EVALUATION OF THE SOCIOECONOMIC IMPACTS ASSOCIATED WITH THE REINTRODUCTION OF THE MEXICAN WOLF

A COMPONENT OF THE FIVE-YEAR PROGRAM REVIEW

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EXECUTIVE SUMMARY

The 1998 Mexican Wolf Final Rule states that the U.S. Fish and Wildlife Service (Service) will evaluate Mexican wolf reintroduction progress and prepare full evaluations of the program after three and five years.[1] These evaluations will include recommendations of whether to continue, modify, or terminate the reintroduction program. The purpose of this analysis is to estimate the social and economic impacts of the Mexican wolf reintroduction program since its inception in 1998 as part of the five-year review assessment of the program being conducted by the Service. This information is intended to assist the Service, cooperating agencies, and stakeholders in their evaluation of the reintroduction program.

The time frame for this evaluation is the initial five-year period for Mexican wolf reintroduction, from March 1998 to December 31, 2003. However, where more recent data are available, it is included in the analysis. The study area is defined as the five counties that include lands within the Blue Range Wolf Recovery Area (BRWRA), including Catron, Sierra, and Grant Counties, New Mexico, and Apache and Greenlee Counties, Arizona. Key findings are summarized below.

Economic Impacts

The economic impacts portion of the analysis attempts to identify changes in economic activities that have occurred since Mexican wolf reintroduction began, and to quantify these changes where possible. To accomplish this, the analysis focuses on comparing the level of economic activity in various sectors after wolf reintroduction to activity levels prior to the reintroduction. The analysis then compares current estimates to estimates presented in the *Reintroduction of the Mexican Wolf Within its Historic Range in the Southwestern United States: Final Environmental Impact Statement* (FEIS).

The FEIS estimated potential economic impacts that would occur once the Mexican wolf population reached 100.[2] Under Alternative A, the Preferred Alternative, the FEIS estimated that impacts associated with livestock losses, reduced hunting value and associated regional expenditures, and land use restrictions near dens, pens, and rendezvous sites (minor impacts)

[1] Establishment of a Nonessential Experimental Population of the Mexican Gray Wolf in Arizona and New Mexico, 63 Federal Register 1763-1772; 50 CFR Section 17.84(k).

[2] U.S. Fish and Wildlife Service. 1996. *Reintroduction of the Mexican Wolf Within Its Historic Range in the Southwestern United States: Final Environmental Impact Statement.*

could occur.[3] Economic benefits were estimated to include increased recreational use and associated expenditures.

This analysis finds that from 1998 to 2003, the economic impacts described in the FEIS were not realized, with the exception of impacts to ranchers and the ranching community. Estimation of economic impacts on ranching communities, and particularly the level of wolf depredation, remains controversial. While FEIS estimates of wolf depredation are roughly consistent with agency logs of depredation over the past five years (low estimate), other estimates presented in this analysis that consider potential unrecorded depredation and rancher estimates (medium and high estimates) suggest that the FEIS may have underestimated actual depredation over this time period. Observable impacts on hunting and tourism have been minimal to date. Nonetheless, future effects on these activities may occur if the wolf population increases. Key findings are summarized below:

Demographics: Overall, the BRWRA study area contains a high percentage of Federal lands and is sparsely populated, with a five-county study area population of 122,000 and an average population density of 4.5 people per square mile. On average, population growth in affected communities has been slower over the past decade than in Arizona and New Mexico as a whole. The majority of communities in proximity to the BRWRA exhibit below average median household incomes and have a larger share of their populations living in poverty than is typical for Arizona and New Mexico. The five counties containing portions of the BRWRA also demonstrate higher rates of unemployment; the average unemployment rate in these counties was 15 percent in 2000 compared to six percent in Arizona and seven percent in New Mexico. Effects of Mexican wolf reintroduction on overall demographic trends are not perceptible over the study period, and the lower population growth rates and median income, as well as the higher poverty and unemployment rates, are most likely not related to the wolf reintroduction. Instead, they are likely the result of broad trends and long-term conditions, such as aging populations and the rural nature of the counties.

The FEIS was accurate when predicting that the areas in proximity to the BRWRA would not experience the same population growth from 1990 to 2000 as elsewhere in Arizona and New Mexico.

Ranchers: The economies of ranching communities that utilize the BRWRA are affected by decisions that alter the uses of Federal lands. Wolves may also venture outside of the BRWRA onto private ranch lands that border the BRWRA and affect those ranches. Ranchers have identified a number of consequences that may result from wolf reintroduction:

- *Physical effects*: Ranch animal depredation, including cattle, sheep, horses, and dog deaths and injuries from wolf attacks; non-lethal physiological impacts on livestock, such as weight loss, stress, and lower birth rates.

- *Additional costs of livestock management*: Need to alter forage use, provide additional labor, and increase expenditures on supplies to prevent depredation.

[3] The FEIS considered four alternative wolf reintroduction scenarios and determined that Alternative A, which includes the BRWRA, was preferable to the others.

- *Positive effects*: Positive impacts could be associated with improved forage conditions due to less competition with elk or increased predation on coyotes.

To date, the primary impacts on ranching activities have been associated with depredation of ranch animals. Exhibit ES-1 presents a range of estimates of wolf depredation from 1998 to 2004.[4] The low estimate represents the average of the agency records of confirmed kills (including records from the Service, USDA Wildlife Services, and the Defenders of Wildlife compensation program). The medium estimate incorporates a multiplier from published literature that estimates unconfirmed kills in addition to confirmed kills. The high estimate reflects estimates of losses due to wolf depredation provided by ranchers. These estimates range from an average of five to 33 cattle killed each year by wolves, which is less than one percent of the 34,800 cattle grazed in the BRWRA annually. The average death loss rate for cattle operations in Arizona and New Mexico from all factors was four percent in 1997, including predation by other animals, digestive, respiratory, and calving problems, disease, weather conditions, poison, theft, and unknown causes.[5] Thus, wolf predation comprises a small portion of the cattle losses experienced annually in the BRWRA. However, some individual ranchers may be disproportionately affected.

Exhibit ES-1

TOTAL NUMBER OF WOLF DEPREDATIONS, 1998 to 2004[a]

		Cattle	Sheep	Horses	Dogs
Number of Kills[b]	**Low Estimate**	32.3	2.3	0.3	2.0
	Medium Estimate	181.1	5.4	3.0	3.0
	High Estimate	233.0	5.4	4.0	3.0
Number of Injuries[c]		5.0	0.0	2.0	1.0

Notes:
[a] While the scope of the five year review is from 1998 through 2003, data for 2004 are included to incorporate the most recent records of depredation.
[b] The low estimate represents the average of the Agency records of confirmed kills. The medium estimate includes a multiplier from published literature that estimates unconfirmed kills in addition to confirmed kills. The high estimate presents the estimates provided by ranchers of losses due to wolf depredation. Section 3 describes the methods used to develop these estimates in detail. Note that the medium estimate does not represent an "average" or "best" estimate; it represents one method for estimating the number of kills.
[c] The costs associated with injury estimates are applied to the low, medium, and high estimates of kills when calculating the total economic impacts to ranchers.

Exhibit ES-2 presents a summary of the economic impacts to ranching that have occurred to date. The value of wolf-related losses is estimated at $39,000 to $206,000, including time to prepare claims.[6] Of these estimated costs, $34,000 in compensation has been paid to ranchers since 1998. In addition, the regional economic impact associated with these losses, as measured

[4] Although the scope of this analysis is 1998 to 2003, this analysis includes readily available information for 2004.

[5] U.S. Department of Agriculture National Agricultural Statistics Service (1999), Meat Animals Production, Disposition, and Income: Final Estimates 1993-1997. Statistical Bulletin Number 959a.

[6] These estimates include data for 2004. Loss estimates for 1998 to 2003, the defined time period of the five-year review, range from $32,000 to $173,000.

in terms of decreased economic output in 2002, the year in which ranchers sustained the most livestock losses, is estimated to range from $3,000 to $99,000 (see Exhibit ES-3).[7] This impact represents less than one percent of the $84.0 million (2004$) in livestock cash receipts in 2002. As stated above, the medium and high estimates of depredation suggest that estimates of impacts on the ranching community contained in the FEIS may have underestimated actual depredation between 1998 and 2004.

Exhibit ES-2

TOTAL ECONOMIC IMPACTS TO RANCHERS, 1998 to 2004[a] (2004$)

Low Estimate[b]	$38,650
Medium Estimate[b]	$163,270
High Estimate[b]	$206,290

Notes:

[a] While the scope of the five year review is from 1998 through 2003, data for 2004 is included to include the most recent records of depredation. Impacts include the market value of livestock and domestic animals killed by wolves, the cost of injuries resulting from wolf attacks, and the value of the time spent by ranchers to prepare claims for compensation. These values do not include (i.e., subtract out) compensation received by ranchers for these losses.

[b] The low estimate represents the average of the agency records of confirmed kills. The medium estimate incorporates a multiplier from the published literature that estimates unconfirmed kills in addition to confirmed kills. The high estimate is based on estimates provided by ranchers of losses due to wolf depredation.

[7] The decreased direct regional economic output includes the direct and induced effects of lost cattle minus any compensation that ranchers received for these cattle. Production losses do not include the value of lost dogs and horses or the value of time spent by ranchers preparing compensation claims since these losses do not affect output (i.e., revenue from cattle and sheep sales). To the extent that ranchers forego investing in livestock herds because they instead spent money replacing dogs and horses or paying for additional labor, this analysis may understate actual production losses. Section 3 discusses these estimates in greater detail.

Exhibit ES-3

ESTIMATED ANNUAL REGIONAL ECONOMIC IMPACT OF REDUCTIONS IN LIVESTOCK PRODUCTION USING 2002 DATA (2004$)[a]

Livestock Loss Estimate[b]	Type of Loss	Direct Effect (Output)	Indirect Effect (Output)	Induced Effect (Output)	Total Impact (Output)
Low Estimate	Output	$1,840	$350	$390	$2,590
	Employment	0.0	0.0	0.0	0.0
Medium Estimate	Output	$34,700	$6,630	$7,440	$48,770
	Employment	0.7	0.1	0.1	0.9
High Estimate	Output	$70,530	$13,470	$15,130	$99,130
	Employment	1.4	0.2	0.2	1.9

Notes:
[a] Regional economic impact measures represent a one-time change in economic activity; thus, they are not additive to other estimates. These estimates represent the estimated regional economic impact from livestock losses in 2002. As 2002 was the year with the highest depredation rate, the regional impact analysis represents the upper bound of annual direct, indirect, and induced effects from 1998 to 2004.
[b] Livestock loss estimates include the uncompensated value of cattle killed by wolves in 2002. No reported cattle injuries or sheep depredations occurred in this year.

Hunters/Outfitters/Guides: Because the hunting outfitter and guide industry operating within the BRWRA relies on state and Federal permits and access to Federal lands, as well as a healthy population of wild prey, it is vulnerable to policy changes concerning the use of resources on Federal lands. The FEIS estimated that a harvest reduction of 120 to 200 elk would occur once the wolf population reached 100. This harvest reduction would have represented two to six percent of annual elk harvest in the BRWRA between 1998 to 2003. Reductions in hunting days equal to the FEIS estimates would have represented one to two percent of total elk hunting days in New Mexico and Arizona in 2001, or four to seven percent of elk hunting days in the BRWRA. However, over the past five years, wolf populations have not reached 100. Due to the small wolf population and more dominant overall trends that are unrelated to wolves, impacts on hunters and hunting effort in this region have not been observable to date. Specifically:

- *Effects on big game population from depredation:* The current BRWRA elk population is larger than the population projected by the FEIS to exist after the wolf population reaches 100. Nonetheless, both elk and deer populations in the BRWRA declined since 1998. However, other factors, such as game manager decision-making strategies as well as an ongoing drought complicate the assessment of whether wolf predation has affected elk populations to date.

- *Effects on hunter visitation to the region:* The number of elk permits sold in the BRWRA increased from 1998 to 2004, as did the number of hunters and hunter days. Thus, this analysis finds no evidence that wolf reintroduction has affected the hunter visitation in the BRWRA area. Correspondingly, this analysis also finds no evidence that the states of New Mexico or Arizona have experienced reductions in elk permit revenue since wolf reintroduction. The number of deer permits issued in Arizona declined from 2,100 in 1998 to 850 in 2003 in Arizona (a decline of 36 percent).[8] This change corresponds to the

[8] The number of deer licenses issued in New Mexico was not available.

decline in deer population, which is the most likely reason for this decline. While wolves may have killed elk over this time period, a change in hunter visitation due to deer and elk population reductions by wolves is not detectable.

- *Reduced hunting success:* Overall, elk hunting success rates in New Mexico show a decrease over the study period, from 39 percent in 1998 to 34 percent in 2003 (on average across GMUs). Success rates in Arizona show a decrease from 48.5 percent to 42 percent over this time period. Despite small increases in the number of elk hunters in recent years, elk harvests have remained relatively constant, resulting in a slight decrease in the elk hunting success rate. This decrease is likely due to the combination of a larger group of elk hunters pursuing a smaller amount of prey. The success rate for deer permits did decline over this time period, however the change corresponds to the decline in deer population, and is the most likely reason for this decline.

- *Lost income to outfitter/guides:* The outfitter/guide industry is an important contributor to local economies and likely brings $13 to $17 million in gross revenues annually. However, revenue impacts are not estimated because no reduction in hunter participation was observed during the study period.

- *Regional Economic Effects:* Regional economic impacts are not estimated because no reduction in hunter participation was observed.

San Carlos Apache and White Mountain Apache Tribes: Although the BRWRA does not include any Tribal lands, the lands of the San Carlos Apache and the White Mountain Apache (Fort Apache Reservation) lie adjacent to the BRWRA. Both Tribes are economically vulnerable to increased costs that could result from Mexican wolf reintroduction. While each Tribe initially objected to the introduction of wolves onto their lands, the White Mountain Apache now have an agreement with the Service that wolf reintroductions may occur. The San Carlos Apache continue to object to the reintroductions, and report that wolf depredation on livestock has occurred on their lands. The Point of Pines Cattle Association on the Reservation reports that "at one branding site there were only two branded calves compared to the past when an Apache reported that three hundred used to be branded at that site. This decline in branding numbers happened after the wolves were reintroduced. Point of Pines was never compensated for those losses."[9] These calves had an economic value of over $100,000 to the Tribe, which may be attributable to wolf reintroduction. However, further investigation of the cause of the livestock losses would be necessary to accurately evaluate impacts to date. Both Tribes also expend considerable effort in attending meetings to discuss management of the Mexican wolf. Other economic impacts on the Tribes, such as impacts on available hunting permits, have not been observable to date.

[9] Letter from Steve Titla, Titla and Parsi, General Counsel for the San Carlos Apache Tribe, Re: Economic impact of wolf depredation to Point of Pines on San Carlos, November 18, 2005.

The FEIS estimated that if the lands of the San Carlos Apache become fully occupied by wolves, impacts of wolf reintroduction could be $4,900 to $21,100 annually. The San Carlos discussion about livestock losses due to wolf depredation would suggest that FEIS could have underestimated impacts on livestock. As stated above, further investigation of the cause of the livestock losses would be necessary to accurately evaluate impacts to date.

Tourism/Conservation: The primary categories of economic benefits of the reintroduction program include:

- *Increased recreation visits.* Greater National Forest visitation could lead to increased regional tourism and recreation-related expenditures in local economies.

- *Existence value.* The public may hold a non-use value for the Mexican wolf that could be enhanced by actions to reintroduce the species to the study area.

- *Agency spending in local areas.* Federal and state agency spending on the reintroduction program may contribute to local economies.

- *Overall ecosystem health.* The restoration of wolves as the top carnivore could restore ecosystem function to the BRWRA area.

Approximately 3.2 million National Forest visits, or 14 percent of National Forest visits to Arizona and New Mexico, occur annually in the BRWRA area. Lack of data makes assessment of recent changes to visitation difficult, though measurable increases in visitation for wolf-related recreation appears unlikely given the small number of wolves and the lack of a current mechanism for issuing guiding permits. The FEIS states that increased recreational value and expenditures may occur in the BRWRA after Mexican wolf reintroduction. However, to date, little evidence exists other than anecdotes that increases in recreation have occurred since wolf reintroduction.

The public holds a non-use value for the Mexican wolf that could be enhanced by actions to reintroduce the species to the study area. However, no studies exist that estimate the existence value for Mexican wolves. While a few studies in the literature have attempted to estimate existence value for other wolf populations, these studies were not conducted in the Southwest. Because the context of the other study areas was unique to those areas (Yellowstone National Park and North Carolina), a transfer of estimated benefits was not conducted.

Federal and State agency funding for the Mexican wolf program totaled $7.8 million from 1998 to 2004, or between $0.67 to $1.4 million annually.[10] Regional impacts of agency expenditures were approximately $1.5 million in regional output annually, with a benefit to employment of 31 jobs, assuming that all funds were spent in the BRWRA area.[11] Actual expenditures are somewhat higher than those estimated in the FEIS, which estimated

[10] From 1998 to 2003, Federal and state agency funding totaled $6.3 million (2004$).
[11] This estimate is based on 2002 expenditures.

expenditures at approximately $5 million from 1998 to 2004. Regional economic impact estimates were not included in the FEIS.

Social Impacts

With the exception of the social impacts on two groups, nearby Tribes and a subset of ranchers, the analysis concludes that social impacts of the reintroduction program between 1998 and 2003 have been minimal. Three factors provide the foundation for this conclusion. First, wolf populations would have to be much higher to generate impacts on most groups in the BRWRA. Second, certain segments of local society are unlikely to see widespread impacts, positive or negative, even if wolves appear in higher numbers. The general population is aware of the presence of wolves, but that fact has little bearing on their day to day social (and economic) lives. Third, social impacts from wolf reintroduction are likely to take a much longer period of time to develop than the five-year study period. For example, if wolf populations grow slowly and after ten years have a negative impact on elk herds, then the number of outfitters might decline as business is slowly reduced.

With these issues in mind, the general conclusions of our social impact assessment are:

- The distribution of social impacts is such that a majority of them fall on a subset of local ranchers, including Tribal operations. These operators have had to repeatedly alter their social lives to accommodate wolves.

- The cultural impacts of wolf recovery on the two Tribes adjacent to the BRWRA are complex. While the impacts are not direct, the Tribes view these impacts to be significant. Though the two Tribes currently view the reintroduction program differently, ranching and outfitting are important components in their social and economic structures. The relationship between the Tribes and the Federal agencies produced some social impacts during the study period, and remains a complex source of possible future impacts.

- Outfitters remain nervous about economic impacts, but social impacts to hunting and outfitting have not emerged to date.

- The information concerning changes to the tourism industry, including hotel operators, tour operators and restaurants, supports a finding of limited social impacts on this group from wolf recovery.

- Local conservationists' social impacts from wolf recovery are positive, heterogeneous and difficult to aggregate due to the wide ranging social, economic and demographic groups they represent. There is little data to support a finding of widespread social impacts.

Comparison of FEIS to Current Assessment

Exhibit ES-4 presents a comparison of the impacts contained in the FEIS to the findings of this report.

Exhibit ES-4

COMPARISON OF SOCIAL AND ECONOMIC IMPACTS OF MEXICAN WOLF REINTRODUCTION IN THE BRWRA TO FEIS ESTIMATES, 1998 TO 2004

Category	Description of Impact	FEIS Estimate[a]	Observed Wolf Impacts (1998 to 2004)
Biological effects	Wolf population in BRWRA	100	2004 popultion: 44
	Elk population in BRWRA	9,300 to 18,000	~20,000: 6,000 in AZ; 14,000 in NM (2002)
	Deer population in BRWRA	35,500 to 64,100	~10,000 in AZ (2002); Unknown in NM.
	Deer population reduction	4,800 to 10,000	Deer population declining in both states.
	Elk population reduction	1,200 to 1,900	Elk population declining in both states.
Hunting[b]	Reduction in deer harvest	300 to 560 annually	Not observable to date. Success rates have declined somewhat.
	Reduction in elk harvest/success	120 to 200 annually	Not observable to date. Elk harvest has remained constant, while deer harvest declined along with population.
	Lost hunting value	$877,900 to $1.6 million annually	Not observable to date. Number of hunters and hunter days increased.
	Lost hunter expenditures	$707,400 to $1.3 million annually	Not observable to date. Number of hunters and hunter days increased.
	Lost revenue to AZ/NM from reduced permit sales (2004$)	$83,100 to $151,700 annually	Not observable to date.
Ranching	Livestock losses	1 to 34 annually	32 to 233 cattle, 2 to 5 sheep, 0 to 4 horses, and 2 to 3 dogs (1998-2004); or 5 to 33 cattle, 0 to 1 sheep and horses, and less than 1 dog annually
	Lost value to ranchers	$840 to $28,560 annually[c]	$38,600 to $206,000 (1998-2004), or $5,500 to $29,500 annually. Regional impacts range from $3,000 to $99,000 annually.
Tribal Activities	Potential reduction in non-member elk hunting permits to San Carlos Apache[d]	$4,900 to $21,100 annually	Not observable to date.
	Livestock depredation	Not quantified	Reported losses of 300 calves in one year.
Benefits	Increased recreational use	Not quantified	Incidental reports only.
	Increased tourism	Not quantified	Incidental reports only.
	Enhanced existence value	Not quantified	Not quantified.
Other	Conflicts with local ordinances	Not quantified	Discussed in social impacts section.
	Minor access restrictions near pens, dens, and rendezvous sites	Not quantified	Not observed to date.
	Agency Expenditures	$5.0 million (1998 - 2004); annual average $713,500	$7.8 million (1998-2004), or between $0.67 to $1.4 million annually, in direct expenditures. Approx. $1.5 million additional regional output annually, with a benefit to employment of 31 jobs.

Notes:
[a]The FEIS estimates compare a point in time five years after the wolf population goal for the area is achieved to what the prey populations were projected to be without wolves. EIS estimated are inflated to 2004 dollars.
[b]The FEIS states that the estimated hunting losses may overstate actual losses, as hunter may pursue substitute sites or to substitute species for hunting. In addition, because hunting in New Mexico and Arizona is dominated by resident hunters, money not spent in the BRWRA is likely to be spent elsewhere in these states.
[c]Value of cattle losses calculated by multiplying estimated number of lost cattle by the average value of cattle sold across all size and weight classes in Arizona and New Mexico in 2004, as reported by U.S. Department of Agriculture (1998 – 2004), Meat Animals Production, Disposition, and Income: Summary, National Agricultural Statistics Service, Mt An 1-1.
[d]Values of lost deer and elk are estimated assuming that 30 wolves utilize the Reservation. Cost estimates do not include lost hunting value or regional expenditures (FEIS 4-35).

Source: U.S. Fish and Wildlife Service. 1996. *Reintroduction of the Mexican Wolf Within Its Historic Range in the Southwestern United States: Final Environmental Impact Statement*.

INTRODUCTION SECTION 1

1.1 Framework for Analysis

The Mexican wolf Final Rule states that the U.S. Fish and Wildlife Service will evaluate Mexican wolf reintroduction progress and prepare full evaluations after three and five years. [12] These evaluations will include recommendations of whether to continue, modify, or terminate the reintroduction program. The purpose of this analysis is to estimate the social and economic impacts of the Mexican wolf reintroduction program since its inception in 1998 as part of the five-year review assessment of the program being conducted by the Service. This information is intended to assist the Service, cooperating agencies, and stakeholders in their evaluation of the reintroduction program.

1.2 Mexican Wolf Reintroduction Program Background

In 1998, the Service, in cooperation with the Arizona Game and Fish Department, the New Mexico Department of Game and Fish, USDA Wildlife Services, and USDA Forest Service, began a program to release a "nonessential experimental" population of Mexican wolves into a portion of its native territory in Arizona and New Mexico. The area where the wolves are allowed to disperse into and colonize, known as the "Blue Range Wolf Recovery Area," encompasses approximately 7,200 square miles of the Apache National Forest in southeastern Arizona and the Gila National Forest in southwestern New Mexico. Wolves may only be released into the primary recovery zone, an area within the BRWRA in eastern Arizona. The rule allows the wolf population to disperse into the remaining portion of the BRWRA, but does not allow wolves to establish territories on lands outside of the BRWRA (except on Tribal or private lands when landowners consent). The primary goal of the reintroduction program is to restore a "self-sustaining population of about 100 wild Mexican wolves distributed over 5,000 square miles of the BRWRA."[13] Under the rule, promulgated under section 10(j) of the Endangered Species Act (Act), private citizens may kill or injure wolves in defense of human life or when wolves are in the act of attacking livestock (with some restrictions).

[12] Establishment of a Nonessential Experimental Population of the Mexican Gray Wolf in Arizona and New Mexico, 63 Federal Register 1763-1772; 50 CFR Section 17.84(k).

[13] Paquet, Paul C. et al. "Mexican wolf recovery: Three year program review and assessment." Prepared by the Conservation Breeding Group for the Service. June, 2001.

Regulatory History Timeline:

- **Pre-1970**: Last confirmed sighting of wild Mexican wolf in Southwestern United States.
- **1976**: Mexican wolf listed as endangered subspecies under the Act.
- **1978**: Entire gray wolf species in North America south of Canada listed as endangered under the Act (listed as threatened in Minnesota).
- **1982**: Mexican wolf recovery plan published.
- **November 1996**: Service releases the FEIS.
- **January 1998**: Service publishes final rule to establish a nonessential experimental population of the Mexican gray wolf in Arizona and New Mexico within the Blue Range Wolf Recovery Area (under section 10(j) of the Act).
- **March 1998**: Service commences reintroduction of Mexican wolf.
- **June 2001**: Three-year review of the Mexican wolf reintroduction program completed.
- **2004-2005**: Release of administrative, technical and socioeconomic components of five-year review of Mexican wolf reintroduction program to the public.

1.3 Analytic Approach

The goal of this socioeconomic analysis is to evaluate the local and regional social and economic impacts of the Mexican wolf reintroduction program that occurred between March 1998 and December 2003, and to compare those impacts to impacts estimated in the 1996 Final Environmental Impact Statement. This analysis is intended to allow resource managers and the public to evaluate the social and economic implications of altering the reintroduction program. The analysis presents two analyses: 1) an assessment of economic impacts and comparison to the FEIS; 2) an assessment of social impacts. The scope of the analysis is as follows:

- This analysis focuses on regional social and economic impacts. As part of this effort, the analysis characterizes the regional economy, population characteristics and community and institutional structures for the study area.
- This analysis focuses on impacts in the five counties that contain lands within the BRWRA: Catron, Grant, and Sierra Counties, New Mexico; Greenlee and Apache Counties, Arizona, as well as adjacent Tribal lands of the White

Mountain Apache (Fort Apache) and the San Carlos Apache. The analysis is retrospective and identifies potential social and economic impacts for the five-year review period.

- This analysis also evaluates the relevance and quality of available research studies related to the attitudes, as well as social and economic impacts of wolves or wolf reintroduction from other areas.

1.4 Data Sources

FEIS estimates are used to provide a basis against which recent activities occurring in the BRWRA study area since Mexican wolf reintroduction are compared. This analysis reviewed a variety of data sources to understand recent and historical activities, including:

- In-person discussions with numerous individuals at Service open house meetings in January and February 2005 as well as personal communication with more than 60 local stakeholders, including private, municipal, state, and Federal sources;

- Published data sources;

- Administrative records from the FEIS and from recent litigation regarding the Mexican wolf reintroduction program;

- Relevant research and policy literature, with a focus on those projects that directly address the social and economic issues arising from wolf reintroduction in the BRWRA in particular and North America in general; and

- Available secondary economic and social data on the BRWRA region describing the county and community level social, demographic, and economic conditions.

1.5 Economic Impact Assessment

The economic impacts portion of the analysis attempts to identify changes in economic activities that have occurred since Mexican wolf reintroduction began, and to quantify these changes where possible. To accomplish this, the analysis focuses on comparing the level of economic activity in various sectors after wolf reintroduction to activity levels prior to the reintroduction. The analysis then compares current estimates to estimates presented in the FEIS. Specifically, this analysis:

1) Characterizes changes to the regional economy since 1996;

2) Describes the issues raised by stakeholders in economic sectors affected by the reintroduction of the Mexican wolf;

3) Discusses whether existing data indicate that the reintroduction of the Mexican wolf has played a role in changes to the affected economic sectors and whether these changes have had an effect on the regional or local economy; and

4) Quantifies such impacts to the extent possible.

Note that, in addition to potential impacts from wolf reintroduction, drought and other factors contributed to changes in the regional economy over the study period, and assigning the cause of change is difficult. Ongoing trends are often well established and overwhelm any observations of incremental effects caused by Mexican wolf reintroduction.

1.6 Social Impact Assessment

This portion of this analysis addresses possible social impacts from Mexican wolf reintroduction in the study area during the initial five year recovery period of 1998 to 2003. Social impacts are defined as "…the consequences to human populations of any public or private actions that alter the ways in which people live, work, play, relate to one another, organize to meet their needs and generally cope as members of society. The term also includes cultural impacts involving changes to the norms, values, and beliefs that guide and rationalize their cognition of themselves and their society."[14] In the context of this analysis, such impacts are hypothesized to derive from the reintroduction and management policies for Mexican wolves during the initial five years of that program (1998-2003).

Social impacts are generally assumed to occur in standard categories consisting of population changes, community and institutional structures, political and social resources, individual and family changes, and community resources. These categories are defined as follows:

- **Population Characteristics:** Ongoing and expected population changes (growth or decline), ethnic and racial makeup, and net migration, temporary residents, seasonal or leisure residents, and age distributions;

- **Community and Institutional Structures:** changes to group and individual relationships with federal and state agencies; changes to the basis of community economic and social stability;

- **Political and Social Resources:** The size, structure, and organization of local government; its relationship with state and federal governments; historical and current patterns of employment and industrial diversification; activities of

[14] Interorganizational Committee, 2003: 231.

voluntary associations, religious organizations, interests groups; relationships between social and political institutions;

- **Individual and Family Changes:** Influences on the daily life of the individuals and families, including attitudes, perceptions, family characteristics, and local social networks; can include changing attitudes toward the policy, an alteration in family and friendship networks, perceptions of risk, health, and safety; fears and aspirations;

- **Community Resources:** Patterns of natural resource and land use; past and current housing and community services (health, police, fire, sanitation); continuity and survival of historical and cultural resources; changes for indigenous people and religious sub-cultures.

Impacts are placed into each category if the analysis establishes that such an impact is related directly to wolf reintroduction or is clearly an indirect impact of wolf reintroduction.

Time and resource limitations allow us to draw general conclusions only as to possible social impacts on most groups and communities. Significant field research is required to adequately address specific direct, indirect, and cumulative impacts of wolf recovery. Hence, this analysis will focus on direct impacts suggested by the limited information gathered for this study.

Impacts on groups can be broken into two general categories: active impacts and passive impacts. Active impacts are social impacts derived from direct interactions with wolves. Ranchers, outfitters and people living in areas where wolves are common are more likely to have active encounters with wolves. Thus, social impacts derived from those encounters are more readily identified. Active impacts appear to be relatively rare for the general public. Passive impacts occur when people in the study area hold strong opinions about wolves and their reintroduction but have few, if any, direct encounters with wolves. Social impacts on such groups are much harder to establish beyond those associated with opinions held about the positive existence value of the wolves.

It must be made clear that social impacts are *prima fascia* neither positive nor negative. Those who feel that their social lives have been significantly altered do typically make a distinction between positive and negative impacts. However, people from different social groups frequently assess the same impact differently. For example, ranchers may label the anxiety they feel when they see wolves in close proximity to their livestock as a negative impact while their neighbors might find the sighting of the very same wolves to have a positive impact on their social lives. We generally speak of impacts as negative or positive if they were described as such by those that were interviewed.

1.7 Socio-Economic Estimates Presented in the Final Environmental Impact Statement

This section presents a brief summary of the estimates presented for the BRWRA as part of Alternative A in the FEIS. [15] These estimates are the basis of comparison for this analysis.

Exhibit 1-1 presents a summary of the impacts that would result from reintroduction of wolves to the BRWRA area, as estimated in the 1996 FEIS. Note that these estimated impacts are projected for "a point in time five years after the wolf population goal for the area of 100 wolves is achieved."[16] Thus, impacts presented in this Exhibit are unlikely to have been realized to date, since the population of wolves has not yet reached 100. As shown, impacts were anticipated to include reductions in prey populations, reductions in hunting and livestock values (both Tribal and non-Tribal), increases in tourism and recreation, and other minor restrictions. The majority of quantified impacts were projected to involve lost hunting value and reductions in hunter expenditures.

1.8 Structure of Report

This remainder of this report is organized as follows:

- Section 2: Demographic Trends In The Blue Range Wolf Recovery Area
- Section 3: Economic Impacts of Mexican Wolf Reintroduction On Ranching Activities
- Section 4: Economic Impacts of Mexican Wolf Reintroduction On Hunting Activities
- Section 5: Economic Impacts of Mexican Wolf Reintroduction On Tribes
- Section 6: Economic Impacts of Mexican Wolf Reintroduction on Tourism And Conservation
- Section 7: Social Impacts of Mexican Wolf Reintroduction

[15] U.S. Fish and Wildlife Service. 1996. *Reintroduction of the Mexican Wolf Within Its Historic Range in the Southwestern United States: Final Environmental Impact Statement.*

[16] U.S. Fish and Wildlife Service. 1996. *Reintroduction of the Mexican Wolf Within Its Historic Range in the Southwestern United States: Final Environmental Impact Statement.*

Exhibit 1-1

SUMMARY OF FEIS ESTIMATES OF SOCIAL AND ECONOMIC IMPACTS OF WOLF REINTRODUCTION IN THE BRWRA

Category	Description of Impact	Value
Biological effects[a]	Wolf population	100
	Deer population reductions	4,800 to 10,000
	Elk population reductions	1,200 to 1,900
Hunting[b]	Reduction in deer harvest	300 to 560
	Reduction in elk harvest	120 to 200
	Lost hunting value (2004$)	$877,900 to $1.6 million annually
	Lost hunter expenditures (2004$)	$707,400 to $1.3 million annually
	Lost revenue to AZ/NM from reduced permit sales (2004$)	$83,100 to $151,700 annually
Ranching	Cattle losses	1 to 34
	Lost value to ranchers (2004$)[c]	$840 to $28,560 annually
Tribal Activities	Potential reduction in non-member elk hunting permits to San Carlos Apache (2004$)[d]	$4,900 to $21,100 annually
	Livestock depredation	
Benefits	Increased recreational use	Not quantified
	Increased tourism	Not quantified
	Enhanced existence value	Not quantified
Other	Conflicts with local ordinances	Not quantified
	Minor access restrictions near pens, dens, and rendezvous sites	Not quantified
	Agency Expenditures (2004$)	$5.0 million (1998 - 2004); annual average $713,500

Notes:

[a]Prey population estimates compare a point in time five years after the wolf population goal for the area is achieved to what the prey populations were projected to be without wolves.

[b]Estimated hunting losses may overstate actual losses, as hunters may pursue substitute sites or to substitute species. In addition, because hunting in New Mexico and Arizona is dominated by resident hunters, money not spent in the BRWRA is likely to be spent elsewhere in these states.

[c]Value of cattle losses calculated by multiplying estimated number of lost cattle by the average value of cattle sold across all size and weight classes in Arizona and New Mexico in 2004, as reported by U.S. Department of Agriculture (1998 – 2004), Meat Animals Production, Disposition, and Income: Summary, National Agricultural Statistics Service, Mt An 1-1.

[d]Values of lost deer and elk are estimated assuming that 30 wolves utilize the reservation. Cost estimates do not include lost hunting value or regional expenditures (FEIS 4-35).

Source: U.S. Fish and Wildlife Service. 1996. *Reintroduction of the Mexican Wolf Within Its Historic Range in the Southwestern United States: Final Environmental Impact Statement.*

DEMOGRAPHIC TRENDS IN THE BLUE RANGE WOLF RECOVERY AREA — SECTION 2

2.1 Introduction

This section describes the general climatic conditions, population trends, and economic activity within and in proximity to the BRWRA both prior to and since the reintroduction of Mexican wolves. The purpose of this section is to provide background on the five counties and communities containing portions of the BRWRA in order to present a context for subsequent sections of this analysis; the purpose is not to suggest that population and economic indicators are the result of the reintroduction program. We begin with an overview of the land use, population, and history of the counties that contain portions of the BRWRA and the communities in proximity to the BRWRA. Subsequent segments present more detailed demographic and socioeconomic information. Throughout this section, we compare population and economic indicators to information and predictions presented in the FEIS.[17]

The BRWRA encompasses approximately 7,200 square miles and straddles the border between Arizona and New Mexico (see Exhibit 2-1). Portions of the BRWRA fall within five counties: Apache and Greenlee counties in Arizona; and Catron, Grant, and Sierra counties in New Mexico. The Service initially released wolves within the Primary Recovery Area, which constitutes approximately 1,200 square miles of the BRWRA and falls within Greenlee County, Arizona.

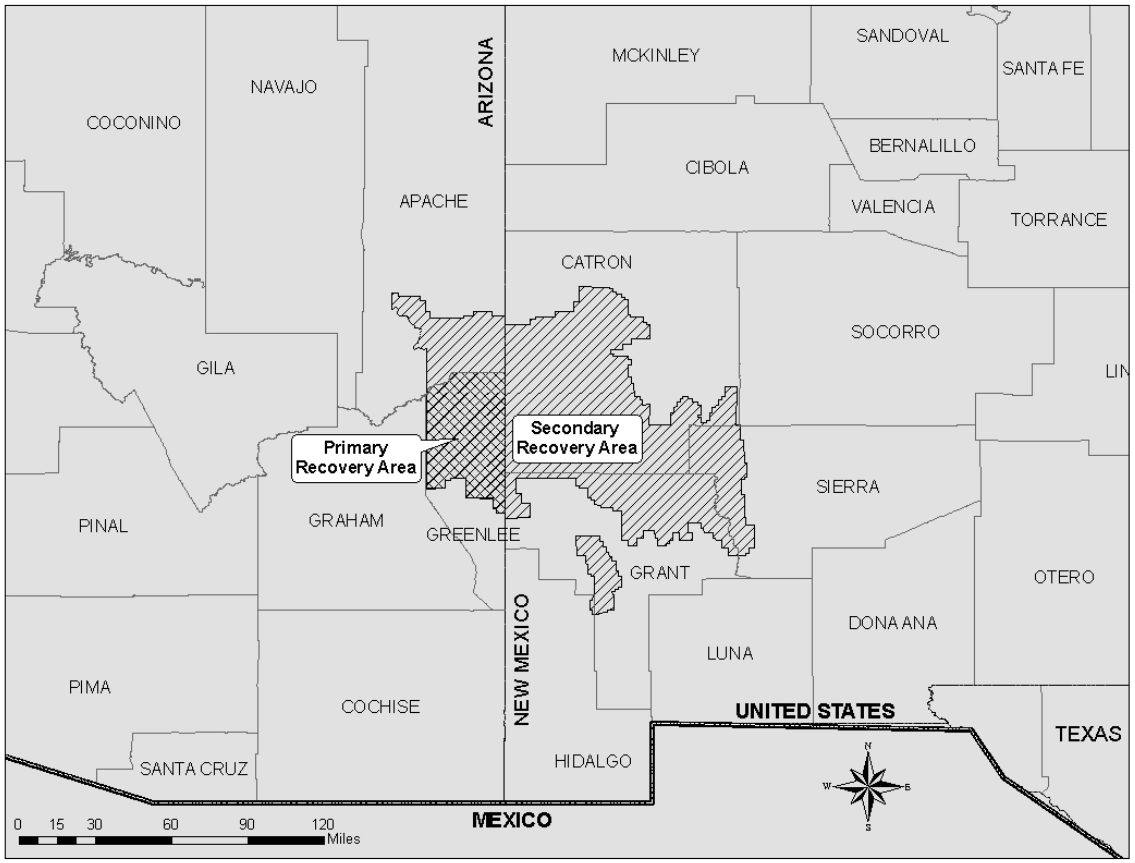
[17] U.S. Fish and Wildlife Service (1996), *Reintroduction of the Mexican Wolf Within Its Historic Range in the Southwestern United States: Final Environmental Impact Statement.* When comparing data describing the BRWRA in this analysis and the FEIS, note that the two analyses have separate definitions of the study area. The FEIS relies on statistics from the 1990 Census tracts that are within the BRWRA (Apache County 3901; Greenlee County 9704; all of Catron County; Grant County 9841, 9842, and 9849; and Sierra County 7824). Since the location of tracts is not consistent between Censuses, however, this analysis defines the study area as the five counties that contain portions of the BRWRA in order to compare statistics between 1990 and 2000.

