

# Appendix K: Social Impact Analysis Report

CABEZA PRIETA NATIONAL WILDLIFE REFUGE

Social Impact Analysis Report

Prepared for

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## SECTION ONE: INTRODUCTION

### PURPOSE OF THE REPORT:

The purpose of the Cabeza Prieta NWR social impacts analysis report is to evaluate and compare the social effects of current management activities and four proposed management alternatives. These effects focus on how management activities affect visitor experiences but also address potential stakeholder concerns for each management alternative.

Public land managers must have an understanding of visitor and visitation characteristics for their management area so that they can address, to the extent possible, the values and beliefs of those who use the public lands. Consequently, managers can improve relations with the public, gain support, and possibly even improve management practices by developing an understanding of visitors and visitation characteristics.

This report explores the issues of the visitation (overall visitation and repeat visitors) to Cabeza Prieta National Wildlife Refuge (hereafter Cabeza Prieta NWR). By looking at visitors' responses to a variety of recreation questions, we attempt to draw some conclusions about how visitors will perceive changes proposed within Environmental Impact Statement (EIS) alternatives. However, it must be stated that visitors to the refuge are not the only individuals or groups with a legitimate interest in how the refuge is managed. While this report attempts to provide analysis of how management activities will affect the broader public, the only quantitative data available are from a visitor survey. The analysis presented in this report can be supplemented by reports compiled from public meetings, public comments on the DEIS after it is released, and other public input that is received.

### **Survey Overview and Methods**

#### *Overview*

The U.S. Fish and Wildlife Service (FWS) is required to develop a Comprehensive Conservation Plan (CCP) for each unit of the National refuge system. The CCP for each refuge must contain an analysis of social and economic conditions, as well as evaluate social and economic results from likely management scenarios. The Cabeza Prieta NWR is unique within the National refuge system because it focuses on the protection of an endangered species of Pronghorn—along with Desert Bighorn Sheep and other flora and fauna—and is located in an extremely arid environment, surrounded by public lands managed by a variety of other agencies and Indian Nations, and a long border with Mexico. Much of the refuge is also officially designated as wilderness. Although visitation at the refuge is small, visitors commonly traverse the refuge along an historic wilderness road that traces the route of early Spanish exploration of the Southwest. The visitor traffic is complicated by the potential for people to employ motorized vehicles in the wilderness areas of the refuge, frequent presence of undocumented aliens seeking entry into the U.S. through the refuge, interest of Native American groups in using the refuge for traditional and religious purposes, hunting for desert bighorn sheep, and cross-boundary management of the endangered Pronghorn population. The refuge manager and regional planning staff of the FWS are responsible for including social and economic assessments in both the CCP and in an Environmental Impact Statement, in such a way that understanding these factors aids planning decisions and helps guide management actions.

#### Survey Design and Distribution

In the fall of 2000 the Policy Analysis and Science Assistance Program (PASA) of the Fort Collins Science Center (FORT) in the U.S. Geological Survey met with the staff of the Cabeza Prieta NWR to discuss the issues related to social, economic, and human dimensions of natural resource management for the CCP planning process. As a result of this meeting, a combination of studies was designed to evaluate how humans are affected by environmental management decisions and how human activities interact with natural resources management.

In 2002 PASA personnel sent a survey by mail to 1090 individuals who purchased a permit to drive onto Cabeza Prieta NWR. We surveyed all of those who received permits from June 18, 2001 to June 17, 2002, because the number of permit holders was relatively small. The surveys were mailed from and received by the staff at the Fort Collins Science Center. The returned surveys were given an identification number and the data was coded and entered into an SPSS™ database.

The design of the survey instruments and methods for conducting this research closely follows Dillman’s Total Design Method (TDM; Dillman 2000). This methodology involves designing a survey that is relatively easy to complete along with written contact information that encourages response by highlighting the importance of study participation and the social utility of the study.

The research team designed the survey for Cabeza Prieta visitors. Refuge staff and CCP planning team members were consulted in the design phase to ensure that the questions reflected conditions and concerns of the refuge. Approval to conduct the survey was obtained through the formal OMB approval process and the OMB control number was displayed on the survey and other written communications.

To administer the survey, a post card was mailed to all potential respondents. The purpose was twofold: to determine the number of “bad addresses” in the mailing list and to inform the potential respondents that the survey was on its way. When postcards were returned as “undeliverable” we removed those addresses from the database, and sent the initial survey and cover letter to all remaining individuals in the study sample. After one week, a postcard was sent to addressees, thanking them for completing the survey or reminding them to do so. Two weeks after the reminder postcard, another survey and cover letter was mailed to subjects who had not returned the completed survey. Four weeks after the reminder postcard, a third copy of the survey and cover letter was sent to individuals who had not completed a survey. Finally, to determine if those who had not responded were different from those who had responded we compared geographic location and month of refuge visit in respondents and non-respondents. We did not any significant differences between the respondents and non-respondents. This methodology has been shown to increase response rates, improve accuracy and reduce costs. The response rate for the survey was 74%. According to Dillman (2000) a response rate of 50% or better is very good for a mail out survey to the general public.

Table 1. Response rate for Cabeza Prieta NWR Visitor survey

Total Addresses	1090
Undeliverable Addresses	162
Respondents	685
Respondent Rate	73.7%

#### Visitor Background

Data from the survey show that of the 685 respondents, 66% were male, 31% were female, and 3% chose not to respond to the question. The average age of the respondents was 53, with nearly 69% of the respondents reporting their age as 45 or older and 48% reporting their age as 55 or older. Forty-six percent of the respondents had two or more years of college or formal education above high school. Another 38% indicated that they had attended graduate or professional school. Respondents were typically from one of five western states: Arizona, Colorado, New Mexico, California, or Texas. The majority of visitors visited Cabeza Prieta NWR once within the year (see table 2).

Table 2: Number of trips made to Cabeza Prieta NWR

Number of trips (Number of respondents)	Percentage of Visitors
1 (391)	59.0%
2-5 (189)	28.5%
6-10 (28)	4.2%
11-20 (13)	2.0%
More than 20 (42)	6.3%

As Table 2 shows, the majority (59%) of visitors to Cabeza Prieta NWR made one visit between June 2001 and June 2002, while another 28.5% made between two and five trips. At the other end, about 1% of visitors made more than 20 trips to Cabeza Prieta NWR within the year. (For a more complete picture of visitors to Cabeza Prieta NWR, see Ponds and Burkardt 2003.)

It is important to note that the average visitor is different from the repeat visitor. When managing public lands, it is essential to take into account not only the most common visitor, but also those repeat visitors who are often the mainstay for the region. For Cabeza Prieta NWR, local residents are the most likely repeat visitors (Table 3). Because public lands are held in trust for all of the American people, management actions affect not only visitors but also all Americans.

Table 3: Who are the repeat visitors?

Location of Residence	Number of Visits				
	1	2-5	6-10	11-20	> 20
Local (Ajo, Why, Yuma) residents	15.0%	50.4%	12.0%	6.8%	4.5%
State residents	62.2%	31.1%	3.1%	0.0%	0.0%
Residents of U.S. states other than Arizona	75.5%	17.0%	1.6%	1.3%	0.0%

Table 3 reveals that locals (residents of Ajo, Why and Yuma) are the most frequent repeat visitors. Visitors from Arizona (but outside of the Ajo, Why, Yuma region) are less likely than locals to be repeat visitors, but more likely than residents of other U.S. states. Finally, residents of U.S. states other than Arizona are the least likely to be repeat visitors.

#### Public uses of refuges

The Refuge Management Improvement Act of 1997 directed refuges to place specific human activities above others, provided the uses could be determined appropriate, and compatible with refuge purposes. These activities are environmental education; interpretation; hunting; fishing; wildlife observation, and nature photography. Cabeza Prieta NWR offers five of these six activities (fishing is not a refuge activity). We designed our survey to ask for responses about the importance of each of these activities.

Survey respondents were asked about the importance of various refuge activities for their decision to visit Cabeza Prieta NWR. When asked to rate, on a scale of one to four, the importance of activities for the decision to make a trip to Cabeza Prieta NWR, the activity most likely to be rated as important (the activity with the highest mean score) was viewing scenery. The activity least likely to be rated important was horseback riding. Overall, six activities were rated as

important (mean score above 3), nine were rated as somewhat important (mean score between 2 and 3), and two were rated as not important (mean score less than 2). See Table 4.

Table 4: Importance of Activities for Recreation Trip to Cabeza Prieta NWR

Important (mean score over 3)	Viewing Scenery
	Seeking Wilderness Solitude
	Viewing Night Skies
	Viewing Rare Wildlife
	Hiking in the Backcountry
	Viewing Other Wildlife
Somewhat Important (mean score between 2 and 3)	Viewing Historic or Heritage Sites
	Camping in the Backcountry
	Wildlife Photography Opportunities
	Camping in the Front-country
	Bird-watching
	Environmental Education
	Hiking in the Front-country
	Environmental Interpretation
Not Important (mean score less than 2)	Biking/ Mountain biking
	Hunting Bighorn Sheep
	Horseback riding

A management alternative that changes the availability of the top six activities (viewing scenery, seeking solitude, viewing night skies, viewing rare wildlife, hiking in the backcountry, and viewing other wildlife) will have a negative impact on refuge visitors. On the other hand, an activity such as hunting bighorn sheep is very important to a small number of visitors (27 respondents, nearly 4% rated bighorn sheep hunting as “very important”) and has been determined to be a compatible refuge activity for Cabeza Prieta NWR.

In the following chapter of this report, we address the social effects of the five DEIS alternatives. The five alternatives are:

- Alternative 1: No-action alternative (current management)
- Alternative 2: Minimum intervention
- Alternative 3: Restrained intervention
- Alternative 4: Active management (preferred action)
- Alternative 5: Maximum effort

To assess the social impacts of each alternative we used several data sources. First was the visitor survey, described above. Because the survey responses provided data about how visitors perceive the refuge and refuge management, this was used as the baseline. Under a no-action alternative, visitor use and satisfaction with the refuge could be expected to stay at very similar levels.

For each alternative, refuge managers estimated the number of projected visitor-days. Table 5 shows expected refuge use levels by alternative.

Table 5: Anticipated number of visitor days by alternative

	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
Recreation visits	7806	7771	7771	8231	8656
Big game hunting	240	0	85-240	265	265
<b>Total</b>	<b>8046</b>	<b>7771</b>	<b>7856-8011</b>	<b>8496</b>	<b>8921</b>

The difference in expected recreation visits across alternatives is small. The largest projected difference is from Alternative 1 to Alternative 5 with an increase of 850 visitor days. Therefore, quantitatively assessing the effects of the proposed alternatives is of limited utility. What is important, in terms of visitor experience, is that increasing one kind of use (for example, opening access to off-street vehicles) will affect the recreation experience of another use (for example, wildlife observation). In addition to survey results, we used peer-reviewed research results in the topic areas of recreation, wilderness experience, public attitudes about hunting, predator management, and others to describe potential impacts of the management alternatives.

Much of the research on non-monetary values of wilderness areas and wildlife presents the argument that these amenities have value that cannot be measured in dollars. In fact, some state that these resources have existence value that accrues to all of society, not only those who “use” the resources. Viewed in this way, one can argue that the resources of an individual wildlife refuge hold value for all of society, and that protecting these resources provides a broad social benefit. Again, this value is difficult to quantify but should not be ignored in the decision making process.

Environmental philosophers have argued that forestry management must embrace values that are beyond traditional production values. Included in this list of values provided by forests are life support values, economic values, scientific values, recreational values, aesthetic values, wildlife values, biotic diversity values, natural history values, and intrinsic values (Holmes and Coufal 1991). These values are provided by other natural resources including national wildlife refuges, wilderness areas, and other public lands.

Numbers of hunting days varies across alternatives from 0 to 265. The economic value of hunting for the regional economy is analyzed in the Economic Analysis Report prepared by Caughlan. Numbers of hunters under each alternative are relatively small, but the presence or absence of hunting on the refuge is of high importance to groups with strong opinions about whether hunting should occur on the refuge. Some who do not have the opportunity to hunt value the existence benefit of the hunting program. Decisions about hunting are complex, but will be important to many in this decision process.

Survey respondents strongly stated that experiencing wilderness solitude was a highly valued part of their trip to Cabeza Prieta. Although there is some variability in how individuals define solitude, the ability to provide these experiences to visitors is a strong indicator of the social impact of each alternative. Respondents also indicated that wildlife viewing was a highly important activity during their visit. The degree to which each alternative continues to provide wildlife viewing opportunities will also be an essential component of this impact analysis.

## **SECTION TWO: EVALUATION OF ALTERNATIVES**

### **2.0 MANAGEMENT ALTERNATIVES**

#### **2.1 ELEMENTS COMMON TO ALTERNATIVES**

Certain elements of endangered and threatened species recovery, wilderness stewardship, and cultural resources management are common to all action alternatives (Alternatives 2 through 5). Some of the alternatives include additional actions beyond the common elements. In all such cases the additional actions are described under the appropriate resource area for the individual alternative.

### **2.1.1 Endangered and Threatened Species**

The presence of endangered and threatened species provides benefits for refuge visitors. Scholars (Loomis 2000; Shogren 2003) note that it is difficult to estimate the worth of wildlife such as threatened and endangered species. However, the public has demonstrated that they value their existence. According to Shogren (2003, 1), “[f]rom society’s perspective, endangered species with limited commercial or consumptive benefits are undervalued by market prices.” In other words, although there is no national estimate of the economic benefits, either private or social, the public values wildlife and is willing to pay, on average between \$6 to avoid the loss of the striped shiner to over \$95 to avoid the loss of the northern spotted owl (Shogren 2003, 4). Furthermore, it is also suggested that benefits from the existence of endangered and threatened species extend beyond the local area, often to the state and possibly even nation- or world-wide (Loomis 2000).

Of the Cabeza Prieta NWR visitors that responded to the survey, 63.5% reported that they participated in wildlife viewing during their visits. Although only 6% of these respondents reported wildlife viewing as the most important reason for their visit, it was the fourth most common response, behind “seeking wilderness solitude,” “sightseeing,” and “backcountry hiking.” Additionally, for respondents who visited the refuge more than ten times within the year, wildlife viewing was the most common response for the most important reason for their visit. Twenty-seven percent of respondents who made 11-20 visits within the year and 24% of respondents who made more than 20 visits within the year reported wildlife viewing to be the most important reason for their visit.

Survey respondents also reported that the opportunity to view rare wildlife was important for their decision to make a trip to Cabeza Prieta NWR. Thirty-five percent of respondents reported that viewing rare wildlife was “very important,” while another 32% reported it to be “important” for their decision to visit Cabeza Prieta NWR. Only 3% of respondents reported viewing rare wildlife as “not important” to their visit.

Respondents also reported both the protection and presence of wildlife as important activities for their recreation satisfaction at Cabeza Prieta NWR. These two activities had the highest mean scores (3.59 and 3.26, respectively, on a four point scale) and lowest standard deviations (0.70 and 0.75 respectively) within the ratings. These results show that there is wide agreement among respondents that these activities are highly important for recreation satisfaction. Respondents also reported general satisfaction with current conditions concerning wildlife protection and wildlife presence at Cabeza Prieta NWR, although there was less consensus about the “satisfied” rating (standard deviation is greater than one for both of these activities).

Others may not visit the refuge, but believe it is important that endangered and threatened species are protected (see Loomis 2000).

Overall, for survey respondents the presence of wildlife within Cabeza Prieta NWR is viewed as highly important. Likewise for many stakeholder groups focusing on Cabeza Prieta NWR, wildlife is a critical issue. This response is similar to the results of other surveys where interest in viewing wildlife is strong, and over half of the respondents reported participation in wildlife viewing (Vaske et al. 2001). Additionally, Vaske et al. (2001) also found that wildlife viewing is on the increase, and thus is likely to be even more important to visitors in the future.

For wildlife issues in the Cabeza Prieta NWR region, the civic groups involved can roughly be divided into two coalitions. One coalition can be termed the “preservationist” coalition and the other the “conservationist” coalition. There is no right or wrong answer about how to make wildlife decisions for the refuge, but there are value differences between the two coalitions that make agreement difficult.

