Exhibit E

Oregon Wolf Conservation and Management Plan
Revised Economic Considerations Chapter

New language is represented by blue text

September 28, 2010

XI. ECONOMIC CONSIDERATIONS

This chapter focuses on economic values and impacts associated with wolf conservation and management. Its main objectives are to describe and assess tradeoffs among different sectors and activities, to evaluate impacts to specific sectors and to explore issues related to incentives and approaches as wolves become re-established in Oregon.

Values of wildlife are reflected in social attitudes and actions associated with wildlife use and management. Until recently the negative economic impacts of wolves such as livestock depredation and wild game losses dominated social perceptions of the species. Yet, economic activities and their relative importance change as social norms and practices change. The reintroduction and subsequent reestablishment of wolf populations in the western United States is an example of a significant shift in society's approach to wildlife management.

Economic frameworks and methods can provide additional structure and information as policy and management decisions are debated. These approaches have the capacity to frame the problem with recognition of competing policies and uses. Within this analysis, tradeoffs among economic sectors and public preferences can be compared. Assessment and analysis of economic values can assist in shaping policies and management approaches, and in predicting outcomes.

A. Types of Economic Analysis

Economic values are used to evaluate this basic question: Will society be better or worse off if a specific policy is implemented? In other words, will the gains to those benefiting from a policy be greater than the losses to those who are made worse off by the policy. The analysis usually compares the status quo to various policy alternatives in order to choose the option that provides the greatest net benefit. Cost-Benefit analysis often is employed to investigate this type of question. The method compares the total economic value or benefits to the opportunity costs of using productive resources. The difference is defined as net benefits, which consist of: 1) producer surplus less the opportunity cost of inputs; and 2) consumer surplus, i.e., consumer benefits less the amount paid for the good in question. Net benefits are forecasted over time, discounted, and summed. Cost-Benefit analysis compares the level of net benefits for each alternative and on the basis of economic efficiency favors the alternative with the highest level of net benefits.

Another type of economic analysis involves the financial activity associated with the money people spend or the sales in a particular region. For example, it might include the goods and services people purchase during recreational trips or the sales of commodities such as cattle. Purchases initiate cash flows with direct and indirect effects on businesses and, through the multiplier process on income, employment and the general level of business activity.

The two measures of economic effects (economic impact and economic values associated with Cost-Benefit analysis) are different dimensions of the economic importance of fish and wildlife. These measures must be kept separate when evaluating the economic importance of fish and wildlife, or when being used to improve resource policy decisions. Impact analysis is not a measure of efficiency because it measures financial effects on the economy without consideration of net benefits. Usually it is a snapshot at a specific point in time that ignores future economic conditions. However, it can be valuable to administrators who are concerned with a specific sector, linkages between sectors of the economy, and impacts on local employment and business. In contrast to valuation used to undertake Cost-Benefit analysis, economic impacts are used to estimate the relationship of wildlife-related activities to the financial economy (business revenues, jobs, personal income) of a local community, county, multi-county region or state. Economic impact models completely ignore consumer surplus, but instead rely on the costs to participate in recreational activities.

A Cost-Benefit analysis is especially useful for considering the tradeoffs among activities in order to explore the most socially efficient outcomes. Often both analyses can provide information to policy-makers. For example, policy-makers may be interested in the number of jobs created as well as efficiency, and may be willing to consider less efficiency for more jobs, especially in regions with relatively few economic opportunities. Each type of analysis is reviewed in the following sections.

B. Valuation Considerations and a Cost-Benefit Framework for Wolves

The results of cost-benefit analysis depend on a number of model assumptions and parameters. Therefore, the absolute results often are less important than the organization and framework the method provides when approaching an issue. However, the definition of net benefits is carefully defined by criteria rooted in economic theory. The analysis attempts to determine the change in net benefits discounted and summed over the life of the project or a specific timeframe. The analysis may be undertaken on the state, regional or national level. Given data limitations such as likely wolf population growth over time and long-term wolf population levels, this study provides annual snapshots related to benchmark wolf population levels cited in the Plan, regions of the state and different sectors.

Since wolf-related impacts will take place in the future and available information is imperfect, uncertainty also is an issue. In order to assess costs and benefits there is a need for biological and economic information, much of which may not be known. For example, the growth and eventual future wolf population sizes are unknown. The lack of detailed data from other regions with wolves and site-specific factors related to Oregon add to uncertainty related to potential impacts on livestock and ungulate populations. Finally, the eventual spatial distribution of wolves relative to these potential concerns is unknown. In the following section, basic assumptions and sources of uncertainty are identified and ranges of specific parameters considered. Although Cost-Benefit analysis may not provide a direct answer to this issue, it provides information regarding its dimensions and the tradeoffs that society faces.

C. Livestock Values

The two main costs associated with livestock include the direct costs of livestock losses to producers, and costs to private individuals, counties, ODFW and Wildlife Services for non-lethal and lethal management actions to avoid depredation[1]. Losses associated with wolves in other regions are small in proportion to the total industry, but with potentially serious consequences for specific areas or individual ranches where chronic problems occur (USFWS 1994). Although depredation rates generally increase with the size of the wolf population, without more detailed information accurate predictions of potential losses in Oregon are uncertain. Another source of uncertainty is associated with undiscovered losses. It has been documented that wolves may carry away or completely consume some carcasses, and that the actual losses exceed confirmed losses, particularly in remote, forested landscapes (Oakleaf, et al. 2000). As part of this Plan's implementation, Wildlife Services and the Oregon Department of Fish and Wildlife (ODFW) should monitor unexplained losses and document changes as predator populations change.

The USFWS Wolf Environmental Impact Statement (USFWS 1994) provides a theoretical model to predict potential depredation, but its efficacy is hampered by its lack of other relevant variables such as wild prey availability, detailed spatial overlap of wolves and livestock, and methods used by ranchers to avoid wolf interactions. The following information is used to predict depredation levels:

- The ratio of the potential Oregon wolf population to the population size in other regions;
- Depredation rate associated with the wolf population size; and
- The number of livestock in the region in question.

Estimates of Oregon losses are obtained by multiplying the number of livestock in a given region, the likely wolf population scaled by the wolf population size in the region of known depredation and the depredation rate per thousand livestock. The depredation rate per thousand from other regions is used to calculate depredation in Oregon by scaling it to the number of livestock in the region of concern. The relative number of wolves in the two regions modifies this result up or down. Depredation rates used from different regions are based on confirmed losses. The formula is:

# of livestock lost = (thousands livestock) X (depredation rate expressed as livestock lost per thousand) X (ratio of wolf populations)

<u>Cattle depredation rates ranging from 0.12 per thousand in Idaho to 0.91 in Alberta, Canada, were used to provide a range of likely losses. Depredation rates for sheep generally were higher with a range from 0.54 per thousand in British Columbia to 3.41 per thousand in Idaho. The most recent data from northwest Montana, Idaho, and Wyoming are composed of wolf numbers and depredation levels averaged over</u>

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[1] Losses of other domestic animals such as working dogs and family pets are another potential cost, although these are difficult to quantify due to data constraints.

the last three years (USFWS et al. 2010). An additional estimate for the entire state of Montana is included, which assumes similar landscape and ranching practices to those found in Oregon (Riggs 2004). Seven different regions are applied to three potential wolf population levels and three corresponding ranges in Oregon. Corresponding livestock numbers were used for each region including northeast Oregon, eastern Oregon and the entire state.