2.2 Overview of Study Area

The five counties in Arizona and New Mexico that contain portions of the BRWRA can be generally characterized as mountainous and sparsely populated. Within the BRWRA, elevations range from under 4,000 feet in the semi-desert lowlands to 11,000 feet in the mountains.[18] The population density across the five counties is approximately 4.5 people per square mile; in contrast, the average population density throughout the U.S. is 79.6 people per square mile.[19]

Exhibit 2-1

LOCATION OF BLUE RANGE WOLF RECOVERY AREA



The majority of land in Apache, Greenlee, Catron, Grant, and Sierra counties is publicly owned. In Apache County, Arizona, 21 percent of the land is publicly owned, 14 percent is privately owned, and 66 percent is within the Apache and Navajo reservations. In Greenlee County, Arizona, 94 percent of the land is publicly owned and only seven percent is privately

[18] John Oakleaf et al. (2004), *Mexican Wolf Recovery: Five-Year Review and Assessment – DRAFT*.

[19] U.S. Census Bureau (2000), Census 2000.

owned. In Catron, Grant, and Sierra counties, New Mexico, the percentages of land that are held publicly total 75, 64, and 82 percent, respectively, and private land comprises 25, 35, and 18 percent of these counties. In addition, tribal lands account for one percent of Grant County.

According to the Bureau of Economic Analysis, government jobs (including Federal, state, local, and military employment) represent the most common sector of employment in four of the five counties containing portions of the BRWRA; in Sierra County, the services sector employs the largest portion of the population. In Apache County, almost 52 percent of employees are employed by government entities, while the percentage of government employment ranges from 10 to 30 percent in the remaining counties. In Apache, Catron, Grant, and Sierra counties, many employees work for various service industries, including professional, technical, administrative, educational, waste, accommodation, food, and other services. The portion of employees in the service industry in these four counties ranges from 11 percent in Catron County to 23 percent in Sierra County. Wholesale and retail trade also represents a major industry in the five counties, employing between six percent (in Greenlee and Catron counties) and 13 percent (in Grant County) of full- and part-time employees. Furthermore, construction employs between five and seven percent of workers in the five counties. Finally, a portion of the population in each of the counties in the study area is employed on farms and ranches. Two percent of full- and part-time employees work on farms in Apache County, three percent work on farms in Grant County, five percent work on farms in Greenlee County, eight percent work on farms in Sierra County, and 20 percent work on farms in Catron County.[20] Raising beef cattle and calves constitutes the primary activity on the farms and ranches in the study area.

As discussed in the FEIS, the majority of the communities in proximity to the BRWRA are small, with only Deming and Silver City, New Mexico, having populations greater than 10,000. Many of these cities and towns were established as mining towns at the turn of the century. Following countywide patterns, primary economic activities in these communities at present are services, retail trade, and some construction. The FEIS noted that tourism and the movement of retirees into these communities represented the primary drivers of these industries; this pattern has continued since 1998. In addition, many residents work for the Federal, state, and local government, and agriculture continues to play an important role, particularly in the smaller communities.

Industries other than retail, services, and the government do employ a substantial number of residents in certain communities. Clifton, Arizona, contains a copper mine that employs 70 percent of the town's residents. Mining activities contribute to the relatively high median income and employment rates in this community (see Exhibits 2-9 and 2-12 later in this section). Furthermore, workers from other communities commute to work at this mine.[21] The primary economic activity in Eagar and Springerville, Arizona, is power generation at two plants. In

[20] These percentages do not include employment in the forestry, fishing, hunting, and agriculture support sector, which accounts for less than one percent of employment in all counties except for Catron, where approximately six percent of employees work in this sector. Source: U.S. Department of Commerce Bureau of Economic Analysis (2005), Regional Economic Accounts, CA25N: Total full-time and part-time employment by industry in 2002, accessed March 23, 2005, at <http://www.bea.doc.gov/bea/regional/reis/default.cfm>.

[21] Arizona Department of Commerce (2005), Arizona Community Economic Base Studies, accessed March 23, 2005, at <http://www.commerce.state.az.us/prop/eir/azcommunitybasestudy.asp>.

addition to work at these utilities, many residents commute to work in other communities such as St. Johns, which is located farther from the BRWRA. Similar to the county employment trends, however, many residents of Eagar and Springerville work for the government, as well as in manufacturing, accommodation, and the food services sectors.[22] The remainder of this section provides more detailed information on climatic conditions, demographic trends, and economic indicators in the counties and communities in proximity to the BRWRA.

2.3 Climatic Conditions

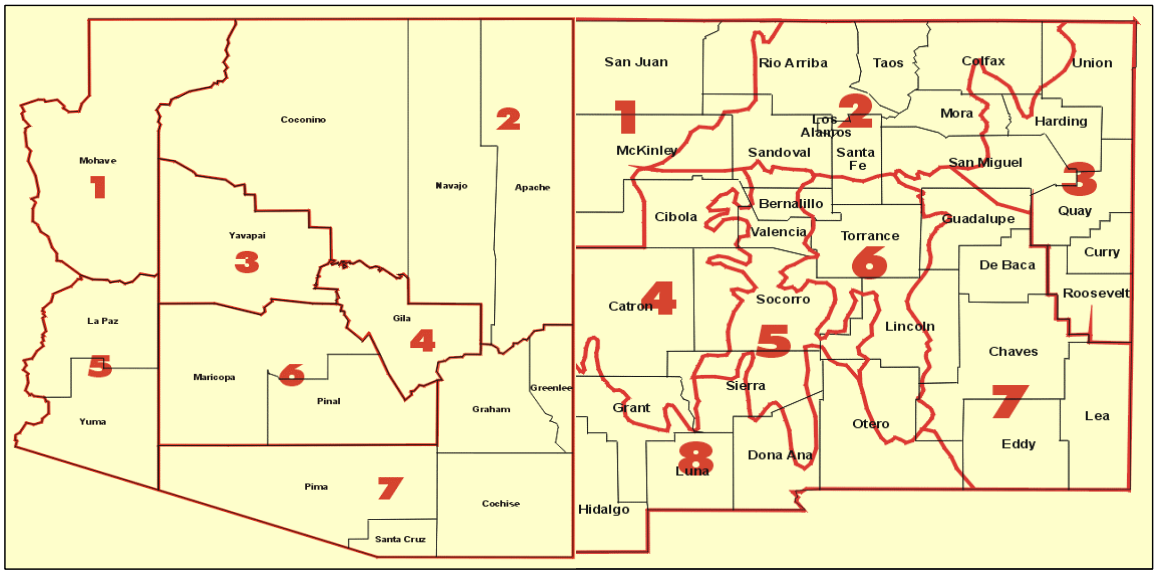
Seasonal and long-term weather patterns affect water availability and plant growth. In the BRWRA, these conditions can directly influence economic activities such as ranching, which relies on available forage for livestock; hunting, which relies on the availability of wild game; and tourism, which is influenced by the weather. Under typical conditions, the amount of rainfall varies substantially throughout the study area. The average annual precipitation is only approximately 12 inches in the lowlands, but annual precipitation levels reach 37 inches in the mixed conifer forests.[23] The Palmer Drought Severity Index (PDSI), prepared by the National Weather Service, represents an index of relative dryness or wetness. The National Weather Service divides states into climate zones and classifies these divisions weekly on a scale ranging from extreme drought to extremely moist. Exhibit 2-2 illustrates the National Weather Service climate divisions for Arizona and New Mexico; Exhibit 2-3 presents the PDSI from 1998 to 2004 in Arizona Zones 2 and 7 and New Mexico Zones 4 and 8, the four climate divisions that overlap with the BRWRA. As Exhibit 2-3 demonstrates, these areas experienced moist conditions in 1998 and the beginning of 2001, but they also underwent prolonged drought periods in 1999 and 2002 through 2004. As discussed in the hunting and grazing sections of this analysis, the recent drought has affected forage availability for cattle and wild game, leading to a reduction in herd numbers due to the decreased carrying capacity of the land.

[22] Arizona Department of Commerce (2005), Arizona Community Economic Base Studies, accessed March 23, 2005, at <http://www.commerce.state.az.us/prop/eir/azcommunitybasestudy.asp>.

[23] John Oakleaf et al. (2004), *Mexican Wolf Recovery: Five-Year Review and Assessment – DRAFT*.

Exhibit 2-2

ARIZONA AND NEW MEXICO PALMER DROUGHT SEVERITY INDEX ZONES

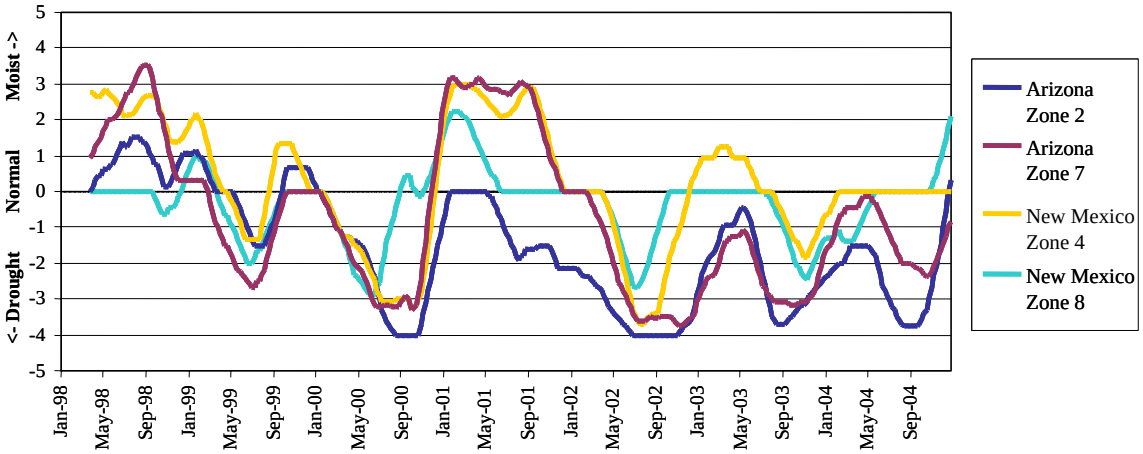


Note: The National Weather Service divides the states into climate zones and classifies these zones weekly on a scale ranging from extreme drought to extremely moist (relative to the normal conditions in each zone).

Source: National Weather Service Climate Prediction Center. 2005. Past Palmer Drought Severity Index Maps by Week for 1998 - 2004. Accessed January 3, 2005, at <http://www.cpc.ncep.noaa.gov/products/monitoring_and_data/drought.shtml>.

Exhibit 2-3

PALMER DROUGHT INDEX: QUARTERLY MOVING AVERAGE (1998 – 2004)



Source: National Weather Service Climate Prediction Center. 2005. Past Palmer Drought Severity Index Maps by Week for 1998 - 2004. Accessed January 3, 2005, at <http://www.cpc.ncep.noaa.gov/products/monitoring_and_data/drought.shtml>.

2.4 Population Trends

This section discusses population trends and age distributions in counties and communities in proximity to the BRWRA. We also compare these data to statewide and U.S. trends in order to better understand how demographics in the study area differ from state and national averages.

2.4.1 Total Population

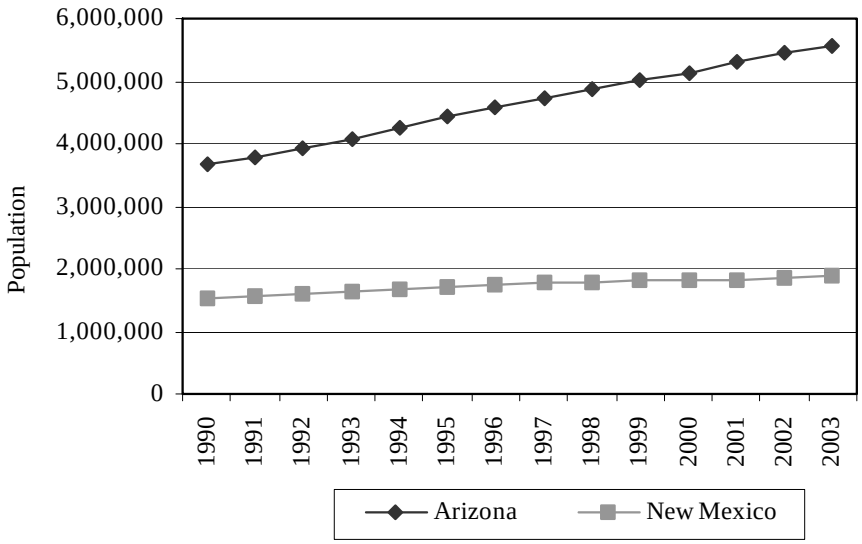
From 1990 to 2003, the U.S. population grew from 248.7 million to 290.8 million, an increase of 17 percent. During this same period, Arizona experienced rapid growth; the number of people living in the state increased from less than 3.7 million in 1990 to an estimated 5.8 million in 2003. This growth represents a 53 percent increase. New Mexico's growth, while more moderate than that of Arizona, also exceeded the national average; it increased 24 percent from 1.5 million to 1.9 million.[24, 25] Exhibit 2-4 depicts these population changes.

[24] U.S. Census Bureau (1990), Census 1990; U.S. Census Bureau, Population Division (2004a), U.S. and State Population Estimates from the U.S. Bureau of the Census: U.S. and State Population Estimates, 2000 to 2004, prepared by the Bureau of Business and Economic Research, University of New Mexico, accessed March 6, 2005, at <http://www.unm.edu/~bber/demo/ usto2000s.htm>.

[25] U.S. Census Bureau projections for the state of New Mexico are lower than those estimated by the University of New Mexico Bureau of Business and Economic Research. To the extent that the UNM estimates are more accurate, figures in this analysis may understate the population in New Mexico and its counties

Exhibit 2-4

ARIZONA AND NEW MEXICO POPULATION
(1990 – 2003)



Note: Population figures from 2001 to 2003 represent projections rather than population counts. U.S. Census Bureau projections for the state of New Mexico are lower than those estimated by the University of New Mexico Bureau of Business and Economic Research. To the extent that the UNM estimates are more accurate, figures in this analysis may understate the population in New Mexico counties.

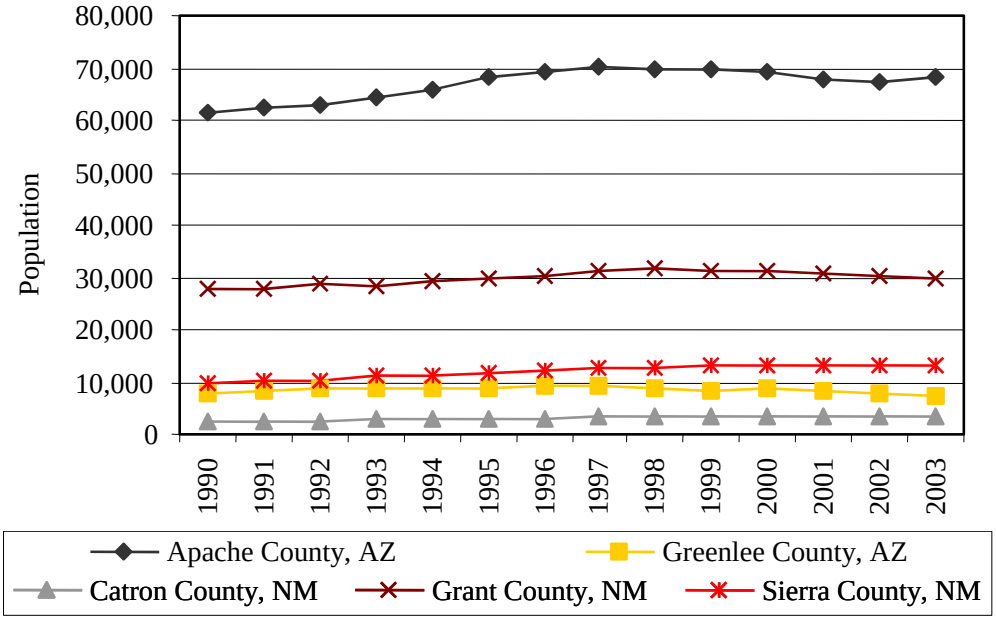
Sources: Arizona, 1990 – 2003: U.S. Census Bureau, Population Division (2004b), Intercensal Population Estimates of Arizona Counties: 1970-2003, accessed February 17, 2005, at <http://www.workforce.az.gov/admin/ uploadedPublications/524_betty70-97-2.pdf>; New Mexico, 1990 - 2000: U.S. Census Bureau, Population Division (2002), New Mexico Revised County Population Estimates from the U.S. Census Bureau, prepared by the Bureau of Business and Economic Research, University of New Mexico, accessed March 6, 2005, at <http://www.unm.edu/~bber/demo/nmcos4-19-02.htm>; New Mexico, 2001 – 2003: U.S. Census Bureau, Population Division (2004c), New Mexico County Population Estimates from the U.S. Census Bureau, prepared by the Bureau of Business and Economic Research, University of New Mexico, accessed March 6, 2005, at <http://www.unm.edu/~bber/demo/copopest.htm>.

The population of the five counties containing portions of the BRWRA totaled approximately 122,000 people in 2003; these counties account for less than two percent of the population in Arizona and New Mexico. While Arizona and New Mexico experienced population growth of roughly 44 percent from 1990 to 2003, Exhibit 2-5 demonstrates that, as projected in the FEIS, population growth was less pronounced in the counties in the BRWRA. From 1990 to 2003, the population increased by 11 percent in the study area. Greenlee County, Arizona, is the only county that experienced a net decrease from 1990 to 2003; its population dropped six percent from 8,000 in 1990 to 7,500 in 2003. Apache County, Arizona, increased 11 percent over the same period, from 61,600 to 68,100. Grant County, New Mexico, experienced a moderate growth rate of eight percent, increasing from 27,700 in 1990 to 29,800 in 2003. Catron and Sierra counties in New Mexico underwent the largest growth rates of 33 and 32 percent, respectively. Catron County grew from 2,600 to 3,400, while Sierra County increased from

9,900 to 13,100.[26] The relatively large population growth in Catron County from 1990 to 2000 represents the only population change not predicted by the FEIS; the FEIS projected stable to negative population growth in Catron County, as opposed to an increase of over 30 percent.

Exhibit 2-5

COUNTY POPULATION TRENDS IN THE BRWRA STUDY AREA (1990 – 2003)



Note: Population figures from 2001 to 2003 represent projections rather than population counts. U.S. Census Bureau projections for the state of New Mexico are lower than those estimated by the University of New Mexico Bureau of Business and Economic Research. To the extent that the UNM estimates are more accurate, figures in this analysis may understate the population in New Mexico and its counties.

Sources: Arizona, 1990 – 2003: U.S. Census Bureau, Population Division (2004b), Intercensal Population Estimates of Arizona Counties: 1970-2003, accessed February 17, 2005, at <http://www.workforce.az.gov/admin/ uploadedPublications/524_betty70-97-2.pdf>; New Mexico, 1990 - 2000: U.S. Census Bureau, Population Division (2002), New Mexico Revised County Population Estimates from the U.S. Census Bureau, prepared by the Bureau of Business and Economic Research, University of New Mexico, accessed March 6, 2005, at <http://www.unm.edu/~bber/demo/nmcos4-19-02.htm>; New Mexico, 2001 – 2003: U.S. Census Bureau, Population Division (2004c), New Mexico County Population Estimates from the U.S. Census Bureau, prepared by the Bureau of Business and Economic Research, University of New Mexico, accessed March 6, 2005, at <http://www.unm.edu/~bber/demo/copopest.htm>.

[26] U.S. Census Bureau (2002), New Mexico Revised County Population Estimates from the U.S. Census Bureau, prepared by the Bureau of Business and Economic Research, University of New Mexico, accessed March 6, 2005, at <http://www.unm.edu/~bber/demo/nmcos4-19-02.htm>; U.S. Census Bureau, Population Division (2004b), Intercensal Population Estimates of Arizona Counties: 1970-2003, accessed February 17, 2005, at <http://www.workforce.az.gov/admin/uploadedPublications/524_betty70-97-2.pdf>; U.S. Census Bureau, Population Division (2004c), New Mexico County Population Estimates from the U.S. Census Bureau, prepared by the Bureau of Business and Economic Research, University of New Mexico, accessed March 6, 2005, at <http://www.unm.edu/~bber/demo/copopest.htm>.

This section also includes population information for selected cities and towns within or in proximity to the BRWRA. Exhibit 2-6 shows the locations of these communities, and Exhibit 2-7 displays their population in 1990 and 2000. On average, the communities' population growth rate was slower than that in Arizona and New Mexico as a whole. Exhibit 2-7 further demonstrates that the majority of the communities significantly lagged behind the average growth rate in their states; only three communities (Show Low, Arizona, and Deming and Reserve, New Mexico) approached or exceeded the Arizona and New Mexico growth rates of 52 and 24 percent, respectively.

Exhibit 2-6

LOCATION OF COMMUNITIES IN PROXIMITY TO THE BLUE RANGE WOLF RECOVERY AREA

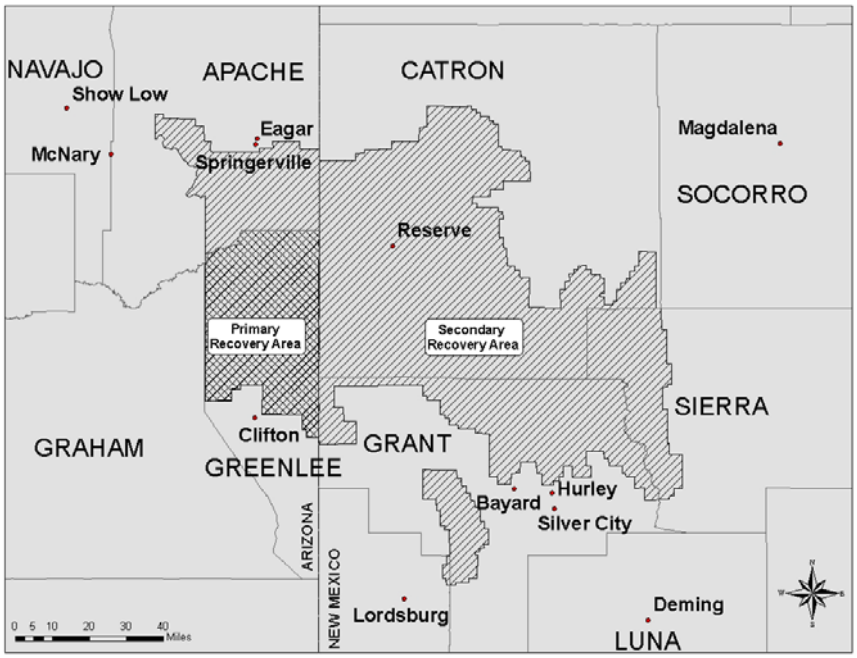


Exhibit 2-7

COMMUNITY POPULATION TRENDS IN THE BRWRA STUDY AREA
(1990 and 2000)

Community	1990 Population	2000 Population	Growth Rate	Average Growth Rate (State)	Average Growth Rate (U.S.)
Clifton, AZ	2,840	2,600	-8.6%	52.3%	16.9%
Eagar, AZ	4,030	4,030	0.2%	52.3%	16.9%
McNary, AZ	360	350	-1.7%	52.3%	16.9%
Show Low, AZ	5,020	7,700	53.3%	52.3%	16.9%
Springerville, AZ	1,800	1,970	9.4%	52.3%	16.9%
Bayard, NM	2,600	2,530	-2.5%	23.7%	16.9%
Deming, NM	10,970	14,120	28.7%	23.7%	16.9%
Hurley, NM	1,530	1,460	-4.6%	23.7%	16.9%
Lordsburg, NM	2,950	3,380	14.5%	23.7%	16.9%
Magdalena, NM	860	910	6.0%	23.7%	16.9%
Reserve, NM	320	390	21.3%	23.7%	16.9%
Silver City, NM	10,680	10,550	-1.3%	23.7%	16.9%

Note: The percentage change between the 1990 and 2000 population figures may not equal the growth rate due to rounding.

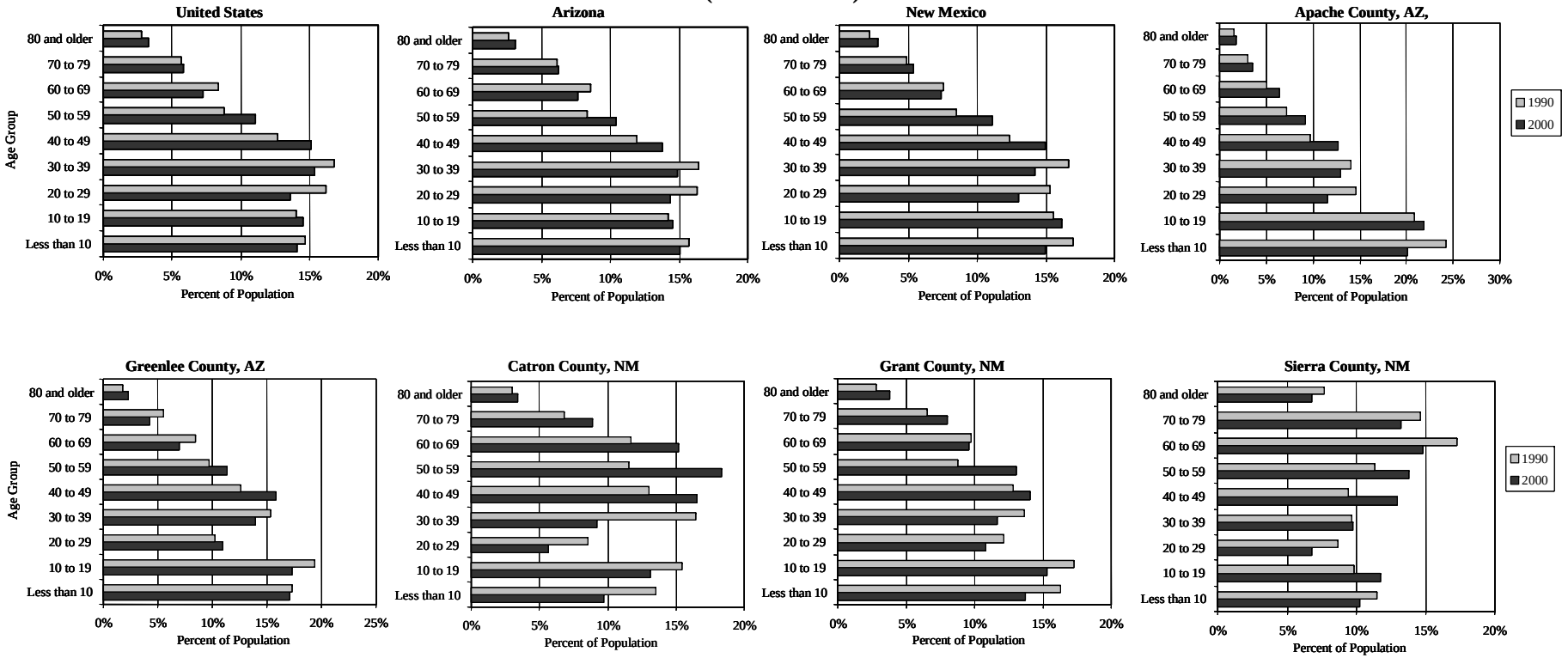
Sources: U.S. Census Bureau (1990), Census 1990; U.S. Census Bureau (2000), Census 2000.

2.4.2 Population Age Structure

Exhibit 2-8 compares the age distribution of the population within the U.S., Arizona, New Mexico, and the five counties containing portions of the BRWRA. Apache and Greenlee counties in Arizona have younger populations than the U.S. and Arizona averages. The counties within New Mexico (Catron, Grant, and Sierra) have disproportionately older populations and lower percentages of people below the age of 30 than the rest of the country and New Mexico. Catron and Grant counties in particular have aging populations, which could likely indicate the movement of retirees into these areas. Such movement could have impacts on median income levels and local industries, as discussed in subsequent sections.

Exhibit 2-8

POPULATION AGE STRUCTURE
(1990 and 2000)



Sources: U.S. Census Bureau (1990), Census 1990; U.S. Census Bureau (2000), Census 2000.

2.5 Economic Indicators

This section describes the economic conditions in the counties and communities in proximity to the BRWRA. Similar to the previous section, the discussion compares economic conditions in Apache, Greenlee, Catron, Grant, and Sierra counties as well as selected communities in the study area to state and national averages. Economic indicators include median household income, poverty rates, trends in employment and the portion of employment in the agriculture, forestry, fishing, and hunting sector, and unemployment rates.

2.5.1 Median Household Income

According to the 1990 U.S. Census, the median household income in Arizona was $42,000 (2004$), which was moderately below the national average of $45,800 (2004$).[27] According to the 2000 U.S. Census, the median income in Arizona was $46,000, compared to the national average of $47,600. The median household income in New Mexico during the same years was further below the national average; it equaled $36,700 and $38,700 in 1990 and 2000, respectively. As Exhibit 2-9 demonstrates, the median household income in the majority of counties in the study area was significantly below the national and state averages. The average median household income in the five counties, weighted by population, was $26,100 in 1990 and $29,400 in 2000. Only Greenlee County approached average income levels; in 1990, the median household income in Greenlee County was $41,900, while in 2000 the county's median household income equaled $44,700. Of the counties in the study area, Apache County, Arizona, demonstrated the lowest median income; it was $21,500 in 1990 and $26,500 in 2000.[28] These figures are below the median income of $32,900 ($21,600 in nominal dollars) reported by the FEIS for the BRWRA in 1990.[29] Income levels may be less than state averages due to the aging populations and number of retirees moving into the counties containing portions of the BRWRA because retired individuals living on fixed incomes typically have lower incomes than other segments of the population. Furthermore, residents of Apache County may demonstrate particularly low income levels because of the large portion of the land that is within Apache and Navajo reservations, areas that typically have lower income and higher poverty rates.

The majority of the communities within and in proximity to the BRWRA also exhibit below average median household incomes. In 1990, only Clifton and Eagar, Arizona, demonstrated income levels similar to state and national averages. The median household income was $41,400 in Clifton and $47,000 in Eagar. These higher incomes could be due to the presence of industry, including mining activity in Clifton and power generation in Eagar. The communities in the study area with the lowest median household incomes in 1990 were McNary, Arizona ($16,800), and Deming, ($23,700), Lordsburg, ($24,500), and Bayard, New Mexico

[27] All dollar values from this point forward are presented in 2004$, adjusted based on the consumer price index for all commodities.

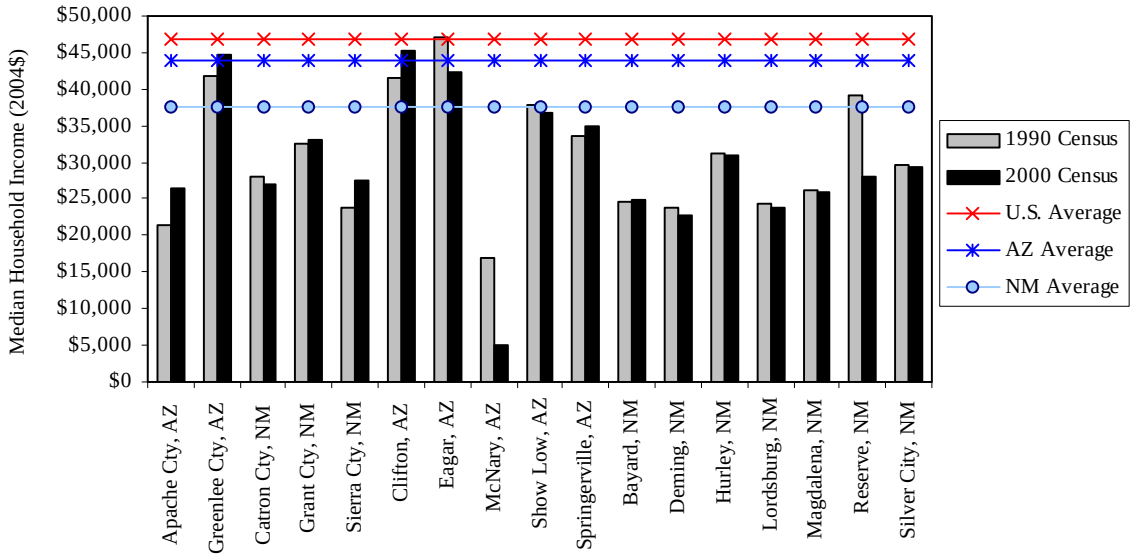
[28] U.S. Census Bureau (1990), Census 1990; U.S. Census Bureau (2000), Census 2000.

[29] While the FEIS also relied on 1990 Census data for income figures, it only considered income levels in tracts within the BRWRA (Apache County 3901; Greenlee County 9704; all of Catron County; Grant County 9841, 9842, and 9849; and Sierra County 7824), while this analysis averages income levels throughout the counties containing portions of the BRWRA.

($24,600).[30] Again in 2000, only Clifton ($45,100) and Eagar ($42,400) had median household incomes that approached state and national levels. McNary ($5,000) and Deming ($22,800) continued to demonstrate the lowest median household incomes among communities in the study area. In Arizona, New Mexico, the U.S., and the majority of counties and communities in the study area, median income levels increased moderately or remained relatively stable from 1990 to 2000. In Eagar and McNary, Arizona, and Reserve, New Mexico, however, income levels decreased by 10, 70, and 28 percent, respectively.[31] Exhibit 2-9 depicts the median household income levels in these areas according to the 1990 and 2000 U.S. Census.

Exhibit 2-9

MEDIAN HOUSEHOLD INCOME
(1990 and 2000)



Sources: U.S. Census Bureau (1990), Census 1990; U.S. Census Bureau (2000), Census 2000.

2.5.2 Poverty Status

Just as median household incomes are disproportionately low in the study area, a greater portion of the population in proximity to the BRWRA lives below the poverty line. The 1990 Census reported that approximately 13 percent of the U.S. population lived in poverty, and the 2000 Census reported that approximately 12 percent lived in poverty. Both Arizona and New Mexico have higher poverty rates. In Arizona, 16 percent of the population lived below the poverty line in 1990 and 14 percent lived below the poverty line in 2000; in New Mexico, these percentages increase to 21 percent and 18 percent in 1990 and 2000, respectively.[32]

[30] Unlike the other communities in the study area, McNary is a Census Designated Place (CDP) rather than an incorporated municipality. This difference may partially account for its low income and high unemployment and poverty rates.

[31] U.S. Census Bureau (1990), Census 1990; U.S. Census Bureau (2000), Census 2000.

[32] U.S. Census Bureau (1990), Census 1990; U.S. Census Bureau (2000), Census 2000.

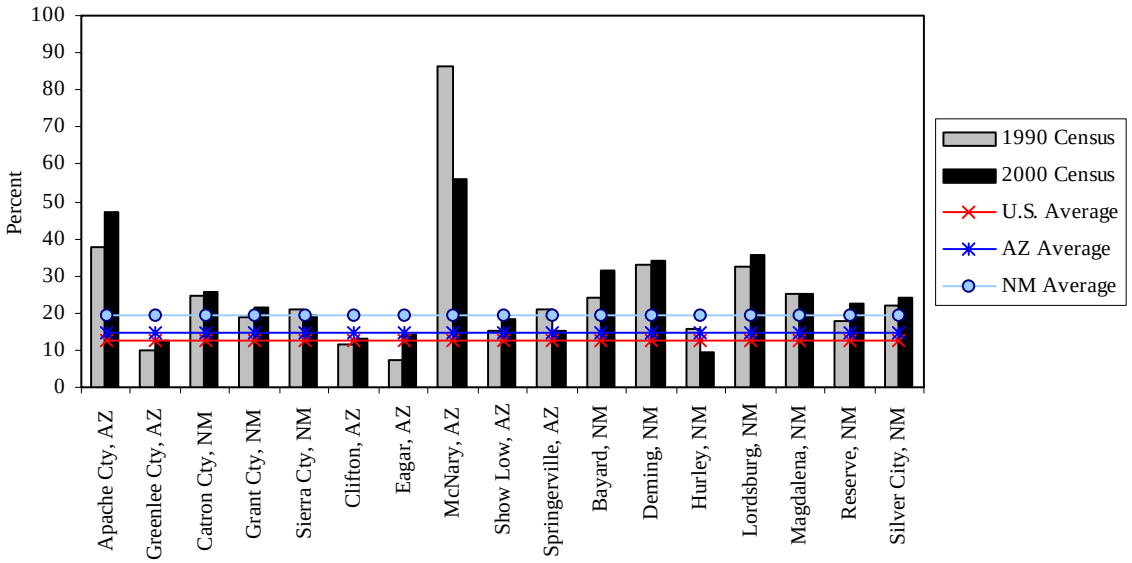
Once again, the majority of the counties containing portions of the BRWRA demonstrate poverty levels above the national average; the average poverty rate in the study area was 35 percent in 1990 and 29 percent in 2000. Only Greenlee County had equal or lower poverty rates (13 percent and 10 percent according to the 1990 and 2000 U.S. Census, respectively). While the poverty levels in Grant County (21 percent in 1990; 19 percent in 2000) and Sierra County (20 percent in 1990; 21 percent in 2000) exceed national levels, they were indicative of poverty rates throughout New Mexico. Apache County, Arizona, had the highest poverty rates of the five counties in both 1990 (47 percent) and 2000 (38 percent). Clifton and Eagar, Arizona, and Hurley, New Mexico, represent the only communities whose poverty rates approximately equal national levels. For the remaining communities, a disproportionate portion of the population lives below the poverty line compared to the remainder of the country. Show Low and Springerville, Arizona, as well as Reserve, New Mexico, have poverty rates similar to statewide averages. McNary demonstrated the highest poverty rate among the communities in the study area; according to the 1990 and 2000 Census, rates equaled approximately 56 and 86 percent, respectively. Bayard, Deming, and Lordsburg, New Mexico, also had higher poverty rates than the surrounding areas.[33] Exhibit 2-10 presents poverty status data for these areas.

