to Sawg_units_rw.shp

5. Calculate weighted score for AIRQNAA attribute:

- 100 for two non-attainment points
- 50 for one non-attainment point
- 0 for no non-attainment points

METADATA FROM OTHER SOURCES (Upload files and paste document file names here)

GENERAL NOTES

A couple of words of explanation: A “nonattainment area” is a defined geographic area that has been designated by EPA, and within which concentrations of a given air pollutant either are, or have been, higher than the national standards. If the area is on a reservation or within a national park or wilderness area, it is outside of the state’s control and is managed by EPA. There are several small federal particulate matter nonattainment areas in Montana. All nonattainment areas in the non-federally managed areas of the state are overseen by MTDEQ. Montana’s air quality is very good, and has actually been improving over the years, so very few nonattainment issues exist, in very small geographic areas of the state. When an area is designated as nonattainment for a given pollutant, and the state cleans it up, then the area can be redesignated. Typically the redesignation is to a status known as “Maintenance Plan” or “Limited Maintenance Plan.” What this means is that the state continues to make specific efforts to keep the area clean, and those efforts are committed to EPA in (you guessed it) a maintenance plan. Basically this means that the area is proven to be in attainment with the National Ambient Air Quality Standards (NAAQS) for that pollutant.

On some occasions, the state and EPA disagree on the best course of action for dealing with air pollutants in an area. This can result in the EPA exercising its authority to challenge or disapprove of a portion of a state’s air quality Implementation Plan (State Implementation Plan = SIP), and CALL for the state to revise the plan. Hence the term “SIP Call.” Typically these SIP Call areas have no specified geographic boundaries, and so within the GIS world are simply represented by points.

So, attached is a zip file containing folders that hold the shape files for the various air quality designations in Montana as discussed above. The areas are very small, and so the shapes files are really tiny in size.

Attainment and airsheds / Recontact DEQ - Hobbie

State list combined with CEORE tool to collect tribal areas and federal areas.

Aquatic resources

SUMMARY (Short overview of the data layer)

The project is temporarily using the USFWS MOYOCO ecosystem analysis from 2003 as a surrogate layer until the Montana Dept. of Fish, Wildlife and Parks aquatic layer is released in the winter/spring of 2010. The MOYOCO analysis was a scored model based on the fish species recorded per stream reach, counting both the native fish species and the total fish species.

SAWG DOCUMENTATION (Put metadata on processing here)

For this model we used the total number of fish species in each watershed and the total native fish species score in a combined model with the following weights:

67 points for native fish species score

33 points for the total number of fish species score

METADATA FROM OTHER SOURCES (Upload files and paste document file names here)

<http://www.fws.gov/moyoco/index.html>

GENERAL NOTES

[Aquatic sport fish](#)

[Aquatic species of concern](#)

[Aquatic native assemblages](#)

Burned Area Probability Map

SUMMARY (Short overview of the data layer)

The crown fire portion of the USFS burned area probability model was used in western and southern Montana (those areas in or near USFS lands where the crown fire model was run). In the north central and north eastern parts of Montana (where the model was not run) we used the Ponderosa Pine and Douglas Fir from Landfire as a surrogate until a future time when the nationwide burned area probability model is available.

SAWG DOCUMENTATION (Put metadata on processing here)

See cover_area.shp for the area of Montana covered by Crown Fire probability model.

Calculate BURNAREA

For hucs within crownfire area: $BURNAREA = CROWNFIRE$

(see crownfire grid)

For hucs outside crownfire area: $BURNAREA = DHRPPDF$

(see FHRPPDF grid)

METADATA FROM OTHER SOURCES (Upload files and paste document file names here)

GENERAL NOTES

Originally we used "burned area probability" as a generic term for two USFS layers: crown fire and surface fire. These were done for all lands in and around USFS lands in Region 1.

Subsequent discussion involved only crown fire and how to fill in the parts of Montana not covered by this effort (surface fire is not being used in any objectives). Discussion of using National effort underway - see notes in this hot link for future enhancements.

- Crown fire and DF/PP where crown fire was not mapped - used only in Obj 2,3,7
- Crown fire by itself only is used in Obj 4 & 5
- Crown fire is also used in Obj 11 along with DF/PP in areas over 50% Landfire canopy cover
- Use crown fire only.
- Surface fire is beneficial to forests and would be measured on an opposite scoring model. Cookie cut out the forested areas before calculating burned area probability area to summarize for surface area fires (subsequently decided not to use surface area fires).

- Historic fires and wind patterns (two layers formerly included as separate layers) were deleted because they are incorporated in this analysis already
- Overlay with land cover species types - high priority species? JPEG
- Map effort by Mark Finney and Laurie Kirth at the Fire Lab - focusing on Crown Fires
- Barry Bollenbach indicated he could acquire this as A GIS layer
- Monte Carlo runs - problem fires
- Took into account the last 20 years
- Barry Bollenbacher: the burn probability map is completed for Montana. could overlay with current veg map layer from landfire to determine which areas and forest types are at most risk. Dry forest types and Whitebark pine are very big priorities on FS
- Determine if probability threshold to be used and presence/absence instead of % of HUC after looking at the data. This data is first choice - localized and FIA based.
- Clip with national version of this if available - Jim Menakis is checking. Compare the two and then make final decision. Last resort - fill in gaps using DF/PP cover types

Use crown fire from the USFS burned area probability model, not surface fire.

Separate Montana into two geographic units, western and southern Montana - those in or near USFS lands where the crown fire model was run (it was run on USFS and Non-USFS lands in these areas, and the North central and north eastern parts of the state where the model was not run. For the latter area used the DF/PP from landfire as a surrogate until future time when nationwide model is available.

Cadastral centroid residential structures

SUMMARY (Short overview of the data layer)

Existing residences in 2009 throughout Montana, derived from the Montana cadastral base map with structure points generated for the parcel centroids for those parcels with a residence listed in the property tax records. This included either a fixed dwelling or a mobile home. All residences were counted and summed in each watershed.

These data were used in two opposite ways in the first objective of Goal 1. For goals associated with urban forests a higher population or number of residences is generally a favorable condition, with more resources available for urban forest management. For rural areas, we assumed that residential growth often precluded active forest management and suburban and exurban residential sprawl was not favorable to forestry. As a result, we split the objective into two separate models, to prevent the results from neutralizing each other.

SAWG DOCUMENTATION (Put metadata on processing here)

1.. Query Residential Properties

- `SELECT * FROM StructureCentroids_Nov2009 WHERE: RESPROPIND = "RESPROPIND" = 'Dwelling' OR "RESPROPIND" = 'Mobile' OR "RESPROPIND" = 'Vacant'`
- Export selected features to Dwelling_Units_dvm.shp

2.. Spatial Join Dwelling_Units_dvm.shp and SWAG_units_dr.shp

- Target Features: StructureCentroids_Nov2009.shp
- Join Features: SAWG_units_dr.shp
- Output: SAWG_Dwelling.shp
- Join Operation: JOIN_ONE_TO_ONE

- 3.. Summarize Huc_10 field from SAWG_Dwelling.shp
- 4.. Summarized JOIN_COUNT on attribute HUC_10 (unique ID for each watershed) to table SAWG_Dwelling_Units_Sum2
- 5.. Joined SAWG_Dwelling_Units_Sum2 to SAWG_unitsDR.shp (Kyle's version) using HUC_10 attribute
- 6.. Calculated CADRESSTRU from summed SAWG_Dwelling_Units_Sum2 ->JOIN_COUNT
- 7.. Copied SAWG_UnitsDR.shp to SAWG_UnitsKB.shp to avoid confusion of file names
- 8.. Joined the SAWG_UnitsKB.shp->CADRESSTRU to the master CVSAWG feature class for Objective U1 and Objective R1 and transferred the number of residential structures to CADRESSTRU in both cases
- 9.. Replaced all null values with value of 0
- 10.. For the Urban model U1 we converted all values to 0 for all watersheds that did not have a UFPP or UFCANCOV value in order to isolate the urban forest watersheds
- 11.. For the rural model R1 we left all values in the model

METADATA FROM OTHER SOURCES (Upload files and paste document file names here)

- <http://gis.mt.gov/>

GENERAL NOTES

All parcels in Montana derived from the Montana cadastral database supported by ITSD and the Department of Revenue. We are considering using the cadastral layer distributed by the Montana State Library in ESRI GIS layer format with a subsample of the cadastral layer. The current version available is dated January 2008 (or the latest that is currently available in July, 2009) from that master polygon database we select those that have a residence in the the Prop_Type database attribute and convert those to the point centroid of each polygon points, are then summarized by 5th code HUC.

Reference for AllCad file from NRIS:

<http://nris.mt.gov/gis/gisdatalib/gisDataList.aspx?datagroup=statewide-regional&searchTerms=cadastral>

Cadastral layer from ITSD, Dept. of Administration:

<http://gis.doa.mt.gov/>

Community Forest

SUMMARY (Short overview of the data layer)

This layer was created by Dan Rogers at DNRC and indicates watersheds with a community forest program. This is a relatively new type of management structure and exists in a few watersheds in the Swan and Blackfoot drainage. The concept of a community forest is different than a typical urban forestry program, and has occurred so far only in rural community settings. This layer should be weighted fairly low with all other things considered, since it does not occur in many locations and can skew modeling results that occur throughout the state.

SAWG DOCUMENTATION (Put metadata on processing here)

Dan Rogers edited the watersheds directly and updated the attribute COMUNTYFOR with a 1 for those watersheds with a Community Forest and 0 for those without one.

METADATA FROM OTHER SOURCES (Upload files and paste document file names here)

GENERAL NOTES

Presence/Absence layer, assigned to 5th code HUCCS

Blackfoot Challenge - Town of Ovando

Swan Ecosystem Center

Separate from general working forests near urban area. Weight these much lower due to limited area coverage and presence/absence. Recommended using CEORE tool if required. Missoula, Helena, Bozeman. Robert and Dan will decide on additional areas to add .

Crown Fire Probability

SUMMARY (Short overview of the data layer)

Crown fire probability for a portion of Montana (primarily western and southern Montana). This map and model were prepared by the US Forest Service. It is based on a map effort by Mark Finney and Laurie Kirth at the National Fire Lab in Missoula. This process focuses on crown fires. The analysis methods include Monte Carlo runs for problem fires, and took into account the last 20 years of actual fires history and behavior. This map was run for about two thirds of the total area of Montana in and around National Forest lands, but did include all lands within that area, not just federal land.

SAWG DOCUMENTATION (Put metadata on processing here)

1. See crownfireprob grid

- Values range from 0-307
- 270 meter grid
- Extends outside Montana
- NAD 83 Albers

2. Clip to ab41

- Project to MT State Plane NAD 83
- Save as CROWNFIRE grid

3. Calculate Zonal Statistics for HUCs

- Spatial Analyst: Zonal Statistics
- Zone dataset: SAWG_Units.shp
- Zone field: HUC_10
- Value raster: crownfire
- Ignore No Data in calculations
- Join output table to zone layer
- Output table: crownfire_tbl.dbf

4. Calculate percent of HUC with crown fire probability

- Join crownfire_tbl.dbf to sawg_units_rw.shp
- Calculate NULL values = 0 (i.e. no crown fire probability within HUC)
- Add field: CROWNFIRE (Short-4)
- Calculate CROWNFIRE = ((crownfire_tbl.COUNT * 72900)/(SAWG_units_RW.GRIDSUM *900)*100)

NOTE: CROWNFIRE field contains zero values.

METADATA FROM OTHER SOURCES (Upload files and paste document file names here)

GENERAL NOTES

- Overlay with land cover species types - high priority species? JPEG
- Map effort by Mark Finney and Laurie Kirth at the Fire Lab - focusing on Crown Fires
- Barry Bollenbach indicated he could acquire this as a GIS layer.
- Monte Carlo runs - problem fires
- Took into account the last 20 years
- Barry Bollenbacher: the burn probability map is completed for Montana. could overlay with current veg map layer from landfire to determine which areas and forest types are at most risk. Dry forest types and Whitebark pine are very big priorities on FS.

CWPP

SUMMARY

Counties that have completed a Community Wildland Fire Protection Plan. This layer was used as a surrogate to indicate the level of demonstrated collaboration on wildland fire planning. It was mapped at the county level, so the data is very coarse. In addition, most of the counties have completed a plan. We recommend that this layer be weighted very low, since it will have undue influence on the model due to the coarse geographical units of the mapping.

SAWG DOCUMENTATION (Put metadata on processing here)

Use UpdatesCWPP_WUI.gdb from DNRC

Calculate zonal majority of CWPP

**

1. Calculate Statistics for HUCs

Spatial Analyst: Zonal Statistics

Zone dataset: SAWG_Units_rw.shp

Zone field: HUC_10

Value raster: cwpp

Ignore No Data in calculations

Join output table to zone layer

Output table: cwpp_tbl.dbf

2. Calculate Zonal majority per HUC

Join cwpp_tbl.dbf to sawg_units_rw.shp

Calculate NULL values = 0 (i.e. no CWPP within HUC)

Add field: CWPP (Short-4)

Calculate CWPP = (cwpp_tbl.MAJORITY)

METADATA FROM OTHER SOURCES (Upload files and paste document file names here)

GENERAL NOTES

Presence/Absence

Liz has a list by county of all that have completed a Community Wildland Fire Protection Plan. These will be assigned to the 5th Code HUCS. Due to lack of consistency in all plans, this will be scored on a presence/absence basis.

Missoula is the only county with more than 1, but it will not be double counted.

Weight this less by factor of 3-4 over the analytical models on fire probability.

No distinction possible between these. Recommended not to use acres of WUI due to inconsistencies.

Good measure of feasibility and collaboration.

Day use recreation areas

SUMMARY (Short overview of the data layer)

Day use recreation sites including: FWP site, fishing access, historic district, historic site, picnic area, roadside park, ski resorts, state park (no camping), trailhead. Sources for this point layer included developed recreation point layer (USFS), state parks, NPS & National Monuments, local government open space lands and parks. BLM Developed Recreation were not included but may be available in digital form from the BLM state office.

SAWG DOCUMENTATION (Put metadata on processing here)

1. Select day use points from dispfrec.shp
 - (Do not include Arbor Day events in this layer.)
 - Save as dayuserec.shp
2. Spatial join to HUC layer
3. Summarize on HUC for count of points
4. Join to Sawg_units_rw.shp
5. Calculate DAYUSEREC attribute

METADATA FROM OTHER SOURCES (Upload files and paste document file names here)

GENERAL NOTES

- Currently everything from dispersed forest recreation that is not a campground or overnight use. Discuss adding Forest Recreation in or near Urban areas if CEORE tool is used.
- Combination of points and polygons including the following:
 - [Developed recreation point layer \(USFS\)](#)
 - [State parks](#)
 - BLM Developed Recreation
 - NPS & National Monuments Developed Recreation
 - USFWS Developed Recreation
 - Local government open space lands and parks (Mt. Sentinel & Jumbo, Mt. Helena, etc.)

Those within 5 miles of an urban area will be rated much higher than those in rural areas

Departure from Desired Vegetation Condition

SUMMARY (Short overview of the data layer)

This layer shows the amount of departure from desired conditions ranging from 1-141%. This layer was created by the USFS Region 1. Caution should be used when examining or weighting with this layer if you are interested in watersheds in much of eastern and north eastern Montana, since the model was not a statewide layer. Geographically it covered areas in and around National Forest lands in Montana. In the eastern part of the state where the USFS model was not available we used dry forest types from the National Landfire program as a surrogate for the areas where departure from desired conditions tends to be the most pronounced.

The Current Departure from Desired Condition polygon layer contains departure indexes for forest dominance types, conifer size class, warm dry forest basal area, and a combined departure index of all three. The CDDC analysis is based on USDA Forest Service FIA data queries by landscape level analysis areas (see description below) to determine current condition estimates for dominance type, conifer tree size class, and warm dry forest basal area. These estimates were compared to either forest plan revision desire condition range or historic range of variability range. The percentage of departure was calculated by subtracting or adding current condition estimates from the low or high ranges for types outside of the range. The combined departure index is the additive sum of dominance type, conifer tree size class, and warm dry forest basal area departure percentages. The combined departure index is used to rank the analysis areas from low to high departure from desired condition or historic range of variability.

SAWG DOCUMENTATION (Put metadata on processing here)

Normalized model number for DEPDVC from two sources - modeled numbers and substituted landfire dry forest type numbers 1) percent of departure from 1-141% 2) Percent of HUC for Dry forest types from Landfire 3) average of the two values per watershed

Normalized Measure = ((Raw Measure) – (Min Raw Measure)) / ((Max Raw Measure)- (Min Raw Measure))

USFS DEPDVC model is min of 0 and max of 142

Need to run percent of HUC for USFS lands vs non-USFS lands then weighted average against normalized score for USFS model

- Draft process * Ken received layer from Chip Fisher at RO USFS - interpret results during WebEx - probably use total percent departure in zonalmean apportionment to HUCS * Downloaded the historic fire regime from National LandFire - use % of huc for class @ * Intersect DOR Forest/Non-forest with landownership classes of USFS and non-USFS lands unioned and subsequently ** Intersect forested non-USFS with Landfire historic fire regime classes with low severity and high frequency ** Intersect forested and USFS with Departure from desired condition R1 layer where it is mapped
- Figure out how to mix the two measurements into one
- % of HUC for final measurement

There are two main attributes in the polygon layer: TOTDEPPERD (combined departure index) and S1BAA (analysis area number). Three additional attributes of interest are: DOMDEPPERD (dominance type departure percent), SIZDEPPERD (sizeclass departure percent), and WDBADEPPERD (warm dry forest basal area departure percent).