The preservationist coalition includes the Wilderness Society, Defenders of Wildlife, Friends of Cabeza Prieta, the Sierra Club, and perhaps others. The conservationist coalition includes the Desert Bighorn Sheep Society, Yuma Valley Rod and Gun Club and other organized wildlife groups. The Arizona Game and Fish Department may also be considered part of this coalition. While the two coalitions are in agreement about the defining wildlife issues on the refuge, they do not necessarily agree about the management objectives for the refuge.

### **2.1.1.1 Sonoran Pronghorn**

The value to the public of endangered and threatened species is discussed in section 2.1.1.

#### **2.1.1.1.1 Population Monitoring**

The social benefit of population monitoring is connected to the public's ability to view endangered wildlife while visiting the refuge. If population monitoring leads to management actions that increase Sonoran pronghorn populations, refuge visitors will receive the benefit of increased wildlife viewing opportunities. Non-governmental groups with an interest in protecting Sonoran pronghorn will benefit in the same manner. Observation of collared wildlife is a benefit to some, who view collars as a sign that positive management actions to protect wildlife are occurring.

The social cost of population monitoring may occur if members of the public observe capture and collaring activities or if they see collared pronghorn. These activities may diminish the experience of "naturalness" for visitors, particularly for those who believe the focus of wilderness management should be maintaining naturalness and solitude (Hendee, et al. 1990; Carter 1997). Likewise, aerial tracking of pronghorn may disturb visitors seeking solitude in the refuge. Because the number of pronghorn is small and visitation at the refuge is relatively low, the probability of visitors observing these activities is considered to be minimal.

Non-governmental groups that focus on animal welfare issues may be negatively affected by population monitoring activities because they may believe them to be inhumane.

#### **2.1.1.1.2 Developed Waters**

The social benefits of developed waters lies in the possibility that providing these waters reduces wildlife mortality, which can increase the opportunities for wildlife viewing by the public.

Although not specifically addressed by the planning process, undocumented aliens also use developed waters as they traverse the refuge. Availability of these waters may reduce human mortality on the refuge. Although border crossing is not an activity that the Fish and Wildlife Service supports, the potential for human suffering is great if water is removed and no alternative sources of water are provided. Providing water confers a social benefit by preventing some loss of life.

The survey that we sent to Cabeza Prieta NWR visitors did not include questions about developed or supplemental waters. Some visitors added comments about their opinions of water and wildlife on the refuge:

**Figure 1: What would have enhanced your experience at Cabeza Prieta National Wildlife Refuge?**

1. More water holes for the wildlife.
2. Opportunity to participate in
3. volunteer wildlife projects such as water hole maintenance, forage enhancement; pronghorn recovery.
4. Have managers provide current info on water holes. Game was protected from us
5. I would like to see the AZ Bighorn Sheep Society be able to improve the water supply by being able to repair old waterhole projects and add new ones.
6. Being able to get access to repair bighorn sheep watering holes, via Arizona Dessert Bighorn Sheep Society

**Figure 2: What experience did you have at Cabeza Prieta National Wildlife Refuge that would bring you back?**

1. The water tanks and the great conditions of roads.
2. Sitting to see Christmas Tank I (the wife) have read a lot about natural water tanks in the desert. It was really neat to actually see one. Unfortunately there wasn't any wildlife in view while we were there.
3. Solitude. Enjoyed trip down to water source.

**Figure 3: Other comments provided by visitors about water on the refuge:**

1. We do NOT believe that services (water tanks) placed by private organizations should be allowed on the refuge for use by illegal aliens!
2. All water developments in disrepair and little or no water available for wildlife
3. Please do not apply archaic (old boy) management practices such as predator (coyote) control while attempting to recover the Sonoran Pronghorn population. Habitat fragmentation, forage availability, human (agency/military) impacts, water catchment's benefits/detriments, illegal border crossings, and AGFD activities must be evaluated and addressed adequately before predator control is considered.
4. I would like to see the Wells, water holes put back, and maintained.
5. I think it is very important for the AZ Bighorn Sheep Society to be able to do waterhole projects. There is so little water. It would improve life for all wildlife.

Another social issue related to provision of supplemental waters concerns the presence of water structures or storage tubs in wilderness areas, the motorized vehicles that are used to haul water to the tanks, and the aerial monitoring of water levels in tanks. Each of these features may affect the wilderness experience of visitors by providing indications of human activity. However, some comments that were received on the survey were favorable about the presence of water for wildlife, and some visitors noted that seeing water tanks was a positive experience (see comments above). Individuals or groups that associate evidence or use of water tanks as beneficial to wildlife may be positively affected by the presence of the tanks and associated activities.

Some developed waters are located in parts of the refuge that are designated wilderness. Visitor activities that may be linked to wilderness are backcountry hiking, backcountry camping, and seeking wilderness solitude. Survey responses indicated that 37.1% participated in backcountry hiking on the refuge, 19.0% participated in backcountry camping; and 53.0% sought wilderness solitude. When asked to indicate which refuge activity was the most important reason for their visit, 22.5% stated “seeking wilderness solitude,” making this the number one reason for refuge visits (“sightseeing” was the second choice at 15.2%). The presence of developed waters in wilderness areas may adversely affect the wilderness experience for visitors because it may be in conflict with the expectation that wilderness areas show no or little sign of human development.

#### **2.1.1.1.3 Captive Breeding/Translocation**

As noted in Section 2.1.1.1, increasing pronghorn numbers may increase the social value of the species because the potential for viewing these animals may increase.

In addition to wildlife viewing, visitor activities that may be affected by a captive breeding/translocation program include sightseeing, hiking near public roads, photography, environmental education, and car camping. The percentages of survey respondents who indicated that they participated in each of these activities is as follows: Sightseeing-66.9%; hiking near public roads- 38.0%; photography- 55.6%; environmental education- 22.5%; car camping- 42.3%.

Depending on the proximity of a captive breeding site to Charlie Bell road, these visitor activities may be enhanced or diminished. For example, the ability to use the captive breeding site as an opportunity for environmental education, with photography and sightseeing as side benefits, could enhance visitor experience. On the other hand, some visitors may not appreciate seeing wildlife in enclosed areas. Vaske et al. (2001, 10) found in their survey of Coloradoans that 70% of respondents would prefer to observe wildlife in wild settings with only a chance of seeing wildlife rather than observing wildlife in enclosed parcels of land where chances of seeing wildlife are greatly increased. In addition, visitor activities may also be diminished if activities such as hiking or camping near the enclosure are curtailed.

Non-governmental groups with an interest in pronghorn recovery will be positively affected if the program is successful. Defenders of Wildlife brought suit against the U.S. Fish and Wildlife Service on the basis that the Sonoran pronghorn recovery plan did not adequately address pronghorn recovery criteria or contain timelines to estimate the amount of time needed for recovery actions. A court-ordered amendment to the plan to address these two issues was published in 2003 (U.S. Fish and Wildlife Service 2003) and is currently being implemented.

Because the translocation and captive breeding plan allows for selective removal of predators, animal rights groups may not have their interests met if this plan is implemented.

#### **2.1.1.1.4 Area Closures**

The refuge voluntarily closed Sonoran pronghorn habitat to public recreational access during fawning season (March 15 through July 15). The earlier weeks of this period are times of relatively high visitor counts, but high temperatures in late spring and summer deter many potential visitors. The social benefit of area closures is the possibility that Sonoran pronghorn populations will recover. The social cost is that the public is prohibited from pursuing recreational activities on much of the refuge for four months of the year. Activities such as driving for pleasure, vehicle camping, and others may be curtailed. Members of Native American tribes who access the refuge to travel to places of cultural or spiritual importance may be unable to do so when parts of the refuge are closed.

The survey administered to refuge visitors asked about satisfaction with road conditions. The survey question did not specifically ask about road conditions related to area closures, and some who replied to this question may have responded in terms of their perceptions of whether the roads were well-maintained and easily traveled. When asked about the importance of road conditions in contributing to recreation satisfaction and satisfaction with the management of the refuge in providing expected road conditions, survey respondents indicated high importance and low satisfaction with road conditions.

Many open-ended comments concerned road conditions. For the survey question, “what would enhance your experience at Cabeza Prieta NWR?” 146 responses mentioned road conditions and/or access issues. While most respondents did not specifically mention closures due to pronghorn issues, any activities or events that cause road closures have the potential to negatively affect visitor experience.

#### **2.1.1.1.5 Supplemental Feeding and Forage Enhancements**

As noted in Section 2.1.1.1, increasing pronghorn numbers may increase the social value of the species because the potential for viewing these animals may increase.

#### **2.1.1.1.6 Fencing**

As noted in Section 2.1.1.1, increasing pronghorn numbers by reducing mortality may increase the social value of the species because the potential for viewing these animals may increase.

#### **2.1.1.2 Lesser Long-nosed Bat**

As described in Section 2.1.1., many visitors to the refuge are attracted by the presence of wildlife and, specifically, by the knowledge that threatened or endangered species are on the refuge.

#### **2.1.1.3 Cactus Ferruginous Pygmy-owl**

As described in Section 2.1.1, many visitors to the refuge are attracted by the presence of wildlife and, specifically, by the knowledge that threatened or endangered species are on the refuge.

#### **2.1.1.4 Pierson’s Milkvetch**

As described in Section 2.1.1, many visitors to the refuge are attracted by the presence of wildlife and, specifically, by the knowledge that threatened or endangered species are on the refuge.

### **2.1.2 Desert Bighorn Sheep Population Monitoring**

Aerial population monitoring is conducted by helicopter every three years. This may have an effect on visitors. For some, the effect is likely to be negative but for others the effect would be expected to be neutral or perhaps even positive. For example, individuals who believe that wildlife monitoring can be used to identify ongoing or potential threats to wildlife populations, and that this identification can lead to management actions to assist wildlife may find the experience of aerial monitoring positive. Because the aerial monitoring occurs infrequently, the total impact on visitors is minor. However, for the few who are affected by monitoring activities the effect might be great. Affects on wilderness experience from aircraft over-flights is considered a threat to wilderness according to scholars such as Hendee and Dawson (2001).

### **2.1.3 Wilderness Stewardship**

Wilderness is known to provide many values to humans through on-site recreation use, rehabilitation of the human condition, and wildlife habitat, in addition to off-site benefits in terms of protecting water quality, sequestering carbon, and providing an environment for scientific research (Loomis and Richardson, 2001). Wilderness is both a metaphor for solitude untrammelled by society, and a place to escape from the increasing demands of society (Hollenhorst and Jones 2001, 58). Due to the diverse benefits, management of wilderness is frequently described as a balancing act (Hendee and Dawson 2001; Hollenhorst and Jones 2001).

The introductory section of this report describes visitor ratings of the importance of various activities, including wilderness experiences, to the Cabeza Prieta experience. Any activity

that diminishes the quality of the wilderness experience will have a negative effect on the majority of Cabeza Prieta visitors. This assumes that the characteristics of Cabeza Prieta visitors will be consistent over time. If management actions lead to changes in the type of visitor or the main activities that are pursued at the refuge, this assumption should be re-examined.

The number of visits made to Cabeza Prieta NWR sheds light on what is most important to return visitors (Table 6). Repeat visitors rank “seeking wilderness solitude” as the most important reason for their trip less frequently than do those who visit the refuge five times or fewer.

Table 6: Most Important Activities by Number of Visits

Number of visits within the year	Most important activities (% of respondents who stated it was their most important activity)
1	Seeking wilderness solitude (24%) Sightseeing (15%)
2-5	Seeking wilderness solitude (27%) Sightseeing (16%) Backcountry hiking (14%)
6-10	Sightseeing (25%) Seeing wilderness solitude (13%) Backcountry hiking (13%)
11-20	Wildlife viewing (27%) Sightseeing (18%)
> 20	Sightseeing (24%) Wildlife viewing (16%) Photography (16%)

Cabeza Prieta visitors are generally satisfied with their wilderness experience at the refuge, as displayed in Table 7.

Table 7: Responses to “The value of the wilderness opportunities and character I experienced here was what I expected it to be”

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly agree	218	31.8	33.9	33.9
	Agree	350	51.1	54.3	88.2
	Not sure	40	5.8	6.2	94.4
	Disagree	30	4.4	4.7	99.1
	Strongly disagree	6	.9	.9	100.0
	Total	644	94.0	100.0	
Missing	No answer	41	6.0		
Total		685	100.0		

### 2.1.3.1 Minimum Requirements Analysis

Application of Minimum Requirements Analysis (MRA) is meant to minimize the impacts of management activities in wilderness areas. Even minimal uses may have a negative effect on an individual’s wilderness experience. If a visitor encounters refuge staff performing these activities, the impact may be that their experience is no longer considered a wilderness experience. Given the remote nature of the refuge, it is possible that human encounters of any type would be disturbing to some visitors, because some place a high value on the ability to encounter few other humans while on the refuge.

### 2.1.3.2 Border Law Enforcement

The Arizona Desert Wilderness Act allows some activities that would otherwise be prohibited in wilderness areas. These activities relate to border law enforcement and military activities. When asked about the importance of border impacts to their visits, survey respondents indicated that this issue was important (mean of 2.95 on a scale from 1-4 where 1= not important and 4= very important; standard deviation of 1.084). Visitors ranked their satisfaction with

conditions somewhat low (mean of 2.39 on a scale from 1-5 where 1= poor conditions and 5= outstanding conditions; standard deviation of 1.258).

When asked to respond to the statement, “Border impacts and activities adversely affected my visit to the refuge, 39% answered either “strongly agree” or “agree” while 38.1% answered either “disagree” or “strongly disagree.” Many open ended comments on the survey alluded to border impacts and activities, almost all in a negative sense. Of the contributions to the open-ended comment page on the back of the survey, about 18% were related to border activities (58 comments out of 321 total). In response to the survey question, “What would enhance your experience at Cabeza Prieta NWR?” about 16% (76 responses out of 480) mentioned some aspect of border activities and control.

Border activities will continue to negatively affect visitors to the refuge under current policies that are, to a large extent, not under the control of the refuge or the Department of the Interior.

### **2.1.3.3 Wilderness Impact Monitoring**

The positive social effect of wilderness impact monitoring is that these activities may lead to preservation of wilderness character over time. Another effect, which may be either positive or negative, is that wilderness visitors may notice monitoring areas. For some this will be a negative experience because it will show evidence of human activity on the landscape. For others it will be a positive experience because it will provide an educational opportunity to view a scientific research project. Other visitors who believe the wilderness monitoring and research are important functions will be positively affected by evidence of monitoring activities.

### **2.1.4 Cultural Resources Management**

Cultural resources include “archeological resources, historic and architectural properties, and areas or sites of traditional or religious significance to Native Americans (614 FW 1, Natural and Cultural Resources Management). Part of the process of cultural resource management includes dealing with issues of access to cultural resources by Native Americans. The Tohono O’odham tribe in southern Arizona traditionally occupied an area of land bounded by the Gila River on the north, the Sonora River on the south, the Colorado River on the West, and the San Pedro River on the east. Thus, Cabeza Prieta NWR exists where the Tohono O’odham and other tribal groups previously lived. To the extent that refuge management activities exclude Native Americans from traditional cultural or sacred sites, there is the possibility for negative impacts to tribal groups.

For many Native Americans, physical features and objects on public lands hold both political and spiritual significance (Zellmer 2002). A close relationship with traditional lands permeates their lives, sustaining the health and well-being of members and the integrity of the tribes (Zellmer 2002). Furthermore, many tribe’s religious beliefs are site-specific, intimately associated with their traditional lands and its natural features (Zellmer 2002, 432). In light of this, Congress has expressed the objective of preserving cultural resources on public land, particularly those of interest to Native Americans. However, public lands laws grant extensive discretion to the land management agencies, “discretion that has been used most frequently to favor economic and recreational activities over cultural practices” (Zellmer 2002, 415). Due to both of these issues, well-designed cultural resource management programs are not only beneficial to the Native peoples—helping protect their culture, but are also ultimately beneficial to the government—forming better relations with Native peoples and broadening the reasons for resource protection, thus drawing attention to the twin issues of environmental protection and cultural survival (Kamieniecki and Scully Granzeier 1998).