In contrast to the findings presented in this analysis, the FEIS reported that approximately 18 percent of the population in the BRWRA lived below the poverty level in 1990. This rate is closer to state and national averages. The difference in poverty rates between the FEIS and this analysis likely results from the difference in study areas; this analysis reports a weighted average for all counties containing portions of the BRWRA, while the FEIS only includes the 1990 Census tracts within the BRWRA (Apache County 3901; Greenlee County 9704; all of Catron County; Grant County 9841, 9842, and 9849; and Sierra County 7824).

[33] U.S. Census Bureau (1990), Census 1990; U.S. Census Bureau (2000), Census 2000.

Exhibit 2-10

PERCENT OF POPULATION LIVING BELOW THE POVERTY LEVEL (1989 and 1999)



Sources: U.S. Census Bureau (1990), Census 1990; U.S. Census Bureau (2000), Census 2000.

2.5.3 Employment

Exhibit 2-11 presents the number of employees by industry in the study area in 2003. As discussed in the overview section, the majority of full- and part-time workers in the study area are employed by the government, trade, and service sectors. As discussed in the FEIS, increasing tourist activity and the movement of retirees into the counties likely drives the trade and service sectors. The same trends are also likely to contribute to employment in the construction and real estate markets in these communities. The government, trade, and service sectors are not as likely to experience significant positive or negative impacts due to the presence of Mexican wolves. The reintroduction program could increase the workload of some government employees. For instance, the U.S. Fish and Wildlife Service would likely require additional staff to administer the program, and state and local officials may spend time attending meetings related to the Mexican wolf. Overall, however, the government sector should not change significantly due to Mexican wolves. The presence of wolves could also affect tourism activities, but no single sector accounts for all such activities. Instead, tourism is only one driver of several sectors such as retail trade, accommodation and food services, arts, entertainment, and recreation, and real estate.

Exhibit 2-11

EMPLOYMENT ACROSS SECTORS, 2003[a]

Industry	Arizona	New Mexico	Apache, AZ	Greenlee, AZ	Catron, NM	Grant, NM	Sierra, NM
Farm	22,523	23,950	459	216	308	442	357
Agricultural Services, Forestry, Hunting, and Fishing	22,835	7,387	(D)	(D)	91	(D)	(D)
Mining	10,707	17,556	(D)	(D)	(L)	609	(D)
Utilities	11,548	4,057	(D)	47	(D)	(D)	(D)
Construction	217,526	63,008	1,181	264	103	987	300
Manufacturing	187,381	42,245	(D)	(D)	28	226	53
Wholesale Trade	102,715	26,404	303	(D)	(D)	198	(D)
Retail Trade	340,332	113,289	2,124	247	87	1,575	504
Transportation and Warehousing	81,482	24,093	(D)	(D)	57	(D)	75
Information	56,069	17,733	145	(D)	(D)	179	32
Finance and Insurance	159,189	31,680	(D)	(D)	13	310	100
Real Estate	141,671	30,922	(D)	(D)	84	414	223
Services[b]	815,708	263,506	3,907	(D)	162	2,502	1,040
Government	417,726	213,002	13,285	532	364	3,618	946
Other[b]	339,055	127,531	1,712	0	31	210	112
Total[c]	**2,926,467**	**1,006,363**	**25,362**	**4,295**	**1,531**	**13,329**	**4,514**

Notes:

[a] The estimates of employment are based on the 2002 North American Industry Classification System (NAICS). (D) signifies that actual employment figures are not shown to avoid disclosure of confidential information, but the estimates for this item are included in the totals. (L) signifies that there are less than 10 jobs in a sector, but the estimates for this item are included in the totals.

[b] Numbers for the "Services" and "Other" sectors may underestimate employment as certain subsectors within these categories do not list employment data for proprietary reasons given the small number establishments within these subsectors.

[c] Employment across sectors may not sum to total because certain sectors do not report employment figures for proprietary reasons given the small number of establishments within these sectors.

Source: U.S. Department of Commerce Bureau of Economic Analysis (2005), Regional Economic Accounts, CA25: Total full-time and part-time employment by industry, accessed May 11, 2005, at <http://www.bea.doc.gov/bea/regional/reis/default.cfm>.

The sectors that most likely experienced the greatest changes due to the Mexican wolf reintroduction program are farming and the services associated with agriculture, hunting, and the fishing sectors; Exhibit 2-12 presents changes in these sectors as well as changes in total employment between 1990 and 2003. In Arizona, New Mexico, and Apache, Greenlee, and Grant counties, agriculture represents five percent or less of total employment in both 1990 and 2003.[34] In Sierra County, agriculture and related services accounted for 11 and eight percent of employment in 1990 and 2003, respectively. Agriculture and related services employ the largest

[34] For the remainder of this section, employment in "agriculture" refers to full- and part-time employment within the agricultural services, forestry, fishing, and hunting sector (SIC 100 in 1990; NAICS two-digit sector "11" in 2003) and employment on farms and ranches. Employment numbers for "agriculture" may underestimate actual employment as certain subsectors within these categories do not list employment data for proprietary reasons given the small number establishments within these subsectors.

portion of the population in Catron County; in 1990 and 2003, these sectors accounted for 23 and 26 percent of the population, respectively.[35]

Exhibit 2-12

TOTAL EMPLOYMENT VERSUS EMPLOYMENT IN THE AGRICULTURE, FISHING, AND HUNTING SECTOR (1990 – 2003)

	Year	1990	2003	Percent Change
Arizona	**Total**[a]	1,909,879	2,926,467	53.23%
	Agriculture[b]	47,114	45,358	-3.73%
	Percent	2.47%	1.55%	N.A.
New Mexico	**Total**[a]	767,139	1,006,363	31.18%
	Agriculture[b]	28,180	31,337	11.20%
	Percent	3.67%	3.11%	N.A.
Apache County, AZ	**Total**[a]	17,876	25,362	41.88%
	Agriculture[b]	483	459	-4.97%
	Percent	2.70%	1.81%	N.A.
Greenlee County, AZ	**Total**[a]	3,607	4,295	19.07%
	Agriculture[b]	187	216	15.51%
	Percent	5.18%	5.03%	N.A.
Catron County, NM	**Total**[a]	1,246	1,531	22.87%
	Agriculture[b]	282	399	41.49%
	Percent	22.63%	26.06%	N.A.
Grant County, NM	**Total**[a]	12,046	13,329	10.65%
	Agriculture[b]	436	442	1.38%
	Percent	3.62%	3.32%	N.A.
Sierra County, NM	**Total**[a]	3,334	4,514	35.39%
	Agriculture[b]	352	357	1.42%
	Percent	10.56%	7.91%	N.A.

Note:
[a] "Total" represents total full and part-time employment, including employees, sole proprietors, and active partners but not unpaid family workers or volunteers.
[b] "Agriculture" represents employment within the agricultural services, hunting, forestry, and fishing sector (SIC 100 in 1990; NAICS two-digit sector "11" in 2003) and employment on farms and ranches. Employment numbers for "Agriculture" may underestimate actual employment as certain subsectors within these categories do not list employment data for proprietary reasons given the small number establishments within these subsectors..

Source: U.S. Department of Commerce Bureau of Economic Analysis (2005), Regional Economic Accounts, CA25: Total full-time and part-time employment by industry, accessed May 11, 2005, at <http://www.bea.doc.gov/bea/regional/reis/default.cfm>.

From 1990 to 2003, total employment across all sectors in Arizona and New Mexico increased by 53 and 31 percent, respectively. This increase in employment resembled changes in population, which increased by 53 percent and 24 percent from 1990 to 2000 in Arizona and New Mexico, respectively. Employment growth did outpace population growth in the study

[35] U.S. Department of Commerce Bureau of Economic Analysis (2005), Regional Economic Accounts, CA25: Total full-time and part-time employment by industry, accessed May 11, 2005, at <http://www.bea.doc.gov/bea/regional/reis/default.cfm>.

area, however; employment increased by 32 percent from 1990 to 2003, while population increased by 11 percent during the same period. Employment increases in the majority of the five counties containing portions of the BRWRA did not match state rates; only Sierra County sustained employment increases that exceeded the state average (35 percent increase, compared to 31 percent throughout New Mexico).

In the majority of the counties containing portions of the BRWRA, employment in the agriculture sectors did not demonstrate the same growth as total employment. In Arizona, employment in the agriculture sectors decreased by almost four percent. Consequently, the percent of employment within the agriculture sector decreased from 1990 to 2003. In New Mexico, both total and agricultural employment increased, but since increases in the agriculture sectors were less substantial, the percent of employment in agriculture declined slightly. The percent of employment attributable to agriculture decreased significantly in Apache County as total employment increased by 42 percent but agricultural employment decreased by five percent. Catron County represents the only county where the percentage of the workforce within the agriculture sectors increased; Bureau of Economic Analysis data suggest that agricultural employment increased by 41 percent from 1990 to 2003 while total employment grew by only 23 percent. In the remaining counties, both agricultural and total employment increased during this period, resulting in little change in the percent of employment attributable to agriculture.[36] The FEIS predicted that farm and ranch employment would decrease by approximately eight percent from 1988 to 2000. While agriculture did not grow as strongly as other sectors in the study area, it did perform better than FEIS predictions.

Growth in employment in the agriculture sectors exceeded population increases in Greenlee and Catron counties between 1990 and 2003. In Greenlee County, population decreased by six percent while employment in the agriculture sectors increased by almost 16 percent. In Catron County, employment in the agriculture sectors increased by 41 percent, compared to a 33 percent increase in population. In the remaining counties in the study area, however, population growth exceeded changes in employment in the agriculture sectors. In Apache County, employment in the agriculture sector decreased by five percent while population increased by 11 percent. In Grant and Sierra counties, employment in the agriculture sectors increased by one percent while population increased by eight and 32 percent, respectively.

2.5.4 Unemployment

In 1990, the unemployment rate was six percent nationwide, seven percent in Arizona, and eight percent in New Mexico.[37] Unemployment was significantly higher in the study area, averaging 17 percent. Of the five counties, Apache County, Arizona, demonstrated the highest unemployment rate (24 percent); this rate could in part be the result of the high percentage of the population living on the Apache and Navajo reservations, as reservations typically demonstrate above-average unemployment rates. Catron and Grant counties, New Mexico, also had rates

[36] U.S. Department of Commerce Bureau of Economic Analysis (2005), Regional Economic Accounts, CA25: Total full-time and part-time employment by industry, accessed May 11, 2005, at <http://www.bea.doc.gov/bea/regional/reis/default.cfm>.

[37] The unemployment rate equals the number of unemployed in the civilian labor force divided by the total civilian labor force.

higher than 10 percent in 1990; unemployment totaled almost 13 percent in Catron County and over 10 percent in Grant County. Unemployment in Greenlee and Sierra counties was closer to the state and national averages. Of the communities, McNary, Arizona, demonstrated the highest unemployment rate, topping 50 percent. Several other communities in the study area also had unemployment rates greater than 10 percent, including Springerville, Arizona (13 percent), and Bayard (13 percent), Deming (17 percent), Hurley (11 percent), Lordsburg (12 percent), and Silver City, New Mexico (11 percent).[38]

The national unemployment rate continued to equal approximately six percent in 2000. Similarly, it equaled six percent in Arizona and seven percent in New Mexico. As in 1990, unemployment throughout the study area was higher, averaging 15 percent in 2000. Apache County continued to have the highest unemployment rate of the five counties; unemployment totaled approximately 22 percent in 2000. The remaining counties experienced moderately high unemployment rates during this time period compared to national and state averages. McNary, Arizona, continued to have the highest unemployment rate among the communities in the study area (21 percent). Fewer cities and towns in the study area demonstrated rates exceeding 10 percent in 2000; only the New Mexico communities of Bayard (11 percent), Deming (17 percent), Lordsburg (12 percent), and Magdalena (13 percent) had double-digit unemployment rates. While unemployment in the U.S., Arizona, New Mexico, and the majority of counties and communities decreased from 1990 to 2000, it increased in Clifton, Arizona (seven percent to nine percent), and Magdalena, New Mexico (seven to 13 percent).[39]

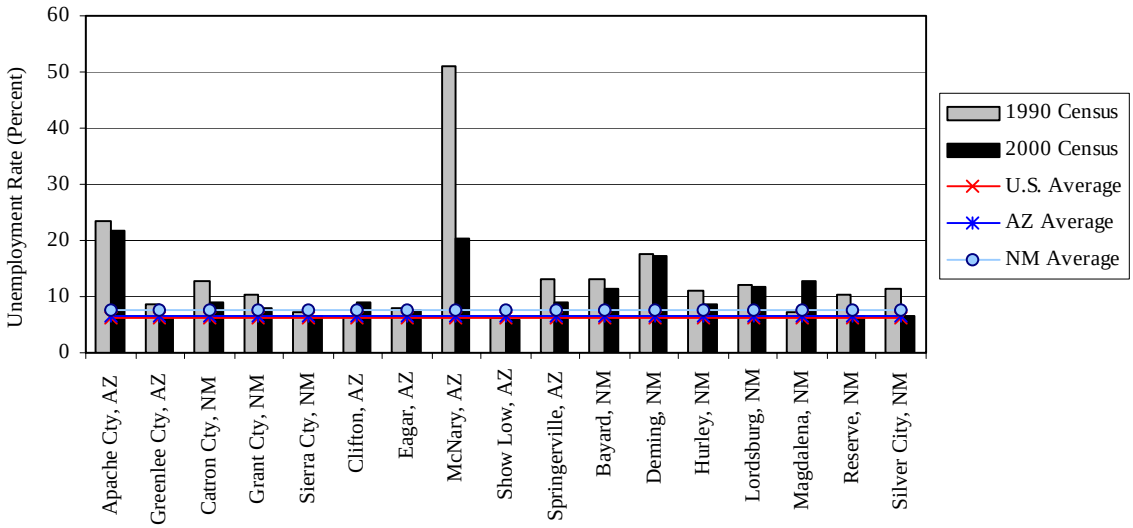
Unemployment rates reported in this analysis are more than twice as high as unemployment rates presented in the FEIS. While this analysis states that the average unemployment rate in the study area was 17 percent in 1990, the FEIS reports an unemployment rate of 8.3 percent. This difference most likely occurs because this analysis calculates unemployment rates across the five counties containing portions of the BRWRA, while the FEIS averages unemployment rates across the 1990 Census tracts that are within the BRWRA.

[38] U.S. Census Bureau (1990), Census 1990; U.S. Census Bureau (2000), Census 2000.

[39] U.S. Census Bureau (1990), Census 1990; U.S. Census Bureau (2000), Census 2000.

Exhibit 2-13

RATE OF UNEMPLOYMENT
(1990 and 2000)



Sources: U.S. Census Bureau (1990), Census 1990; U.S. Census Bureau (2000), Census 2000.

2.6 Conclusions

The majority of counties and communities in proximity to the BRWRA exhibit weaker demographic and economic indicators than Arizona and New Mexico as a whole. The poverty and unemployment rates are, in general, higher than elsewhere in the states and nationwide. Likewise, communities in proximity to the BRWRA have lower median household incomes. Employment in the agriculture, fishing, and hunting sector remains a small percentage of total employment with no clear increasing or decreasing trend.

Certain portions of the study area demonstrated particularly lower household income and higher poverty and unemployment rates. Apache County may have weaker economic indicators (i.e., lower median incomes and higher poverty and unemployment rates) in part due to the large portion of Native American-owned land in the northern part of the county (66 percent). McNary, Arizona, may demonstrate lower income and higher poverty and unemployment rates than other communities in the study area because it is a Census Designated Place (CDP) rather than an incorporated municipality. While the majority of the communities have weaker economic indicators than the state averages, Clifton's higher than average income and employment rate and a lower poverty rate may result from local mining activities. As discussed above, a nearby mine employs citizens from Clifton as well as residents in the surrounding areas, bringing economic activity to the area.

The FEIS was accurate when predicting that the areas in proximity to the BRWRA would not experience the same population growth from 1990 to 2000 as elsewhere in Arizona and New

Mexico. Similarly, the FEIS also noted that median income levels in the BRWRA were below state and national averages in 1990 (the FEIS did not project future income trends). As both the FEIS and this analysis note, lower income levels could be the result of aging populations and the movement of retirees into the study area.

While some FEIS projections are similar to trends reported in this analysis, other economic indicators vary between the two studies. Most notably, 1990 poverty and unemployment rates reported in the FEIS are significantly lower than in this analysis. This difference most likely occurs because the FEIS relies on statistics from the 1990 Census tracts that are within the BRWRA (Apache County 3901; Greenlee County 9704; all of Catron County; Grant County 9841, 9842, and 9849; and Sierra County 7824). Since the location of tracts is not consistent between Censuses, however, this analysis defines the study area as the five counties that contain portions of the BRWRA in order to compare statistics between 1990 and 2000.

ECONOMIC IMPACTS OF MEXICAN WOLF REINTRODUCTION ON RANCHING ACTIVITIES SECTION 3

This section of the analysis discusses the economic impacts of Mexican wolf reintroduction in the BRWRA on local ranching activities from 1998 to 2004.[40] The section begins by identifying categories of economic impacts that ranchers have identified as concerns for operations in proximity to wolves. Estimates are then presented of the number of livestock killed and injured by wolves and the associated costs of these losses to ranchers, including both the value of lost livestock and the time spent on activities related to the compensation process. In addition, this analysis compares the total value of losses with the monetary compensation that ranchers have received for livestock losses and considers the regional impact of decreased cattle production in the BRWRA. Finally, depredation estimates are compared to projected losses reported in the FEIS.[41]

3.1 Economic Concerns of the Ranching Industry Utilizing the BRWRA

Ranchers and researchers have identified a number of consequences that may result from the reintroduction of wolves in proximity to ranch operations. These impacts are summarized in the following categories:

Physical Effects:

1) **Depredation of ranch animals**: Includes cattle, sheep, horse, and dog deaths and injuries resulting from wolf attacks; and

2) **Non-lethal physiological impacts on ranch animals:** Includes weight loss, stress, and lower birth rates.

[40] This analysis evaluates the economic impacts associated with the wolf reintroduction program from 1998 to 2003. However, data for 2004 is included where available. Throughout this analysis, the "impacts" refer to both (positive) benefits and (negative) costs that could result from the Mexican wolf reintroduction program.

[41] U.S. Fish and Wildlife Service (1996), *Reintroduction of the Mexican Wolf Within Its Historic Range in the Southwestern United States: Final Environmental Impact Statement.*

Effects on Livestock Management:

3) **Need to alter forage use**: Ranchers may have to move cattle more often, or move them to alternative grazing sites;

4) **Need for additional labor**: Ranchers must invest time to report depredation losses, and may increase herd supervision;

5) **Increased expenditures on supplies**: Includes purchasing replacement cattle and additional herding dogs, as well as increased wear on vehicles; and

6) **Positive impacts**: Includes improved pasture conditions due to decreased grazing by livestock and wildlife and decreased predation by other carnivores.

To identify the consequences for ranchers, we interviewed cattle and sheep ranchers in the BRWRA and in Idaho, collected data from relevant Federal and state agencies, and reviewed literature on wolf reintroductions in the U.S. Our research included discussions with ranchers outside of Arizona and New Mexico because wolves were reintroduced earlier in other areas of the country, such as Yellowstone National Park, and their impacts in these regions are sometimes more established. In evaluating these consequences, we also considered whether sufficient evidence exists to demonstrate that these concerns 1) are resulting in economic impacts on ranchers grazing livestock within the BRWRA; 2) have costs that can be quantified throughout the BRWRA; and 3) can be compared to cost estimates presented in the FEIS.

This analysis estimates the economic costs of wolf reintroduction on ranching activities due to wolf predation on ranch animals, as well as the value of time spent by ranchers to apply for compensation. We also consider compensation received by ranchers for animal losses and estimate the annual regional economic effects of decreased livestock production. The economic impact of non-lethal physiological impacts on cattle, increased expenditures on ranch supplies, and potential impacts are also discussed in more detail but are not quantified in this analysis.

3.2 Brief Overview of Ranching Activities in the BRWRA

According to the USDA 2002 Census of Agriculture, there are 122,500 cattle, at least 300 sheep and lambs, and 9,000 horses and ponies in Apache and Greenlee counties, Arizona, and Catron, Grant, and Sierra counties, New Mexico.[42] Based on acreage, this analysis estimates that 34,800 cattle, (6,900 in Arizona and 27,800 in New Mexico), at least 120 sheep (80 in Arizona and 40 in New Mexico), and 1,600 horses (800 in Arizona and 800 in New Mexico) grazed in the BRWRA in 2002.[43] While these estimates are less than half of the 82,600 cattle estimated in the

[42] Sheep and lamb data underestimate total numbers because Apache and Catron counties do not report sheep inventories in order to protect the proprietary information of the few establishments that raise sheep. U.S. Department of Agriculture National Agricultural Statistics Service (2002), 2002 Census of Agriculture, accessed March 9, 2005, at <http://www.nass.usda.gov/census/>.

[43] In order to estimate the number of livestock in the BRWRA, this analysis multiplies the total county livestock figures by the percentage of the county that falls within the BRWRA.

FEIS to graze in the BRWRA, they are consistent with the number of cattle that are authorized to graze in the Gila and Apache National Forests.[44] The difference in estimates between this analysis and the FEIS could be explained by 1) a recent decrease in the number of authorized head in the national forests, in part due to a multi-year drought; and 2) the FEIS figures are based on permitted head, which represents the maximum number of cattle that may potentially graze in an allotment.[45]

Exhibit 3-1 presents the number of authorized animal unit months (AUMs) from 1986 to 2002 for cattle in the Gila National Forest, the portion of the BRWRA within New Mexico.[46] As the Exhibit indicates, the number of authorized AUMs declined over the past two decades. This trend is likely to result from multiple factors, including declining forage conditions due to drought and competition for forage by other ungulates, as well as attempts by USFS range managers to improve riparian habitat and to comply with other endangered species requirements.

The average death loss rate for cattle and calves in Arizona and New Mexico was four percent in 1997 (the year prior to the Mexican wolf reintroduction program); the average death loss rate for sheep in the two states was five percent in 1997.[47] Applying these percentages to the estimated number of livestock in the BRWRA, approximately 1,310 cattle and calves and six sheep died from causes other than slaughter or predation by wolves in the BRWRA in 2002.

[44] The methodology employed in this analysis estimates that 27,800 cattle grazed in the Gila National Forest in 2002. According to the U.S. Forest Service, up to 30,100 cattle are permitted to graze in the forest, while in 2004 only 18,800 cattle were actually authorized to do so.

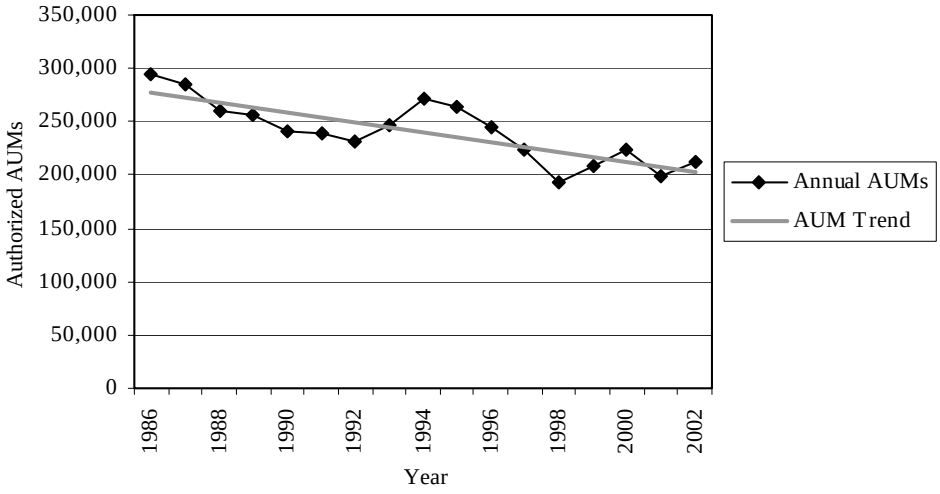
[45] The estimates derived in this analysis for the number of horses and sheep grazing in the BRWRA are higher than USFS authorizations; we estimate that almost 900 horses and 100 sheep existed in the Gila National Forest in 2002, while the U.S. Forest Service reports that only approximately 300 horses and no sheep were authorized to graze in the forest in 2004. The source of the 2002 authorization numbers is: U.S. Forest Service (2005), 2004 Livestock Head Estimates, received from Russell Ward, Gila National Forest, March 9, 2005.

[46] Data describing AUMs in the Apache-Sitgreaves National Forest, which contains the Arizona portion of the BRWRA, are not readily available for the same time period.

[47] Death losses include deaths caused by predators (such as coyotes, dogs, mountain lions, and bobcats); digestive, respiratory, and calving problems; weather conditions; poison; theft; and unknown causes. U.S. Department of Agriculture National Agricultural Statistics Service (1999), Meat Animals Production, Disposition, and Income: Final Estimates 1993-1997. Statistical Bulletin Number 959a.

Exhibit 3-1

AUTHORIZED AUMs IN THE GILA NATIONAL FOREST
(1986 – 2002)



Source: U.S. Forest Service, Southwestern Region (3), 2003. Summary of Region 3 Forests' AUMs, provided by Ray Suazo.

According to the USDA's 2002 Census of Agriculture, there are almost 9,700 cattle and calf ranches in New Mexico and Arizona; approximately eight percent of these ranches are within the five counties containing portions of the BRWRA.[48] Exhibit 3-2 demonstrates that within the study area, the majority of cattle and calf ranches (60 percent) are very small, consisting of fewer than 50 head. Fourteen percent of ranches are classified as small (50 to 99 head); 20 percent are medium (100 to 499 head); and six percent are large (at least 500 head). The distribution of cattle and calf ranches by size within the five counties is indicative of trends throughout Arizona and New Mexico. The USDA also reports that livestock cash receipts (including, but not limited to, cattle and calf establishments) in the five counties totaled $83.9 million (2004$).[49] Based on acreage, this analysis estimates that approximately $17.4 million of this revenue is attributable to activities within the BRWRA.

[48] In contrast, Section 3 of this analysis notes that the five counties contain less than two percent of Arizona and New Mexico's population.

[49] U.S. Department of Agriculture National Agricultural Statistics Service (2002), 2002 Census of Agriculture, accessed March 9, 2005, at <http://www.nass.usda.gov/census/>.

Exhibit 3-2

CATTLE AND CALVES: NUMBER OF OPERATIONS BY SIZE GROUP, 2002

	Area	Total Operations	Extra Small < 50 Head	Small 50-99 Head	Medium 100-499 Head	Large > 500 Head
States	Arizona	2,838	1905	278	443	212
	New Mexico	6,845	3983	810	1388	664
	Total	**9,683**	**5,888**	**1,088**	**1,831**	**876**
	Percent	**100%**	**61%**	**11%**	**19%**	**9%**
Counties	Apache, AZ	227	155	38	26	8
	Greenlee, AZ	79	59	7	10	3
	Catron, NM	154	83	17	38	16
	Grant, NM	192	103	32	44	13
	Sierra, NM	107	54	13	31	9
	Total	**759**	**454**	**107**	**149**	**49**
	Percent	**100%**	**60%**	**14%**	**20%**	**6%**

Source: U.S. Department of Agriculture National Agricultural Statistics Service (2002), 2002 Census of Agriculture, accessed March 9, 2005, at <http://www.nass.usda.gov/census/>.

3.3 Economic Impacts of Wolf Depredation of Ranch Animals

Loss of ranch animals to predation by wolves is the biggest concern of the livestock industry in the BRWRA. Indeed, across the U.S, wolves have attacked cattle, sheep, horses, and dogs following their reintroduction. Depredation estimates are described in more detail below and presented in Exhibits 3-2 through 3-8.

According to ranchers' experience, depredation rates vary based on the size of wolf packs and livestock's proximity to wolf home ranges and rendezvous sites. In addition, wolves tend to return to sites where they have successfully killed prey before.[50] It is therefore not surprising that in the BRWRA, certain ranchers have suffered repeated wolf attacks on livestock while neighboring ranchers have experienced few problems.[51] For example, one rancher noted that wolves no longer attacked her cattle when she moved the cattle to another pasture. However, the move caused her neighbor to experience more wolf attacks as the wolves began to prey on the neighbor's herd instead.[52]

Sources indicate that calves are most commonly killed because they are more vulnerable than adult cattle, even when cows attempt to protect them. Bjorge and Gunson report that of 377 cattle killed by wolves in Alberta, Canada, 62 percent were calves, 23 percent were cows, 15

[50] Robert Loucks, Wolf Coordinator for Lemhi County, Idaho, personal communication, March 3, 2005.

[51] Repeated attacks could also be the result of other factors such as management and husbandry practices.

[52] Darcy Ely, Arizona rancher, personal communication, March 4 and 24, 2005.

percent were yearlings, and 0.2 percent were bulls.[53] Oakleaf et al. (2003) found that wolves tend to kill younger calves more frequently than calves born earlier in the spring.[54] Some ranchers indicate that yearlings are also commonly killed because they are more likely to approach wolves.[55] While depredation estimates are often not reported by age of animal, anecdotal evidence and Defenders of Wildlife (DoW) records suggest that wolves in the BRWRA kill more calves than adult cattle.[56] Because of the lack of data describing age of lost livestock, this analysis does not subdivide loss estimates by age.

In the BRWRA, the DoW Bailey Wildlife Wolf Compensation Trust compensates ranchers who have lost ranch animals to Mexican wolves. The program pays ranchers for 100 percent of the market value of a confirmed kill, 50 percent of the value of a probable kill, and 100 percent of the veterinary services to treat an injured animal or the decreased market value of the animal. A state or Federal wildlife agent (most commonly, Wildlife Services within the U.S. Department of Agriculture's Animal and Plant Health Inspection Service) must determine whether the kill is confirmed or probable upon inspecting the carcass; if no body is recovered, DoW will not compensate ranchers.[57] Ranchers are frequently unable to locate carcasses or notify wildlife agents soon enough to receive a confirmed or probable designation because of the rugged and vast terrains where livestock graze, consumption by predators and scavengers, and carcass decomposition.[58] In addition, some ranchers who cannot locate carcasses may not bother to report their losses. Consequently, it is likely that more ranch animal depredation has occurred than has been recorded by wildlife agencies and DoW.

3.3.1 Estimating the Number of Livestock Losses

Sufficient evidence exists to indicate that ranch animal depredations have occurred as the result of Mexican wolves in the BRWRA. However, estimating of the exact number of livestock that have been killed by wolves remains controversial due to difficulties associated with locating carcasses and determining the cause of death. Thus, this analysis presents three estimates of the number and type of ranch animals killed by wolves since the reintroduction program began:[59]

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[53] R.R. Bjorge and J.R. Gunson (1983), Wolf predation of cattle on the Simonette River pastures in northwestern Alberta, 1983, pp.. 106-111 in Ludwig N. Carbyn, ed, in *Wolves in Canada and Alaska, Proceedings of the Wolf Symposium, Edmonton, Alberta, 1983*, Canadian Wildlife Services Report Series, Ottawa, Canada.

[54] John K. Oakleaf et al. (2003), Effects of wolves on livestock calf survival and movements in central Idaho, *Journal of Wildlife Management* 67(2): 299-306.

[55] Darcy Ely, Arizona rancher, personal communication, March 4 and 24, 2005; Robert Loucks, Wolf Coordinator for Lemhi County, Idaho, personal communication, March 3, 2005.

[56] Darcy Ely, Arizona rancher, personal communication, March 4 and 24, 2005; Laura Schneberger, New Mexico rancher, personal communication, March 26, 2005; Defenders of Wildlife, The Bailey Wildlife Foundation Wolf Compensation Trust: Payments to Ranchers for Livestock Losses Caused by Wolves, accessed January 24, 2005, at <http://www.defenders.org/ wildlife/wolf/wolfcomp.pdf>.

[57] Craig Miller, Defenders of Wildlife, personal communication, March 20, 2005.

[58] John K. Oakleaf et al. (2003), Effects of wolves on livestock calf survival and movements in central Idaho, *Journal of Wildlife Management* 67(2): 299-306.

[59] For all estimates in this analysis, the number of cattle, sheep, horse, and dog killed by wolves is separate from and does not include the number of livestock lost for other reasons such as depredations by other carnivores, consuming poisonous plants, disease, weather conditions, or other causes.

- **Low Estimate:** For cattle, sheep, horse, and dog kills, the low estimate equals the average number of kills confirmed by the U.S. Fish and Wildlife Service (USFWS, or the Service), the U.S. Department of Agriculture (USDA), and DoW. Probable kills are not included in this estimate.

- **Medium Estimate:**[60] For cattle and sheep kills, the medium estimate represents the average number of confirmed kills (i.e., the low estimate) multiplied by a factor from published literature that estimates the ratio of total kills to confirmed kills.

  For horse and dog kills, the medium estimate includes probable deaths reported by USFWS, USDA, and DoW in addition to confirmed kills. [61]

- **High Estimate:** The high estimates of cattle and horse kills are based upon estimates of total livestock losses to wolf depredation by ranchers within the BRWRA.[62]

Ranchers in the BRWRA did not provide estimates of total sheep and dog kills in the BRWRA from 1998 to 2004. Thus, the high estimate of these kills is assumed to equal the medium estimate.

Exhibits 3-3 through 3-8 present estimates of confirmed and probable ranch animal depredations by wolves in the BRWRA from 1998 through 2004. We also present one estimate for cattle, sheep, horse, and dog injuries resulting from wolf attacks as only DoW reports these data (presented in Exhibit 3-8). The economic impacts associated with ranch animal injuries are incorporated into the low, medium, and high estimates of impacts.

[60] Medium estimate represents neither an average nor a "best" estimate of depredations. Rather, low, medium, and high estimates represent three separate methods for estimating livestock losses resulting from reintroduction of Mexican wolf.

[61] The literature review and interviews with ranchers suggest that horses killed by wolves are generally recoverable. While some ranchers do mention that they have lost herding dogs to wolves and were unable to locate the dogs' remains, no estimates exist approximating the ratio of estimated total dog losses to confirmed dog predations by wolves. In years when USDA, USFWS, and DoW reports of confirmed and probable kills vary, this analysis assumes the higher estimate of kills.

[62] Laura Schneberger, a New Mexico rancher, compiled estimates from ranchers throughout the BRWRA of losses that they believe are attributable to Mexican wolves.

Exhibit 3-3

REPORTED NUMBER OF CATTLE KILLS IN THE BRWRA
(1998 – 2004)

	1998	1999	2000	2001	2002	2003	2004	Total[a]
Wolf Population in BRWRA	*4*	*15*	*22*	*26*	*42*	*55*	*44*	*NA*
Low Estimate: Agency-Recorded Kills [A]								
USDA	0	5	1	3	9	3	NR	21
USFWS	0	5	1	6	11	3	NR	26
DoW	0	5	2	6	6	10	7	36
Average	*0*	*5*	*1.3*	*5*	*8.7*	*5.3*	*7*	*32.3*
Probable Kills [B]								
USDA	0	5	2	3	0	6	NR	16
USFWS	0	4	2	5	1	5	NR	17
DoW	0	0	0	16	3	5	3	27
Average	*0*	*3*	*1.3*	*8*	*1.3*	*5.3*	*3*	*22*
Agency Confirmed Plus Probable [A+B]								
USDA	0	10	3	6	9	9	NR	37
USFWS	0	9	3	11	12	8	NR	43
DoW	0	5	2	22	9	15	10	63
Average	*0*	*8*	*2.7*	*13*	*10*	*10.7*	*10*	*54.3*
High Estimate: Rancher Reported Kills								
BRWRA Rancher Estimates[b]	0	44.5	8.5	12	92	38	38[c]	233

Notes:

[a] For the USDA and the USFWS estimates, totals equal the sum of depredations from 1998 to 2003, while totals presented for Defenders of Wildlife estimates represent totals from 1998 to 2004.

[b] Some rancher estimates did not distinguish whether losses occurred in 1999 or 2000. Where this occurred, this analysis divides the livestock losses between the two years, resulting in some "half" losses. Other anecdotal evidence from ranchers suggest that more cattle, particularly calves, may have been killed by Mexican wolves based on numbers of missing head. Since exact estimates of these missing cattle are not readily available, however, they are not included in this analysis. The "Impacts on Tribes" section of this analysis does discuss alternate estimates of losses among cattle owned by tribes.

[c] Rancher estimates of cattle depredations in 2004 are not readily available; consequently, this analysis assumes that cattle losses were equal in 2003 and 2004. These estimates only include losses that ranchers believe are attributable to wolves.

Sources:

Wolf population (1998 to 2003), USDA, and USFWS estimates from John Oakleaf et al (2004), *Mexican Wolf Recovery: Five-Year Review and Assessment – DRAFT*; 2004 wolf population from Arizona Game and Fish Department et al. (2005), Mexican Wolf Blue Range Reintroduction Project Interagency Team Annual Report; DoW data from Defenders of Wildlife (2005), The Bailey Wildlife Foundation Wolf Compensation Trust: Payments to Ranchers for Livestock Losses Caused by Wolves, accessed January 24, 2005, at <http://www.defenders.org/wildlife/wolf/wolfcomp.pdf>; BRWRA rancher estimates compiled by Laura Schneberger, New Mexico rancher, personal communication, March 26, 2005.

Exhibit 3-4

REPORTED NUMBER OF SHEEP KILLS IN THE BRWRA
(1998 – 2004)

	1998	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**Total[a]**
Wolf Population in BRWRA	*4*	*15*	*22*	*26*	*42*	*55*	*44*	*NA*
Low Estimate: Agency-Recorded Kills								
USDA	0	0	1	0	0	1	NR	2
USFWS	0	0	1	0	0	1	NR	2
DoW	0	0	0	0	0	0	1	1
Average	0	0	0.7	0	0	0.7	1	2.3

Notes:
[a] For the USDA and the USFWS estimates, totals equal the sum of depredations from 1998 to 2003, while totals presented for Defenders of Wildlife estimates represent totals from 1998 to 2004. No rancher estimates of sheep killed by wolves are readily available.

Sources:
Wolf population (1998 to 2003), USDA, and USFWS estimates from John Oakleaf et al. (2004), *Mexican Wolf Recovery: Five-Year Review and Assessment – DRAFT*; 2004 wolf population from Arizona Game and Fish Department et al. (2005), Mexican Wolf Blue Range Reintroduction Project Interagency Team Annual Report; DoW data from Defenders of Wildlife (2005), The Bailey Wildlife Foundation Wolf Compensation Trust: Payments to Ranchers for Livestock Losses Caused by Wolves, accessed January 24, 2005, at <http://www.defenders.org/wildlife/wolf/wolfcomp.pdf>.