Total Departure

Source Data:

totdepperd GRID

30 meter grid

NAD 83 Montana State Plane

1. Clip Raster to Montana State Boundary

- Spatial Analysis > Options > Analysis Mask > ab41.shp
- Spatial Analysis > Raster Calculator > totdepperd
- Save clipped raster as depdvc

2. Zonal Statistics

- Spatial Analyst Tools > Zonal > Zonal Statistics
- Input raster or feature zone data: SAWG_units_KB

- Zone field: Huc_10
- Input value raster: depdvc
- Output: depdvc_tbl.dbf
- Statistics type: MEAN
- Join output table to zone layer
- Ignore NoData

Forest Service Lands

Source Data:

MontanaOwnershipClasses.shp

1. Query Forest Service Lands

- SELECT * FROM MontanaOwnershipClasses WHERE: "OWNER" = 25
- Export selection as FS_Lands.shp

2. Convert fslands.shp to Raster

- Conversion Tools > To Raster > Polygon to Raster
- Input: FS_Lands.shp
- Value: Value
- Output: fslands
- Cell Assignment type: CELL_CENTER
- Priority field: NONE
- Cellsize: 30

3. Calculate Zonal Statistics for HUCs

- Spatial Analyst: Zonal Statistics
- Zone dataset: SAWG_Units.shp
- Zone field: HUC_10
- Value raster: fslands
- Ignore No Data in calculations
- Output table: fslands_zonal_stats_tbl.dbf

Canopy

*Used in calculation for % departure of historic fire regimes

If7278854 (western Montana)

If3789264 (eastern Montana)

- Albers83
- 30 meter grid

From Landfire metadata (see link below for additional classes)

Percent canopy is composed of the merged canopy from each of the 3-lifeform regression tree outputs (forest, shrub, herb.). The 3-lifeform mask developed during the mapping of existing vegetation is used to identify the appropriate areas.

LANDFIRE Canopy Definition

Forest	
100	Sparse_Vegetation_Canopy
101	>= 10 and < 20
102	>= 20 and < 30

103	>= 30 and < 40
104	>= 40 and < 50
105	>= 50 and < 60
106	>= 60 and < 70
107	>= 70 and < 80
108	>= 80 and < 90
109	>= 90 and <= 100

1. Extract Canopy Attributes

- Spatial Analyst Tools > Extract by Attributes (batch)

Input Raster	Where Clause	Output Raster
lf7278854	Value >=100 and Value<=109	canopy1
lf3789264	Value >=100 and Value<=109	canopy2

2. Project Canopy Rasters

- Projections and Transformations > Raster > Project Raster (batch)

Input Raster	Output Raster	Output Coord.	Resampling	Cell Size
canopy1	canopy1proj	NAD 83 MT SP	NEAREST	30
canopy2	canopy2proj	NAD 83 MT SP	NEAREST	30

3. Clip to Montana State Boundary

- Spatial Analyst > Options > Analysis Mask = ab41.shp
- Clip canopy1proj and canopy2proj
- Save as canopy1clip and canopy2clip

4. Merge the Rasters

- Spatial Analyst > Raster Calculator
- Merge (canopy1clip, canopy2clip)
- Save as canopymerge

5. Reclassify

- Spatial Analyst > Reclassify
- Save as canopyreclass

Old Value	New Value
100	1
101	1
102	1
103	1
104	1
105	20

106	40
107	60
108	80
109	100

6. Zonal Statistics

- Spatial Analyst: Zonal Statistics
- Zone dataset: SAWG_UnitsKB.shp
- Zone field: HUC_10
- Value raster: canopyreclass
- Ignore No Data in calculations
- Output table: canopy_tbl.dbf

Calculate the Departure from Desired Vegetation Condition

1. Add Temporary Attribute Fields

- Add FSCNT field --- Join to SAWG_UnitsKB.shp --- populate with count from zonal statistics of FSLANDS GRID
- Add NONFSCNT field --- Join to SAWG_UnitsKB.shp --- FSCNT-GRIDSUM
- Add DEPDVCavg field --- Join to SAWG_UnitsKB.shp --- populate with mean from zonal statistics of DEPDV GRID
- Add CANOPY field --- Join to SAWG_UnitsKB.shp --- populate with mean from zonal statistics of CANOPYRECLASS GRID

2. Join Tables

- Join fslands_zonal_stats_tbl.dbf to SAWG_UnitsKB.shp
- Join depdvc_tbl.dbf to SAWG_UnitsKB.shp
- Join canopy_tbl.dbf to SAWG_UnitsKB.shp

3. Populate Temporary Attribute Fields

- FSCNT = fslands_zonal_stats_tbl.COUNT
- NONFSCNT = fs_lands_zonal_stats_tbl.COUNT - SAWG_UnitsKB.GRIDSUM
- DEPDVCavg = depdvc_tbl.MEAN
- CANOPY = canopy_tbl.MEAN

4. Calculate DEPDVC field in SAWG_UnitsKB.shp

- Add DEPDVC field (Long Int)
- $DEPDVC = (FSCNT * DEPDVCavg) + (NONFSCNT * CANOPY)$

5. Delete Temporary Attribute Fields

- Delete FSCNT field
- Delete NONFSCNT field
- Delete DEPDVCavg field
- Delete CANOPY field

METADATA FROM OTHER SOURCES (Upload files and paste document file names here)

Abstract from formal metadata on this layer created by Chip Fischer, R1, USFS.

The Current Departure from Desired Condition polygon layer contains departure indexes for forest dominance types, conifer size class, warm dry forest basal area, and a combined departure index of all three. The CDDC analysis is based on USDA Forest Service FIA data queries by landscape level analysis

areas (see description below) to determine current condition estimates for dominance type, conifer tree size class, and warm dry forest basal area. These estimates were compared to either forest plan revision desired condition range or historic range of variability range. The percentage of departure was calculated by subtracting or adding current condition estimates from the low or high ranges for types outside of the range. The combined departure index is the additive sum of dominance type, conifer tree size class, and warm dry forest basal area departure percentages. The combined departure index is used to rank the analysis areas from low to high departure from desired condition or historic range of variability. There are two main attributes in the polygon layer: TOTDEPPERD (combined departure index) and S1BAA (analysis area number). Three additional attributes of interest are: DOMDEPPERD (dominance type departure percent), SIZDEPPERD (sizeclass departure percent), and WDBADEPPERD (warm dry forest basal area departure percent). In the section below are descriptions of the analysis areas and the departure index calculations.

The Integrated Restoration Protection Strategy analysis base units are 6th code hucs with more than 1% USDA Forest Service managed lands. Scenario 1b analysis areas were developed by grouping 6th code hucs into landscape level analysis areas based on Forest Planning Zones. In the Idaho Panhandle and Kootenia National Forest planning zone administrative forest boundaries, ecological subsections, and forest plan revision geographic areas were used (analysis areas 101-111). For the Flathead, Lolo, and Bitterroot National Forest planning zone administrative forest boundaries, ecological subsections, and forest plan revision geographic areas were used (analysis areas 112-133). In the Clearwater and Nez Perce National Forest planning zone administrative forest boundaries, ecological subsections, and three landform types (breaklands, uplands, and subalpine) were used (analysis areas 161-176). For the Beaverhead-Deerlodge National Forest planning zone the administrative forest boundary and 2001 AMS landscape areas were used (analysis areas 207-212). For the Helena, Lewis-Clark, Gallatin, and Custer National Forest planning zone the 2001 AMS landscape areas were used (analysis areas 201-206 and 213-221). The analysis areas range in size from 223 KAcres to 1866 KAcres with a mean of 765 KAcres. The FIA data was intersected with analysis areas and percentage of current condition dominance type per forest plan revision desired condition class or historic range of variation class were done. The current condition dominance type estimate was then compared to the ranges and a percentage of departure was calculated. Several dominance type departures per analysis area were calculated (varies based on forest planning zone) including: Ponderosa Pine, Douglas-fir, Lodgepole Pine, Whitebark Pine, Subalpine Fir/Spruce mix, Grand Fir/Cedar mix, and others. Each dominance type departure is calculated and the summed up to a total dominance type departure for all species. For example in analysis area 101 (Idaho Panhandel), the Ponderosa Pine current condition mean estimate from FIA data is 3.2%. The Ponderosa Pine desired condition range is 4-10%. Since the current condition mean estimate is less than desired condition lower range, departure is: $4\% - 3.2\% = 0.8\%$. In analysis area 101 there are several other dominance types analyzed with a total dominance type departure of 57.9%.

The conifer tree size class departure was calculated in a similar fashion by analysis area with 3-5 size class groups (varies by forest planning zone): 0-4.9" dbh, 5-9.9" dbh, 10-14.9" dbh, 15-19.9" dbh, 20+" dbh. For example in analysis area 101 (Idaho Panhandel), the 10-14.9"dbh size class current condition mean estimate from FIA data is 28.8%. The 10-14.9"dbh size class desired condition range is 12-27%. Since the current condition mean estimate is greater than the desired condition upper range, departure is: $28.8\% - 27\% = 1.7\%$.

The warm dry forest basal area departure is calculated by first calculating the percentage of warm dry forest (mostly Ponderosa Pine and Douglas-fir). Then within the warm dry forest the percentage of a single basal area canopy cover class of 55-75% for westsize forests or 40-70% for eastside forests is

calculated. The relative percentage of the basal area canopy class per warm dry forest per analysis area is then calculated. For example in analysis area 101 (Idaho Panhandle), the warm dry forest type current condition mean estimate is 8.9%. Within the warm dry forest, the basal area canopy cover class is 2% for a relative percentage is 22.5%. The warm dry forest basal area canopy cover class desired condition relative percentage range is 40-60%. Since the current condition warm dry basal area canopy cover class estimate is less than the desired condition lower range, departure is: $40\% - 22.5\% = 17.5\%$.

GENERAL NOTES

Chip Fisher from USFS Regional Office is providing this data layer first week of January, 2010 (Posted 12/31/2009)

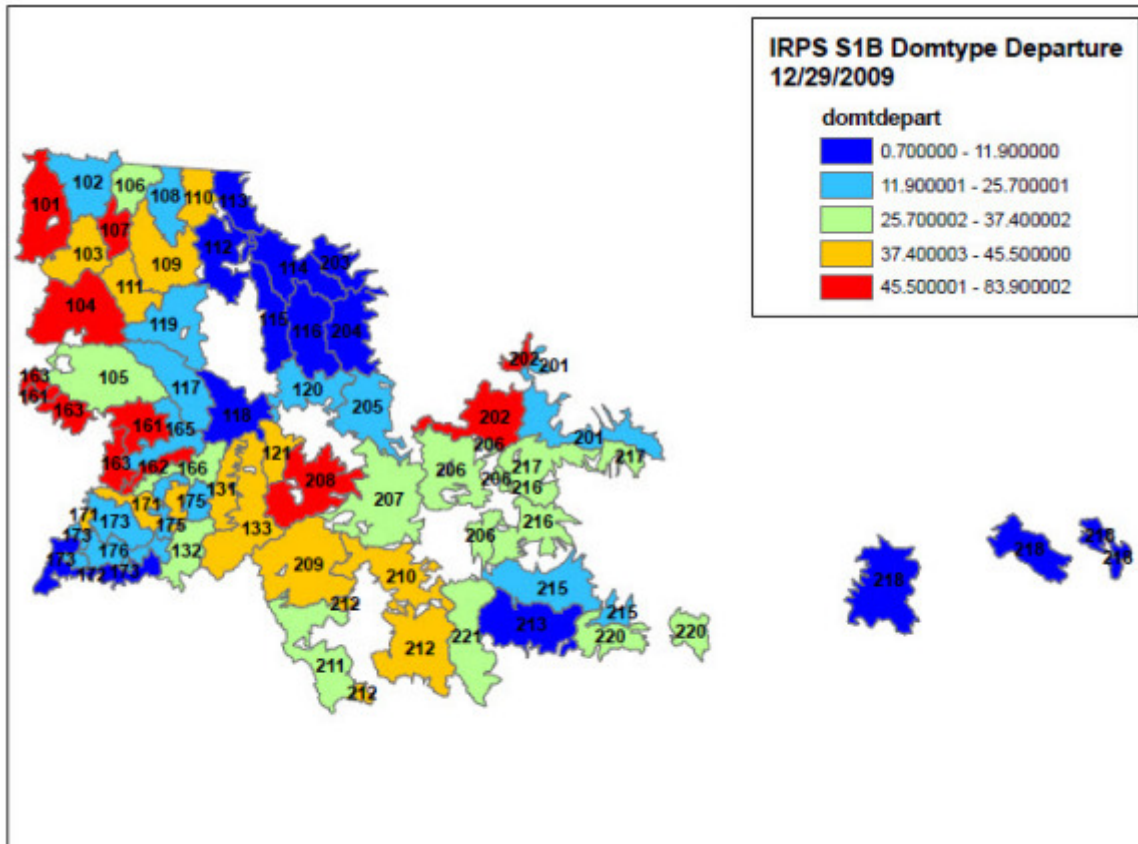
We are still working on the Current Departure from Desired Condition/HRV based on FIA data by S1B analysis areas (see attachment below). We hope to have a product early next week and possibly get it to you wed Jan 6th. I need to check with Barry to see if you need any other GIS layers from IRPS Scenario 1B.

The CDDC layer is by analysis areas made up of 6th code hucs clustered into groups based on two different criteria, one for the westside forests and another for the eastside forests. The westside forest S1BAA's are based on a combination of forest boundaries, ecological subsections, and forest plan revision geographic areas by 6th code huc. The eastside forest S1BAA's are based on landscape areas used in the 2001 AMS by 6th code huc. Each S1BAA tends to have 15-30 6th code hucs within it and are similar in size to a 5th code huc.

I will send you a polygon shapefile or file geodatabase with polygon feature class with attributes for total percent departure and total number of departed classes. Below I have attached a map (pdf) of the draft domtype CDDC I made yesterday. The quick and dirty map shows the percent departure of dominance types from DC or HRV. The intent is to identify areas with the largest departure for prioritization. The final map or polygon departure will be based on several dominance types, conifer tree size classes, and lower montane canopy cover. I will have metadata for the layer and possibly a word doc report on the process. Hopefully this gives you a heads up on what to expect next week.

Example attributes in polygon layer:

- S1BAA - analysis area number 101-176 westside forests, 201-221 eastside forests (short int)
- TOTDEPPERD - total departure in percent maybe greater than 100 (float)
- TOTDEPNUMD - total number of dominance+sizeclass+canopycover departed classes (short int)
- DOMDEPPERD - dominance type departure in percent maybe greater than 100 (float)DOMDEPNUMD - dominance type number of dominance types departed (short int)
- SIZDEPPERD - sizeclass+canopy cover departure in percent maybe greater than 100 (float)
- SIZDEPNUMD - sizeclass+canopy cover number departed (short int)



[s1b_domtype_departure_12292009.pdf](#)

December, 2009 from Wiki site - Barry Bollenbacher:

Currently in this objective we have adequately identified risk agents; bark beetles, burn probability, etc.. What is missing is what is at risk. I propose that we add as a value as one of the layers in this objective, that is at risk, is the desired vegetation condition, and an assessment of how departed current conditions are from the desired. The more departed, or the more acres in a HUC that are departed from the DC the more vulnerable the forest will be to disturbance processes that are not consistent with or detract from a trajectory toward DCs (an example might be that a DC on the Dry forest type might be a relatively open grown forest with species that can tolerate frequent low intensity fire) in this situation many times if visited by fire, the fire would be relatively non-lethal in nature. If the forest is greatly departed from the DC and is very densely stocked with species that are often killed by fire, generally the type of fire that will visit these types of forests will be lethal crown fire, rather than non lethal surface fire. A similar situation exists for bark beetle hazard. FRCC at the broadscale does not adequately characterize the values at risk.

I propose that for non Forest Service area, that we assess how many acres or what % of the area had a historical non-lethal fire regime. This can be obtained from the historical fire regime layer in LANDFIRE. The non FS lands are generally lower elevation, and had a lot of this type of historical fire regime. A fairly high % of this fire regime is departed from what could be considered a Desired Condition even on the

various PVT ownerships in the State(A DC that is not very vulnerable to crown fire and bark beetle mortality) Thus, the more are departed, the higher priority for treatment.

I propose that for FS lands the assessment should use the results from a departure assessment from DC of vegetation attributes that have been part of the Forest Plan revision process. Due to the fact that vegetation ranges from dry to cold, the DCs on FS lands are more complex. A product of this type will be available prior to January 1.

The combination of departure from DC on all lands then could be assessed by 5th code watershed to identify where areas are most departed from the DC which is the value that is at risk.

The combination of the amount of the value and the amount of the risk would then help prioritize HUCs for some type of treatment.

Dispersed forest recreation

SUMMARY (Short overview of the data layer)

Dispersed forest recreation sites outside the five mile urban buffer. This layer was entirely composed of point files representing dispersed recreation sites from the US Forest Service and MT Dept. of Fish, Wildlife and Parks, and historic districts and historic points from the State Historic Preservation Office. The recreation points were included as dispersed if they were outside a five mile buffer for selected cities and towns, measured from the center of the incorporated towns and places.