Cultural resources management provides social benefits because these practices preserve historical sites. The visitor survey did not ask specific questions about perceptions of cultural resources on the refuge. Two open-ended comments received on the survey focused on access to archeological sites by research groups.

### **2.1.5 Research**

As noted by Loomis and Richardson (2001, 32), wilderness provides a “natural bench-mark or control area for judging the effects of human development on natural systems and understanding

of unfettered ecological processes.”

## **2.1.5.1 Biological Research**

### **2.1.5.1.1 Sonoran Pronghorn**

Research to support Sonoran pronghorn recovery goals has the net social benefit of recovering a population considered important to the nation, as recognized by its designation as an endangered species under the Endangered Species Act of 1973, as amended (16 U.S.C. 1532 et seq.).

Research activities may enhance or diminish visitor experiences on the refuge, depending on the type of activity and the perception of the individual visitor about the activity.

### **2.1.5.1.2 Desert Bighorn Sheep**

Research to better understand the biology of desert bighorn sheep will assist in maintaining a viable population on the refuge. This provides social benefits of wildlife viewing, hunting, and the advancement of scientific knowledge.

Research activities may enhance or diminish visitor experiences on the refuge, depending on the type of activity and the perception of the individual visitor about the activity.

### **2.1.5.1.3 Other Species**

Research to support recovery goals for any threatened or endangered species has the net social benefit of recovering a population considered important to the nation, as recognized by designation as an endangered or threatened species under the Endangered Species Act of 1973, as amended (16 U.S.C. 1532 et seq.).

Research to investigate the status of non-threatened or non-endangered species may have a social benefit by providing information to managers about the distribution and abundance of refuge species. This may allow managers to fulfill their public trust duties to protect wildlife and plants under their jurisdiction.

Research activities may enhance or diminish visitor experiences on the refuge, depending on the type of activity and the perception of the individual visitor about the activity.

### **2.1.5.1.4 Ecological Integrity**

Research to investigate the ecological integrity of the refuge may have a social benefit by providing information to managers about the ecological health of the refuge. This may have the broader social benefit of contributing to ecosystem integrity in the Sonoran Desert ecosystem.

Refuge visitors were not asked survey questions that directly related to ecological integrity. However, many visitors to the refuge value the benefits provided in the ecoregion by the diversity of vegetation that supports a rich variety of mammals, reptiles, birds, and amphibians. Management activities that promote ecosystem integrity are likely to increase visitor satisfaction by providing opportunities to view wildlife and plants.

Research activities may enhance or diminish visitor experiences on the refuge, depending on the type of activity and the perception of the individual visitor about the activity.

### **2.1.4.1.5 Exotic and Invasive Species**

Research to investigate the exotic and invasive species on the refuge may confer a social benefit by providing information to managers about the level of exotic species infestation on the refuge so that control measures may be taken and the results of these measures can be monitored. This may have the broader social benefit of contributing to the ecological health of the refuge and other locations in the Sonoran Desert ecosystem.

Refuge visitors were not asked survey questions that directly related to ecological integrity. However, many visitors to the refuge value the benefits provided in the ecoregion by the rich variety of mammals, reptiles, birds, and amphibians. Exotic and invasive species may affect the abundance and diversity of native flora and fauna.

A potential negative effect of strategies to control exotic and invasive species is that visitors may be prohibited from using pack animals on the refuge. This effect is anticipated to be minimal because only a few individuals use pack animals on the refuge each year, and some proposed alternatives prohibit these uses.

Research activities may enhance or diminish visitor experiences on the refuge, depending on the type of activity and the perception of the individual visitor about the activity.

#### **2.1.5.2 Wilderness Research**

As noted in Sections 2.1.1.1.2 and 2.1.3, wilderness experiences are highly valued by visitors to Cabeza Prieta NWR. Research to identify threats to wilderness has the potential benefit of preserving the wilderness character of the refuge, which is a benefit to visitors and to society as a whole.

Research activities may enhance or diminish visitor experiences on the refuge, depending on the type of activity and the perception of the individual visitor about the activity.

#### **2.1.5.3 Visitor Service Research**

Research on visitor experiences and perceptions is beneficial because it helps refuge managers and planners provide refuge-compatible recreational activities for visitors. Increased knowledge of visitors and visitation trends allows managers to plan for future recreation trends. In the face of changing demographics across the United States, understanding trends about visitor characteristics is important.

Providing refuge-compatible recreation experiences is not the only reason to conduct visitor service research. The results of research can also help managers identify opportunities for interpretation of refuge resources, and for education about the value of refuges.

Office of Management and Budget protocols govern survey research conducted by federal scientists or with federal funds. When these protocols are followed and OMB clearance is obtained, the social costs of collecting survey data are considered to be minimal.

#### **2.1.5.4 Cultural Resources Research**

Cultural resources research may have either a positive or a negative effect on the Tohono O'odham, the Hia-Ced O'odham and Yuman/Patayan Nations. If this research is done in cooperation with these nations and provides information that is valued, the social effect will be positive. If the research is conducted in a manner that is not considered culturally acceptable, the social effect may be negative.

Research activities may enhance or diminish visitor experiences on the refuge, depending on the type of activity and the perception of the individual visitor about the activity.

## **2.2 ALTERNATIVE 1: NO ACTION ALTERNATIVE (CURRENT MANAGEMENT)**

This alternative describes the current management activities at the refuge. These programs and activities would continue if none of the action alternatives (Alternatives 2 through 5) were adopted. Management activities are focused on recovery of the endangered Sonoran pronghorn, maintaining the populations of desert bighorn sheep, monitoring nongame wildlife species, monitoring and controlling invasive species, protecting wilderness character, and providing visitors with quality wildlife-dependant recreational experiences that are compatible with the refuge purposes. If this alternative were adopted, a total of 8146 visitor days would be expected. Of these, 7806 visitor days would be by recreational users and 240 by big game hunters.

### **2.2.1 Goal: Wildlife and Habitat Management**

Protect, maintain, enhance, and/or restore the diversity and abundance of wildlife species and ecological communities of the Sonoran Desert represented at Cabeza Prieta NWR.

#### **2.2.1.1 Endangered and Threatened Species**

See discussion above in Section 2.1.1 under Elements Common to All Alternatives.

#### **2.2.1.2 Desert Bighorn Sheep**

Conservation of the desert bighorn sheep was central to the purpose of creation of Cabeza Prieta NWR. Sheep occupy all of the mountain ranges within the refuge. As discussed in Section 2.1.1, 63.5% of visitors to Cabeza Prieta NWR reported that they participated in wildlife viewing during their visit.

Creation of a national wildlife refuge implies that the unit has importance that transcends local or even regional issues. The mission of the national wildlife refuge system is "...to administer a national network of lands and waters for the conservation, management, and where appropriate, restoration of the fish, wildlife, and plant resources and their habitats within the United States for the benefit of present and future generations of Americans" [16USC668dd (a)(2)]. Because Cabeza Prieta was created, in part, to protect desert bighorn sheep, the social value of the sheep population is an essential feature of the refuge.

##### **2.2.1.2.1 Developed Waters**

The social effects of providing developed waters for desert bighorn sheep are discussed in Section 2.1.1.2. The no-action alternative would provide continued desert bighorn sheep viewing and hunting opportunities for Cabeza Prieta visitors. Wildlife viewing is usually considered a positive activity. Hunting is considered a positive activity to some, and a negative activity to others.

Possible negative effects of developed waters include impairment of visitors' wilderness experience because of the evidence of human presence, in terms of water structures, monitoring cameras, and refuge staff involved in water hauling activities. Water hauling is subject to Minimum Requirements Analysis. Use of motorized transport is likely to have a stronger effect on visitor experience than use of non-motorized transport.

##### **2.2.1.2.2 Population Goal**

Attainment of population goals is related to number of desert bighorn sheep available for wildlife viewing and hunting. Under the no-action alternative, visitors would continue to visit the refuge to see desert bighorn sheep. Hunting would continue at approximately the same level (8 or fewer permits per year).

### **2.2.1.3 Desert Ecosystem Integrity Monitoring**

#### **2.2.1.3.1 Migratory Birds**

Bird watching is an important activity for many visitors to Cabeza Prieta and the surrounding Sonoran Desert. Just over 33% of Cabeza Prieta NWR visitors indicated that they participated in bird watching during their most recent trip to the refuge. When survey respondents were asked how important various activities were in their decision to take a recreation trip to the

refuge, 43.5% stated that bird watching was either “important” or “very important” to their decision, while another 33.9% noted that it was “somewhat important.” One interpretation of this result is that visitors anticipate birding during their visit but do not have the opportunity to do so once they arrive at the refuge. These results are similar to those found by Vaske et al. (2001). Additionally, Vaske et al. (2001) note that despite large numbers of visitors who state that wildlife viewing (including bird watching) is very important to their trip, a certain percentage of these visitors are not successful in seeing wildlife, thus the numbers of those who participated in the activity are lower than the numbers of those who state it as important to their trip. Finally, Vaske et al. (2001, 35) also suggest that birders frequently have a strong commitment to birds, a breadth of knowledge, and are willing to make financial investments in bird watching, thus they provide benefits to areas that support bird watching.

#### **2.2.1.3.2 Reptiles and Amphibians**

The presence of reptiles and amphibians on the refuge may be one indicator of ecosystem health. Refuge visitors find the opportunity to view wildlife important to their experience. The no-action alternative, which includes survey and monitoring of reptile and amphibians, provides benefits by supporting opportunities for wildlife viewing.

#### **2.2.1.3.3 Game Animals**

The no-action alternative does not allow hunting for game animals other than desert bighorn sheep. The value of these animals for visitors is that they provide opportunities for wildlife viewing, which is an important refuge activity.

#### **2.2.1.3.4 Long-term Desert Integrity Monitoring**

The no-action alternative provides the social value of monitoring, with the long-term objective of maintaining desert health. This provides a benefit to visitors and to others.

Remote sensing meteorological instruments and vegetation transects, if located in wilderness, may impinge on visitors’ sense of remoteness and solitude.

#### **2.2.1.3.5 Exotic/Invasive Species**

Public uses of the refuge are affected by the presence of exotic or invasive species. If native flora is replaced by exotic species, food sources for refuge wildlife may be damaged or destroyed. A resulting loss of wildlife would affect opportunities for wildlife viewing and hunting, and perhaps the survival of endangered species on the refuge. The no-action alternative may have a negative effect on visitors and the greater public if it does not aggressively control invasive species.

### **2.2.2 Goal: Wilderness Stewardship**

Protect and conserve refuge wilderness employing strategies of wildlife and plant conservation that will maintain and restore the wilderness character of Cabeza Prieta NWR.

#### **2.2.2.1 Abandoned Vehicles**

The no-action alternative may enhance enjoyment of refuge wilderness by removing signs of human activity. Studies of wilderness users have shown that the sense of a lack of human developments contributes to an individual’s belief that they are in a wilderness setting (Hall 2001).

Actions to remove the vehicles may have a negative impact on visitor experience. Sounds of vehicles are known to be a negative experience for wilderness visitors (Hall 2001; Taylor 2003). These removal activities may also cause wildlife disturbance. Because wildlife viewing and hunting are permitted refuge uses, this disturbance may diminish visitor experiences and cause negative social impacts.

The no-action alternative provides the net benefit of removing signs of humans but may have a negative effect on those who are in the locale when the removal activities are conducted.

#### **2.2.3.2 Military Debris Removal**

Removing active ordnance protects human health and safety. The activities required for removal may diminish the experience of refuge visitors, depending on the time of year and other factors that affect visitation levels on the refuge. Because of the possibility of harm to humans if left intact, the no-action alternative provides a positive benefit.

#### **2.2.3.3 Administrative Trails**

Use of administrative trails for refuge management activities and border patrol activities provides benefits in supporting essential management activities. Rehabilitation of non-authorized vehicle trackways also provides benefits by protecting refuge resources and wilderness character.

The presence and use of administrative trails will have a positive impact on those who view access-dependent management activities as positive. For example, maintaining water tanks and hauling water to some of the tanks is currently achieved by using the administrative trails for access. This provides a benefit for those who support the use of water tanks for wildlife. Closure of trails would make access difficult, or would require alternative means of access. This could cause a negative impact to those who support the use of water tanks for wildlife.

The presence and use of administrative trails is likely to have a negative effect on some wilderness recreational users. Some will be affected by the sight and presence of administrative trails, believing that these trails should not be present in wilderness areas. Others will be negatively affected if they encounter vehicles on trails because it diminishes the sense of solitude, which is an important wilderness value (Hall 2001; Hollenhorst and Jones 2001). Some organized wilderness groups oppose the current uses of administrative trails in wilderness areas (Wild Wilderness 2003). Continuing the use of administrative trails in wilderness areas will have a negative social affect on wilderness groups that share this perspective.

#### **2.2.3.4 Childs Mountain Communications Site**

The visibility of the Childs Mountain Communication site from wilderness areas of the refuge may have a negative effect on wilderness experience. As noted in Section 2.2.2.1, evidence of human impacts or developments in wilderness areas may diminish the quality of a wilderness experience.

### **2.2.4 Goal: Visitor Services Management**

Achieving these visitor services goals will enhance the experience of refuge visitors and achieve refuge purposes.

#### **2.2.4.1 Access Management**

Access to the refuge is not limited by number. Visitors must obtain permits to drive on refuge roads, and must comply with postings of closed areas. In some portions of the refuge, high-clearance vehicles are required.

The requirement to obtain a permit for entry to the refuge may deter some visitors. On the visitors' survey, 59.1% indicated that the permit system was "important" or "very important" in contributing to recreation satisfaction and 51.8% were satisfied with the management of the permit system. Fifty-two percent stated that limits on the total number of visitors was "important" or "very important" to their recreation satisfaction, and 39.0% stated that the refuge was "good" or "outstanding" at providing limits. Although visitors may believe that the refuge limits visitation, in fact there are no limits. Difficult roads, hot summers, and remoteness may naturally limit the number of visitors at this time.

The fact that the refuge office is closed on Sunday may deter some visitors, especially those who make unplanned stops.

Limits on types of vehicles on refuge roads means that some potential refuge visitors may be denied access. Although this is a negative impact for those individuals, it may be offset by the fact that it will not be necessary for refuge staff to rescue unprepared motorists. Less vehicle traffic is a benefit to the wilderness character of the refuge, which is highly valued by many visitors. Traffic, vehicle noise, and high numbers of visitors are sometimes reported as negative experiences by wilderness users. These factors may also contribute to wildlife disturbance.

#### **2.2.4.2 Hunt Program**

Hunting is one of the big six uses of refuges and is allowed if it is determined to be compatible with refuge purposes. Hunting programs also have long been supported in wilderness areas within the United States. However, as times have changed, visitors to public lands and wilderness areas have also changed. Thus, the trend is more toward recreation and less towards hunting within these areas. Additionally, there is a degree of conflict between hunters and non-

hunters. Traditional users such as hunters may find the presence of others as threatening to successful hunting (Watson 2001, 64). On the other hand, non-hunters frequently value the scenic quality of seeing large, wild animals and can be negatively affected when encountering the realities of hunting (Watson 2001).

The social benefits of the current hunt program are that the program provides a high quality and unique hunting experience for those who obtain hunting permits. In addition to those who obtain permits or accompany permit holders on hunting and scouting trips, some non-governmental groups promote hunting and invest time and other resources in activities related to bighorn sheep conservation. Hunting may, then, have a positive social impact even if an individual does not have the opportunity to hunt. This may be considered in a parallel way to the concept of “existence values” of wilderness. To those who support hunting, the knowledge that hunting is available may provide a benefit, even if not every individual participates in that activity.

Not all members of the public believe that hunting in national wildlife refuges is an acceptable activity and question the wisdom of maintaining game for hunt purposes. Thus, the hunt program produces a negative effect for some (see Fund For Animals 2003).