Exhibit 3-5

REPORTED NUMBER OF HORSE KILLS IN THE BRWRA
(1998 – 2004)

	1998	1999	2000	2001	2002	2003	2004	Total[a]
Wolf Population in BRWRA	*4*	*15*	*22*	*26*	*42*	*55*	*44*	*NA*
Low Estimate: Agency-Recorded Kills [A]								
USDA	0	0	0	0	0	0	NR	0
USFWS	0	0	0	1	0	0	NR	1
DoW	0	0	0	0	0	0	NR	0
Average	*0*	*0*	*0*	*0.3*	*0*	*0*	*0*	*0.3*
Probable [B]								
USDA	0	0	0	0	1	0	NR	1
USFWS	0	0	0	0	0	1	NR	1
DoW	0	0	0	0	0	1	0	1
Average	*0*	*0*	*0*	*0*	*0.3*	*0.7*	*0*	*1*
Agency Confirmed Plus Probable [A+B]								
USDA	0	0	0	0	1	0	NR	1
USFWS	0	0	0	1	0	1	NR	2
DoW	0	0	0	0	0	1	0	1
Average	*0*	*0*	*0*	*0.3*	*0.3*	*0.7*	*0*	*1.3*
High Estimate: Rancher Reported Kills								
BRWRA Rancher Estimates[b]	0	0.5	0.5	0	3	0	0	4

Notes:

[a] For the USDA and the USFWS estimates, totals equal the sum of depredations from 1998 to 2003, while totals presented for Defenders of Wildlife estimates represent totals from 1998 to 2004.

[b] Some rancher estimates did not distinguish whether losses occurred in 1999 or 2000. Where this occurred, this analysis divides the livestock losses between the two years, resulting in some "half" losses. Rancher estimates of horse depredations in 2004 are not readily available; consequently, this analysis assumes that horse losses were equal in 2003 and 2004. These estimates only include losses that ranchers believe are attributable to wolves.

Sources:

Wolf population (1998 to 2003), USDA, and USFWS estimates from John Oakleaf et al. (2004), *Mexican Wolf Recovery: Five-Year Review and Assessment – DRAFT*; 2004 wolf population from Arizona Game and Fish Department et al. (2005), Mexican Wolf Blue Range Reintroduction Project Interagency Team Annual Report; DoW data from Defenders of Wildlife (2005), The Bailey Wildlife Foundation Wolf Compensation Trust: Payments to Ranchers for Livestock Losses Caused by Wolves, accessed January 24, 2005, at <http://www.defenders.org/wildlife/wolf/wolfcomp.pdf>; BRWRA rancher estimates compiled by Laura Schneberger, New Mexico rancher, personal communication, March 26, 2005.

Exhibit 3-6

REPORTED NUMBER OF DOG KILLS IN THE BRWRA[a]
(1998 – 2004)

	1998	1999	2000	2001	2002	2003	2004	Total[b]
Wolf Population in BRWRA	*4*	*15*	*22*	*26*	*42*	*55*	*44*	*NA*
Agency-Recorded Kills								
USDA	1	0	0	0	1	0	NR	2
USFWS	1	0	0	0	1	0	NR	2
DoW	1	0	0	0	0	1	0	2
Average	*1*	*0*	*0*	*0*	*0.7*	*0.3*	*0*	*2*

Notes:
[a] Some of the dogs reported as being killed or injured by wolves in this analysis may be hunting dogs rather than herding or guard dogs. To the extent that this is true, the analysis may overestimate losses and economic impacts to ranchers because hunting dogs are not associated with ranching operations.
[b] For the USDA and the USFWS estimates, totals equal the sum of depredations from 1998 to 2003, while totals presented for Defenders of Wildlife estimates represent totals from 1998 to 2004. No rancher estimates of dogs killed by wolves are readily available.

Sources:
Wolf population (1998 to 2003), USDA, and USFWS estimates from John Oakleaf et al. (2004), *Mexican Wolf Recovery: Five-Year Review and Assessment – DRAFT*; 2004 wolf population from Arizona Game and Fish Department et al. (2005), Mexican Wolf Blue Range Reintroduction Project Interagency Team Annual Report; DoW data from Defenders of Wildlife (2005), The Bailey Wildlife Foundation Wolf Compensation Trust: Payments to Ranchers for Livestock Losses Caused by Wolves, accessed January 24, 2005, at <http://www.defenders.org/wildlife/wolf/wolfcomp.pdf>.

Exhibit 3-7

DEVELOPMENT OF MEDIUM ESTIMATE: RATIOS OF ESTIMATED TOTAL LIVESTOCK LOSSES TO CONFIRMED KILLS

Source	Ratio
Cattle[a]	
Naughton-Treves et al. (2003)[d]	2:1
Bjorge and Gunson (1985)[e]	6.7:1
Oakleaf et al. (2003)[f]	8:1[b]
Average Cattle Ratio	*5.6:1*
Sheep	
Hinson (2005)[g]	2.3:1[c]
Average Sheep Ratio	*2.1:1*

Notes:

[a] The ratios of estimated total cattle losses to confirmed kills are based upon published estimates, although some ranchers also estimate these ratios. According to one rancher in the study area, all yearling and cow losses have been confirmed but no calf kills have been confirmed as resulting from wolf attacks. Comparing the estimated number of cow, yearling, and calf losses with the number of confirmed kills, the ratio equals approximately 29.4:1. Source: Darcy Ely, Arizona rancher, personal communication, March 4 and 24, 2005.

[b] Oakleaf et al. (2003) may overestimate the ratio of estimated total losses to confirmed kills because their study focused on calves, which are often particularly difficult to recover because they are consumed more rapidly.

[c] Because no published sources exist that estimate the ratio of total sheep losses to confirmed kills, we rely on ranchers' estimates. One rancher received 100 percent compensation for some confirmed kills and 50 percent compensation for probable kills from the Defenders of Wildlife. She also received additional compensation from the Idaho Office of Species Conservation, but this analysis does not include that compensation since the OSC compensation is not available to ranchers in the BRWRA. Instead, the ratio compares the total number of sheep that the rancher believes she lost to wolves to all of the confirmed kills.

Sources:

[d] Lisa Naughton-Treves et al. (2003), Paying for tolerance: rural citizens' attitudes toward wolf depredation and compensation, *Conservation Biology* 17(6) 1500-1511.

[e] As cited in Idaho Office of Species Conservation (2004), Idaho Wolf Depredation Compensation Plan, accessed March 7, 2005, at <http://www.accessidaho.org/species/wolf_plan_GS_feb_05.pdf>.

[f] John K. Oakleaf et al. (2003), Effects of wolves on livestock calf survival and movements in central Idaho, *Journal of Wildlife Management* 67(2): 299-306.

[g] Margaret Hinson, Idaho rancher, personal communication, March 7, 2005.

This analysis presents low, medium, and high estimates of the number of livestock killed by Mexican wolves in the BRWRA from 1998 to 2004. The average numbers of confirmed kills presented in Exhibits 3-3 through 3-6 represent the low estimate of cattle, sheep, horse, and dog kills. To derive the medium estimates for cattle and sheep kills, the analysis multiplies the average number of confirmed kills by the average ratio of estimated total livestock losses to confirmed livestock losses presented in Exhibit 3-7. Neither published nor anecdotal sources provide ratios of total kills to confirmed kills for horse and dog depredations by wolves. Therefore, the medium estimates of horse and dog kills equal the confirmed plus the probable kills. When sources provide conflicting estimates in a given year, we assume the larger of the estimates equals the number of kills. The high estimates for cattle and horse kills represent estimates provided by ranchers grazing livestock in the BRWRA. Rancher estimates of sheep

and dog kills resulting from wolf attacks are not readily available; consequently, high estimates of these kills equal medium estimates of sheep and dog kills. This analysis only presents one estimate of injuries based upon DoW records. Although rancher estimates of livestock injuries also exist, the value of these injuries is not readily available. Given that the number of injuries does not vary significantly (DoW reports eight injuries; ranchers estimate 11 injuries), this analysis relies on DoW data for the number and value of livestock injuries. Exhibit 3-8 presents the low, medium, and high estimates of the number of livestock deaths and injuries caused by wolf attacks in the BRWRA since the wolf reintroduction program began in 1998. In a given year, these mortalities and injuries represent less than one percent of the roughly 34,800 cattle, 120 sheep, and 1,600 horses and ponies that graze in the BRWRA annually.

Based on the number of wolves in the BRWRA from 1998 to 2004, Mexican wolves killed between 0.1 cattle per wolf per year under the low depredation estimate to 1.1 cattle per wolf per year under the high depredation estimate.[63] The remaining annual ranch animal mortalities and injuries (including cattle injuries) averaged zero per wolf from 1998 to 2004.

[63] From 1998 to 2003, the actual years included under the five-year review, Mexican wolves also killed between 0.1 and 1.1 cattle per wolf.

Exhibit 3-8

SUMMARY OF WOLF DEPREDATION ESTIMATES IN THE BRWRA
(1998 – 2004)

		1998	1999	2000	2001	2002	2003	2004	Total
Wolf Population in BRWRA[a]		*4*	*15*	*22*	*26*	*42*	*55*	*44*	*NA*
Kills: Low Estimate[b]	**Cattle**	0	5	1.3	5	8.7	5.3	7	32.3
	Sheep	0	0	0.7	0	0	0.7	1	2.3
	Horse	0	0	0	0.3	0	0	0	0.3
	Dog[f]	1	0	0	0	0.7	0.3	0	2
Kills: Medium Estimate[c]	**Cattle**	0	28	7.5	28	48.5	29.9	39.2	181.1
	Sheep	0	0	1.5	0	0	1.5	2.3	5.4
	Horse	0	0	0	1	1	1	0	3
	Dog[f]	1	0	0	0	1	1	0	3
Kills: High Estimate[d]	**Cattle**	0	44.5	8.5	12	92	38	38	233
	Sheep	0	0	1.5	0	0	1.5	2.3	5.4
	Horse	0	0.5	0.5	0	3	0	0	4
	Dog[f]	1	0	0	0	1	1	0	3
Injuries[e]	**Cattle**	0	1	0	2	0	0	0	5
	Horse	1	0	0	1	0	0	0	2
	Dog[f]	0	1	0	0	0	0	0	1

Notes and Sources:

[a] 1998 through 2003: John Oakleaf et al. (2004), *Mexican Wolf Recovery: Five-Year Review and Assessment – DRAFT*; 2004: Arizona Game and Fish Department et al. (2005), Mexican Wolf Blue Range Reintroduction Project Interagency Team Annual Report;.

[b] "Low" estimates represent the average of confirmed kills as reported by the U.S. Department of Agriculture and U.S. Fish and Wildlife Service from John Oakleaf et al. (2004), *Mexican Wolf Recovery: Five-Year Review and Assessment – DRAFT* and Defenders of Wildlife (2005), The Bailey Wildlife Foundation Wolf Compensation Trust: Payments to Ranchers for Livestock Losses Caused by Wolves, accessed January 24, 2005, at <http://www.defenders.org/wildlife/wolf/wolfcomp.pdf>.

[c] For cattle and sheep, "medium" estimates derived by multiplying average number of confirmed kills by average ratios of total estimated losses to confirmed losses, as presented in Exhibit 3-7. For horses and dogs, medium estimates represent sum of confirmed and probable kills as reported by the U.S. Department of Agriculture, the U.S. Fish and Wildlife Service, and Defenders of Wildlife. Where estimates differ among sources for a particular year, the higher estimate is used. U.S. Department of Agriculture and U.S. Fish and Wildlife Service from John Oakleaf et al. (2004), *Mexican Wolf Recovery: Five-Year Review and Assessment – DRAFT* and Defenders of Wildlife (2005), The Bailey Wildlife Foundation Wolf Compensation Trust: Payments to Ranchers for Livestock Losses Caused by Wolves, accessed January 24, 2005, at <http://www.defenders.org/wildlife/wolf/ wolfcomp.pdf>.

[d] For cattle and horses, "high" estimates based upon ranchers' estimates of total losses to wolves as provided by Laura Schneberger, New Mexico rancher, personal communication, March 26, 2005. For sheep and dogs, high estimates equal medium figures because no rancher estimates of sheep and dog kills are readily available.

[e] Since only one estimate of ranch animal injuries from wolves within the BRWRA exists, there is no low, medium, and high injury estimate. Economic impacts associated with injuries are added to the low, medium, and high estimates of impacts associated with ranch animal kills. Defenders of Wildlife (2005), The Bailey Wildlife Foundation Wolf Compensation Trust: Payments to Ranchers for Livestock Losses Caused by Wolves, accessed January 24, 2005, at <http://www.defenders.org/wildlife/wolf/ wolfcomp.pdf>.

[f] Some of the dogs reported as being killed or injured by wolves in this analysis may be hunting dogs rather than herding or guard dogs. To the extent that this is true, the analysis may overestimate losses and economic impacts to ranchers because hunting dogs are not associated with ranching operations.

3.3.2 Value of Ranch Animals

This section calculates the value of ranch animals lost to Mexican wolf predation in the BRWRA. The values used to estimate losses to ranch animals are the following:

- **Cattle:** For cattle and calves killed by wolves, the analysis applies the average value per head in Arizona and New Mexico in the year that a loss occurred (ranging from $740 to $840 in 2004$) to estimated losses in order to calculate the value of animals killed by wolves;[64]

- **Sheep:** For sheep killed by wolves, the analysis applies the average value per head in Arizona and New Mexico in the year that a loss occurred (ranging from $90 to $120 in 2004$) to estimated losses in order to calculate the value of animals killed by wolves;[65]

- **Horses:** For horses killed by wolves, the analysis assumes that a DoW compensation value of $1,500 has remained nominally constant from 1998 through 2004. Converting this figure to 2004$, the value ranges from $1,500 to $1,740. This figure is similar to values cited by New Mexico State University and University of Arizona cost and return estimates; the NMSU study valued ranch horses at $1,050 in 1997, and the Arizona study's values for ranch horses ranged from $1,500 to $2,500 in 2000;[66]

- **Dogs:** The value of a dog is based on compensation payments by DoW and conversations with ranchers indicating that the nominal value of a dog equaled $500 in multiple years during this time period; we convert these figures to real 2004$ ranging from $500 to $580; and[67]

- **Injuries to Ranch Animals:** DoW compensates ranchers for their veterinary expenses or for the decreased market value of the animal that resulted from

[64] Livestock values represent values reported by: U.S. Department of Agriculture (1998 – 2004), Meat Animals Production, Disposition, and Income: Summary, National Agricultural Statistics Service, Mt An 1-1. This value represents the average value of livestock sold across all size and weight classes for each state.

[65] Livestock values represent values reported by: U.S. Department of Agriculture (1998 – 2004), Meat Animals Production, Disposition, and Income: Summary, National Agricultural Statistics Service, Mt An 1-1. This value represents the average value of livestock sold across all size and weight classes for each state.

[66] Defenders of Wildlife (2005), The Bailey Wildlife Foundation Wolf Compensation Trust: Payments to Ranchers for Livestock Losses Caused by Wolves, accessed January 24, 2005, at <http://www.defenders.org/wildlife/wolf/wolfcomp.pdf>; L. Allen Torell et al. (2000), Range Livestock Cost and Return Estimates for New Mexico, 1997, New Mexico State University Agricultural Experiment Station, College of Agriculture and Home Economics, Research Report 738; Trent Teegerstrom and Russell Tronstad (2000), Cost and Return Estimates for Cow/Calf Ranches in Five Regions of Arizona, University of Arizona Department of Agricultural and Resource Economics, Cooperative Extension, Publication AZ1193.

[67] Defenders of Wildlife (2005), The Bailey Wildlife Foundation Wolf Compensation Trust: Payments to Ranchers for Livestock Losses Caused by Wolves, accessed January 24, 2005, at <http://www.defenders.org/wildlife/wolf/wolfcomp.pdf>

the injury. The analysis uses DoW's compensation amounts for injuries to value the cost of non-lethal wolf attacks on livestock.[68]

Exhibits 3-9 through 3-11 present the value of livestock losses attributable to Mexican wolves in the BRWRA. As shown, Mexican wolf kills have resulted in costs ranging from $27,890 (2004$) to $195,530 since their reintroduction into the BRWRA in 1998. Using the medium estimate, $145,580 (95%) of these losses are attributable to lethal attacks on cattle. Horse mortalities represent $4,700 (three percent), dog mortalities cost ranchers approximately $1,620 (one percent), and sheep mortalities account for $590 (less than one percent). Exhibits 3-9 through 3-11 also demonstrate that losses from lethal wolf attacks were most severe in 2002 ($42,100), followed by 2004 ($33,200). Not surprisingly, the lowest value of losses occurred in 1998 ($580), when the fewest wolves existed in the BRWRA.

From 1998 to 2004, the economic impact of injuries caused by Mexican wolves totaled $4,520 (2004$) (see Exhibit 3-12). The majority of this value ($4,050) is attributable to 2001, when wolves injured two calves and one horse. Defenders of Wildlife recorded less costly injuries in 1998 and 1999 and no injuries in 2000 and 2002 through 2004.

[68] Defenders of Wildlife (2005), The Bailey Wildlife Foundation Wolf Compensation Trust: Payments to Ranchers for Livestock Losses Caused by Wolves, accessed January 24, 2005, at <http://www.defenders.org/wildlife/wolf/wolfcomp.pdf>; Craig Miller, Defenders of Wildlife, personal communication, March 20, 2005.

Exhibit 3-9

VALUE OF RANCH ANIMAL LOSSES TO WOLF DEPREDATION IN THE BRWRA – LOW ESTIMATE (1998 – 2004)

	1998	1999	2000	2001	2002	2003	2004	Total
Cattle								
Estimated Kills[a]	0	5	1.3	5	8.7	5.3	7	32.3
Value per Head (2004$)[b]	$760	$740	$780	$810	$820	$790	$840	NA
Total Value (2004$)	$0	$3,690	$1,050	$4,030	$7,140	$4,220	$5,880	$26,000
Sheep								
Estimated Kills[a]	0	0	0.7	0	0	0.7	1	2.3
Value per Head (2004$)[b]	$120	$90	$100	$100	$90	$110	$120	NA
Total Value (2004$)	$0	$0	$70	$0	$0	$70	$120	$260
Horses								
Estimated Kills[a]	0	0	0	0.3	0	0	0	0.3
Value per Head (2004$)[c]	$1,740	$1,700	$1,650	$1,600	$1,580	$1,540	$1,500	NA
Total Value (2004$)	$0	$0	$0	$530	$0	$0	$0	$530
Dogs								
Estimated Kills[a]	1	0	0	0	0.7	0.3	0	2
Value per Head (2004$)[d]	$580	$570	$550	$530	$530	$510	$500	NA
Total Value (2004$)	$580	$0	$0	$0	$350	$170	$0	$1,100
Total Value All Kills (2004$)	**$580**	**$3,690**	**$1,110**	**$4,560**	**$7,490**	**$4,460**	**$6,000**	**$27,890**

Notes:

[a] "Low" estimates of total kills represent the average of confirmed kills as reported by the USDA and USFWS from John Oakleaf et al. (2004), *Mexican Wolf Recovery: Five-Year Review and Assessment – DRAFT* and Defenders of Wildlife (2005), The Bailey Wildlife Foundation Wolf Compensation Trust: Payments to Ranchers for Livestock Losses Caused by Wolves, accessed January 24, 2005, at <http://www.defenders.org/wildlife/wolf/wolfcomp.pdf>.

[b] Cattle and sheep values represent the average value of livestock sold across all size and weight classes in Arizona and New Mexico. Livestock values represent values reported by: U.S. Department of Agriculture (1998 – 2004), Meat Animals Production, Disposition, and Income: Summary, National Agricultural Statistics Service, Mt An 1-1.

[c] This analysis relies on a 2003 compensation value determined by DoW. The compensation value is similar to values cited by New Mexico State University and University of Arizona cost and return estimates. The NMSU study valued ranch horses at $1,050 in 1997, and the Arizona study's values for ranch horses ranged from $1,500 to $2,500 in 2000. Sources: L. Allen Torell et al. (2000), Range Livestock Cost and Return Estimates for New Mexico, 1997, New Mexico State University Agricultural Experiment Station, College of Agriculture and Home Economics, Research Report 738; Trent Teegerstrom and Russell Tronstad (2000), Cost and Return Estimates for Cow/Calf Ranches in Five Regions of Arizona, University of Arizona Department of Agricultural and Resource Economics, Cooperative Extension, Publication AZ1193.

[d] The value of a dog is based on compensation payments by DoW and conversations with ranchers indicating that the nominal value of a dog equaled $500 in multiple years during this time period; we convert these figures to real 2004$. Some of the dogs reported as being killed or injured by wolves in this analysis may be hunting dogs rather than herding or guard dogs. To the extent that this is true, the analysis may overestimate losses and economic impacts to ranchers because hunting dogs are not associated with ranching operations.

Exhibit 3-10

VALUE OF RANCH ANIMAL LOSSES TO WOLF DEPREDATION IN THE BRWRA – MEDIUM ESTIMATE (1998 – 2004)

	1998	1999	2000	2001	2002	2003	2004	Total
Cattle								
Estimated Kills[a]	0.0	28.0	7.5	28.0	48.5	29.9	39.2	181.1
Value per Head (2004$)[b]	$760	$740	$780	$810	$820	$790	$840	NA
Total Value (2004$)	$0	$20,640	$5,860	$22,550	$40,000	$23,610	$32,930	$145,580
Sheep								
Estimated Kills[a]	0.0	0.0	1.5	0.0	0.0	1.5	2.3	5.4
Value per Head (2004$)[b]	$120	$90	$100	$100	$90	$110	$120	NA
Total Value (2004$)	$0	$0	$160	$0	$0	$170	$270	$590
Horses								
Estimated Kills[c]	0.0	0.0	0.0	1.0	1.0	1.0	0.0	3.0
Value per Head (2004$)[d]	$1,740	$1,700	$1,650	$1,600	$1,580	$1,540	$1,500	NA
Total Value (2004$)	$0	$0	$0	$1,600	$1,580	$1,540	$0	$4,710
Dogs								
Estimated Kills[c]	1.0	0.0	0.0	0.0	1.0	1.0	0.0	3.0
Value per Head (2004$)[e]	$580	$570	$550	$530	$530	$510	$500	NA
Total Value (2004$)	$580	$0	$0	$0	$530	$510	$0	$1,620
Total Value All Kills (2004$)	**$580**	**$20,640**	**$6,010**	**$24,150**	**$42,100**	**$25,830**	**$33,200**	**$152,510**

Notes:

[a] "Medium" estimates of total cattle and sheep kills derived by multiplying average number of confirmed kills by average ratios of estimated total losses to confirmed losses, as presented in Exhibit 3-7.

[b] Cattle and sheep values represent the average value of livestock sold across all size and weight classes in Arizona and New Mexico. Livestock values represent values reported by: U.S. Department of Agriculture (1998 – 2004), Meat Animals Production, Disposition, and Income: Summary, National Agricultural Statistics Service, Mt An 1-1.

[c] "Medium" estimates of horse and dog kills represent sum of confirmed and probable kills as reported by the USDA, the USFWS, and DoW. Where estimates differ among sources for a particular year, the higher estimate is use. USDA and USFWS from John Oakleaf et al. (2004), *Mexican Wolf Recovery: Five-Year Review and Assessment – DRAFT* and Defenders of Wildlife (2005), The Bailey Wildlife Foundation Wolf Compensation Trust: Payments to Ranchers for Livestock Losses Caused by Wolves, accessed January 24, 2005, at <http://www.defenders.org/wildlife/wolf/wolfcomp.pdf>.

[d] This analysis relies on a 2003 compensation value determined by DoW. The compensation value is similar to values cited by New Mexico State University and University of Arizona cost and return estimates. The NMSU study valued ranch horses at $1,050 in 1997, and the Arizona study's values for ranch horses ranged from $1,500 to $2,500 in 2000. Sources: L. Allen Torell et al. (2000), Range Livestock Cost and Return Estimates for New Mexico, 1997, New Mexico State University Agricultural Experiment Station, College of Agriculture and Home Economics, Research Report 738; Trent Teegerstrom and Russell Tronstad (2000), Cost and Return Estimates for Cow/Calf Ranches in Five Regions of Arizona, University of Arizona Department of Agricultural and Resource Economics, Cooperative Extension, Publication AZ1193.

[e] The value of a dog is based on compensation payments by DoW and conversations with ranchers indicating that the nominal value of a dog equaled $500 in multiple years during this time period; we convert these figures to real 2004$. Some of the dogs reported as being killed or injured by wolves in this analysis may be hunting dogs rather than herding or guard dogs. To the extent that this is true, the analysis may overestimate losses and economic impacts to ranchers because hunting dogs are not associated with ranching operations.

Exhibit 3-11

VALUE OF RANCH ANIMAL LOSSES TO WOLF DEPREDATION – HIGH ESTIMATE (1998 – 2004)

	1998	1999	2000	2001	2002	2003	2004	Total
Cattle								
Estimated Kills[a]	0.0	44.5	8.5	12.0	92.0	38.0	38.0	233.0
Value per Head (2004$)[b]	$760	$740	$780	$810	$820	$790	$840	NA
Total Value (2004$)	$0	$32,800	$6,670	$9,660	$75,830	$30,040	$31,920	$186,920
Sheep[c]								
Estimated Kills	0.0	0.0	1.5	0.0	0.0	1.5	2.3	5.4
Value per Head (2004$)[b]	$120	$90	$100	$100	$90	$110	$120	NA
Total Value (2004$)	$0	$0	$160	$0	$0	$170	$270	$590
Horses								
Estimated Kills[a]	0.0	0.5	0.5	0.0	3.0	0.0	0.0	4.0
Value per Head (2004$)[d]	$1,740	$1,700	$1,650	$1,600	$1,580	$1,540	$1,500	NA
Total Value (2004$)	$0	$850	$820	$0	$4,730	$0	$0	$6,400
Dogs								
Estimated Kills[e]	1.0	0.0	0.0	0.0	1.0	1.0	0.0	3.0
Value per Head (2004$)[f]	$580	$570	$550	$530	$530	$510	$500	NA
Total Value (2004$)	$580	$0	$0	$0	$530	$510	$0	$1,620
Total Value All Kills (2004$)	**$580**	**$33,650**	**$7,650**	**$9,660**	**$81,080**	**$30,720**	**$32,190**	**$195,530**

Notes:

[a] "High" estimates of cattle and horse kills based upon ranchers' estimates of total losses to wolves as provided by Laura Schneberger, New Mexico rancher, personal communication, March 26, 2005.

[b] Cattle and sheep values represent the average value of livestock sold across all size and weight classes in Arizona and New Mexico. Livestock values represent values reported by: U.S. Department of Agriculture (1998 – 2004), Meat Animals Production, Disposition, and Income: Summary, National Agricultural Statistics Service, Mt An 1-1.

[c] "High" estimates of sheep kills derived by multiplying average number of confirmed kills by average ratios of total losses to confirmed losses, as presented in Exhibit 3-7.

[d] This analysis relies on a 2003 compensation value determined by DoW. The compensation value is similar to values cited by New Mexico State University and University of Arizona cost and return estimates. The NMSU study valued ranch horses at $1,050 in 1997, and the Arizona study's values for ranch horses ranged from $1,500 to $2,500 in 2000. Sources: L. Allen Torell et al. (2000), Range Livestock Cost and Return Estimates for New Mexico, 1997, New Mexico State University Agricultural Experiment Station, College of Agriculture and Home Economics, Research Report 738; Trent Teegerstrom and Russell Tronstad (2000), Cost and Return Estimates for Cow/Calf Ranches in Five Regions of Arizona, University of Arizona Department of Agricultural and Resource Economics, Cooperative Extension, Publication AZ1193.

[e] "High" estimates of dog kills represent sum of confirmed and probable kills as reported by USDA, USFWS, and DoW. Where estimates differ among sources for a particular year, the higher estimate is use. USDA and USFWS from John Oakleaf et al. (2004), *Mexican Wolf Recovery: Five-Year Review and Assessment – DRAFT* and Defenders of Wildlife (2005), The Bailey Wildlife Foundation Wolf Compensation Trust: Payments to Ranchers for Livestock Losses Caused by Wolves, accessed January 24, 2005, at <http://www.defenders.org/wildlife/wolf/wolfcomp.pdf>.

[f] The value of a dog is based on compensation payments by DoW and conversations with ranchers indicating that the nominal value of a dog equaled $500 in multiple years during this time period; we convert these figures to real 2004$. Some of the dogs reported as being killed or injured by wolves in this analysis may be hunting dogs rather than herding or guard dogs. To the extent that this is true, the analysis may overestimate losses and economic impacts to ranchers because hunting dogs are not associated with ranching operations.

Exhibit 3-12

VALUE OF RANCH ANIMAL INJURIES IN THE BRWRA[a]
(1998 – 2004)

	1998	1999	2000	2001	2002	2003	2004	Total
Cattle Injured	0	1	0	2	0	0	0	5
Total Value (2004$)	$0	$30	$0	$1,280	$0	$0	$0	$1,310
Horses Injured	1	0	0	1	0	0	0	2
Total Value (2004$)	$370	$0	$0	$2,770	$0	$0	$0	$3,130
Dogs Injured[b]	0	1	0	0	0	0	0	1
Total Value (2004$)	$0	$80	$0	$0	$0	$0	$0	$80
Total Value All Injuries (2004$)	**$370**	**$100**	**$0**	**$4,050**	**$0**	**$0**	**$0**	**$4,520**

Sources and Notes:

[a] The number and value of injuries based on DoW data from Defenders of Wildlife (2005), The Bailey Wildlife Foundation Wolf Compensation Trust: Payments to Ranchers for Livestock Losses Caused by Wolves, accessed January 24, 2005, at <http://www.defenders.org/wildlife/wolf/wolfcomp.pdf>; Craig Miller, Defenders of Wildlife, personal communication, March 20, 2005. Alternate rancher estimates suggest that 11 livestock were injured from 1998 to 2004. The analysis does not use these data because information on the value of the alternate injuries estimate is not readily available. Rancher estimates from Laura Schneberger, New Mexico rancher, personal communication, March 26, 2005.

[b] Some of the dogs reported as being injured by wolves in this analysis may be hunting dogs rather than herding or guard dogs. To the extent that this is true, the analysis may overestimate losses and economic impacts to ranchers because hunting dogs are not associated with ranching operations.

3.4 Physiological Impacts on Livestock

In addition to depredation, the presence of wolves in proximity to livestock may induce behavioral changes in livestock that result in physical effects. For example, livestock may lose weight because wolves force them off of suitable grazing habitat or away from water sources. In addition, the presence of wolves may agitate livestock, causing them to expend more energy. Decreased feeding, drinking, and increased agitation rates may also lower birthrates by reducing conception levels and causing miscarriages. While both ranchers and research concur that such outcomes are possible, no evidence exists that these behavioral changes have occurred in response to Mexican wolves.[69]

Observations suggest that wolves may have less impact on livestock behavior than they do on wild ungulate behavior, such as elk. Furthermore, many variables could result in weight loss and decreased birthing rates, such as poor forage or weather conditions. Given the lack of evidence and uncertainty associated with verifying that wolves are causing detrimental physical effects on livestock, this analysis does not attempt to quantify the economic impacts of such outcomes.

[69] John K. Oakleaf et al. (2003), Effects of wolves on livestock calf survival and movements in central Idaho, *Journal of Wildlife Management* 67(2): 299-306. Oakleaf's study observed no evidence, however, that the presence of wolves affected cattle movement or herd size.

3.5 Need to Alter Forage Use

Anecdotal evidence suggests that the number of depredations is dependent on the proximity of livestock to wolf rendezvous sites. For this, or other reasons, ranchers may decide to modify grazing practices in an attempt to avoid wolves. Rancher responses could include herding or hauling livestock to different portions of their grazing allotment or bringing livestock off the range. Multiple ranchers report, however, that they have little flexibility regarding alternative grazing sites; they do not own sufficient pasture or possess sufficient Federal grazing allotments. In addition, changing grazing areas could result in penalties from land management agencies.[70] One Arizona rancher reported purchasing additional land in order to have more grazing options for avoiding wolves.[71] As wolf populations grow and their presence becomes more common, however, avoiding them is likely to become increasingly difficult.

While ranchers have mentioned instances in which they have hauled livestock to different grazing areas or purchased additional land, estimates do not exist regarding the frequency or nature of these actions across the BRWRA. Therefore, this analysis does not attempt to quantify the economic impacts of modifying grazing activities in response to the reintroduction of Mexican wolves into the BRWRA.

3.6 Need for Additional Ranch Labor

Changes in ranch management techniques in order to avoid livestock depredation by wolves may require additional time on behalf of ranchers and their employees. Many ranchers report increasing herd supervision when wolves are in the area.[72] In addition, they have spent time treating injured cattle, moving cattle to new grazing areas, checking cows for pregnancy that may have aborted due to wolves, and implementing new management techniques to avoid the predators. For example, one rancher volunteered to tag her cattle with radiotransmitters in order to better track her livestock and depredation incidents as part of an independent study. While the Service compensated her for the material, the agency did not reimburse her for the time that she spent tagging the animals.[73]

Ranchers also report spending time when they apply for wolf compensation. Thompson estimates that each compensation requires approximately ten hours for the rancher to locate the livestock carcass, wait for a wildlife agent to inspect the kill, complete the necessary paperwork, and conduct any further correspondences or negotiations to ensure that payment is received.[74] The DoW, however, compensates ranchers only for the value of the lost livestock; payments do not reimburse ranchers for the time spent to receive compensation.

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[70] Idaho Office of Species Conservation (2004), Idaho Wolf Depredation Compensation Plan, accessed March 7, 2005, at <http://www.accessidaho.org/species/wolf_plan_GS_feb_05.pdf>.

[71] Darcy Ely, Arizona rancher, personal communication, March 4 and 24, 2005.

[72] Margaret Hinson, Idaho rancher, personal communication, March 7, 2005.

[73] Darcy Ely, Arizona rancher, personal communication, March 4 and 24, 2005.

[74] James G. Thompson (1993), Addressing the human dimensions of wolf reintroduction: an example using estimates of livestock depredation and costs of compensation, *Society and Natural Resources* 6: 165-179.

Due to the additional time that ranchers and employees must spend on various activities when wolves are in proximity to cattle, they often must reduce time spent on other activities such as ranch maintenance and improvement. For example, ranchers may not have time to repair fences, and cattle may escape. In some cases, ranchers have hired additional employees specifically for the purpose of supervising livestock when wolves are in the area.[75] DoW does offer some compensation for ranchers who change their management practices in order to avoid conflicts with wolves through the Bailey Wildlife Foundation Proactive Conservation Fund.

This analysis recognizes that the reintroduction of Mexican wolves into the BRWRA has increased the amount of time that ranchers must spend managing their livestock. Sufficient evidence does not exist, however, to quantify the economic impacts of additional hired labor or labor input from ranchers and family members or decreased time for other activities throughout the study area. Consequently, the analysis only calculates the economic impact of the estimated time that ranchers spend on the compensation process for depredation losses.

3.6.1 Rancher Time Spent Applying for Compensation

For each confirmed and probable kill, ranchers need approximately ten hours to identify the carcass, coordinate the inspection with wildlife agents, complete necessary paperwork, and correspond and negotiate with authorities until payment is received.[76] This section estimates the time spent on confirmed and probable kills and injuries for cattle, sheep, horses, and dogs. While more losses may occur, we assume that these carcasses are never identified and, therefore, ranchers do not spend time applying for compensation claims. To the extent that ranchers do spend time on claims that are not identified as confirmed or probable, this analysis may understate the economic impact of the time associated with seeking compensation. The analysis values an hour of time between $7.59 and $8.71 (2004$), based on U.S. Department of Agriculture hourly wage rates for livestock workers in Arizona and New Mexico.[77] Exhibit 3-13 shows that ranchers spent 750 hours, valued at $6,240, preparing compensation claims from 1998 to 2004; on average, all ranchers in the BRWRA spent almost 110 hours, valued at $890 on average, each year.

[75] Darcy Ely, Arizona rancher, personal communication, March 4 and 24, 2005.

[76] James G. Thompson (1993), Addressing the human dimensions of wolf reintroduction: an example using estimates of livestock depredation and costs of compensation, *Society and Natural Resources* 6: 165-179.

[77] U.S. Department of Agriculture National Agricultural Statistics Service (2005), Farm Labor: 1998 – 2004, accessed March 11, 2005, at <http://usda.mannlib.cornell.edu/reports/nassr/other/pfl-bb/>. This value represents the wage rate for ranch labor. To the extent that compensation claims are prepared by ranch management who are more highly compensated, this value may understate the economic impact of ranchers' time.

Exhibit 3-13

ECONOMIC COSTS OF COMPENSATION CLAIM PREPARATION (1998 – 2004)

	1998	1999	2000	2001	2002	2003	2004	Total
Confirmed and Probable Losses[a]	2	7	2	27	9	17	11	75
Preparation Hours[b]	20	70	20	270	90	170	110	750
Hourly Rate[c]	$7.59	$8.14	$7.75	$8.21	$8.71	$8.68	$8.09	NA
Economic Impact	$150	$570	$160	$2,220	$780	$1,480	$890	$6,240

Sources:
[a] DoW data from Defenders of Wildlife (2005), The Bailey Wildlife Foundation Wolf Compensation Trust: Payments to Ranchers for Livestock Losses Caused by Wolves, accessed January 24, 2005, at <http://www.defenders.org/wildlife/wolf/wolfcomp.pdf>.
[b] James G. Thompson (1993), Addressing the human dimensions of wolf reintroduction: an example using estimates of livestock depredation and costs of compensation, *Society and Natural Resources* 6: 165-179.
[c] U.S. Department of Agriculture National Agricultural Statistics Service (2005), Farm Labor: 1998 – 2004, accessed March 11, 2005, at <http://usda.mannlib.cornell.edu/reports/nassr/other/pfl-bb/>.

3.7 Additional Expenditures on Ranch Supplies

The presence of wolves may cause ranchers to purchase additional provisions and animals in order to protect livestock and maintain herd size. Some ranchers report purchasing more dogs in order to increase the number guarding herds. Furthermore, the presence of wolves may decrease the useful life of dogs from nine or ten years to five or six years because of the additional stress caused by the presence of wolves; thus, ranchers might need to replace the dogs more rapidly.[78] Ranchers may also replace calves and yearlings when large numbers are depredated in a particular year in order to maintain herd size and ensure future calf crops. As mentioned in the section on grazing modifications, some ranchers have reported purchasing additional land or allotments in order to increase alternative grazing sites for the purpose of avoiding wolf ranges. Another material expense occurs if ranchers increase the frequency of visits to range areas in order to inspect livestock when wolves are in the area or if they haul livestock to different grazing areas. Either of these activities would require fuel and increase the wear on ranch vehicles. Finally, some ranchers have mentioned purchasing camping equipment for herdsmen so that they may sleep out on the range with the livestock in order to protect the animals from depredation. In these cases, DoW has provided compensation to the ranchers for the material because they were able to demonstrate that the purchases were for the purpose of protecting livestock from wolf depredations.[79]

This analysis recognizes that ranchers have spent money on goods in order to better manage their operations in the presence of wolves. No estimates exist, however, describing the frequency and scale of the costs spent on these materials throughout the BRWRA. Therefore, the analysis does not attempt to calculate the economic impact of material acquisitions.