SAWG DOCUMENTATION (Put metadata on processing here)

1. Merge recreation points from the following layers and outside the five mile urban buffer:

- see ct106_buffer5.shp including Incorporated City, Incorporated Town, City area, City/County Entity (Anaconda and Butte)
- rec_sites_r1MT.shp (from USFS)
- fasPoints.shp (from MTFWP)
- fwplndpt.shp (from MTFWP)
 - include public access sites only
 - hatchery
 - wildlife conservation easement
 - wildlife habitat protection area
 - wildlife management area
 - do not include fishing access since they are included in faspoints.shp
 - do not include state parks since they are included in stateparkspts.shp
- StateParksPts.shp (from MTFWP)
 - add Camping attribute to the 25 state parks with camping facilities
- Historic_Districts.shp (centroids)from MT_Historical_Final.mdb
- Historic Sites from MT_Historical_Final.mdb
- American ski Resorts_points.shp (in Montana)

METADATA FROM OTHER SOURCES (Upload files and paste document file names here)

[fasPoints.htm](#)

[fwplndpt.htm](#)

[StateParksPts.htm](#)

GENERAL NOTES

Decision made at WebEx for Obj 10 to Lump all motorized and non-motorized recreation point layers into one master layer. Include the following:

[Overnight public recreation areas](#)

[Day use recreation areas](#)

[State parks](#)

[Ski areas](#)

DNRC HCP

SUMMARY (Short overview of the data layer)

DNRC High Conservation Priority areas, maintained by the Forestry Division of the Montana Department of Natural Resources and Conservation.

SAWG DOCUMENTATION (Put metadata on processing here)

RIEBE:

DNRC Trust Land tracts were selected for proposed inclusion in the HCP

Those tracts were copied to a separate data layer

1. Use DNRC_HCP.shp
 - Convert to grid: DNRCHCP
2. Calculate Zonal Statistics for HUCs
 - Spatial Analyst: Zonal Statistics
 - Zone dataset: SAWG_Units.shp
 - Zone field: HUC_10
 - Value raster: dnrchcp
 - Ignore No Data in calculations
 - Join output table to zone layer
 - Output table: dnrchcp_tbl.dbf
3. Calculate percent of HUC with DNRC HCPs
 - Join dnrchcp_tbl.dbf to sawg_units_rw.shp
 - Calculate NULL values = 0 (i.e. no HCP within HUC)
 - Add field: DNRCHCP (Short-4)
 - Calculate $DNRCHCP = ((dnrchcp_tbl.COUNT) / (SAWG_units_RW.GRIDSUM)) * 100$

METADATA FROM OTHER SOURCES (Upload files and paste document file names here)

GENERAL NOTES

DNRC High Conservation Priority areas. Donna has this layer. Does it need to be aggregated up to the HUC level by presence absence, or by % of acres by HUC broken into ordinal classes?

Forest Economic characteristics

SUMMARY (Short overview of the data layer)

We discussed using the 2004 Bureau of Business and Economic Analysis 2004 data report and other county based timber harvest historic data. An update is scheduled for this data by BBER to be completed

in 2010. Unfortunately, the industry is in a very volatile economic situation right now, and the judgment of the steering committee was to use the public land ownership scoring used in actively sustained forest management as a surrogate here for the timber supply side of the equation. The scores represent a relative probability for meaningful forest management and stewardship actions by mechanical means (excluding the use of wildland fire as a tool). Private industrial lands were ranked as the highest probability for forest harvest activity. The USFS general lands ranked low at 10 points, and roadless and wilderness ranked the lowest, since timber harvest is not allowed in these areas. The steering committee recommended updating this layer in the next annual update using the 2010 BBER timber harvest data.

SAWG DOCUMENTATION (Put metadata on processing here)

Use PUBLANDF value.

Recode using the following agreed scores:

(25) USFS - Lower score

(55) BLM - High score

(55) BIA - High score

(10) USFWS - Lowest score

(20) OTHER federal

State:

(60) State trust - 7+ types - highest

(60) Montana correctional - moderate

(60) Montana Univ - lower

(40) MDFWP - lower

(50) HCP - Habitat Conservation Plans

Private

(60) Non - industrial

(70) Industrial

Montana Legacy

(55) Montana Legacy Lands

(1) Wilderness, roadless, national parks, non forested

METADATA FROM OTHER SOURCES (Upload files and paste document file names here)

GENERAL NOTES

FIA query? BBER research? PNREAP queries?

We have several variables from BBER report on MMBF per county, do we want to use historic, or just 2009?

Apportion county based data at county level to 5th code watersheds. Examine weighting this by total % public land vs private land.

Decision not to use employees in forest, farm, and fisheries from PNREAP and ESRI Bureau of Census 2009 data

This year this variable will be market forest values, next year when MDFWP completes their analysis include non-market values from hunting and fishing and explore other non-market values.

One source - PNREAP Bearfacts web site for forest industry percentages and trends over the last 10 years. This article takes some development is to listen I website by County is mapped extractors

variables that are critical for this process to build a database of attributes by county and subsequently apportioned to fifth or fourth code HUCS.

Another option might be to explore Dave Jackson's forest economics for school trust land, economics by DNRC region. Probably not applicable, but worth a look.

Forest industry infrastructure

SUMMARY (Short overview of the data layer)

The forest industry infrastructure is composed of processing facilities, mills and other processing collection points. The source for these are from data collection process combining the CEORE tool (Capture Expert Opinion from Resource Experts) with 16 DNRC service foresters in regions throughout Montana processed in December, 2009. This data layer was measured in two ways as two separate GIS layer inputs: 1) Average proximity to any infrastructure point via the road network in each watershed, and 2) The total capacity in cubic feet per acre of processing capacity per mill aggregated to the watershed.

SAWG DOCUMENTATION (Put metadata on processing here)

1- ((forindinf - 42931) / (1414840-42931))

1. Import CEORE data on forest mill locations

- Use CEORE_FI20100113.shp
- Seven points were manually moved from outside the state to the closest place inside the state so that they could be included in the proximity.
- Save as ceore_fi.shp

CLASS	DESC	VALUE
1	Very low	20
2	Low	40
3	med	60
4	high	80
5	Very high	100

2. Create road cost grid

- Extract Montana roads from ESRI street map
 - Save as mtstreetmaprds.shp
- Convert to raster
 - mtsmrds grid (64 meter pixel)
- Assign VALUE based on road speed

SPEED	COST (rounded values)	NOTE
65	1	
60	1.08	
55	1.18	
50	1.3	

45	1.44	
40	1.63	
35	1.86	
30	2.17	
25	2.6	
20	3.25	
15	4.33	
10	6.5	
5	13	all roads with no speed value
2	32.5	no roads: walking

- Use nonframeworkroads_clip.shp (from DNRC)
 - Convert to raster nfrds grid (64 meter pixel)
 - Assign VALUE = 13 (all roads with no speed value)
- 3. Create road cost grid
 - Assign VALUE of 65 (no roads: walking) to state grid
 - Merge (mtsmrds, nfrds, state)
 - Save as roadcost64 grid
- 4. Cost Distance Analysis
 - Spatial Analyst: Distance: Cost Weighted
 - Distance to: CEORE_FI.shp
 - Cost raster: roadcost64
 - Output raster: dforindinf
 - Output cell size: 30 meters
- 5. Calculate Statistics for HUCs
 - Spatial Analyst: Zonal Statistics
 - Zone dataset: SAWG_UNIT_RW.shp
 - Zone field: HUC_10
 - Value raster: dforindinf
 - Ignore No Data in calculations
 - Join output table to zone layer
 - Output table: dforindinf_tbl.dbf
- 6. Calculate normalized proximity measure
 - Add field: FORINDINF (Double)
 - Normalized Proximity Measure = $((\text{Raw Proximity Measure}) - (\text{Min Raw Proximity Measure})) / ((\text{Max Raw Proximity Measure}) - (\text{Min Raw Proximity Measure}))$
 - Minimum mean value proximity measure for all values = 42882.398
 - Maximum mean value proximity measure for all values = 1415390
 - FORINDINF = $((\text{dforindinf_tbl.MEAN} - 42882.398) / (1415390 - 42882.398))$

METADATA FROM OTHER SOURCES (Upload files and paste document file names here)

[BBER MMIS Wood Products List](#)

GENERAL NOTES

ESRI BA list from Geodata to Dan - Dan contact Todd Morgan-Montana Wood Products - also check with Montana Logging Association - list or count of loggers by geographic area

Existing or planned mills and other forestry infrastructure. Bureau of Business and Economic research (BBER) has some of this information in house Also DNRC possibly does? Need to research BBER data and accessibility.

Decision in 12/16/2009 WebEx discussion to not measure loggers or logging equipment operators - too much in flux now, and the loggers are working all over the region to try and stay in business. Counting them using their address is not meaningful.

Proximity to mills and other infrastructure.

Bureau of Business and Economic research (BBER) 2004 report and mill infrastructure data examined but not used due to volatility and change in the timber industry market sectors

Compared and combined with expert opinion captured with CEORE tool and input from 16 DNRC service foresters

Add any biomass processing facilities to the infrastructure list above that are not captured with other methods

Add any missing entities from Timber Purchaser DNRC list maintained by Donna and Brian

Dropped contract loggers and logging equipment operators due to market volatility and wide range for operating markets.

Forest influence on urban areas

SUMMARY (Short overview of the data layer)

Percent of watershed based on count of acres of forested lands within one mile of the urban areas.

Using forest/non-forest from DOR and one mile buffer around the same list of selected urban areas used in the urban recreation attributes. This variable is to supplement the urban forest canopy cover that Dan Rogers estimated and is intended to also include the urban influence areas which included the forested areas adjacent to urban areas that play a similar role as the urban trees in scrubbing CO₂, etc. The DOR forest/non-forest delineation did a good job in the wildland urban interface areas adjacent to the urban areas but they didn't capture forests in the urban areas themselves.

SAWG DOCUMENTATION (Put metadata on processing here)

1. Clip forest_nonfor

- Spatial Analyst > Options > General
- Set Analysis Mask: urban_buffer1
- Raster Calculator: forest_nonfor
- Save clipped raster as finurban

2. Zonal Statistics

- Spatial Analyst Tools > Zonal > Zonal Statistics
- Input raster or feature zone data: SAWG_units_KB
- Zone field: Huc_10
- Input value raster: finurban
- Output: finurban_tbl.dbf
- Statistics type: MEAN
- Join output table to zone layer

- Ignore NoData

3. Populate FINURBAN Field

- Add FINURBAN field (short int) to SAWG_UnitsKB.shp
- <NULL> = 0
- (finurban_tbl.COUNT/SAWG_units_kb.GRIDSUM)*100
- Remove table join

METADATA FROM OTHER SOURCES (Upload files and paste document file names here)

GENERAL NOTES

Forest productivity

SUMMARY (Short overview of the data layer)

Dept. of Revenue 2009 pre-public release of the statewide forest productivity layers to be used in the taxation of private forest lands. The 2009 forest land reappraisal included 3.9 million acres of private land in the state. The purpose was to determine commercial forest land and potential forest productivity and yield. The inventory included areas with 15 contiguous acres under one ownership, with commercial quantities of wood products. NRCS has provided 4 soil elements that were determinants of forest land productivity and University of Montana conducted the valuation and obtained climatological data for the state to use in the valuation. National Agricultural Imagery Program 2005 aerial orthophotos, with 1 meter resolution were used for forest/non-forest delineation, and the database includes progressive classes of potential forest productivity. Ordinal scale data included 5 classes developed by DOR.

A derivative of this product, the delineation of forested and non-forested areas throughout the state was used in several layers whenever a screen of forested land was required. We found this to be the highest overall quality forest delineation available from any source. It did not include forested urban lands in the towns and cities themselves, and the wildland and National Forest Lands did not have detailed NAIP based edits, but the data is extremely good in the wildland urban interface areas.

SAWG DOCUMENTATION (Put metadata on processing here)

1. Merge Individual County Productivity Shapefiles

- Unpack shapefiles
- Data Management Tools > General > Merge
- Input Datasets: 48 county productivity shapefiles
- Output Dataset: Productivity_Merge.shp
- Data Management Tools > Features > Repair Geometry
- Input: Productivity_Merge.shp
- Delete Features with Null Geometry

2. Assign Productivity Attribute Values

- Add Value field (short int)
- Assign attribute values
 - New Value - Description (Old Value)
 - 100 - Very High (1)
 - 84 - High (2)
 - 68 - Moderate (3)

- 52 - Low (4)
 - 36 - Very Low (5)
 - 20 - Non Commercial (9)
3. Productivity_Merge.shp to Raster
 - Conversion Tools > To Raster > Polygon to Raster
 - Input Features: Productivity_Merge.shp
 - Value Field: Value
 - Output: forprod
 - Cell assignment: CELL_CENTER
 - Priority Field: Value
 - Cellsize: 30
 4. Zonal Statistics
 - Spatial Analyst Tools > Zonal > Zonal Statistics
 - Input raster or feature zone data: SAWG_units_dr
 - Zone field: Huc_10
 - Input value raster: forprod
 - Output: forprod_tbl.dbf
 - Statistics type: MEAN
 - Join output table to zone layer
 - Ignore NoData
 5. Calculate percent of Huc with forest productivity
 - Calculate <NULL> = 0
 - Calculate FORPROD = (forprod_tbl.COUNT/SAWG_units_dr.GRIDSUM)*100
 - Remove table join
 6. Selected all values in forprod_tbl.dbf where minimum and maximum = 1 and replaced them with 0
 7. Joined the forprod_tbl.dbf to OR1IdentifyConserveHighPriority feature class in CViz and calculated mean value to FORPROD

METADATA FROM OTHER SOURCES (Upload files and paste document file names here)

GENERAL NOTES

Dept. of Revenue 2009 - Productivity / Review SAP Road and Forest Cover model

2009 Forest Land Reappraisal for 3.9 million acres of private land in the state. Purpose was to determine commercial forest land and productivity/yield. Inventory includes 15 contiguous acres under one ownership, with commercial quantities of wood products

NRCS has provided 4 soil elements that are determinants of forest land productivity and University of Montana who did the valuation obtained climatological data for the state

NAIP was used for forest/non-forest delineation, and the database includes progressive classes of potential forest productivity.

RIEBE: 20091119 waiting on forest cover documentation from Ted Chase DOR

Original Riebe data analysis was combined forest and agriculture and was discarded - notes form that process below

RIEBE:

- Data was obtained from DOR with raw data values across most (some counties not included) not all the state. Missing Toole, Daniels, Sheridan, Roosevelt, McCone, Richland, Dawson and Wibaux

counties. DOR disclaimer that data was ONLY good for forested lands. Converted cubic foot values to board foot values by dividing by 4 Data classed statewide into the 6 classes 10, 8, 6, 4, 2, 0 The 2009 DOR data was recoded into 6 classes, 0 – 0 bf ft/yr, 2 >0 and less than or equal to 25 bf ft/yr, 4 >25 – 45 bf ft/yr, 6 >45-65 bf ft/yr, 8 65-85 bf t/yr, 10 greater than 85 bf ft/yr. These values are only for forested area according to Ted Chase DOR, so should be corrected for water and non-forested areas.

Forest recreation in and near urban areas

SUMMARY (Short overview of the data layer)

Dispersed forest recreation sites inside the five mile urban buffer for selected cities and towns, measured from the center of the incorporated towns and places. This layer was entirely composed of point files representing dispersed recreation sites from the US Forest Service and MT Dept. of Fish, Wildlife and Parks, and historic districts and historic points from the State Historic Preservation Office.

SAWG DOCUMENTATION (Put metadata on processing here)

1. Merge recreation points from the following layers and inside the five mile urban buffer:
 - see ct106_buffer5.shp including Incorporated City, Incorporated Town, City area, City/County Entity (Anaconda and Butte)
 - rec_sites_r1MT.shp (from USFS)
 - fasPoints.shp (from MTFWP)
 - fwplndpt.shp (from MTFWP)
 - include public access sites only
 - hatchery
 - wildlife conservation easement
 - wildlife habitat protection area
 - wildlife management area
 - do not include fishing access since they are included in faspoints.shp
 - do not include state parks since they are included in stateparkspts.shp
 - StateParksPts.shp (from MTFWP)
 - add Camping attribute to the 25 state parks with camping facilities
 - Historic_Districts.shp (centroids)from MT_Historical_Final.mdb
 - Historic Sites from MT_Historical_Final.mdb
 - American ski Resorts_points.shp (in Montana)
2. Spatial join to HUC layer
3. Summarize on HUC for count of points
4. Join to Sawg_units_rw.shp
5. Add one point for each Arbor Day event (from Dan)
6. Calculate FRECURBAN attribute

METADATA FROM OTHER SOURCES (Upload files and paste document file names here)

[fasPoints.htm](#)

[fwplndpt.htm](#)

[StateParksPts.htm](#)

GENERAL NOTES

ARBOR DAY/TREE CITY EVENTS NOTES

Dan Rogers has a list of these event hosts. These will be assigned to 4th or 5th code HUCs.

Future arbor day/tree city events should put the focus on existing trees within a community. To often, these trees are overlooked in terms of biological health & structural safety. Also, countless trees that could be considered as: "heritage", "noteworthy", "veteran", "historic" are completely ignored. Planting new trees is "fun" yet the vast majority of these newly planted trees are not afforded any plant health care (PHC) maintenance options that if properly implemented, would ensure longer-lived, more esthetically-appeasing, and structurally stronger (safer) trees.

