

These abbreviated summary minutes and the audio recording will become the official adopted minutes at the next Land Board meeting when the board votes to officially approve them. Until then they are considered a draft.

MINUTES
REGULAR MEETING OF THE BOARD OF LAND COMMISSIONERS
Tuesday, February 20, 2018 at 9:00 am
State Capitol, Room 303
Helena, MT

Please note: *The Land Board has adopted the audio recording of its meetings as the official record, as allowed by [2-3-212, MCA](#). These minutes provide an abbreviated summary of the Land Board discussion, public testimony, action taken, and other activities. The time designations listed are approximate and may be used to locate the referenced discussion on the audio recording of this meeting. Access to an electronic copy of these minutes and the audio recording is provided from the Land Board webpage at <http://dnrc.mt.gov/LandBoard>. The written minutes summary, along with the audio recordings, are listed by meeting date on the Land Board Archive webpage.*

Members Present

Governor Steve Bullock
Attorney General Tim Fox
Commissioner of Securities and Insurance Matthew Rosendale
Secretary of State Corey Stapleton
Superintendent of Public Instruction Elsie Arntzen

Members Absent

None

Testifying Staff

John Tubbs, DNRC Director
Martha Williams, FWP Director
Shawn Thomas, DNRC TLMD Administrator

Attachments

Related Materials, Attachment 1 – sign-in sheet
Related Materials, Attachment 2 – materials related to public comment by Sam Milodragovich on item 0218-1

Call to Order

00:07:59 Governor Bullock called the meeting to order.
00:08:12 Attorney General Fox moved to approve the January 22, 2018 minutes. The motion was seconded by Superintendent Arntzen and carried unanimously.

Business Considered

0218-1 FWP: Horse Creek Complex Conservation Easements

00:08:32 Mr. Tubbs
00:08:46 Ms. Williams gave an overview of the item.
00:16:25 Governor Bullock

Public Comment

00:17:10 Nick Gevock, Montana Wildlife Federation Conservation Director
00:19:36 Lilia Tyrrell, Attorney representing Rob and Carla Delp
00:25:44 Glen Marx, Montana Association of Land Trusts Executive Director
00:27:27 Adel Stenson, Land Owner

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00:33:34 Andrew Dana
00:37:23 Justin Schaaf
00:40:10 Joe Perry
00:43:49 Allen Olson, Montana Petroleum Association Executive Director
00:47:29 Amber Stenson, Land Owner
00:49:09 Sam Milodragovich, Skyline Sportsmen Association
00:52:58 John Borgreen, Montana Sportsmen Alliance
00:54:31 George Wolcott, Forward Montana Foundation
00:55:30 Attorney General Fox moved to approve item 0218-1. The motion was seconded by Commissioner Rosendale.

Board Discussion/Comments

00:55:52 Attorney General Fox
00:55:57 Ms. Williams
00:55:59 Mr. Tubbs
00:56:01 Attorney General Fox
00:56:45 Ms. Williams
01:00:32 Attorney General Fox
01:00:34 Governor Bullock
01:00:36 Attorney General Fox
01:03:31 Ms. Williams
01:04:49 Attorney General Fox
01:04:50 Governor Bullock
01:04:52 Attorney General Fox
01:05:10 Ms. Williams
01:05:49 Attorney General Fox
01:06:24 Governor Bullock
01:06:33 Commissioner Rosendale
01:06:54 Ms. Williams
01:07:46 Commissioner Rosendale
01:07:48 Governor Bullock
01:07:49 Commissioner Rosendale
01:08:05 Ms. Williams
01:08:41 Commissioner Rosendale
01:08:42 Governor Bullock
01:08:43 Commissioner Rosendale
01:08:57 Ms. Williams
01:09:13 Commissioner Rosendale
01:09:25 Ms. Williams
01:09:27 Commissioner Rosendale
01:09:28 Governor Bullock
01:09:29 Commissioner Rosendale
01:09:38 Mr. Perry
01:09:39 Commissioner Rosendale
01:09:58 Mr. Perry
01:10:37 Commissioner Rosendale
01:10:41 Mr. Perry
01:10:45 Commissioner Rosendale
01:10:46 Governor Bullock
01:10:50 Commissioner Rosendale
01:10:57 Ms. Tyrrell

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01:10:58 Commissioner Rosendale
01:11:07 Ms. Tyrrell
01:11:08 Commissioner Rosendale
01:11:09 Ms. Tyrrell
01:13:29 Commissioner Rosendale
01:13:30 Governor Bullock
01:13:30 Commissioner Rosendale
01:13:39 Ms. A. Stenson
01:13:41 Commissioner Rosendale
01:13:58 Ms. A. Stenson
01:14:40 Governor Bullock
01:14:42 Superintendent Arntzen
01:15:17 Ms. Williams
01:15:59 Superintendent Arntzen
01:16:01 Ms. Williams
01:16:02 Superintendent Arntzen
01:16:22 Ms. Williams
01:16:23 Superintendent Arntzen
01:16:30 Ms. Williams
01:18:21 Superintendent Arntzen
01:18:23 Governor Bullock
01:18:27 Secretary Stapleton
01:19:26 Mr. Dana
01:21:41 Secretary Stapleton
01:22:44 Ms. A. Stenson
01:24:54 Secretary Stapleton
01:24:55 Ms. A. Stenson
01:25:52 Governor Bullock
01:26:06 Ms. Tyrrell
01:26:07 Governor Bullock
01:26:29 Ms. Tyrrell
01:26:42 Governor Bullock
01:26:44 Ms. Tyrrell
01:26:47 Governor Bullock
01:26:47 Ms. Tyrrell
01:27:14 Governor Bullock
01:27:20 Ms. Tyrrell
01:27:41 Governor Bullock
01:27:46 Ms. Tyrrell
01:27:48 Governor Bullock
01:27:52 Ms. Tyrrell
01:28:09 Governor Bullock
01:28:14 Ms. Tyrrell
01:28:15 Governor Bullock
01:28:28 Ms. Tyrrell
01:28:41 Governor Bullock
01:28:54 Ms. Tyrrell
01:29:00 Governor Bullock
01:29:09 Ms. Tyrrell
01:29:10 Governor Bullock
01:29:16 Ms. Tyrrell

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01:29:20 Governor Bullock
01:29:33 Mr. Olsen
01:29:34 Governor Bullock
01:29:40 Mr. Olsen
01:29:50 Governor Bullock
01:30:03 Mr. Olsen
01:30:04 Governor Bullock
01:30:16 Mr. Olsen
01:30:41 Governor Bullock
01:31:09 Mr. Olsen
01:31:17 Governor Bullock
01:31:34 Mr. Olsen
01:31:55 Governor Bullock
01:32:05 Mr. Olsen
01:32:32 Governor Bullock
01:32:35 Mr. Olsen
01:33:13 Governor Bullock
01:34:01 Ms. A. Stenson
01:37:22 Governor Bullock
01:40:01 Attorney General Fox
01:42:59 Governor Bullock
01:43:02 Superintendent Arntzen
01:44:46 Governor Bullock
01:45:59 Superintendent Arntzen
01:47:02 Governor Bullock
01:47:02 Attorney General Fox
01:47:03 Governor Bullock
01:47:45 Attorney General Fox
01:49:01 Governor Bullock
01:49:03 Secretary Stapleton
01:49:29 Secretary Stapleton submitted a substitute motion to delay action on item 0218-1. Commissioner Rosendale seconded the motion.
01:50:06 Governor Bullock
01:51:41 Commissioner Rosendale
01:52:50 Governor Bullock
01:53:00 Secretary Stapleton
01:54:22 Attorney General Fox
01:56:20 Governor Bullock

01:56:45 The substitute motion to delay action on item 0218-1 carried 3-2, Governor Bullock and Attorney General Fox dissenting.

0218-2 Timber Sale: Swamp Fire Salvage

01:56:57 Mr. Tubbs gave an overview of the item.
01:57:32 Governor Bullock
01:57:55 Secretary Stapleton moved to approve item 0218-2. The motion was seconded by Commissioner Rosendale and carried unanimously.

0218-3 Land Banking Parcels: Final Approval for Sale

01:57:57 Mr. Tubbs gave an overview of the item.
01:58:21 Governor Bullock

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01:58:30 Attorney General Fox moved to approve item 0218-3. The motion was seconded by Secretary Stapleton.

Board Discussion/Comments

01:58:38 Secretary Stapleton
01:58:40 Governor Bullock
01:58:41 Secretary Stapleton
01:58:44 Governor Bullock
01:58:47 Secretary Stapleton
01:58:48 Governor Bullock
01:58:49 Secretary Stapleton
01:58:50 Governor Bullock

01:59:02 The motion to approve item 0218-3 carried unanimously.

0218-4 Land Banking Acquisitions: Final Approval for Purchase – Angela Farm

01:59:05 Mr. Tubbs
01:59:32 Governor Bullock
01:59:34 Mr. Thomas gave an overview of the item.
02:03:39 Governor Bullock

Public Comment

02:03:51 Bryan Mussard, Montana Stock Growers Association President
02:05:50 Ty Jones, Southeastern Montana Livestock Association President
02:12:57 Dennis Pluhar
02:18:29 John Youngberg, Montana Farm Bureau Executive Vice President
02:19:22 Nick Gevock, Montana Wildlife Federation Director
02:20:06 Attorney General Fox moved to approve item 0218-4. The motion was seconded by Commissioner Rosendale.

Board Discussion/Comments

02:20:13 Governor Bullock
02:20:19 Commissioner Rosendale
02:20:28 Mr. Thomas
02:20:32 Commissioner Rosendale
02:21:19 Mr. Thomas
02:22:49 Commissioner Rosendale
02:22:52 Governor Bullock
02:22:52 Commissioner Rosendale
02:22:53 Governor Bullock
02:22:53 Commissioner Rosendale
02:23:16 Mr. Mussard
02:23:18 Commissioner Rosendale
02:23:34 Mr. Mussard
02:23:38 Commissioner Rosendale
02:23:51 Mr. Mussard
02:24:17 Commissioner Rosendale
02:24:36 Mr. Mussard
02:25:31 Governor Bullock
02:25:33 Attorney General Fox
02:26:00 Mr. Mussard

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02:26:27 Attorney General Fox
02:26:32 Mr. Thomas
02:26:34 Attorney General Fox
02:26:58 Mr. Thomas
02:30:11 Attorney General Fox
02:30:36 Mr. Thomas
02:30:37 Governor Bullock
02:30:41 Superintendent Arntzen
02:31:24 Mr. Thomas
02:31:24 Superintendent Arntzen
02:31:27 Mr. Thomas
02:33:43 Governor Bullock

02:37:03 The motion to approve item 0218-4 carried 4-1, Secretary Stapleton dissenting.

0218-5 Cabin and Home Site Sales: Set Minimum Bid for Sale

02:37:08 Mr. Tubbs gave an overview of the item.
02:37:52 Governor Bullock
02:38:18 Commissioner Rosendale moved to approve item 0218-5. The motion was seconded by Superintendent Arntzen and carried unanimously.

0218-6 Cabin and Home Site Sales: Final Approval for Sale

02:38:20 Mr. Tubbs gave an overview of the item.
02:38:59 Governor Bullock
02:39:28 Attorney General Fox moved to approve item 0218-6. The motion was seconded by Commissioner Rosendale and carried unanimously.

0218-7 Indemnity Selections: Final Approval – Phase 1

02:39:29 Mr. Tubbs
02:39:52 Mr. Thomas gave an overview of the item.
02:39:55 Governor Bullock
02:39:57 Mr. Thomas
02:43:53 Commissioner Rosendale moved to approve item 0218-7. The motion was seconded by Attorney General Fox.

Board Discussion/Comments

02:44:17 Governor Bullock
02:44:18 Attorney General Fox
02:44:41 Governor Bullock

02:44:53 The motion to approve item 0218-7 carried unanimously.

0218-8 Easements

02:44:56 Mr. Tubbs gave an overview of the item.
02:45:15 Governor Bullock
02:45:38 Commissioner Rosendale moved to approve item 0218-2. The motion was seconded by Secretary Stapleton and carried unanimously.

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General Public Comment

None

Adjournment

02:46:00 Adjournment

PRESIDENT

ATTEST

/s/ Steve Bullock
Steve Bullock, Governor

/s/ John E. Tubbs
John E. Tubbs, DNRC Director

SIGN-IN SHEET
REGULAR MEETING OF THE BOARD OF LAND COMMISSIONERS
February 20, 2018 at 9:00 am

NAME	AFFILIATION	E-MAIL	Check to be added to the interested parties list.
Yetta Stein	constituent	yystein@pdx.edu	
Lilia Tywell	constituent	ltywell@kmlaw.net	✓
Carla Delp			✓
Robin Delp	↓		✓
Chris Trumpower	American Bridge		
Mary Adelaide Stenson	Springhill Ranch		
Skyler Stenson	Springhill Ranch		
Jessica Stenson	" "		
Amber Stenson	" "		
Pip Stenson	Springhill Ranch		
JOHN ENSIGN	FWP		
Kevin League	FWP		
Colin Delp			
Justin SchAAF	Hunter	jschaaf71@gmail.com	
Joe Perry	MSA	circles@5rivers.net	✓
JOHN BORGREEN	MSA	jsidze@icub.com	
Earl F. Griffith	Springhill Ranch/FWP		
Andrew Dana	MT Assoc. of Land Tru	andy@conservationlawassociates.com	
Nick Gevock	MWF	ngevock@mtwf.org	
ERROL RICE	MSGA	ERROL@MTBEEF.ORG	
Ty Jones	Southeast Livestock Assoc		
Dennis PLOWAR	✓ ✓		

Email landboard@mt.gov or indicate on this sign-in sheet if you would like to be placed on the Land Board interested parties list.