The Montana estimate was one of several predictive models that were developed to forecast depredation levels in Oregon from experiences in other western states (Riggs 2004). Although only one explanatory variable, the number of wolves, is available to explain changes in the number of livestock lost, a significant relationship between the number of wolves and depredation level was found for most regions. The analysis also provided guidance with respect to the bounds on likely outcomes for the region being considered. However, direct application to Oregon requires the same assumption used above, that biological elements of the system, ranching practices, and the spatial configuration of wolf populations and cattle are similar in the areas being compared.

Although highly variable, it is assumed that the wolf population in Oregon will consist of 14.8 animals for each breeding pair. This assumption is based on minimum fall wolf population by recovery region and the number of breeding pairs in the Northern Rocky Mountain states (USFWS et al. 2010). In the Northern Rocky Mountain States, the population size per breeding pair has increased over time as the wolf population level increased. For the periods documented for each region, the number of wolves per breeding pair ranged from approximately 10 to 17 per breeding pair. In 2009, this population segment was estimated to have 14.8 wolves per breeding pair.

Table XI-1. Wolf depredation rates from different regions. Montana, Idaho, and Wyoming levels are the average of the last three years through 2009. Livestock numbers are the approximate levels in regions where wolves are present and are derived by county from the USDA 2007 Census of Agriculture. (USFWS, Nez Perce Tribe, USDA ~~2004~~ 2009, USFWS 1994)

Region	Cattle	Sheep	# of Wolves	Cattle Losses #/000	Sheep losses #/000
Alberta	257,941	10,000	1,500	0.91	3.3
British Col.	587,750	48,000	1,500 to 6,300	0.37	0.54
Minnesota	229,065	23,719	1,625	0.12	2.11
Montana	669,665	53,365	481 *	0.12 *	2.11 *
Idaho	610,988	69,463	807 *	0.12 *	3.41 *
Wyoming	155,655	29,847	327 *	0.25 *	2.64 *

*** three-year average**

Table XI-2. Estimated annual losses of numbers and value of cattle in Oregon based on different regional depredation levels, wolf populations and numbers of livestock. Northeast Oregon includes Baker, Umatilla, Union and Wallowa counties. The eastern region includes the northeast, and counties in the Blue Mountains and

adjacent areas. Livestock numbers are derived from the USDA 2007 Census of Agriculture. The Riggs 2004 Montana estimate is based on the predicted 95 percent upper bound values for livestock losses across a range of minimum wolf populations.

Region compared	NE Oregon 228,271 cattle 4 pairs 59 wolves		Eastern Oregon 589,573 cattle 7 pairs 104 wolves		OR Statewide 1,389,189 cattle 14 pairs 207 wolves	
Alberta	(8)	$ 6,800	(37)	$ 31,450	(174)	$147,900
British Columbia	(3)	$ 2,550	(15)	$ 12,750	(71)	$ 60,350
Minnesota	(1)	$ 850	(5)	$ 4,250	(21)	$ 17,850
Montana	(3)	$ 2,550	(15)	$ 12,750	(72)	$ 61,200
Idaho	(2)	$ 1,700	(9)	$ 7,650	(43)	$ 36,550
Wyoming	(10)	$ 8,500	(47)	$ 39,950	(220)	$187,000
MT (Riggs 2004)	(9)	$ 7,650	(15)	$ 12,750	(31)	$ 26,350

Table XI-3. Estimated annual losses of numbers and value of sheep in Oregon based on different regional depredation levels, wolf populations and numbers of livestock. Livestock numbers are derived from the USDA 2007 Census of Agriculture. The (Riggs 2004) Montana estimate is based on the predicted 95 percent upper bound values for livestock losses across a range of minimum wolf populations.

Region Compared	NE Oregon 15,720 sheep 4 pairs 59 wolves		Eastern OR 26,761 Sheep 7 pairs 104 wolves		OR Statewide 217,401 sheep 14 pairs 207 wolves	
Alberta	(2)	$ 244	(6)	$ 732	(99)	$12,078
British Columbia	(0)	$ 0	(1)	$ 122	(16)	$ 1,952
Minnesota	(1)	$ 122	(4)	$ 488	(58)	$ 7,076
Montana	(4)	$ 488	(12)	$ 1,464	(197)	$24,034
Idaho	(4)	$ 488	(12)	$ 1,464	(190)	$23,180
Wyoming	(7)	$ 854	(22)	$ 2,684	(363)	$44,286
MT (Riggs 2004)	(20)	$ 2,440	(44)	$ 5,368	(105)	$12,810

Lost value can be calculated by multiplying the number of losses by the market value of the animals lost (Duffield and Neher 1996). The average sale prices are provided in the publication "Oregon Agripedia, 2009" with an average price of $850 per head for cattle and $122 per head for sheep. In some cases wolves prey on calves and lambs more frequently than adult livestock, with approximate ratios of one adult to two young (USFWS 1994). However, since the likely Oregon ratio is unknown, the adult price has been used for all potential lost animals.

Tables XI-2 and XI-3 provide a range of possible depredation levels based on other regions in North America. For the case of four breeding pairs in northeastern Oregon, losses are predicted to be relatively low ranging from one to 10 cattle and zero to ~~21~~ 20 sheep. The cattle prediction is similar to the levels reported in neighboring states. The sheep prediction is scaled to the relatively low number of animals in northeastern Oregon. The highest predicted level of ~~21~~ 20 sheep is associated with an estimate that is not scaled by the number of livestock. As expected, the number of losses increases with increases in the number of wolves and the number of livestock in a given region. Statewide predictions increase markedly for cattle, 21 to 220, and sheep, 16 to 363, in part because it is assumed that all state livestock become vulnerable to wolf depredation. Additional losses of household pets, guard dogs and other livestock also are likely, but calculations were not attempted due to uncertainties related to the relatively small numbers of losses in other states.

General examination of depredation over time in different regions provides several insights. First, there is significant variability among regions, and annually within the same region. For example, in Alberta from 1974 to 1990 annual cattle and sheep losses ranged from 22 to 217 and from one to 127 respectively, and more recently in the Wolf Recovery Area of the Northern Rocky Mountain states from 1997 to 2009 annual cattle and sheep losses ranged from 21 to 214 and 12 to 721 respectively. The highest cattle losses per thousand of any region were for the Simonette River, Alberta, where an average of 5.88 cattle per thousand were lost ~~during~~ between 1976 and 1981. The pastures were characterized as small remote wooded grazing leases with no wolf control during the first four years (USFWS 1994).