It all starts with educating a community in the concepts of a "new tree biology" that was the hallmark of Dr. Alex Shigo's philosophy. Sadly enough, the local board members of my community's tree/park committee had absolutely no idea of what "USA/Tree City" was all about!

-Mike Garvey, Billings

contributed by Guest User on Dec 21 11:13am

Forest Stocking

SUMMARY

Forest stocking has not been systematically collected and summarized statewide in Montana. As a surrogate for stocking levels we used canopy cover data. For DNRC state lands, data consisted of polygons from Trust Lands Stand Level Inventory. Each forested polygon (with the exception of those currently not 'treed') had a high med or low class assigned based on DNRC's stocking code. Stocking code was based on the crown density of trees ≥ 9 " in diameter for softwoods and ≥ 11 " in diameter for hardwoods.

- Low - 0% to 39% crown canopy
- Med - 40% to 69% crown canopy
- High - $\geq 70\%$ crown canopy

For all other forested lands the National Landfire Canopy Cover layer was used and the same crown canopy cover classes as used by the state were assigned.

SAWG DOCUMENTATION (Put metadata on processing here)

1. Use lf72728854 (western Montana) and lf37898264 (eastern Montana)

- From Landfire metadata (see link below for additional classes)
 - Percent canopy is composed of the merged canopy from each of the 3-lifeform regression tree outputs (forest, shrub, herb.). The 3-lifeform mask developed during the mapping of existing vegetation is used to identify the appropriate areas.

LANDFIRE Canopy Definition

Forest	
100	Sparse_Vegetation_Canopy
101	≥ 10 and < 20
102	≥ 20 and < 30
103	≥ 30 and < 40
104	≥ 40 and < 50
105	≥ 50 and < 60

106	>= 60 and < 70
107	>= 70 and < 80
108	>= 80 and < 90
109	>= 90 and <= 100

- Albers83
 - 30 meter grid
 - See VALUE/ Label:
 - LOW (33)
 - 100 Sparse_Vegetation_Canopy
 - 101 Tree_Cover_>=10_and<20%
 - 102 Tree_Cover_>=20_and_<30%
 - 103 Tree_Cover_>=30_and_<40%
 - MEDIUM (66)
 - 104 Tree_Cover_>=40_and_<50%
 - 105 Tree_Cover_>=50_and_<60%
 - 106 Tree_Cover_>=60_and_<70%
 - HIGH (100)
 - 107 Tree_Cover_>=70_and_<80%
 - 108 Tree_Cover_>=80_and_<90%
 - 109 Tree_Cover_>=90_and_<=100%
2. Extract values >=100 and <=109
 3. Clip and project to MT State Plane 83 meters
 4. Reclass values (as above)
 - Rec_temp1f72
 - Rec_temp1f37
 5. Use DNRCstking.shp from DNRC
 - Assign VALUE: Low (33), Medium (66), High (100)
 - Convert to raster : dnrcstock grid
 - 30 meter grid
 6. MERGE dnrcstock,rec_temp1f72, rec_temp1f37, ab41
 - Save as forstock grid
 7. Calculate Zonal Statistics for HUCs
 - Spatial Analyst: Zonal Statistics
 - Zone dataset: SAWG_Units.shp
 - Zone field: HUC_10
 - Value raster: forstock
 - Ignore No Data in calculations
 - Join output table to zone layer
 - Output table: forstock_tbl.dbf
 8. Calculate Zonal mean per HUC
 - Join forstock_tbl.dbf to sawg_units.shp
 - Add field: FORSTOCK (Short-4)
 - Calculate forstock = (forstock_tbl.MEAN)

METADATA FROM OTHER SOURCES (Upload files and paste document file names here)

See lf72728854: meta1.html

See lf37898264: meta1.html

GENERAL NOTES

Decision after WebEx discussion:

COmbined [Forest Stocking-Non-State](#)

and

[Forest Stocking-State DNRC](#)

Classify the Landfire based federal % of canopy cover in the same classes used by Donna for the DNRC lands, then calculate average percent canopy cover weighted by acreage for overall average by watershed.

[Forest Stocking-State DNRC](#)

and

[Landfire Refresh Existing Vegetation Cover](#)

Discuss measurement scale to be used - ordinal

Forested areas with higher risk: Lodgepole Pine

SUMMARY (Short overview of the data layer)

This layer was required as a surrogate for areas of the map not covered by USFS burned area probability maps in the north-east and eastern portions of Montana. The data was used to identify Lodgepole pine vegetation types and was derived from the Landfire national products. Other sources were considered, including REGAP NW and National Land Cover database. The Landfire data incorporated FIA data plots and was judged superior for the forest types desired for this project.

SAWG DOCUMENTATION (Put metadata on processing here)

- Download from <http://www.landfire.gov/NationalProductDescriptions12.php>
 - RR98443434 grid
 - RR88615663 grid
- Use LPP_types from Landfire Rapid Refresh (RR grids)
 - Extract from RR98443434 grid and RR88615663 grid
 - Extract by attributes
 - "VALUE" = 2050 OR "VALUE" = 2167
 - (2045 and 2051 are already included in FHRPPDF)

VALUE	EVT_NAME	SYSTEMGR_1
2050	Rocky Mountain Lodgepole Pine Forest	Lodgepole Pine Forest and Woodland
2167	Rocky Mountain Poor-Site Lodgepole Pine Forest	Lodgepole Pine Forest and Woodland

- Merge and clip to state (ab41) and project to MT SP
 - Save as FHRLP grid

4. Calculate Zonal Statistics for HUCs

- Spatial Analyst: Zonal Statistics
- Zone dataset: SAWG_Units.shp
- Zone field: HUC_10
- Value raster: FHRLP
- Ignore No Data in calculations
- Join output table to zone layer
- Output table: FHRLP_tbl.dbf

5. Calculate percent of HUC with LP

- Join FHRLP_tbl.dbf to sawg_units.shp
- Calculate NULL values = 0 (i.e. no LP within HUC)
- Add field: FHRLP(Short-4)
- Calculate FHRLP = ((FHRLP_tbl.COUNT / SAWG_units_RW.GRIDSUM) * 100)

NOTE: FHRLP field contains zero values.

METADATA FROM OTHER SOURCES (Upload files and paste document file names here)

See RR88615663: meta1.html

See RR98443434: meta1.html

GENERAL NOTES

Weight this layer lower. The departure from desired conditions is not high for Lodgepole pine.

Compare to [NW ReGAP Analysis - key species at risk from insect and disease](#) to see about consistency.

Barry thought Landfire would be more consistent with USFS work and others. Note the vegetation type does not use FIA plots but different corrections of layers done on this than ReGAP

[Landfire Refresh Existing Vegetation Type](#)

Forested areas with higher risk: Ponderosa Pine and Douglas Fir

SUMMARY (Short overview of the data layer)

This layer was required as a surrogate for areas of the map not covered by USFS burned area probability maps in the north-east and eastern portions of Montana. The data was used to identify Ponderosa pine and Douglas Fir vegetation types and were derived from the Landfire national products. Other sources were considered, including REGAP NW and National Land Cover database. The Landfire data incorporated FIA data plots and was judged superior for the forest types desired for this project.

SAWG DOCUMENTATION (Put metadata on processing here)

1. Download from <http://www.landfire.gov/NationalProductDescriptions12.php>

- RR98443434 grid
- RR88615663 grid

2. Use DF_types and PP_types from Landfire Rapid Refresh (RR grids)

- Extract from RR98443434 grid and RR88615663 grid
- Extract by attributes
- "VALUE" = 2045 OR "VALUE" = 2047 OR "VALUE" = 2051 OR "VALUE" = 2053 OR "VALUE" = 2054 OR "VALUE" = 2117 OR "VALUE" = 2165 OR "VALUE" = 2166 OR "VALUE" = 2179 OR "VALUE" = 2227

VALUE	EVT_NAME	SYSTEMGR_1
2166	Middle Rocky Mountain Montane Douglas-fir Forest and Woodland	Douglas-fir Forest and Woodland
2165	Northern Rocky Mountain Foothill Conifer Wooded Steppe	Douglas-fir Forest and Woodland
2227	Pseudotsuga menziesii Forest Alliance	Douglas-fir Forest and Woodland
2047	Northern Rocky Mountain Mesic Montane Mixed Conifer Forest	Douglas-fir-Grand Fir-White Fir Forest and Woodland
2045	Northern Rocky Mountain Dry-Mesic Montane Mixed Conifer Forest	Douglas-fir-Ponderosa Pine-Lodgepole Pine Forest and Woodland
2051	Southern Rocky Mountain Dry-Mesic Montane Mixed Conifer Forest and Woodland	Douglas-fir-Ponderosa Pine-Lodgepole Pine Forest and Woodland
2179	Northwestern Great Plains-Black Hills Ponderosa Pine Woodland and Savanna	Ponderosa Pine Forest Woodland and Savanna
2053	Northern Rocky Mountain Ponderosa Pine Woodland and Savanna	Ponderosa Pine Forest, Woodland and Savanna
2117	Southern Rocky Mountain Ponderosa Pine Savanna	Ponderosa Pine Forest, Woodland and Savanna
2054	Southern Rocky Mountain Ponderosa Pine Woodland	Ponderosa Pine Forest, Woodland and Savanna

3. Merge and clip to state (ab41) and project to MT SP

- Save as FHRPPDF grid
- fhrppdf_tbl.dbf

4. Calculate Zonal Statistics for HUCs

- Spatial Analyst: Zonal Statistics
- Zone dataset: SAWG_Units.shp
- Zone field: HUC_10
- Value raster:FHRPPDF
- Ignore No Data in calculations
- Join output table to zone layer
- Output table:FHRPPDF_tbl.dbf

5. Calculate percent of HUC with DF/PP

- JoinFHRPPDF_tbl.dbf to sawg_units.shp
- Calculate NULL values = 0 (i.e. no DF/PP within HUC)
- Add field:FHRPPDF(Short-4)
- CalculateFHRPPDF= ((FHRPPDF_tbl.COUNT / SAWG_units_RW.GRIDSUM)*100)

NOTE: FHRPPDF field contains zero values.

METADATA FROM OTHER SOURCES (Upload files and paste document file names here)

See RR88615663: meta1.html

See RR98443434: meta1.html

GENERAL NOTES

Compare to [NW ReGAP Analysis - key species at risk from insect and disease](#) to see about consistency. Barry thought Landfire would be more consistent with USFS work and others. Note the vegetation type does not use FIA plots but different corrections of layers done on this than ReGAP

[Landfire Refresh Existing Vegetation Type](#)

Highest fire hazard areas

SUMMARY (Short overview of the data layer)

High fire hazard layers were based on acres of high hazard fire potential exacerbated by climate change. This layer was derived from the Landfire National products and was combined in this instance with the crown fire potential model developed by the US Forest Service and the whitebark pine model developed by the National Fire Lab. The processing rules included areas with crown fire potential greater and areas with Landfire canopy cover greater than or equal to 50%. The USFS crown fire model did not include portions of northern and eastern Montana, and in these areas the Douglas Fir and Ponderosa Pine landfire vegetation types were substituted with crown fire and the same canopy coverage rules were applied. Last, areas with both white-bark pine and crown fire were added to the map.

SAWG DOCUMENTATION (Put metadata on processing here)

1. Resample crownfire grid to 30 meters
 - resample (crownfire, 30, NEAREST)
2. Create grid from landfire data with canopy cover >=50%
 - Use lf72728854 grid and lf37898264 grid
 - 30 meter grids
 - (ignore DNRC data for this layer only)
 - Select "VALUE" >= 105 AND "VALUE" <= 109
 - Merge, clip to ab41, project to MT State Plane
 - Save as canopy50 grid
3. Convert cover_area.shp to coverarea grid
 - (area without crown fire prob = 1, area with crown fire prob = 2)
4. Select areas with crown fire and >= 50% canopy cover (area with crown fire prob grid)
 - CON (crownfire30 >= 0 & canopy50 >= 105 & coverarea == 2, 1 , 0)
 - Save as cfc50 grid
5. Select areas with PPDF and >= 50% canopy cover in (area without crown fire prob grid)
 - Save as ppdfc50 grid
6. Select areas with whitebark pine and crown fire
 - Use wbpfht grid (29.992 m cell size) value = 100
 - Originally from mtwhitebark grid (1000 m cell size)
 - CON (crownfire30 >= 0, wbpfht, 0)
 - Reclass values to 1
 - Save as wbpcf grid

7. create final grid
 - merge (wbpcf, cfc50, ppdfc50)
 - save as firehhp grid
8. Run Zonal Statistics
 - Calculate percent of firehhp pixels in each watershed
 - $((\text{firehhp_tbl.COUNT} / \text{SAWG_units_RW.GRIDSUM}) * 100)$

METADATA FROM OTHER SOURCES (Upload files and paste document file names here)

GENERAL NOTES

Historic fires near urban areas

SUMMARY (Short overview of the data layer)

Fires within five miles of the urban buffer for selected cities and towns, measured from the center of the incorporated towns and places in Montana. All fire perimeters from USFS, state and federal sources between 1985 to 2009 were merged for this analysis.

SAWG DOCUMENTATION (Put metadata on processing here)

Each fire will be turned into a raster grid with a value of 1 and these will be summed to account for overlapping fire boundaries.

112508_Fire_Hist_1988_2008.shp

r1_1985to2005.shp

Fires_2009

1. Repair geometry on the three fire perimeter shapefiles (see above)
2. Merge fire perimeter shapefiles
 - Data Management Tools > General > Merge
 - Input: three fire perimeter shapefiles
 - Output: Fires_Merge.shp
3. Value Field
 - Add Value field (short int) to Fires_Merge.shp attribute table
 - Value = 1
 - Clip Fires_Merge.shp to Montana state boundary
4. Convert Fires_Merge_Clip.shp to Raster
 - Conversion Tools > To Raster > Polygon to Raster
 - Input Features: Fires_Merge_Clip.shp
 - Value field: Value
 - Output Raster Dataset: fires88_09
 - Cell assignment type: CELL_CENTER
 - Priority field: NONE
 - Cellsize: 30
5. Clip to urban buffer
 - Clip fires88_09 to ct106_buffer5.shp (urban area five mile buffer)
6. Zonal Statistics:
 - Spatial Analyst Tools > Zonal > Zonal Statistics
 - Input raster or feature zone data: SAWG_units_rw

- Zone field: Huc_10
- Input value raster: firehist
- Output: firehist_tbl.dbf
- Statistics type: MEAN
- Ignore NoData

7. Populate FIREHIST Field:

- (firehist_tbl.COUNT/SAWG_units_rw.GRIDSUM)*100

METADATA FROM OTHER SOURCES (Upload files and paste document file names here)

GENERAL NOTES

Look at the large fires within proximity to urban areas and compare to canopy cover in exurban areas. Given the discussion, if we use this layer we will likely rate the large fires near urban areas as a positive value in reducing future air quality issues.

Hunter and angler valued areas

SUMMARY (Short overview of the data layer)

Hunter and angler valued areas developed by Bill Geer, Theodore Roosevelt Conservation Partnership. The map includes count of number of hunter and angler groups interested in specific areas of Montana identified by the hunter and angler groups.

SAWG DOCUMENTATION (Put metadata on processing here)

1. Use Interest_g grid from TRCP
 - 1609 meter cell size (1 square mile cell)
 - Save as huntfish grid
2. Calculate Statistics for HUCs
 - Spatial Analyst: Zonal Statistics
 - Zone dataset: SAWG_Units.shp
 - Zone field: HUC_10
 - Value raster: huntfish
 - Ignore No Data in calculations
 - Join output table to zone layer
 - Output table: huntfish_tbl.dbf
3. Calculate Zonal mean per HUC
 - Join huntfish_tbl.dbf to sawg_units.shp
 - Calculate NULL values = 0 (i.e. no groups within HUC)
 - Add field: HUNTFISH (Double)
 - Calculate HUNTFISH = (huntfish_tbl.MEAN)

METADATA FROM OTHER SOURCES (Upload files and paste document file names here)

GENERAL NOTES

Areas of interest identified by hunter and angler groups throughout Montana by Bill Geer of the Theodore Roosevelt Conservation Partnership

Impervious surfaces

SUMMARY (Short overview of the data layer)

Percent of watershed based on count of area of impervious surfaces. This data was derived from a national US Geological Survey data set using Landsat satellite imagery with a 30 meter resolution, meaning the smallest feature visible would be the size of a softball diamond. This map is intended to be used in urban forest management layers, and should be used with caution. Most tree crowns are smaller than a softball diamond since and when viewed from a satellite measuring a portion of the visible light spectrum, there is often a mixed value where trees overlap concrete or asphalt. The end result has mixed accuracy in urban areas.

SAWG DOCUMENTATION (Put metadata on processing here)

impervious3_092606.img

impervious4_091406.img

impervious6_091406.img

1. Reclassify

- Reclassify each of the three impervious layers (change data value 127 to NoData)

2. Merge, Clip, Project

- Merge three impervious layers with Raster Calculator
- `merge(impervious3_092606, impervious4_091406, impervious6_091406)`
- Save merged raster layers as IMPERVIOUS
- Clip merged impervious layer to Montana state boundary
- Project raster to NAD 83 State Plane Montana

3. Zonal Statistics

- Spatial Analyst Tools > Zonal > Zonal Statistics
- Input raster or feature zone data: SAWG_units_KB
- Zone field: Huc_10
- Input value raster: impervious
- Output: impervious_tbl.dbf
- Statistics type: MEAN
- Join output table to zone layer
- Ignore NoData

4. Populate IMPERVIOUS Field

- `<NULL> = 0`
- `(impervious_tbl.COUNT/SAWG_units_dr.GRIDSUM)*100`
- Remove table join

METADATA FROM OTHER SOURCES (Upload files and paste document file names here)

GENERAL NOTES

MRLC? Impervious surface and canopy cover

Is the rating on this going the right way?