[78] Margaret Hinson, Idaho rancher, personal communication, March 7, 2005.

[79] Darcy Ely, Arizona rancher, personal communication, March 4 and 24, 2005; Margaret Hinson, Idaho rancher, personal communication, March 7, 2005.

3.8 Positive Impacts

The majority of potential economic impacts resulting from wolf reintroduction programs represent costs to ranchers. The possibility does exist, however, that the establishment of wolves in their former habitat could restore ecosystems and increase vegetation. If so, such a change would benefit ranch operations because it would increase the quality of forage available for grazing. For example, wolves reintroduced to Yellowstone National Park controlled elk populations and ended their overgrazing of local vegetation, thus improving grass conditions and allowing trees to repopulate the area. The increase in vegetation has benefited other species such as beaver, fox, bear, and birds.[80] It is unlikely, however, that the presence of wolves to date has reduced elk competition sufficiently to improve forage in the BRWRA. Consequently, the analysis does not attempt to estimate the economic impacts of forage improvements resulting from the reintroduction of Mexican wolves.

Wolves could also compete with and reduce the number of other predators that threaten ranch animals in the BRWRA, such as coyotes. No evidence exists that suggests wolves have reduced other carnivore populations to date, however. Consequently, this analysis also does not attempt to estimate the economic impacts of reduced death loss rates from predators other than wolves.

3.9 Total Economic Impacts

Exhibit 3-14 summarizes the economic impacts to ranchers associated with Mexican wolf reintroduction in the BRWRA. The table presents low, medium, and high estimates based on the sum of the values of livestock kills, injuries, and time spent by ranchers to prepare compensation claims. As the exhibit indicates, impacts from 1998 to 2004 range from $38,650 to $206,290 (2004$). The average annual impacts range from $5,520 to $29,470 (2004$).

Exhibit 3-14

ECONOMIC IMPACT OF LIVESTOCK LOSSES IN THE BRWRA, 1998 – 2004 (2004$)

	1998	1999	2000	2001	2002	2003	2004	Total
Livestock Kills [A]								
Low Estimate	$580	$3,690	$1,110	$4,560	$7,490	$4,460	$6,000	$27,890
Medium Estimate	$580	$20,640	$6,010	$24,150	$42,100	$25,830	$33,200	$152,510
High Estimate	$580	$33,650	$7,650	$9,660	$81,080	$30,720	$32,190	$195,530
Livestock Injured [B]								
Value	$370	$100	$0	$4,050	$0	$0	$0	$4,520
Compensation Claim Preparation [C]								
Value	$150	$570	$160	$2,220	$780	$1,480	$890	$6,240
Total Value of Impacts to Ranchers [A+B+C]								
Low Estimate	$1,100	$4,360	$1,270	$10,820	$8,280	$5,940	$6,890	$38,650
Medium Estimate	$1,100	$21,310	$6,170	$30,410	$42,890	$27,310	$34,090	$163,270
High Estimate	$1,100	$34,320	$7,810	$15,920	$81,860	$32,200	$33,080	$206,290

[80] Jim Robbins (2004), Lessons from the wolf, *Scientific American*, June: 76-81.

3.9.1 Uncompensated Ranch Losses

While ranchers who did not or could not report livestock losses lost the production value associated with their lost livestock over the study period, some ranchers who did report wolf depredation received compensation from Defenders of Wildlife. In theory, if the value of livestock to the ranchers was compensated at a fair market value for the lost production value of the livestock, as well as the time and materials invested in reporting the claim, then the ranchers should have been "made whole" through these payments. At present, DoW is the only source of compensation available to ranchers for livestock losses.[81] This section of the analysis compares the impacts to ranchers provided in Exhibit 3-14 (including the value of kills, injuries, and ranchers' time) to the amount of compensation paid out by Defenders of Wildlife during this time period. As shown in Exhibit 3-15, "uncompensated" economic impacts to ranchers range from $5,020 to $172,660 from 1998 to 2004.

Exhibit 3-15

UNCOMPENSATED LOSSES TO RANCHERS IN THE BRWRA FROM 1998 - 2004 (2004$)

		1998	1999	2000	2001	2002	2003	2004	Total
Value of Livestock Killed (A)	**Low Estimate[a]**	$1,100	$4,360	$1,270	$10,820	$8,280	$5,940	$6,890	$38,650
	Medium Estimate[a]	$1,100	$21,310	$6,170	$30,410	$42,890	$27,310	$34,090	$163,270
	High Estimate[a]	$1,100	$34,320	$7,810	$15,920	$81,860	$32,200	$33,080	$206,290
Compensation paid by DoW[b] (B)		$540	$2,440	$1,540	$10,230	$5,300	$8,500	$5,090	$33,630
Uncompensated Losses (A-B)	**Low Estimate[c]**	$560	$1,920	-$270	$590	$2,970	-$2,560	$1,800	$5,020
	Medium Estimate[b]	$560	$18,870	$4,630	$20,180	$37,590	$18,810	$29,000	$129,640
	High Estimate[b]	$560	$31,880	$6,270	$5,690	$76,560	$23,700	$27,990	$172,660

Notes and Sources:
[a] Economic impacts equal the value of livestock killed by wolves, the veterinary expenses for livestock injured by wolves, and the time spent by ranchers preparing compensation claims; these economic impacts are summarized in Exhibit 3-14.
[b] DoW compensation data from Defenders of Wildlife (2005), The Bailey Wildlife Foundation Wolf Compensation Trust: Payments to Ranchers for Livestock Losses Caused by Wolves, accessed January 24, 2005, at <http://www.defenders.org/wildlife/wolf/wolfcomp.pdf>.
[c] Uncompensated losses represent the difference between economic impacts and compensation values.

3.9.2 Regional Economic Impacts of Decreased Livestock Production

This analysis models the regional impacts of reduced production in the livestock industry in the five-county study area. Reduced production equals the value of cattle and sheep killed by wolves in the BRWRA, minus any compensation that ranchers received for these losses.[82] Cattle and sheep losses will primarily affect the livestock-related sectors of the economy. Decreased

[81] See the Social Impacts Section for a discussion of rancher sentiments about the current compensation program.

[82] Production losses do not include the value of lost dogs and horses or the value of time spent by ranchers preparing compensation claims since these losses do not affect output (i.e., revenue from cattle and sheep sales). To the extent that ranchers forego investing in livestock herds because they instead spent money replacing dogs and horses or paying for additional labor, this analysis may understate actual production losses.

operations in these industries would also result in secondary effects on related sectors in the study area. Some of these related sectors may be closely associated with livestock, such as feed grains and hay and pasture, while others may be less closely associated with the industry, such as the insurance sector. In order to model the economic impacts of these initial and secondary effects, the analysis utilizes a software package called IMPLAN to estimate the total economic effects of the reduction in economic activity in the livestock-related industries in the study area.[83] IMPLAN is commonly used by State and Federal agencies for policy planning and evaluation purposes. The model draws upon data from several Federal and State agencies, including the Bureau of Economic Analysis and the Bureau of Labor Statistics. IMPLAN translates initial changes in expenditures into changes from demand for inputs to affected industries. These effects can be described as direct, indirect, or induced, depending on the nature of the change:

- **Direct effects:** Changes in output attributable to a change in demand or a supply shock. These are specified initially by the modeler (e.g., the change in recreation expenditures on goods and services, by sector);

- **Indirect effects:** Changes in output industries that supply goods and services to those that directly affected by the initial change in expenditures; and

- **Induced effects:** Changes in household consumption, arising from changes in employment (which in turn are the result of direct and indirect effects). For example, changes in employment in a region may affect the consumption of certain goods and services.

These categories are calculated for all industries to determine the regional economic impact of livestock losses resulting from wolf attacks in the BRWRA.[84]

Because the model estimates impacts on an annual basis, this analysis calculates the regional impact of productivity losses using data from the year with the most depredations: 2002. In this year, wolves killed between 9 and 92 cattle, though no sheep kills or livestock injuries were reported. The analysis subtracts any compensation that ranchers received from DoW for these depredations from the value of the lost cattle. Consequently, the analysis measures the

[83] For the IMPLAN analysis, the study area represents the five counties containing portions of the BRWRA: Apache and Greenlee counties in Arizona, and Catron, Grant, and Sierra counties in New Mexico.

[84] There are two important caveats relevant to the interpretation of IMPLAN model estimates, generally, and within the context of this analysis. The first is that the model is static in nature and measures only those effects resulting from a specific policy change (or the functional equivalent specified by the modeler) at a single point in time. Thus, IMPLAN does not account for posterior adjustments that may occur, such as the subsequent re-employment of workers displaced by the original policy change. In the present analysis, this caveat suggests that the long-run net output and employment effects resulting from the Mexican wolf reintroduction are likely to be smaller than those estimated in the model, which implies an upward bias in the estimates. A second caveat to the IMPLAN analysis is related to the model data. The IMPLAN analysis relies upon input/output relationships derived from 1998 data. Thus, this analysis assumes that this historical characterization of the affected counties' economies are a reasonable approximation of current conditions. If significant changes have occurred since 1998 in the structure of the economies of the counties in the study area, the results may be sensitive to this assumption. The magnitude and direction of any such bias are unknown.

regional impact of uncompensated decreases in cattle production in 2002. This is an attempt to best measure the likely regional annual losses due to wolf depredation on livestock.

Exhibit 3-16 presents the results of the IMPLAN analysis. According to the model analysis, the reduction in livestock production as a result of predation by wolves caused a total economic loss in regional output of $2,590 under the low estimate, $48,770 under the medium estimate, and $99,130 under the high estimate (2004$). In addition, the livestock losses resulted in the loss of approximately zero jobs (under the low estimate), one job (under the medium estimate), or two jobs (under the high estimate) across all sectors of the regional economy in 2002.[85]

Exhibit 3-16

ESTIMATED ANNUAL REGIONAL ECONOMIC IMPACT OF REDUCTIONS IN LIVESTOCK PRODUCTION USING 2002 DATA (2004$)[a]

Livestock Loss Estimate[b]	Type of Loss	Direct Effect (Output)	Indirect Effect (Output)	Induced Effect (Output)	Total Impact (Output)
Low Estimate	Output	$1,840	$350	$390	$2,590
	Employment	0.0	0.0	0.0	0.0
Medium Estimate	Output	$34,700	$6,630	$7,440	$48,770
	Employment	0.7	0.1	0.1	0.9
High Estimate	Output	$70,530	$13,470	$15,130	$99,130
	Employment	1.4	0.2	0.2	1.9

Notes:
[a] Regional economic impact measures represent a one-time change in economic activity; thus, they are not additive to other estimates. These estimates represent the estimated regional economic impact from livestock losses in 2002. As 2002 was the year with the highest depredation rate, the regional impact analysis represents the upper bound of annual direct, indirect, and induced effects from 1998 to 2004.
[b] Livestock loss estimates include the uncompensated value of cattle killed by wolves in 2002. No reported cattle injuries or sheep depredations occurred in this year.

3.10 Conclusions and Comparison to FEIS

This analysis quantifies the economic impacts to ranchers of livestock kills, injuries, and time spent preparing compensation claims that have resulted from the reintroduction of the Mexican wolf into the BRWRA. This analysis estimates that from 1998 to 2004, Mexican wolves killed between 32 and 233 cattle, between two and five sheep, between zero and four horses, and between two and three dogs. In addition, wolves injured five cattle, two horses, and one dog over the same period. The economic impacts to ranchers of these kills, injuries, and lost time totals between $38,650 and $206,290 (2004$). While other management changes in response to the presence of wolves (such as increased labor time and purchasing additional dogs to guard livestock and breeding animals to replace those lost) have also cost ranchers time and money, sufficient evidence does not exist to value these ranch modifications. Therefore, to the extent that ranchers incur costs due to wolves that are in addition to depredation losses and time applying for compensation, this analysis understates the losses and economic impacts to

[85] These data are from IMPLAN for the Range-Fed, Ranch-Fed and Cattle Feedlots livestock sectors.

livestock operations. From 1998 to 2004, DoE paid $33,630 ranchers as compensation for lost livestock. Thus, uncompensated losses range from $5,020 to $172,660, depending on the depredation estimate used.[86]

The FEIS estimates that a population of 100 wolves would be confirmed to kill between one and 34 cattle each year. While the FEIS notes that wolves would likely kill more cattle and other ranch animals, the FEIS does not estimate the number or value of additional ranch animals that would be killed or injured by wolves. The FEIS also mentions that ranchers may expend additional time and resources to avoid wolves, but the 1996 analysis did not quantify these impacts.

To compare the FEIS projections to impacts that occurred during the study period, this analysis adjusts the FEIS estimates downward based on the number of wolves in the BRWRA during the study period. The adjusted FEIS estimates project that Mexican wolves would have killed 36 cattle from 1998 to 2004.[87] As stated above, the FEIS did not quantify estimates of sheep, horse, or dog depredation. Our current analysis suggests that, on average, the wolves killed a total of 32 to 233 cattle, or between 4.6 and 33.3 cattle per year from 1998 to 2004. Thus, while the FEIS aligns well with the number of confirmed kills presented as low end of the estimates in this analysis, medium and high estimates of depredations, which include unconfirmed kills, are higher than estimates included in the FEIS.

As stated above, there are 122,500 cattle, at least 300 sheep and lambs, and 9,000 horses and ponies in Apache and Greenlee counties, Arizona, and Catron, Grant, and Sierra counties, New Mexico.[88] This analysis assumes that 34,800 of these cattle, 120 of these sheep, and 1,600 of these horses and ponies are within the BRWRA. Thus, the livestock depredation estimates presented in this analysis all represent less than one percent of the cattle, sheep, and horses in the BRWRA. In comparison, the average death loss rate for cattle in Arizona and New Mexico was four percent in 1997 (the year prior to the Mexican wolf reintroduction program); the average death loss rate for sheep in the two states was five percent in 1997.[89] The FEIS also projected that depredations would total less than one percent of livestock grazing activities in the BRWRA.

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[86] From 1998 to 2003 (i.e., the years included in the five-year review), wolves killed between 25 and 195 cattle, between one and three sheep, between zero and four horses, and between two and three dogs. Wolves still injured five cattle, two horses, and one dog. The total impacts of these losses ranged from $31,770 to $173, 210. During this period, DoW provided ranchers with $28,550 in compensation, and uncompensated losses ranged from $3,210 to $144,660.

[87] U.S. Fish and Wildlife Service (1996), *Reintroduction of the Mexican Wolf Within Its Historic Range in the Southwestern United State: Final Environmental Impact Statement*; John Oakleaf et al. (2004), *Mexican Wolf Recovery: Five-Year Review and Assessment – DRAFT*; Arizona Game and Fish Department et al. (2005), Mexican Wolf Blue Range Reintroduction Project Interagency Team Annual Report.

[88] U.S. Department of Agriculture National Agricultural Statistics Service (2002), 2002 Census of Agriculture, accessed March 9, 2005, at <http://www.nass.usda.gov/census/>.

[89] Death losses include deaths caused by predators (such as coyotes, dogs, mountain lions, and bobcats); digestive, respiratory, and calving problems; weather conditions; poison; theft; and unknown causes. U.S. Department of Agriculture National Agricultural Statistics Service (1999), Meat Animals Production, Disposition, and Income: Final Estimates 1993-1997. Statistical Bulletin Number 959a.

The U.S. Department of Agriculture reports that livestock cash receipts from Apache, Greenlee, Catron, Grant, and Sierra counties totaled $84.0 million in 2002 (2004$). Based on the percentage of these counties' land that is in the BRWRA, this analysis estimates that $17.4 million of the cash receipts are attributable to livestock activities in the BRWRA. This analysis estimates that the losses attributable to Mexican wolves in 2002 (the year with the most depredations) ranged from $8,300 to $81,900 and the uncompensated losses ranged from $3,000 to $77,000, depending on the depredation estimate used. Thus, the total direct economic impacts represented between 0.05 percent and 0.47 percent of total cash receipts, and the uncompensated losses represent between less than 0.02 percent and 0.44 percent of total cash receipts in the BRWRA. As this was the year with the most recorded depredations, this represents the upper bound estimate of annual impacts on livestock receipts to date.

The estimated annual economic impact on regional outputs due to the decreased cattle production (estimated for 2002, the year with the most cattle losses) totaled between $2,590 and $99,130. These regional impacts represent less than one percent of the $84.0 million in livestock cash receipts in that year. As above, because 2002 was the year with the most recorded depredations, this represents the upper bound estimate of annual impacts on livestock receipts to date. While these losses and impacts may not be significant on a regional level, wolf depredations do not affect ranchers uniformly throughout the BRWRA. Therefore, certain establishments grazing livestock in proximity to Mexican wolf ranges could experience a disproportionate portion of the impacts, and their losses could significantly affect these operations.

ECONOMIC IMPACTS OF MEXICAN WOLF REINTRODUCTION ON HUNTING ACTIVITIES SECTION 4

This section of the analysis evaluates the changes to hunting activities associated with the wolf reintroduction program from 1998 to 2003. Data for 2004 is also presented where available.

4.1 FEIS Estimates of Impacts on Hunting Activities

Because wolves prey on ungulates, there has been concern from hunters and the outfitting and guide industries that utilize the BRWRA that wolf reintroduction may have economic impacts on the hunting industry. Indeed, the largest economic impacts quantified in the FEIS are potential impacts on big game hunting. The FEIS estimated that when the population of wolves reaches 100 in the BRWRA, hunting days could be reduced by 9,800 to 18,200 hunting days for deer, and 2,800 to 4,600 hunting days for elk annually. This reduction would result in reduced recreational expenditures of $0.7 to $1.3 million annually in New Mexico and Arizona (2004$). In addition, the social cost of the lost enjoyment of elk and deer hunting in the BRWRA would be reduced by $0.9 to $1.6 million annually (2004$). Finally, hunting permit revenues to the states of Arizona and New Mexico would be reduced by $83,000 to $152,000 annually (2004$). This section of the analysis discusses the experiences of the outfitter and guide industry since wolf reintroduction, and presents data to assist with evaluation of impacts of wolf reintroduction on this industry since the program began. Exhibit 4-1 summarizes the estimates presented in the FEIS as well as the assumptions that were used to derive the estimates.

Exhibit 4-1

FEIS ASSUMPTIONS AND ESTIMATES OF ECONOMIC IMPACTS ON HUNTING (DEER AND ELK), 2004$

Assumptions

	Deer		***Elk***	
Number of Wolves = 100				
Hunting Success Rate	23.9%	23.9%	33.7%	33.7%
Average Days Per Big Game Hunter	7.79	7.79	7.79	7.79
Willingness to Pay per Hunting Day (2004$)	$ 69.83	$ 69.83	$ 69.83	$ 69.83
Hunting expenditures per day (2004$)	$ 55.74	$ 55.74	$ 58.15	$ 58.15

Estimates

	Deer		***Elk***	
	Low	**High**	**Low**	**High**
Harvest reduction	300	560	120	200
Number of Reduced Hunting Days	9,795	18,284	2,776	4,627
Value of Lost Hunting Days	$ 684,000	$ 1,276,800	$ 193,900	$ 323,100
Value of Reduction in Hunter Expenditures	$ 546,000	$ 1,019,200	$ 161,400	$ 269,100
			Deer and Elk	
Total Value Lost Hunting Days (Deer and Elk)			$ 877,900	$ 1,599,900
Total Value Reduction in Hunter Expenditures (Deer and Elk)			$ 707,400	$ 1,288,300
Value of Lost Permit Revenue (Deer and Elk)			$ 83,100	$ 151,700

Source: U.S. Fish and Wildlife Service. 1996. Reintroduction of the Mexican Wolf Within Its Historic Range in the Southwestern United States: Final Environmental Impact Statement. Costs adjusted to 2004$ using the Consumer Price Index, accessed at http://data.bls.gov/cgi-bin/dsrv.

4.2 Economic Concerns of Outfitters, Guides, and Hunters Who Utilize the BRWRA

The BRWRA is a prime hunting area, particularly for elk. Some of the largest bull elks on record have been hunted in this area. There were 249 outfitters listed as registered as Active New Mexico Outfitters in 2004. In addition, about 100 additional outfitters hold inactive licenses in New Mexico.[90] Many of these outfitters operate within the BRWRA. Typically, 75 to 80 outfitters hold active permits to hunt in the Gila National Forest each year, or about 32 percent of active outfitters in New Mexico.[91] Approximately 30 outfitters operate in Apache National Forest.[92] Most outfitters operating in the BRWRA get most of their income from elk hunting.[93]

[90] Personal communication with New Mexico Council of Outfitters and Guides, March 8, 2005.

[91] Based on the number of outfitter/guide permits issued annually in the Gila National Forest. Email communication with Paula Barnhill, Gila National Forest, March 18, 2005.

[92] Personal communication with Michael Frances, Apache National Forest, Springerville District, March 10, 2005. The number of outfitter/guide permits for Clifton and Alpine Ranger Districts were assumed to be similar to the number issued in Springerville.

[93] Personal communication with San Francisco River Outfitters, March 8, 2005.

New Mexico Department of Fish and Game (NMDFG) reports that approximately 12 percent of non-resident elk hunters utilize the services of the guide/outfitter industry each year.[94]

The outfitting and guiding industry in the BRWRA area is vulnerable because it relies on state and Federal permits to operate, usually requires Federal lands access, and depends on a healthy population of wild prey. The primary concerns of hunters and the hunting industry regarding economic impacts fall into five major categories:

1) **Big Game Population Effects:** Elk and other big game species populations may be reduced by wolves to the point that permit numbers are decreased and/or the overall quality of hunt is decreased.

2) **Effects of Hunter Visitation to the Region:** The reputation of the area could be tarnished, resulting in fewer hunters visiting the area. Outfitters have reported that some hunters at trade shows have responded negatively to hearing that wolves are present, and may have chosen other places to visit.

3) **Hunting Success Effects:** Hunting efforts in the area could become more arduous and ultimately less successful as game are chased and dispersed into hard to reach areas. Outfitters report that some elk herds in the BRWRA have been displaced from meadows, and are now found in more heavily wooded areas.

4) **Lost Income/Costs to Outfitters:** Hunting income to outfitters and guides would be reduced if hunter visitation declines. In addition, hunting dogs could be lost to wolf predation, which is not compensated for under the current 10(j) rule, increasing costs to some outfitters.

5) **Regional Economic Effects:** Hunting effort reductions would lead to reduced direct expenditures by hunters in local businesses, leading to reductions in total regional spending, reduced employment and reduced taxes collected.

The following discussion provides data that offers insight into what hunters and the hunting industry have experienced since Mexican wolf introduction.

4.3 Big Game Population Effects

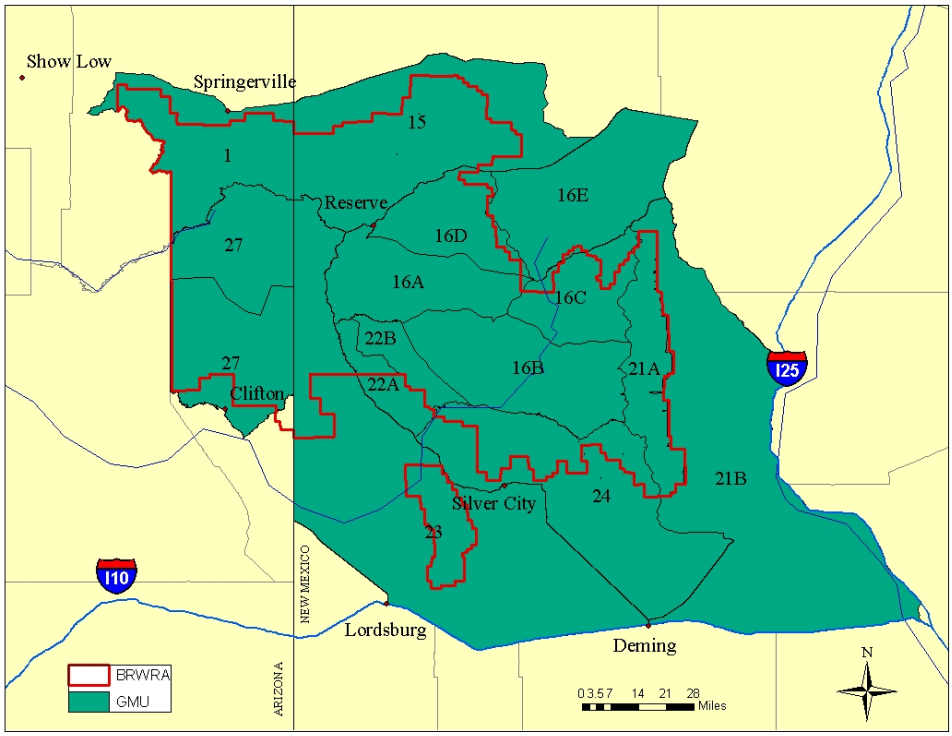
Outfitters and hunters are concerned that Mexican wolf reintroduction may affect the population of game available for hunting. Indeed, the FEIS estimated that the population of deer and elk could be reduced once the wolf population reached 100. Thus, this section investigates whether game populations may have declined in recent years due to wolf reintroduction.

[94] Kohlmann, Stephan. "Elk Management in New Mexico: An Introduction." NMGFD, Elk Program, Undated. Received March 3, 2005.

The State Game and Fish Agencies in New Mexico and Arizona are responsible for managing game resources within the states, on both public and private land. The majority of lands within the BRWRA are divided into five Game Management Units. Apache National Forest is divided into Arizona Game Management Units 1 and 27. The majority of lands in the Gila National Forest are made up of GMUs 15, 16, and 23. These units are primarily hunted for elk, mule deer, white-tailed deer, and wild turkey. Secondary game species include antelope, javelina, and Rocky Mountain bighorn sheep. Exhibit 4-2 presents the GMUs in the BRWRA.

Exhibit 4-2

GAME MANAGEMENT UNITS IN THE BRWRA



Sources: GIS Data layers produced by NMGFD and AZGFD showing Game Management Units, 2005.

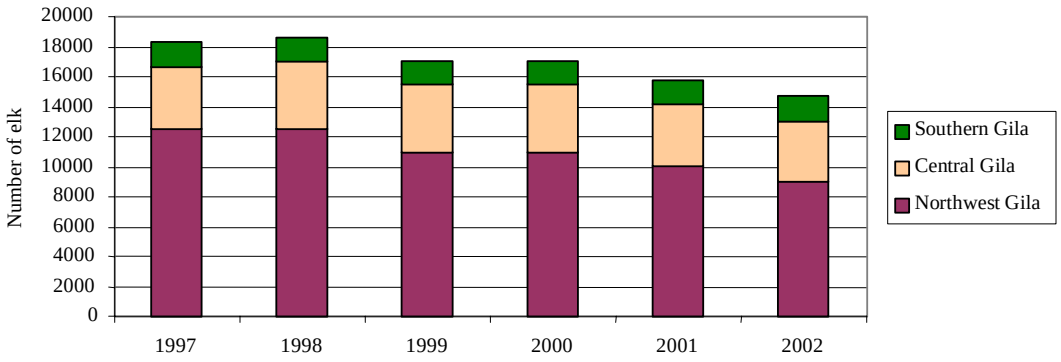
The State of New Mexico is currently home to approximately 70,000 elk, of which approximately 15,000 (21 percent) reside in the BRWRA in Gila National Forest.[95] The population of elk in Apache National Forest was approximately 5,000 in 2004. Exhibits 4-3 and 4-4 present estimated elk populations within the BRWRA during recent years. The New Mexico elk population has declined since 1998 from approximately 18,500 in 1998 to approximately 15,000 in 2002 (a decrease of 19 percent). In Arizona, the estimated elk population has declined steadily, declining from 8,500 to 6,000 between 1998 and 2002 (a decrease of 29 percent). NMDFG and ADGFD, as well as outfitters, report that these populations are closely managed and that these units were purposely reduced in size by regulating the number of hunting permits

[95] Kohlmann, Stephan G. "Elk Management in New Mexico: An Introduction." New Mexico Department of Game and Fish. Received March 3, 2005.

for these areas. These statements are supported by the reported number of elk permits sold in these units, which has increased in these units during this time period.

The FEIS based its elk population estimates on a study by Green Hammond,[96] which estimated that the elk population in the BRWRA was 15,900 in 1996 (NM population: 10,200; AZ population: 5,700).[97] The FEIS projected that five years after the population of wolves reached 100, elk populations would range from 9,300 to 18,000. The actual elk population in the BRWRA in 2002 (the latest date for which data was available for both states) is estimated to range from 16,500 to 20,600. Since the wolf population has not yet reached 100, determining whether the projected effects on elk populations will occur is not yet possible. However, the current BRWRA population is larger than the projected population after the wolf population reaches 100. Other factors, such as game manager decision-making strategies as well as climate further complicate the assessment of whether wolf predation has affected elk populations to date.

Exhibit 4-3
ELK POPULATION IN THE NEW MEXICO PORTION OF THE BRWRA
1997-2002

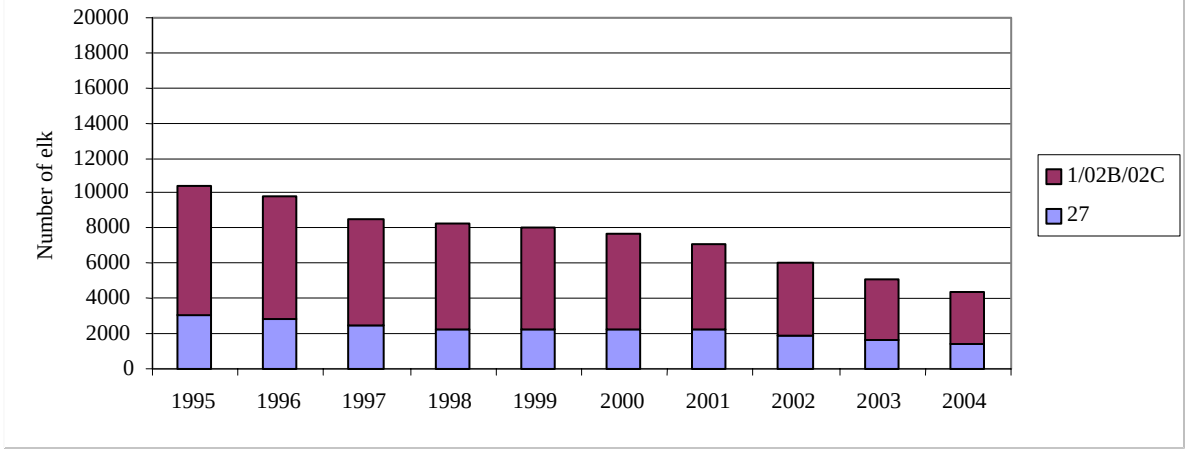


Source: Elk Hunter Survey - Estimated Results From Hunter Surveys by Game Management Unit, New Mexico Department of Game and Fish, 2005.

[96] Green Hammond, Katherine. "Assessment of Impacts to Populations and Human Harvest of Deer and Elk Caused by the Reintroduction of Mexican Wolves." Prepared for U.S. Fish and Wildlife Service, Order No. 20181-4-0201, April 11, 1994.

[97] Data for New Mexico was not available for a direct comparison of this FEIS estimate to current data sources, but Arizona estimates are roughly consistent with this estimate, ranging from 2,000 to 9,000. This range of estimates and those presented in Exhibits 4-3, include estimates for GMUs 2B and 2C in Arizona, though these units are not in the BRWRA. Data provided by AZGFD did not allow disaggregation of this data from Unit 1. As a result, estimates of population in the Arizona portion of the BRWRA are presented as a range.

Exhibit 4-4
ELK POPULATIONS IN THE ARIZONA PORTION OF THE BRWRA
(UNITS 1 AND 27), 1995-2004



Source: Elk Management Summaries for 2003/2004, Arizona Game and Fish Department records, February 2005. Population estimates for GMUs 2B and 2C are included, though these units are not in the BRWRA. Data provided by AZGFD did not allow disaggregation of theses data from Unit 1 data.

Deer populations have been declining for the past decade in the BRWRA area.[98] In the Arizona portion of the BRWRA, mule deer populations declined from a population of approximately 12,000 in 1998 to a population of approximately 8,000 in 2002, as presented in Exhibit 4-5. State wildlife agencies attribute this decline to a combination of factors, including overall forest succession, lack of natural fires, and resulting lack of available forage for deer.[99] The whitetailed deer population in Arizona was approximately 2,300 in 2003 (trend data was not available to estimate changes in population of white-tailed deer over time, but game managers report trends similar to mule deer). While official deer population estimates were not available for the BRWRA in New Mexico, state deer managers and outfitters report that similar declines in mule deer and white-tailed deer have been observed in the Gila National Forest.[100]

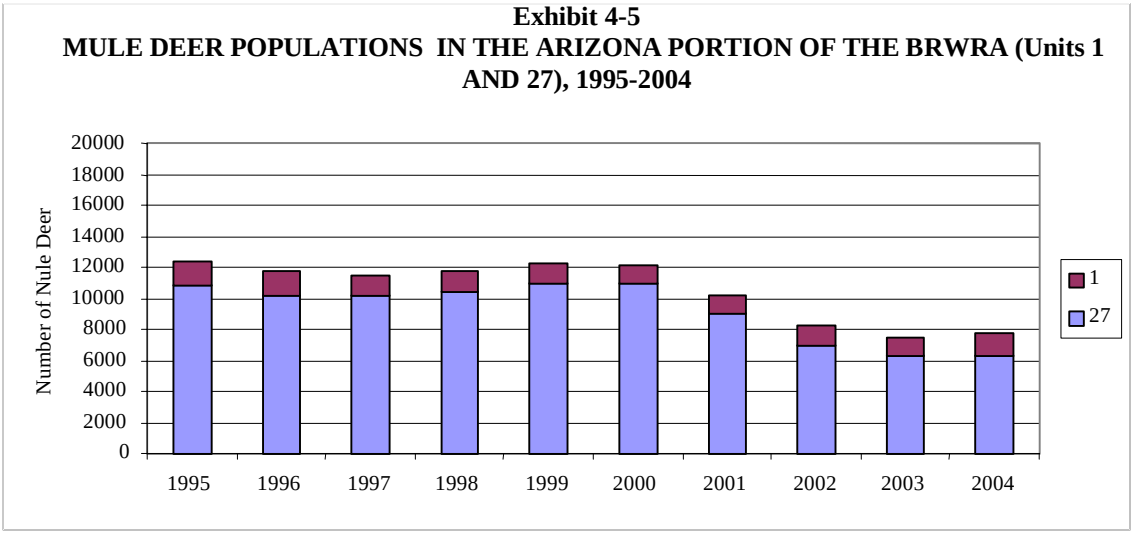
The FEIS estimates that deer populations in the BRWRA will range from 35,500 to 64,100 five years after the wolf population reaches 100. Given the apparent continued decline in population, these projected population estimates may be high. However, because population estimates were not available to estimate deer populations in the BRWRA, direct comparisons are not possible. Even if populations were known, estimating deer population reductions that result from wolf predation would be complicated by other factors, such as changes to climate and forage conditions, that have lead to ongoing downward trends in deer populations.

[98] Personal communication with Barry Hale, Deer Program Manager, New Mexico Department of Game and Fish, December 28, 2004. Personal communication, NM Council of Outfitters and Guides, March 8, 2005.

[99] Personal communication with Steve Kohlmann, Elk Program Manager, NMGFD, March 3, 2005.

[100] Deer population in the Gila National Forest are surveyed periodically, but total population is not estimated. Personal communication with Pat Mathis, Regional Game Manager, Southwest Region, NMGFD, March 7, 2005; Barry Hale, Deer Program Manager, New Mexico Department of Game and Fish, December 28, 2004.

Exhibit 4-5
MULE DEER POPULATIONS IN THE ARIZONA PORTION OF THE BRWRA (Units 1 AND 27), 1995-2004



Source: Mule Deer Management Summaries for 2003/2004, Arizona Game and Fish Department records, February 2005.

4.4 Effects on Hunter Visitation to the Region

4.4.1 Number of Permits Sold

The FEIS estimated that the number of elk and deer hunting permits sold by the states of New Mexico and Arizona in the BRWRA could decline after the wolf population reached 100, leading to a reduction in fees collected by the states (as shown in Exhibit 4-1).[101] This section examines whether a downward trend in permit sales can be identified in the BRWRA since reintroduction.

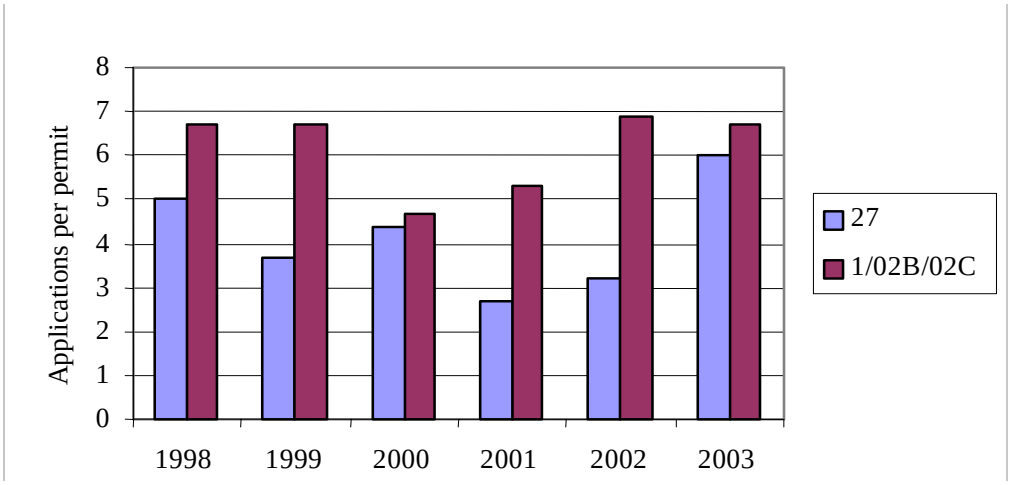
In New Mexico and Arizona, elk hunting is permitted through an annual lottery system. In both Arizona and New Mexico, the demand for elk permits exceeds the number of permits issued. In Arizona's Region 1 there are, on average, four first choice elk permits for every permit issued. AZGF reports that hunter demand is greatest for the early bull rifle permits, with 80 to 150 applicants for every permit issued.[102] The number of first choice applications per approved elk permit from 1998 to 2003 in the Arizona portion of the BRWRA is presented in Exhibit 4-6. Because of the high demand for these permits, the number of permits sold is usually determined by state quotas, which are chosen with the goal of maximizing the sustainable population of elk, while also maximizing the hunting experience of hunters and minimizing conflicts with other land uses. Exhibits 4-7 and 4-8 present the trend in elk permits sold in the BRWRA since wolf reintroduction.