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**Report for Montana Department
of Fish, Wildlife and Parks**

**BREWER PROPERTY ACQUISITION
SOCIAL AND ECONOMIC IMPACT ASSESSMENT**

**John Duffield
June 1989**

MAJOR FINDINGS

- No unfavorable changes in taxable valuation or tax revenues to local county governments
- Annual expenditures resulting from DFWP plan estimated at \$223,000 versus \$40,000 for no purchase alternative
- Total annual economic impact on the state of Montana is \$527,500 for the DFWP plan and \$99,000 for the no purchase alternative
- Present value of net social benefits associated with the DFWP plan are estimated at \$2.3 to \$3.2 million compared to the DFWP cost of \$1.2 million
- Proposed purchase by DFWP appears to be in the public interest

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ACKNOWLEDGEMENTS

Many people contributed time and energy to this study. I am especially grateful to the individuals most directly impacted by this project, including the Brewer family, adjacent landowners, outfitters and local merchants, for sharing their views with me. A number of Montana Department of Fish, Wildlife and Parks personnel also contributed materially to this project, including Rob Brooks, Candy Post, Greg Risdahl, Neal Martin and Gary Hammond. Bruce Bugbee and Jan Konigsberg provided useful background information on conservation easements. Michael Reilly and Terry Anderson at Montana State University kindly provided copies of studies concerning outfitting and fee hunting. John Widdoss provided additional interpretation of his property appraisal. None of these individuals is in any way responsible for the interpretation and analysis made here.

EXECUTIVE SUMMARY

The Montana Department of Fish, Wildlife and Parks (DFWP) has proposed to purchase the 34,342 acre Brewer Ranch near Broadus for purposes of protecting and enhancing wildlife habitat. DFWP intends to place a conservation easement on this property to ensure protection of the sagebrush-grassland habitat and to provide open access to hunters. The easement encumbered property will be traded back into private ownership for conservation easements on adjoining property. The likely final project size will be on the order of 90,000 acres. This report provides a social and economic impact assessment of the purchase as required by HB 720 (1989 Montana State Legislature).

On financial grounds and from the viewpoint of DFWP, the cost of the proposed Brewer property purchase is around \$1.2 million. There are expected to be no unfavorable changes in taxable valuation or tax revenue to local county governments. This is because agricultural land in Montana is taxed on a production basis. Unless the state legislature changes the tax law for agricultural land to a market value basis, a decline in market value due to a conservation easement will not be reflected in assessed valuation. During the interim period of DFWP ownership, the Montana code (sec.87-1-603) is unambiguous as to DFWP's obligation to make payments to counties in lieu of taxes.

The likely alternative to the DFWP plan is sale of the Brewer ranch on the open market to a private party. It is conceivable that a new owner-operator of the Brewer property would purchase haying equipment subject to county tax. However, this possibility holds equally for an owner-operator who gains control of the property through an exchange for conservation easements. The dominant use of the ranch will continue to be as a livestock operation; this use is unchanged across management alternatives.

Except for the open access provision, all of the key terms in the conservation easement are oriented to protect habitat: no sodbusting, limit sagebrush control, no commercial development, institution of a rest rotation grazing system and range monitoring. With regard to habitat protection, the difference between the DFWP plan and the no purchase alternative (except for rest rotation) is one of degree. The easement protects the habitat with virtual certainty for perpetuity. The alternative of no purchase entails a possibility of habitat degradation: sod-busting, sagebrush control, and possibly overgrazing. The likelihood and extent of this degradation is difficult to quantify. A major clear difference in the two alternatives with regard to habitat protection has to do with the rest-rotation system. It appears that this should be regarded as a promising experiment as far as presently quantifiable differences for this specific habitat and species mix.

There are no obvious direct use changes associated with preservation of the wildlife habitat per se, though the implications for indirect benefits are significant, as developed below. The main immediate difference between the DFWP plan and the no purchase alternative has to do with the management of hunting on the land. Following the Widdoss appraisal of the highest and best use of the land, it is assumed that "no purchase" by DFWP will lead to fee hunting on the property. This seems reasonable since land currently leased for hunting adjoins the Brewer property.

Annual hunter expenditures associated with the DFWP plan amount to \$223,000 compared to \$40,000 for the no purchase alternative (Table A). The majority of these expenditures for both alternatives are by nonresidents, amounting to \$211,000 per year and \$39,600 per year respectively. The total economic impact on the State of Montana is \$527,500 for the DFWP plan and \$99,000 under the no purchase alternative. The significantly higher expenditures (and associated economic impacts) for the DFWP plan are somewhat surprising and are explained by two factors. The first is that current use on the Brewer property, which appears to be typical of block management in Region 7, is at a fairly high hunter density of 3.78 hunters per square mile over the big game season. This is almost four times as high as the historic average density (deer and antelope hunters combined) for Region 7 (Table B). By contrast, guided hunting (particularly for exceptional trophy animals) is very land intensive; the largest outfitter in the Broadus area averages .128 guided hunters per square mile. This is about one eighth the regional average and about 25 times as low a density as on block management units. A total of 203 hunters used the Brewer property under the 1988 block management program. At a guided hunter density of .15, this 53 square mile ranch would support 8 guided hunters. In short, the expenditure difference in part reflects the very differing number of hunters under a hunting lease arrangement compared to block management.

TABLE A
Economic Impact of Hunter Expenditures
Under Management Alternatives for Brewer Property
(1989 dollars)

	DFWP Plan	No Purchase Alternative
Total hunting expenditure on Brewer's 34,342 acres	87,196	15,743
Total hunting expenditure on final easement area of 88,000 acres	223,000	40,000
Nonresident expenditure on 88,000 acre project	211,000	39,600
Total economic impact on state of Montana	527,500	99,000

Note: assumes multiplier of 2.5 used by Taylor and Reilly (1986).

The second reason expenditures are surprisingly high for block management is the unexpectedly high share of nonresidents. The historic Region 7 average is for about 20 percent nonresident hunters for both deer and antelope. Permission slip records for Region 7 block management indicate that nonresidents make up 68 percent of total hunters, or over three times the regional average. It appears that nonresident use is concentrated on block management because of information availability and assured access. Unguided nonresident expenditures per hunting trip (averaging about \$598 for the property) are about ten times higher than resident expenditures (\$72) per trip. Accordingly the nonresident hunter share is an important factor in showing block management related hunting expenditures being much higher than a similar sized area under lease hunting. It may be noted that average expenditure per guided hunter (including landowner exceptions at a ratio of one for every guided hunter) for the property are \$1968 per trip.

The influence of both hunter density and relative expenditures per hunter are summarized in Table B. Fee hunting in the Broadus area with low hunter density but high expenditure per hunter generates about \$295 in hunter expenditure per square mile leased. Block management in the Broadus area has lower expenditure per hunter, but supports many more hunters and generates \$1509 in hunter expenditure per square mile. The regional average is for intermediate hunter densities, but low expenditure per hunter (because only about 20 percent are nonresident hunters) and hunter expenditures per square mile of \$181. In the Broadus area, both fee hunting and block management are therefore more "productive" than the regional average as far as expenditure generated per square mile.

Net social benefits associated with the project are primarily in two categories: indirect values for habitat and wildlife preservation and direct use values. Indirect values refer to the desire of many individuals to protect valuable resources for their children, future generations, possibly their own future use, or just for the satisfaction that something valued is being protected. Indirect values associated with wildlife habitat preservation on the Brewer property are difficult to quantify but may lie in the range of \$750,000 to \$1.6 million (Table C). The lower end of the range is supported by the fact that The Nature Conservancy (TNC) showed considerable interest in purchasing the site to protect wildlife values. Since TNC funds all such purchases through voluntary donations, this is market evidence of indirect values associated with wildlife and wildlife habitat. The upper end of the estimate is based on economic survey studies that tend to show indirect values for recreational sites that are at least equivalent to the direct recreational use values. Such site-specific studies are the appropriate method for the problem of valuing indirect uses, but were beyond the scope of this particular project.

The present value of net social benefits associated with hunting under the DFWP plan is \$1.6 million (Table C). These values are based on detailed economic studies of Montana hunters using methodologies approved by the U.S. Water Resources Council for recreation valuation. The present value of net social benefits for the purchase alternative is \$419,000, including benefits to guided hunters and net income to landowners and outfitters. The net value used for guided hunts was adjusted upward by 30 percent (compared to the values used for the DFWP plan) to reflect higher success ratios, strong preferences for hunting, and typically higher income associated with this group of hunters.

Taken together, the value of wildlife habitat protection and open access hunting suggest total net social benefits in the \$2.3 to \$3.2 million range (Table C). Since the cost to DFWP is around \$1.2 million, these estimates indicate a favorable benefit/cost ratio for the proposed purchase. Given that there are negligible negative impacts on the local community, this project appears to be in the public interest.

From a distributive standpoint, it was found that the major beneficiaries of the proposed project are likely to be nonresident hunters. This may be viewed as an equitable arrangement in that most of the funds in the DFWP habitat acquisition budget come from increased nonresident license fees. Of the total approximately 6000 hunters using block management in this region in 1988, about 68 percent were nonresidents.

Much of the controversy related to the Brewer property acquisition seemed to have little to do with the kind of factual issues summarized above. Many individuals seemed to base their views of the issue on political principles or views of what is right. One principle often expressed was that individuals (including Bud Brewer) have "the right to sell to whoever they want". The opposing principle was that "the government shouldn't be

TABLE B
Region 7 Deer and Antelope Hunting - Montana
Relative Hunter Density and Expenditures
Block Management versus Fee Hunting

	hunters per sq. mile	sq. miles per hunter	expenditure per hunter (dollars)	expenditure per sq. mile (dollars)
Fee hunting	.15	6.7	1968	295
Block management	3.51	.28	430	1509
Region 7 average	.98	1.02	185	181

Notes: Fee hunter density based on outfitters in Broadus area. Block management based on average for 11 landowners in Broadus area. Regional average for hunter density is ten year historical average. Expenditure data derived from Brooks (1988) and Loomis (1988) and is updated to 1989 price levels. Fee hunting expenditure is per guided hunter and includes spending by one landowner exception for every two guided hunters. All expenditures assume one trip per hunter. Expenditure for Region 7 average is based on 73 percent deer hunters and 27 percent antelope hunters and 17.7 percent of deer hunters being nonresidents and 25.3 percent of antelope hunters being nonresidents.

buying up private land". There is little an economist can contribute to a discussion on this level, as the issues are more in the judicial or ethical realm.

The considerable controversy concerning the Brewer property also seems to reflect public concern with a more tractable but still complex general problem - that of managing hunting opportunities in Eastern Montana. Many seem to view the situation as one of inevitable conflict between fee hunting and open access. However, from the standpoint of economic theory, it appears that block management and fee hunting may be complementary approaches. The implication of this perspective for the allocation of hunting opportunities in Region 7 can be briefly outlined.

A fundamental economic problem arises when game is publicly owned (and managed) while land is private. This disparity in property rights leads to a situation where landowners are not compensated for costs they bear related to policing trespass, property damage and the general costs of dealing with hunters. When hunting pressure is very high, as it has occasionally been in Region 7 as a whole, the costs to the landowner may outweigh any benefits such as reduced game damage or the satisfaction of positive and long-standing landowner sportsmen relationships. Additionally, the landowner has no financial incentive to improve or protect wildlife habitat.

Both block management and fee hunting compensate the landowner. They differ in that block management typically compensates the landowner through a personal services contract for managing the hunters (policing trespass and giving permission and information). The hunting lease generally places responsibility for dealing with hunters on the outfitter, and more or less removes the landowner from contact with sportsmen. Additionally, the compensation under lease hunting is essentially for the right of access. However, the biggest difference between the two systems probably has to do with the hunting experience. Guided hunters have a higher probability of bagging trophy animals, are catered to in the field, experience much lower congestion, and are in an arms-length market relationship with the land owner. From the standpoint of economic theory, what is being observed is product differentiation, with block management and fee hunting serving somewhat different clients. It appears that more or less separate markets for at least two distinctly different types of hunts have emerged. If this is true, it is likely that the total social benefits associated with hunting in Region 7 would be maximized by a mix of the two management approaches.

This perspective raises the interesting allocative question of the optimal share of Region 7 land that should be in fee hunting versus block management. (Posing the question in this way is of course a simplification in that a third type of hunting is going on as well and that is the traditional situation where individuals hunt on private land with permission of the owner and often in a relatively uncongested setting. It also implies that currently closed land and publicly available lands are assumed to be a fixed constraint to the problem.) Although it is beyond the scope of this study to investigate this problem in detail, one can look at the statistics for the Brewer property to indicate what is happening at the margin. It appears that the demand for block management is so high that the expenditure and associated net social benefits far outweigh those for fee hunting on a typical property. This implies that it is socially beneficial to expand the block management program.

It is likely that the total demand for block management type hunting in Region 7 is more as less stable, being dominated by the spatial location of population centers vis-a-vis SE Montana and by the economics of travel and hunter participation rates. Accordingly, if more lands were included in the program, hunter densities would drop. This would also tend to raise the overall quality of the experience and perhaps tend to disperse nonresidents more broadly and entice greater resident hunter participation. Since hunter density and nonresident share are the key factors that effect the economic comparison of block management and fee hunting, eventually a breakeven point would be reached where the social returns to each were equal. At this point an approximately optimal allocation would hold. For example, with the average hunter expenditure levels used in this report, suppose that the nonresident share of hunters using block management declined from 68 percent to the regional average of around 20 percent. At this nonresident share, hunter expenditures are equal per square mile (or for a given ranch) if use density on block management drops to 1.6 hunter per square mile. It is considerably beyond the scope of this report to identify the amount of block management land needed for this situation to occur.