Focus In urban areas. air quality and energy conservation are the key focuses of this objective. Canopy cover and impervious is the focus in and around urban areas.

Decision to separate urban and rural areas for this but we need more examination of data and discussion to determine how to do this.

Impractical forest operations SAP undevelopable areas

SUMMARY (Short overview of the data layer)

Areas impractical for forest operations. These are defined as areas greater than 40% slope on all lands combined with the roadless, wilderness and protected areas layer, where traditional forest management actions are either not allowed by law, or are likely not going to be an option in the next year or two.

SAWG DOCUMENTATION (Put metadata on processing here)

1. Calculate slope (from mtdem grid) and reclass
 - Slope $\geq 40\%$ = 1
 - Slope $< 40\%$ = 0
 - savev as reclass_slope grid
2. Merge roadless grid (MTProtected_Roadless.shp)and reclass_slope grid
3. Select forested
 - CON (forest_nonfor \neq 1, Calculation, 0)
 - Save as UNDEVELOP grid
4. Calculate Zonal Statistics for HUCs
 - Spatial Analyst: Zonal Statistics
 - Zone dataset: SAWG_Units.shp
 - Zone field: HUC_10
 - Value raster: UNDEVELOP
 - Ignore No Data in calculations
 - Join output table to zone layer
 - Output table: UNDEVELOP_tbl.dbf
5. Calculate percent of HUC with UNDEVELOP
 - Join UNDEVELOP_tbl.dbf to sawg_units.shp
 - Calculate NULL values = 0 (i.e. no UNDEVELOP within HUC)
 - Add field: UNDEVELOP (Short-4)
 - Use sum (count of pixels that are > 0)
 - Calculate UNDEVELOP = ((undevelop_tbl.SUM / SAWG_units_RW.GRIDSUM) *100)

METADATA FROM OTHER SOURCES (Upload files and paste document file names here)

[National Elevation Dataset for Montana.htm](#)

GENERAL NOTES

Slopes $> 40\%$

Open water

Wilderness

National Parks

National Wildlife Refuges

Roadless areas

Insect & disease for all species except Bark Beetles

SUMMARY (Short overview of the data layer)

Continuous value of acres of all insect and disease species other than Bark Beetles using composite of all data 2000-2009. The data was based on The Forest Health Protection (FHP) Aviation Program in Region One annual insect and disease detection surveys, primarily using fixed-wing aircraft.

SAWG DOCUMENTATION (Put metadata on processing here)

from RIEBE InsectAndDiseaseDataDevelopmentNotes.doc

- 1.. Data was initially downloaded from the USFS website as a geodatabase. Metadata was included with this dataset.
- 2.. Data was copied into the project folder as a shapefile, stripping out all data attributes except the Bug1 attribute.
- 3.. Data was clipped to the Montana state border.
- 4.. Other fields were added
 - 1.. PestNum (N)
 - 2.. Comb1 (C20)
 - 3.. Class (N)
- 5.. Coding for the pests in table below (not all fields have data records represented in the database, this is a list of possibilities only).

PestNum	PNAME	Comb1
1	Douglas-fir Beetle	Bark beetle
2	Spruce Beetle	Bark beetle
3	Pine Engraver Beetle (PP)	Bark beetle
4	Mountain Pine Beetle (WP)	Bark beetle
5	Mountain Pine Beetle (PP)	Bark beetle
6	Mountain Pine Beetle (LPP)	Bark beetle
7	Mountain Pine Beetle (WBP)	Bark beetle
8	Western Pine Beetle	Bark beetle
9	Fir Engraver Beetle	Bark beetle
10	Douglas-fir Engraver Beetle	Bark beetle
11	Subalpine fir mortality	Other biotic cause
12	Unidentified Bark Beetle	Bark beetle
13	Pine Engraver Beetle (LPP)	Bark beetle
14	Mountain Pine Beetle (LIM)	Bark beetle
15	Mountain Pine Beetle (Hi Elev 5-needle Pines)	Bark beetle
17	Balsam Woolly Adelgid	Other biotic cause
18	Needle miner	Other biotic cause
19	Terminal weevil	Other biotic cause
20	Spruce Budworm	Other biotic cause
21	Larch Casebearer	Other biotic cause
22	Douglas-fir Tussock Moth	Other biotic cause

23	Pine Butterfly	Other biotic cause
24	Black-headed Budworm	Other biotic cause
25	Larch Bud Moth	Other biotic cause
26	Pine Looper	Other biotic cause
27	Pine Tortrix	Other biotic cause
28	Forest Tent Caterpillar	Other biotic cause
29	Leaf Beetle	Other biotic cause
30	Larch Sawfly	Other biotic cause
31	Western Hemlock Looper	Other biotic cause
32	Larch Looper	Other biotic cause
33	False Hemlock Looper	Other biotic cause
34	Pine Needle-sheath Miner	Other biotic cause
35	Pine Sawfly	Other biotic cause
36	Pine Tussock Moth	Other biotic cause
37	Cankerworm	Other biotic cause
38	Variable Oak Leaf Caterpillar	Other biotic cause
39	Unknown Defoliator	Other biotic cause
40	Phellinus weirii	Other biotic cause
41	Heterobasidion annosum	Other biotic cause
42	Armillaria ostoyae	Other biotic cause
43	Phaeolus schweinitzii	Other biotic cause
44	Phomopsis	Other biotic cause
45	Cytospora	Other biotic cause
46	Western Gall Rust	Other biotic cause
47	Comandra Rust	Other biotic cause
48	Stalactiform Rust	Other biotic cause
49	Atropellis	Other biotic cause
50	White Pine Blister Rust	Other biotic cause
51	Dwarf Mistletoe	Other biotic cause
52	Elytroderma	Other biotic cause
53	Aspen defoliation	Blank
54	Fluoride Damage	Blank
55	Chemical Damage	Blank
56	Lohodermium pinastri	Other biotic cause
57	Rhabdocline pseudotsugae	Other biotic cause
58	Lophodermella arcuata	Other biotic cause
59	Lecanostica aciocola	Other biotic cause
60	Lophodermella needle cast in pines	Other biotic cause
61	Dothistroma pini	Other biotic cause
62	Larch Needle Disease	Other biotic cause
63	Root/butt diseases	Other biotic cause
64	Unknown	Blank

65	Discoloration	Blank
66	Frost	Blank
67	Winter injury	Blank
68	Diplodia canker	Other biotic cause
69	Larch Needle cast	Other biotic cause
70	Fire	Blank
71	Animal Damage	Blank
72	Other abiotic damage (known)	Blank
73	Flooding-high water	Blank
74	Lodgepole Needleminer	Other biotic cause
75	Decline	Blank
76	Drought	Blank
77	Avalanche	Blank
78	Stem Breakage (Ice)	Blank
79	Dieback	Blank
80	Hail	Blank
81	Volcano	Blank
82	Root/Butt Diseases	Other biotic cause
83	Stem Decays	Other biotic cause
84	Unknown foliage/shoot disease	Other biotic cause
85	Stem Rust	Blank
98	Out	Blank
99	Unknown	Blank

Additional analysis done by Geodata:

Data was received at last minute for 2009 with major expansion of insect and disease in 2009. The 2009 layers were added to the 2000-2008 layers completed by Donna and merged into a final grid with the procedures below:

- 1.. New fields were populated.
 - 1.. PestNum was populated with the Bug1 code converted to a numeric code.
 - 2.. Comb1 was populated with either "Bark beetle" or "Other biotic cause". Those records with abiotic causes were left blank.
 - 3.. All records with a comb1 value of "Bark beetle" was given a Class value of 2, all those with a value of "Other Biotic Causes" was given a 3. Those indicated by Blank in the table were left blank in the database
- 2.. Data has overlapping polygons, so will be converted into Grid using the Class value. This may result in some pixels being present in both Bark Beetle and Biotic Causes datasets.
 - 1.. Insdismpb – surface grid with bark beetle only
 - 2.. Insdisalls – surface grid with insect and disease excluding bark beetles.
- 3.. Grid created and updated to share drive.

METADATA FROM OTHER SOURCES (Upload files and paste document file names here)

<http://www.fs.fed.us/r1-r4/spf/fhp/aerial/index.html>

GENERAL NOTES

Aggregate to Huc 5th. Examine data before deciding aggregation method majority value vs presence in any 6th code HUC. Look at new Landfire Program (2011). Deal with Bark Beetle as separate layer

Insect & disease for existing Bark Beetles

SUMMARY (Short overview of the data layer)

Continuous value of acres of all insect and disease species (Bark Beetles) using composite of all data 2000-2009. The data was based on The Forest Health Protection (FHP) Aviation Program in Region One annual insect and disease detection surveys, primarily using fixed-wing aircraft.

SAWG DOCUMENTATION (Put metadata on processing here)

from RIEBE InsectAndDiseaseDataDevelopmentNotes.doc

- 1.. Data was initially downloaded from the USFS website as a geodatabase. Metadata was included with this dataset.
- 2.. Data was copied into the project folder as a shapefile, stripping out all data attributes except the Bug1 attribute.
- 3.. Data was clipped to the Montana state border.
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8	Western Pine Beetle	Bark beetle
9	Fir Engraver Beetle	Bark beetle
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53	Aspen defoliation	Blank
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55	Chemical Damage	Blank
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67	Winter injury	Blank
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70	Fire	Blank
71	Animal Damage	Blank
72	Other abiotic damage (known)	Blank
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77	Avalanche	Blank
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82	Root/Butt Diseases	Other biotic cause
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84	Unknown foliage/shoot disease	Other biotic cause
85	Stem Rust	Blank
98	Out	Blank
99	Unknown	Blank

Additional analysis done by Geodata:

Data was received at last minute for 2009 with major expansion of insect and disease in 2009. The 2009 layers were added to the 2000-2008 layers completed by Donna and merged into a final grid with the procedures below:

- 1.. New fields were populated.
 - 1.. PestNum was populated with the Bug1 code converted to a numeric code.
 - 2.. Comb1 was populated with either "Bark beetle" or "Other biotic cause". Those records with abiotic causes were left blank.
 - 3.. All records with a comb1 value of "Bark beetle" was given a Class value of 2, all those with a value of "Other Biotic Causes" was given a 3. Those indicated by Blank in the table were left blank in the database
- 2.. Data has overlapping polygons, so will be converted into Grid using the Class value. This may result in some pixels being present in both Bark Beetle and Biotic Causes datasets.
 - 1.. Insdismpb – surface grid with bark beetle only
 - 2.. Insdisalls – surface grid with insect and disease excluding bark beetles.
- 3.. Grid created and updated to share drive.

METADATA FROM OTHER SOURCES (Upload files and paste document file names here)

<http://www.fs.fed.us/r1-r4/spf/fhp/aerial/index.html>

GENERAL NOTES

Insect & disease for the probability of Bark Beetle

SUMMARY (Short overview of the data layer)

Probabilities for bark beetle species. This data was based on a model developed by the USFS Region 1. Values were weighted for Douglas Fir, Ponderosa pine and Lodgepole pine beetles and combined with mountain pine beetles. The Western spruce beetles were not included in this analysis. The area covered by this model only included National Forest lands.

SAWG DOCUMENTATION (Put metadata on processing here)

Received polygon file in 5th code HUC format from Erin Nock.

Clipped to watersheds intersecting Montana to file R1_Beetle_hazard_MT.shp

Values from cumulative attribute of 1, 2 or 3 based on pine beetle probabilities for three bark beetle species. Brought the values in their native format. This was subsequently corrected by Barry Bollenbacker at the Jan 1 WebEx. We are ignoring Western Spruce pine beetle, it is a minor issue. We did not catch that there were larger integers for some values of either DF, LPp or PP beetles. No metadata available with file. Used a weighted count of all beetles except wp_mpb, than gave the following cumulative score to the result.

(df + lpp_mpb + pp_mpb)

SUM VALUE	SCORE
1	50
2	60
3	70
4	80
5	90
7	100

Watersheds have different codes and in a few cases different polygons, so converted to a grid INDISBB and ran zonal statistics on SCORE

Joined this to intermediate sawg_unitskw.shp file and calculated INSDISBB value to be MEAN value used it as an input for final model tables for Objectives 3,4,7

METADATA FROM OTHER SOURCES (Upload files and paste document file names here)

GENERAL NOTES

Aggregate to Huc 5th. Examine data before deciding aggregation method majority value vs presence in any 6th code HUC. Look at new Landfire Program (2011). Deal with Bark Beetle as separate layer.

Mapped from FIA data at 5th code HUC but based only on USFS lands within the HUC.

Use USFS R1 map layer

Also Use National layer if available from FHTET site to fill in gaps with USFS.
Compare two products to determine best way to combine.

Mill Capacity

SUMMARY (Short overview of the data layer)

The forest industry infrastructure is composed of processing facilities, mills and other processing collection points. The sources for these are from a data collection process combining the CEORE tool with 16 foresters in regions throughout Montana processed in December, 2009. This data layer was measured as cubic feet per acre of processing capacity per watershed in five classes ranging from very low to very high.

SAWG DOCUMENTATION (Put metadata on processing here)

1. Import CEORE data on forest mill locations

- use CEORE_FI20100113.shp
- Seven points were manually moved from outside the state to the closest place inside the state so that they could be included in the proximity measure.
- save as millcapac.shp

CLASS	DESC	VALUE
1	Very low	20
2	Low	40
3	med	60
4	high	80
5	Very high	100

2. Add HUC code to each mill point

- Summarize and calculate sum of VALUE
- Millcapac (mill capacity) = add class value of all mills in each huc

METADATA FROM OTHER SOURCES (Upload files and paste document file names here)

[BBER MMIS Wood Products List](#)

GENERAL NOTES

ESRI BA list from Geodata to Dan - Dan contact Todd Morgan-Montana Wood Products - also check with Montana Logging Association - list or count of loggers by geographic area

Existing or planned mills and other forestry infrastructure. Bureau of Business and Economic research (BBER) has some of this information in house Also DNRC possibly does? Need to research BBER data and accessibility.

Decision in 12/16/2009 WebEx discussion to not measure loggers or logging equipment operators - too much in flux now, and the loggers are working all over the region to try and stay in business. Counting them using their address is not meaningful.

Noxious weeds

SUMMARY (Short overview of the data layer)

Category 1 noxious weeds were mapped at the county level. This data is the best available resolution of weed mapping available in Montana at a statewide scale. The Category 1 weed species in Montana included Canada thistle, field bindweed, whitetop or hoary cress, leafy spurge, Russian knapweed, spotted knapweed, diffuse knapweed, dalmatian toadflax, St. Johnswort, sulfur (Erect) cinquefoil, common tansy, ox-eye daisy, hounds tongue, yellow toadflax, hoary alyssum. Each species mapped by present/not present in county. Assign attribute value of 1 for presence of noxious weed in each county. Subsequently we summed all noxious weed fields in each county. The steering committee recommends ranking this attribute lower than others based on the coarseness of the geographic scale mapped to the county level. Care should also be exercised in comparing this data to data mapped at a finer scale.

SAWG DOCUMENTATION (Put metadata on processing here)

Category 1 weed species in Montana

- Canada thistle
- Field bindweed
- Whitetop or hoary cress
- Leafy spurge
- Russian Knapweed
- Spotted knapweed
- Diffuse knapweed
- Dalmatian toadflax
- St. Johnswort
- Sulfur (Erect) cinquefoil
- Common tansy
- Ox-eye daisy
- Houndstongue
- Yellow toadflax
- Hoary alyssum

Each species mapped by present/not present in county

1. Create Noxious Weed Shapefile

- Download Counties, Montana Cadastral Geodatabase data layer from NRIS
- Rename shapefile to Noxious_Weeds.shp
- Add attribute field (short int) for each of the Category 1 noxious weeds (listed above)
- Assign attribute value of 1 for presence of noxious weed in each county
- Add Value attribute field (short int)
- Sum all noxious weed fields in Value field

2. Convert to Raster

- Conversion Tools > To Raster > Polygon to Raster
- Input Features: Noxious_Weeds.shp
- Value field: Value
- Output Raster Dataset: noxweeds
- Cell assignment type: CELL_CENTER
- Priority field: NONE

- Cellsize: 30

3. Zonal Statistics

- Spatial Analyst Tools > Zonal > Zonal Statistics
- Input raster or feature zone data: SAWG_units_dr
- Zone field: Huc_10
- Input value raster: noxweeds
- Output: noxweeds_tbl.dbf
- Statistics type: MEAN
- Join output table to zone layer
- Ignore NoData

4. Populate NOXWEEDS Field

- $(\text{noxweeds_tbl.COUNT}/\text{SAWG_units_dr.GRIDSUM}) * 100$
- Remove table join

METADATA FROM OTHER SOURCES (Upload files and paste document file names here)

[2008weedPlan.pdf](#)

GENERAL NOTES

Presence/Absence of noxious weeds (or by species type?) - assume ordinal scale, but need to define for experts to consistently rank

Category 1 weeds - count by county for weed presence

Overnight public recreation areas

SUMMARY (Short overview of the data layer)

Overnight public recreation sites, including campgrounds, campsites, and state parks with camping.