Actual depredation occurrences in Oregon also give insight into what the future might hold. In 2009 and 2010, there have been seven confirmed calf deaths from wolves, one goat, and 27 sheep. Oregon had one documented breeding pair of wolves in 2009. Prior to this time period, there were no known or confirmed depredations from wolves in Oregon.

Ranching businesses can incur costs that are not directly related to depredation. In some cases the presence of wolves may result in alterations to the timing or availability of range. For example, livestock producers may elect to use alternate pastures in response to wolf presence. A key difficulty in quantifying the costs of these actions is the uncertainty related to the displacement of ranching activities due to wolf use. This depends on the degree of overlap between wolf use areas and cattle range. Individual operations may face different costs based on their available rangeland and the circumstances that make some land less suitable for cattle or sheep grazing due to wolf activity. Another issue is the timing of the wolf activity on livestock pastures. Wolf packs may rendezvous on areas that are used for grazing during summer months. Livestock producers may elect to keep cattle from these areas. These areas may lose value for livestock leasing although changes in practices and values in other regions have been difficult to quantify (ibid.). According to a 2002 Oregon Cattlemen's Association survey, 58 percent of respondents answered that their cattle are pastured on range not closely attended during part or all of the year.

Any delay to turn livestock out on available rangelands may cause livestock producers to incur additional costs. For example, the costs associated with keeping cattle from rangeland are approximately $1.80 per head per day for hay, labor, and equipment. If alternate pastureland is rented, this can cost $0.65 per cow/calf pair per day. Labor to tend livestock during the delay to go to pasture is estimated to cost $150 per day (information provided by Oregon Cattleman's Association, Sept 2010). While these costs are per head of cattle, estimates are not available to determine the extent of displacement of grazing due to wolf presence or how many head of cattle might be affected. Such an analysis would require specific knowledge of wolf pack locations as they relate to available grazing land over time and may vary by year.

There are other measures that can help prevent wolf-livestock conflicts. For example, livestock producers may elect to purchase guard dogs and these can cost approximately $800 to $1,500. Range riders may also be an effective deterrent to wolf depredation. Monthly costs to hire range riders are approximately $1,800 to $2,500. Other measures used to prevent loss may include fladry, exclusion fencing, herding, and night penning. These methods may also help prevent depredation by other carnivores such as coyotes, mountain lions and bears. It is not possible to provide the additional costs of preventative measures that will be solely attributable to wolves.

Aside from depredation kills, wolves are also capable of wounding, chasing, or testing cattle. Stress-related illnesses and interference with reproduction can increase costs to livestock producers. Indirect effects of carnivores on livestock foraging behavior can include reduced forage efficiency, greater time spent on vigilance, and possibly selection of poorer habitat and diet to avoid predators (Howery and DeLiberto, 2004.) Harassment by predators can cause livestock to become nervous or aggressive (Lehmkuhler, et al, 2007.) but additional costs to handle such livestock are not accounted for in any study. Reduced animal health, decreased reproduction, lower weaning weights, and lost weight due to reduced forage efficiency can affect the revenues of livestock producers, while handling costs and costs of measures to prevent wolf depredations can increase the costs to livestock producers.

~~For those areas that incur wolf depredation, farm level costs will increase because of the use of avoidance, harassment and other methods will be used to decrease depredation levels. Farm-level costs also may increase because remote areas become too risky for use.~~ ~~**Increases in staffing on farms and ranches may be one cost that these businesses incur to prevent livestock depredation. Costs of fladry or other preventative measures could also apply if these measures are taken. Wolves also may test, chase or wound cattle. Additional costs may be incurred because of effects on animal health and losses in weight gain because of stress. It is also possible that harassment by wolves could interfere with the health of livestock, including low pregnancy rates among cows and sheep. The costs to livestock production from wolf harassment are another economic factor that must be taken into account. These areas also are likely to lose value for livestock leasing although changes in practices and values in other regions have been difficult to quantify (ibid.). According to a 2002 Oregon Cattlemen's Association survey, 58 percent of respondents answered that their cattle are pastured on range not closely attended during part or all of the year.**~~

~~**Control methods are potentially costly depending on the need and specific situation. Non-lethal methods used to prevent loss include guard dogs, exclusion fencing, herding and night penning. Lethal methods and services are provided by government agencies such as Wildlife Services. Many of these methods currently are employed for carnivores such as coyotes, mountain lions and bears. It is not possible to provide the additional costs of control that will be solely attributable to wolves. Initially one of the largest additional agency costs in northwest Montana was for investigations of potential wolf-related losses (ibid.). Expenditures related to both private and governmental efforts should be included in the cost estimates if not included under management costs.**~~

Wolves will be part of a much larger system that includes interactions among a number of carnivore and prey species. Coyotes currently are the cause of the majority of damage by carnivores to livestock operations. Of the approximately 1,700 average annual sheep losses in Oregon, 1,400 were lost due to coyote depredation (Wildlife Services, 2003**). Of nearly 4,500 cattle and calves lost annually in Oregon, 2,300 were lost to coyotes (NASS, USDA, 2006).** Wolf populations may interact with, and compete with coyote populations. Wolf-coyote interactions appear to depend on three factors.

1) Coyotes benefit from scavenging on the carcasses resulting from wolf kills.
2) Wolves tend to kill coyotes, but do not consume them.
3) Coyotes may space themselves away from wolves (Ballard, Carbyn and Smith 2003, p. 267).

Short-term changes in the Yellowstone region indicate that coyote populations may decrease in the presence of wolves (ibid.). If so, coyote depredation could decrease because wolves would take their place in the ecosystem. It is likely that the greatest impact would be on sheep operations. These changes also may affect the costs of Wildlife Services operations or result in a shift of some operations from targeting coyotes to wolves.

D. Hunting Values

Whether on public or private land, the public asserts its implied rights under the Public Trust Doctrine for fisheries and wildlife protection. In essence, this doctrine assigns the rights to most fish and wildlife not to the landowner, but to the citizens of the state (Loomis 1993, p14). Rights to use or appreciate these resources are controlled by state and federal agencies, and are not often bought and sold in a competitive market. However, private landowners often restrict access to resources on their property. Although recreational days are not obtained at a market price, hunting and viewing experiences may be highly valued.[2] No market prices exist to indicate how society values resources, or to signal society, as a resource producer, how much should be supplied. Yet these non-market values are embodied in people's choices such as time spent, and expenditures on travel, lodging and related goods. Choices also are made among many recreational possibilities depending on individual preferences.