#### **2.2.4.3 Leave-No-Trace Program**

The LNT program provides an opportunity for environmental education and interpretation, which are two recognized purposes of national wildlife refuges. Providing this training is of social value. Some researchers have noted that recreational impacts in wilderness areas have increased in recent decades despite efforts to educate the public about low-impact uses (Cole 1994). The refuge’s LNT program may prevent recreational impacts from damaging refuge resources.

#### **2.2.4.4 Environmental Education**

Environmental education is one of six wildlife dependent refuge activities defined by the U.S. Fish and Wildlife Service. Environmental education is another issue area where wilderness such as Cabeza Prieta NWR provides benefits. According to Loomis and Richardson (2001, 33), wilderness provides a natural laboratory for not only public and private schools, but also for organizations that help teenagers and adults develop life skills. Environmental education may increase individual awareness of the importance of protected areas.

#### **2.2.4.5 Interpretation**

Interpretation is one of six wildlife dependent activities designated by the U.S. Fish and Wildlife Service. Interpretation activities increase visitor understanding of the refuge. They also broaden the scope of the type of activities in which visitors may participate. Interpretation in the no-action alternative provides benefits to visitors who drive onto the refuge and to those who make shorter visits to less-remote areas of the refuge or to the visitor center.

#### **2.2.4.6 Camping**

The no-action alternative allows for the continuation of camping on the refuge, with some restrictions. Camping provides a benefit to refuge visitors by providing the opportunity to explore more remote areas of the refuge and experience wilderness solitude. Respondents to visitor surveys indicated that these are important experiences. Campers may cause resource damage and wildlife disturbance. To the extent that this occurs, camping may produce a negative social impact.

#### **2.2.4.7 Pack and Saddle Stock**

The no-action alternative allows continued use of pack and saddle stock, subject to limitations. The benefits accrue mainly to hunters, as it would be difficult to access hunting areas and remove hunted bighorn sheep without pack and saddle stock.

### **2.2.5 Goal: Cultural Resources Management**

This is addressed in Section 2.1.4.

## **2.3 ALTERNATIVE 2: MINIMUM INTERVENTION**

This alternative features an approach to refuge management that minimizes active intervention on ecological processes, particularly within the refuge wilderness areas. Other than management activities required for Sonoran pronghorn or other endangered species recovery, the refuge will not haul water in wilderness; develop new, or redevelop existing, wildlife waters; or otherwise attempt to support wildlife populations greater than those that refuge natural resources and precipitation support in the context of existing decimating factors. These factors include changes in native vegetation due to past over-grazing by domestic livestock, introduction of exotic plants and animal species, fragmentation of the habitats of wide ranging species and introduction of diseases from domestic livestock. Under this alternative, a projected 7771 visitor days would be anticipated. Of these, all would be for recreational use and none for hunting.

### **2.3.1 Goal: Wildlife and Habitat Management**

Protect, maintain, enhance and/or restore the diversity and abundance of wildlife species and ecological communities of the Sonoran Desert represented at Cabeza Prieta NWR.

#### **2.3.1.1 Endangered and Threatened Species**

In addition to the measures described in Section 2.1.1 above, Elements Common to All Alternatives, the following measure will be implemented.

##### **2.3.1.1.1 Sonoran Pronghorn Population Monitoring**

When weather and populations conditions permit radio collaring Sonoran pronghorn, any collaring operations will proceed only in non-wilderness areas. The social benefit of this practice is the possibility that radio collaring will assist with long term Sonoran pronghorn recovery efforts.

If limiting these activities to non-wilderness areas is less successful than the option radio collaring in both wilderness and non-wilderness, and populations continue to decline the social effect will be fewer opportunities for wildlife viewing and the potential to lose an endangered species.

Radio collaring may be perceived negatively by the public and animal rights groups. Part of this is the visual impact of seeing a radio collared animal and part is concern over capture myopathy. Other groups and individuals may not perceive radio collaring as a negative activity, and may believe the long term benefit of encouraging recovery of the Sonoran pronghorn outweighs the short term costs of radio collaring.

##### **2.3.1.1.2 Sonoran Pronghorn Developed Waters**

If photovoltaic sensors are installed fewer water hauling trips may be necessary. Because water hauling activities are likely to have a negative effect on visitor experiences, especially in wilderness areas, minimizing these trips would have a positive effect on visitor experiences.

Groups and individuals with concerns regarding adequate provision of water for Sonoran pronghorn would not be affected by this practice.

##### **2.3.1.1.3 Supplemental Feeding and Forage Enhancements for Sonoran Pronghorn**

Locating forage enhancement plots or supplemental feeding programs in non-wilderness areas would minimize impacts on visitors' wilderness experience.

Locating these programs in non-wilderness areas may result in some restrictions of visitor access. This may be partially offset by increased opportunities for wildlife viewing, both in the short-term (visitors may see wildlife congregated in feeding areas) and in the long-term (larger pronghorn populations may increase potential for wildlife viewing).

##### **2.3.1.2 Desert Bighorn Sheep**

Conservation of the desert bighorn sheep was central to the purpose of creation of Cabeza Prieta NWR. Sheep occupy all of the mountain ranges within the refuge.

##### **2.3.1.2.1 Developed Waters**

Removing developed waters in wilderness areas would provide the social benefit of diminishing signs of human intervention in these areas. This would benefit visitors or wilderness

advocates who find the developed waters a negative feature. If removal of these waters results in lower numbers of desert bighorn sheep, or causes harm to other species this would cause a negative impact to society and to specific groups or individuals with concerns about wildlife in Cabeza Prieta NWR.

The activities required to remove water tanks in wilderness would potentially harm visitors' wilderness experience if they were in a location when removal activities were underway.

Undocumented aliens who use developed waters as they traverse the refuge would also face potential harm.

#### **2.3.1.2.2 Population Goal**

A population goal of 100 to 200 would benefit those who believe that supplemental water provision supports an unnaturally high number of sheep.

This population goal would result in an end to the hunt program on the refuge. Hunting is a highly important activity for a small number of people each year. Elimination of the hunt would create a negative impact for hunters, or for potential hunters. Members of organized groups with an interest in desert bighorn sheep would also be negatively affected by a population goal of 100 to 200 sheep. For example, the mission of the Arizona Desert Bighorn Sheep Society is to "promote the management of bighorn sheep and increase their population in the state of Arizona" (Arizona Desert Bighorn Sheep Society 2003).

#### **2.3.1.3 Desert Ecosystem Integrity**

##### **2.3.1.3.1 Migratory Birds**

See Section 2.2.1.3.1.

##### **2.3.1.3.2 Reptiles and Amphibians**

See Section 2.2.1.3.2.

Limiting research activities could curtail the ability of managers to take necessary action to protect reptiles and amphibians. Loss of or damage to these resources is a potential negative social impact.

##### **2.3.1.3.3 Long-term Desert Integrity Monitoring**

See Section 2.2.1.3.4.

##### **2.3.1.3.4 Exotic/Invasive Species**

See Section 2.2.1.3.5.

Refuge staff will continue to record the location of exotic species infestations. Staff will continue to hand pull fountain grass where new infestations occur and remove trespass cattle, goats and burros.

### **2.3.2 Goal: Wilderness Stewardship**

Protect and conserve refuge wilderness employing strategies of wildlife and plant conservation that will maintain and restore the wilderness character of Cabeza Prieta NWR.

#### **2.3.2.1 Abandoned Vehicles**

See Section 2.2.2.1.

#### **2.3.2.2 Military Debris Removal**

See Section 2.2.2.2

#### **2.3.2.3 Border Law Enforcement**

2.3.2.4 See Section 2.1.3.2

#### **2.3.2.4 Administrative Trails**

See Section 2.2.3.3.

Closing some administrative trails will improve the wilderness experience and sense of solitude for some refuge visitors. Administrative trail closure may cause negative impacts associated with diminished ability to haul water or maintain water tanks.

#### **2.3.2.5 Wilderness Impact Monitoring**

In addition to the social impacts described in Section 2.1.3.3, this alternative provides the social benefit of documenting damage to wilderness resources from a variety of uses, both legal and illegal. If the ability to monitor these changes leads to management actions this will provide a social

benefit to those who value wilderness.

The addition of over flights to document impacts will cause minimal social impacts because the frequency is anticipated to be biennial. Few visitors will be affected by this practice.

#### **2.3.2.6 Childs Mountain Communications Site**

Removal of facilities from the Childs Mountain site would eliminate the negative visual impacts of the site. This would benefit those in wilderness areas within view of the communications site. If the facilities provide services to the public that are not replaceable, this will produce a negative social impact.

### **2.3.3 Goal: Visitor Services Management**

See Section 2.2.4

#### **2.3.3.1 Access Management**

See Section 2.2.4.1. Elimination of pack and saddle stock from all areas of the refuge would affect those who wish to ride horses in the refuge. The visitors' survey of 685 respondents included 4 who indicated that they rode horseback on the refuge, and none indicated that it was the most important reason for their visit. The effect of eliminating pack and saddle stock from the refuge would be negative for the few who participate but minimal overall. Because hunting is not allowed under this alternative, and most who use pack and saddle stock do so as part of a hunting trip, the effect of this action is likely to be minimal.

#### **2.3.3.2 Hunt Program**

Potential hunters would be negatively affected by this alternative because no hunting is allowed. Organized groups that support hunting would be negatively affected.

This alternative would provide a benefit to those opposed to hunting. It would also benefit those whose wilderness experiences are negatively affected by hunting activities.

#### **2.3.3.3 Leave-No-Trace Program**

See Section 2.2.4.3.

Requiring the leaders of organized groups to receive LNT training may reduce human impacts to refuge resources, thereby providing a social benefit.

#### **2.3.3.4 Environmental Education**

See Section 2.2.4.4.

#### **2.3.3.5 Interpretation**

See Section 2.2.4.5.

Keeping the visitors' center open seven days a week during the winter season will increase opportunities for interpretation, which is a recognized refuge purpose. It may also serve the purpose of increasing visitation as it offers the opportunity for visitors to receive permits every day of the week.

#### **2.3.3.6 Camping**

See Section 2.2.4.6.

This alternative decreases the number of developed campgrounds to one, from three. This may have the benefit of protecting refuge resources, including wildlife, because each campground leaves signs of human activity. This is considered a social benefit because protection of refuge resources has a value that extends beyond the individual refuge.

Because this alternative reduces the number of people or groups that may camp on the refuge at any given time, the potential negative impact is that people who wish to camp may be unable to do so. Visitors indicated that camping in the front-country and camping in the backcountry were somewhat important to their experience at the refuge. Reducing the total number of camping sites will reduce opportunities for wildlife observation and photography.

### **2.3.4 Goal: Cultural Resources Management**

See Section 2.1.4.

## **2.4 ALTERNATIVE 3: RESTRAINED INTERVENTION**

This alternative uses a limited amount of active management/habitat manipulation in wilderness. While a primary focus of this alternative is supporting wildlife populations primarily with naturally occurring precipitation and the forage it fosters, supplemental water will be provided to developed waters, as an infrequent measure during periods of drought. While not embracing aggressive manipulation of habitats and processes, this alternative includes support of wildlife populations through some maintenance of developed waters and hauling of supplemental water during dry periods. This alternative also favors increased habitat manipulation outside of wilderness.

Under this alternative, a total of 7856-8011 visitor days is expected. Of these, 7771 would be recreational and 85-240 would be for hunting.

### **2.4.1 Goal: Wildlife and Habitat Management**

Protect, maintain, enhance and/or restore the diversity and abundance of wildlife species and ecological communities of the Sonoran Desert represented at Cabeza Prieta NWR.

#### **2.4.1.1 Endangered and Threatened Species**

##### **2.4.1.1.1 Sonoran Pronghorn Developed Waters**

See Section 2.3.1.1.2

##### **2.4.1.1.2 Predator Studies**

This alternative will investigate predators on the refuge. The social benefit relates to the ability to determine the effect of coyote predation on Sonoran pronghorn populations. Because protecting endangered species has been determined to be a broad social benefit, the ability to understand the effects of predation on pronghorn populations is important.

Some individuals and non-governmental interest groups object to predator control. These individuals and groups will be negatively affected by predator control activities. Studies to determine public attitudes about predators and predator control have shown that the public's attitudes have shifted. Generally, attitudes towards predators were unfavorable prior to the 1970s but have become more favorable in the decades since then (Hewitt, 2001). Attitudes towards lethal methods of predator control are generally unfavorable (Andelt et al. 1999; Reiter et al. 1999). Messmer et al. (1999) conducted a survey of the general public and found that when survey questions about predator control were put in the context of a specific management objective, support for some types of predator control increased.

Some groups and individuals support predator hunts for the protection of other species, and for other reasons. A predator hunt would provide social benefits for these groups and individuals.

##### **2.4.1.1.3 Fencing**

As noted in Section 2.1.1.1, increasing pronghorn numbers by reducing mortality may increase the social value of the species because the potential for viewing these animals may increase. Other impacts of fencing are covered in Sections 2.1.1.3 and 2.1.1.1.3.

This alternative removes some barriers to wildlife movements and provides the social benefit of protecting an endangered species.

##### **2.4.1.1.4 Habitat Restoration Research**

This research could promote pronghorn survival by providing forage and conferring the social benefit of helping to protect an endangered species.

#### **2.4.1.2 Desert Bighorn Sheep**

Conservation of the desert bighorn sheep was central to the purpose of creation of Cabeza Prieta NWR. Sheep occupy all of the mountain ranges within the refuge.

##### **2.4.1.2.1 Developed Waters**

See Section 2.3.1.2.1.

The possibility of locating additional developed waters in non-wilderness areas may offset the removal of waters from wilderness areas. These additional waters could provide wildlife

viewing opportunities for visitors.

#### **2.4.1.2.2 Population Goal**

A population goal of 250-350 would benefit those who believe that supplemental water provision supports an unnaturally high number of sheep.

This population goal allows for limited hunting in non-drought years. Hunting is an important activity for a small number of people each year. During drought years potential hunters would be negatively affected by this alternative. Members of organized groups with an interest in desert bighorn sheep might be negatively affected by the population goal set forth in this alternative.

Visitors may have increased opportunities to view desert bighorn sheep if developed waters are more accessible than those in wilderness areas.

The number of desert bighorn sheep in this alternative is fewer than what the refuge may have supported in the past. Therefore, the potential negative social impact is conditioned by the fact that long term impacts to refuge resources makes it difficult to ascertain what conditions prevailed prior to human-caused changes.

#### **2.4.1.2.4 Predator Studies**

Predator studies may result in management actions to reduce desert bighorn sheep mortality. This provides a social benefit to potential hunters and to visitors who view wildlife. It also provides the broad social value of protecting an important refuge species. In addition, gaining knowledge about predators and predator-prey dynamics adds to the body of scientific knowledge, which is considered by the scientific community to be a social benefit. Additionally, these studies may confer the benefit of providing information for management decisions.

#### **2.4.1.3 Desert Ecosystem Integrity Monitoring**

##### **2.4.1.3.1 Migratory Birds**

See Section 2.2.1.3.1

##### **2.4.1.3.2 Reptiles and Amphibians**

See Section 2.3.1.3.2.

##### **2.4.1.3.3 Long-term Desert Integrity Monitoring**

See Section 2.2.1.3.4.

The additional monitoring activities in this alternative would provide social benefits by providing managers with data for decisions about protecting desert health. If the refuge utilizes the data produced in management activities, this provides a benefit to visitors to the refuge by helping to maintain refuge resources.

##### **2.4.1.3.4 Exotic/Invasive Species**

See Section 2.2.1.3.5.

This alternative allows for more aggressive exotic/invasive control and revegetation. Active management of invasive species provides a social benefit by conserving refuge resources and addressing the underlying aspects of habitat degradation.

#### **2.4.2 Goal: Wilderness Stewardship**

Protect and conserve refuge wilderness employing strategies of wildlife and plant conservation that will maintain and restore the wilderness character of Cabeza Prieta NWR.

##### **2.4.2.1 Minimum Requirements Analysis**

See Section 2.1.3.1.