SAWG DOCUMENTATION (Put metadata on processing here)

1. Select overnight use points from dispfreq.shp
 - Includes campgrounds, campsites, state parks with camping.
 - Save as overnrec.shp
2. Spatial join to HUC layer
3. Summarize on HUC for count of points
4. Join to Sawg_units_rw.shp
5. Calculate OVERNREC attribute

METADATA FROM OTHER SOURCES (Upload files and paste document file names here)

GENERAL NOTES

Explore USFS data - if there is capacity by site we could use that instead of count of points.

The layers below that identify campgrounds will be included in this layer*

[Developed recreation point layer \(USFS\)](#)

- [State parks](#)
- BLM Developed Recreation

- NPS & National Monuments Developed Recreation
- USFWS Developed Recreation

USFS R1 Campgrounds and Recreation Areas

Temporary population - USFS has a layer for USFS areas, possibly use state parks for state representation? Too expensive to gather all the recreation sites data - mostly manual process for trailheads, etc.?

Montana State Parks

Preservation, Wilderness, research/designated land use and roadless areas

SUMMARY (Short overview of the data layer)

This layer is built from a dataset that contained all the lands in Montana that are managed by public agencies, private lands that are within government designated areas such as national forests, and private lands that are under conservation easements and conservation leases. Land ownership is not shown. Each managed area is identified by its name and has contact information for the agency associated with its management. Those areas not specifically considered 'protected' from forestry activities have been removed. This layer was part of the Montana Stewardship Database.

SAWG DOCUMENTATION (Put metadata on processing here)

The Stewardship Database included land ownership, easement, and lease status information as separate layers, available at:

http://nris.mt.gov/nsdi/nris/stew_owners.html

http://nris.mt.gov/nsdi/nris/stew_easements.html

http://nris.mt.gov/nsdi/nris/stew_leases.html

Riebe:

The parks and easement designations were cut out of this dataset as they appear as their own separate layers.

1. Create grid

- Use protected grid (from MontanaProtectedAreas.shp) and roadless grid (from MTProtectedRoadless.shp)
- Merge (protected, roadless)
- Save as PROTAREA

2. Calculate Zonal Statistics for HUCs

- Spatial Analyst: Zonal Statistics
- Zone dataset: SAWG_Units.shp
- Zone field: HUC_10
- Value raster: protarea
- Ignore No Data in calculations
- Join output table to zone layer
- Output table: protarea_tbl.dbf

3. Calculate percent of HUC with DNRC HCPs

- Join PROTAREA_tbl.dbf to sawg_units_rw.shp
- Calculate NULL values = 0 (i.e. no PROTAREA within HUC)
- Add field: PROTAREA (Short-4)

- Calculate PROTAREA = ((protarea_tbl.COUNT / SAWG_units_RW.GRIDSUM) * 100)

METADATA FROM OTHER SOURCES (Upload files and paste document file names here)

[MontanaProtectedAreas.xml](#)

GENERAL NOTES

RIEBE: This layer was developed from the information in the Stewardship layer. The database has been trimmed up to make it more manageable.

Priority watersheds

SUMMARY (Short overview of the data layer)

Derived from the "Water Quality Integrated Report For Montana 2004" and lists the 6th code watersheds that intersect with TMDL 303(d) impaired or threatened waters.

SAWG PROCESSING DISCUSSION

The SAP layer is based on 2004 report - appears to still be the latest complete data set. Final processing was done at the 6th code HUC level. Recommend we use % of 5th code HUC as the relevant measurement.

We still have the original stream segments and lakes that these were created from, so we could also do length of segment inside 5th code watersheds, but that would be some work to split the streams on 5th code boundaries.

SAWG DOCUMENTATION (Put metadata on processing here)

1. Use Priority watersheds from SAP
 - priorityh2o6 grid
2. Calculate Zonal Statistics for HUCs
 - Spatial Analyst: Zonal Statistics
 - Zone dataset: SAWG_Units.shp
 - Zone field: HUC_10
 - Value raster: priorityh2o6
 - Ignore No Data in calculations
 - Join output table to zone layer
 - Output table: priorityh2o6_tbl.dbf
3. Calculate percent of HUC with priority 6th code HUC
 - Join priorityh2o6_tbl.dbf to sawg_units.shp
 - Calculate NULL values = 0 (i.e. no priority 6th code HUC within HUC)
 - Add field: PRIWSHEDS (Short-4)
 - Calculate PRIWSHEDS = ((priorityh2o6_tbl.SUM / SAWG_units_RW.GRIDSUM) * 100)

METADATA FROM OTHER SOURCES (Upload files and paste document file names here)

GENERAL NOTES

2006 DEQ report?

SAP Priority watersheds

Layer name: HUC6th.shp (reprojected from huc12 polygon coverage)

Data type: polygon

Location: \DNRC_SAP\BaseData\Hydro\

Metadata: View with ArcCatalog

*6th-code hydrologic subbasins

*TMDL 303(d) impaired or threatened waters

Layer name: tmdlstr2004.shp (streams) & wb04cat.shp (lakes)

Data type: line and polygon

Location: \DNRC_SAP\BaseData\Hydro\305b\

Metadata: none, however the "Water Quality Integrated Report For Montana 2004"

(2004_Overview.pdf) is available and it has information about the category ratings.

1. Select records from tmdlstr2004.shp and wb04cat.shp with SEGCOD values of 4 or 5. Use spatial select to select all 6th code HUC polygons that intersect any streams or lakes with a category 4 or 5 impaired waters classification.

2. Convert the 6th code HUC polygon layer to a grid with the polygons containing TMDL category 4 or 5 impaired waters coded to 1 and unimpaired areas coded 0.

Based on SAP process with 2004 DEQ report of 303(D) projects- will be comparing to 2006 report and if significantly different consider upgrade otherwise use SAP. Dan didn't think the difference was likely to be significant.

Private Overnight Recreation areas

SUMMARY (Short overview of the data layer)

Private (commercial) overnight recreation areas, including Standard Industrial Classification Code (SIC) 7032 Sporting and recreational camps and SIC 7033 Recreational vehicle parks and campsites.

SAWG DOCUMENTATION (Put metadata on processing here)

1. Create privrec.shp from ESRI Business Analyst On-line data
 - 7032 Sporting and recreational camps
 - 7033 Recreational vehicle parks and campsites
2. Spatial join to HUC layer
3. Summarize on HUC for count of points: privrec_tbl.dbf
4. Join to Sawg_units_rw.shp
5. Calculate PRIVEREC attribute

METADATA FROM OTHER SOURCES (Upload files and paste document file names here)

GENERAL NOTES

If available:

- Church camps
- Boy and Girl Scout Camps
- Others?

Public land ownership

SUMMARY (Short overview of the data layer)

Montana public land ownership status. The layer contains most public land parcels that are at least 40 acres in size. In addition to public lands, it shows areas owned by the Plum Creek Timber Company, areas owned by some private land trusts, and the status of surface waters which were shown as polygons on USGS 1:100,000 scale maps. Private lands and corrected positioning of Montana Trust Lands were added as a processing step. This layer is part of the Montana Stewardship Database. The Stewardship Database also includes land management and easement lease status information as separate layers, available at the Montana State Library Natural Resource Information System.

SAWG DOCUMENTATION (Put metadata on processing here)

1. Use MontanaOwnershipClasses.shp (from DNRC)

Add VALUE per list

(0) Wilderness, roadless, national park service, local govt, city govt, local govt

(10) USFWS

(20) OTHER federal

(25) USFS

(40) Montana FWP

(50) HCP - Habitat Conservation Plans

(53) BLM

(54) BIA and Tribal

(55) Montana Legacy Lands

(59) Private Non - industrial (private, other, and land trusts)

(60) Montana State Trust Lands, Corrections, DNRC Water Projects, Transportation, University System, State of Montana

(70) Industrial (Plum Creek)

2. Use DNRC_HCPareas.shp

Calculate VALUE = 50

Convert to dnrchcp grid

3. Use LegacyLandsFinal.shp

Calculate VALUE = 55

Convert to legacy grid

4. Use MontanaProtectedAreas.shp

Calculate VALUE = 1

Convert to protected grid

5. Use MTProtected_Roadless.shp

Calculate VALUE = 1

Convert to roadless grid

6. Merge (hcp, legacy, roadless, protected, mtforown)

Reclass value = 1 to value = 0

7. Select forested (from F/NF)

CON (forest_nonfor <>1, publicland, 0)

Save as publandf grid

8. Calculate Zonal Mean PUBLANDF (Floating value)

METADATA FROM OTHER SOURCES (Upload files and paste document file names here)

[MontanaOwnershipClasses.htm](#)

http://nris.mt.gov/nsdi/nris/stew_management.html

http://nris.mt.gov/nsdi/nris/stew_easements.html

GENERAL NOTES:

Major areas of public lands. Which source to use for this is to be determined. Two statewide layers of authority are being maintained. One by the ITSD and one by Montana Heritage. The Heritage Montana heritage version was based on BLM service land status maps and the Montana Department of Administration ITSD version had been adapted to match the Montana cadastral. An MOU is in progress to coordinate on the mapping. Further discussions with Karen Walker at Montana Heritage are needed to determine which layer to use for public land ownership.

Multi ownership opportunities - checkerboard multi and fed up high - Higher score - do we take this into account?

Donna has corrected DNRC state lands

<http://giscoordination.mt.gov/data.asp>

<http://giscoordination.mt.gov/cadastral/PublicLands121608.xml>

Public Lands(from Information Technology Service Division (ITSD), Montana Department of Administration Stewardship geodatabase)

Source

Layer name: *Publiclands*

Data type: polygon – geodatabase feature class

Location: \DNRC_SAP\BaseData\Stewardship_PublicLands\Stewardship.mdb\ParcelFeatures

a) public lands & Plum Cr. timber industry lands

ALternate source - USGS Western States Ownership - prepared for Sage Grouse mapping effort by multi-agency project: <http://sagemap.wr.usgs.gov/SearchData.aspx>

See [Land Ownership of Public and Conservation Lands](#) for details on MHP/NRIS version of public lands.

Override the public land ownership with this layer:

[Montana Forest Legacy areas](#)

RIEBE: Datalayer development notes [PublicLandOwnership.xml](#)

NRIS Stewardship data union with polygon of montana boundary based on county polygons. Null polygons were assigned Private ownership class.

Union of current stewardship dataset (1:100,00) with public and private land ownership classes with current Trust Land ownership tracts (1:24,000). Any resulting slivers of Stewardship level Trust Land polygons were assigned to the Other class.

All ownership classes were left in the polygon level to allow custom aggregation. Ownername and classnumb are unique.

Public lands and conservation easements

SUMMARY (Short overview of the data layer)

Forested areas on public lands and forested areas on conservation easements on public or private lands.

The conservation easements were obtained from the cadastral layer without modification. These were

intersected with all forested areas from the Dept. of Revenue Forest Productivity forest/non-forest delineation completed in 2010.

SAWG DOCUMENTATION (Put metadata on processing here)

Riebe:

Conservation easements are from the cadastral layer without modification

See Field: EaseHoldNm

Assign Public/Private?

1. Use Current easements.shp for all conservation easements

Convert to raster with VALUE = 1

Save as Easements grid

2. Use MontanaOwnershipClasses.shp for public lands

RECLASS PUBLIC LANDS= 1

(0) Wilderness, roadless, national parks, local govt

(10) USFWS

(20) OTHER federal

(25) USFS

(40) MDFWP

(50) HCP - Habitat Conservation Plans

(53) BLM

(55) Montana Legacy Lands

(60) State trust

(60) Montana correctional

(60) Montana Univ

RECLASS PUBLIC LANDS=0

(54) BIA and Tribal

(59) Private Non - industrial (private, other, and land trusts)

(70) Industrial (Plum Creek)

3. Merge reclassified publicland grid with easements grid

4. Select forested

CON (forest_nonfor <>1, publicland, 0)

5. Save as publandce grid

6. Run zonal stats

Use sum (count of pixels that are > 0)

PUBLANDCE = (publandce_tbl.SUM / SAWG_units_RW.GRIDSUM) *100

METADATA FROM OTHER SOURCES (Upload files and paste document file names here)

20080918 version

GENERAL NOTES

WebEx decision to not score public ownership separately by category but lump them all together and add easements, then cookie cut out the forested lands for final acreage counts.

This layer was originally developed by the Montana Natural Heritage Program (MTNHP) as part of its Montana Stewardship layer. The MTNHP easement layer was integrated with the Montana Cadastral Layer by the Montana Base Map Service Center, which maintains the most current version of the layer.

Please see <http://giscoordination.mt.gov> for more information on the Cadastral Layer.

Positive or negative? depends on the context. Determining whether forest provisions are explicit may be too costly to gather?

RIEBE: This conservation easement dataset is from the Montana Stewardship data.

CurrentEasements.xml

Field: EaseHoldNm

Public Water Supply

SUMMARY (Short overview of the data layer)

Purpose is to identify and locate public water system sources (wells, springs, and surface water intakes) and provide access to Source Water Delineation and Assessment Reports (SWDARs). This database provides information on Public Water Systems (PWS) and facilitates access to Source Water Protection Program reports that are referred to as Source Water Delineation and Assessment Reports (SWDARs). A public water system is a system that serves 25 or more people or has 15 or more service connections and operates at least 60 days per year. The Department of Environmental Quality (DEQ) regulates all types of PWSs in Montana with the exception of those owned and operated by the Native American nations. There are currently over 2,000 PWSs in Montana and between 75 and 100 are added each year.

SAWG PROCESSING DISCUSSION

This is a point layer. We could use a simple count of PWS points or could weight the count by the number of persons served year round, or served on a temporary basis by a public water system. Discussion here to weight by population served (discuss inconsistencies with water quality measurements).

SAWG DOCUMENTATION (Put metadata on processing here)

pws.shp

1. Query Public Water Supply for Surface Water

- SELECT * FROM pws WHERE: "SOURCETYPE" = 'Surface Water'
- Export selected features to surface_water.shp

2. Spatial Join

- Analysis Tools > Overlay > Spatial Join
- Target Features: surface_water.shp
- Join Features: SAWG_UnitsKB.shp
- Output: surface_water_spatialjoin.shp
- Join Operation: JOIN_ONE_TO_ONE
- Match Option: INTERSECTS

3. Summarize

- Summarize RESPOPUL attribute field from surface_water_spatialjoin.shp
- Join Sum_Output.dbf with SAWG_UnitsKB.shp

4. Calculate the percent of persons served by public water supply per Huc

- Calculate <NULL> = 0
- Calculate PUBWATER = (Sum_Output.Sum_RESPOP/86986)*100

***Note: 86986 used in the above calculation was the maximum from the RESPOP field and was used to weight the count by the number of persons served year round

METADATA FROM OTHER SOURCES (Upload files and paste document file names here)

[pws.html](#)

GENERAL NOTES

Check in SAP data collection - Possibly for some watersheds Add below ground water source uptakes
SAP Public Water Supply

Layer name: pws

Data type: raster

Location: \DNRC_SAP\InputGrids\

Public Water Supply Data Restrictions:

Release of this layer to the general public directly or through other agencies or entities is not authorized by DEQ.

Please refer to MetaSWP_PWS.doc for the full text on data restrictions.

We will use a count of PWS points

Will be using surface public water supply only.

Count the lowest for any watershed as half of maximum (50) and then assign 1 to all watersheds without a public water supply. WebEx reviewers requested a much lower weighting for these.

Public Water Sources Locations

Layer name: SW_PWSs.shp

Data type: point

Description: Spring, well, or surface water intake locations of public water supply systems, know as the Source Water Protection Database maintained by the Source Water Protection Program of the Montana DEQ.

Location: \DNRC_SAP\BaseData\PWSS\

Metadata: MetaSWP_PWS.doc

Recreation and trail networks

SUMMARY (Short overview of the data layer)

National Forest System Trails for the National Forests. Trails were not edge matched. The trails include several types, but for this project all trails were lumped into one category and measured by linear miles of trail per watershed.

SAWG DOCUMENTATION (Put metadata on processing here)

Riebe:

Exported out trails from the composite roads and trails geodatabase for Region One of the US Forest Service.

Data was then clipped to within the state boundary.