[101] The FEIS states that the estimated hunting losses may overstate actual losses, as hunter may pursue substitute sites or to substitute species for hunting. In addition, because hunting in New Mexico and Arizona is dominated by resident hunters, money not spent in the BRWRA is likely to be spent elsewhere in these states.

[102] AZGFD, "Regional Elk Management Operational Plans," March 25, 2004.

Exhibit 4-6

NUMBER OF FIRST CHOICE APPLICATIONS PER APPROVED ELK PERMITS IN THE ARIZONA PORTION OF THE BRWRA (UNITS 1 AND 27), 1998-2003



Source: Elk Management Summaries for 2003/2004, Arizona Game and Fish Department records, February 2005. Note that this data includes units 2B and 2C as well as unit 1, because AZGFD collected the data in this manner.

In New Mexico, most permits for deer hunting licenses on public lands have traditionally been purchased "over the counter," with no draw system for most hunts. In order to improve the deer hunting experience in NM, NMGF has begun using a lottery system in 2005, which is likely to result in fewer deer licenses issued overall.[103]

The price of a deer or elk permit or license depends on whether it is over-the-counter or acquired through a draw, whether the hunter is a resident, non-resident, junior, or senior, and, in New Mexico, whether the hunt is a standard hunt, quality hunt, or high-demand hunt.[104] For all permit types, non-residents pay significantly more than residents for hunting permits in both New Mexico and Arizona. In these states, current resident elk permit fees range from $46 to $76, while non-resident elk permit fees range from $291 to $766 for non-residents (ranging from 5 to 17 times greater for non-residents).[105] NMDGF reports that license fees from elk licenses typically amount to $7 million annually. Draw permit-tags for deer range from $22 in Arizona to $32 in New Mexico for residents, and $113 to $196 for non-residents. Statewide revenues from Arizona for all licenses, including fishing licenses, was $10.6 million in 2001.

[103] Barry Hale, Deer Program Manager, New Mexico Department of Game and Fish, December 28, 2004.

[104] A "quality" hunt is determined by the State Game Commission (NM), and is designed to provide an increased opportunity for a successful harvest; a "high demand" hunt is a hunt that had at least 20 percent nonresident applicants for the previous two license years. New Mexico Big Game and Furbearer Rules and Information: 2005-2006 License Year, NM Game and Fish, 2005.

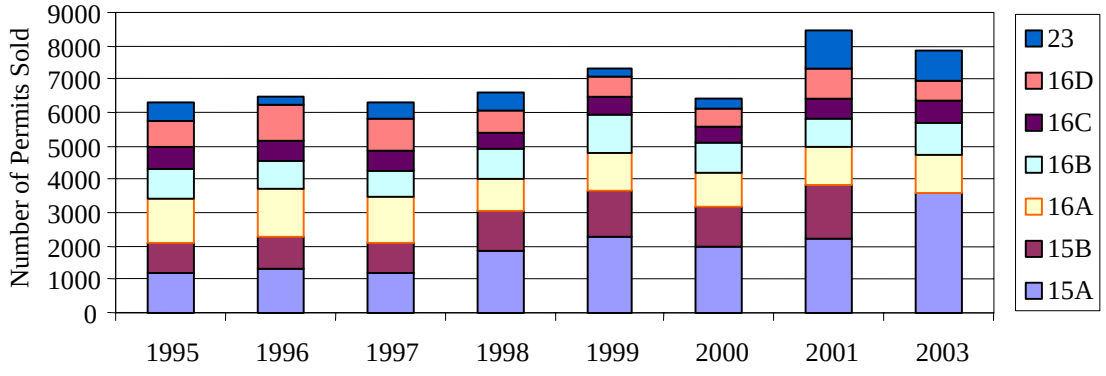
[105] Fees presented are for adult licenses and permits. Sources: New Mexico Game and Fish Department. "New Mexico Big Game and Furbearer Rules and Information, 2005-2006 License Year, 2005; 2004-2005 Arizona Hunting and Trapping Regulations, Arizona Fish and Game Department, 2004.

Outfitters and guides must be authorized for an annual or priority use special use permit to conduct commercial activities on USFS lands. An outfitter can be (but is not limited to): a hunting guide, fishing guide, backpacking guide and horse packer. In 2002, over 1,050 outfitter guide permits were authorized across USFS Region 3 (Arizona and New Mexico). Outfitter permits in the BRWRA represent approximately 10 percent of all outfitter permits granted by the USFS across Region 3.[106]

The FEIS estimates that elk hunting effort will be reduced by 2,700 to 4,600 hunting days and deer hunting will be reduced by 9,700 to 18,400 hunting days after the population of Mexican wolves reaches 100. As a result of this reduction, a corresponding decrease in state permit revenues of $68,700 to $125,500 annually is projected. However, the number of elk permits sold in the BRWRA has increased since wolf reintroduction. In the New Mexico portion of the BRWRA, the number of elk permits sold increased by 20 percent between 1998 and 2003. The trend in the Arizona portion of the BRWRA is less clear, but also shows an increase of 15 percent from 1998 to 2003. Since the reintroduction of wolves began, the number of applications per elk permit has remained relatively stable at between 3 and 7 applications per permit from 1998 to 2003 in the BRWRA. Thus, this analysis finds no evidence that wolf reintroduction has affected the number of elk permits granted by the states for hunting in the BRWRA area. Correspondingly, this analysis also finds no evidence states of New Mexico or Arizona have experienced reductions in elk permit revenue since wolf reintroduction.

The number of deer licenses issued in New Mexico was not available. The number of deer permits issued in Arizona declined from 2,100 in 1998 to 850 in 2003 in Arizona (a decline of 36 percent). This change corresponds to the decline in deer population, and is the most likely reason for this decline.

Exhibit 4-7
NUMBER OF ELK PERMITS SOLD IN NEW MEXICO PORTION OF BRWRA
(GMU 15, 16, AND 23), 1995-2003

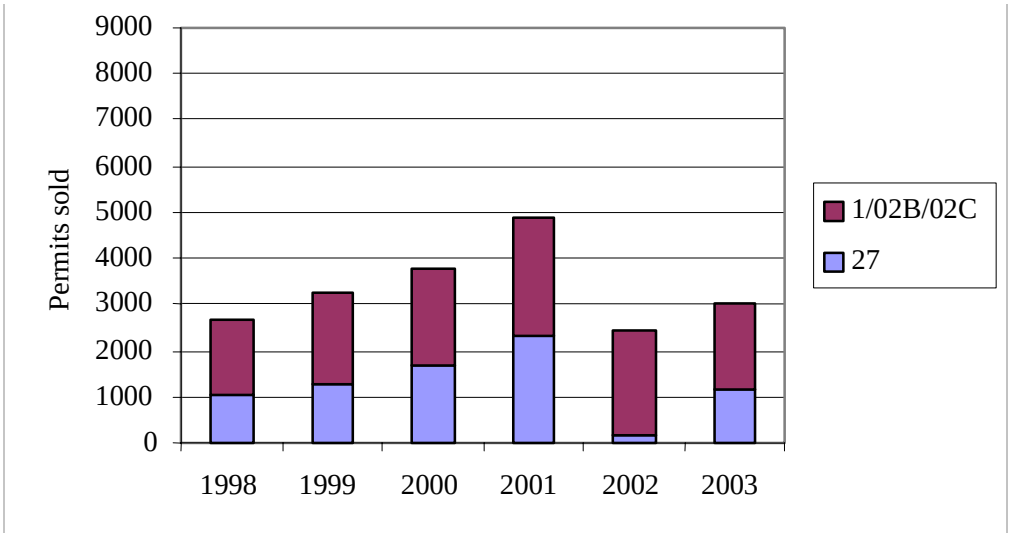


Source: Elk Hunter Survey - Estimated Results From Hunter Surveys by Game Management Unit, New Mexico Department of Game and Fish, 2005.

[106] U.S. Forest Service, Region 3. Draft Biological Assessment for 11 Land and Resource Management Plans, November 2003.

Exhibit 4-8

ELK PERMITS SOLD IN THE ARIZONA PORTION OF THE BRWRA (UNITS 1 AND 27), 1998-2003



Source: Elk Management Summaries for 2003/2004, Arizona Game and Fish Department records, February 2005.
Note that this data includes units 2B and 2C as well as unit 1, because AZGFD collected the data in this manner.

4.4.2 Hunting Effort (Number of Hunters and Hunter Days)

The FEIS estimated that the number of hunter days in the BRWRA would decline after the wolf population reached 100. This section examines whether a downward trend in hunters or hunter days was observable in the BRWRA since reintroduction.

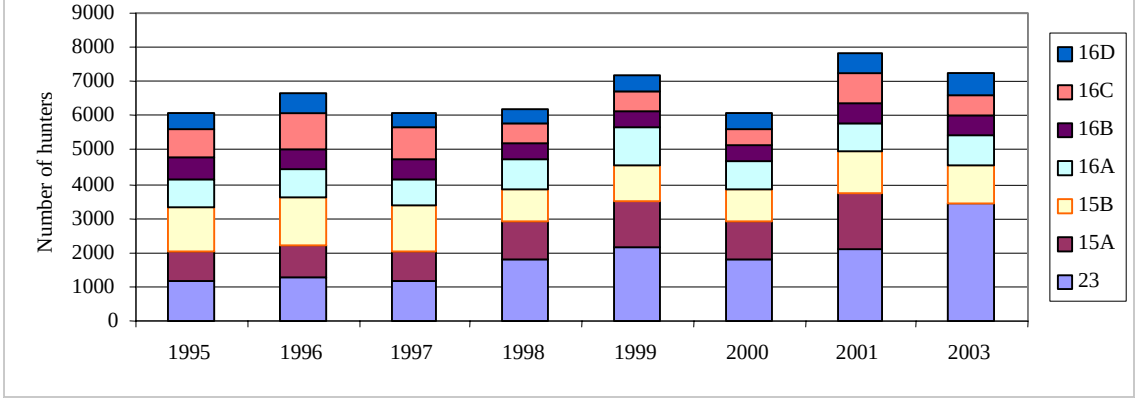
Non-resident hunters comprise approximately ten percent of annual hunting efforts in New Mexico and Arizona, which is consistent with hunting patterns nationally on a statewide basis. Big game hunters make up 86 percent of hunters in New Mexico, which is consistent with national trends (84 percent). By contrast, only 36 percent of hunters in Arizona hunted big game in 2001.[107]

Approximately one third of elk hunting activities (number of hunters and hunting days) in New Mexico occurred in the BRWRA in the 2003-2004 season. The number of elk hunters and hunting days are estimated annually by the state game agencies using a sample of returned hunter surveys. Exhibits 4-9 and 4-10 present the estimated number of hunters and the number of hunters days in the BRWRA since wolf reintroduction.[108]

[107] U.S. Fish and Wildlife Service, 2001 National Survey of Fishing, Hunting, and Wildlife-Associated Recreation, Revised March 2003; New Mexico Silberman, John. "The Economic Importance of Fishing and Hunting", Arizona State University West, 2002.

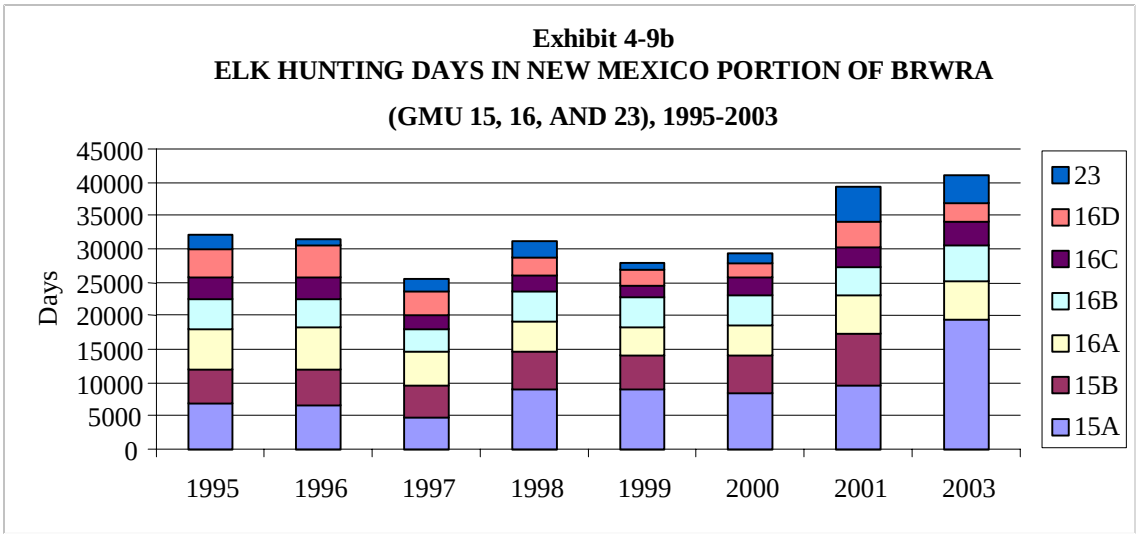
[108] Note that hunting days are reported by season (e.g., 1995-1996 hunting season). In the exhibits, hunting seasons are represented by the year in which the season began (e.g., the 1995-1996 season is represented as 1995).

Exhibit 4-9a
NUMBER OF ELK HUNTERS IN NEW MEXICO PORTION OF BRWRA
(GMU 15, 16, AND 23), 1995-2003



Source: Elk Hunter Survey - Estimated Results From Hunter Surveys by Game Management Unit, New Mexico Department of Game and Fish, 2005. Hunting seasons are represented by the year in which the season began (e.g., the 1995-1996 season is represented as 1995).

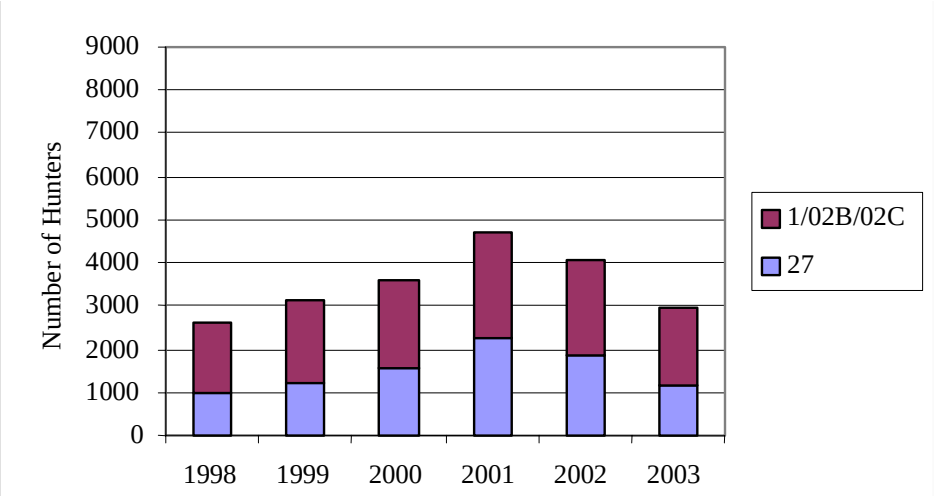
Exhibit 4-9b
ELK HUNTING DAYS IN NEW MEXICO PORTION OF BRWRA
(GMU 15, 16, AND 23), 1995-2003



Source: Elk Hunter Survey - Estimated Results From Hunter Surveys by Game Management Unit, New Mexico Department of Game and Fish, 2005. Hunting seasons are represented by the year in which the season began (e.g., the 1995-1996 season is represented as 1995).

Exhibit 4-10a

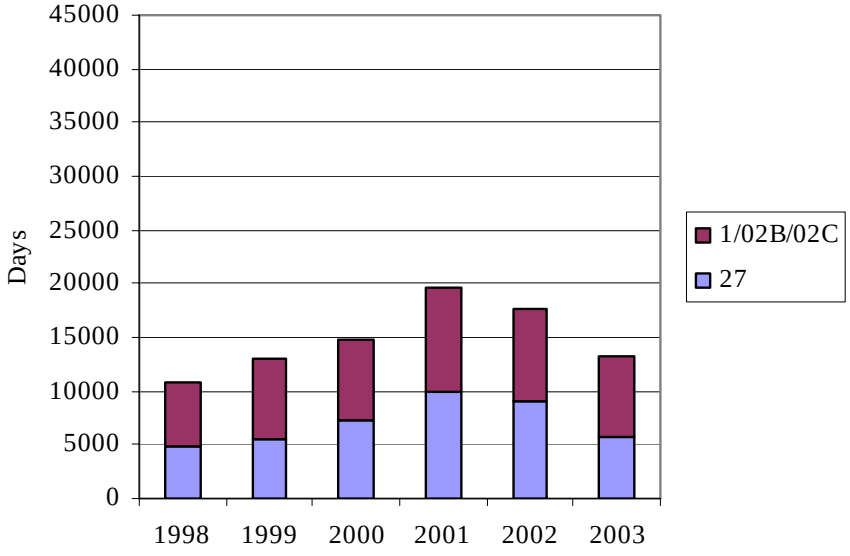
NUMBER OF ELK HUNTERS IN THE ARIZONA PORTION OF THE BRWRA (UNITS 1 AND 27), 1998-2003



Source: Elk Management Summaries for 2003/2004, Arizona Game and Fish Department records, February 2005. Hunting seasons are represented by the year in which the season began (e.g., the 1995-1996 season is represented as 1995).

Exhibit 4-10b

ELK HUNTER DAYS IN THE ARIZONA PORTION OF THE BRWRA (UNITS 1 AND 27), 1998-2003



Source: Elk Management Summaries for 2003/2004, Arizona Game and Fish Department records, February 2005. Hunting seasons are represented by the year in which the season began (e.g., the 1995-1996 season is represented as 1995).

In 2001, five percent of total hunting days statewide occurred in Apache and Greenlee Counties (28,000 and 34,000 days, respectively), though 10 percent of all big game hunting days occurred in those counties.[109] Despite the relatively small contribution to total hunting effort in the state, these counties primarily attract big game hunters, who contributed 52 percent and 82 percent of hunting days in Apache and Greenlee Counties, respectively.[110] Exhibit 4-11 presents the distribution of hunters across the GMUs in the BRWRA in the 2003-2004 season. As shown, Units 15 and 16A in New Mexico and Unit 1 in Arizona had the most licensed hunter visits during this season.

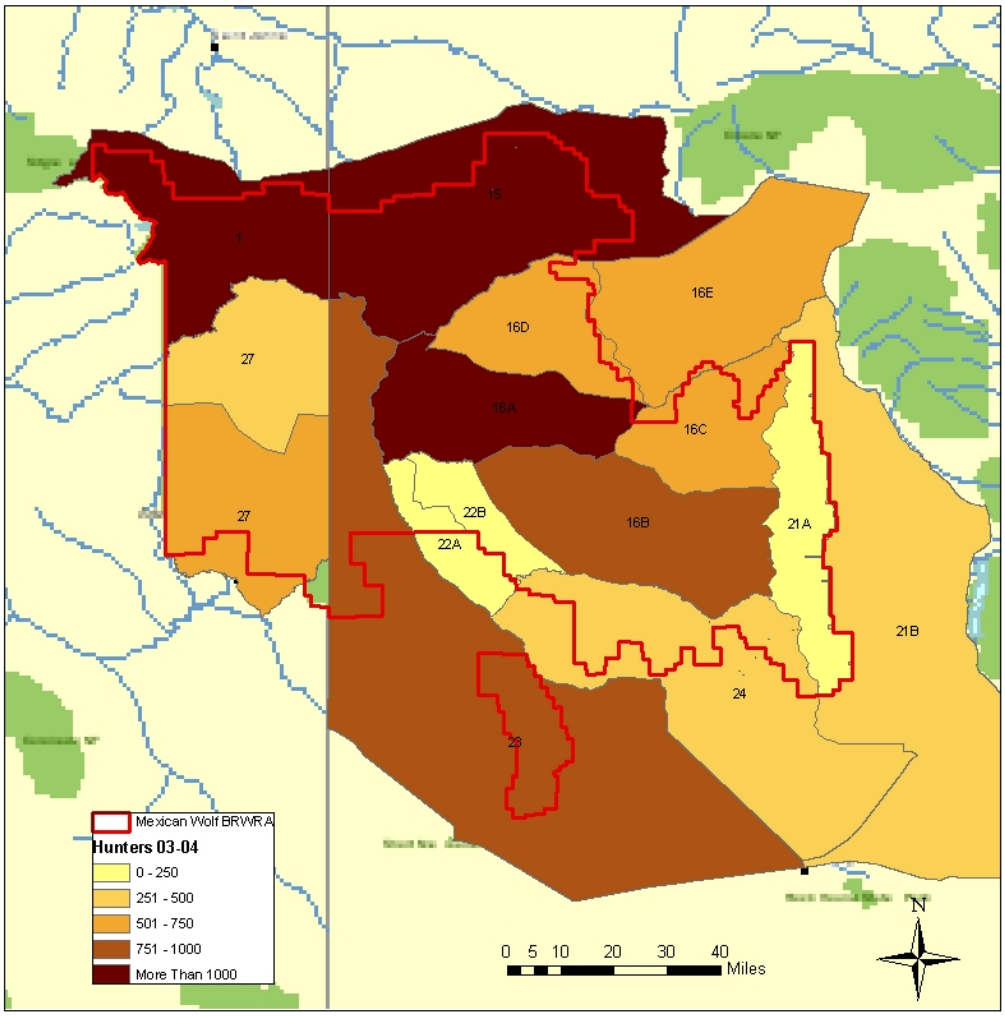
As stated above, the FEIS estimates that elk hunting effort would be reduced by 2,700 to 4,630 hunting days and deer hunting would be reduced by 9,700 to 18,400 hunting days after the population of Mexican wolves reaches 100. While the wolf population did not reach 100, some decline in hunter effort could have been observed to date given the current wolf population. However, the level of hunting activity did not decline since wolf reintroduction. Thus, the number of elk hunters and hunter days does not appear to have been affected by the reintroduction of Mexican wolves to date.

[109] Silberman, John. "The Economic Importance of Fishing and Hunting", Arizona State University West, 2002.

[110] *Ibid*.

Exhibit 4-11

NUMBER OF HUNTERS UTILIZING BRWRA DURING THE 2003-2004 HUNTING SEASON, BY GMU



Sources: GIS Data layers produced by NMGFD and AZGFD showing Game Management Units, 2005; Source: Elk Hunter Survey - Estimated Results From Hunter Surveys by Game Management Unit, New Mexico Department of Game and Fish, 2005. Source: Elk Management Summaries for 2003/2004, Arizona Game and Fish Department records, February 2005.

4.5 Effects on Hunting Success

4.5.1 Deer and Elk Harvest

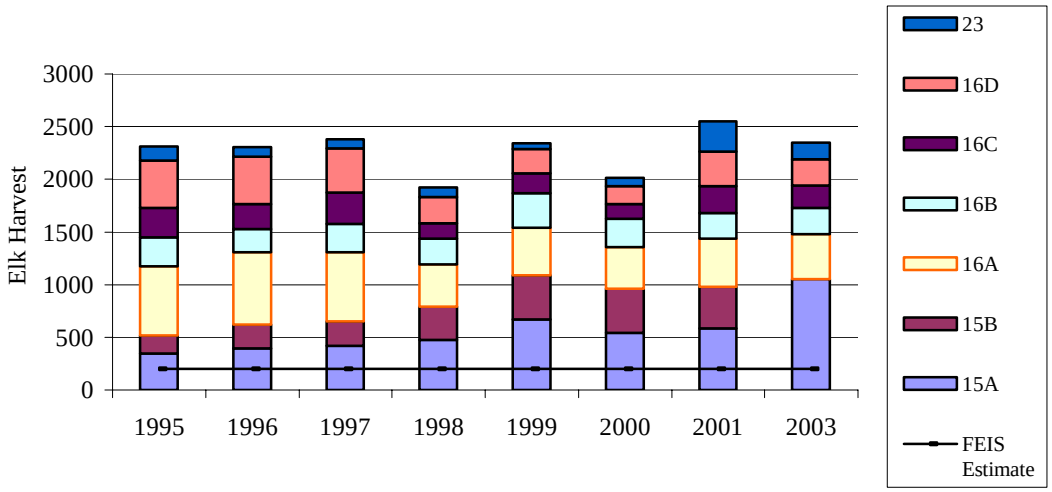
Hunters and outfitters have expressed concerns that wolf presence could result in reduced hunting success, either from reduced prey populations or through behavioral changes to the prey populations that render them more difficult to hunt, e.g., herds become more dispersed. The

FEIS estimated that once the wolf population reached 100, a reduction in harvest of 120 to 200 elk and 300 to 560 deer would be expected annually. This estimate is based on assumptions about the deer and elk population reduction, the rate of hunter success, and the number of days typically hunted in the BRWRA. This section examines whether there was an observable downward trend in elk harvest or success rate since wolf reintroduction.

NMGF estimates that total elk harvest in New Mexico is typically close to 15,000 annually.[111] In Arizona, the statewide elk harvest is roughly 10,000 annually.[112] Exhibits 4-12 and 4-13 present data on estimated annual elk harvest in the BRWRA since wolf reintroduction. Elk harvest in the BRWRA comprised between 12 and 19 percent of statewide harvest in Arizona between 1998 and 2003, assuming that annual state-wide harvests were constant over this period. In New Mexico, BRWRA harvest comprised 13 to 17 percent of statewide elk harvest.

Exhibit 4-12a

ELK HARVEST IN NEW MEXICO PORTION OF BRWRA (GMU 15, 16, and 23), 1995-2003



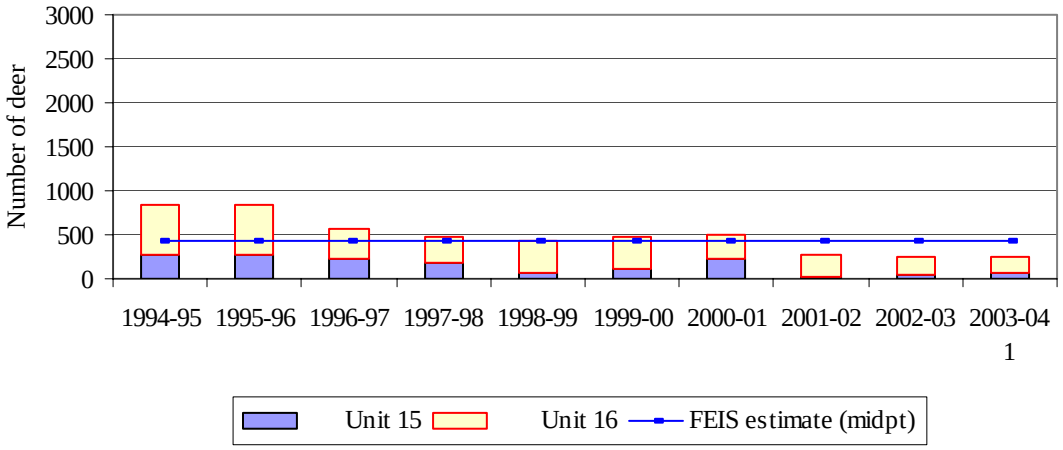
Source: Elk Hunter Survey - Estimated Results From Hunter Surveys by Game Management Unit, New Mexico Department of Game and Fish, 2005.Note that Units 15A and 15B were combined in 2003. Data for the combined Unit 15 is presented in Unit 15A for 2003. FEIS estimate includes estimated harvest reduction for NM and AZ portions of the BRWRA once a population of 100 wolves is reached.

[111] Personal communication with Steve Kohlmann, Elk Program Manager, NMGFD, March 3, 2005.

[112] "Elk", Arizona Game and Fish website. Accessed at <http://www.gf.state.az.us/h_f/game_elk.shtml> on December 15, 2004.

Exhibit 4-12b

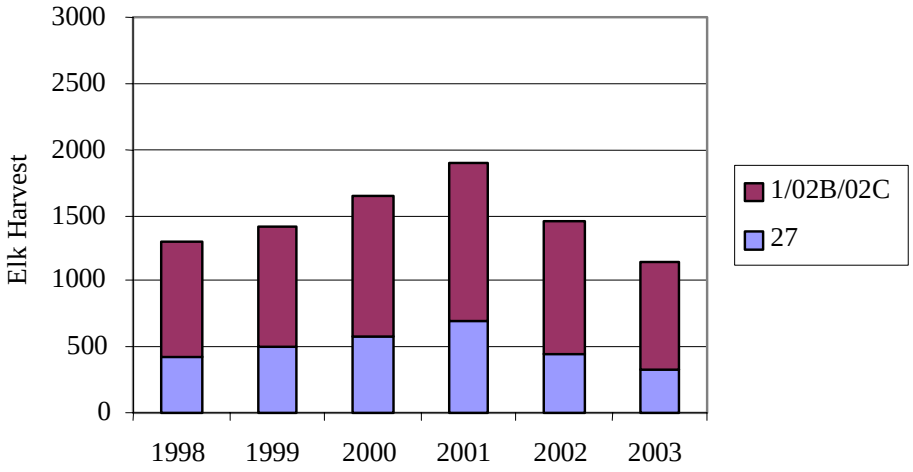
DEER HARVEST IN NEW MEXICO PORTION OF BRWRA (UNITS 15 AND 16), 1995-2003



Source: Deer Hunter Harvest and Success Rates for the Apache National Forest (New Mexico portion) And Gila National Forest, provided by New Mexico Department of Game and Fish, Deer Program Manager, December, 2005.

Exhibit 4-13

ELK HARVEST IN THE ARIZONA PORTION OF THE BRWRA (UNITS 1 AND 27), 1998-2003

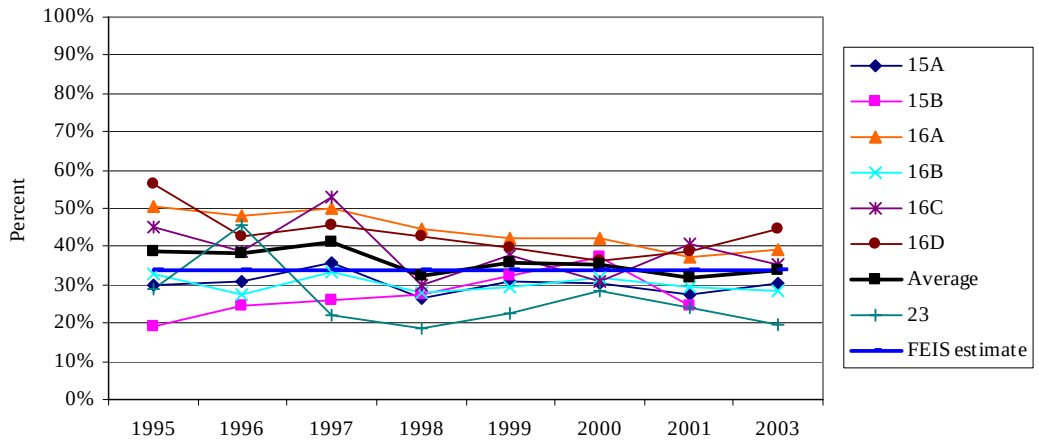


Source: Elk Management Summaries for 2003/2004, Arizona Game and Fish Department records, February 2005. Note that this data includes units 2B and 2C as well as unit 1, because AZGFD collected the data in this manner.

The FEIS estimated that hunting success rates for deer and elk hunting would be approximately 24 and 33 percent, respectively. As shown in 4-14 and 4-15, the reported success rate in the BRWRA from 1998 to 2003 was higher for elk hunting (37.5 percent weighted average), and a lower for deer hunting (14 percent) than projected.[113] Note that elk harvest and success rate records are estimated by the state game agencies based on a limited sample of hunter surveys as well as the number of permits sold. NMGFD game managers caution that success rates may be somewhat inflated due to the natural human tendency to "brag."[114] Thus, if recent success rates are indicative of future rates, projected estimates of lost deer harvest may have been somewhat high, and projected estimates for lost elk harvest may have been somewhat low, all else being equal.

Exhibit 4-14a

ELK HUNTING SUCCESS RATES REPORTED IN NEW MEXICO PORTION OF BRWRA (GMU 15, 16, AND 23), 1995-2003



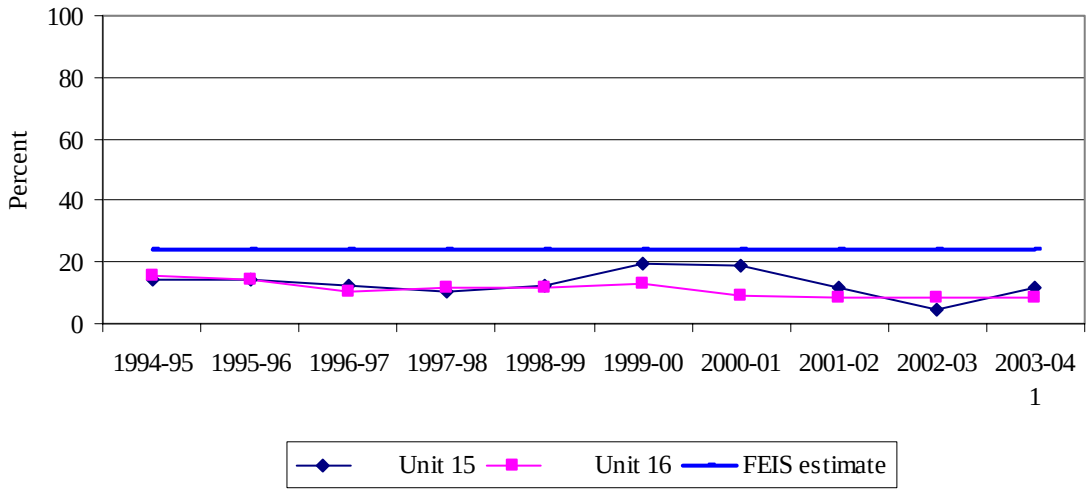
Source: Elk Hunter Survey - Estimated Results From Hunter Surveys by Game Management Unit, New Mexico Department of Game and Fish, 2005.

[113] Success rate is defined as number of kills (harvest) divided by the number of hunters. Rates are presented as a weighted average across Arizona and New Mexico.

[114] Email communication with Steve Kohlmann, Elk Program Manager, NMGFD, January 3, 2005.

Exhibit 4-14b

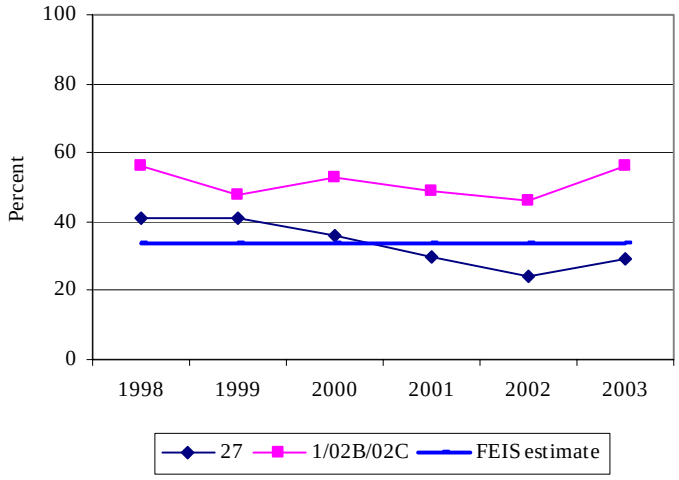
SUCCESS RATES FOR DEER HARVEST IN NEW MEXICO PORTION OF BRWRA (UNITS 15 AND 16), 1995-2003



Source: Deer Hunter Success Rates for the Apache National Forest (New Mexico portion) And Gila National Forest, provided by New Mexico Department of Game and Fish, Deer Program Manager, December, 2005.

Exhibit 4-15

ELK HUNTING SUCCESS RATES IN THE ARIZONA PORTION OF THE BRWRA (UNITS 1 AND 27), 1998-2003

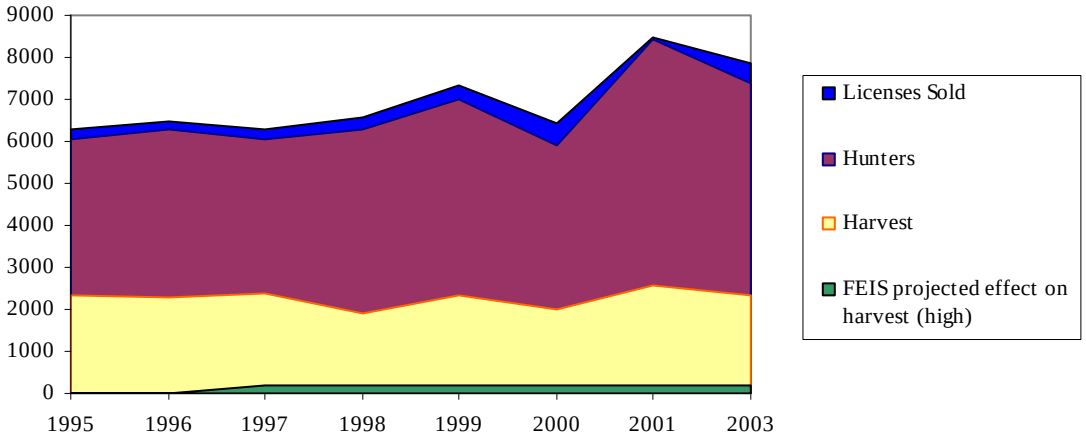


Source: Elk Management Summaries for 2003/2004, Arizona Game and Fish Department records, February 2005.

Overall, elk hunting success rates in New Mexico show a marginal decrease over the study period, from 39 percent in 1998 to 34 percent in 2003 (on average across GMUs). Success rates in Arizona show a decrease from 48.5 percent to 42 percent over this time period. Exhibit 4-16 compares the number of elk licenses, number of elk hunters, and elk harvest over time in the New Mexico portion of the BRWRA. This comparison shows that despite small increases in the number of elk hunters in recent years, elk harvests have remained relatively constant, resulting in a slight decrease in the elk hunting success rate. This decrease is likely due to the combination of a larger group of elk hunters (as shown in Exhibits 4-8 and 4-9) pursuing a smaller amount of prey (as shown in Exhibits 4-2, 4-3 and 4-4). The success rate for deer permits did decline over this time period, however the change corresponds to the decline in deer population, and is the most likely reason for this decline.

Exhibit 4-16

COMPARING TOTAL ELK HARVEST, HUNTERS, AND LICENSES SOLD IN THE BRWRA (NM GMU 15, 16 AND 23) FOR 1995-2003



Source: Elk Hunter Survey - Estimated Results From Hunter Surveys by Game Management Unit, NMDGF, 2005.