##### **2.4.2.2 Abandoned Vehicles**

See Section 2.2.2.1.

Use of helicopters to remove abandoned vehicles provides the social benefit of removing a human caused disturbance to wilderness.

The social cost of this activity is the noise and visual intrusion of helicopters. Wilderness visitors highly value solitude and silence. Any impact to these wilderness qualities negatively affects wilderness recreationists.

### **2.4.2.3 Military Debris Removal**

See Section 2.2.2.2.

Removing tow darts would provide the social benefit of removing visual intrusions from the refuge. The social cost is connected to the human activity and noise required to accomplish these removals. Another potential social cost is related to wildlife impacts. If military debris removal disturbs wildlife, this creates a negative social impact because protection and preservation of wildlife is a primary refuge purpose.

### **2.4.2.4 Administrative Trails**

Closing some administrative trails will improve the wilderness experience and sense of solitude for some refuge visitors. Closures may also limit the ability of refuge managers to perform certain activities. If this limit results in damage to refuge resources, including refuge wildlife, a negative impact will occur.

### **2.4.2.5 Wilderness Impact Monitoring**

See Section 2.3.2.5.

This alternative includes a plan to study wilderness use and values. This will provide a positive social benefit. A large number of visitors to the refuge are attracted by the opportunity for wilderness solitude. Gaining a better understanding of how visitors respond to the wilderness character of the refuge, and how refuge visitors perceive human impacts, will help refuge managers to provide high quality wilderness experiences.

This action will cause a negative social effect to potential or current wilderness users if some refuge uses are restricted as a result of wilderness studies.

### **2.4.2.6 Border Law Enforcement**

See Section 2.1.3.2.

Providing training to border patrol agents on refuge resources may provide social benefits by leading to a decrease in border patrol impacts. Some visitors noted the impacts of border patrol, and future visitors may be more satisfied with visits to the refuge if border patrol activities were less intrusive.

### **2.4.2.7 Childs Mountain Communications Site**

See Section 2.3.2.6.

## **2.4.3 Goal: Visitor Services Management**

See Section 2.2.4.

### **2.4.3.1 Access Management**

See Section 2.3.3.1.

### **2.4.3.2 Hunt Program**

#### **2.4.3.2.1 Desert Bighorn Sheep**

See Section 2.2.4.2.

### **2.4.3.3 Leave-No-Trace Program**

See Section 2.3.3.3.

### **2.4.3.4 Environmental Education**

See Section 2.2.4.4.

### **2.4.3.5 Interpretation**

This alternative provides a greater volume of interpretive materials, increasing the value of this activity to visitors. The potential for a loop road would increase opportunities for visitors to view refuge resources and is anticipated to increase visitation. This would provide a social benefit to visitors who may have not visited the refuge in the past due to access issues. It could provide a social cost to refuge visitors who value solitude. If wildlife is negatively affected by the presence of an additional road and increased vehicular traffic this would cause a negative social impact.

**2.4.3.6 Camping**

See Section 2.3.3.6.

**2.4.4 Goal: Cultural Resources Management**

See Section 2.1.4.

## **2.5 ALTERNATIVE 4 (PROPOSED ALTERNATIVE): ACTIVE MANAGEMENT**

This alternative features an approach to refuge management focusing on supporting Sonoran pronghorn and desert bighorn sheep population numbers through maintenance and supply of developed waters. In the context of providing reliable water for desert bighorn sheep and Sonoran pronghorn, the refuge will continue to investigate and implement measures, including biological monitoring, to reduce and eventually eliminate the need to haul water in wilderness. Refuge visitation under this alternative is projected at 8496 visitor days. This includes 8656 recreational visitor days and 265 hunter visitor days.

### **2.5.1 Goal: Wildlife and Habitat Management**

Protect, maintain, enhance and/or restore the diversity and abundance of wildlife species and ecological communities of the Sonoran Desert represented at Cabeza Prieta NWR.

#### **2.5.1.1 Endangered and Threatened Species**

The refuge will continue to participate in recovery of endangered and threatened species as described above in Section 2.1.1 under Elements Common to All Alternatives, with the following additions.

##### **2.5.1.1.1 Sonoran Pronghorn Developed Waters**

For discussion of the social effects of developed waters, see Sections 2.1.1.1.2, 2.3.1.2.1, and 2.2.1.2.1.

Under this alternative, the refuge will implement a program of up grading existing developed waters in wilderness. This will have the short-term social cost of increasing human caused intrusions into wilderness areas. The sights and sounds of the construction activities may impinge on visitors' sense of solitude. The long term social benefit of upgrading the tanks and installing photovoltaic sensors is that trips to haul water may be less frequent, causing less intrusion into visitors' wilderness experience. If the appearance of tanks is modified to create less visual intrusion, this will confer a benefit by creating less visual disturbance to visitors in wilderness. If tanks support wildlife populations, those who value wildlife and wildlife-dependent activities will receive a net social benefit.

Weekly aerial reconnaissance to check water levels may disturb wilderness visitors.

##### **2.5.1.1.2 Predator Management**

**See Section 2.4.1.1.2.**

The benefit of predator management is that this form of control may promote the long term survival of Sonoran pronghorn. Individuals who value Sonoran pronghorn, or wildlife generally, may receive a benefit either by opportunities to view wildlife or by knowing that these opportunities are available.

One potential cost of predator management is that it may reduce wildlife viewing opportunities. Visitors may find it enjoyable to view predators. Reducing opportunities to view any kind of wildlife may decrease visitor satisfaction.

Some individuals and non-governmental interest groups object to predator control. These individuals and groups will be negatively affected by predator control activities.

##### **2.5.1.1.3 Lesser Long-nosed Bat**

See Section 2.1.1.

As described in Section 2.1.1., many visitors to the refuge are attracted by the presence of wildlife, and specifically by the knowledge that threatened or endangered species inhabit the refuge.

This alternative potentially offers a higher level of protection to bats and their maternity roosts than Alternatives 1-3, which provides the social benefit of endangered species protection. This alternative does not necessarily offer increased opportunities for wildlife viewing, and restricts access to maternity roosts. Thus, the benefit is in long term protection of the species rather than visitor observation of the lesser long nosed bat. The negative impact associated with retaining the roost is that the roost is a man-made structure. Evidence of human intervention in wilderness

areas may cause a negative social impact.

Some refuge visitors may be unable to use the bats' roost for protection from the elements under this alternative. This activity may be more likely to be engaged in by illegal visitors to the refuge. However, loss of shelter may cause human suffering, particularly during severe weather events.

#### **2.5.1.1.4 Cactus Ferruginous Pygmy-owl**

See Section 2.1.1.

#### **2.5.1.1.5 Desert Pupfish**

This activity will provide the social benefits of protecting an endangered species and contributing to the integrity of the Sonoran desert ecosystem.

A refugium for desert pupfish will create additional opportunities for environmental education and interpretation on the refuge. These are recognized purposes for wildlife refuges. Providing these opportunities for refuge visitors will create a social benefit.

#### **2.5.1.2 Desert Bighorn Sheep**

Conservation of the desert bighorn sheep was central to the purpose of creation of Cabeza Prieta NWR. Sheep occupy all of the mountain ranges within the refuge.

##### **2.5.1.2.1 Developed Waters**

Under this alternative, the refuge will implement a program of upgrading existing developed waters in wilderness. This will have the short-term social cost of increasing human caused intrusions into wilderness areas. The sights and sounds of the construction activities may impinge on visitors' sense of solitude. The long term social benefit of upgrading the tanks and installing photovoltaic sensors is that trips to haul water may be less frequent, causing less intrusion into visitors' wilderness experience. If the appearance of tanks is modified to create less visual intrusion, this will confer a benefit by creating less visual disturbance to visitors in wilderness.

Weekly aerial reconnaissance to check water levels may disturb wilderness visitors.

If developing new water sources enhances refuge wildlife, this will provide a social benefit to those who value wildlife. Wildlife dependent activities are essential activities in Cabeza Prieta NWR.

This alternative allows for consideration of development of new water sources, or cessation of water provision in some areas. This decision will be made based on species' response to water availability as determined by research. The decision may have no social effect, other than those noted above, because it will be based on the best available science to support bighorn sheep survival.

##### **2.5.1.2.2 Population Goal**

This population goal would provide the benefit of wildlife viewing opportunities for visitors, although at a lower level than would be expected in the absence of human impacts to refuge resources.

Hunting would be allowed at this population level at a slightly higher level than is currently allowed. This provides social benefits to hunters and groups that support hunting. Those opposed to hunting, as individuals or as members of organized groups, would be negatively affected by the hunting implications of this population goal.

##### **2.5.1.2.3 Predator Management**

The benefit of predator management is that this form of control may promote the higher numbers of desert bighorn sheep because of reduced predation by both coyotes and mountain lions.

A potential social benefit of the proposed research activities of this alternative is that it would increase the scientific knowledge of predators and predator-prey relationships. This can contribute to more effective scientifically based predator management actions.

One potential cost of predator management is that it may reduce wildlife viewing opportunities. Visitors may find it enjoyable to view predators. Reducing opportunities to view any kind of wildlife may decrease visitor satisfaction.

Some individuals and non-governmental interest groups object to predator control. These individuals and groups will be negatively affected by predator control activities. Others support

predator control. These groups and individuals will be positively affected by predator control activities.

### **2.5.1.3 Desert Ecosystem Integrity Monitoring**

#### **2.5.1.3.1 Migratory Birds**

See Section 2.2.1.3.1.

The actions under this alternative expand research and monitoring activities to include more species than those listed in the previous alternatives. An increase in these activities may result in better birding opportunities, thus increasing visitor satisfaction. Opportunities for interpretation and environmental education may be increased if the refuge provides research results to refuge visitors.

#### **2.5.1.3.2 Reptiles and Amphibians**

See Section 2.2.1.3.2.

The actions under this alternative expand research and monitoring activities to include more species than those listed in the previous alternatives. An increase in these activities may result in more opportunities to encounter reptiles and amphibians on the refuge, thus increasing visitor satisfaction. Opportunities for interpretation and environmental education may be increased if the refuge provides research results to refuge visitors in formats appropriate to the level of scientific/technical knowledge of visitors.

#### **2.5.1.3.3 Raptors and Ravens**

This alternative expands research and monitoring activities to include raptors and ravens. Opportunities for interpretation and environmental education may be increased if the refuge provides research results to refuge visitors.

Inventorying and monitoring raptors and ravens provides social benefits because these activities provide information to refuge managers that can help make refuge management decisions.

#### **2.5.1.3.4 Long-term Desert Integrity Monitoring**

See Section 2.4.1.3.3.

#### **2.5.1.3.5 Exotic/Invasive Species**

See Section 2.4.1.3.4.

Expanding an exotic/invasive strategy to include coordination with the Mexican government may be socially beneficial because a control program is likely to be more effective if areas beyond the refuge boundaries are included. Controlling invasive species confers the broad social benefit of restoring or enhancing desert ecosystem health.

#### **2.5.1.4 Mule Deer**

This program may lead to an increase in opportunities for wildlife viewing, and/or hunting if management actions follow the survey. Wildlife viewing is an important refuge activity, so increasing these opportunities may provide social benefits. Hunting will provide benefits to hunters and hunting groups, but will create a negative impact for those opposed to hunting.

Providing information about this species may provide opportunities for environmental education and interpretation.

### **2.5.2 Goal: Wilderness Stewardship**

Protect and conserve refuge wilderness employing strategies of wildlife and plant conservation that will maintain and restore the wilderness character of Cabeza Prieta NWR.

#### **2.5.2.1 Minimum Requirements Analysis**

See Section 2.4.2.1.

#### **2.5.2.2 Abandoned Vehicles**

See Section 2.4.2.2.

#### **2.5.2.3 Military Debris Removal**

See Section 2.4.2.3.

This alternative does not include refuge-developed standards to prioritize tow darts for removal. Potentially, this could mean that tow darts with a negative effect on visitor experience are not prioritized for removal.

#### **2.5.2.4 Administrative Trails**

See Section 2.4.4.

Concentrating backcountry hikers and campers on administrative trails will have positive and negative social impacts.

The positive social effect is that reducing physical impacts by concentrating human use in specified areas could help to preserve the wilderness character of areas outside of administrative trails.

The negative social effects are that some visitors seeking wilderness solitude may be less likely to find solitude if they follow the recommendations to hike and camp on administrative trails. Studies have shown an inverse relationship between perceived crowding in wilderness areas and visitor satisfaction, although individuals have differing thresholds for when they feel crowded. Additionally, perceptions of crowding are only one of several variables that affect visitor satisfaction with wilderness (Dawson and Watson 2000).

#### **2.5.2.5 Wilderness Impact Monitoring**

See Section 2.3.2.5.

#### **2.5.2.6 Childs Mountain Communications Site**

See Section 2.4.2.7.

### **2.5.3 Goal: Visitor Services Management**

Provide visitors with compatible, high quality wildlife-dependent recreational and educational experiences designed to foster better appreciation, understanding and protection of the plant, animal and wilderness resources of Cabeza Prieta NWR.

#### **2.5.3.1 Access Management**

See Section 2.4.3.1.

This alternative prohibits certain types of vehicles that are not expressly banned by other alternatives. The social value lies in protection of fragile desert resources, and prevention of additional types of noises from vehicle engines. Wilderness solitude is negatively affected by sounds of human-caused activities. The negative social effect is that owners of prohibited vehicles will be unable to access the refuge using these forms of transport.

#### **2.5.3.2 Hunt Program**

##### **2.5.3.2.1 Desert Bighorn Sheep**

See Sections 2.2.4.2 and 2.4.3.2.1.

##### **2.5.3.2.2 Mule Deer**

Hunting has both positive and negative social impacts, as described in Section 2.2.4.2. Allowing a mule deer hunt would amplify both the social benefits and the social costs because it would increase the number of hunters on the refuge. Depending on number of hunting tags and length of the season, expanding the hunt could negatively affect wilderness users' experiences because they may encounter hunters or hear sounds of hunting.

##### **2.5.3.2.4 Predator Hunts**

See Section 2.4.1.1.2 for a discussion of the public's perception of predator control activities. Predator hunting is a controversial issue across the country.

#### **2.5.3.3 Leave-No-Trace Program**

See Section 2.4.3.3.

#### **2.5.3.4 Environmental Education**

See Section 2.4.3.4.

#### **2.5.3.5 Interpretation**

See Section 2.2.4.5.

This alternative provides increased opportunities for interpretation from a variety of sources. The net social benefit is likely to include increased visitation, longer visits to the refuge due to increased opportunities in some of the less-remote areas of the refuge, and increased ability to learn about the refuge and refuge resources.

### **2.5.3.6 Camping**

See Sections 2.2.4.6 and 2.3.3.6.

This alternative allows wood burning in some campsites. The social value is that some campers find the campfire experience important to their outdoor experience.

### **2.5.3.7 Pack and Saddle Stock**

See Section 2.2.4.7.

## **2.5.4 Goal: Cultural Resources Management**

Protect, maintain and interpret cultural and historic resources on Cabeza Prieta NWR, in cooperation with Tribal governments and the State of Arizona to benefit present and future generations.

### **2.5.4.1 General Provisions**

The general provisions for achieving this goal are addressed as described above in Section 2.1.4 under Elements Common to All Alternatives.

### **2.5.4.2 Onsite Interpretation**

This action will increase opportunities for interpretation, a recognized recreational use for refuges. See Section 2.3.3.5 for a discussion of the value of interpretation. If interpretation of cultural resources is conducted with tribal authority and cooperation, harmful social effects to tribal members are more likely to be avoided.

### **2.5.4.3 Site Stabilization/Patrols**

Protecting cultural resources provides a social value to tribal members and others interested in maintaining these historically important places.

If stabilization activities are conducted with tribal authority and cooperation, harmful social effects to tribal members are more likely to be avoided.

### **2.5.4.4 Training**

This activity will increase protection of cultural resources, providing a social benefit to tribal members and others interested in preserving cultural resources in the face of border protection activities. This training may also reduce conflict between tribal members and government officials.