License fees and expenditures capture only a portion of the total value of the experience. Hunters are willing to pay at least as much or a greater amount to hunt than the total paid for the hunting permit and associated costs of travel and equipment. Economists use the term "willingness to pay" to explain the benefit that consumers gain from the use of goods or experiences. The difference between the willingness to pay and the amount that consumers actually pay is termed consumer surplus or net benefits. It might be conceptualized as the amount that consumers save by buying at the price they paid instead of the greatest price they would be willing to pay. Many techniques have been devised to assess these values indirectly by using travel cost (the distance traveled to the recreational site), contingent valuation (the hypothetical question of how much the participant is willing to pay for the activity), and discrete choice (how people trade this experience against other experiences that can be valued monetarily).

Wolf predation on elk and deer may have negative impacts on related hunting activities. Hunting benefits are measured in terms of hunting days. The demand and associated value for hunting days is dependent on a number of factors such as expected success rate, congestion in the hunting area, quality and type of animal, location of the hunting area, and

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[2] Private hunting and fishing operations and guide services attempt to capture a portion of this value relative to public hunting opportunities.

other characteristics of the experience. Therefore, the value of a hunting day will change as characteristics of the experience change.

Even more basic is the availability or supply of hunting opportunities if the allowable harvest of animals decreases. Although there is a decreasing trend in the number of hunting licenses sold as a proportion of total population, the demand for big game hunts in eastern Oregon generally is greater than the opportunities supplied by ODFW. As elk and deer populations change, tag numbers and other management measures or regulations adjust to control harvests. More stringent game management will translate into fewer hunter days in the field and a loss in net economic benefits directly related to the loss of hunter days. These changes can be examined with a bioeconomic analysis that considers both the biology and economics with the following relationships:

Wolf population growth → Impacts on prey populations → Decrease in allowable hunter harvest → Change in the number and or quality of hunter days → Change in the net benefits of hunting

If one can make a biological forecast of changes in prey populations, it becomes possible to estimate the change in the number of hunter days according to past experiences with resource fluctuations. As a starting point, the analysis assumes that the kill rate will be 17.3 kills per wolf per year, the average of early and late winter kills per wolf of which 90 percent were elk (Phillips and Smith 1997, Smith 1998). The ratio of major prey items included in this total depends on the relative vulnerability and availability of prey. The following analysis assumes that the wolf diet in Oregon will consist of approximately equal proportions of elk and deer. The deer portion will include nearly three times the number of elk due to their relative biomass value (Fuller 1989), resulting in the consumption of 7.8 elk and 23.4 deer per wolf per year.

The number of days in the field in the Blue Mountains region was plotted as a function of the number of annual kills in deer and elk hunts. A significant linear relationship was defined for the range of available data from 1992 to 2002. Deer hunting days increased by a factor of 3.2 for each additional deer taken in the preceding year, and elk hunting days increased by a factor of 7.5 days for each additional elk taken in the preceding year. Wolf kills are assumed to result in a direct loss in hunter success. The loss in number of rifle and bow hunting days in the field for each species then can be calculated and related to the net benefits associated with elk and deer hunting in Oregon.

In 2001 the average net economic value of elk hunting in Oregon was $92 dollars per day, expressed in 2009 dollars (USFWS 2003a). For example, a loss of 1,000 hunter days would result in a net economic loss to society of $92,000. This is likely to be an overestimate if hunters can substitute a hunt in another location, albeit one they do not value as highly. For general hunts it also may be an overestimate of losses because some hunters will continue to hunt at lower success rates. As noted earlier, changes in the characteristics of the hunting experience will change the demand and associated value of a hunting day. Although uncertainty exists with regard to the level of reduction in the number of hunting days and hunting day values, the most difficult challenge is defining and quantifying the sources of prey population fluctuations.

Table XI-4. Potential hunting losses in the Blue Mountains region associated with wolves without consideration of likely compensatory mechanisms. As stated in the previous section, the number of wolves in the population per pair may vary ranging up to 50 percent higher than the following estimates.

Number of wolves	Deer and elk taken by wolves	Loss in hunting days	Net benefits per hunting day	Total loss in hunting net benefits
4 pairs 59 individuals	1,381 deer 460 elk	4,418 deer 3,451 elk	$68/day deer $92/day elk	$ 300,400 $ 317,500
7 pairs 104 individuals	2,434 deer 811 elk	7,788 deer 6,083 elk	$68/day deer $92/day elk	$ 529,600 $ 559,600

Table XI-5. Averages for total hunting activity in the Blue Mountains region for 1992 to 2002. CI represents the 95 percent confidence interval for average days in the field given the level of variation during the time period.

Hunt	Number of hunters/yr	Animals taken/yr	Average days in the field/yr	Total net benefits/yr
Deer archery/ rifle	52,357	20,408	282,688 CI = +/- 11,053	$19.2 million
Rocky Mt Elk archery/rifle	68,583	14,345	398,528 CI=+/- 21,300	$36.7 million

Total big game net benefit losses of ~~$460,700~~ 617,900 for ~~three~~ four wolf pairs is approximately one percent of $55.9 million, the average net economic benefits of big game hunting for deer and elk in the Blue Mountains region during the ~~last 1~~ 12 year period. The higher loss estimate for fourteen pairs is $2,168,500, approximately 3.8 percent of the total net value of deer and elk hunting in the region. When compared to the variation in days hunted during the ~~last 1~~ 12 year period as shown in table XI-5, potential losses related to wolves appear to be relatively small. No consideration of the potential value of wolf hunting is considered if wolves are classified as game animals and hunted sometime in the future.

The preceding model assumes that wolf-related mortality is additive and that the number of wolf kills can be directly subtracted from the number of animals taken by hunting. This is likely to be an overestimate because of relationships among sources of mortality. Wolves are part of a much larger system in which interactions will occur among a number of species. Mountain lions and other carnivores are believed to impact elk populations in specific regions. Researchers question whether wolf predation on these prey species will be additive, or whether there will be compensation associated with competition among carnivores.

E. Wildlife Watching

Wildlife watching is a recreational activity that could increase net social benefits as wolves become re-established in Oregon. In 2006, the net economic value of wildlife

viewing in Oregon was $48 per participant per day and $334 per participant per year (USFWS 2009). The value reported by the U.S. Fish and Wildlife Service is highly aggregated and includes a variety of wildlife, but does not include trips to zoos, circuses, aquariums, museums and scouting game. The trips identified by survey respondents were characterized by respondents as taken solely for the purpose of viewing wildlife.

In 2006 there were nearly 1.5 million wildlife viewers in Oregon, spending approximately $776 million to participate.(USFWS 2008). The addition of wolves could increase wildlife viewing days or the quality of a viewing day. For example, in Yellowstone National Park from 1995 to 2000, 70,000 visitors observed wolves in a nonforested part of the park (Fritts, Stephenson and Boitani 2003). According to Mech (1995), opportunities to see wolves without professional assistance are rare and limited to areas of open terrain.