MT_TravelRoutes_Trails.shp (from Riebe)

3214 records

372 have no TRAIL_TYPE

74 SNOW TRAIL

2767STANDARD/TERRA TRAIL

1 WATER TRAIL

Miles of Trail per HUC

1. Polyline to Raster

- Input Features: MT_TravelRoutes_Trails.shp
- Value Field: Value (=1)
- Output Raster dataset: rectrails
- Cell Assignment Type: Maximum Length
- Priority Field: NONE
- Cellsize: 30 meters

2. Calculate Statistics for HUCs

- Spatial Analyst: Zonal Statistics
- Zone dataset: SAWG_Units.shp
- Zone field: HUC_10
- Value raster: rectrails
- Ignore No Data in calculations
- Join output table to zone layer
- Output table: rectrails_tbl.dbf

3. Calculate Miles of trail per HUC

- Join rectrails_tbl.dbf to sawg_units.shp
- Calculate NULL values = 0 (i.e. no trail within HUC)
- Add field: RECTRAILS (Short-4)
- Calculate RECTRAILS = ((rectrails_tbl.COUNT*30 meters) /1609 meters per mile)
- Contains zero values

METADATA FROM OTHER SOURCES (Upload files and paste document file names here)

[TravelRoutes R1.xml](#)

FIELDS:

TRAIL_

TRAIL_ID

RTE_NO

POS_BREAK

MEAS_BREAK

RTE_CN

BMP

EMP

ACTION_

ACTIONSTAM (ACTIONSTAMP)

OBJECTID_1

RTE_CN_1

ID

NAME

TRAIL_TYPE

BEGIN_TERM (BEGIN_TERMINI)

END_TERMIN (END_TERMINI)

BMP_1

EMP_1

ACCESSIBIL (ACCESSIBILITY STATUS)

ADMIN_ORG

CONGRESSIO (CONGRESSIONAL_DISTRICT)
COUNTY
DESIGNED_U (DESIGNED_USE)
HISTORIC_S (HISTORIC_SIGNIFIFANCE)
JURISDICTI (JURISDICTION)
MANAGING_O (MANAGING_ORG)
TRAIL_CLAS (TRAIL_CLASS)
TRAIL_STAT (TRAIL_STATUS)
TRAIL_SURF (TRAIL_SURFACE)
TRAIL_SYST (TRAIL_SYSTEM)
TYPICAL_SI (TYPICAL_SIDESLOPE)
TYPICAL_SO (TYPICAL_SOIL_TYPE)
TYPICAL_TR (TYPICAL_TRAIL_GRADE)
TYPICAL_1 (TYPICAL_TREAD_WIDTH)
TYPICAL_VE (TYPICAL_VEG_BRUSH)
TYPICAL_2 (TYPICAL_VEG_TIMBER)
SECURITY_I
BMP_OLD
EMP_OLD
TRL_NO
TRL_NO2
ARCLENGTH
MEASURELEN (MEASURELENGTH)
LOWMEASURE
HIGHMEASUR (HIGHMEASURE)
FIRSTSECTI (FIRSTSECTION)
LASTSECTIO (LASTSECTION)
NUMSECTION (NUMSECTIONS)
ACTION_CAL (ACTION_CALIBRATE)
TRLRT
TRLRT_ID
TRLNO
TRLABEL
ARC_MILES
ACTION
ACTIONST_1 (ACTIONSTAM)
TRAIL_NAME
TYPE
SNOW_GRM
NS_TRACKS
RT_ACTION

GENERAL NOTES

Riebe Notes:

Dataset was converted to a shape file of only the trails from the composite roads and trails database from the USFS. Data was clipped to state boundary.

Residential annual growth rate 2009-2014

SUMMARY (Short overview of the data layer)

Residential annual growth rate from ESRI Business Analyst On-line. These growth rate predictions are modeled by ESRI based on census data and more than 15,000 additional data variables such as birth and death records, US Postal code changes and other sources. The predictions are updated semi-annually, and originate at the block group level of census. These were apportioned to watersheds and stored as the percent growth rate for the five year period. In rural objectives higher residential growth rates were generally judged as less favorable for forest management practices. The opposite was true for urban forest applications and air quality objectives.

SAWG DOCUMENTATION (Put metadata on processing here)

- 1.. Started with ESRIAO query and the HHGRWCYFY attribute which was the annual household growth rate for 2009-2014 as a positive or negative floating point number representing the annual growth rate as a percent.
- 2.. Imported data into COmmunityViz and made the ESRIAO a dynamic layer
- 3.. Ran the suitability wizard in CommunityViz with the HHGRWCYFY variable as a higher model score and as a lower model score in order to normalize the positive and negative values into a range of 0-1 as a percentage.
 - 1.. The higher score option was used to populate the ESRIAO09 attribute
 - 2.. The lower score option was used to populate the ESRIAO09R attribute - this was only used for the rural areas, with the rationale that higher growth rates and urban sprawl typically impacts the ability to perform forest management and stewardship.

The CommunityViz model uses the following formula to normalize the scores

Normalized Suitability Measure = ((Raw Suitability Measure) – (Min Raw Suitability Measure)) / ((Max Raw Suitability Measure)- (Min Raw Suitability Measure))

METADATA FROM OTHER SOURCES (Upload files and paste document file names here)

Attribute transferred from SAWG_ESRIAO.shp attribute HHGRWCYFY 2009-2014 annual growth rate estimates by watershed with one decimal place - can be positive or negative

GENERAL NOTES

This is only applicable to the urban areas for the green infrastructure objective, but statewide for the others. Larger population would get a higher score than smaller for urban, for other objectives the score would be opposite

Discuss pulling urban forest scores out of model for first objective so the scores don't negate each other.

Residential annual growth rate 2009-2014 for Urban Objective 1

SUMMARY (Short overview of the data layer)

Residential annual growth rate from ESRI Business Analyst On-line. These growth rate predictions are modeled by ESRI based on census data and more than 15,000 additional data variables such as birth and

death records, US Postal code changes and other sources. The predictions are updated semi-annually, and originate at the block group level of census. These were apportioned to watersheds and stored as the percent growth rate for the five year period. In this instance higher growth rates were judged as favorable for urban forest management.

SAWG DOCUMENTATION (Put metadata on processing here)

Normalized Suitability Measure = ((Raw Suitability Measure) – (Min Raw Suitability Measure)) / ((Max Raw Suitability Measure) - (Min Raw Suitability Measure))

Temporarily 1-((([HHGRWCYFY](#) - 2.1) / (4.6 - 1.2)) * 100 and select those that are completely not forest and make them 0

METADATA FROM OTHER SOURCES (Upload files and paste document file names here)

Attribute transferred from SAWG_ESRIBAO.shp attribute HHGRWCYFY 2009-2014 annual growth rate estimates by watershed with one decimal place - can be positive or negative

GENERAL NOTES

This is only applicable to the urban areas for the green infrastructure objective, but statewide for the others. Larger population would get a higher score than smaller for urban, for other objectives the score would be opposite

Discuss pulling urban forest scores out of model for first objective so the scores don't negate each other.

Roadless Wildfire

SUMMARY (Short overview of the data layer)

Roadless areas were derived from the Clinton administration roadless area administrative rule maps. These are subsets of National Forest and Department of Interior lands that are designated roadless, starting in the RARE II process in the 1980's and continuing to the present. The roadless lands have bounced back and forth in various administrative and judicial status in the last 30 years. Some levels of forest management may have occurred in some roadless areas, and they are not prohibited from timber management by statute like wilderness areas. For this process roadless and wilderness were considered as areas where wildfire is the primary tool for management and mechanical operations are not practical or possible.

SAWG DOCUMENTATION (Put metadata on processing here)

1. Clip roadless areas shapefile to Montana state boundary
 - Resulting shapefile Roadless_MT.shp
2. Merge Roadless_MT.shp and MontanaProtectedAreas.shp
 - resulting shapefile: Protarea.shp
 - add Value attribute field and assign value of 100
3. Convert Protected_Roadless.shp to Raster
 - Conversion Tools > To Raster > Polygon to Raster
 - Input: Protarea.shp
 - Value Field: Value
 - Output: protardless
 - Cell Assignment: CELL_CENTER
 - Priority: NONE

- Cellsize: 30

4. Merge Rasters

- merge (firehist*, protardless, ab41)
- *see metadata for Historic Fires

5. Reclassify

- Input: Calculation from Step 4 above
- Reclass Field: Value

Old Values	New Values
0	0
1	100
100	50

6. Zonal Statistics

- Spatial Analyst Tools > Zonal > Zonal Statistics
- Input raster or feature zone data: SAWG_units_dr
- Zone field: Huc_10
- Input value raster: rdlessfire
- Output: rdlessfire_tbl.dbf
- Statistics type: MEAN
- Join output table to zone layer
- Ignore NoData

7. Calculate mean value of roadless fire per huc

- Calculate <NULL> = 0
- Calculate RDLESSFIRE = rdlessfire_tbl.MEAN
- Remove table join

METADATA FROM OTHER SOURCES (Upload files and paste document file names here)

GENERAL NOTES

This layer is an analysis combination of several unique data layers:

Wilderness areas

[Roadless areas](#)

[LandFire Rapid Assessment Fire Regime Classes](#)

Fire use %

Patch size - Clip LandFire Rapid Assessment within Roadless and other protected lands and run fragmentation index

SAP Forest patches

SUMMARY (Short overview of the data layer)

The DNRC SAP Forest Patches layer was used for this analysis. This layer used the 2001 forest/non-forest inventory in combination with the current state road network. Roads were buffered by type and turned into a raster grid of cells representing developed areas. These were subsequently intersected with the

forest areas and the remaining forest patches larger than 100 acres were identified. Core habitat forest areas of a minimum of 100 acres or greater resulted from the process.

SAWG DOCUMENTATION (Put metadata on processing here)

SAP Metadata

Forest patches

Layer name: forpatches051

Data type: raster

Location: \DNRC_SAP\InputGrids\

Metadata: none

Source Layers:

1) Roads

Layer name: Road

Data type: line

Location:

\DNRC_SAP\BaseData\Transportation\TransportationAddressingFramework_1-6.mdb\TransportationFeatures

Metadata: View in ArcCatalog

2) Forest

Layer name: nlcd_for051

Data type: raster

Location: \DNRC_SAP\BaseData\NLCD\

Note:

Initial specifications called for roads to be buffered by type: 100 feet for interstates, 55 feet for state and federal highways, and 38 feet for all other roads. But, because the analysis layers will be either 30 meter or 90 meter cell grids, it is impossible to use the desired buffers. Buffering the linear roads and then creating grids from the buffer polygons, creates undesired breaks in the road corridor continuity. Also, it is impossible to exactly replicate 38 ft., 55 ft., or 100 ft. buffer polygons with 30 or 90 meter cells. However, creating a road grid, with 30 meter cell size, directly from the vector road features maintains continuity of road corridors and, more or less, approximates a buffer zone along the roads. The grid representation of a linear feature (i.e. roads) resulted in buffer zones ranging from about 0 to over 120 feet on one side of the linear element, but continuity was maintained when using the FOUR option with the regiongroup routine. Using FOUR prevented cells that only have adjacent corners from being assigned to the same group, so it did not connect forest patches on opposite sides of a road.

Road type is specified in the field, System (and also DisplayClass).

System DisplayClass

NHS INTERSTATE 1

NHS NON-INTERSTATE 2

OFF SYSTEM 6

OTHER 8

PRIMARY 3

SECONDARY 4

URBAN 5

USFS 7

Processing:

1. Generate the raster road layer using DisplayClass as the value field.
2. Use the Arc Toolbox Expand tool with the road grid, and set the parameters as follows: Number of cells = 1, and Zone value = 1 (to expand the interstate road sections by one additional cell on either side).
3. Use the expanded road grid as a mask to cut out the forest areas from the NLCD forest layer that fall within the road "buffer" zones. That is, areas that were classified as forest in NLCD that are in a road buffer area are set to non-forest.
4. Use the REGIONGROUP function to assign unique IDs to contiguous groups of grid cells. (Use the FOUR option in the REGIONGROUP function for connectivity because FOUR only connects adjacent cells that have coincident sides, EIGHT will also connect cells with adjacent corners which would connect forest patches on opposite sides of roads.)
5. Reclassify the groups by area. Forest patches equal to or greater than 100 acres are assigned a value of 1, and those less than 100 acres are set equal to 0 (i.e. not shown as forest). In order to use an expression to reclassify the forest patches grid, the Arc Toolbox CON tool must be used.

Parameters:

input condition (input grid): patch_groups

true: 1

false: 0

output grid: forpatches051

Expression: Value <> 0 AND Count >= 450*

- (450 cells of 30 meter cell size is approximately 100 acres.)

NEW PROCESSING STEPS

- 1.. Loaded forpatches051 grid
- 2.. Calculated mean value with Zonal Statistics using SAWG_UnitsKW as zone layer and forpatches051 as the value raster joining output to the table
- 3.. Joined SAWG_unitsKW.shp to the COmmunityViz project R1 Identify and Conserve and calculated the FORPATCH attribute as a count
- 4.. Calculate FORPATCH using $(\text{Forpatch_tbl.SUM} / \text{SAWG_unitsKW.GRIDSUM} * 100)$ to determine percent of HUC that are forest patches

METADATA FROM OTHER SOURCES (Upload files and paste document file names here)

GENERAL NOTES

Species with accelerated effects from climate change: Dry forest types

SUMMARY (Short overview of the data layer)

The data was used to identify Ponderosa Pine and Douglas Fir vegetation types and was derived from the Landfire national products. Other sources were considered, including REGAP NW and National Land Cover database. The Landfire data incorporated FIA data plots and was judged superior for the forest types desired for this project.

SAWG DOCUMENTATION (Put metadata on processing here)

USE Forested areas with higher risk: Ponderosa Pine and Douglas Fir (FHRPPDF)

METADATA FROM OTHER SOURCES (Upload files and paste document file names here)

LANDFIRE Existing Vegetation Type - <http://www.landfire.gov/NationalProductDescriptions21.php> , like MTREGAP is based on [NatureServe's Ecological Systems classification](#) .

Group's preference is to use LandFire version - does anyone have this already clipped and prepared for Montana? If we have to proces it from scratch from the National Map site, we may use NWRegap instead.

GENERAL NOTES

Dry Forest Type - DF PPine

Use USFS MT_Dry/mtdryforest grid and Landfire DFPP where this doesn't exist

Dry Forest Type - DF PPine/Check with Dan and Barry - just these two species from REGAP?

Douglas Fir and Ponderosa Pine. USFS is building sub model for this. Other sources ReGAP & LandFir

Dan - Please delete all species types that are not applicable, and I'll pull the remaining from the REGAP grid

Columbia Basin Foothill Riparian Woodland and Shrubland

Columbia Plateau Steppe and Grassland

Columbia Plateau Vernal Pool

Cultivated Cropland

Developed, High Intensity

Developed, Low Intensity

Developed, Medium Intensity

Developed, Open Space

Geysers and Hot Springs

Great Plains Prairie Pothole

Harvested forest-grass regeneration

Harvested forest-shrub regeneration

Harvested forest-tree regeneration

Inter-Mountain Basins Active and Stabilized Dune

Inter-Mountain Basins Aspen-Mixed Conifer Forest and Woodland

Inter-Mountain Basins Big Sagebrush Shrubland

Inter-Mountain Basins Big Sagebrush Steppe

Inter-Mountain Basins Cliff and Canyon

Inter-Mountain Basins Greasewood Flat

Inter-Mountain Basins Mat Saltbush Shrubland

Inter-Mountain Basins Mixed Salt Desert Scrub

Inter-Mountain Basins Montane Sagebrush Steppe

Inter-Mountain Basins Mountain Mahogany Woodland and Shrubland

Inter-Mountain Basins Shale Badland

Introduced Riparian and Wetland Vegetation

Introduced Upland Vegetation - Annual Grassland

Introduced Upland Vegetation - Forbland

Introduced Upland Vegetation - Perennial Grassland

Introduced Upland Vegetation - Shrub

Middle Rocky Mountain Montane Douglas-fir Forest and Woodland
No Data
North American Alpine Ice Field
North American Arid West Emergent Marsh
Northern Rocky Mountain Conifer Swamp
Northern Rocky Mountain Dry-Mesic Montane Mixed Conifer Forest
Northern Rocky Mountain Foothill Conifer Wooded Steppe
Northern Rocky Mountain Lower Montane Riparian Woodland and Shrubland
Northern Rocky Mountain Lower Montane, Foothill and Valley Grassland
Northern Rocky Mountain Mesic Montane Mixed Conifer Forest
Northern Rocky Mountain Montane-Foothill Deciduous Shrubland
Northern Rocky Mountain Ponderosa Pine Woodland and Savanna
Northern Rocky Mountain Subalpine Deciduous Shrubland
Northern Rocky Mountain Subalpine Woodland and Parkland
Northern Rocky Mountain Subalpine-Upper Montane Grassland
Northern Rocky Mountain Western Larch Savanna
Northwestern Great Plains - Black Hills Ponderosa Pine Woodland and Savanna
Northwestern Great Plains Floodplain
Northwestern Great Plains Mixedgrass Prairie
Northwestern Great Plains Riparian
Northwestern Great Plains Shrubland
Open Water
Pasture/Hay
Quarries, Mines and Gravel Pits
Recently burned forest
Recently burned grassland
Recently burned shrubland
Rocky Mountain Alpine Bedrock and Scree
Rocky Mountain Alpine Dwarf-Shrubland
Rocky Mountain Alpine Fell-Field
Rocky Mountain Alpine Turf
Rocky Mountain Alpine-Montane Wet Meadow
Rocky Mountain Aspen Forest and Woodland
Rocky Mountain Cliff, Canyon and Massive Bedrock
Rocky Mountain Foothill Limber Pine-Juniper Woodland
Rocky Mountain Lodgepole Pine Forest
Rocky Mountain Lower Montane Riparian Woodland and Shrubland
Rocky Mountain Lower Montane-Foothill Shrubland
Rocky Mountain Poor-Site Lodgepole Pine Forest
Rocky Mountain Subalpine Dry-Mesic Spruce-Fir Forest and Woodland
Rocky Mountain Subalpine Mesic-Wet Spruce-Fir Forest and Woodland
Rocky Mountain Subalpine-Montane Fen
Rocky Mountain Subalpine-Montane Mesic Meadow
Rocky Mountain Subalpine-Montane Riparian Shrubland
Rocky Mountain Subalpine-Montane Riparian Woodland

Southern Rocky Mountain Dry-Mesic Montane Mixed Conifer Forest and Woodland
Southern Rocky Mountain Montane-Subalpine Grassland
Southern Rocky Mountain Ponderosa Pine Woodland
Unconsolidated Shore
Western Great Plains Badland
Western Great Plains Cliff and Outcrop
Western Great Plains Closed Depression Wetland
Western Great Plains Dry Bur Oak Forest and Woodland
Western Great Plains Floodplain
Western Great Plains Open Freshwater Depression Wetland
Western Great Plains Riparian Woodland and Shrubland
Western Great Plains Saline Depression Wetland
Western Great Plains Sand Prairie
Western Great Plains Shortgrass Prairie
Western Great Plains Wooded Draw and Ravine
Wyoming Basins Dwarf Sagebrush Shrubland and Steppe

Species with accelerated effects from climate change: Lodgepole pine

SUMMARY (Short overview of the data layer)

The data was used to identify Lodgepole pine vegetation types and was derived from the Landfire national products. Other sources were considered, including REGAP NW and National Land Cover database. The Landfire data incorporated FIA data plots and was judged superior for the forest types desired for this project.