4.6 Lost Income/Costs to Outfitters

Outfitters and guides have raised concerns that their incomes may be affected if Mexican wolves either reduce the hunter success in the area or drive hunters away due to poor perceptions of the area. Advertised guided elk hunts in the Gila National Forest average $3,000 to $4,500 for a typical five-day guided hunt. Most, if not all of professional outfitters are small businesses that rely on a healthy elk population for their business. If the number of licenses issued or the number of hunters visiting is reduced in the BRWRA, these outfitters will be affected. Here is an estimate of the annual revenues of outfitters that utilize the BRWRA:

- 110 outfitters in the BRWRA (80 in NM, 30 in AZ)
- 20-40 hunters per outfitter per season
- $4000 average cost of five day elk hunting trip in BRWRA area
- $120,000 to $160,000 in annual gross income to outfitter
- $13.2 to $17.6 million in gross revenues for outfitters in BRWRA

Hunters have also expressed concerns that wolves may prey on hunting dogs, which are currently compensated for by Defenders of Wildlife. The number of dogs reported killed to FWS or Wildlife Services to date has been small (see Section 3). However, these kills may not be reported due to the current policy on compensation for them. While data does not exist to quantify total costs that may have resulted from dog kills to date, breeders report that dogs are valuable. Puppies can be sold for $600-$2,000, and adult dogs are reported to easily exceed $5,000.[115] Breeders point out that the loss of a dog used for breeding can result in loss of potential valuable offspring. Good adult hunting dogs are the result of years of training, which is also lost if a dog is taken by a wolf.

However, as stated above, there is little evidence to suggest that the number of hunters visiting the area was reduced by the reintroduction of Mexican wolves between 1998 and 2003. In fact, the number of elk permits sold in the BRWRA has increased since wolf reintroduction, as stated above. The number of deer permits issued in Arizona did decline over this time period, however the change corresponds to the decline in deer population, and is the most likely reason for this decline.[116]

4.7 Regional Economic Impacts

The International Association of Fish and Wildlife Agencies report on the Economic Importance of Hunting in America estimates that hunters spent $196 million in New Mexico and

[115] Email communication with NAV office, hunting hound breeder, Illinois on February 28, 2005.

[116] The number of deer licenses issued in New Mexico was not available.

$298.4 million in Arizona in 2001.[117] Distributing these direct expenditures across 3.36 million hunter days spent in these states that year, direct expenditures per hunter per day are estimated at $118 (NM) and $106 (AZ).[118] Regional economic impacts of these expenditures (which include equipment and travel expenditures) are estimated at $561.9 million in output for Arizona and $342 million in total output for New Mexico, in addition to impacts on employment and jobs.

Using the per day total expenditures estimates, direct expenditures associated with elk and deer hunting days in the BRWRA (71,000 in 2001) are estimated to have been $7.5 million. Regional economic impacts would be associated with these expenditures. This information is provided for context, however, as no reductions in hunter visitation have been observed since Mexican wolf reintroduction began in the BRWRA.

4.8 Conclusions and Comparison to FEIS

The estimated harvest reduction of 120 to 200 elk would have represented 2 to 6 percent of annual elk harvest in the BRWRA between 1995 to 2003. Reductions equal to the FEIS estimates would have represented one to two percent of total elk hunting days in New Mexico and Arizona in 2001, or four to seven percent of elk hunting days in the BRWRA. However, over the past five years, wolf populations have not reached 100. For this or other reasons, impacts on hunters and hunting effort in this region appears to have been minimal to date. Exhibit 4-17 presents a comparison of current estimates to FEIS estimates.

Population effects: The current BRWRA elk population is larger than the population projected by the FEIS to exist after the wolf population reaches 100. However, both elk and deer populations in the BRWRA show declines since 1998. Other factors, such as game manager decision-making strategies as well as climate further complicate the assessment of whether wolf predation has affected elk populations to date.

Hunting effort and permit revenues: The number of elk permits sold in the BRWRA increased from 1998 to 2004, as did the number of hunters and hunter days. Thus, this analysis finds no evidence that wolf reintroduction has affected the hunter visitation in the BRWRA area. Correspondingly, this analysis also finds no evidence states of New Mexico or Arizona have experienced reductions in elk permit revenue since wolf reintroduction. The number of deer permits issued in Arizona declined from 2,100 in 1998 to 850 in 2003 in Arizona (a decline of 36 percent).[119] This change corresponds to the decline in deer population, and is the most likely reason for this decline.

Hunting success: Overall, elk hunting success rates in New Mexico show a decrease over the study period, from 39 percent in 1998 to 34 percent in 2003 (on average across GMUs). Success

[117] International Association of Fish and Wildlife Agencies, Economic Importance of Hunting in America, 2002. This estimate is an adjusted estimate of the Service's National Survey of Fishing, Hunting and Wildlife-Associated Recreation, 2001 Survey.

[118] *Ibid.*

[119] The number of deer licenses issued in New Mexico was not available.

rates in Arizona show a decrease from 48.5 percent to 42 percent over this time period. Despite small increases in the number of elk hunters in recent years, elk harvests have remained relatively constant, resulting in a slight decrease in the elk hunting success rate. This decrease is likely due to the combination of a larger group of elk hunters pursuing a smaller amount of prey. The success rate for deer permits did decline over this time period, however the change corresponds to the decline in deer population, and is the most likely reason for this decline.

Lost income to outfitter/guides: This industry is an important contributor to local economies, and likely brings $13 to 17 million in gross revenues annually. However, revenue impacts are not estimated because no reduction in hunter participation was observed during the study period

Regional economic effects: Not estimated because no reduction in hunter participation was observed.

Exhibit 4-17

SUMMARY OF FEIS ESTIMATES AND OBSERVATIONS OF IMPACTS OF WOLVES ON HUNTING ACTIVITY IN THE BRWRA, 1998-2004

Concerns	FEIS Estimates	Observations (1998-2004)	Conclusions
Prey Population Effects	Elk and deer population reduction expected.	Elk and deer populations have declined in the BRWRA.	Population declines likely due to forage factors and management decisions. Not likely due to wolf.
Hunter Visitation	Reduced hunting days expected.	Increase in hunter days and hunters.	No effect.
Hunting Success	Harvest reduction expected. Constant success rate.	No observable change in elk harvest. Decreased success rate for deer and elk.	Increased hunting pressure combined with decreased prey base lead to decreased success rate.
Lost Income to Outfitter/Guides	Not quantified.	No observable change.	No effect to date.
Regional Economic Impacts	Not quantified.	No observable change.	No effect to date.

ECONOMIC IMPACTS OF MEXICAN WOLF REINTRODUCTION ON TRIBES SECTION 5

This section of the analysis evaluates the socioeconomic impacts to tribes associated with the wolf reintroduction program from 1998 to 2003. Data for 2004 is also presented where available.

Although the BRWRA does not include any Tribal lands, the lands of the San Carlos Apache and the White Mountain Apache (Fort Apache Reservation) lie adjacent to the BRWRA, and have had experiences with wolves. The FEIS discussed potential effects that wolf reintroduction could have on Tribal activities if Tribal lands become "fully occupied," with an estimated wolf population of 20 to 30 wolves. This discussion uses several economic indicators to present the overall economic vulnerability of the Tribes to impacts from Mexican wolf introduction, as well as summarizing known economic impacts on the Tribes from reintroduction to date. Both Tribes are economically vulnerable to increases in costs that could result from Mexican wolf reintroduction, and the San Carlos report that depredation of their cattle has occurred. Both Tribes also expend considerable effort in attending meetings to discuss management of the Mexican wolf.

5.1 San Carlos Apache

The FEIS identifies several potential impacts of Mexican wolf reintroduction on the San Carlos Apache Tribe if the Reservation becomes fully occupied by wolves. The potential effects include impacts on big game hunting activities if elk populations are reduced, especially if wolves take large trophy bull elk. The FEIS also discusses the potential for livestock depredation, which is deemed "likely." The FEIS states that costs of lost deer, elk, and cattle could range from $4,100 to $17,500 annually, but does not include estimates of lost hunting value to hunters or reduced regional expenditures. Other negative impacts are identified, such as conflicts with the existing Tribal resolution opposing wolf recovery and conflicts with Tribal sovereignty rights. Positive impacts mentioned include increased tourism, existence value, and long-tem ecological balance.

5.5.1 Population Trends and Population Density

Based on U.S. Census data, the San Carlos Apache Reservation population has shown some growth in recent years, increasing from an estimated 7,294 in 1990 to 9,385 in 2000. The State of Arizona estimated that population on the reservation was 9,791 in 2003, and the Tribe estimates that current population is more than 12,000.[120] Population is nonetheless sparse overall when compared to Arizona as a whole. While the San Carlos Apache Reservation encompasses over 1.8 million acres, population density on the Reservation is approximately 3.2 people per square mile, compared to an overall population density in Arizona of 32.1. Because the population is rural, fewer employment opportunities exist to substitute for losses in income, should that occur as a result of wolf reintroduction.

5.1.2 Unemployment and Per Capita Income

Based on the 2000 Census, the unemployment rate on the San Carlos Apache reservation was 35.4 percent. A recent study by the Tribe found that the unemployment rate is much higher, at 76 percent, indicating that at least seven out of ten people in the Tribe's labor force are unemployed.[121] Using either measure, the employment rate on the San Carlos Reservation is far higher than surrounding counties (Apache County, which has the highest unemployment rate in the study area, had an unemployment rate of 24 percent in 2000) or Arizona as a whole (7 percent).

Tribal per capita income was $5,200 in 2000, or about one-fifth of the Arizona average. In addition, the poverty rate on the San Carlos Apache Reservation is 48 percent. Again, this rate is far higher than surrounding counties or Arizona as a whole.

5.1.3 Dependence on Hunting Revenues and Livestock Grazing

The San Carlos Apache Tribe's economy includes cattle operations, forestry, a small service sector, and tourism and recreation. The Tribe has five cattle associations and operates two Tribal ranches. Livestock grazing is an important source of income for the San Carlos Apache Tribe. Typically, herds roam free and unattended, and are rounded up periodically for branding. However, many cattle remain unbranded, and determining ownership in the case of depredation could be difficult. In addition, there is no established calving season, and thus cattle breed and give birth throughout the year. This management regime complicates the protection of cattle, and calves in particular, from wolf depredation.[122]

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[120] Letter from Susan B. Montgomery, Sparks, Tehan & Ryley, P.C. re: Comments to Draft Economic Analysis Regarding Possible Designation of Critical Habitat for the Southwestern Willow Flycatcher on the San Carlos Apache Reservation, dated October 6, 2004.

[121] Letter from Steve Titla, Titla and Parsi, General Counsel for the San Carlos Apache Tribe, Re: Economic impact of wolf depredation to Point of Pines on San Carlos, November 18, 2005; Letter from Joe Sparks, Sparks, Tehan & Ryley, P.C. re: Request for Information Regarding Possible Designation of Critical Habitat for the Southwestern Willow Flycatcher, dated September 7, 2004.

[122] Pavlik, Steve. "San Carlos and White Mountain Apache Attitudes toward the Reintroduction of the Mexican Wolf to its Historic Range in the American Southwest." Wicazo SA Review, Spring 1999.

Tribal representatives have expressed concerns that the cattle herd on the Reservation has been affected by wolf depredation. The Point of Pines Cattle Association on the Reservation reports that "at one branding site there were only two branded calves compared to the past when an Apache reported that three hundred used to be branded at that site. This decline in branding numbers happened after the wolves were reintroduced. Point of Pines was never compensated for those losses."[123] The Tribe calculates that this may have resulted in annual cattle losses of $119,000 since 1998.

The San Carlos Apache derive significant revenues from big game hunting permits, particularly elk permits. In 1999, the elk herd was estimated to be 1,200 animals. As in the surrounding areas, these elk can be quite large, and have been recorded as “world class” in the Boone and Crockett Club records. In 1999, trophy elk permits had a basic cost of $20,000, which could be increased with the size of the animal to as much as $60,000. Annual revenue from elk hunting was estimated at $500,000 in 1999.

5.2 White Mountain Apache Tribe

The FEIS states that, if fully occupied, hunting and livestock activities on Fort Apache Reservation could be affected, but that the more important land use activities on the Reservation are timber and recreation, which would only be affected through minor land use restrictions, if any. Effects on the Tribe's ski area were not anticipated.

5.2.1 Population Trends and Population Density

The population of White Mountain Apache at Fort Apache is somewhat larger than the population of the San Carlos Apache. Population has also shown some increases in recent years, from 10,394 in 1990 to 12,429 in 2000. The State of Arizona estimated the population at 13,235 in 2003. With a reservation of 1.6 million acres, the population density was 4.2 people per square mile in the 1990 census.

5.2.2 Unemployment and Per Capita Income

Like the San Carlos, the unemployment rate on the Fort Apache reservation was 20.7 percent in the 2000 census, far higher than in surrounding counties or Arizona as a whole. Average income per capita was $6,358 in 2000, far lower than surrounding counties or Arizona has a whole. Poverty rates among the White Mountain Apache are also high, at 49 percent of the population in 2000.[124]

[123] Letter from Steve Titla, Titla and Parsi, General Counsel for the San Carlos Apache Tribe, Re: Economic impact of wolf depredation to Point of Pines on San Carlos, November 18, 2005.

[124] U.S. Census Bureau (2000), Census 2000 American Indian and Alaska Native Summary File, accessed March 2005 at <http://www.factfinder.census.gov>.

5.2.3 Dependence on Hunting Revenues and Livestock Grazing

A 1993 study indicated that Tribal enterprises of the White Mountain Apache, including the Tribal Herd, which owns and manages cattle, and the Agricultural Enterprise, which grows and sells livestock feed, were among 10 primary enterprises that are major contributors for Tribal members and residents of surrounding communities.[125] A resolution by the Tribe in 1995 stated that "the Mexican wolf reintroduction and subsequent migration onto Fort Apache Indian Reservation lands may cause adverse effects with game populations as well as livestock. The resolution further stated that this "could cause additional economic stresses to tribal enterprises as well as possible conflicts with policy issues."[126]

The White Mountain Apache Tribe also derive significant revenues from big game hunting permits, particularly from elk. In 1999, the elk herd population on the Fort Apache Reservation was estimated at 12,000 animals (ten times larger than on San Carlos lands). A website states that over 100 Rocky Mountain elk in the All-Time Boone and Crockett Record Book were taken on Fort Apache lands.[127] The basic cost of an elk permit for Fort Apache is $16,000, plus an additional $3,000 for a Record Book bull. Both the 1998 and 2001 hunting seasons were very good hunting seasons, with eight to ten clients harvesting elk that qualified for the Record Book. The Tribe also offers one bighorn sheep permit at $40,000, 40 turkey permits at $1,500, as well as bear and mountain lion permits annually.[128] Annual Tribal revenues from elk hunting was estimated at $1 million in 1999.[129]

[125] Kalt, Joseph P., "Economic Analysis of Proposed Designation of Critical Habitat for *Salix arizonica* (Arizona Willow) on the Fort Apache Indian Reservation," submitted to White Mountain Apache Tribe, Fort Apache Indian Reservation, Harvard University and the Economics Resource Group, 1993.

[126] White Mountain Apache Tribal Council Resolution No. 12-95-371, December 6, 1995, as quoted by Pavlik, Steve. "San Carlos and White Mountain Apache Attitudes toward the Reintroduction of the Mexican Wolf to its Historic Range in the American Southwest." Wicazo SA Review, Spring 1999.

[127] Accessed at <http://162.42.237.6/wmatod/lk.shtml> on March 3, 2005.

[128] Accessed at <http://162.42.237.6/wmatod/elk.shtml> on March 3, 2005.

[129] Pavlik, Steve. "San Carlos and White Mountain Apache Attitudes toward the Reintroduction of the Mexican Wolf to its Historic Range in the American Southwest." Wicazo SA Review, Spring 1999.

Exhibit 5-1

COMPARISON OF 2000 SOCIOECONOMIC INFORMATION OF AFFECTED TRIBES TO STATE AND NATIONAL AVERAGES

Area/Tribal Lands	Population	Unemployment Rate	Per Capita Income	Poverty Rate[a]
National Level Information				
USA	281,421,906	4.2%	$21,587	12.4%
State Level Information				
Arizona	5,130,632	5.6%	$20,275	13.9%
California	33,871,648	7.0%	$22,711	14.2%
New Mexico	1,819,046	7.3%	$17,261	18.4%
Tribal Level Information				
Fort Apache	12,429	20.7%	$6,358	48.8%
San Carlos Apache	9,385	35.4%[b]	$5,200	48.2%

Notes:

[a] Poverty rate represents the percent of individuals below the applicable poverty threshold level. Poverty thresholds are the same for all parts of the country, but vary depending on the applicable family size, age of householder, and number of related children under 18. Poverty thresholds are shown at http://www.Census.gov/hhes/poverty/threshld/thresh99.html.

[b] A recent study by the San Carlos Apache Tribe found that the unemployment rate is 76 percent. Letter from Joe Sparks, Sparks, Tehan & Ryley, P.C. re: Request for Information Regarding Possible Designation of Critical Habitat for the Southwestern Willow Flycatcher, dated September 7, 2004. Letter from Steve Titla, Titla and Parsi, General Counsel for the San Carlos Apache Tribe, Re: Economic impact of wolf depredation to Point of Pines on San Carlos, November 18, 2005.

Source: U.S. Census Bureau, Census 2000, accessed at <http://censtats.census.gov/pub/Profiles.shtml>.

5.3 Conclusions and Comparison to FEIS

As the socioeconomic statistics provided in this section demonstrate, the Tribes adjacent to the BRWRA are more vulnerable economic positions than their surrounding communities or states. Unemployment on these Tribal lands is higher than in surrounding areas; any lost income or employment on these Reservations would likely not be replaced by employment opportunities in other sectors.

While few specific economic impacts of wolf reintroduction have been quantified to date, continued growth in the wolf population on the BRWRA could affect the Tribes in the future. While increases in tourism could benefit the Tribes, the Tribes also have economic interests in livestock and hunting activities that could be negatively affected.

The FEIS estimated that if the lands of the San Carlos Apache become fully occupied by wolves, impacts of wolf reintroduction could be $4,100 to $17,500 annually. The San Carlos discussion about livestock losses due to wolf depredation would suggest that FEIS could have underestimated impacts on livestock. Further investigation of the cause of the livestock losses would be necessary to accurately evaluate impacts to date.

ECONOMIC IMPACTS OF MEXICAN WOLF REINTRODUCTION ON TOURISM AND CONSERVATION SECTION 6

This section of the analysis evaluates the positive tourism and conservation-related impacts associated with the wolf reintroduction program from 1998 to 2004.[130]

6.1 Potential Economic Benefits of Mexican Wolf Reintroduction

The published economics literature has documented that real social welfare benefits can result from the conservation and recovery of endangered and threatened species.[131] Such benefits have also been ascribed to preservation of open space and biodiversity, both of which are associated with species conservation.[132] Likewise, regional economies and communities can benefit from the preservation of healthy populations of endangered and threatened species, and the habitat on which these species depend.

The primary goal of the Act is to enhance the potential for species recovery. Thus, the benefits of actions taken under the Act are primarily measured in terms of the value the public places on species preservation (e.g., avoidance of extinction, and/or an increase in a species' population). Such social welfare values may reflect both use and non-use (i.e., existence) values.

[130] Impacts can be either positive (i.e., benefits of increased tourism or conservation) or negative (i.e., costs incurred by industry or citizens). The majority of the impacts discussed in this section are positive.

[131] Bishop R.C. 1978. Endangered species and uncertainty: the economics of a safe minimum standard. *American Journal of Agricultural Economics*, 60:10-18; Bishop R.C. 1980. "Endangered Species: An Economics Perspective." *Transactions of the 45th North American Wildlife and Natural Resources Conference.* Published by the Wildlife Management Institute, Washington D.C. Brookshire, D.S., L.S. Eubanks, and A. Randall. 1983. Estimating option prices and existence values for wildlife resources. *Land Economics*, 59:1-15; Hageman, R.K. 1985. Valuing marine mammal populations: benefit valuation in a multi-species ecosystem. Administrative report No. LJ-85-22, National Marine Fisheries Service, Southwest Fisheries Center, La Jolla, CA. 88p; Samples, K., J. Dixon, and M. Gowen. 1986. Information disclosure and endangered species valuation. *Land Economics* 62:306-312. Stoll, J.R. and L.A. Johnson. 1984. Concepts of value, nonmarket valuation, and the case of the whooping crane. Texas Agricultural Experiment Station Article No. 19360. Natural Resource Workshop, Department of Agricultural Economics, Texas A&M University. 30p.

[132] Pearce, D. and D. Moran. 1994. *The Economic Value of Biodiversity*. The World Conservation Union. London: Earthscan. Fausold, C.J. and R.L. Lilieholm. 1999. The economic value of open space: A review and synthesis. *Environmental Management* 23(3):307-320.

For example, use values might include the potential for recreational use of a species, should recovery be achieved. The FEIS states that increased recreational value and expenditures may occur in the BRWRA after Mexican wolf reintroduction. Non-use values are not derived from direct use of the species, but instead reflect the utility the public derives from knowledge that a species continues to exist.

In addition, as a result of actions taken to preserve endangered and threatened species, various other collateral benefits may accrue to the public, such as preserving habitat for other species and enhancing nearby residential property values (e.g., preservation of open space).

This chapter describes the categories of benefits identified by stakeholder groups as potentially occurring as a result of Mexican wolf reintroduction. It then discusses the extent to which existing information supports the occurrence of these benefits since 1998, as well as existing data and valuation studies that can be used to monetize these benefits. In particular, it considers the economic literature regarding the public's willingness to pay to preserve the gray wolf. The primary categories of potential economic benefits of wolf reintroduction that have been identified by stakeholders include:

1. **Increased Recreation Visits and Expenditures:** Increases in tourism will result as people interested in seeing, hearing, or tracking wolves visit the area. Increases in consumer surplus will accompany increases in recreation use. Furthermore, increased expenditures in local economies will result from increased tourism. As stated above, the FEIS reports that increased tourism may result from wolf reintroduction.

2. **Existence Value:** The public holds a non-use value for the Mexican wolf that could be enhanced by actions to reintroduce the species to the study area. [133]

3. **Agency Spending:** Increased expenditures in local economies will result from meetings, staffing, and other spending by cooperating agencies. These expenditures would represent a redistribution of resources to the BRWRA area rather than an overall increase in social welfare.

4. **Overall Ecosystem Health:** The restoration of wolves as the top carnivore could restore ecosystem function to the BRWRA area.

5. **Other Positive Impacts:** Other positive impacts could result from the reintroduction of Mexican wolves into the BRWRA, such as (but not limited to) increased educational opportunities.

As discussed below, it is not feasible to fully describe and accurately monetize the benefits of this designation in the context of this economic analysis.[134] The discussion presented

[133] See, for example, Letter from Tim Kroeger, Defenders of Wildlife, "Issues pertaining to the Economic portion of the Mexican wolf Socio-Economic Analysis" to Industrial Economics, October 21,2004.

[134] In its guidance for implementing Executive Order 12866, OMB acknowledges that it may not be feasible to monetize, or even quantify, the benefits of environmental regulations due to either an absence of defensible, relevant

in this report provides insight into the benefits of the program *to date* based on information obtained in the course of developing the economic analysis. It is not intended to provide a complete analysis of the economic benefits that may result from this program in the future, or to fully quantify the biological benefits of the program.

6.2 Increased Recreation Visits and Expenditures

6.2.1 National Forest Visitation

A direct measure of whether Mexican wolf reintroduction has affected tourism in the BRWRA would be to observe whether visitation to the National Forests within the study area has increased either at the site, district, or Forest level. Unfortunately, neither Apache nor Gila National Forests keep annual estimates of visitation at the forest or district level. Only partial estimates are available for some recreation sites within the forests because many sites are unmanned and forests rely on "self-pay" stations to collect fees. Thus, these estimates to not provide an overall picture of trends in visitation to the forests since Mexican wolf reintroduction.

The USFS estimates that approximately 23 million National Forest visits annually occur in USFS Region 3 (New Mexico and Arizona).[135] Of these, approximately 3.2 million (14 percent) occur in the BRWRA area. The National Visitor Use Monitoring Program (NVUM), which was established by the USFS in 1998 to create a standardized recreation sampling system for the forests that can be repeated every four years, provides more comprehensive data on forest visitation. The first NVUM survey for Apache and Gila National Forests, conducted in 2002, reports 2001 visitation data.

The NVUM Survey of Apache-Sitgreaves National Forest estimated that 1.9 million forest visits occurred in 2001.[136] As shown in Exhibit 6-1, the most common primary activity named at this forest was "General/other—relaxing, hanging out, escaping noise and heat, etc." (43 percent of visitors), followed by fishing (20 percent), hiking (nine percent), and camping in developed sites (seven percent). One percent of visitors stated that "viewing wildlife, birds, fish, etc. on National Forest system lands" was their primary activity, though 73 percent of visitors stated that it was an activity they participated in.[137]

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studies or a lack of resources on the implementing agency's part to conduct new research. U.S. Office of Management and Budget, "Circular A-4," September 17, 2003, available at <http://www.whitehouse.gov/omb/circulars/a004/a-4.pdf>.

[135] Draft Biological Assessment for 11 Land & Resource Management Plans USDA Forest Service Southwestern Region, November 2003.

[136] The study defines a "national forest visit" as the entry of one person upon a National Forest to participate in recreation activities for an unspecified period of time. Error rate 14 percent.

[137] Kocis, Susan M. et al. "National Visitor Use Monitoring Results: Apache-Sitgreaves National Forest." USDA Forest Service Region 3, National Visitor Use Monitoring Project, August 2002.

Exhibit 6-1

APACHE-SITGREAVES NATIONAL FOREST ACTIVITY PARTICIPATION AND PRIMARY ACTIVITY

Activity	Percent participation	Percent who said it was their primary activity
General/other- relaxing, hanging out, escaping noise and heat, etc.	84.2	41.3
Fishing- all types	50.5	19.6
Hiking or walking	62.2	8.7
Camping in developed sites (family or group)	35.7	7.2
Off-highway vehicle travel (4-wheelers, dirt bikes, etc.)	11.3	4
Viewing natural features such as scenery, flowers, etc., on National Forest system lands	79.3	3.5
Primitive camping	19.4	3.3
Driving for pleasure on roads	53.3	3.2
Picnicking and family day gatherings in developed sites (family or group)	47.8	1.5
Hunting- all types	3	1.3
Viewing wildlife, birds, fish, etc., on National Forest system lands	73.5	1
Other non-motorized activities (swimming, games and sports)	6.9	0.9
Visiting a nature center, nature trail or visitor information services	18.3	0.5
Horseback riding	3.4	0.4
Bicycling, including mountain bikes	11.5	0.3
Motorized water travel (boats, ski sleds, etc.)	6.8	0.2
Gathering mushrooms, berries, firewood, or other natural products	27.6	0.2
Backpacking, camping in unroaded areas	4	0.1
Visiting historic and prehistoric sites/area	11	0.1
Resorts, cabins and other accommodations on Forest Service managed lands (private or Forest Service run)	13.7	0
Nature study	4.8	0
Snowmobile travel	0	0
Other motorized land/air activities (plane, other)	1.1	0
Non-motorized water travel (canoe, raft, etc.)	6.4	0
Downhill skiing or snowboarding	0.1	0

Source: Kocis, Susan M. et al. "National Visitor Use Monitoring Results: Apache-Sitgreaves National Forest." USDA Forest Service Region 3, National Visitor Use Monitoring Project, August 2002.

The NVUM Study for Gila National Forest estimated that 1.3 million National Forest visits occurred in 2001. In contrast to Apache-Sitgreaves, the most common primary activity by visitors to Gila National forest was picnicking and family day gatherings in developed sites (21 percent), followed by hiking or walking (19 percent), and hunting (14 percent), as shown in

Exhibit 6-2. In this survey, five percent of those surveyed stated that wildlife viewing was their primary activity, while 35 percent stated that it was an activity that they participated in.[138]

Exhibit 6-2

GILA NATIONAL FOREST ACTIVITY PARTICIPATION AND PRIMARY ACTIVITY

Activity	Percent participation	Percent who said it was their primary activity
Picnicking and family day gatherings in developed sites (family or group)	37.4	20.5
Hiking or walking	53.6	18.8
Hunting- all types	14.3	14.2
General/other- relaxing, hanging out, escaping noise and heat, etc.	56.1	6.5
Viewing natural features such as scenery, flowers, etc., on National Forest system lands	55.8	6.3
Backpacking, camping in unroaded areas	9.6	5.5
Viewing wildlife, birds, fish, etc on National Forest system lands	34.9	5.2
Camping in developed sites (family or group)	17.8	4.9
Visiting historic and prehistoric sites/area	20.9	4
Fishing- all types	8.6	2.8
Gathering mushrooms, berries, firewood, or other natural products	9.6	2.4
Driving for pleasure on roads	19.9	1.9
Horseback riding	3.6	1.5
Off-highway vehicle travel (4-wheelers, dirt bikes, etc.)	2.7	1.4
Primitive camping	10.4	1.1
Visiting a nature center, nature trail or visitor information services	9.9	1
Nature study	20.3	0.8
Resorts, cabins and other accommodations on Forest Service managed lands (private or Forest Service run)	0.9	0.7
Non-motorized water travel (canoe, raft, etc.)	0.9	0.6
Bicycling, including mountain bikes	1.8	0.1
Other non-motorized activities (swimming, games and sports)	2.2	0

Source: Kocis, Susan M. et al. "National Visitor Use Monitoring Results: Gila National Forest." USDA Forest Service Region 3, National Visitor Use Monitoring Project, August 2002.

The paucity of visitation data makes evaluation of trends in forest visitation since wolf reintroduction difficult. Ideally, visitation information would be obtained through a series of surveys and interviews with recreational users at the project site. Given resource and time constraints, however, designing a study to collect primary data from the project site is beyond the scope of this analysis. To get a sense of the potential magnitude of impacts, USFS recreation staff at Apache and Gila National Forests were interviewed to discuss their observations of

[138] Kocis, Susan M. et al. "National Visitor Use Monitoring Results: Gila National Forest." USDA Forest Service Region 3, National Visitor Use Monitoring Project, August 2002.

tourism trends since Mexican wolf reintroduction. Staff were not able to identify any changes in observed visitation that they could attribute to wolf reintroduction, citing the small numbers of wolves in the forest as the likely reason. Staff noted that assessment of visitation data is complicated by the recent drought and incidence of several large forest fires that have closed some areas to visitation in recent years.

6.2.2 Regional Tourism

If Mexican wolf reintroduction results in increased visits to recreation sites, then these increases will likely also generate increased visitation and visitor expenditures in the local areas outside of the forests. For example, the presence of wolves in Yellowstone National Park has stimulated visitation to areas where wolves can be viewed. In addition, items featuring wolves (such as tee-shirts) have sold quickly. Fewer opponents of wolves exist in proximity to Yellowstone National Park, however, largely because the area is less reliant on livestock grazing.[139] Consequently, these benefits may not be replicated in the BRWRA where a more vocal ranching community is against the wolves.

This analysis was unable to identify a trend in increased visitation at the BRWRA, but data used for this assessment was not perfect. Thus, this analysis also investigates expenditures associated with recreation and whether recent visitation levels to the surrounding area may indicate fluctuations that may have resulted from Mexican wolf reintroduction.

6.2.2.1 National Forest Recreation Expenditures

The economic impact of visits to National Forests can be monetized by considering the expenditures of visitors at these forests and their consumer surplus.[140] The NVUM Study collected information on the number of trips to forests as well as expenditures associated with these trips. Exhibit 6-3 presents the NVUM estimates of current consumer expenditures within the National Forests that comprise the BRWRA.[141] However, these data represent expenditures for all recreation to these Forests, rather than recreation that resulted directly from wolf reintroduction. If additional recreational activities were to occur due to wolf reintroduction, the value of these trips could also be measured in terms of consumer expenditures and consumer surplus. Information relating to the number of trips taken specifically to see wolves does not exist, although anecdotal evidence suggests that, to date, few specifically wolf-related trips have occurred. Because data on recreation related to wolf reintroduction is not available, data are not presented that describe the consumer surplus associated with National Forest visitation to this area due to wolves.

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[139] Michael Milstein (2005), Call of the wild a boon to tiny town, Billings Gazette, sD p1, July 23.

[140] Consumer expenditures represent the amount that individuals pay to participate in a particular industry or sector, such as recreation. Expenditures provide one measure of the economic benefit that different industries or sectors can provide to a local or regional economy. Consumer surplus is a value that measures what individuals are *willing to pay* for something above and beyond what they are required to spend. That is, consumer surplus measures the difference between what a person is willing to pay and the amount he/she actually is required to pay (i.e., expenditures).

[141] Note that a portion of the Apache-Sitgreaves National Forest is outside the BRWRA, but all of the Gila National Forest is within the recovery area.

Exhibit 6-3

2002 VISITOR SPENDING TO THE BRWRA AREA USING NATIONAL FOREST USING NVUM DATA (2002$)

	Non-local			Local			Non-Primary	Total
	Day Trip	OVN-NF	OVN	Day Trip	OVN-NF	OVN		
Apache-Sitgreaves National Forest								
Rec. visits								1,976,149
Segment shares	**3%**	**42%**	**34%**	**9%**	**4%**	**6%**	**2%**	**100%**
Visits	40,118	561,645	454,665	120,353	53,490	80,235	26,745	1,337,250
Avg. Party size	2.7	2.9	2.8	2.2	2.7	2.7	2.7	2.7
Trip Exp. per Party	$66.44	$207.57	$281.34	$32.63	$119.16	$138.13	$227.39	
Trip Exp. Total	$987,000	$40,200,000	$45,684,000	$1,785,000	$2,361,000	$4,105,000	$2,252,000	$97,374,000
Percent of Total Expenditures	**1%**	**41%**	**47%**	**2%**	**2%**	**4%**	**2%**	**100%**
Gila National Forest								
Rec. visits								1,337,250
Segment shares	**1%**	**11%**	**22%**	**23%**	**5%**	**16%**	**22%**	**100%**
Visits	13,373	147,098	294,195	307,568	66,863	213,960	294,195	1,337,250
Avg. Party size	2.1	2.1	2.4	2.1	2.1	2.1	2.1	2.1
Trip Exp. per Party	$50.25	$155.22	$224.38	$30.09	$110.72	$99.26	$30.09	
Trip Exp. Total	$320,000	$10,873,000	$27,505,000	$4,407,000	$3,525,000	$10,113,000	$4,215,000	$60,958,000
Percent of Total Expenditures	**0%**	**18%**	**45%**	**7%**	**6%**	**17%**	**7%**	**100%**

Notes:
OVN: Overnight Trips spent outside the Forest. OVN-NF: Overnight trips spent in the Forest. Non-Primary: Forest visitation for which the forest was not the primary destination. Forest-wide expenditures are distributed by the percent of trips by each segment of visitors visiting the forest multiplied by the average expenditures by that segment type.
Note that a portion of the Apache-Sitgreaves National Forest is outside the BRWRA, but all of the Gila National Forest is within the recovery area.

Source:
Kocis, Susan M. et al. "National Visitor Use Monitoring Results: Gila National Forest." USDA Forest Service Region 3, National Visitor Use Monitoring Project, August 2002; Kocis, Susan M. et al. "National Visitor Use Monitoring Results: Apache-Sitegreaves National Forest." USDA Forest Service Region 3, National Visitor Use Monitoring Project, August 2002.

Direct trip expenditures of $97.3 million at Apache-Sitgreaves and $60.9 million at Gila National Forest (2002$) also result in regional effects on these economies (the multiplier effect). While these values represent the direct spending associated with all recreation trips to these forests in 2001, rather than wolf-related expenditures, they highlight several interesting features of these forests: 1) In Apache-Sitgreaves, non-local visitors comprised 79 percent of visitors, non-local visitors comprised only 34 percent of visitors to the Gila; 2) local day trippers comprise 23 percent of visitors, but only 6 percent of expenditures in the Gila national forests; 3) non-local overnight visitors comprise the largest segment of trip expenditures for both forests (47 percent and 45 percent, respectively). However, because data on wolf-related visitation was

unavailable, quantification of the value of wolf-related recreation over the study period is not possible.

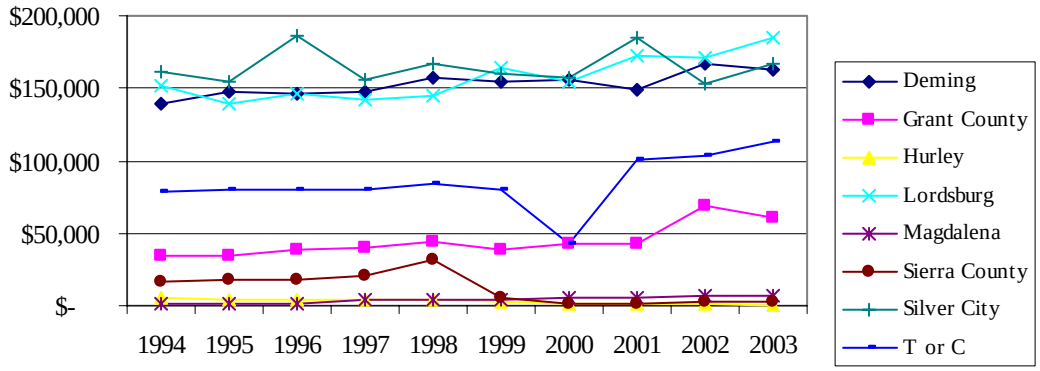
6.2.2.2 Lodging Revenues

One measure of the number of overnight tourists visiting an area is the amount of taxes collected by hotels and motels in affected towns. Because they are collected on a per-room basis, taxes collected present a general measure for whether the number of overnight visitors to an area is increasing over time. Exhibit 6-4 presents the tax revenues for New Mexico towns near the BRWRA between 1994 and 2003. This data shows that tax revenues from 1994 to 1998 increased eight percent; they increased by an additional six percent from 1998 to 2002. Available data do not distinguish whether the six percent increase is a continuation of the mid-1990's trends or if this change could be attributable to wolves.