## **2.6 ALTERNATIVE 5: MAXIMUM EFFORT**

This alternative emphasizes active management aimed at increasing the size of the refuge desert bighorn sheep population and also enhancing the refuge visitor experience. An assumption basic to this alternative is that desert bighorn abundance was historically much greater in the region prior to habitat fragmentation, groundwater withdrawals, surface water diversion and the introduction of diseases carried by domestic livestock. In view of this assumption, a population goal established for desert bighorn sheep reflects the densities observed in the better stocked existing habitats in the region today. This density is considered a component of refuge wilderness character.

Under this alternative 8921 visitor days would be expected. Of these, 8656 would be recreational visitor days and 265 hunter visitor days. The increase in visitation would be anticipated because of increased hunting opportunities (big game and small game), increased interpretation in close proximity to the visitors' center, and increased access to the refuge due to road paving, and the ability of off road vehicles to use refuge roads.

### **2.6.1 Goal: Wildlife and Habitat Management**

Protect, maintain, enhance and/or restore the diversity and abundance of wildlife species and ecological communities of the Sonoran Desert represented at Cabeza Prieta NWR.

#### **2.6.1.1 Endangered and Threatened Species**

The refuge will continue to participate in recovery of endangered and threatened species as described above in Section 2.1.1 under Elements Common to All Alternatives, with the following additions.

##### **2.6.1.1.1 Sonoran Pronghorn Population Monitoring**

See Section 2.1.1.1.1. The increased number of population surveys may affect visitors' perceptions of wilderness solitude.

##### **2.6.1.1.2 Sonoran Pronghorn Developed Waters**

See Section 2.5.1.1.1.

The option of increasing the number of developed waters for Sonoran pronghorn could lead to increased population levels. Should this occur, wildlife viewing opportunities may increase. Other positive impacts would be the social value of contributing to the recovery of an endangered species.

The negative effects of this action would be the visual intrusion of water tanks and the visual and sound intrusion of water hauling activities.

##### **2.6.1.1.3 Forage Enhancement**

See Section 2.1.1.

##### **2.6.1.1.4 Predator Management**

See Section 2.5.1.1.2.

##### **2.6.1.1.5 Lesser Long-nosed Bat**

See Section 2.5.1.1.3.

##### **2.6.1.1.5 Cactus Ferruginous Pygmy-owl**

See Section 2.5.1.1.4.

##### **2.6.1.1.7 Desert Pupfish**

See Section 2.5.1.1.5.

#### **2.6.1.2 Desert Bighorn Sheep**

Conservation of the desert bighorn sheep was central to the purpose of creation of Cabeza Prieta NWR. Sheep occupy all of the mountain ranges within the refuge.

##### **2.6.1.2.1 Developed Waters**

See Section 2.5.1.2.1.

This alternative would provide additional waters for desert bighorn sheep. If this leads to increased desert bighorn sheep populations, and a corresponding increase in number of hunt permits, this would provide a benefit for hunters.

Visitor satisfaction with wildlife viewing activities may increase if the desert bighorn sheep

population increases.

Activities associated with water hauling and provision (noise and visual intrusion) could have a negative impact on visitor experience.

#### **2.6.1.2.2 Forage Enhancement**

If forage enhancement increases numbers of desert bighorn sheep, hunting opportunities may increase. Visitor satisfaction with wildlife viewing experiences may increase. The visual impacts of forage enhancement plots may be positive (visitors may learn about forage management) or negative (visitors may perceive that the plots intrude on their visual experience).

#### **2.6.1.2.3 Population Goal**

This population goal would provide the benefit of wildlife viewing opportunities for visitors at a higher frequency than the current conditions.

Hunting would be allowed at this population level. This provides social benefits to hunters and groups that support hunting. Those opposed to hunting, as individuals or as members of organized groups, would be negatively affected by the hunting implications of this population goal.

#### **2.6.1.2.4 Predator Management**

See Section 2.5.1.2.3.

This alternative adds the possibility of a public predator hunt if studies determine that predation is negatively affecting desert bighorn sheep populations. The benefit of this hunt could be the protective effect for desert bighorn sheep and the provision of hunting opportunities on the refuge. Those who support predator hunting would be positively affected by this alternative.

The negative effects would be related to public opposition to predator hunts. This opposition is fairly widespread around the United States and may be an issue if a public predator hunt is proposed for the refuge.

### **2.6.1.3 Desert Ecosystem Health**

#### **2.6.1.3.1 Migratory Birds**

See Section 2.5.1.3.1. This alternative includes species not considered in other alternatives. Social benefits may be slightly greater than those listed in Section 2.5.1.3.1.

#### **2.6.1.3.2 Raptors and Ravens**

See Section 2.5.1.3.3.

#### **2.6.1.3.3 Reptiles and Amphibians**

See Section 2.5.1.3.2.

#### **2.6.1.3.4 Long-term Desert Integrity Monitoring**

See Section 2.5.1.3.4.

A greatly increased scope of research on refuge resources will provide important information for managers. This has the long-term social value of increasing the knowledge base for management decisions. The short-term social cost is the expense and staff requirements for this effort. A potential social effect is the potential for intrusion on cultural resources. Large scale monitoring efforts could disturb cultural sites or could intrude on areas considered sacred to tribal members.

#### **2.6.1.3.5 Exotic/Invasive Species**

See Section 2.5.1.3.5.

### **2.6.1.4 Game Animals**

One social benefit of this activity is that it helps to establish hunt numbers, which can benefit hunters. Other, more diffuse benefits accrue because a population survey helps managers make better-informed decisions with increased levels of knowledge about refuge resources.

## **2.6.2 Goal: Wilderness Stewardship**

Protect and conserve refuge wilderness employing strategies of wildlife and plant conservation that will maintain and restore the wilderness character of Cabeza Prieta NWR.

### **2.6.2.1 Minimum Requirements Analysis**

See Section 2.1.3.1.

#### **2.6.2.2 Abandoned Vehicles**

See Section 2.2.2.1.

**2.6.2.3 Military Debris Removal**

See Section 2.2.3.3.

**2.6.2.4 Administrative Trails**

See Sections 2.2.3.3 and 2.5.2.4.

**2.6.2.5 Wilderness Impact Monitoring**

See Section 2.3.2.5.

**2.6.2.6 Childs Mountain Communications Site**

See Section 2.2.3.4.

**2.6.3 Goal: Visitor Services Management**

Provide visitors with compatible, high quality wildlife-dependent recreational and educational experiences designed to foster better appreciation, understanding and protection of the plant, animal and wilderness resources of Cabeza Prieta NWR.

**2.6.3.1 Access Management**

See Section 2.5.3.1.

This alternative would allow increased refuge access by a greater variety of types of vehicles. Projections show that recreational visitor-days under this alternative would increase by approximately 425 annually. The effect of allowing off road vehicles and motorcycles could be that more visitors would travel on refuge roads. This would be a benefit for these new users but could degrade the wilderness experience of others because of noise and increased density of visitors. Wildlife viewing opportunities could be affected if the noise of vehicles caused wildlife disturbances.

Allowing two wheel drive vehicles on a new road loop in the non-wilderness portion of the Childs Valley, and maintaining the Charlie Bell Road to a standard allowing use of ordinary passenger cars at low speed would also increase visitor numbers. This could allow more opportunities for refuge access but could impair some visitors' experiences because of noise and visual intrusion.

**2.6.3.2 Hunt Program**

**2.6.3.2.1 Desert Bighorn Sheep**

See Section 2.2.4.2.

**2.6.3.2.2 Mule Deer**

See Section 2.5.3.2.2.

**2.6.3.2.3 Small Game**

Allowing a small game hunt would likely increase visitation on the refuge. This would have both positive and negative impacts on the refuge and on visitor experiences, particularly wilderness experiences.

Society is divided on the issue of hunting, and some oppose hunting on refuges. Others support refuge hunting of small game and would be positively affected if this were allowed in Cabeza Prieta NWR.

**2.6.3.2.4 Predators**

See Section 2.5.3.2.4. Predator hunts are likely to increase visitation. Increasing visitation in a refuge that is primarily wilderness will affect visitor experiences.

**2.6.3.3 Leave-No-Trace Program**

See Section 2.5.2.5.3.3.

**2.6.3.4 Environmental Education** See Section 2.5.3.4.

**2.6.3.5 Interpretation**

See Section 2.5.3.5.

**2.6.3.6 Camping**

See Section 2.5.3.6.

Three primitive campsites would be added under this alternative. Because the impact of implementing this alternative is increased visitor numbers, more campsites would be necessary.

**2.6.3.7 Pack and Saddle Stock**

See Section 2.5.3.7.

**2.6.4 Goal: Cultural Resources Management**

Protect, maintain and interpret cultural and historic resources on Cabeza Prieta NWR, in cooperation with Tribal governments and the State of Arizona to benefit present and future generations.

**2.6.4.1 General Provisions**

This goal is addressed as described above in Section 2.1.4 under Elements Common to All Alternatives.

**2.6.4.2 Onsite Interpretation**

See Section 2.5.4.2.

**2.6.4.3 Site Stabilization/Patrols**

See Section 2.5.4.3.

**2.6.4.4 Inventory**

This action may increase the social benefits for the Tohono O'odham tribe by adding to tribal knowledge about locations of cultural sites. If the investigation is not conducted in accordance with tribal protocol and with tribal approval, this will create a negative impact for the tribe.

**2.6.4.5 Training**

See Section 2.5.4.4.

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# Appendix L: Regional Economic Effects of Current and Proposed Management Alternatives for Cabeza Prieta National Wildlife Refuge

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## Introduction

The National Wildlife Refuge System Improvement Act of 1997 requires all units of the National Wildlife Refuge System to be managed under a Comprehensive Conservation Plan (CCP). The CCP must describe the desired future conditions of a Refuge and provide long range guidance and management direction to achieve Refuge purposes. Cabeza Prieta National Wildlife Refuge (NWR), located in Arizona is in the process of developing a range of management goals, objectives, and strategies for the CCP. The CCP for Cabeza Prieta NWR must contain an analysis of expected effects associated with current and proposed Refuge management strategies.

The purpose of this study was to provide the economic analysis needed for the Cabeza Prieta NWR CCP by evaluating the regional economic impacts associated with the Cabeza Prieta NWR CCP management strategies. For Refuge CCP planning, an economic impact analysis describes how current (No Action Alternative) and proposed management activities (alternatives) affect the local economy. This type of analysis provides two critical pieces of information: 1) it illustrates a refuge's true value to the local community; and 2) it can help in determining whether local economic effects are or are not a real concern in choosing among management alternatives.

There are five alternatives evaluated in the CCP. Alternative 1, (No Action) describes the current management activities at the Refuge. These programs and activities would continue if none of the action alternatives (Alternatives 2 through 5) were adopted. Current management activities (Alternative 1) are focused on recovery of the endangered Sonoran pronghorn, maintaining the populations of desert bighorn sheep, monitoring nongame wildlife species, monitoring and controlling invasive species, protecting wilderness character, and providing visitors with quality wildlife-dependant recreational experiences that are compatible with the refuge purposes. Alternative 2 (minimum intervention) features an approach to Refuge management that minimizes active intervention on ecological processes, particularly within the Refuge wilderness areas. Alternative 3 (restrained intervention) focuses on providing a minimal level of active management intervention on natural processes at the Refuge. Alternative 4 (active management) emphasizes maintaining ecological integrity on the Refuge and protecting the Refuge's wilderness character. Alternative 5 (maximum effort) emphasizes active management aimed at increasing the size of the Refuge desert bighorn sheep population and also enhancing the Refuge visitor experience.

This report first provides a description of the local community and economy near the Refuge. An analysis of current and proposed management strategies that could affect the local economy is then presented. The Refuge management activities of economic concern in this analysis are Refuge personnel staffing and Refuge spending within the local community, and spending in the local community by Refuge visitors.

## Regional Economic Setting

Cabeza Prieta NWR is located in Yuma and Pima Counties in southwestern Arizona. The Mexican State of Sonora is located immediately south of the Refuge. Geographically, 60% of the refuge lies

in southeastern Yuma County while 40% lies in western Pima County. The refuge headquarters is located on the northern edge of the town of Ajo, in Pima County.

***Pima County*** - is situated in the central portion of southern Arizona, bordering Mexico to the south, Maricopa and Pinal Counties to the north, Santa Cruz and Cochise Counties to the east, and Yuma County to the west. Pima County covers 9,184 square miles, consisting of Tucson metropolitan center and scattered satellite communities in outlying areas. Most of Pima County's economic and population base is concentrated in eastern Pima County in the greater Tucson area. The San Xavier, Pascua Yaqui, and Tohono O'odham Nation lands together account for 42.1%, State lands 14.9%, public lands 29.2% and private lands 13.8% of Pima County's land base (Arizona Department of Commerce 2002).

By the 1950s, the rural and small town setting of Pima County had changed. Agriculture, ranching, and mining activities slowed considerably as educational, medical, and defense-funded research and manufacturing in metropolitan Tucson began to develop and expand (Arizona Department of Commerce 2002). Arizona's mild climate and relatively inexpensive cost of living also served to attract people to the area. Land development as a result of the influx of residents further changed and diversified the economic structure of the county.

Smaller rural communities in western Pima County near the refuge, including Ajo and Why, have developed a separate and distinct economic structure from eastern Pima County. Historically, western Pima County was heavily dependent on large-scale mining operations (Ajo Community Comprehensive Plan 2001). In recent years, however, the economy has been adversely affected by the loss of mining activities in the immediate area, and the collapse of the Gulf of California shrimp industry in Mexico. In an attempt to revive the sluggish economy, recreation and tourism have been increasingly marketed as replacements to lost industries (Ajo Community Comprehensive Plan 2001).

*Ajo* - The town of Ajo is located immediately to the east of the eastern boundary of the refuge with its major access road being Highway 85. Until the mid 1980's Ajo was historically heavily dependent on mining operations for economic stability. In 1984, Phelps Dodge shut down the mine and smelter operation due to a drastic reduction in the value of copper and labor dispute problems (Ajo Community Comprehensive Plan 2001). In order to replace lost mining employment and revenues, the town has marketed itself to retirees and tourists to capitalize on Ajo's mild winters and close proximity to Cabeza Prieta NWR and Organ Pipe Cactus National Monument. According to the Ajo Community Comprehensive Plan (2001), many residents feel the key to Ajo's survival lies in converting the town into a retirement community and tourist center.

***Yuma County*** - is situated in the southwestern corner of Arizona, bordering Mexico to the south, California to the west, La Paz County to the north, and Maricopa and Pima counties to the east. Yuma County covers 5,522 square miles of desert land accented by rugged mountains. The valley regions contain an abundance of arable land, irrigated with water from the Colorado River. Yuma County's economy is centered on its hot, dry climate, its location along the Colorado River, and its location midway between the metropolitan areas of southern Arizona and southern California. Agriculture, tourism, military and government are the County's principal industries (Arizona Department of Commerce 2002). Major communities near the Refuge include Yuma and Welton. Public lands account for 81.6%, State lands, 7.7%, Native American Nation lands 1.2%, and private land 10.5% of Yuma County's land base.

***The Tohono O'odham Nation*** - The Nation of the Tohono O'odham consists of four separate reservation lands. The largest, known as the Tohono O'odham reservation stretches 90 miles across Pima County, covering 2,773,357 acres and lies immediately to the east of the town of Ajo and the Refuge. Two principal economic activities on the Tohono O'odham Nation lands include

employment by federal, state, and tribal agencies, and cattle ranching and related activities. Growth in tourism, agricultural, retail/tourism, and utilities sectors are expected as tribal development plans are implemented (Arizona Department of Commerce 2002). Proposed development projects will also provide jobs in construction as new housing units, a shopping center, a gaming center, mining and chemical concerns, and several tourism facility projects are planned (Arizona Department of Commerce 2002). A gaming facility was constructed in 1999 for the Gu Vo district located in the western region of the nation's lands.