Quantifying the level of potential benefits from wolf viewing is similar to that of hunting. The average net value per day is multiplied by the number of wolf viewing days to provide the total value of wolf viewing. The net value of a viewing day is likely to depend on a variety of factors such as the probability of actually viewing a wolf, the duration of viewing, proximity of wolves, substitute activities and other characteristics of the experience. Even with detailed data from other areas, the direct applicability in Oregon is limited by site-specific characteristics. If areas exist where there are high probabilities of wolf viewing, the potential exists for significant benefits. **For example, a relatively small increase in wildlife viewing days in Oregon such as 20,000 days at a value of $48 per day would be nearly equal to potential losses to deer and elk hunting.**

F. Existence Values

Another broad category of value involves nonuse values or "existence value". Existence value is the benefit that people gain from knowing that something exists, even in cases where they may never visit and benefit directly (Krutilla 1967). These values often are associated with a historical place or building, a natural area or preservation of a species. Two reasons why people might hold values unrelated to their current use are the preservation of options for future use and bequeathing natural resources to one's heirs (Krutilla 1967). Economists use terms such as existence, bequest, generational, preservation and intrinsic values for this general category. Although difficult to assess, these values are reflected in expressions of social and cultural values. There is broad agreement among economists that these values exist and that ignoring them could lead to serious errors and resource misallocations (Freeman 1993). However, there also is disagreement regarding appropriate terminology and how to measure these values empirically (Freeman 1993). These values usually are investigated by asking hypothetical questions regarding the individual's willingness to pay for the existence of the subject in question.

It has been shown that the greatest benefits associated with wolves at the national and regional levels are nonuse or existence values (USFWS 1994, Duffield and Nehr 1996, Chambers and Whitehead 2003). These are the values people place on knowing that wolves exist in the wild. Individuals may never see or hear a wolf and may not even consider this to be desirable, but still value wolves' existence. Minnesota and Yellowstone National Park studies provide evidence of both use (viewing) and nonuse (existence) values. In the Yellowstone case, Duffield and Nehr (1996) estimated a one-time willingness to pay, nearly $23 for wolf recovery. The total value then was aggregated over the number of households in the study area. Even when corrections are made for the ease with which hypothetical payments may be made, the total values were calculated in the millions. In Minnesota, Chambers and Whitehead (2003) found a willingness to pay for a wolf management Plan of $4 to $21 depending on the region. This translated into a lump sum of $665,131 at the county level and approximately $27.5 million at the state level (Chambers and Whitehead 2003).

It also should be noted that there is a willingness to pay for wolf exclusion. This value will be partially captured in the hunting and depredation losses cited in previous sections. Without doubt there also are individuals who do not directly incur damage, who would be willing to pay to keep wolves out of Oregon. These feelings or beliefs are likely to be related to fear of a wolf encounter, perceived and actual impacts on local economies and resistance to external control and regulation. Generally, rural inhabitants place a high value on their way of life and attributes related to independence and self-sufficiency. Many of these elements are not directly related to wolf establishment, but involve a larger set of social concerns and perceptions.

In order to calculate these values, a study specific to Oregon would have to be undertaken. Survey design and a sufficient sample size are two of the most important elements of such a study. Other regional studies indicate two important factors. First, there is public support and potentially large net benefits associated with wolf conservation in the United States. Second, with the right mechanisms, this potential willingness to pay may translate into significant program financing.

G. Economic Impact Studies and Input-Output (I/O) Models

Impact studies using input/output models can be constructed using surveys of state or regional economies. The U.S. Forest Service originally developed a computer system called IMPLAN which can be used to construct county or multi-county I/O models for any region in the United States. The regional I/O models are derived from technical coefficients of a national I/O model and localized estimates of total gross outputs by sectors. IMPLAN adjusts the national level data to fit the economic composition and estimated trade balance of a chosen region.

The output (sales) multiplier calculates how much money is "stirred up" in an economy, but it does not mean that someone in the local area is making a wage or profit from this money. The differences between output multipliers and income coefficients often are confused, leading to misuse. It is important for decision-makers to know and understand what type of multiplier or coefficient is being used in the assessment of the economic impact of proposed policy decisions. A more useful measure of the contribution of a sector's activity is the amount of personal income, salaries and wages that are directly and indirectly generated from an increase (or decrease) in sales.

The size of the personal income coefficient largely is determined by the amount of personal income generated by the first round of expenditures. In an industry that is very labor intensive, the output (sales) multiplier may not be very large, while the income coefficient is above average. On the other hand, if the industry goes through several transactions but is not very labor intensive throughout the process, the output (sales) multipliers may be large and the income coefficient small.

The amount a hunter (or wildlife viewer) spends in order to take part in a hunting trip also has an impact on state or regional economies as well as local economies. For example, expenditures related to hunting in northeast Oregon also generate income outside the area for several reasons. First, a portion of area nonresidents' hunting trip expenditures are made near hunters' homes and en route to the hunting destination, and thus generate income for those areas. Second, income also is generated outside of the area because of "leakages" or purchases from the larger state and regional economies. Thus, the hunter who hunted in northeast Oregon made expenditures that generated personal income in the state.

The purpose of this section is to provide examples of economic impacts on livestock ranching and wildlife-related recreation, with a geographical focus on Wallowa County in eastern Oregon. Analysis of the impacts on Wallowa County personal income can be accomplished using the IMPLAN (input-output) model along with data specific to livestock ranching, big game hunting and wildlife viewing. This section also provides perspective regarding some of the important economic aspects of the potentially affected sectors.

Some 29,000 head of beef cows were in inventory in Wallowa County as of January 1, 2002 (Oregon Agricultural Statistics Service 2001-2002). Including the bulls and cull cows associated with cow/calf operations, each cow/calf unit consumes an average of about 15 Animal Unit Months, (AUMs) annually, or about 435,000 AUMs in total. This enables ranchers to produce calves at an average of 530 pounds that sell for approximately $0.90 per pound. Total sales per cow amount to about $496 annually, including some of the bull and cull cow sales.

The economic contribution in personal income terms is estimated at $20.15 per AUM used in beef production. About $8.45 of that is generated directly by the livestock industry, $6.55 is generated in the supply industry (indirect impact), and $4.63 is generated (induced impact) in the general regional economy. The beef cow industry in Wallowa County thus generates about $8.8 million in total personal income. Since there are 15 AUMs per animal, the loss of 10 head will result in a loss in 150 AUMs. Given the loss estimates (based on depredation levels in northwest Montana, as shown in Table XI-2) of ~~15~~ **10** cattle for northeast Oregon and ~~59~~ **47** cattle for eastern Oregon, the loss in personal income would total approximately ~~$4,500~~ $**3,000** and ~~$19,000~~ $**14,200** per year, respectively. In addition, costs related to the need for additional depredation control, loss of other animals such as pet or guard dogs and modification of operations are likely to be much greater, perhaps increasing economic impacts by an order of magnitude. IMPLAN economic impact estimates for sheep ranching were not available.