On the Arizona side, gross lodging and motel sales have increased in affected counties since 1998, as shown in Exhibit 6-5. However, little evidence exists to determine whether this increase in sales relates to the reintroduction of Mexican wolf. Anecdotal discussions with business owners in the BRWRA areas suggests that due to the low number of wolves in the area, little perceptible change in tourist visitation has occurred due to wolf reintroduction to date in either Arizona or New Mexico.[142]

Exhibit 6-4

LODGING TAXES COLLECTED IN NEW MEXICO COMMUNITIES NEAR BRWRA 1994-2003, (2004$)

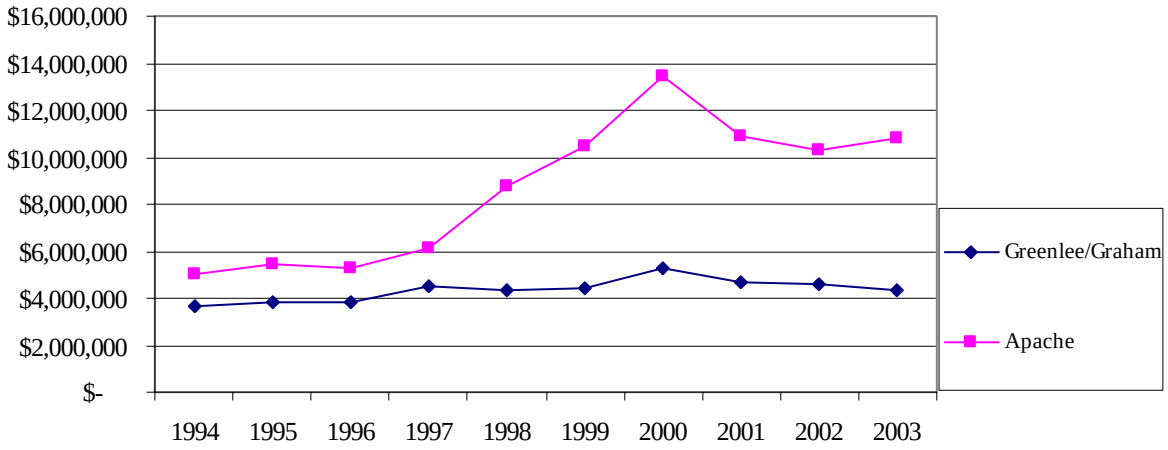


Source: New Mexico Department of Finance and Administration, Local Government Division data, 2005.

[142] Personal communication with M. Sauber, New Mexico resident and business owner, March 25, 2005.

Exhibit 6-5

GROSS LODGING/MOTEL SALES IN GREENLEE/GRAHAM, AND APACHE COUNTIES, ARIZONA
1994-2003 (2004$)



Source: Arizona Dept. of Revenue, Calculated Taxable Sales by County and Sector. Graham and Greenlee County sales are combined to meet minimum reporting requirements regarding number of establishments.

6.2.3 Establishment of For-Profit Wolf Tourism

The Southwest Environmental Center reports that they held a workshop to discuss "potential tourism ideas related to reintroduced Mexican wolves" in May 2003, which 40 people attended. Results from that meeting indicate an awareness that the establishment of wolf tourism permits in the National Forests was likely to require a formal review process by USFS, and perhaps a NEPA assessment. However, there is no evidence that this process has been started. One of the issues complicating the decisions of agencies that provide permits would be determining whether wolf guiding would be considered harassment of wolves. USFS at Apache-Sitgreaves and Gila National Forest could also not locate any applications to date for outfitter/guides proposing to run trips to track or otherwise observe wolves as of March 2005. One private citizen reports that she led two hiking trips for several people who wished to see wolves. [143] However, this appears to be the only case of wolf-related tourism occurring to date in the BRWRA.

6.3 Agency Expenditures

Expenditures by managing agencies, including the Service, Arizona Game and Fish Department, New Mexico Game and Fish Department, USDA Wildlife Services, and USFS, to

[143]Personal Communication with Jean Ossoria, New Mexico resident, October 27, 2004; Personal communication with Dutch Salmon, New Mexico resident, March 25, 2005.

run the Mexican wolf program have not been insignificant. While many of these expenditures would have been spent by the agencies in some other capacity if the Mexican wolf program did not exist, they do represent a redistribution of resources and are a regional contribution to the BRWRA study area in many cases. Since the 1970's, the agencies estimate that they have expended $11.7 million on the program (2004$). For the period of the five-year review, the agencies have spent approximately $6.2 million (2004$). Exhibit 6-6 presents the total agency expenditures each year that data were available.

Exhibit 6-6
FEDERAL AND STATE AGENCY EXPENDITURES ON THE MEXICAN WOLF PROGRAM, 1977-2005 (2004$)

Pre-Reintroduction	1970-1990	$137,200
	1991	$61,900
	1992	$187,400
	1993	$220,700
	1994	$279,900
	1995	$666,100
	1996	$623,200
	1997	$520,300
Post-Reintroduction	1998	$671,300
	1999	$881,100
	2000	$1,112,400
	2001	$1,326,100
	2002	$1,124,100
	2003	$1,231,000
	2004	$1,409,100
	2005	$1,513,000
Grand Total, 1970-2005		$11,964,800
Total, 1998-2004		$7,755,100

Source: AZGFD, Estimated Costs of Mexican Wolf Conservation, Revised September 1, 2004. Cost estimates include expenditures by the Service, Arizona Game and Fish Department, New Mexico Game and Fish Department, USDA Wildlife Services, and USFS. Costs adjusted to 2004$ using the Consumer Price Index, accessed at http://data.bls.gov/cgi-bin/dsrv.

As stated above, agencies would have spent many of these government expenditures in some other capacity if the Mexican wolf program did not exist. Nonetheless, because they do represent a redistribution of expenditures, they are likely to result in some regional economic effects, to the extent that expenditures actually occur in the BRWRA area. Using IMPLAN (see Section 3 for a more detailed discussion of this model), this analysis finds that in 2002, the increased government expenditures are likely to have resulted in local economic output of $1.5 million, and employment of 31 people.[144] Exhibit 6-7 presents the estimated annual regional economic effects of the wolf program expenditures.

[144] Estimates are presented using 2002 data, which is used as a proxy for an "average" year of expenditures since reintroduction.

Exhibit 6-7

IMPLAN DATA RESULTS FOR ANNUAL GOVERNMENT EXPENDITURES ON WOLVES IN 2002 (2004$)

	Direct	Indirect	Induced	Total
Output	$1.1 million	$0	$406,300	$1.5 million
Employment	24	0	7	31

Notes and Sources:
IMPLAN model results, 1998 data presented in 2004 dollars. Annual regional impacts are calculated for 2002 to demonstrate "average" impacts. Section 3 also calculates regional impacts for 2002.

In addition to the "Mexican wolf team" agencies whose expenditures are included above, many non-agency people have spent considerable time at meetings and presentations relating to this program. This analysis assumes that many of these people would have preferred to spend their time elsewhere on other activities were the wolf program not to exist. These attendees would have an opportunity cost associated with their attendance (i.e., they participated in lieu of other activities of value). In contrast, some attendees at these meetings may consider the time spent on wolf-related issues to be a benefit to them. Because the ratio of those bearing opportunity costs to those who feel they benefit from meetings is unknown, this analysis does not include time, or expenditures associated with this time, to be a benefit or cost of the program. For context purposes, this analysis presents an estimate of the number of meetings with non-wolf team attendees since reintroduction in Exhibit 6-8. The exhibit does not include school presentations, since attendance by children is assumed to not to affect local expenditures or, alternatively, to result in an opportunity cost. Note that some of attendees may have traveled to the BRWRA region for these meetings, and expended funds in the local communities as a result. Thus, the BRWRA communities may have experienced some localized benefits from funds that would have been spent elsewhere.

Exhibit 6-8

TOTAL NUMBER OF MEETINGS WITH PEOPLE NOT EMPLOYED BY FEDERAL OR STATE AGENCIES (NOT PART OF THE "WOLF TEAM")

Year	Number of Meetings
1998	47
1999	38
2000	33
2001	39
2002	60
2003	60
Total	**277**

Sources and Notes: Mexican Wolf Program Annual Progress Reports: 1991-2003, USFWS.. Where identified in the progress reports, meetings with school groups are excluded. Educational impacts for school-age children are discussed in Section 6.6. Estimates of number of meetings held was not included in the 2003 progress report. Thus, this analysis assumes that effort was equal to 2002.

6.4 Existence Value (Intrinsic Value)

A number of published studies have demonstrated that the public holds values for endangered and threatened species separate and distinct from any expected direct use of these species (i.e., willingness to pay to simply ensure that a species will continue to exist).[145] Since species conservation values are not generally observed in market transactions, economists rely on estimates of the public's willingness to pay that are developed using stated preference tools (e.g., contingent valuation surveys). While the public may hold measurable existence, or non-use, values for Mexican wolves, the calculation of existence values for Mexican wolves is beyond the scope of this analysis. A benefits transfer is not attempted here, as existing wolf valuation studies were not conducted in the Southwest, and were unique to the areas where the studies were conducted. Indeed, authors have stated that it is not appropriate to transfer studies from other areas where wolves have been reintroduced to the Southwest because different social conditions and primary economic activities can strongly affect the public's opinion of reintroduction and the potential for economic benefits.[146] However, for context, a brief discussion of existing studies is presented here.

A few willingness-to-pay studies reported in the economics literature attempt to estimate the non-use value the public holds for recovery of wolves. While these studies do not estimate the willingness to pay that individuals would have for the reintroduction of the Mexican wolf, they support the notion that conservation of wolves may generate social welfare benefits to the public.

These studies include a contingent valuation study by Duffield (1996) where the respondents were simply asked whether or not they would be willing to buy a lifetime membership in a trust fund established to support or oppose efforts to reintroduce gray wolves into Yellowstone National Park. Respondents were presented with varying dollar costs for trust fund membership. They received 335 completed surveys from a regional subsample, and 313 completed surveys from a national sample. Overall, the study found that nationally, supporters of wolf reintroduction outnumbered opponents by two to one. However, in the affected states, opposition and support were nearly evenly divided (49 percent favored, 43 percent opposed, eight percent undecided). Values for both supporters and opponents were higher locally than nationally, with local supporters offering $24.68 (2004$) to fund reintroduction, while opponents offered $10.74 (2004$) to prevent reintroduction. Nationally, values for supporters averaged $12.14 (2004$), while opponents averaged $1.83 (2004$).[147] These values are presented in Exhibit 6-9.

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[145] For examples, see Boyle, K.J. and R.C. Bishop. 1986. "The Economic Valuation of Endangered Species in Wildlife." *Transactions of the Fifty-First North American Wildlife and Natural Resources Conference.* Published by the Wildlife Management Institute, Washington D.C; Loomis, J.B. and D White. 1996. Economic benefits of rare and endangered species: Summary and meta analysis. *Ecological Economics* 18:197-206; Kotchen, M.J. and S.D. Reiling. 1998. Estimating and questioning economic values for endangered species: an application and discussion. *Endangered Species Update* 15(5):77-83.

[146] Michael Milstein (2005), Call of the wild a boon to tiny town, Billings Gazette, SD p1, July 23.

[147] Duffield, John and C. Neher. "Economics of Wolf Recovery in Yellowstone National Park", Trans 61st North American Wildlife And Natural Resources Conference, 1996.

Exhibit 6-9

ESTIMATED MEAN VALUES OF WOLF REINTRODUCTION IN THE YELLOWSTONE AREA, PER PERSON (2004$)

	Local	National
Support	$24.68	$10.74
Oppose	$12.14	$1.83
Net	$12.55	$8.91

Source: Duffield, John and C. Neher. "Economics of Wolf Recovery in Yellowstone National Park", Trans 61st North American Wildlife And Natural Resources Conference, 1996. Costs adjusted to 2004$ using the Consumer Price Index, accessed at http://data.bls.gov/cgi-bin/dsrv.

It should be noted that while contingent valuation provides a useful method for estimating a full range of values (i.e., use value, non-use value, existence value, etc.), the reliability and validity of this method has been the subject of much controversy.[148] Some economists express particular concern about the ability of the method to provide meaningful estimates of non-use values for public goods. The debate primarily focuses on whether respondents can provide reliable estimates of the value of these types of goods, given that the public has little or no experience with purchasing such goods. Critics note that for a variety of reasons, respondents' stated intentions may not equal true willingness to pay. Observers have noted that respondents may not carefully consider personal budget constraints when stating willingness to pay. Likewise, individuals' bids may be affected by the "warm glow" of giving. That is, bids may reflect individuals' interest in contributing to a worthy cause rather than their true value for the resource in question.

In addition to concerns regarding the contingent valuation method, transfer of existing value of wolf reintroduction in the context of Yellowstone National Park to the Southwest would require consideration of all of the key elements for a successful transfer (e.g., adjustment for biases, treatments of outliers and protest bids, internal consistency, etc.), including whether populations sampled, reintroduction programs, and reintroduction areas are similar enough to conduct a reliable transfer. Because of the unique character of Yellowstone as a highly prized national tourist attraction, this analysis does not attempt a benefits transfer using results of this analysis.

6.5 Overall Ecosystem Health

Several stakeholders have commented that wolves represent an integral part of the ecosystem in which they live because, as a top predator, they keep other animal populations in check and consequently provide ecological balance. For example, wolves could decrease overgrazing by controlling ungulate populations. The reintroduction of gray wolves in Yellowstone National Park appears to have increased tree sapling survival, and the revegetation

[148] For example, see Diamond, P. and J. Hausman. 1993. *Contingent Valuation: A Critical Assessmen*t. North Holland Press; Clark, J, R.G. Ethier, G.L. Poe, and W.D. Schulze. 2000. A comparison of hypothetical phone and mail contingent valuation responses for green pricing electricity programs. *Land Economics* 76(1):54-67.

has in turn benefited beaver and bird populations.[149] Although the BRWRA represents a different habitat than Yellowstone, protecting the Mexican wolf may benefit other organisms that cohabit these areas and ecosystem health overall.

To date, no evidence exists suggesting that Mexican wolves have altered or improved ecosystem health in the BRWRA. Ecosystem changes take time, however, and some residents claim that Mexican wolves have not been established in the area long enough to alter the ecosystem. The lack of change since the reintroduction program began could also be because not enough wolves currently inhabit the area.[150] To the extent that either of these reasons are true, the reintroduction of Mexican wolves may have positive impacts on the BRWRA in the future although benefits cannot be quantified at present.

6.6 Other Positive Impacts

The reintroduction of Mexican wolves could result in other positive impacts for the BRWRA, such as the movement of people to the area and increased educational opportunities. For instance, to the extent that the presence of wolves enhances the "wilderness" experience, they may attract new residents to the area. Specifically, many retirees move to communities surrounding the BRWRA in order to escape the city. No residents that were interviewed knew of individuals who had moved to the area specifically because of the Mexican wolf reintroduction program, however.[151]

The presence of wolves could also offer educational opportunities by stimulating interest in the natural environment. In the communities surrounding the BRWRA, there has been some talk of opening a museum on the local ecology, and the wolves would feature prominently in potential exhibits.[152] Another resident mentioned a new charter school that would use the outdoors as a laboratory to study ecology. Many lessons could focus on the effects of the wolf reintroduction.[153] Finally, a local bookstore owner reports that two books have sold particularly well since the wolf reintroduction began due to renewed interest in Mexican wolves; one book was brought back into print after the program was proposed. Gross revenues from these book sales are estimated at $27,500 since 1998.[154]

[149] Jim Robbins (2004), Lessons from the wolf, *Scientific American*, June: 76-81.

[150] Personal communication with D. Stevens, New Mexico resident, March 25, 2005; Personal communication with D. Dolan, New Mexico resident, March 25, 2005; Personal communication with G. and J. Martin, New Mexico residents, personal communication, March 25, 2005.

[151] For example, personal communication with D. Dolan, New Mexico resident, March 25, 2005

[152] Personal communication with S. Morgan, New Mexico resident, March 29, 2005.

[153] Personal communication with J. Gilchrist, New Mexico resident, March 29, 2005.

[154] Personal communication with D. Salmon, New Mexico resident, March 25, 2005.

6.7 Conclusions and Comparison to FEIS

The FEIS states that increased recreational value and expenditures may occur in the BRWRA after Mexican wolf reintroduction. However, to date, little evidence exists that increased recreation has occurred since wolf reintroduction.

The public holds a non-use value for the Mexican wolf that could be enhanced by actions to reintroduce the species to the study area. While a few studies in the literature have attempted to estimate existence value for Mexican wolves, these studies were not conducted in the Southwest. Because the contextual issues in the other study areas were distinct, a benefits transfer was not conducted.

Federal and state agency funding has not been insignificant, totaling $7.6 million from 1998 to 2004. Estimated annual regional impacts of these expenditures, assuming that they are spent locally, totaled $1.5 million in regional output in 2002, with a benefit to employment of 31 jobs.

SOCIAL IMPACTS WITHIN BRWRA SECTION 7

This section of the analysis evaluates the social impacts associated with the Mexican wolf reintroduction in the BRWRA from 1998 to 2003. Social impacts are defined as "…the consequences to human populations of any public or private actions that alter the ways in which people live, work, play, relate to one another, organize to meet their needs and generally cope as members of society. The term also includes cultural impacts involving changes to the norms, values, and beliefs that guide and rationalize their cognition of themselves and their society."[155] This section first provides a brief description of the types of social impacts examined in this analysis. It then discusses the methods and data sources used to identify existing social impacts. Finally, this section presents the social impacts to ranchers, outfitters, guides, and hunters, Tribes, and tourism and conservationists.

7.1 Introduction

Social impacts are generally assumed to occur in standard categories consisting of population changes, community and institutional structures, political and social resources, individual and family changes, and community resources. These categories are defined as follows:

- **Population Characteristics:** Ongoing and expected population changes (growth or decline), ethnic and racial makeup, and net migration, temporary residents, seasonal or leisure residents, and age distributions;

- **Community and Institutional Structures:** Changes to group and individual relationships with Federal and state agencies; changes to the basis of community economic and social stability;

- **Political and Social Resources:** The size, structure, and organization of local government; its relationship with state and Federal governments; historic and current patterns of employment and industrial diversification; activities of voluntary associations, religious organizations, interests groups; relationships between social and political institutions;

- **Individual and Family Changes:** Influences on the daily life of the individuals and families, including attitudes, perceptions, family

[155] Interorganizational Committee, 2003: 231.

characteristics, and local social networks; can include changing attitudes toward the policy, an alteration in family and friendship networks, perceptions of risk, health, and safety; fears and aspirations;

- **Community Resources:** Patterns of natural resource and land use; past and current housing and community services (health, police, fire, sanitation); continuity and survival of historical and cultural resources; changes for indigenous people and religious sub-cultures.

Impacts are placed into each category if the analysis establishes that such an impact is related directly to wolf reintroduction or is clearly an indirect impact of wolf reintroduction.

Impacts on groups can be broken into two general categories: active impacts and passive impacts. Active impacts are social impacts derived from direct interactions with wolves. These impacts appear to be relatively rare for the general public. Ranchers, outfitters and people living in areas where wolves are common are more likely to have active encounters with wolves. Thus, social impacts derived from those encounters are more readily identified. Passive impacts occur when people in the study area hold strong opinions about wolves and their reintroduction but have few (if any) direct encounters with wolves. Social impacts on such groups are much harder to establish beyond those associated with the existence value of the wolves.

7.2 Methodology and Data Sources

Unstructured, personal interviews with individuals living in BRWRA communities form the basis of this analysis. A snowball sample was used to identify interview subjects; this approach is used when a random or probability sample is not a viable option and evaluating small groups or social networks is required.[156] Interviewees were asked to offer referrals to other individuals living in the BRWRA. The goal of this approach is to understand the dynamics of small groups and social networks.

Two starting points were used to generate the snowball sample. First, public open houses in the reintroduction area concerning wolf recovery were conducted in February 2005 that yielded numerous contacts. Individuals interviewed at these meetings were asked to suggest additional contacts. These names were added to those offered by agency personnel and people formally active in the reintroduction program. From this group, about one dozen unstructured interviews were conducted. Second, local individuals approached in gas stations, grocery stores, restaurants, bars, hotels and parks in BRWRA communities were asked to discuss the wolf and their communities. These individuals were also asked to suggest additional local contacts. This method generated more than forty unstructured interviews within the area. In total, roughly 60 percent of interviews were conducted in New Mexico and 40 percent in Arizona.

The goal of these interviews was to understand how the respondents perceived the role of the wolf in their social lives. First, some personal history was established, along with general perceptions of the social conditions in their community. Then the relationship between social

[156] Salganik, M.J. and D.D. Heckathorn. 2004. Sampling and Estimation in Hidden Populations Using Respondent-Driven Sampling. *Sociological Methodology* 34:193-239.

conditions and natural resource programs, Federal landowners, and others was discussed. After these issues had been explored, the issue of wolves was examined.

In addition, this analysis uses the information provided in the FEIS as a baseline. The administrative records from the FEIS and recent litigation regarding the Mexican wolf reintroduction program, research, and policy literature were also used, with a focus on those projects that directly address the social and economic issues arising from wolf reintroduction in the BRWRA in particular, and the North America in general. The interviews drive the majority of the social impact information and conclusions, while the additional sources are used to supplement and reinforce conclusions.

It must be made clear that social impacts are *prima fascia* neither positive nor negative. Those who feel that their social lives have been significantly altered do typically make a distinction between positive and negative. However, people from different social groups frequently assess the same impact differently. For example, ranchers may label the anxiety they feel when they see wolves in close proximity to their livestock as a negative impact while their neighbors might find the sighting of the very same wolves to have a positive impact on their social lives. We generally speak of impacts as negative or positive if they were described to us as such.

7.3 Overview

Many ongoing social forces affect the communities in the BRWRA. For example, some communities are experiencing growth, while others face population contraction. Other factors such as significant and persistent poverty and demographic shifts (e.g., an aging population) have social impacts (see Section 2 for more information on population and economic trends in the study area). For example, Exhibit 2-8 indicates that Catron County experienced a decline in child rearing age classes (age 20 to 39 years) between 1990 and 2000. At the same time, the post-child age classes (age 40+ years) increased significantly. This demographic shift reduced school enrollments. Although different arguments exist as to why this change occurred, a common theme is that the loss of the timber industry changed the employment mix of Catron County. Young families found it difficult to make a living and chose to leave. At the same time, retirees and others without children have moved into the county. The cumulative impact over time is declining school enrollments. Further, numerous public land policies changed in the years leading up to and since the reintroduction of the wolves in the BRWRA. Thus, significant social change within the BRWRA is occurring independent of wolf recovery efforts. General social forces such as these can overwhelm social impacts from a specific policy such as wolf reintroduction. It is therefore difficult to separate the direct social effects exclusively caused by the wolf program from broader social trends. Through interviews and a review of relevant literature, this analysis does attempt to identify social impacts associated with the wolf reintroduction, where possible.

Social impacts from wolf recovery appear to consist of diffused social benefits and concentrated social costs.[157] Positive social impacts to larger communities were difficult to identify. There were numerous indications that supporting wolf recovery is a position some people hold publicly and many hold privately to avoid significant social pressure. Nonetheless, positive impacts appear to be diffused across the area. Positive social impacts appear to be related mostly to individuals (and families) of wolf supporters and their social networks. The existence of dense local networks of people with a common set of values supporting wolf recovery appear plausible from the information at hand. People involved in such networks may spend time and effort to see and experience wolves, as well as to derive general personal benefits from the return of wolves to the local ecosystem.

To a great extent, negative impacts are experienced at the individual and family levels and are difficult to see in the larger context of the community or at an institutional level. Such impacts are diffused across the study area. Many people who are opposed to wolves never interact with them and never risk any of their own financial or social capital due to wolves. The exception is a subset of ranchers who have experienced livestock impacts from wolves, including Tribal cattle operations. Social impacts from these encounters appear uniformly negative and concentrated on individual ranch families, Tribal cattle associations, and related communities.

7.4 Social Impacts on Ranching Activities

Potential impacts to ranchers are more readily identifiable since ranchers are a well-defined group engaged in a well defined economic and social activity. Some ranchers experience direct social impacts of wolf recovery as well as some indirect effects because wolves can affect the social and material well being of ranchers. They are responsible for predation on livestock. Almost all of the direct impacts fall on those ranchers who experience wolf impacts repeatedly over time. Ranchers who experience wolf conflicts sporadically are less likely to feel the same enduring social impacts, though they feel some negative impact associated with the wolf conflicts.

The primary social impacts of wolves on ranchers include, but are not limited to, uncertainty about herd losses and accompanying economic losses, trade-offs of time required to manage for wolves rather than work on other ranch needs, feelings of diminution and anger over the management of compensation programs, and, for Tribes, loss of culturally important calves and the associated cultural impacts. In addition, the presence of wolves influences the management logistics of the ranch and the allocation of family and hired labor. Ranchers also pointed to the personal and family stress involved with trying to run a ranch with wolves present. Finally, the available compensation program for economic losses appears to add to the social impacts due to the rules in place and the manner in which those rules are implemented. Ranchers feel that the compensation programs insufficiently mitigate the social impacts of wolf reintroduction on ranchers because they only pay for a portion of actual losses (see Section 3 for a more complete description of compensation programs).

[157] Naughton-Treves, Lisa, Rebecca Grossberg and Adrian Treves. 2003. Paying for tolerance: Rural citizens' attitudes toward wolf depredation and compensation. Conservation Biology 17(6): 1500-1511.

A possible positive impact of these disturbances is increased social cohesion within rancher networks and within those local networks that sympathize and support them. However, when social cohesion increases across a narrow section of the community, it can become a negative social impact on the community by creating additional fractures between groups in the local social structure.

Social impacts are divided into the following categories:

- **Population Characteristics:** Some ranchers in active wolf areas have sold ranches and other ranchers attribute this to difficulties managing with wolves. Other changes in ranch and herd numbers related to drought and economics rather than wolf recovery are demonstrable. Thus, without surveying ranchers who have left the business in the study area since 1998, we cannot draw a conclusion as to the social impacts in this category.

- **Community and Institutional Structures:** Some people in the study area are sympathetic to ranchers and see social impacts from wolves as an erosion of the cultural and economic stability of local communities. Others do not share that sympathy and see wolves' effects on ranchers as having little negative social impact, and even a positive impact. Given the available data, social impacts on community structures from wolf recovery remain vague. If there is a single shared social impact across groups and communities, it appears to be a general exasperation with the recovery agencies, and with implementation of the program on the ground. Ranchers voiced concern that public involvement has declined to a point that only a limited group of salaried representatives attend meetings. They attribute this to exhaustion and frustration with the process, and point to this as evidence of the erosion of trust between themselves and FWS.

- **Political and Social Resources:** Most political and social resource impacts i are related to changes in local economic and social structures that are not due to wolf recovery. Thus, no changes could be identified.

- **Individual and Family Changes:** This category is the primary area of social impact on ranchers. The most likely social impacts due to individual changes are from personal stress due to managing livestock when wolves are nearby and/or preying on livestock and other domestic animals. This comports with the findings of Naughton-Treves, et al.[158] Ranchers report sleep deprivation and exhaustion when faced with wolves nearby. Family changes producing social impacts could include similar stresses. More time dealing with wolves changes the allocation of family labor and responsibility. Ranchers provided detailed logs of changes they had to make when wolves were near their herds. The logs described additional time checking and moving herds, feelings of anxiety over finding evidence of wolves, and added efforts to find and

[158] Naughton-Treves, Lisa, Rebecca Grossberg and Adrian Treves. 2003. Paying for tolerance: Rural citizens' attitudes toward wolf depredation and compensation. Conservation Biology 17(6): 1500-1511.

confirm predation. Perceptions of risk include fear of going out of business, concerns that trying to manage for wolves would conflict with U.S. Forest Service grazing allotment management plans, and concerns about risks to personal health. Ranchers also perceived that there was a risk that the cooperating agencies seek to remove ranchers from public land.

Reported impacts at the individual and family level may also have indirect impacts on extended family and community social networks. One example was offered where four ranches shipped cattle together to fill trailers and get the best shipping rates. This cooperation also allowed them to fill trailers with calves of similar weights and sex, helping to increase prices when sold. One rancher in the group had numerous losses to wolves. He sold his calves early at low weights to avoid further losses. This reduced the number of calves available to ship with the other ranchers, thereby negating the benefits of shipping calves together. Indirect impacts such as these cannot be further analyzed without significant additional field work.

Another social impact on ranchers relates to the structure and implementation of the compensation program for lost livestock. Less than timely response from state and Federal agencies, unrealistic evidentiary requirements, agency unwillingness to accept rancher data or information, and the response from agencies that they lack the resources to be more diligent were cited generally as negative aspects of the program. Ranchers expressed frustration that, over the initial five years of the program, no significant improvements to the structure and implementation of the compensation program were achieved, despite the feedback they have provided. These issues were reported to produce feelings of powerlessness and frustration that grew over the study period. Montag et al. (2003) also documented many of these concerns.[159]

- **Community Resources:** Impacts on ranchers possibly include the perception that ranching as both a dominant use of public lands in the BRWRA and as a recent cultural resource are being eroded by the reintroduction program. Finally, some locals fear that wolves will add to the long-term, negative cumulative social impacts on communities of public land management policies.

7.5 Social Impacts: Outfitters, Guides, and Hunters

The possible social impacts to outfitters, guides and hunters in the study area are less demonstrable than those to ranchers in the same area. If changes in the amount of harvest and number of hunting days had occurred at the level predicted in the FEIS, some social impacts could accrue to local communities related to hunting impacts. Social impacts would be possible

[159] Jessica M. Montag et al. (2003), Political and Social Viability of Predator Compensation Programs in the West: Final Project Report, Wildlife Biology Program, School of Forestry, University of Montana, Missoula, MT.

if outfitters were going out of business or hunter success dropped dramatically. However, changes of that magnitude were not observed. Thus, social impacts on outfitters, guides, and hunters are described as follows:

- **Population Characteristics:** If big game numbers change sufficiently, some outfitters may leave the area and some hunters may hunt elsewhere. It is difficult to say if wolf population changes would cause these changes without interviewing outfitters who left the industry and hunters who move to other areas.

- **Community and Institutional Structures:** Outfitters and hunting in general appear integral to local communities. Loss of outfitting opportunities would have a social impact due to their role in both the local economy and the community social structure. Reductions in outfitting and hunting would affect other economic activities as well as the social networks within which outfitters and hunters are embedded. However, no data is available to evaluate this possible impact.

- **Political and Social Resources:** No data is available to evaluate social impacts on outfitters and hunters in this category.

- **Individual and Family Changes:** Outfitters are nervous about the long-term changes that wolf reintroduction might bring to their personal lives and industry. Their major worry is that the economic viability (and associated value) of their operations may change as the wolf population grows. Although this anxiety was expressed throughout the study period, there is no data to support a conclusion that such changes have occurred. Most social impacts in this category remain in the realm of perceived risk.

- **Community Resources:** Reductions in outfitting and hunting represent potential changes to communities within the BRWRA. Some changes did occur during the study period, as discussed in Section 4. However, no data is available to examine the possible cultural and social impacts from those changes.

7.6 Social Impacts: Tribes

Possible social impacts to the two Tribes with lands adjacent to the BRWRA, the San Carlos Apache and the White Mountain Apache, stem from their economic and cultural activities as well as their intergovernmental relationship with the wolf reintroduction agencies.[160] The full spectrum of potential impacts is difficult to assess without significant additional fieldwork. Social impacts on the Tribes are difficult to evaluate due to the complex social structures on the reservations. Nonetheless, the intricate ties between indigenous culture, ranching, and outfitting

[160] Steve Pavlik (1999), "San Carlos and White Mountain Apache Attitudes toward the Reintroduction of the Mexican Wolf to its Historic Range in the American Southwest." Wicazo Sa Review 14 Spring:129-145.

indicate that Tribes are more likely to experience social impacts other groups or communities. The social impacts to Tribes include:

- **Population Characteristics:** No data is available to evaluate social impacts in this category due to wolf reintroduction.

- **Community and Institutional Structures:** As stated in Section 5, the Tribes are more economically vulnerable than other communities in the area. The Tribal cattle associations and outfitting programs are important economic and social foundations for them. As the wolf population grows and wolf interactions with livestock operations and outfitters become more frequent, the likelihood of social impacts increases.

- **Political and Social Resources:** Wolf issues directly affect tribal relationships with the USFWS. Initially, both Tribes declined to cooperate in the wolf reintroduction program.[161] The San Carlos Tribe passed a Tribal resolution against the program that is still in force. The White Mountain Tribe has decided to cooperate with USFWS and now employs some Tribal members in the wolf program. These are issues of both intergovernmental relations and political sovereignty, which are difficult to evaluate without additional information.

- **Individual and Family Changes:** The impact of the program on Tribal sovereignty over their cattle operations is a major source of concern, particularly for the San Carlos Tribe. The impact of wolf predation on Tribal herds for individuals, families and Tribal groups is seen as being significant, though its magnitude is unclear.

- **Community Resources:** The role of ranching and outfitting in Tribal cultures appears to be an important cultural and social resource that is related directly to the wolf reintroduction program. The cultural and social ties between these activities and wolf populations were evident during the study period, particularly regarding conflicts over livestock. Social impacts appear more likely to occur as the wolf population increases.

7.7 Social Impacts: Tourism and Conservation

The social impacts to those involved in tourism and conservation in the study area for the five-year period of reintroduction are difficult to demonstrate. Individuals involved with these activities are very heterogeneous and lack readily identifiable social or economic activities or structures. Tourism drives many sectors, including retail trade, accommodations, real estate, and foodservices.[162] Local people involved in tourism may well benefit from increases in visitors

[161] Steve Pavlik (1999), "San Carlos and White Mountain Apache Attitudes toward the Reintroduction of the Mexican Wolf to its Historic Range in the American Southwest." Wicazo Sa Review 14 Spring:129-145.

related to wolf recovery. Significant discussion about the potential for increased tourism occurred prior to and during the reintroduction program. No such increases in wolf-related recreation could be identified to date, however. Thus, social impacts on the tourism industry are not evaluated.

Conservationists are not always members of organized groups. This analysis included many local people who were not involved in any organized group yet expressed attitudes and opinions consistent with wolf supporters and conservationists in general. Most social impacts accruing to local conservationists are to individuals, though a strengthening of local networks could occur due to social conflict over wolves. The social impacts include:

- **Population Characteristics:** Some citizens argue that people are moving into the BRWRA because of wolf reintroduction. A significant population change due to directly to wolf-driven migration does not appear to have occurred during the study period, however. Others claim that people seeking to interact with wolves have visited the BRWRA. Some respondents stated that people already drawn to the area are seeking to recreate near wolves for personal enjoyment.

- **Community and Institutional Structures:** Changes to the tourism industry and conservation communities due to wolf reintroduction do not appear to have altered the social and economic structures of communities during the study period. Tourism continues to play an important role in the local economy. Community change appears to be happening independent of wolves. No significant impacts related to wolf reintroduction could be identified.

- **Political and Social Resources:** Relationships between wolf supporters and local government appear to be virtually non-existent. Supporters appear to know each other and retain a social network accordingly. Social impacts on the tourism industry might have occurred if wolf reintroduction had produced an increase in tourism activities. Local tourism businesses such as hotels, resorts, restaurants, grocery stores and gas stations appear in favor of almost any activity that increases business, whether it is for wolves or for any other factors. Impacts during the study period were not identifiable given the available data.

- **Individual and Family Changes:** The presence of wolves presents a positive change in the lives of wolf supporters and an opportunity to seek enjoyment from having wolves as neighbors. These impacts are difficult to aggregate, but appear generally positive. Tourism sectors, such as hotels, resorts, restaurants, grocery stores and gas stations, do not report large increases in visitation due to wolf reintroduction over the study period. Social impacts are, however, difficult to evaluate because the groups are so diverse. For example,

[162] Tourism is not the only activity influencing these sectors, however.

gas stations may well be capturing an increase in people driving to the BRWRA to camp near wolves, but that increase might not translate into sales at the grocery store. Thus, potential positive changes are disaggregated and no data exists to evaluate them as a whole.

- **Community Resources:** No data is available to evaluate social impacts in this category.

7.8 Conclusions: Attitudes Toward Mexican Wolf Reintroduction

The vast majority of social science analysis concerning wolf recovery in North America involves attitude research using general survey techniques. Attitude data can assist resource managers in deciding what types of education or public outreach efforts they might focus on by outlining the public's perceptions and what the public might want from a policy or program. General conclusions drawn from numerous studies of attitudes towards wolves provide a useful context for understanding the social conflicts and attitudes encountered in the BRWRA. These general conclusions provide a social context for understanding why people in the BRWRA see social impacts as significant, insignificant, positive, or negative. It is important to note, however, that previous attitude research is of little direct utility to an analysis of specific social impacts from wolf recovery in the BRWRA. As Naughton-Treves et al. note, "[t]he impact of direct experience with wolf depredation on individual attitudes has seldom been examined."[163]

Browne-Nuñez and Taylor (2002) review 50 studies of attitudes toward wolves in North America conducted between 1974 and 2000.[164] These surveys conclude that although the general public usually holds very positive attitudes toward wolves and their reintroduction, respondents living in rural areas are often split or generally opposed to both the wolf and its return. The studies generally find that people living in rural areas that are likely to encounter the wolf (i.e., farmers and ranchers) and older people oppose reintroduction. In contrast, the studies find that younger people, people living in urban areas, and people with higher levels of education are typically more likely to support wolf recovery. Based on Browne-Nuñez and Taylor's literature review, the most common conclusion appears to be a call for more education about wolves and recovery efforts, though some research reported that increased knowledge about wolves and recovery efforts did not affect attitudes.[165]

Few studies are specific to the BRWRA. The Browne- Nuñez and Taylor review found only four (4) studies conducted on the Mexican wolf specifically.[166] These studies generally

[163] Lisa Naughton-Treves et al. (2003), Paying for tolerance: Rural citizens' attitudes toward wolf depredation and compensation, *Conservation Biology* 17(6): 1500-1511.

[164] C. Brown-Nuñez and J. G. Taylor (2002), Americans' attitudes toward wolves and wolf reintroduction: An annotated bibliography, *Information and Technology Report*, USGS/BRD/ITR-2002-0002, U.S. Government Printing Office, Denver, CO, 15p.

[165] J.W. Enck and T.L. Brown (2002), New Yorkers' attitudes toward restoring wolves to the Adirondack Park, *Wildlife Society Bulletin* 30:16-28.

[166] James R. Biggs (1988), Reintroduction of the Mexican Wolf into New Mexico: An Attitude Survey, M.S. thesis, New Mexico State Univ.; 66p. 1988.; T.B. Johnson (1990) Preliminary results of a public opinion survey of Arizona residents and interest groups about the Mexican wolf, Arizona Department of Fish and Game, Phoenix, AZ;

comport with other North American studies in that it is reasonable to conclude that rural respondents in the recovery area are less supportive of reintroduction than their urban counterparts. The studies note concern for livestock losses and general support for compensation to ranchers should such losses occur.

Additional social research studies attitudes of various groups towards compensating people for ranch animal losses and the programs set up to accomplish this mitigation.[167] Research into ongoing compensation programs by Montag et al. indicates that social support for such programs stems mainly from the desire to equitably distribute the costs of large carnivore restoration. [168] They also found that program attributes such as methods of verification and funding sources were important in identifying supporters and non-supporters of compensation programs. Naughton-Treves et al. conclude that compensation programs do little to change attitudes toward wolves.[169] Montag et al. support this conclusion, noting that many compensated ranchers criticize the programs for not solving the actual problem of wolves eating cattle. Even with compensation, many ranchers still approved of lethal control of predatory wolves.

This evidence seems to indicate strongly held attitudes toward wolves in the BRWRA. Anti- and pro-wolf groups are readily identifiable. Weisiger (2004) remarks on the vehemence with which groups held their position on the wolf and the anger they held for the opposition.[170] These groups appear to represent a significant population with a variety of strong opinions about wolves, but with little direct involvement in the reintroduction.

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