Table C
Summary of Annual and Present Net Values
Net Social Benefits Associated with
Management Alternatives on Total 88,000 Acre Project
(1989 dollars)

	DFWP Plan	No Purchase Alternative
A. Net Social Benefits - Annual		
Wildlife habitat protection	49,000 to 103,000	none
Hunting use	103,000	27,000
Total	152,000 to 206,000	27,000
B. Net Social Benefits - Present Value		
Wildlife habitat protection	750,000 to 1,588,000	none
Hunting use	1,588,000	419,000
Total	2,338,000 to 3,176,000	419,000

Notes: Present value derived based on the annual benefits into perpetuity and with a capitalization rate of .065 based on Widdoss (1988). Considerable uncertainty is associated with the wildlife habitat protection values, as indicated by the range of values.

I. INTRODUCTION, BACKGROUND AND METHODS

HB 526 as passed by the 1987 Montana legislature authorizes the Montana Department of Fish, Wildlife and Parks (DFWP) to acquire an interest in land for the purpose of protecting and enhancing wildlife habitat. Such interest can be gained by the purchase of leases, conservation easements or fee title. A fee title acquisition currently being considered by DFWP is the Brewer Ranch. The latter is a large cattle ranch located 25 miles northeast of Broadus, MT at Powderville (on the Powder River). The operational size of this unit is 34,341.76 acres including 17,845.76 deeded, 12,151 acres of BLM lease, 4,265 acres of State lease and 80 acres of private lease. The property and a preliminary management plan are described in DFWP's "Wildlife Habitat Protection Interim Report" (DFWP, 1989). A comprehensive real estate appraisal report has also been completed for the property (Widdoss, 1988).

The purpose of this report is to provide a social and economic impact analysis of the proposed Brewer acquisition as required by HB 720 (1989 Montana legislature). HB 720 basically requires an analysis of the following: wildlife populations and current use; the potential value of the land for protection, preservation and propagation of wildlife; management goals; impacts to adjacent lands; and significant potential social and economic impacts to local governments and the state including tax revenue, local government services, employment, schools, and impacts on private local businesses.

The approach taken in this analysis was to first identify major potential issues and impacts through discussions with agency personnel, local government officials, adjacent landowners and sportsmen. A list of individuals contacted in person or by phone is provided in Appendix A. This phase of the study also provided an opportunity to collect information on a variety of physical and social aspects of the purchase. The final study phase involved analysis and description of the major social and economic impacts.

The remainder of this report is organized in three major sections: description of the physical and institutional setting, identification of issues, and social and economic impacts.

II. PHYSICAL AND INSTITUTIONAL SETTING

A. PROPERTY DESCRIPTION

The Brewer Ranch is bordered on the north by the Powder River and lies basically on a northwest-southeast axis; it is 12 miles north to south and 8 miles east to west at the widest point. The topography includes 450 acres of terraced hay fields along the Powder, timbered and somewhat rough terrain in the center (the Pine Hills) and rolling grassland-sagebrush grazing land north and south of the Pine Hills. Widdoss (1989) concludes that the ranch has above average agricultural appeal due to the balance of the hay ground, river bottoms, Pine Hills and rough terrain for natural protection. Additionally, there are natural springs on the central and southern portions and seasonal runoff in Timber Creek and Stump Creek, which traverse the property. These same features provide for diverse and potentially abundant wildlife populations.

B. HABITAT AND WILDLIFE POPULATIONS

DFWP biologists in Region 7 have ranked the Brewer Ranch as their highest priority for habitat acquisition. The most important and productive wildlife habitat in SE Montana is sagebrush-grassland. The Brewer Ranch provides an example of this habitat type which is in at least "fair" condition (DFWP, 1989) - having not been heavily overgrazed. Additionally, while much of the sagebrush habitat in Region 7 has been removed or altered, the Brewer property has never been "sodbusted". The property provides habitat principally for mule deer, antelope and sage grouse, but also supports white-tailed deer, turkey and sharp-tailed grouse. DFWP (1989) notes that numerous prairie dog towns on the property may also support the black-footed ferret. At present mule deer and antelope populations are estimated at about 5/square mile for each species.

While not well-documented in the Department's interim wildlife habitat protection report, it is apparent that DFWP biologists view the sagebrush-grassland habitat type as both important and threatened. Martin (1989) has summarized some of the scientific literature relating sagebrush and wildlife, the actual extent of

this habitat type and the magnitude and significance of sagebrush control projects. The importance of tall sagebrush for wintering antelope and deer is well-known. Risdahl (1989) states that the sagebrush-grassland habitat type has been officially determined to be the most threatened habitat type with regard to upland game bird species in Montana by the state (DFWP) Bird Management Committee. The sage grouse is, of course, totally dependent on the sage habitat.

With regard to vegetation and plant communities in general, no documentation was made available concerning species diversity, or rare or endangered species. There is however some anecdotal information that the property may have some unique qualities in this regard. Bud Brewer related a story about a range expert who had been on the Brewer Ranch and reportedly found "grasses that I thought were gone out of this country". Brewer also noted the same balance with regard to topography that Widdoss (1988) comments on. Brewer stated that they have been able to winter cattle without feeding hay in all but 3 of the last 20 years.

C. CURRENT USES

The Brewer property is a working cattle ranch and has been in this use for around 80 years. Widdoss estimates the carrying capacity of the ranch at 1000 AU's. Currently the unit is leased on various year-to-year leases to local operators. The 450 acres of bottom hay land has historically produced 750-800 tons per year.

The major use of the ranch's wildlife resources is for hunting. An aspect of this case is that the access to the BLM and state leased land is possible through the private sections. Brewer was one of the initial participants in DFWP's Block Management program in Region 7. Brewer is a long-time hunter himself and values the tradition of hunting as a family activity. Brewer is interested in selling to DFWP in part because of his desire to benefit the public with free open-access hunting. In discussions with Brewer, it is apparent that the traditional sportsman-landowner relationship has been a positive and important part of his life. DFWP records (permission slips) indicate that in 1988, 203 individuals hunted on the Brewer property. This includes 65 Montana residents and 138 nonresidents.

D. MANAGEMENT ALTERNATIVES

As described in greater detail below, basically four alternatives for the Brewer property have been identified by DFWP administrators:

- 1) DFWP purchase and exchange for conservation easements
- 2) no purchase
- 3) DFWP purchase of fee title
- 4) DFWP purchase with BLM land exchanges

Alternatives 1) and 2) are extensively analyzed in this report. Alternative 3) differs from 1) only in scale; alternative 3) is limited to Brewer's 34,342 acre operational unit, while 1) assumes an eventual total of 88,000 acres with conservation easements in place. Typically in the quantitative analysis below, estimates are provided both for the Brewer property and for the larger 88,000 project. The documentation available on alternative 4) is insufficient to provide even a cursory discussion at this point.

DFWP Purchase and Exchange

Alternative 1) is detailed in DFWP (1989). The basic idea is that DFWP would purchase the property (apparently for the assessed value of \$1.1 million) and encumber the base property with an easement. The encumbered property would be traded to adjacent landowners in exchange for a conservation easement on their property. The principle terms of the conservation easements are defined in DFWP (1989) as:

- 1) No farming (or sod-busting), except for existing hay base
- 2) Grazing under a rest-rotation grazing system (include range monitoring)
- 3) Managed public access during hunting season
- 4) No commercial developments

An additional specific term that has been discussed is:

- 5) Control removal of sagebrush

As further described by Arnie Olson at the Montana Fish and Game Commission meeting of March 9, 1989, the management plan would be implemented over a course of perhaps 10 years. Initially a three pasture rest-rotation grazing system on the property would be established and designed through consultation with a range specialist. The grazing system would be coordinated with the Department of State Lands and BLM and utilize neighboring landowner's cattle. Over a three year period short term leases or agreements with adjoining landowners would be developed relating to improvement of riparian areas, maintaining and enhancing sage brush, more tolerance of game damage, no additional sod busting and access for hunters under a block management system. As noted by Olson: "This time period would build rapport between the department and the involved landowner and each would be able to assess if a long-term conservation easement system would work." Beyond a five year time period, long-term or perpetual conservation easements would be formalized. Neighboring ranchers would acquire fee title on the Brewer property and thus additional grazing for their livestock. DFWP would divest itself of the property, but assure the management goals of habitat protection through the conservation easements.

Given that this is a complex and innovative proposal, it is useful to at least briefly comment on feasibility. The innovative elements are the rest-rotation grazing system and the conservation easements. First, with regard to rest-rotation, DFWP is developing experience with this system on the 23,000 acre Mount Haggin Wildlife Management Area near the town of Anaconda. Following Hormay (1970), the basic idea is that by timing grazing to coincide with seed production, livestock activity tramples seeds into the soil. Following this treatment with a year of no grazing allows the plants to establish root systems and grow. Mike Frisina, the range scientist at Mount Haggin, has authored papers (including Frisina, 1986) that indicate that cattle grazing is actually beneficial (complimentary) to elk at this site. The rest-rotation cycle also appears to benefit other species, including (at Mount Haggin) greater sandhill cranes (Frisina and Canfield, 1987). Rest-rotation is also being demonstrated at the Fleecer Elk Winter Range (Frisina and Morin, 1988) and at the Wall Creek Allotment (Brannon, 1989).

These rest-rotation experiments indicate that the system is feasible to implement, even where more than one rancher is involved in the lease. The specific quantitative impacts for vegetation and wildlife in a setting like the Brewer Ranch (cattle with mule deer and antelope in a sagebrush grassland habitat) are, however, apparently difficult to predict. Olson (in commission minutes) notes that among other things, three cycles of rest/rotation grazing should result in increased reproduction of several deciduous shrubs such as snowberry, rose and willow. It does appear safe to assume that the current level of livestock operation (1000 AU's) will be consistent with DFWP's habitat protection plan.

The feasibility of conservation easements has also been demonstrated in Montana. The Montana Land Reliance (Helena) is one of the leading land trusts in the nation, with 24 conservation easements over 21 ranches and 56,000 acres. The details of the easement procedures are described by Konigsberg (1984). DFWP has worked with Bruce Bugbee, a consultant based in Missoula, in preparing a brochure on conservation easements. Adjacent landowners appear to be generally receptive to the idea despite the fact that the easement terms have only been rather vaguely described to date. Obviously a specific model easement needs to be drawn up and appraised at some point.

In order to analyze the social and economic impacts of alternative 1), it is necessary to have some idea of the total final scale of the land under easement. This requires knowing the terms of trade of the easement encumbered fee title on the Brewer property for easements on adjoining land. Because DFWP has not drafted a model conservation easement and has not had the value of these easements appraised, it is somewhat difficult to quantify the likely terms of the trade. Discussions with knowledgeable individuals indicate that easements with provisions described above may reduce the market value of the land by up to 20 to 30 percent. The reasoning is as follows. The value of an easement depends on the value of the prohibited uses. For example, the standard no subdivision (or no commercial development) provision may be costly on a property adjoining the Madison River. However, given access and location, this does not appear to be a plausible use in Powderville (see also Widdoss, 1988). The main commercial value foregone in this case is probably fee hunting. Estimates of the value of a lease on the Brewer Ranch from two outfitters in the Broadus area ranged from \$5000 to \$7000 per year. Using Widdoss's capitalization rate of .065, this implies a drop in market value per acre of \$4.31 to \$6.03 or 8 to 11 percent on a per acre value for the Brewer property of \$55.27.

While the real cost of the easement may be around 10 percent, market negotiation may push it to 20 to 30 percent. One factor is the perceived cost of having the government as a partner in perpetuity. Assuming that the easement reduces the market value of Brewer's land by about 25 percent (is worth about \$14 per acre), fee title of the encumbered base property (now worth \$41 per acre) could be traded for a similar easement on about three acres. This assumes similar easements and similar values on the adjoining land. Under these assumptions Brewer's 17,846 deeded acres could be traded for easements on 53,538 acres. Counting the public lands accessed through Brewer, this makes for a potential 88,000 acre project under Alternative 1).

As noted in DFWP (1989), the project could conceivably be even larger. There is a possibility that other adjoining landowners may be willing to donate conservation easements under a provision of the 1985 Farm Bill. The latter provides for financially stressed landowners to restructure their debt by donating a conservation easement to a qualifying organization or agency. While some adjacent landowners are reportedly interested in this possibility, there is insufficient information to formally incorporate additional specific lands in the analysis. Additionally DFWP has noted the potential for coordination with BLM in providing access to large blocks of unavailable public land. This also remains unquantified.

No Purchase Alternative

The no purchase alternative also requires some assumptions since management can vary depending on the specific buyer. For purposes of this report, I have relied on the Widdoss appraisal as to the property's highest and best use. Quoting from the appraisal (p. 18):

In considering the highest and best use of the property, I gave consideration to its current use, historic operation, and uses to which the ranch was capable of being adapted. The single most important factor relates to the attitudes of typical investors for a property of this type and this particular locale. The subject property is located approximately 25 miles northeast of Broadus in a remote area of Montana. The limitations imposed by access, length of growing season, and larger size are all viewed as factors in light of the real estate market...It is my opinion, the subject would be one of the primary choices of a prospective buyer given the property mixture, i.e., hayland to grazing ratio, natural shelter, water, and improvement ratio.

I have also considered the recreational aspects of the property with regard to hunting. Upon inspection, I observed a large herd of antelope and over one hundred deer along Powder River, Pine Hills, and rougher portions of the ranch. Given the access and deeded land orientation, the ability to charge for hunting rights would appear feasible.

In summary, the most probable use for the property is agricultural purposes stressing a livestock grazing operation with limited recreational overtones. There is no demand or any other form of use for the property in the foreseeable future. The most profitable and likely use of the property is as a livestock ranch with marketing of fall hunting rights.

Mr. Widdoss was also contacted to discuss the specifics of the likely ranch operation. Issues were the extent to which another owner/operator might deviate from the way Bud Brewer has managed the ranch. With regard to sod-busting, Widdoss's opinion was that current government incentives made it unlikely that any would occur in the near future. Additionally, he felt that most of the Brewer property was too rough for sodbusting. He also thought that extensive sagebrush control on the property was unlikely, given the cost and return from spraying. He did say he would like to see more sagebrush control on the property. The hay operation would require some equipment, including a swather, baler, rake, stackhand and tractor. This equipment new would cost around \$100,000 but Widdoss felt that good used equipment could be had for around 25 cents on the dollar or \$25,000.