SAWG DOCUMENTATION (Put metadata on processing here)

USE Forested areas with higher risk: Lodgepole Pine (FHRLP)

METADATA FROM OTHER SOURCES (Upload files and paste document file names here)

LANDFIRE Existing Vegetation Type - <http://www.landfire.gov/NationalProductDescriptions21.php> , like MTREGAP is based on [NatureServe's Ecological Systems classification](#) .

Group's preference is to use LandFire version - does anyone have this already clipped and prepared for Montana? If we have to proces it from scratch from the National Map site, we may use NWRegap instead.

GENERAL NOTES

Dry Forest Type - DF PPine/Check with Dan and Barry - just these two species from REGAP?
Douglas Fir and Ponderosa Pine. USFS is building sub model for this. Other sources ReGAP & LandFir
Dan - Please delete all species types that are not applicable, and I'll pull the remaining from the REGAP grid

Columbia Basin Foothill Riparian Woodland and Shrubland
Columbia Plateau Steppe and Grassland
Columbia Plateau Vernal Pool
Cultivated Cropland

Developed, High Intensity
Developed, Low Intensity
Developed, Medium Intensity
Developed, Open Space
Geysers and Hot Springs
Great Plains Prairie Pothole
Harvested forest-grass regeneration
Harvested forest-shrub regeneration
Harvested forest-tree regeneration
Inter-Mountain Basins Active and Stabilized Dune
Inter-Mountain Basins Aspen-Mixed Conifer Forest and Woodland
Inter-Mountain Basins Big Sagebrush Shrubland
Inter-Mountain Basins Big Sagebrush Steppe
Inter-Mountain Basins Cliff and Canyon
Inter-Mountain Basins Greasewood Flat
Inter-Mountain Basins Mat Saltbush Shrubland
Inter-Mountain Basins Mixed Salt Desert Scrub
Inter-Mountain Basins Montane Sagebrush Steppe
Inter-Mountain Basins Mountain Mahogany Woodland and Shrubland
Inter-Mountain Basins Shale Badland
Introduced Riparian and Wetland Vegetation
Introduced Upland Vegetation - Annual Grassland
Introduced Upland Vegetation - Forbland
Introduced Upland Vegetation - Perennial Grassland
Introduced Upland Vegetation - Shrub
Middle Rocky Mountain Montane Douglas-fir Forest and Woodland
No Data
North American Alpine Ice Field
North American Arid West Emergent Marsh
Northern Rocky Mountain Conifer Swamp
Northern Rocky Mountain Dry-Mesic Montane Mixed Conifer Forest
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Northern Rocky Mountain Lower Montane Riparian Woodland and Shrubland
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Northern Rocky Mountain Mesic Montane Mixed Conifer Forest
Northern Rocky Mountain Montane-Foothill Deciduous Shrubland
Northern Rocky Mountain Ponderosa Pine Woodland and Savanna
Northern Rocky Mountain Subalpine Deciduous Shrubland
Northern Rocky Mountain Subalpine Woodland and Parkland
Northern Rocky Mountain Subalpine-Upper Montane Grassland
Northern Rocky Mountain Western Larch Savanna
Northwestern Great Plains - Black Hills Ponderosa Pine Woodland and Savanna
Northwestern Great Plains Floodplain
Northwestern Great Plains Mixedgrass Prairie
Northwestern Great Plains Riparian

Northwestern Great Plains Shrubland
Open Water
Pasture/Hay
Quarries, Mines and Gravel Pits
Recently burned forest
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Rocky Mountain Alpine Bedrock and Scree
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Western Great Plains Saline Depression Wetland
Western Great Plains Sand Prairie
Western Great Plains Shortgrass Prairie
Western Great Plains Wooded Draw and Ravine
Wyoming Basins Dwarf Sagebrush Shrubland and Steppe

Species with accelerated effects from climate change: Whitebark pine

SUMMARY (Short overview of the data layer)

The whitebark pine layer was developed by Dr. Bob Keanne at the National Fire Lab. It includes existing whitebark pine stands and potential areas where whitebark pine stands may recover.

SAWG DOCUMENTATION (Put metadata on processing here)

USE Whitebark pine forest health threats (WBPFFT)

METADATA FROM OTHER SOURCES (Upload files and paste document file names here)

LANDFIRE Existing Vegetation Type - <http://www.landfire.gov/NationalProductDescriptions21.php> , like MTREGAP is based on [NatureServe's Ecological Systems classification](#) .

Group's preference is to use LandFire version - does anyone have this already clipped and prepared for Montana? If we have to proces it from scratch from the National Map site, we may use NWRegap instead.

GENERAL NOTES

Dry Forest Type - DF PPine/Check with Dan and Barry - just these two species from REGAP?

Douglas Fir and Ponderosa Pine. USFS is building sub model for this. Other sources ReGAP & LandFir

Dan - Please delete all species types that are not applicable, and I'll pull the remaining from the REGAP grid

Columbia Basin Foothill Riparian Woodland and Shrubland

Columbia Plateau Steppe and Grassland

Columbia Plateau Vernal Pool

Cultivated Cropland

Developed, High Intensity

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Developed, Medium Intensity

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Harvested forest-tree regeneration

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Western Great Plains Shortgrass Prairie
Western Great Plains Wooded Draw and Ravine
Wyoming Basins Dwarf Sagebrush Shrubland and Steppe

Tree Farms and Stewardship plans

SUMMARY (Short overview of the data layer)

Layer added by Dan Rogers 1/11/2010 after meeting with State Forester Bob Harrington. These records are the ownership areas for all tree farms and stewardship plans maintained by Dan Rogers and DNRC. These areas are an indicator of landowner interest in forest management, though they are not generally accessible to the public.

SAWG DOCUMENTATION (Put metadata on processing here)

1. Create tfarmsplan grid
 - Use treefarmpoly.shp from Dan Rogers
 - Add VALUE = 1
 - Save as treefarm grid
 - Use 2005-09_current_plans.shp from Dan Rogers
 - Project to MT State Plane 83 meters
 - Add VALUE = 1
 - Save as currentplans grid
 - Merge (treefarm, currentplans)
 - Save as tfarmsplan grid
2. Calculate Zonal Statistics for HUCs
Spatial Analyst: Zonal Statistics
Zone dataset: SAWG_Units_RW.shp

Zone field: HUC_10

Value raster: tfarmsplan

Ignore No Data in calculations

Join output table to zone layer

Output table: tfarmsplan_tbl.dbf

3. Calculate percent of HUC with tree farms or stewardship plans

Join tfarmsplan_tbl.dbf to sawg_units_rw.shp

Calculate NULL values = 0 (i.e. no crown fire probability within HUC)

Add field: tfarmsplan (Double)

Calculate tfarmsplan = ((tfarmsplan_tbl.COUNT)/(SAWG_units_RW.GRIDSUM)*100)

METADATA FROM OTHER SOURCES (Upload files and paste document file names here)

GENERAL NOTES

Urban forest canopy cover

SUMMARY (Short overview of the data layer)

This data layer is a visual estimate of canopy cover for the general urban footprint of the 96 managing and developed cities and towns. Prepared by Dan Rogers, DNRC, the percent of urban forest cover was estimated with 2005 National Agricultural Imagery Program aerial images with 1 meter resolution.

SAWG DOCUMENTATION (Put metadata on processing here)

Used CANOPYCOV attribute in Dan Rogers SAWG_Units shapefile completed 01/08/2010 using expert opinion assignment of percent canopy coverage in the urban areas while viewing the 2005 NAIP image coverage service hosted at NRIS.

Units were in percent recorded as integers between 0-100. Entire watersheds were assigned the urban canopy cover.

Data transferred to Obj 1 Urban and put in UFCANCOV attribute as integers.

METADATA FROM OTHER SOURCES (Upload files and paste document file names here)

GENERAL NOTES

Urban forest program presence

SUMMARY (Short overview of the data layer)

This layer comes from the "managing and developing" definitions used in Federal reporting. Dan Rogers identified 96 Montana communities with the presence of or potential for presence of an urban forest program.

SAWG DOCUMENTATION (Put metadata on processing here)

All 5th code watersheds with cities and towns that fall under the "managing and developing" definition are coded 100. All others are coded 0. Attribute transferred from UFPP attribute in Dan Rogers SAWG_Units shapefile completed 01/08/2010 using expert opinion.

METADATA FROM OTHER SOURCES (Upload files and paste document file names here)

GENERAL NOTES

This is only applicable to the urban areas. Presence of urban forest program - Managing vs developing urban forest communities. Forest management infrastructure

USFS Priority HUCS for fish

SUMMARY (Short overview of the data layer)

Priority watersheds for fish as identified by the US Forest Service. These were derived with two criteria, the quality of fish habitat, and the relative costs for restoration or improvement, with the concept of where dollars could be spent to restore or enhance fisheries with the greatest value per dollar spent.

SAWG DOCUMENTATION (Put metadata on processing here)

restoration_priority_fish062_r1MT.shp

1. Convert restoration_priority_fish062_r1MT.shp to Raster

- Conversion Tools > To Raster > Polygon to Raster
- Input: restoration_priority_fish062_r1MT.shp
- Value field: Value
- Output: usfspf
- Cell assignment type: CELL_CENTER
- Priority: NONE
- Cellsize: 30

2. Zonal Statistics

- Spatial Analyst Tools > Zonal > Zonal Statistics
- Input raster or feature zone data: SAWG_units_KB
- Zone field: Huc_10
- Input value raster: usfspf
- Output: usfspf_tbl.dbf
- Statistics type: MEAN
- Join output table to zone layer
- Ignore NoData

3. Calculate USFSPF Field

- Add USFSPF field (short int) to attribute table
- Calculate USFSPF = (usfspf_tbl.COUNT/SAWG_units_kb.GRIDSUM)*100
- Remove table join

METADATA FROM OTHER SOURCES (Upload files and paste document file names here)

GENERAL NOTES

2 layers, priority 1-5 restoration priority for Water quality and fish (priority 1 are most important)
Depends on data format on how to assign ordinal scale

USFS Priority HUCS for water quality

SUMMARY (Short overview of the data layer)

Priority watersheds for water quality as identified by the US Forest Service. These were derived with two criteria, the overall quality issues in the watershed, and the relative costs for restoration or improvement, with the concept of where dollars could be spent to restore or enhance water quality with the greatest value per dollar spent.

SAWG DOCUMENTATION (Put metadata on processing here)

restoration_priority_wtrshd062_r1MT.shp

1. Convert restoration_priority_wtrshd062_r1MT.shp to Raster

- Conversion Tools > To Raster > Polygon to Raster
- Input: restoration_priority_wtrshd062_r1MT.shp
- Value field: Value
- Output: usfspwq
- Cell assignment type: CELL_CENTER
- Priority: NONE
- Cellsize: 30

2. Zonal Statistics

- Spatial Analyst Tools > Zonal > Zonal Statistics
- Input raster or feature zone data: SAWG_units_KB
- Zone field: Huc_10
- Input value raster: usfspwq
- Output: usfspwq_tbl.dbf
- Statistics type: MEAN
- Join output table to zone layer
- Ignore NoData

3. Calculate USFSPWQ Field

- Add USFSPWQ field (short int) to attribute table
- Calculate USFSPWQ = (usfspwq_tbl.COUNT/SAWG_units_kb.GRIDSUM)*100
- Remove table join

METADATA FROM OTHER SOURCES (Upload files and paste document file names here)

GENERAL NOTES

- 2 layers, priority 1-5 restoration priority for Water quality and fish (priority 1 are most important)

Depends on data format on how to assign ordinal scale.

Best place to put dollars in USFS perspective - most cost effective in 15 year timeframe

Discussion of duplication with MDFWP fish -

Barry recommended using both.

Whitebark pine forest health threats

SUMMARY (Short overview of the data layer)

The whitebark pine layer was developed by Dr. Bob Keanne at the National Fire Lab. It includes existing whitebark pine stands and potential areas where whitebark pine stands may recover.

SAWG DOCUMENTATION (Put metadata on processing here)

mtwhitebark GRID

1. Reclassify mtwhitebark
 - All values = 100
 - Resulting GRID wbpfht
2. Zonal Statistics
 - Spatial Analyst Tools > Zonal > Zonal Statistics
 - Input raster or feature zone data: SAWG_units_KB
 - Zone field: Huc_10
 - Input value raster: wbpfht
 - Output: wbpfht_tbl.dbf
 - Statistics type: MEAN
 - Join output table to zone layer
 - Ignore NoData
3. Calculate percent of pixels based on forest health threat to Whitebark pine per Huc
 - Calculate <NULL> = 0
 - Calculate WBPFFT = (wbpfht_tbl.COUNT/SAWG_units_dr.GRIDSUM)*100
 - Remove table join

METADATA FROM OTHER SOURCES (Upload files and paste document file names here)

GENERAL NOTES

USFS RO

% of HUC

natural breaks

Compare ReGAP to Bob Keanne data

Blister rust potential

Need to know more about the grid attribution for this layer to determine if the GIS analysis is appropriate.

Wildland Urban Interface

SUMMARY (Short overview of the data layer)

Healthy Forests Restoration Act - Wildland Urban Interface for Montana & North Idaho. This layer was provided by DNRC.

SAWG DOCUMENTATION (Put metadata on processing here)

HFRA_Clip_MT_Yes.shp

1. Add Value Field and Project
 - Add Value field (short int) and assign value of 100
 - Project HFRA_Clip_MT_Yes.shp to NAD 83 MT State Plane
2. Convert HFRA_Clip_MT_Yes.shp to Raster
 - Conversion Tools > To Raster > Polygon to Raster
 - Input: HFRA_Clip_MT_Yes.shp
 - Value field: Value
 - Output: wui
 - Cell assignment type: CELL_CENTER
 - Priority: NONE

- Cellsize: 30

3. Zonal Statistics

- Spatial Analyst Tools > Zonal > Zonal Statistics
- Input raster or feature zone data: SAWG_units_KB
- Zone field: Huc_10
- Input value raster: wui
- Output: wui_tbl.dbf
- Statistics type: MEAN
- Ignore NoData

4. Calculate percent of pixels of wildland urban interface per Huc

- Calculate <NULL> = 0
- Calculate WUI = (wui_tbl.COUNT/SAWG_units_dr.GRIDSUM)*100
- Remove table join

METADATA FROM OTHER SOURCES (Upload files and paste document file names here)

[hfra_wui0904_meta.pdf](#)

Healthy Forests Restoration Act - Wildland Urban Interface for Montana & North Idaho Geographic Information System Layer and Supporting Data

HFRA WUI GIS layer construction

In developing this HFRA WUI GIS layer, definitions and descriptions presented in the Healthy Forest Restoration Act of 2003 were the guidelines and focus. Although other options for inclusion are available, adhering to the closest representation of HFRA was the goal. We used all Communities at Risk identified in the January 4, 2001 Federal Register as point locations of the U.S. Postal Office for that community. We also used a Population Density surface of 2000 census data generated using daysemetric mapping methods produced by the Wildlife Spatial Analysis Lab at the University of Montana. All areas in Montana and North Idaho with population densities of greater than or equal to 28 people per square mile were carried forward in the mapping process. Also included in developing the HFRA WUI GIS layer were major roads in Montana and Idaho and sustained slopes generated from 30 meter digital elevation models.

To develop the HFRA WUI GIS layer, the communities at risk, population density, and roads were all buffered by ½ mile and merged together. This intermediate product was then buffered by an additional 1 mile and merged with areas of slopes greater than 25% that were at least 5 acres in size (our interpretation of sustained steep slope'). This 1½ mile total buffer was then reduced back to the extent of the areas of steep slope or all the way back to ½ mile if sustained steep slopes were not present in the ½ to 1½ mile buffer zone. Details on the specific analytical processes used can be found in the HFRA WUI GIS metadata.

GENERAL NOTES

HFRA WUI / Residential centroids - Compare Cadastral MT to Univ. of Wisconsin Census/LandCover WUI. Instead of a variable, might want to use this as a mask or screen to determine which subset of watersheds gets a score for this variable - all absent polygons would have score of 0 in all categories for this one

Montana Cadastral - with a defined residential density map derived from the [Montana Residence Centroids](#) and an appropriate cutoff in values to define the WUI. This layer will be used as a screen to clip the [LandFire Rapid Assessment Fire Regime Classes](#) and the [Burned Area Probability Map](#) layers. It

will be a subset of the same layers used in the "Restore fire-adapted lands and reduce risk of wildfire impacts" Objective. **