Deer and elk hunting also produce personal income in Wallowa County. Hunters spend money in the county during their hunting trips. Table XI-6 provides estimates of the expenditures of hunters during hunts on the Starkey Experimental Forest in 1989-1991. A portion of those hunters came from western Oregon. Therefore, hunter expenditures and associated impacts on total personal income were partitioned into statewide and eastern Oregon impacts. **Using the eastern Oregon income impact estimates, updated to 2009 dollars, it is possible to approximate the personal income impact of deer and elk hunting in eastern Oregon wildlife management units.**

Table XI-6. Starkey Experimental Forest Elk and Deer Hunter Average Hunter Day Expenditures and Associated Impacts on Total Personal Income.

Hunt period	Usable responses	Average total trip expenditures (per hunter day)	State level income impacts	Average eastern Oregon expenditures (per hunter day)	Eastern Oregon income impact
ELK HUNTS					
1989	37	$ 48.95	$ 36.55	$ 18.49	$ 8.58
August 1990	129	$ 46.40	$ 35.23	$ 26.32	$ 12.95
December 1990	37	$ 71.13	$ 54.31	$ 42.81	$ 21.56
August 1991	138	$ 51.18	$ 38.44	$ 27.17	$ 12.38
December 1991	95	$ 60.46	$ 45.68	$ 31.22	$ 14.25
WEIGHTED AVERAGE	436 total	$ 53.29	$ 40.25	$ 28.39	$ 13.41
WEIGHTED AVERAGE (2009 $)		**$ 77.80**	**$ 58.76**	**$ 41.45**	**$ 19.58**
DEER HUNTS					
1989	**68**	**$ 46.29**	**$ 35.05**	**$ 21.25**	**$ 9.03**
October 1990	**20**	**$ 48.09**	**$ 34.12**	**$ 20.95**	**$ 8.25**
October 1991	**19**	**$ 57.18**	**$ 42.98**	**$ 36.82**	**$ 17.48**
WEIGHTED AVERAGE	**107 total**	**$ 48.56**	**$ 36.28**	**$ 23.96**	**$ 10.38**
WEIGHTED AVERAGE (2009 $)		**$70.90**	**$52.97**	**$34.97**	**$15.15**

Source: ODFW unpublished data from Chris Carter, former staff economist.

Applying the eastern Oregon impact per hunter day estimates from Table XI-6, the total and potential changes in income impacts of deer and elk hunting for the Blue Mountains region are provided in the following tables.

Table XI-7. Total impact of elk and deer hunting expanded from Wallowa County data for the Blue Mountains region and the state of Oregon. Assumes that local impacts are likely to be the same as those for the original study area. ($ in millions)

Hunt	Total days	Regional expenditure	Regional personal income	State expenditure	State personal income
Deer archery and rifle	**282,688**	**$9.9**	**$4.3**	**$20.0**	**$15.0**
Elk archery and rifle	**398,528**	**$16.5**	**$7.8**	**$31.0**	**$23.4**

Table XI-8 . Changes in impacts including expenditures and personal income for the Blue Mountains region and the state of Oregon. Assumes that local impacts are likely to be the same as those for the original study area.

Hunt	Losses in days	Regional loss expenditure	Regional loss personal income	State loss expenditure	State loss personal income
Deer archery and rifle 4 pairs	4,418	$ 154,497	$ 66,932	$ 313,236	$ 234,021
Elk archery and rifle 4 pairs	3,452	$ 120,716	$ 67,590	$ 268,565	$ 202,839
Deer archery and rifle 7 pairs	7,788	$ 272,300	$ 118,000	$ 552,170	$ 412,500
Elk archery and rifle 7 pairs	6,083	$ 252,100	$ 119,100	$ 473,257	$ 357,400
Deer archery and rifle 14 pairs	15,501	$ 542,069	$ 234,800	$1,099,000	$ 821,100
Elk archery and rifle 14 pairs	12,113	$ 502,100	$ 237,200	$ 942,391	$ 711,800

With respect to wildlife viewing, there are no available data on numbers of wildlife viewing trips or related estimates of trip expenditures and personal income impacts per wildlife viewing day in eastern Oregon. **Statewide information based on Oregon wildlife viewing from the 2006 National Survey of Fishing, Hunting and Wildlife-Associated Recreation (USFWS 2008) estimate average expenditures per individual at $35 per day.**

H. Additional Economic Elements of the Issue

When markets do not exist for wildlife or damages, the public sector often is called on to sort out the resulting confusion, controversy and inefficiencies. The creation of markets or a mechanism for exchange can lead to solutions that are both efficient and acceptable to concerned parties. This is potentially true of the wolf issue in Oregon for several reasons. The initial units of a resource such as the first wolves to move into the state are highly valued by many members of the public. Yet, the harm caused to other sectors is likely to be concentrated and spread across a relatively small number of individuals. Economist Ronald Coase, a Nobel Prize winner, surmised that given the right conditions and the opportunity to bargain, mutually beneficial arrangements can be achieved. Both groups are made better off than in the absence of an agreement. Initially, the willingness to pay exhibited by environmental interests and members of the general public will be greater than the damages associated with wolf reestablishment. If this accurately describes the situation in Oregon, then a mutually beneficial outcome may be reached.

Unfortunately these outcomes are hampered by the difficulties in bringing all parties to the table, termed by economists as transaction costs. When the cost of organizing and providing venues for all interests to interact becomes too great, agreement will not be reached. Although the number of people in favor of wolf reestablishment may be large, their individual willingness to pay may be small, and a mechanism by which payments can be realized could be difficult to implement. Therefore the challenge is to provide mechanisms by which the willingness to pay for wolf existence can be translated into funds that can be transferred to those who will be negatively affected. The Defenders of Wildlife program is similar to this in nature, and takes advantage of these differences in benefits and costs.

A difficult to quantify but potentially important element of wolf re-establishment involves changes to the associated ecosystem. As mentioned earlier in this chapter, it is likely that wolves will affect other predator populations. For example, related economic sectors such as sheep ranching may benefit if there are decreases in coyote populations. Many other changes are possible such as shifts in wildlife populations that feed on wolf-killed carcasses, and shifts in elk distribution that may affect vegetation types and cover. These impacts will vary by region, but general system characteristics such as diversity and resilience are likely to change as the wolf population increases. These changes may affect economic values of wildlife and the environment. For example, shifts in abundance might provide a greater variety of wildlife viewing opportunities or stream habitat improvements might be linked to changes in vegetation type or cover adjacent to streams. The biological nature, timing and magnitude of these changes are difficult to predict, but they are likely to impact the economic and social environment.