Comparison of Alternatives

The major outcomes of the two alternatives described above can be summarized as follows:

1. Livestock operation. Both alternatives envision the basic ranching use of the property with 1000 AU's to continue.

2. Personal property. An owner operator may invest in additional equipment for haying. However, the same may be said of the future owner under the DFWP exchange plan. A 450 acre haying operation would require a certain amount of dedicated equipment.

3. Habitat protection. Except for the open access provision, all of the key terms in the conservation easement are oriented to protect habitat: no sodbusting, limit sagebrush control, no commercial development, rest rotation and range monitoring. The difference (except for rest rotation) is one of degree. The easement protects the habitat with virtual certainty for perpetuity. The alternative of no purchase entails a possibility of habitat degradation: sod-busting, sagebrush control, and possibly overgrazing. The likelihood and extent of this degradation is difficult to quantify. A major clear difference in the two alternatives with regard to habitat protection has to do with the rest-rotation system. It appears that this should be regarded as a promising experiment as far as presently quantifiable differences for this specific habitat and species mix.

4. Hunting. The DFWP exchange would result in public access; following Widdoss's assessment, it is assumed that purchase by a private party would result in a fee hunting operation.

III. ISSUES AND CONCERNS

A large number of individuals were contacted for their views on how the Brewer property acquisition would impact them or their community. The purpose of these discussions was not to poll public opinion, but to identify issues and concerns that should (and hopefully could) be quantified in the social and economic impact assessment. One general finding was that there was a good deal of misunderstanding and uncertainty about DFWP's actual plans. The discussion here is organized around the general type of issue or argument identified; these include ethical or political principles, actual losses or gains, and distributive issues.

A. POLITICAL OR ETHICAL PRINCIPLES

Many individuals who perceived that they would not be directly impacted by the proposed purchase nonetheless had strong feelings about it. This stemmed from their feelings about what was right or ethical. For example, one adjacent landowner, Nellie Howell, stated "a person has a right to sell to whoever they want". Many people expressed this view. Nellie didn't seem to think she would be in any way affected by the purchase, and seemed to make up her mind in favor of the purchase totally on principle. The other principle commonly expressed led to an opposite stand: "the government shouldn't be buying up private land". For example, this was the view of the county commissioners contacted (including Gerald Himelspach, Brooks Study and Ted Fletcher of Powder River County and Milton Marcuson from Carter County). The commissioners also felt the county had a direct interest in what they perceived to be a likely reduction in taxable value. Obviously these two principles are at odds. Some individuals, for example Doug Gardner (a rancher and partner in Powder River Outfitters) seemed to believe both principles were valid, but (in Doug's case) the opposition to government purchase was judged to be more important.

There also seemed to be some consideration of principle with regard to fee hunting. Some land owners seem to feel it isn't "right" in some sense, perhaps because it violates tradition. Similarly sportsmen spoke of the "right" to access public lands, which may conflict with the landowner's property rights concerning trespass.

Ethical or political principles are appropriate and important considerations in public policy decisions. They also happen to be on a level separate and distinct from an economist's calculations. These specific principles are mentioned here because they were often referenced and seem to explain the specific stands taken by many individuals.

B. LOSSES OR GAINS

A common reaction to the proposed purchase was that individuals didn't really expect it to directly impact them at all. For example, Earl McGill, an adjacent landowner, commented that he didn't think the purchase would have significant local impacts, but that he generally favored it because of his views on fee hunting. However, some local landowners, such as Dan Denson, who lives on the road between Powderville and

Broadus, expected that permanently opening the Brewer property to public access would lead to a lot of traffic and trespass on his own place. Most of the adjacent landowners seemed to be neutral to or favor the purchase. Some see the possibility of trading for additional grazing and others may be interested in a conservation easement donation under the 1985 farm bill.

One adjacent landowner that is somewhat opposed to the purchase is Charlie Miles. This seemed to be partly on principle of opposing additional government ownership. He also seemed concerned about the sale lowering market values.

Outfitters contacted included Doug Gardner of Powder River Outfitters and John Stuver of Cedar Breaks. Both outfitters contacted were opposed to the purchase. Gardner didn't see himself or his business being directly affected, but (as mentioned) opposed it on principle. Stuver leases hunting rights on at least one ranch adjoining Brewer, Mike Leemaster's place. Stuver expects that open access on the Brewer property would lead to additional policing costs and trespass on lands he has leased. He stated that if there was a guarantee of no trespass he would be neutral to the purchase. (It should be noted that the trespass issue cuts both ways in that some landowners alleged instances of trespass on the part of outfitters.) Should Leemaster participate in an exchange, Stuver would additionally bear the costs of relocating his hunting camp; he estimated the cost of moving at \$3000.

As noted, the Powder River County commissioners opposed the purchase in part because of the potential for removing property from tax rolls or causing reductions in taxable values. In a letter to the Billings Gazette, the commissioners noted "If this property is taxed at the reduced value" (reduced by 25 percent due to the easement) the taxable value in their county would decline by \$20,151.25 and property tax revenues by \$2522.66.

Business people in various communities were also contacted. In Ekalaka, motel owners and retailers seemed to expect little or no impact on their businesses. However in Broadus, a motel owner (Jean Hough) and a restauranter (Chuck Millar) both indicated that fee hunting in the area had considerably reduced their sales during hunting season. Jean Hough tabulated her occupancy rates for 1975 to the present for the period from the start of deer season to around November 15. She found that occupancy was at 95 to 100 percent through 1978, but declined dramatically in 1979 to 65 percent and has averaged 69 percent to present. Both Hough and Millar felt this was for two reasons. Guided hunters had leased a lot of property around Broadus and greatly reduced the total number of hunters in the area. Additionally the outfitted clients do not stay in town but are rather catered and lodged on the hunting sites. However, Jean Hough noted that her occupancy rates may also have been affected by competition from new motels, the decline of the oil industry in 1985, etc.

Although a statistical analysis of Hough's data has not been undertaken, the decline in occupancy does not appear to be due to the cycle of Region 7 hunting pressure. For example, the number of total deer hunters in the region actually was at a low of 15,766 in 1976 and increased steadily to 39,365 hunters in 1983. The difference between Ekalaka and Broadus may have to do with the relative availability of public land (there is some Custer National Forest land just south and east of Ekalaka) or the pattern of where hunting leases are located.

Sportsmen contacted, such as Paul Berg of Billings, were concerned with the loss of hunting opportunity for the average hunter as more land was being leased for fee hunting. The Brewer purchase was perceived as a gain in hunting opportunity for most hunters.

C. DISTRIBUTIVE ISSUES

Aside from the total gains and losses associated with purchase of the Brewer property, there is concern over how those gains and losses are distributed among various groups or individuals. Doug Gardner raised several distributive issues. One was that DFWP habitat acquisition funding under HB 526 was raised almost entirely by increases in nonresident hunter license fees. He viewed the Brewer purchase (and perhaps block management approach to access in general) as mainly benefiting resident hunters. Gardner thought that it was unfair or inequitable that nonresidents were being "taxed" to improve hunting for residents.

Gardner also was concerned that provisions for donation of easements in the 1985 Farm Bill would ultimately be paid for in higher interest charges for farmers and ranchers who were no better off on average than the financially distressed operation making an easement donation.

The previously mentioned losses to Broadus businesses also raises a distributive issue. While businesses in the local community may be worse off due to fee hunting, the latter does provide income to ranchers and employment for guides, outfitters and individuals catering the food and lodging on the hunting site.

A distributive issue raised by sportsmen and some landowners was that fee hunting is expensive and limits the hunting opportunity in some areas to those with high incomes. The latter may be typically from out of state; some resident hunters see this as being unfair.

IV. SOCIAL AND ECONOMIC IMPACTS

The preceding sections identified the major physical and social consequences associated with the two main future management alternatives for the Brewer property. As compared to the "no purchase" alternative, purchase by DFWP and trading for easements mainly prevents degradation and likely provides improvement in wildlife habitat. Additionally DFWP purchase leads to open access (as opposed to fee) hunting. This section quantifies the social and economic impacts of the two alternatives following three basic accounting stances: financial, expenditures, and net social benefits. The discussion of financial impacts is from the narrow standpoint of anticipated changes in actual cash transactions for the initiating agency, DFWP. Comments on financial impacts to local governments are also included. Expenditure analysis identifies changes in cash transactions throughout the economy. Expenditures provide the basic data for analyzing impacts on the local economy in terms of income and employment. Net social benefit analysis measures the net gains and losses throughout the economy including nonmarket changes. The latter is the perspective required by applied welfare economics (benefit/cost analysis) and the approach here is consistent with federal standards for this type of analysis (for example, U.S. Water Resources Council, 1983).

A. FINANCIAL IMPACTS

The main financial impacts on DFWP are the purchase price of the property (\$1.1 million) and the administrative costs associated with implementing the management plan. The latter are estimated in DFWP (1989) at \$10,000/year for year 2 through 20 of the plan. The initial year startup costs are \$30,200 including the design of the rest-rotation grazing system and purchase transaction costs (title insurance, etc.). There are undoubtedly additional administrative costs associated with the evaluation of the purchase decision which have not been quantified. On the revenue side, it is doubtful that this project in and of itself will impact DFWP revenues - for example related to license sales. However, in the long run and as a demonstration project, it is conceivable that the total number of hunters supported by Region 7 could be influenced. This is difficult to quantify.

Potential financial impacts to local governments are limited to changes in taxes. The property is located at the intersection of three counties, with 241.70 acres in Custer, 6,726.76 acres in Powder River and 10,877.30 acres in Carter (Widdoss, 1988, Addenda). Total assessed value is \$51,759 and 1988 taxes paid were \$1457.77 to Powder River, \$70.90 to Custer and \$2800.68 to Carter for a total of \$4329.35. As noted previously, the Powder River Commissioners estimated a potential loss of \$20,151.25 on taxable value and \$2,522.66 in property tax money for Powder River County assuming 80,000 acres of land with conservation easements. The commissioners other key assumption is that the property would be taxed at a reduced value of 25 percent.

Conversations with county assessors and individuals knowledgeable in the tax area indicated that it is very unlikely that the property would be taxed at a reduced value due to an easement. The main reason is that agricultural land in Montana is taxed based on a production base system (AUM's or bushels/acre, for example). The DFWP proposal does not envision reducing the livestock operation. If anything, the rest-rotation system is intended to increase the productivity of the land. Tax records were examined in detail for the Carter County, where the largest share of the Brewer property is located and where the most taxes are paid. These records

are provided in Appendix B. Most of the Brewer property is in classed as Grade 3 or Grade 4 grazing land. For example, based on the Montana Department of Revenue Agricultural Land Classification system, Grade 3 is land that requires 28 to 37 acres over a 10 month grazing season to support a 1000 pound steer or equivalent (Appendix B). This converts to .27 to .357 AUM/acre, which is in the range of the production assumption used by Widdoss (1988) in his appraisal of Brewer's rangeland. The state requires that this grade be assessed at \$3.72 per acre. This productivity is unchanged by a conservation easement with the terms described above.

Accordingly, for the tax reduction envisioned by the county commissioners to occur, two things would have to happen. The first is that the state would have to change from a production base to a market value assessment system. It is highly speculative to assume that this will happen. Secondly, even under a market assessment system, one would need comparable sales records for properties with and without easement. Comparisons that could withstand legal challenge may be difficult to obtain.

Relatedly, for the period that DFWP owns the land, Montana code (Section 87-1-603, also in Appendix B) requires that DFWP pay the county "a sum equal to the amount of taxes which would be payable on county assessment of the property were it taxable to a private citizen". This payment in lieu of taxes provision seem quite clear and appears to guarantee the counties no change in taxes under the proposed management plan.

Discussions with county commissioners raised another tax concern, that if another private party owned the property they would have additional equipment for haying. As noted above, it does appear that an owner-operator would require dedicated equipment for the 450 acres of hay bottoms. However, this holds equally for the owner-operator under the "no purchase" alternative as well as the owner-operator envisioned to acquire the property through a conservation easement exchange.

It appears safe to conclude that the DFWP purchase would not reduce county taxes. Under either main alternative taxes may increase due to additional equipment. Under the DFWP purchase there is at least a possibility of increased productivity due to rest-rotation and associated changes in land classification. Additionally, adjoining ranches that trade easements for grazing land may enjoy increased financial stability that would ultimately provide more security for the county tax base. The potentially increased financial stability could arise from larger economic unit sizes.

A final tax consideration relates to taxes on economic activity associated with the alternatives. As developed below, there is considerably more gross expenditure associated with the DFWP purchase alternative. This translates into taxes related to income and employment such as the state income tax and the bed tax on motel lodging. These tax considerations are of a second order of magnitude and have not been calculated here.

B. EXPENDITURES

As measured by expenditures, by far the major activity on the property is the livestock operation. However, as noted above, there is no expected difference with regard to livestock numbers between the "no purchase" and DFWP plan. The main differences between the two alternatives with regard to expenditures have to do with the management of hunting. In order to quantify these differences, it is necessary to develop estimates of the total number of hunters, the distribution of total hunters among residents and nonresidents, and expenditures for both guided hunters (under a fee hunting system) and for hunters attracted to open access sites.