**Mexico** – The Mexican state of Sonora is located immediately south of the refuge. Northwestern Sonora is sparsely populated, with inhabitants located in small communities or scattered on many cooperative and private farms that cover the state. The northwestern part of Sonora immediately adjacent to Organ Pipe Cactus NM is included in the Municipio of Plutarco Elias Calles. The Municipio includes the town of Sonoyta approximately 2 miles south of Lukeville, near the United States border.

The ease of access between Puerto Penasco and Arizona (via State Route 85) creates a tight symbiotic relationship through the export of shrimp from Mexico to Phoenix and Tucson, and tourism in the Gulf of Mexico resulting from devaluation of the peso in 1980 (Arizona Department of Commerce 2002). In recent years, however, the shrimp industry has collapsed as a result of continuous over harvesting. Tourism businesses have suffered losses as inflation has countered low prices for goods and services that followed the peso's devaluation.

**Population, Employment, and Income**

*Population*

The 2000 Census estimated Pima County's population at 843,746 and Yuma County's population at 160,026 (Table 1). Sixteen percent of Arizona residents resided in Pima County while three percent resided in Yuma County (US Census Bureau). As shown in Table 1, both Pima and Yuma County experienced a population increase from 1990 to 2000 of 26.5% and 49.7% respectively, however, Yuma County experienced a higher increase than the 40% population increase for the State of Arizona (US Census Bureau).

Table 1. Regional and Local Population Estimates

	Population		
	1990	2000	% Change
Arizona	3,665,228	5,130,632	40.0%
Pima County	666,880	843,746	26.5%
Yuma County	106,895	160,026	49.7%
<i>Communities near Cabeza Prieta NWR</i>			
Ajo	2,919	3,705	26.9%
Tohono O'odham Reservation	18,730	10,787	-42.4%
Welton	1,066	1,829	71.6%
Yuma	54,923	77,515	41.1%

Source: US Census Bureau and Arizona Department of Economic Security

As shown in Table 1, of the local communities surrounding the Refuge, Welton experienced the largest population increase of 71.6% while the Tohono O'odham Nation experienced the only

population decrease of 42.4% from 1990 to 2000 (US Census Bureau). Subsequent to the closure of the mining operations in 1984, Ajo's population decreased by 56% from 5,189 to 2,919 from 1980 to 1990 (Arizona Department of Security 2001). Between 1990 and 2000, the population increased 26.9% as retirees have continued to move to Ajo (US Census Bureau). Since 1986, nearly 900 houses once owned by Phelps Dodge have been sold to new residents, mostly retirees (Arizona Department of Commerce, 2002).

Population composition percentages are presented in Table 2. In spite of the high proportion of non-native and non-Hispanic newcomers, the multicultural flavor of Pima and Yuma County still remains. According to the 2000 Census, 29% of Pima County and 50.5% of Yuma County's residents are of Hispanic or Latino origin, compared to the state average of 25.3% and the national average of 12.5% (Table 2).

Table 2. Population Composition for the Year 2000.

				<i>Communities near Cabeza Prieta NWR</i>			
	Arizona (%)	Pima County (%)	Yuma County (%)	Ajo (%)	Tohono O'odham Reservation (%)	Welton (%)	City of Yuma (%)
White	75.5	75.1	68.3	83.0	8.7	70.6	71.7
Black or African American	3.1	3.0	2.2	0.6	0.3	2.1	3.8
American Indian and Alaska Native	5.0	3.2	0.2	9.7	90.8	2.1	2.2
Asian	1.8	2.0	0.1	0.6	0.2	0.5	2.1
Native Hawaiian and Other Pacific Islander	0.1	0.1	0.0	0.2	0.2	0.4	0.3
Persons reporting some other race	11.6	13.3	23.6	10.8	0.9	27.2	23.9
Persons of Hispanic or Latino origin	25.3	29.3	50.5	37.6	7.1	40.7	45.7
White persons not of Hispanic/Latino origin	63.8	61.5	44.3	54.4	92.9	55.3	47.5

Source: US Census Bureau

*Employment and Income*

Employment status statistics for 2000 are presented in Table 3. In 2000, the 4.6% unemployment rate in Pima County was very close to the State average of 4.4% while the 6.1% unemployment rate for Yuma County was considerable higher than the State average (US Census Bureau). The Tohono O'odham Nation's 9.9% unemployment rate was more than triple the State average in 2000. According to the Arizona Department of Commerce (2001), additional Tohono O'odham Nation jobs are expected to result from new tribal development plans and construction activities on the reservation. Due to the large number of retired residents, 64.4% of Ajo's and 66.1% of Welton's population were not in the 2000 labor force (Table 3). In the city of Yuma, the Marine Corps Air Station and US Army Yuma Proving Grounds accounted for 5.4% of the 2000 labor force.

Table 3. Employment Status in 2000

	Communities near Cabeza Prieta NWR						
	Arizona (%)	Pima County (%)	Yuma County (%)	Ajo (%)	Tohono O'odham Reservation (%)	Welton (%)	Yuma City (%)
Population in labor force	62.9	61.8	59.1	35.6	41.2	33.9	59.6
Employed	57.6	56	47.3	32.2	31.3	29.5	49.3
Unemployed	4.4	4.6	6.1	3.3	9.9	4.4	4.9
Armed Forces	0.9	1.2	5.7	0.1	0	0	5.4
Not in labor force	37.1	38.2	40.9	64.4	58.8	66.1	40.4

Source: US Census Bureau

Employment occupation trends for 2000 are presented in Table 4. The 2000 employment occupational structure for Pima County closely matched the overall State occupational structure. In Yuma County, agricultural based employment accounts for a larger percent of employment as compared to Pima County and the State of Arizona (US Census Bureau). According to the Arizona Department of Commerce (2001), agriculture is a major economic factor in Yuma County and at the current rate of growth for Yuma-area agribusiness is expected to soon become a billion dollar industry.

Table 4. Regional and Local Employment Occupation for the Year 2000

	Communities near Cabeza Prieta NWR						
	Arizona (%)	Pima County (%)	Yuma County (%)	Ajo (%)	Tohono O'odham Reservation (%)	Welton (%)	Yuma City (%)
Management, professional, and related occupations	32.7	35	26.7	23.9	23.4	20.7	30.2
Service occupations	16.2	17.6	17.7	28.8	25.7	17.5	18.8
Sales and office occupations	28.5	27.1	26.4	25.5	24	26.9	28.7
Farming, fishing, and forestry occupations	0.6	0.2	6.3	0	1.2	9.2	2.5
Construction, extraction, and maintenance occupations	11	10.7	10.7	10	13.7	9	9.8
Production, transportation, and material moving occupations	10.9	9.4	12.2	11.8	12	16.8	10

Source: US Census Bureau

According to the Arizona Department of Commerce (2002), federal, state, and tribal agencies are the largest employers on the Tohono O'odham Nation, with cattle ranching forming the second most important employment source. The agricultural, retail-tourism, utilities, and construction sectors are expected to grow as tribal plans are implemented (Arizona Department of Commerce 2002).

In 1980, 60% of Ajo's population was employed by the Phelps Dodge Corporation (Arizona Department of Commerce, 2002). Following the closure of the mining operations in 1984, employment in Ajo decreased by more than sixty percent from a labor force of 1,902 to 751 workers

from 1980 to 1990. To accommodate the increasing demand in the retirement and tourist industries in Ajo, the services sector has accounted for a majority of the shift in the employment base (Arizona Department of Commerce 2002). In 1999, Ajo's principal employment was in the tourist, service and commercial sectors (Arizona Department of Commerce 2002).

The income and poverty status for 2000 is presented in Table 5. Per capita income is the mean income computed for every man, woman, and child in a geographic area (US Census Bureau). Individuals are classified as below poverty if their total income was less than the poverty threshold (US Census Bureau). In 2000, the US Census poverty threshold for an individual under 65 years old was set at \$8,667 (Table 5). In 2000, 46.4% of the Tohono O'odham Nation residents were classified as below poverty while the State average was 13.9%. In 2000, the Tohono O'odham per capita income was \$6,998, the State average was \$ 20,275 (Table 5). According to the US Census estimates, the Tohono O'odham Nation is severely impoverished.

Table 5. Regional and Local Income and Poverty Status for the Year 2000.

				<i>Communities near Cabeza Prieta NWR</i>			
	Arizona	Pima County	Yuma County	Ajo	Tohono O'odham Reservation	Welton	Yuma City
Per capita income	\$20,275	\$19,785	\$14,802	\$14,548	\$6,998	\$13,644	\$16,730
Percent of individuals below poverty level	13.9%	14.7%	19.2%	22.3%	46.4%	21.3%	14.7%

Source: US Census Bureau

Yuma County's 2000 per capita income of \$ 14,802 was well below Pima County's per capita income of \$19,785 and the State average of \$20, 275 (US Census Bureau). In 2000, Ajo's per capita income was \$5,237 lower than the per capita income of Pima County (Table 5). According to the Ajo Community Comprehensive Plan (2001), the lack of economic opportunities results in many young adults leaving Ajo after high school and many of those that stay are low skilled workers with little educational opportunities to advance their careers. This steady increase in services employment is generally reflected in lower paying jobs and lower household income.

Mexico - The community of Sonoyta Mexico, part of the Municipio of Plutarco Elias Calles, is located approximately 2 miles south of Lukeville, near the United States border. In 2000, the Municipio had a reported population of 11,278 and a population increase of 1.5% between 1990 and 2000 (INEGI 2002). Approximately 80% of the population is located in the urban area of Soynota, and the remaining population occupies the surrounding agricultural areas. In 1995, the economic structure of Sonoyta consisted of approximately 60% commercial and industrial services, 20% financial and other services. Tourism is a major component of the economic structure of the community; however, American visitors traveling to and from the Gulf areas contribute to only a part of tourism revenues received by the community. Of at least equal or greater importance than Sonoyta's tourist industry is the town's position along the major Mexican highway between the large population centers in Baja California and interior Mexico.

### **Modeling the Economic Impacts of Current and Proposed Management Activities**

Special interest groups and local residents are quick to criticize a change in refuge management especially if there is a perceived negative impact to the local economy. Having objective data on income and employment impacts often show that these economic fears are drastically overstated.

Quite often, these residents do not realize the extent of economic benefits a refuge provides to a local community. Spending associated with refuge recreational activities such as wildlife viewing and hunting can generate considerable tourism activity for the regional economy. Refuge personnel typically spend considerable amounts of money purchasing supplies in the local lumber and hardware stores, repairing equipment and purchasing fuel at the local service stations, as well as reside and spend their salaries in the local community.

For refuge CCP planning, an economic impact analysis describes how current (No Action Alternative) and proposed management activities affect the local economy. Economic impacts are typically measured in terms of number of jobs lost or gained, and the associated result on employment and income. Economic input-output models are commonly used to determine how economic sectors will and will not be affected by demographic, economic, and policy changes. This type of analysis provides two critical pieces of information: 1) it illustrates a refuge's true value to the local community; and 2) it can help in determining whether local economic effects are or are not a real concern in choosing among management alternatives.

The economic impacts of the management alternatives for Cabeza Prieta NWR were estimated using IMPLAN, a regional input-output modeling system developed by the USDA Forest Service (Minnesota IMPLAN Group 2002). IMPLAN is a computerized database and modeling system that provides a regional input-output analysis of economic activity in terms of 10 industrial groups involving as many as 528 sectors (Olson and Lindall, 1996). IMPLAN estimates for employment include both full time and part time workers which are measured in total jobs.

A region (and its economy) is usually defined as the area within 30 miles of a refuge. Cabeza Prieta NWR is located in Yuma and Pima Counties. Most of the local spending by refuge staff and visitors occurs within the town of Ajo, located in Pima County. Typically, IMPLAN models are built using county level data files, but zip code level files are also available. Most of Pima County's economic and population base is concentrated in eastern Pima County in the greater Tucson area. Smaller rural communities in western Pima County near the refuge, including Ajo, have developed a separate and distinct economic structure from eastern Pima County. Because the economic base of Pima County does not represent the local economic base surrounding the Refuge, the town of Ajo will serve as the main economic impact region for estimating the economic impacts associated with the management of Cabeza Prieta NWR. The year 2000 Ajo Zip Code level file and the state level IMPLAN data file were used in this study. The IMPLAN employment data estimates were comparable to the US Department of Commerce, Bureau of Economic Analysis, and Regional Economic Information System data at the 1 digit Standard Industrial Code level for the year 2000.

***Refuge Management Activities***

For the current conditions, (Alternative 1) staffing at the Refuge consists of twelve full time employees consisting of: one Project Leader; one Deputy Project Leader; two Wildlife Biologists; two Outdoor Recreation/Outreach personnel; three Law Enforcement Officers; two Maintenance Workers; and one Office Assistant. According to Refuge budgeting estimates for 2004, the current staff accounts for an annual payroll (including salaries and benefits) of \$832,837. In addition to providing salaries and benefits, the Refuge estimates goods and services purchases totaling \$415,200 for 2004, approximately 15% of which will be spent locally in the Ajo economy.

Table 6 shows the additional proposed staffing needs for Alternatives 2, 3, 4, and 5. Additional annual funding needed for the proposed personnel/staffing (including benefits) is anticipated to cost \$32,670 for Alternative 2, \$119,790 for Alternative 3, \$168,190 for Alternative 4, and \$264,990 for Alternative 5.

Table 6. Proposed Additional Staffing Needs for Alternatives 2, 3, 4, and 5.

Alternative 2	Outdoor Recreation Planner or Office Assistant GS-5/6
Alternative 3	Wildlife Biologist, GS-9 Maintenance Worker, WG-10
Alternative 4	Wildlife Biologist, GS-9 Maintenance Worker, WG-10 Law Enforcement Officer GS-9
Alternative 5	Wildlife Biologist, GS-9 Wildlife Biologist, GS-9 Maintenance Worker, WG-10 Law Enforcement Officer GS-9 Outdoor Recreation Planner GS-9

For Alt 2 (Min. Intervention), annual nonsalary expenditures are anticipated to be reduced by 10% as compared to Alternative 1. This reduction accounts for considerable decreases in refuge maintenance in the field, but an increase in operational hours at the visitor center. Annual nonsalary expenditures are anticipated to increase by 10% for Alt 3 (Restrained Intervention) to fund the additional sheep monitoring called for in this alternative. Annual nonsalary expenditures are anticipated to increase by 25% for Alt 4 (Proposed Alternative) to reflect an increased level of effort to construct improved water catchments and small increases in monitoring. For alternative 5 (Maximum Intervention), annual nonsalary expenditures are anticipated to be double the level of Alternative 1. This increase reflects considerable increases in desert bighorn sheep monitoring, development of new water catchments (beyond the improvements to existing catchments proposed in Alt 4), and road improvements to the Copper Canyon Loop.

For each alternative, it is assumed that approximately 15% of nonsalary expenditures will still be spent locally in the Ajo economy. Table 7 summarizes the anticipated annual nonsalary and salary expenditures by management alternative.

Table 7. Refuge Staffing and Budgeting Expenditures by Management Alternative

	Annual Expenditures by Alternative				
	Alt 1	Alt 2	Alt 3	Alt 4	Alt 5
<b>Salary</b>	\$832,837	\$865,507	\$952,627	\$1,001,027	\$1,097,827
<b>Non-salary</b>	\$415,200	\$373,680	\$456,720	\$519,000	\$830,400
<b>Total</b>	\$1,248,037	\$1,239,187	\$1,409,347	\$1,520,027	\$1,928,227

*Economic Impacts Associated with Refuge Management*

Because of the way industries interact in an economy, a change in the activity of one industry affects activity levels in several other industries. For example, an increase in funding could allow the Refuge to start new projects or hire additional staff members. This added revenue will directly flow to the businesses from which the Refuge purchases goods and services and to the new Refuge employees. As additional supplies are purchased or as new staff members spend their salaries within the community, local businesses will purchase extra labor and supplies to meet the increase in demand for additional services. The income and employment resulting from Refuge purchases and Refuge employees' spending of salaries locally represents the *direct* effects of Refuge management activities within Ajo. In order to increase supplies to local businesses, input suppliers must also increase their purchases of inputs from other industries. The income and employment resulting from these secondary purchases by input suppliers are the *indirect* effects of Refuge management activities within the county. The input supplier's new employees use their incomes to purchase goods and services. The resulting increased economic activity from new employee income is the *induced* effect of visitor spending. The sums of the direct, indirect and induced effects describe the total economic effect of Refuge management activities in Ajo.