The level of compliance with laws and regulations is an essential component of any attempt to manage human activities. Often managers assume perfect compliance or ignore the role of noncompliance when considering how to reach management objectives. Research in this area indicates that compliance is at least in part dependent on the individual's calculation of potential costs and benefits. If the individual is assumed to be maximizing welfare, then non-compliance can be predicted given several factors in the following order:

- The probability of being caught;
- If caught, the probability of the case going to court and being sanctioned;
- If sanctioned the size of the fine; and
- The level of the fine in relation to the anticipated benefit of breaking the law as calculated by the conditional probabilities and the size of the fine.

However, it has been shown that other factors dictate compliance as well. Moral suasion, the tendency for people to try to do the "right thing," has a powerful influence on compliance. It is often the product of several factors such as the perceived fairness of the rules and regulations and the process by which the regulations are promulgated. Another factor involves peer pressure, as it is less likely that an individual will break the law if his or her peers follow the law.

It may not be necessary to do a formal analysis of compliance and enforcement, although enforcement activities will incur costs and some indication of the added burden should be taken into account for. Perceptions of the process as the Plan moves forward and recourse in the face of individual hardships are factors that will affect incentives related to compliance with wolf-related regulations.

I. Conclusion and Future Considerations

Costs associated with likely delisting criteria, although potentially significant on the individual or regional level, are not large in comparison to current predation or fluctuations in big game populations due to weather and other carnivores. In addition, management alternatives are likely to be much more constrained during the early phases of wolf reestablishment. The largest economic and social impacts and concerns may revolve around more general positive and negative existence values associated with wolf re-establishment. However, as is the case in Minnesota, there is a possibility of significant long-term increases in the size of the wolf population. The growth in cougar populations illustrates the possible consequences of unintended impacts on big game populations. It appears that without proper planning, costs in the more distant future could be significant. Given the future timing of significant impacts, all parties can benefit from recognition that the largest challenges may be several decades removed from the present.

J. Literature Cited

Ballard, W.B., L.N. Carbyn, and D.W. Smith. 2003. "Wolf Interactions with Non-prey." In: *Wolves, Behavior Ecology, and Conservation*. Eds. L. David Mech and Luigi Boitani. University of Chicago Press.

Bangs, Edward. Personal communication, USFWS, Montana, July 2004.

Carter, C.N., and H.D. Radtke. 1986. An Economic Comparison of the Income Aspects of Livestock Ranching and Big Game Hunting. Oregon Department of Fish and Wildlife Staff Report. April.

Carter, C.N. Estimates of Hunter Expenditures and Associated Personal Income Impacts for Deer and Elk Hunting on the Starkey Experimental Forest, 1989-1991. Oregon Department of Fish and Wildlife. Unpublished data. Undated.

Chambers, C.M. and Whitehead, J.C. 2003. A contingent Valuation Estimate of the Benefits of Wolves in Minnesota. *Environmental and Natural Resource Economics*, 26:249-267.

Duffield, J.W. and Nehr, C.J. Economics of Wolf Recovery in Yellowstone Park. 1996. *Transactions of the 61st North American Wildlife and Natural Resource Conference*.

Fritts, S.H., Stephenson, R.O., Hayes, R.D. and Boitani, L. 2003. "Wolves and Humans." In: *Wolves Behavior, Ecology and Conservation*. Eds. L. David Mech and Luigi Boitani, University of Chicago Press.

Freeman, A.M. 1993. The Measurement of Environmental and Resource Values. Theory and Methods. Resources for the Future, Washington DC.

Fuller, T.K. 1989. Population dynamics of wolves in north-central Minnesota. Wildlife monographs, no. 105. The Wildlife Society, Bethesda, MD.

Howery, L.D. and T.J. DeLiberto. 2004. Indirect effects of carnivores on livestock foraging behavior and production. Sheep and Goat Research Journal. 14:.

Idaho Legislative Wolf Oversight Committee. 2002. Idaho Wolf Management Plan.

Krutilla, J.V. 1967. Conservation Reconsidered. *American Economic Review*. 57(4):777-786.

Lehmkuhler, J., G. Palmquist, D. Ruid, B. Willging, and A. Wydeven. 2007. Effects of wolves and other predators on farms in Wisconsin: beyond verified depredations. Wisconsin Wolf Science Committee, Wisconsin Department of Natural Resources, Madison, USA.

Loomis, John B. 1993. Integrated Public Lands Management. 1st Edition.

Mech, L.D. 1995. How can I see a wolf? Int. Wolf 5(1):8-11.

Oakleaf, J., Murray, D. and Mack, C. 2000. Preliminary Assessment of Wolf Predation on Livestock on the Diamond Moose Allotment in Central Idaho during the 1999 Grazing Season. Report available from the principal investigator.

Oregon Cattlemen's Association. 2002. Oregon Cattlemen's Association Survey Summary, November 2002, Provided by NW Farm Credit Services.

Oregon Department of Agriculture, 2009 Oregon Agripedia, 2009.

Phillips, M.K. and D.W. Smith. 1997. Yellowstone Wolf Project: Biennial report 1995-1996. National Park Service, Yellowstone Center for Resources, Yellowstone natl. Park, Wyoming. YCR-NR-97-4.

Riggs, R. 2004. Defining reseaonable expectations for livestock depredations by wolves in Oregon. Wolf Advisory Briefing Paper. July 23, 2004.

Smith, D.W. 1998. Yellowstone Wolf Project: Annual Report, 1997. National Park Service, Yellowstone Center for Resources, Yellowstone Natl. Park, Wyoming. YCR-NR-98-2.

United States Department of Agriculture, National Agricultural Statistics Service, 2006. Cattle Death Loss, May 5, 2006.

--------. 2003. 2002-2003 Oregon Agriculture & Fisheries Statistics. Annual Summary for 2003. Oregon Agricultural Statistics Service. State Statistical Office of the National Agricultural Statistics Service. United States Department of Agriculture. Portland, OR, 2003.

--------. 2009. 2007 Census of Agriculture: United States Summary and State Data, Volume 1.

U.S. Fish and Wildlife Service. 1994. The reintroduction of gray wolves to Yellowstone National Park and central Idaho: Final Environmental Impact Statement, U.S. Department of the Interior, Fish and Wildlife Service, Denver CO.

--------. 2003a. Net Economic Values for Wildlife-Related Recreation in 2001. U.S. Department of the Interior. Washington, D.C.

--------. 2003b. 2001 National and State Economic Impacts of Wildlife Watching. U.S. Department of the Interior. Washington, D.C.

--------. and U.S. Census Bureau. 2003c. 2001 National Survey of Fishing, Hunting and Wildlife-Associated Recreation. U.S. Department of the Interior. Washington, D.C.