Hunter Densities Under Management Alternatives

With regard to total hunters and hunter densities, it is useful to begin with historical averages for Region 7 (basically Southeastern Montana). Table 1 shows approximately 16,500 deer hunters and 15,000 antelope hunters used this region for the most recent year with complete data (1988 and 1987 respectively). This amounts to about .50 hunters per square mile for the region, with 18 percent of deer hunters being nonresidents and 25 percent for antelope hunters. A hunter density of .50 per square mile over a season is considered "light" hunting pressure. Looking at historical data, antelope hunters are at an all time high for

TABLE 1
Montana - Region 7
Total Deer and Antelope Hunters and Hunter Density

Category	Deer		Antelope	
	Hunters	Density	Hunters	Density
A. Most Current				
1988	16,449	.51		
1987			15,015	.47
B. Recent 10-Year Average				
1979-1988	23,174	.73		
1978-1987			8,401	.27
C. Historic Low				
1976	15,766	.49		
1979			2,067	.06
D. Historic High				
1974	51,239	1.60		
1987			15,015	.47

Notes: Data provided by Candy Post, DFWP Research Bureau, Bozeman. Density is in hunters per square mile. Region 7 size is 31,953 square miles. Nonresident use for 10-year average for deer is 17.7 percent; for antelope is 25.3 percent.

the postwar period; the average for the most recent 10 years is 8,400 hunters or a density of .26. The low point for antelope hunting was 1979 when only 2067 hunters were afield in Region 7 (density of .06).

Deer hunting is currently at a low point (close to the recent historic low of 15,800 hunters in 1976 and a density of .49). The recent 10 year average is .73 hunters per square mile or 23,200 hunters. The historic high is three times the present with 51,239 hunters in 1974 or a density of 1.60 hunters per square mile. Populations and associated hunting pressure are extremely cyclical in Region 7 due to weather, disease and the exposure of a prairie environment.

Average success in Region 7 for 1987 is 66 percent for deer hunters and 75 percent for antelope hunters. Nonresidents tend to have slightly higher success. For antelope nonresidents average 3.63 days per hunter and residents 2.87. Deer hunters average 4.5 days per hunter for both residents and nonresidents. Regional averages give a perspective on hunter densities and success; however, use is by no means evenly distributed over the region. Accordingly, densities specific to the Brewer property need to be estimated for both the DFWP plan and for the no purchase (fee hunting) alternative.

The Brewer property is currently under block management, which is the proposed system for managing open access under the DFWP plan. Under block management the landowner typically gets a personal services contract from the department (often around \$1000 per year) as compensation for policing trespass and writing permission slips. The landowner retains total discretion regarding who hunts and when. Alternatively, DFWP will assign field personnel to handle trespass and permission (.6 FTE among six individuals was paid in Region 7 in 1988).

As noted, in 1988 203 hunters used the Brewer property or 3.78 hunters per square mile (including the BLM and state lease). Since this includes both deer and antelope hunters, it should be compared to the sum of deer and antelope hunter densities for the region, which is about 1.0 hunter per square mile. This shows that the hunter density on Brewer's place at present is about 4 times the regional average. In order to see if this was typical for block management, the average for the regional program was also calculated (Table 2). In 1988,

TABLE 2
Montana - Region 7
Block Management Characteristics for 1988

Characteristic	Measure
Total acreage	1,329,280
Total square miles	2,077
Number of land owners participating	62
Harvest	
Antelope	2,250
Deer	3,960
Turkey	200
Number of Hunters	
Resident	1,913
Nonresident	4,087
Total	6,000
Hunters per square mile	2.89

Source of data: Greg Risdahl, Montana Department of Fish, Wildlife and Parks, Broadus.

approximately 6000 hunters hunted on 1,329,280 acres in Region 7 block management or 2.89 hunters per square mile. Nonresidents made up 68 percent of all hunters or about three times the proportion of nonresidents in the entire Region 7 hunter population. Block management areas appear to attract a disproportionate share of nonresidents because information on access is available and access can be obtained. Locals and other residents are more likely to know what areas are open to hunting outside block management or to have long-standing relationships with landowners.

The Region 7 block management program includes 62 landowners; statistics were also developed (Table 3) for a subsample of 11 landowners located in old deer hunting districts 773, 781, 790 and 791 (essentially the area south and east of Broadus and Ekalaka and including the Brewer property). For this area 160,000 acres were in block management and supported 878 hunters of which 68 percent were nonresident. The average hunter density was 3.51 per square mile. These statistics indicate that the densities and nonresident share on the Brewer property are typical of block management in this area. Detailed origin data was tabulated for 10 of the 11 landowners. Nonresidents were from 23 states ranging from California to New York to Alabama; however, the majority (55 percent) were from Wisconsin or Minnesota. A little more than half the residents were from local towns (Alzada, Broadus, Ekalaka, Baker and Biddle). The remaining 45 percent were from a considerable distance including Butte, Bozeman, Billings, Stevensville, Philipsburg, Missoula, Twin Bridges, etc.

TABLE 3

**Block Management Characteristics - 1988
for Region Defined by Hunting Districts 773, 781, 790 and 791**

Characteristic	Measure
Acreage	160,000
Square miles	250
Cost to DFWP	\$10,850
Number of landowners participating	11
Harvest	
Antelope	579
Deer	329
Turkey	29
Number of hunters	
Resident	280
Nonresident	598
Total	878
Hunter days	3,282
Days per hunter, average	3.74
Hunters per square mile	3.51

Source of data: Greg Risdahl, Montana Department of Fish, Wildlife and Parks, Broadus.

Densities on outfitter leased lands in the Broadus area were estimated based on interviews with two local outfitters, John Stuver of Cedar Breaks Outfitters and Doug Gardner of Powder River Outfitters. Gardner's business has approximately 400,000 acres leased. Based on the ratio of fee title lands to access controlled public lands on his own ranch (about 4:1), he estimates his total hunting area with more or less exclusive access at about 500,000 acres or 781 square miles (Table 4). His total number of clients averages about 100 per year (mostly deer and antelope hunters) of which 100 percent are nonresidents. This implies a hunter density of .128 per square mile. The regional (combined deer and antelope) average hunter density is about 10 times this and the density on block management is over 25 times as high. Gardner's clients pay around \$1500 for a five day hunt, with prices varying slightly depending on the ratio of hunters to guides (2:1 or 1:1).

TABLE 4
Characteristics of Hunting Leases and Outfitted Hunting
in the Vicinity of Broadus, Montana

Characteristic	Outfitter	
	Powder River	Cedar Breaks
Approximate acres leased		
private	400,000	170,000
adjacent public	100,000	43,000
total	500,000	213,000
Square miles leased	781	333
Approximate number of guided hunters per year	100	55
Guided hunters/square mile	.128	.166
Percent of hunters that are nonresident	100	95
Guiding fees		
5 day combination hunt	\$1500	
6 day combination hunt		\$1800
3 day trophy antelope	\$800	
4 day trophy antelope		\$950
5 day trophy deer		
1 on 1	\$1550	
2 on 1	\$1400	\$1500

Source of data: interviews with Doug Gardner and John Stuver; business brochures and rate sheet.

Basic statistics for Stuver's operation are similar, though on a smaller scale. Stuver has 170,000 acres leased and it is assumed that the ratio of closed access public is the same as for Gardner. Stuver's guided hunter density is estimated at .166, which is similar to Gardner's.

Estimated hunter use of the Brewer property is summarized in Table 5. The block management alternative is based on the current actual of 203 hunters of which 68 percent are nonresident. The fee hunting alternative is based on a density of .15 hunters per square mile, which implies a total of 8 guided hunters, all of whom are assumed to be nonresidents. Additionally Gardner noted that often landowners will want exceptions in the hunting lease to assure hunting privileges for themselves, family or friends. Gardner estimated that there may be as many as one exception for every two guided hunters. This implies another four hunters under the fee option, all of whom are assumed to be residents. These exceptions may include residents that Gardner guides during the late season to kill does on their A tags. Advertising locally and offering free guiding, Gardner got 65 hunters to shoot does on his leased land in 1988.

Stuver, who has hunted some on the Brewer property, was also asked how much hunting his clients would do on that property if he held the lease. He estimated 40 to 45 days. If most hunts are 5 day, this is consistent with the 8 guided hunter estimate.

Hunter Expenditures

Estimated hunter expenditures are summarized in Table 6. License fees are actual for 1989 and guide fees are based on Gardner's and Stuver's fee schedules for 1989. Other hunter expenditures are based on a survey of Montana hunters (Brooks, 1988; Loomis, 1988) undertaken by DFWP in 1986. This survey collected data on hunter expenditures for transportation, lodging, meals and other expenditures on a per trip basis for the

TABLE 5
Estimated Hunter Use on Brewer Property
Under Management Alternatives

Management	Resident	Nonresident	Total
A. Block Management			
Number of hunters	65	138	203
Hunters per square mile			3.78
B. Fee Hunting			
Number of hunters			—
Guided		8	8
Exceptions	4		4
Total			12
Hunters per square mile			
Guided			.15
Exceptions			.07
Total			.22

fall of 1985. Original estimates were inflated from October 1985 to March 1989 price levels based on the consumer price index. For deer hunters, the estimated expenses for residents total \$70.94, for unguided nonresidents \$759.14 and for guided nonresidents \$2259.14. For antelope hunters, the three categories are \$73.52, \$436.53 and \$1386.53 per trip respectively. Incorporating the full cost of hunting licenses for nonresidents is appropriate as most make only one trip per season; this same convention was used for residents and slightly overstates their total expenses.

No other source of detailed expenditure information specific to Montana deer and antelope hunting is currently available. However, expenditures for all guided and unguided nonresident hunters were estimated by Taylor and Reilly (1986) also based on the 1985 season. This study, commissioned by the Montana

TABLE 6
Montana Deer and Antelope Hunter Expenditure per Trip
(1989 dollars)

Expenditure Type	Resident	Nonresident	
		Unguided	Guided
A. Deer Hunting			
Food, lodging transportation	61.94	559.14	559.14
Licenses	9.00	200.00	200.00
Guide			1500.00
Total	70.94	759.14	2259.14
B. Antelope Hunting			
Food, lodging transportation	65.52	314.53	314.53
Licenses	8.00	122.00	122.00
Guide			950.00
Total	73.52	436.53	1386.53

Source of data: Brooks (1988); Loomis (1988); outfitter rate sheets.

TABLE 7

**Total Expenditures Per Year Related to Hunting
on Brewer Property under Varying Management Alternatives
(1989 dollars)**

Alternative	Resident	Nonresident	Total
A. Brewer 34,342 Acre Property Under Block Management			
1. Deer hunting			
Number of hunters	33	69	102
Dollars/trip	70.94	759.14	
Total expenditures	2,341	52,381	54,722
2. Antelope hunting			
Number of hunters	32	69	101
Dollars/trip	73.52	436.53	
Total expenditures	2,353	30,121	32,474
3.Total expenditures	4,694	82,502	87,196
B. Fee Hunting on Brewer Property			
1. Deer hunting			
Guided			
Number of hunters		5	5
Dollars/trip		2259.14	
Total expenditures		11,296	11,296
Exceptions			
Number of hunters	3		3
Dollars/trip	70.94		
Total expenditures	213		213
2. Antelope hunting			
Guided			
Number of hunters		3	3
Dollars/trip		1386.53	
Total expenditures		4160	4,160
Exceptions			
Number of hunters	1		1
Dollars/trip	73.52		
Total expenditures	74		74
3.Total expenditures	287	15,456	15,743

Outfitters and Guides Association, shows nonresident guided hunters spending \$2878 per trip and unguided hunters spending \$1391. These estimates are probably most representative for elk hunters, which comprised the greatest share of guided hunts in Montana in 1985.

By comparison, the same DFWP survey referenced above was also tabulated for elk hunters (Duffield, 1988) and showed a total of \$2565 for guided nonresident elk hunters. This is about 10 percent lower than the Taylor and Reilly estimate of \$2878, but certainly in the same range. The difference may not be statistically significant. For example, Taylor and Reilly estimated the average guide fee at \$1507, while the DFWP study showed \$1430. However, a 95 percent confidence interval on the latter is plus or minus \$217 around the mean or \$1196 to \$1630. This range includes the Taylor and Reilly estimate. To conclude, the expenditure information appears generally consistent with other sources.

Total hunter expenditures per year for the two management alternatives on the Brewer property are summarized in Table 7. It is assumed that each hunter has made one trip to the property for hunting purposes. Since the block management data for the area shows 3.7 days per hunter, this is probably appropriate. Lacking more specific information, it is assumed that half the hunters under block management are antelope hunters and half are deer hunters. For the guided hunters, it is assumed that 5 are hunting deer and 3 antelope. In both cases there are undoubtedly hunters hunting both species; information on the share of combination hunts was not available and would in any case have little effect on the results. Total expenditures under the DFWP plan is \$87,196 per year, almost 95 percent of which is due to nonresidents. Expenditure under fee hunting is \$15,743 of which 98 percent is by nonresidents.

The DFWP plan produces an estimated five and one-half times as much hunter expenditure as fee hunting. This is because although the expenditure per hunter is much higher for fee hunters, it is not sufficiently high to outweigh the 17:1 ratio of open access hunting pressure to fee hunting pressure (including landowner exceptions). For example, if the block management hunter density was only .68 (which is somewhat below the regional average), the two plans would show identical expenditures. The much higher expenditure for the DFWP plan is also dependent on the surprisingly high ratio of nonresident use (68 percent), since expenditures per hunter even for nonguided nonresidents are 6 to 10 times as high as resident expenditures.

The totals in Table 7 are for the 34,342 acre Brewer operational unit. Totals for the assumed final 88,000 acre project under easement are in direct proportion at a ratio of 2.56:1. In other words, total expenditures on the 88,000 final project size under the DFWP plan would be about \$223,000 per year compared to \$40,000 per year for the area under fee hunting.

Economic Impacts of Hunting

These totals can be used in a simple export base model to show the approximate amount of total economic activity generated by these expenditures. Following Taylor and Reilly (1986), it is assumed that each dollar spent in Montana by nonresidents results in \$2.50 of economic activity. This reflects the "multiplier effect" of money turning over in the economy once it is spent. For example, Taylor and Reilly estimated guided hunter expenditures at \$2878 for 5200 guided nonresident hunters in Montana in 1985, or \$14,967,992 total expenditure. This was multiplied by 2.5 to get the total economic impact related to just guided hunters. Similar calculations for the project at hand are provided in Table 8. Total nonresident expenditures under the two alternatives are \$211,000 and \$39,600 respectively for the DFWP easement plan on 88,000 acres versus fee hunting on the same 88,000 acres. The associated economic impact of the DFWP plan is \$527,500 or about five times the impact of the no purchase alternative at \$99,000. These are all annual figures.

A limitation of the Taylor and Reilly methodology is that all hunter expenditures by nonresidents are assumed to have been made in Montana. Undoubtedly some share of expenditures, for example on transportation, were made out of state either at home or on route. Accordingly, even accepting the 2.5 multiplier assumption, these estimates may represent the upper end of a reasonable range for impacts. In any case, this caveat holds equally for both the DFWP plan and the no purchase alternative.

TABLE 8
Economic Impact of Hunter Expenditures
Under Management Alternatives for Brewer Property
(1989 dollars)

	DFWP Plan	No Purchase Alternative
Total hunting expenditure on Brewer's 34,342 acres	87,196	15,743
Total hunting expenditure on final easement area of 88,000 acres	223,000	40,000
Nonresident expenditure on 88,000 acre project	211,000	39,600
Total economic impact on state of Montana	527,500	99,000

Notes: assumes multiplier of 2.5 used by Taylor and Reilly (1986).

It may be noted that the definition of the region of impact is arbitrary and is illustrated above for the State of Montana. If one was interested in the economic impact on Carter, Custer and Powder River Counties, out-of-county expenditures would be added to nonresident expenditures to identify total local economic impact. This is because a dollar of expenditure by someone from Kalispell has the same impact on the Broadus economy as a dollar spent by someone from Minneapolis. A local impact assessment would show an even greater relative impact associated with the DFWP alternative.

The difference shown in Table 8 in terms of total economic impact for the two styles of hunting management is dramatic. Given that in fact the Broadus area has had considerable increase in fee hunting, it is certainly plausible that local businesses (such as those motels and restaurants) have seen a decline in their hunting-related revenues.

C. NET SOCIAL BENEFITS

The preceding analysis focused on identifiable expenditure differences between the two alternatives for the Brewer property. Results for both alternatives are mainly of interest from a distributive standpoint. The general idea is that given a certain level of disposable income, changing expenditure patterns affect the geographic location of economic activity, but not necessarily the total. For example, the "gain" to Montana or the Powder River area from a Minnesota hunter spending his money here has an approximately equal offsetting negative affect on the economy in Minnesota. Unless a person for some reason prefers Montana to Minnesota, he might be indifferent to where a hunter spends his money. In fact from the standpoint of the society, expenditures are a cost, not a benefit.

This section examines the problem from the third basic accounting stance; the issue here is what are the net social benefits associated with the two alternatives. In other words, how much better off is society over and above the costs associated with a given activity. We will begin here with an analysis of the activity which is most easily quantified (again, the hunting impacts) and latter address the more difficult issue of placing a value on habitat protection.

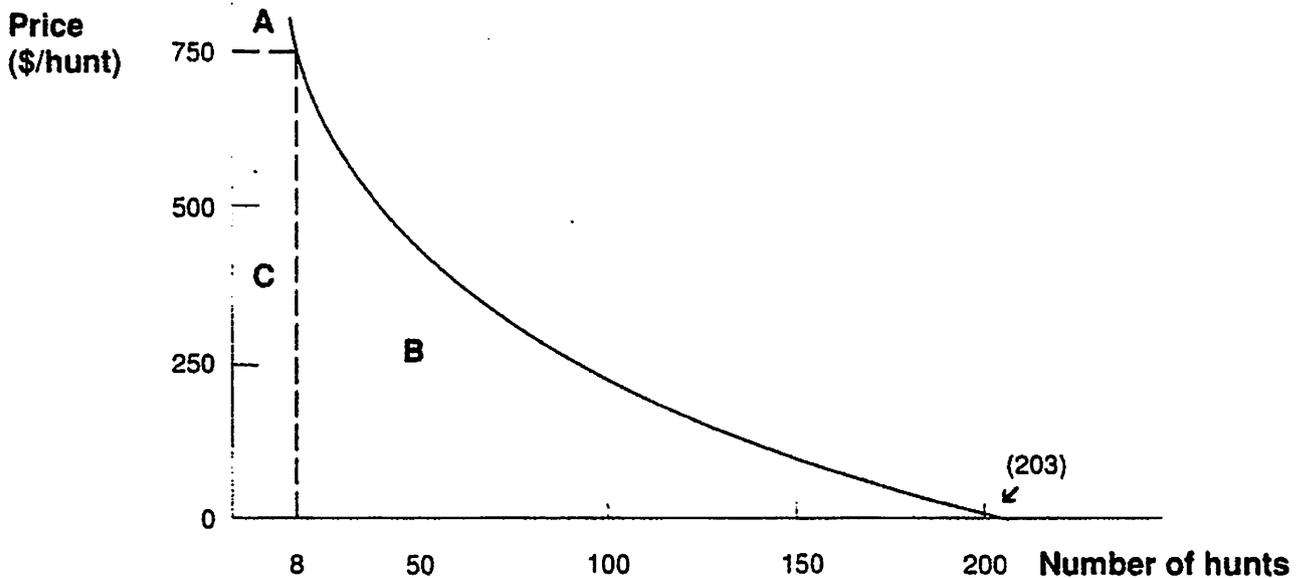
Net Social Benefits of Hunting

For a recreational activity like hunting, net social benefits are measured by what an individual would be willing to pay over and above his actual costs (for example, see Just, Hueth and Schmitz, 1982). This dollar amount is called "net willingness to pay". As an example, an individual may pay a \$5 entrance fee to visit Yellowstone Park, but his nominal cost is probably a very bad underestimate of the true value he or she places on the visit - especially if the person just drove all the way from New York primarily to visit Yellowstone Park. By contrast, one might imagine the kind of fee that could be charged at Yellowstone if these parks were privately owned and the business could maximize profits by charging whatever they wanted.

A simple model that illustrates the net value of hunting on the Brewer land is shown in Figure 1. This figure is an economic demand curve and shows the usual inverse relationship of price and quantity demanded. Just like the market for gasoline or wheat, the lower the price the greater the demand. As shown, when access is open (price of zero), 203 hunts were observed in 1988. What is the price of a hunt under fee hunting? The typical \$1500 price charged by Broadus area outfitters for a five day hunt covers not just access but also guiding service, food and lodging. One estimate of the access price might be to divide the estimated lease fee for Brewer's property (\$5000 to \$7000) by the number of hunters. For example, \$6000 divided by 8 is \$750; in other words about half the typical outfitting fee may be for access to leased lands. As illustrated in Figure 1, at \$750 there may be only 8 hunters. The net willingness to pay on the part of the 203 open access users is theoretically the area under the demand curve and above the price (zero in this case) or areas marked A, B and C in Figure 1. Area A is the net willingness to pay for the 8 fee hunters. For the simple model illustrated there is a "welfare loss" in the amount of area B if use is restricted from 203 hunters to only 8 - either through price or other means.

FIGURE 1

**Simple Model of Economic Demand
for Hunting Opportunity of the Brewer Property**



Notes: Area A represents aggregate net willingness to pay for fee hunters. Area A plus B plus C represents aggregate net willingness to pay in the event of open access (zero price).

TABLE 9

**Estimated Net Social Benefits Associated with Hunting
on 34,342 Acre Brewer Property under Management Alternatives
(1989 dollars)**

	Number of Hunter	Net WTP/Hunter	Net Benefits
A. Block Management Alternative			
Deer hunting	102	259.66	26,485
Antelope hunting	101	191.59	19,351
Total			45,836
Less marginal cost of management at \$27.22/hunter			5,526
Net benefits			40,310
B. Fee Hunting Alternative			
1. Guided			
Deer hunting	5	337.56	1,688
Antelope	3	249.07	747
2. Exceptions			
Deer hunting	3	259.66	779
Antelope	1	191.59	192
Total net benefits to hunters			3,406
Net income			
Landowner at value of hunting lease			6,000
Outfitter at 12% return on revenue of 10350			1,242
Total net benefits			10,648

Notes: Hunter net willingness to pay per trip derived from Brooks (1988) and Loomis (1988). Outfitter profit rate derived from Taylor and Reilly (1986).

This is an extremely simplified model meant to illustrate the basic concepts. In fact a more complex and realistic model would recognize that the hunting experiences provided under the fee hunt may be quite different than those under open access. For example, these hunts will likely differ in terms of success, the probability of taking a trophy animal, and congestion. The difference may be sufficient to warrant modeling the alternatives as two distinct markets, or at a minimum to incorporate "quality" as a shift variable in the basic demand function. Additionally, one would need to incorporate measures of the costs associated with hunting (such as the cost of policing trespass and managing hunters) to identify true net benefits.

For the case at hand, net willingness to pay will be approximated by using average net willingness to pay estimates for Montana deer hunters from Brooks (1988). The latter study provides estimates on a hunting area basis; the study's area corresponding to the SE corner of Montana shows an average net willingness to pay per trip of \$230.80 in 1985. Inflated to current price levels this is \$259.66. The range of values across hunting areas in Brooks (1988) is from \$54 to \$246; accordingly the SE corner of Montana has deer hunting values that are at the top end of the scale for the state. An estimate for antelope for region 7 is taken from Loomis (1988), at \$191.59 per trip. These estimates are based on the travel cost model, which is one of two basic methods approved by the U.S. Water Resources Council (1983) for estimating net recreation benefits.

The major limitation of these studies is that estimates of net willingness to pay specific to guided versus open-access hunts for deer in Montana are not available. As mentioned, it is likely that these two experiences are valued differently. Related work has shown that net willingness to pay, as one would expect, is positively correlated to hunting success. For example, in a study of elk hunting in Montana, Loomis, Cooper and Allen (1988) show that while the state average net willingness to pay for an elk hunting trip is \$262, hunters valued increased (doubled) chances of bagging a 6-point bull at an additional \$83 or 30 percent higher. Information is not readily available on the relative chances of shooting a mature buck under open access versus fee hunting. Assuming that chances of bagging a mature buck are doubled for fee hunting, the value for the fee hunting experience may be around 30 percent higher than the value of the average hunting experience. Accordingly, for purposes here net willingness to pay for fee hunting trips is assumed to be 30 percent higher or \$337.56 for deer and \$249.07 for antelope.

Based on these average net willingness to pay estimates, the social benefits to hunters associated with hunting on the Brewer property range from \$45,836 for open access to \$3,405 for fee hunting (Table 9). For open access, the marginal costs associated with management are estimated at the DFWP average cost per hunter day for block management in region 7 or \$7.28. At 3.74 days/hunter this amounts to an estimated marginal cost of providing the hunting opportunity at \$27.22 per hunter or \$5526 for the Brewer property. The net social benefits associated with open access hunting on the Brewer property are worth \$40,310 (Table 9).

For fee hunting, there is net income to the outfitter and the landowner that needs to be added to the benefits to hunters. An outfitter return is estimated at 12 percent on sales based on Taylor and Reilly's estimates of total income and expenditures for Montana outfitters in 1985 (\$15,936,556 income and \$14,002,282 expenses). For 5 hunters at \$1500 and 3 at \$950 this is a return of \$1242 to the outfitter. The entire lease fee of \$6000 is assumed net income to the landowner. Accordingly, adjusted net benefits associated with fee hunting is \$10648 (Table 9). This may be a little high in that it assumes the landowner is totally compensated for any damage to property and improvements (so that the full fee of \$6000 is net). One case was alleged, for example, where the outfitter drove dirt roads when they were wet and caused considerable uncompensated damage.

To summarize, the net social benefits associated with hunting on the Brewer property are estimated at \$40,310 under the DFWP plan and \$10,648 under fee hunting. Similarly, for the full 88,000 final area under easement, the net benefits for hunting are \$103,194 for the DFWP plan and \$27,259 for the no purchase alternative (Table 10). These are annual values. When capitalized into a present value using Widdoss's rate (.065), the net social benefits of the 88,000 acre final easement area is \$1,578,600 under the DFWP plan and \$419,370 under fee hunting. When just the net benefits of hunting for the DFWP plan are compared to the project cost of around \$1 million, it is apparent that there is a favorable benefit-cost ratio for the project. The present value calculation is for the annual benefits in perpetuity. It is assumed that these annual benefit streams are unchanged over time.

TABLE 10

**Summary of Annual and Present Net Value
Net Social Benefits Associated with Hunting
Management Alternatives on Brewer Property
(1989 dollars)**

	DFWP Plan	No Purchase Alternative
A. Net Social Benefits - Annual		
On Brewer's 34,342 acres	40,310	10,648
On planned project including 88,000 acres	103,194	27,259
B. Net Social Benefits - Present Value		
On Brewer's 34,342 acres	620,154	163,815
On planned project including 88,000 acres	1,587,600	419,370

Notes: Present value derived based on the annual benefits into perpetuity and with a capitalization rate of .065 based on Widdoss (1988).

There are several limitations to these estimates. It may well be that the net benefits associated with trophy deer and antelope hunting are considerably higher than the estimate used here. Aside from the differing quality of the hunt experience, individuals who pay for a guided hunt may be more dedicated and have higher incomes. On the other hand, given the institutional realities that limit the landowner/outfitter ability to manage game, fee hunting may lead to high wildlife densities and associated game damage. The cost of this game damage has not been quantified, although estimates could be developed. One example is the long-standing DFWP experience with fee-hunting for elk in the Bozeman area. Typically guided hunters harvest only mature bulls and eventually populations need to be reduced. Costs are the costs associated with game damage and with managing special hunts. Offsetting benefits of the special hunt are realized by hunters who value the opportunity of hunting cow elk with high success.