---------.2008. 2006 National Survey of Fishing, Hunting, and Wildlife-Associated Recreation.

---------.2009. Net Economic Values of Wildlife-Associated Recreation in 2006.

---------.2010. Nez Perce Tribe, National Park Service, Montana Fish, Wildlife, and Parks, Blackfeet Nation, Confederated Salish and Kootenai Tribes, Idaho Fish and Game, and USDA Wildlife Services. Rocky Mountain Wolf Recovery 2009 Interagency Annual Report. C.A. Sime and E.E. Bangs, eds.

Wildlife Services. 2003. Resource Losses Reported to Wildlife Services Program 1996-2002.

~~Ballard, W.B., L.N. Carbyn, and D.W. Smith. 2003. "Wolf Interactions with Non-prey." In: *Wolves, Behavior Ecology, and Conservation*. Eds. L. David Mech and Luigi Boitani. University of Chicago Press.~~

~~Bangs, Edward. Personal communication, USFWS, Montana, July 2004.~~

~~**Boyle, Kevin J, Brian Roach and David G. Waddington. 1998. 1996 Net Economic Values for Bass, Trout and Walleye Fishing, Deer, Elk and Moose Hunting, and Wildlife Watching. Addendum to 1996 National Survey of Fishing, Hunting and Wildlife Associated Recreation. Report 96-2. Division of Federal Aid. U.S. Fish and Wildlife Service, U.S. Department of the Interior. Washington, D.C.**~~

~~Carter, C.N., and H.D. Radtke. 1986. An Economic Comparison of the Income Aspects of Livestock Ranching and Big Game Hunting. Oregon Department of Fish and Wildlife Staff Report. April.~~

~~Carter, C.N. Review of Wildlife Values for Oregon. Oregon Department of Fish and Wildlife Staff Paper. Undated.~~

~~--------. Estimates of Hunter Expenditures and Associated Personal Income Impacts for Deer and Elk Hunting on the Starkey Experimental Forest, 1989-1991. Oregon Department of Fish and Wildlife. Unpublished data. Undated.~~

~~Chambers, C.M. and Whitehead, J.C. 2003. A contingent Valuation Estimate of the Benefits of Wolves in Minnesota. *Environmental and Natural Resource Economics*, 26:249-267.~~

~~Duffield, J.W. and Neher, C.J. Economics of Wolf Recovery in Yellowstone Park. 1996. *Transactions of the 61st North American Wildlife and Natural Resource Conference.*~~

~~Fritts, S.H., Stephenson, R.O., Hayes, R.D. and Boitani, L. 2003. "Wolves and Humans." In: *Wolves Behavior, Ecology and Conservation*. Eds. L. David Mech and Luigi Boitani, University of Chicago Press.~~

~~Freeman, A.M. 1993. The Measurement of Environmental and Resource Values. Theory and Methods. Resources for the Future, Washington DC.~~

~~Fuller, T.K. 1989. Population dynamics of wolves in north-central Minnesota. Wildlife monographs, no. 105. The Wildlife Society, Bethesda, MD.~~

~~Idaho Legislative Wolf Oversight Committee. 2002. Idaho Wolf Management Plan.~~

~~Krutilla, J.V. 1967. Conservation Reconsidered. *American Economic Review*. 57(4):777-786.~~

~~Loomis, John B. 1993. Integrated Public Lands Management. 1st Edition.~~

~~Mech, L.D. 1995. How can I see a wolf? Int. Wolf 5(1):8-11.~~

~~Oregon Cattlemen's Association. 2002. Oregon Cattlemen's Association Survey Summary, November 2002, provided by NW Farm Credit Services.~~

~~Oakleaf, J., Murray, D. and Mack, C. 2000. Preliminary Assessment of Wolf Predation on Livestock on the Diamond Moose Allotment in Central Idaho during the 1999 Grazing Season. Report available from the principal investigator.~~

~~Phillips, M.K. and D.W. Smith. 1997. Yellowstone Wolf Project: Biennial report 1995-1996. National Park Service, Yellowstone Center for Resources, Yellowstone natl. Park, Wyoming. YCR-NR-97-4.~~

~~Riggs, R. 2004. Defining reseaonable expectations for livestock depredations by wolves in Oregon. Wolf Advisory Briefing Paper. July 23, 2004.~~

~~Smith, D.W. 1998. Yellowstone Wolf Project: Annual Report, 1997. National Park Service, Yellowstone Center for Resources, Yellowstone Natl. Park, Wyoming. YCR-NR-98-2.~~

~~USDA 2003. 2002-2003 Oregon Agriculture & Fisheries Statistics. Annual Summary for 2003. Oregon Agricultural Statistics Service. State Statistical Office of the National Agricultural Statistics Service. United States Department of Agriculture. Portland, OR, 2003.~~

United States Department of Agriculture, National Agricultural Statistics Service. 2006. Cattle Death Loss, May 5, 2006.

United States Department of Agriculture, National Agricultural Statistics Service, 2008-2009 Oregon Agriculture and Fisheries Statistics, December, 2009.

United States Department of Agriculture, 2007 Census of Agriculture: United States Summary and State Data, Volume 1. December, 2009.

United States Fish and Wildlife Service, 2006 National Survey of Fishing, Hunting, and Wildlife-Associated Recreation, 2008.

United States Fish and Wildlife Service, Net Economic Values of Wildlife-Associated Recreation in 2006, July 2009.

United States Fish and Wildlife Service, Nez Perce Tribe, National Park Service, Montana Fish, Wildlife & Parks, Blackfeet Nation, Confederated Salish and Kootenai Tribes, Idaho Fish and Game, and USDA Wildlife Services. 2010. Rocky Mountain Wolf Recovery 2009 Interagency Annual Report. C.A. Sime and E. E. Bangs, eds.

U.S. Fish and Wildlife Service. 1994. The reintroduction of gray wolves to Yellowstone National Park and central Idaho: Final Environmental Impact Statement, U.S. Department of the Interior, Fish and Wildlife Service, Denver CO.

--------. 2003a. Net Economic Values for Wildlife-Related Recreation in 2001. U.S. Department of the Interior. Washington, D.C.

--------. 2003b. 2001 National and State Economic Impacts of Wildlife Watching. U.S. Department of the Interior. Washington, D.C.

--------. and U.S. Census Bureau. 2003c. 2001 National Survey of Fishing, Hunting and Wildlife-Associated Recreation. U.S. Department of the Interior. Washington, D.C.

--------, Nez Perce Tribe, USDA Wildlife Services. 2004. Rocky Mountain Wolf Recovery 2003 Annual Report. T. Meier, ed. USFWS, Ecological Services, 100 N Park, Suite 320, Helena, MT.

Wildlife Services. 2003. Resource Losses Reported to Wildlife Services Program 1996-2002.