The analysis here is also considerably simplified in that each type of hunting was treated in isolation. In fact given the aggregate demand for hunting in region 7 (and adjoining areas), there is a complex interrelationship between the markets for various types of opportunities. For example, the regional average hunting density of around 1.0 hunter per square mile obscures the considerable variety of hunting experience available in the region. This includes fee hunting at densities of at least .128 hunters per square mile to block management at close to 4.0 hunters per mile. It is interesting to note that there are about 32,000 square miles in region 7 and that 2077 square miles (or 6.5 percent) are in block management (Table 2). However this area is used by 4087 nonresident hunters, while the entire region in most recent years had a total of only 4609 nonresident deer hunters and 5483 antelope hunters. Accordingly at least 40 percent of nonresident hunters are being crowded onto less than 7 percent of the land. The two outfitters in the Broadus area alone control approximately 1100 square miles or about half what is in the entire region 7 block management. Only about

150 guided hunters plus another 75 to 100 exceptions hunt this entire area. This is not necessarily bad. From the standpoint of economic theory we are seeing "product differentiation". In other words, a market has arisen that is providing services that are clearly in demand and differentiated from what is available in open access. There is an economic literature that argues the benefits of fee hunting; basically, if something is valued, then it will be managed more efficiently (see for example, "Privatising America's West", *The Economist*, October 22, 1988).

The two management approaches that are emerging in region 7, block management and fee hunting, are actually complementary in that the tremendous relative demand for block management areas is in part the result of hunters being pushed off leased land. As noted, if this wasn't occurring, the Brewer property would show hunting pressure more like the regional average, both for density and nonresident share, and would not show a favorable benefit-cost ratio on the basis of hunting alone. It is likely that the total social benefits to hunting in Region 7 would be maximized by some combination of differing hunting opportunities, rather than one approach alone. It is beyond the scope of this analysis to begin to identify this optimum; however, the comparison at the margin on the Brewer property seems to indicate a strong case for a relative expansion of the block management opportunity. Both approaches address a fundamental economic problem that arises due to public ownership of game and private ownership of land. Hunters impose costs directly on the landowner due to congestion, damage to improvements, and the need to police trespass. Additionally wildlife also impose costs on landowners directly due to competition with livestock for feed. In the traditional open access situation, landowners received no direct compensation for bearing the costs public hunting imposed on them and no incentive to improve hunting. Block management and fee hunting are both responses to this situation.

With regard to the distributive issue raised by Doug Gardner, it is interesting to note that nonresidents in fact appear to be the major beneficiaries of the Brewer purchase. This is because of the surprising concentration of use by nonresidents on block management units. Given that the majority of the DFWP habitat acquisition budget comes from increases in nonresident sporting licenses, this may be regarded as an equitable arrangement.

Net Social Benefits of Wildlife Habitat

While the direct recreational use of the Brewer property may be dominately associated with hunting, there are other values associated with the protection of wildlife habitat. Following Krutilla (1967), economists recognize that in addition to direct use values, natural environments may have considerable "indirect values". The latter may include people valuing the idea that something has been protected ("preservation value") or will be available for future generations to enjoy ("bequest value") or leave them the option of directly using it themselves in the future ("option value"). Many Montanans may value the idea that a good example of the grassland sagebrush ecosystem with its associated wildlife is being preserved on the Brewer project. Methods have been developed for estimating these types of values and require a site-specific type of survey study that is beyond the scope of this project. As an example, Boyle and Bishop (1987) applied the survey method to a study of the value of protecting wildlife (in this case bald eagles in Wisconsin). They found that the direct use values (associated with viewing the wildlife) were outweighed in a 10:1 ratio by the indirect values held by people that valued the idea that eagles had a safe home somewhere in Wisconsin. Fisher and Raucher (1984) provide an extensive review of this kind of literature and find that typically indirect use values on recreational lands are at least equivalent to direct use. Very crudely, this might suggest that the value of wildlife habitat preservation on the Brewer project is equal to the direct use hunting benefits of \$1.6 million (Table 9).

One demonstration of these values for the Brewer project is the fact that The Nature Conservancy (TNC) considered purchasing the property for habitat protection. TNC personnel visited the property and had numerous discussions with Mr. Brewer. According to Bob Kiesling of the Montana TNC office, TNC was impressed by the fact that the property has a very good grass base and winters livestock extremely well - generally without feed supplements. The property has the right component mix of topography, grasses, water, and shelter to make it an ideal, contained and balanced domestic unit. These same characteristics also provide for high quality wildlife habitat. Since TNC did not complete the purchase, it might be assumed that from TNC's view the wildlife habitat values were somewhat below the asking price. One can only speculate how

far below - perhaps at \$750,000? Alternatively, it could be that TNC was merely making intelligent use of its scarce resources and backed off from the purchase when it became apparent that DFWP was seriously interested in purchasing the property for the same habitat protection reasons. Lacking further information, it will be assumed that TNC valued the property at \$750,000; this may well be overly conservative.

Taking these two estimates together, it is possible that the indirect value of the property for wildlife habitat falls between \$750,000 and \$1.6 million. Since habitat preservation and hunting are compatible, these two components of net value are additive. Total net social benefits of the proposed DFWP project are in the range of \$2.3 to \$3.2 million. This indicates a favorable benefit/cost ratio compared to project costs of around \$1.2 million.

V. DIRECTIONS FOR FURTHER RESEARCH

This study was undertaken with a limited budget and a time frame of about one and one-half months. There are a number of ways in which this study could be improved and extended. These will be briefly summarized.

A. EXPENDITURE AND IMPACT ANALYSIS

The basic scale and physical impacts of the DFWP plan will undoubtedly be better defined in the future. It would be useful to have a comprehensive survey of the property as to plant and animal life. A model conservation easement needs to be specified and appraised. Once the rest rotation grazing system has been designed for the property, it may be possible to have quantitative information on changes in plant and animal productivity. This basic institutional and biological information would provide the basis for an improved analysis of expenditure and actual expected uses.

The impact analysis could be expanded by using available input/output models such as the IMPLAN program developed by the U.S. Forest Service or the model currently being used by the U.S. Bureau of Land Management to predict the impacts of coal mining in a seven county region of southeast Montana. These models and related analysis would allow identification of changes in labor income and associated tax revenues.

B. NET SOCIAL BENEFIT ANALYSIS

The Brewer purchase was analyzed as a separate project within the DFWP wildlife habitat acquisition program. In fact the project is best evaluated in the context of land allocation and management issues affecting much of eastern Montana. For example with regard to the organization and allocation of land for hunting, there has been no comprehensive analysis of the interrelationship of traditional open access hunting, the DFWP block management program and fee hunting. No aggregate data is available on the extent of fee hunting leases; even the most rudimentary information on lease terms has not been summarized in any published sources. As suggested earlier in this study, fee hunting and block management appear to be complimentary responses to the same basic economic problem. There is a need to develop a data base and undertake an analysis to inform public policy in response to changes now taking place in this region.

A specific limitation of this study was that net values for guided versus open access hunters are unavailable for Montana deer and antelope hunters. In fact survey data on deer hunters is now being developed by DFWP that should allow this question to be addressed.

The indirect values associated with habitat preservation on any given site, such as the Brewer ranch, can be estimated through economic survey research. This is an important analytical tool that should be used in future project evaluation.

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Appendix A.
LIST OF INDIVIDUALS CONTACTED

Landowners

Bud and Mollie Brewer
Earl McGill
Gib and Verna Kreital
Mike, Dan and Barbara Denson
Nellie Howell
Mary Hill
Charlie Miles
Cap and Jessie Keith
Jerry Harkins
Ken Schultz
Paul Ringling

Outfitters

Doug Gardner
John Stuver

Businesses

Jean Hough
Chuck Millar
Richard and Bernice Rolfson
Robert Lucas
Francis Hill
Roland Quade
Joyce Rutledge

Local Government

Gerald Himelspach
Brooks Study
Ted Fletcher
Milton Marcuson
Spencer Huether

Sportsmen

Paul Berg
Dyrck Van Hyning

Appendix B.

TAX DATA RELATED TO BREWER PROPERTY

- 1) Classes, Grades and Values for Montana Agricultural Lands
- 2) Brewer Tax Statement for 1988, Carter County
- 3) List by section of grazing land and taxes for Brewer ranch in Carter County.
- 4) Montana Code Section 87-1-603. Payments to Counties for Department Owned Land.

**CLASSES, GRADES, AND VALUES FOR MONTANA AGRICULTURAL LANDS AS APPROVED
BY THE STATE DEPARTMENT OF REVENUE**

NON-IRRIGATED FARM LAND (F)

WILD HAY LAND (WH)

<u>Grade</u>	<u>Bu. Wheat Per Acre On Summer Fallow</u>	<u>Assessed Value Per Acre</u>	<u>Grade</u>	<u>Tons of Hay Per Acre</u>	<u>Assessed Value Per Acre</u>
1A8	40 & over	81.08	1	3.0 & over	67.60
1A7	38 - 39	74.51	2	2.5 - 2.9	53.03
1A6	36 - 37	67.94	3	2.0 - 2.4	41.38
1A5	34 - 35	61.37	4	1.5 - 1.9	29.43
1A4	32 - 33	54.80	5	1.0 - 1.4	19.38
1A3	30 - 31	48.60	6	.5 - .9	10.05
1A2	28 - 29	42.79	7	Less than .5	5.54
1A1	26 - 27	37.31			
1A	24 - 25	32.22			
1B	22 - 23	27.50			
2A	20 - 21	23.15			
2B	18 - 19	19.17			
2C	16 - 17	15.56			
3A	14 - 15	12.31			
3B	12 - 13	9.44			
4A	10 - 11	6.94			
4B	8 - 9	4.81			
5	Under 8	3.06			

GRAZING LAND (G)

**NON-IRRIGATED CONTINUOUSLY CROPPED
FARM LAND (CC)**

<u>Grade</u>	<u>Acres Per 1000# Steer 10 Mos.</u>	<u>Assessed Value Per Acre</u>	<u>Grade</u>	<u>Bu. of Wheat Per Acre Each Year</u>	<u>Assessed Value Per Acre</u>
1A2	Under 3	71.69	1A4	44 & over	125.71
1A1	3 - 5	44.18	1A3	42 - 43	116.94
1A+	5.1 - 5.9	31.27	1A2	40 - 41	108.17
1A	6 - 10	20.51	1A1	38 - 39	99.40
1B	11 - 18	10.53	1A	36 - 37	90.63
2A	19 - 21	7.17	1	34 - 35	81.86
2B	22 - 27	5.42	2	32 - 33	73.09
3	28 - 37	3.72	3	30 - 31	64.81
4	38 - 55	2.52	4	28 - 29	57.05
5	56 - 99	1.47	5	26 - 27	49.75
6	100 or over	.82	6	24 - 25	42.96
			7	22 - 23	36.67
			8	20 - 21	30.87
			9	18 - 19	25.56
			10	16 - 17	20.75
			11	14 - 15	16.41
			12	12 - 13	12.59
			13	10 - 11	9.25
			14	Less than 10	6.41

Related Materials
Attachment 2

S.D.	DESCRIPTION	SEC.	TWP.	RGE.	ACRES	IRRIGATED		NON-IRRIGATED		GRAZING		WILD HAY		TIMBER		TOTAL ACRES	TOTAL LAND VALUE	TOTAL IMPVT. VALUE
						ACRES	VALUE	ACRES	VALUE	ACRES	VALUE	ACRES	VALUE	ACRES	VALUE			
15	E $\frac{1}{2}$ SW, SWSE	31	1S	55E						120	446					120	446	
	ALL	32	1S	55E						640	2045					640	2045	
	W $\frac{1}{2}$	33	1S	55E						320	903					320	903	
	S $\frac{1}{2}$ NW, N $\frac{1}{2}$ SW	24	2S	55E						80	298					80	298	
	LOTS 5,6,7,8,9,																	
	10,11,12,S $\frac{1}{2}$	3	2S	55E						640	2003					640	2003	
	LOTS 3,4,5,6,	4	2S	55E						567.30	1910					567.30	1910	
	10,11,12,S $\frac{1}{2}$																	
	LOTS 5,6,7,8,9,																	
	10,11,12,S $\frac{1}{2}$	5	2S	55E						640	2418					640	2418	
	LOTS 3,4,5,6,7,																	
	9,10,11,12	6	2S	55E						317.95	1182					317.95	1182	
	ALL PR'L.	7	2S	55E						625.80	1913					625.80	1913	
	ALL	8	2S	55E						640	2688					640	2688	
	W $\frac{1}{2}$	9	2S	55E						320	1143					320	1143	
	N $\frac{1}{2}$, N $\frac{1}{2}$ SW, SE	17	2S	55E						560	1939					560	1939	
	LOTS 1,2,3,4,																	
	E $\frac{1}{2}$ W $\frac{1}{2}$, E $\frac{1}{2}$	18	2S	55E						626.12	2185					626.12	2185	
	LOTS 1,2,3,4,																	
	E $\frac{1}{2}$ W $\frac{1}{2}$, E $\frac{1}{2}$	19	2S	55E						626.32	2282					626.32	2282	
	W $\frac{1}{2}$ NW, N $\frac{1}{2}$ SW	20	2S	55E						160	595					160	595	
	N $\frac{1}{2}$ NW, NENE, S $\frac{1}{2}$ SE,																	
	NWSE	21	2S	55E						200	744					200	744	
	SW	25	2S	55E						160	595					160	595	
	E $\frac{1}{2}$ SW, W $\frac{1}{2}$ SE, SESE,																	
	S $\frac{1}{2}$ NW	22	2S	55E						240	778					240	778	
	SE, E $\frac{1}{2}$ SW, S $\frac{1}{2}$ SW,																	
	SENE	23	2S	55E						320	1190					320	1190	
	ALL	26	2S	55E						640	2381					640	2381	
	NE, E $\frac{1}{2}$ SE	27	2S	55E						240	845					240	845	

FORM 8-108 8-83 43143 TRIBUNE

RECAPITULATION AND REMARKS

ASSESSOR'S CODE 1150170

SUBDIVISION	SEC.	TWP.	RGE.	IRRIGATED		NON-IRRIGATED		GRAZING		WILD HAY		TIMBER	TOTAL ACRES ASSESSED	R/W	TOTAL ACRES	IMPROVEMENTS
				GRADE	GRADE	GRADE	GRADE	GRADE	GRADE							
42-0958-31-3-01-01	31	1S	55E					63	64				40		40	
N $\frac{1}{2}$ SW								40					40		40	
S $\frac{1}{2}$ SW								40					40		40	
42-0958-32-71-01-01	32	1S	55E										40		40	
N $\frac{1}{2}$ NW								40					40		40	
N $\frac{1}{2}$ NE								40					40		40	
S $\frac{1}{2}$ NE								40					40		40	
S $\frac{1}{2}$ NW								40					40		40	
N $\frac{1}{2}$ NE								40					40		40	
NENE								40					40		40	
SENE								40					40		40	
SWNE								40					40		40	
NWSE								40					40		40	
NESE								40					40		40	
SESE								40					40		40	
SWSE								40					40		40	

87-1-603. Payments to counties for department-owned land — exceptions. Before November 30 of each year, the treasurer of each county in which the department owns any land shall describe the land, state the number of acres in each parcel, and request the drawing of a warrant to the county in a sum equal to the amount of tax which would be payable on county assessment of the property were it taxable to a private citizen. The director shall approve or disapprove the request. The director may disapprove a request only if he finds it to be inconsistent with this section. If the director disapproves a request, he shall return it with an explanation detailing the reasons for the disapproval to the appropriate county treasurer for correction. If the director approves a request, he shall transmit it to the state auditor, who shall draw a warrant payable to the county in the amount shown on the request and shall send the warrant to the county treasurer. The warrant is payable out of any funds to the credit of the department of fish, wildlife, and parks. No payment may be made to a county in which the department owns less than 100 acres. No payment may be made to a county for lands owned by the department for game or bird farms or for fish hatchery purposes or lands acquired and managed for the purposes of Title 23, chapter 1.

History: En. Sec. 1, Ch. 1, L. 1951; amd. Sec. 1, Ch. 188, L. 1953; amd. Sec. 21, Ch. 511, L. 1973; amd. Sec. 13, Ch. 417, L. 1977; R.C.M. 1947, 26-133; amd. Sec. 2, Ch. 218, L. 1979; amd. Sec. 1, Ch. 486, L. 1987.

Compiler's Comments

1987 Amendment: Deleted references to "voucher" throughout section; at beginning of first sentence substituted "Before November 30" for "The director shall before October 15" and near middle, before "the drawing", inserted "and request"; at beginning of second sentence deleted "A county treasurer receiving a voucher shall execute it and return it to" and after

"approve" inserted "or disapprove the request"; inserted third and fourth sentences concerning disapproval of request; at beginning of fifth sentence inserted "If the director approves a request, he shall"; at end of section substituted "acquired and managed for the purposes of Title 23, chapter 1" for "administered with money from the general fund"; and made minor changes in phraseology.

Appendix C.
STATEMENT OF QUALIFICATIONS, JOHN DUFFIELD

JOHN W. DUFFIELD

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Missoula, Montana 59803
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Department of Economics
University of Montana
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(406) 243-4646

EDUCATION

Ph.D. Economics, Yale University, 1974
B.A. Economics, Northwestern University, 1968

AWARDS AND HONORS

Phi Beta Kappa
Woodrow Wilson Fellow
National Science Foundation Fellowship in Economics, Yale University 1970-73
Resources for the Future Dissertation Fellowship, 1973-74.
Research Sabbatical, Inst. of Economics, University of Oslo, 1983.

PROFESSIONAL EXPERIENCE

Dr. Duffield is currently Professor of Economics at the University of Montana where he has taught since 1974. His areas of specialization are environmental and natural resource economics and energy economics. His teaching responsibilities include microeconomic theory and mathematical economics.

In the last fifteen years, Dr. Duffield has participated in research examining a wide range of environmental and natural resource issues including air pollution standards, energy forecasting, benefit/cost analysis of hydroelectric projects, and optimization of residential energy systems. His current and most recent research is largely in the area of nonmarket valuation. Dr. Duffield recently directed a two-year study of the economic values associated with hunting and fishing resources for the State of Montana. Currently he is directing a study for the U.S. Forest Service Rocky Mountain Experiment Station aimed at developing economic methodologies for valuing instream flows. A study for the Montana Water Resources Center is utilizing revealed preference methods to also address the instream flow issue.

During his graduate and undergraduate education, Dr. Duffield worked in a part-time consulting capacity with a variety of organizations including the Association of American Medical Colleges, Southern Railway System, and Metrecon Division of Larry Smith and Co.

MEMBERSHIP

Association of Environmental and Resource Economists

RECENT GRANTS AND CONTRACTS

- 1988-1990 Director, research project for Montana Water Resources Center (U.S. Geological Survey support), "Net Economic Values of Instream Flows: A Regional Travel Cost Model of Montana Trout Streams". Develop pooled time-series/cross-sectional travel cost application.
- 1988-1989 Contract with Montana Department of Fish, Wildlife and Parks to direct (with Rob Brooks) contingent valuation studies of wilderness lake fishing and deer hunting in Montana.
- 1988 Contract with Montana Department of Fish, Wildlife and Parks to analyze fishery regulations on Rock Creek (contingent valuation analysis of bank angler/float fisherman conflict).
- 1987-1989 Director, research project for U.S. Forest Service, with Stewart Allen and John Loomis, "Economic Value of Recreation and Preservation Benefits of Instream Flows". Application of contingent valuation methods to instream flows; empirical study of Big Hole and Bitterroot Rivers.
- 1985-1987 Director, Montana Bioeconomics Study for Montana Department of Fish, Wildlife and Parks, with John Loomis, Stewart Allen and Rob Brooks. Comprehensive contingent valuation and travel cost modeling of stream and lake fishing and elk, deer and antelope hunting in Montana.
- 1985 Contract with Montana Department of Fish, Wildlife and Parks (with Stewart Allen) to evaluate the social carrying capacity and congestion costs on Nelson's Spring Creek (a fee fishery).
- 1985-1987 Contract with Montana Department of Revenue to evaluate coal severance tax issues.
- 1985-1986 Contract with National Wildlife Federation to provide cost/benefit analysis of proposed Salt Caves Hydroelectric Project (Oregon).
- 1985 Contract with Missoula County to provide expert testimony on Colstrip 3 and 4. Analysis of market value of major coal-fired plants for rate-basing hearings before the Montana Public Service Commission.
- 1984-1985 Director, research project (with Arnold Silverman) for Montana Department of Commerce, "Montana Coal Market to the Year 2000: Impact of Severance Tax, Air Pollution Control and Reclamation Costs". Spatial market analysis of Northern Great Plains coal market.

PUBLICATIONS AND REPORTS

Ph.D. Dissertation: *Wilderness: A Political and Economic Analysis* (Yale, 1974).

Projections of Northern Great Plains Coal Mining and Energy Development NSF-RANN (May 1976)
172 pp. (co-authored).

"Defining the Market for Great Plains Coal", 14 *Montana Business Quarterly* 3 (Summer 1976)
pp. 18-25 (co-authored)

"Toward Planet Terrarium: A Household Production Function for Solar Energy" (Paper
presented at the Western Economics Association Meetings, Anaheim, California, June 20-23,
1977).

The Future Prices of Electricity in Montana, Montana Energy Advisory Council (105 pgs.) Jan. 20,
1977.

"Regional Electricity Models: A Case Study of Montana" (Paper presented at the Western
Social Science Association meetings in Denver, Colorado, April, 1977).

"The Costs of Congestion: An Econometric Analysis of Wilderness Recreation, by Charles
Cicchetti and V. Kerry Smith" (Book Review) 1 *Environmental Management* 5 (June 1977).

Economic Critique of the Auburn-Folsom South Unit Central Valley Project, Audubon Society (47
pgs.) March 17, 1978.

"The Lands Nobody Wanted: Policy for National Forests in the Eastern United States" (Book
Review) 2 *Environmental Management* 4. (July 1978).

Review of *The Economics of Solar Home Heating*, 4 *Journal of Energy & Development* 1 (Autumn,
1978).

Economic Analysis of the U.S. Corps of Engineers Red River and Trinity River Waterways, Audubon
Society (80 pgs.) March, 1978.

Some Economic Aspects of Air Pollution in Montana (87 pgs.) Air Quality Bureau, Montana
Department of Health and Environmental Sciences. December (with Ted Otis).

Energy Forecasting: A Survey of Methodologies Applicable to the State of Montana final report for
Ford Foundation grant (145 pgs.) January, 1979 (with Ted Otis).

"Solar Energy and Market Failure" published in Conference Proceedings of Department of
Energy, Technology for Energy Conservation Conference, Tucson, Jan. 23-25, 1979 (refereed),
and in *Energy News Digest*.

Benefits or Costs II: An Analysis of the Water Resource Council's Manual of Procedures for Evaluation of Benefits and Costs, National Wildlife Federation, August, 1979 (46 pgs.) Edited and co-authored.

"Auburn Dam: A Case Study of Water Policy and Economics," 16 *Water Resources Bulletin* 2 (April, 1980).

"Solar Economics and Ethics" and "Passive Solar Meets North Slope Rockies", *Proceedings of the 5th National Passive Solar Conference*, October 19-26, 1980, Amherst, Mass.

"Energy and Shelter in Scandinavia", Final Report for International Environmental Problems Grant, November, 1979.

"Joint Optimization of Solar and Superinsulation in a Cold Climate" and "An Integrated Passive Solar and Wood Design for the Pacific Northwest" in *Proceedings of the 6th National Passive Solar Conference*, September, 1981, Portland.

"A Preliminary Estimate of the Value of Recreational Use on the Upper Clark Fork and Its Tributaries", report for Montana Department of Fish and Game, February, 1981.

"Economics of Oil and Gas Leasing on the Sun River Game Range" in *Sun River Game Range Preliminary Environmental Review*, February, 1981, Montana Department of Fish, Wildlife and Parks.

"Optimization of Solar and Superinsulation", *Proceedings of the Third International Symposium on Energy Conservation in the Built Environment* (Dublin, March, 1982).

A High-R Handbook for Superinsulated Buildings, Technical Report Series, National Center for Appropriate Technology, Butte, (co-authored with Robert Corbett, 1982).

"Energy and Environment in Scandinavia" in *International Dimensions of the Environmental Crisis*, Richard Barrett, editor, Westview Press (1982).

"The Value of Recreational Use of Kootenai Falls" (July, 1982) chapter in the Draft EIS on Kootenai Falls Hydroelectric Project for Montana Department of Natural Resources.

"Projections of Coal Demand from the Northern Great Plains Through the Year 2010 (May, 1982). Senior author and co-editor with Arnold Silverman and other participants in the coal study group. Available through NTIS (600 pgs., Final Report under OSM grant G5105076).

"Forecasting Coal Demand in the Western U.S." in *The Use of Simulation Models in Energy Planning*, pp. 101-114, Proceedings of the International Conference held at Riso National Laboratory, Denmark, May, 1983. Published by the Commission of the European Communities (1983).

"The Demand for Northern Great Plains Coal to the Year 2010", in *Coal Development: Collected Papers*, Vol 1, pp. 53-57. Proceedings of the Conference on Coal in the West, Grand Junction, May, 1982, and Casper, June, 1982. Bureau of Land Management (July, 1983), (co-authored with Arnold Silverman).

"Logit Analysis of a Spatial Market Boundary: Case Study of Powder River Coal", Final Report, University Research Grant Program, University of Montana (1984).

"Travel Cost and Contingent Valuation: A Comparative Analysis" in *Advances in Applied Microeconomics*, Vol, 3, V. Kerry Smith, editor, AJI Press (1984).

"Forecasting, Uncertainty and Resource Planning" Paper presented at the annual meeting of the Pacific Northwest Economics Association in Olympia, Washington (May, 1984).

Montana Coal Market to the Year 2000: Impact of Severance Tax, Air Pollution Control and Reclamation Costs (January, 1985). Montana Department of Commerce, co-authored with Arnold Silverman and John Tubbs.

"Supply and Demand of Electricity in Two Regional Systems: Norway and the Pacific Northwest". Paper presented at the Pacific Northwest Regional Economic Conference, May 1-2, 1986.

"Hydropower in Norway and the Pacific Northwest: Preservation or Development". 13 *Western Wildlands* 1:28-35. (1987).

Economic Analysis of Social Carrying Capacity on a Fee Fishery: Case Study of Nelson's Spring Creek. Montana Department of Fish, Wildlife and Parks. October, 1986.

The Net Economic Value of Fishing in Montana. Co-authored with John Loomis and Rob Brooks. Montana Department of Fish, Wildlife and Parks. April, 1987.

Heteroskedasticity and Functional Form: Alternative Specification of a Travel Cost Model Demand Function for Montana Cold Water Stream Fishing. Montana Department of Fish, Wildlife and Parks. July, 1987.

A Regional Travel Cost Demand Model of Montana Elk Hunting. Montana Department of Fish, Wildlife and Parks August, 1987.

Contingent Valuation of Montana Trout Fishing by River and Angler Subgroup. Montana Department of Fish, Wildlife and Parks. March, 1988.

"The Worth of Fishing", 19 *Montana Outdoors* 6:31-35 (November/December 1988).

"Implications of a Discrete Probability Model for the Design and Interpretation of Logistic Contingent Valuation", with David Patterson. Paper being presented at W-133 meeting (Outdoor Recreation and Public Interest, a Regional Research Project of the Western Association of Agricultural Experiment Station Directors) in San Diego, February 1989.