Table 8 shows the economic impacts associated with current and proposed management staffing. IMPLAN estimates for employment include both full time and part time workers, which are measured in total jobs. The current level (Alternative 1) of Refuge personnel directly accounts for 12 jobs and \$547,805 in personal income in the Ajo economy. The associated indirect and induced effects generate an additional 3.5 jobs and \$96,264 in personal income throughout the Ajo economy for a total economic impact of 15.5 jobs and \$664,069 associated with the current level of Refuge personnel. Due to the increased staffing levels for Alternatives 2, 3, 4, and 5 (Table 8), the associated economic effects generate more jobs and income than Alternative 1. Discrepancies between the IMPLAN modeling results on the direct impacts of Refuge staffing and the proposed number of staff for each alternative (Table 6) are primarily attributable to the low wages associated with the proposed staffing needs relative to the average income of nonmilitary federal employees in Ajo.

Table 8. Impacts of Refuge Staffing Expenditures in the Ajo Economy

<b>Ajo Economy</b>	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
<b>Salary Impacts</b> <i>(excludes benefits)</i>					
<i>Direct Effects (Federal Government Sector)</i>					
Income (\$/year)	\$547,805	\$569,293	\$626,598	\$658,433	\$722,104
Jobs	12	12.6	13.8	14.5	15.9
<i>Indirect and Induced Effects (in Ajo Economy)</i>					
Income (\$/year)	\$96,264	\$100,071	\$110,144	\$115,740	\$126,932
Jobs	3.5	3.6	4	4.2	4.6
<b>Total Effects</b>					
<b>Income (\$/year)</b>	<b>\$644,069</b>	<b>\$669,364</b>	<b>\$736,742</b>	<b>\$774,173</b>	<b>\$849,036</b>
<b>Jobs</b>	<b>15.5</b>	<b>16.2</b>	<b>17.8</b>	<b>18.7</b>	<b>20.5</b>

Refuge personnel spend money purchasing supplies in the local lumber and hardware stores, repairing equipment and purchasing fuel at the local service stations. Table 9 shows the economic impacts associated with current and proposed management nonsalary spending in Ajo. For each alternative, it is assumed that 15% of the nonsalary expenditures reported in Table 7 are spent locally in the Ajo economy. The current level (Alternative 1) of Refuge nonsalary expenditures directly accounts for 1 job and \$27,924 in personal income. The associated indirect and induced effects generate an additional less than one half of a job (0.4) and \$11,511 in personal income throughout the Ajo economy for a total economic impact of 1.4 jobs and \$39,435 associated with the current level of Refuge nonsalary spending in the local economy. Because there is a 10% decrease in the nonsalary expenditures for Alternative 2, the associated economic effects generate slightly less jobs and income than Alternative 1. Due to the increased non-salary spending levels for Alternatives 3, 4, and 5 (Table 7), the associated economic effects generate more jobs and income than Alternative 1.

Table 9. Economic Impacts of Refuge Non Salary Expenditures in Ajo.

<b>Ajo Economy</b>	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
<b>Non Salary Impacts</b>					
<i>(15% of total non salary expenditures spent locally)</i>					
<b>Direct Effects</b> <i>(in General Merchandise and Auto Repair/Service Industries)</i>					
Income (\$/year)	\$27,924	\$25,132	\$30,716	\$34,905	\$55,848
Jobs	1.0	0.9	1.1	1.3	2.1
<b>Indirect and Induced Effects</b> <i>(in Ajo Economy)</i>					
Income (\$/year)	\$11,511	\$10,359	\$12,662	\$14,388	\$23,021
Jobs	0.4	0.3	0.4	0.5	0.7
<b>Total Effects</b>					
<b>Income (\$/year)</b>	<b>\$39,435</b>	<b>\$35,491</b>	<b>\$43,378</b>	<b>\$49,293</b>	<b>\$78,869</b>
<b>Jobs</b>	<b>1.4</b>	<b>1.2</b>	<b>1.5</b>	<b>1.8</b>	<b>2.8</b>

Table 10 presents the combined economic impacts associated with refuge staffing and non salary spending in Ajo. Refuge management activities currently generate 16.9 jobs and \$683,504 in personal income in Ajo and account for 0.88% of total income and 1.19% of total employment in Ajo. Because of increases in staffing, Alternatives 2, 3, 4, and 5 would generate more jobs and income than Alternative 1. However, even though more jobs and income are generated, the overall impact on the Ajo economy is not significant.

Table 10. Combined Refuge Staffing and Non Salary Expenditures in the Town of Ajo.

<b>Ajo Economy</b>	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
<b>Total Refuge Staffing and Budgeting Impacts</b> <i>(salary and non-salary)</i>					
<b>Direct Effects</b>					
Income (\$/year)	\$575,729	\$594,425	\$657,314	\$693,338	\$777,952
Jobs	13.0	13.5	14.9	15.8	18.0
<b>Indirect and Induced Effects</b> <i>(in Ajo Economy)</i>					
Income (\$/year)	\$107,775	\$110,430	\$122,806	\$130,128	\$149,953
Jobs	3.9	3.9	4.4	4.7	5.3
<b>Total Effects</b>					
<b>Income (\$/year)</b>	<b>\$683,504</b>	<b>\$704,855</b>	<b>\$780,120</b>	<b>\$823,466</b>	<b>\$927,905</b>
<b>Jobs</b>	<b>16.9</b>	<b>17.4</b>	<b>19.3</b>	<b>20.5</b>	<b>23.3</b>
<i>% of Total Ajo Income</i>	<i>0.88%</i>	<i>0.91%</i>	<i>1.00%</i>	<i>1.06%</i>	<i>1.19%</i>
<i>% of Total Ajo Employment</i>	<i>1.19%</i>	<i>1.22%</i>	<i>1.36%</i>	<i>1.44%</i>	<i>1.64%</i>

### Recreation Activities

Cabeza Prieta NWR offers visitors a variety of recreation and educational opportunities. The visitor center and short interpretive trail near the refuge office offers an introduction to the ecology of the Sonoran desert. For the well prepared, the Refuge offers plentiful hiking, photography, wildlife observation, and primitive camping opportunities. Over 90 percent of the refuge was designated as wilderness by the 1990 Arizona Wilderness Act. To help maintain the wilderness character of the Refuge, no vehicle traffic is allowed except on designated public use roads. A limited number of desert bighorn sheep hunting permits provide a few hunters a high quality desert wilderness hunting experience.

Spending associated with recreational and tourism activities can generate considerable economic benefits for the local and state economy. A tourist usually buys a wide range of goods and services while visiting an area. Major expenditure categories include lodging, food, supplies, and gasoline. The following analysis of spending by Cabeza Prieta NWR visitors will address: the impact of spending by non-local recreation visitors (those living outside of the Ajo area) on the Ajo economy; the impact of spending by non resident recreation visitors (those living outside of Arizona) on the larger statewide economy; and the impact of spending Refuge hunter visitors on the Ajo economy.

## Economic Impacts Associated with Visitor Spending

The economic impacts associated with spending by Refuge visitors are estimated by the following equation:

$$\text{Number of Refuge visitors} * \text{average spending} * \text{regional multiplier} = \text{Economic Impact}$$

For the purposes of this analysis, Cabeza Prieta NWR annual visitation estimates from the year 2001 were used as the base visitation estimates. Results from the 2002 visitor survey (Burkardt et. al. 2003) on visitor spending provide the average spending per visitor day. The IMPLAN modeling system was used to derive the multipliers that capture the secondary (indirect and induced) effects needed to determine the economic impacts of visitor spending.

Refuge visitation records account for visitors on a per day basis. In 2001, annual visitation consisted of 19,515 visitor days. A majority of these visits (11,709) were brief stops at the visitor center, 7,806 were recreation (wilderness area) visitor days and 240 were hunter visitor days. For the purposes of the visitor spending analysis, visitor center visitor days are not included because these brief visits are typically incidental or a spur of the moment stops by people passing through the Ajo area. Table 11 presents the current and anticipated average annual visitation for recreational and hunter visitation by management alternative.

Table 11. Anticipated Number of Visitor Days by Alternative

	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
Recreation Visits	7806	7771	7771	8231	8656
Big Game Hunting	240	0	85-240	265	265
<b>Total</b>	<b>8046</b>	<b>7771</b>	<b>7856-8011</b>	<b>8496</b>	<b>8921</b>

As shown in Table 11, for Alt 2 (Min. Intervention) no hunting would be allowed plus a small general decrease in recreation visitor days is anticipated as compared to Alternative 1. For Alt 3 (Restrained Intervention), no hunting during drought years plus a small general decrease in recreation visitor days is anticipated as well. Annual recreation and hunter visitor days are expected to increase for Alt 4 (Proposed Alternative) due to increased opening of the Childs Mountain overlook after the Sonoran pronghorn population is stabilized and increased hunting opportunities for mule deer and predators. For alternative 5 (Maximum Intervention), recreation and hunter visitor days are expected to include the same increases as Alternative 4 plus have a slightly higher increase in recreation visits. This increase is due to expanded public use opportunities including use of dead or downed wood, use of off-highway vehicles on the public access road as well as improvements to the Copper Canyon Loop road.

### *Local and Statewide Impacts of Recreation Visitor Spending*

The economic impacts of visitor spending will be estimated at the local (town of Ajo) and statewide level. To determine the local economic impacts of visitor spending in the Town of Ajo, only spending by persons living outside the local area is included in the analysis. The rationale for excluding local visitor spending is two fold. First, money flowing into Ajo from visitors living outside is considered new money injected into the Ajo economy. Second, if local residents visit Cabeza Prieta NWR more or less due to the management changes, they will correspondingly change their spending of their

money elsewhere in the Ajo area, resulting in no net change to the local economy. These are standard assumptions made in most regional economic analyses at the local level. For the statewide economic impact analysis, visitors were split between Arizona residents and visitors that did not reside in the State of Arizona (hereafter referred to as nonresidents). The rationale is the same as the local analysis split. When estimating the spending by visitors within the State of Arizona, spending by Arizona residents is not considered as being new money injected into the state economy. It is likely Arizona residents will spend their money else where in the state even if they decide to visit the Refuge less often due to management changes.

Results from the visitor survey (Burkardt et al. 2003) indicate that 21% of annual recreation visitors are local residents, 34% are non local Arizona residents, and 45% are nonresidents. Because only spending by recreation visitors living outside the Ajo area is included in the local impact analysis, the number of visitor days for each alternative reported in Table 11 was adjusted accordingly. For Alternative 1, the annual average of 6,167 non local visitor days was used as the non local visitation estimate for the local economic impact model and 3,513 nonresident visitor days was used as the nonresident visitation estimate for the statewide economic impact model.

Table 12 illustrates the visitor survey results (Burkardt et al. 2003) for average amount spent locally in Ajo and Yuma by non-local visitors and total spent within the State of Arizona by non resident visitors. Amounts of local spending in Ajo and Yuma are the average expenditures non-local visitors (living outside of Ajo and Yuma) reported spending in the local communities near the Refuge. Because the Refuge has entrances near Ajo and Yuma, the survey asked visitors to specify which town local purchases were primarily made in. Results from the visitor survey (Burkardt et al. 2003) show that 84% of local purchases were made in Ajo, 16% were made in Yuma. The amounts of spending in the State of Arizona are the summed expenditures that non resident visitors reported spending in the local area near the Refuge and the amount spent in rest of Arizona en route to the Refuge.

Table 12. Average Visitor Spending

	<b>Visitor Spending</b>	
	\$ per Group per Trip	\$ Per Person per Day
<b>Non-Local Spending in Ajo and Yuma</b>		
Gasoline/related automobile costs	50.55	5.67
Hotels	24.69	2.77
Camping	29.12	3.27
Restaurants	39.68	4.45
Grocery Stores	52.61	5.90
Supplies & Souvenirs	15.05	1.69
Other Expenses	21.16	2.37
<b>Total Spending</b>	<b>232.86</b>	<b>26.11</b>
<b>Nonresident Spending in Arizona</b>		
Gasoline/related automobile costs	120.71	13.54
Hotels	55.64	6.24
Camping	84.60	9.49
Restaurants	78.72	8.83
Grocery Stores	116.95	13.11
Supplies & Souvenirs	43.01	4.82
Rental Car	41.30	4.63
Other Expenses	50.30	5.64
<b>Total Spending</b>	<b>591.23</b>	<b>66.30</b>

Not every group had expenditures in every category, so the numbers reported in Table 12 represent an average across all visitors, including some who had no expenditure in that category. It should be noted that all expenditure categories asked in the survey were included in the regional economic analysis, not just the major categories shown in the table below. The average expenditures reported in each category were divided by the average number of persons in each group sharing the expenses (3.38 persons) and then divided by the average number of days (2.64) spent in the local area to determine the average spending per person per day. Table 12 shows that on average, non local visitors spent the most on grocery stores, gasoline, and restaurants in the local area near the Refuge. Nonresident visitors spend the most on gasoline, grocery stores, camping, and restaurants while in the state of Arizona.

*Local Economic Impacts*

The current level of Refuge recreational visitor days accounts for \$161,032 of spending annually by non-local visitors in the local communities near the Refuge (Ajo and Yuma). Because the local economic impact model only includes the town of Ajo and the survey results showed that 16% of the local spending occurred in Yuma, the economic impact analysis only accounted for 84% of the trip spending reported in Table 12 in order to accurately reflect the purchases made in the Ajo area. Therefore, the amount of visitor spending occurring in Ajo is approximately \$135,267 per year.

Table 13 shows the economic impacts associated with the expected levels of Refuge visitation by alternative for the town of Ajo. The table shows the direct impact, the indirect impact (e.g., the multiplier effect), and the summed total impact of income and jobs. The current level (Alternative 1) of Refuge visitation accounts for \$55,233 in personal income and 2.2 jobs which represents less than one quarter of one percent of total income and employment in the Ajo economy. Small decreases in associated visitor days for Alternatives 2 and 3 would decrease employment by 0.1 of a job and personal income by \$250 as compared to Alternative 1. Increases in visitation for Alternatives 4 (Proposed Alternative) and 5 would generate slightly more economic impacts than Alternative 1. However, because the economic impacts associated with current (Alternative 1) Refuge visitation represent such a small impact on the local economy, even a substantial change from the current visitation will only have minor economic impacts.

Table 13. Economic Impacts of Non Local Visitor Spending in the Town of Ajo.

<b>Ajo Economy</b>	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
<b>Direct Effects</b>					
Income (\$/year)	\$38,547	\$38,372	\$38,372	\$40,640	\$42,741
Jobs	1.7	1.6	1.6	1.7	1.8
<b>Indirect and Induced Effects</b>					
Income (\$/year)	\$16,686	\$16,611	\$16,611	\$17,593	\$18,502
Jobs	0.5	0.5	0.5	0.5	0.6
<b>Total Effects</b>					
<b>Income (\$/year)</b>	<b>\$55,233</b>	<b>\$54,983</b>	<b>\$54,983</b>	<b>\$58,233</b>	<b>\$61,243</b>
<b>Jobs</b>	<b>2.2</b>	<b>2.1</b>	<b>2.1</b>	<b>2.2</b>	<b>2.4</b>
<i>% Total Ajo Income</i>	<i>0.07%</i>	<i>0.07%</i>	<i>0.07%</i>	<i>0.07%</i>	<i>0.08%</i>
<i>% Total Ajo Employment</i>	<i>0.15%</i>	<i>0.15%</i>	<i>0.15%</i>	<i>0.15%</i>	<i>0.17%</i>

Table 14 provides a breakdown of the impact current (Alternative 1) Refuge non local visitation has on local Ajo employment industry. While there are a total of 2.2 jobs in Ajo that are directly and indirectly attributed to Refuge visitation, as Table 14 shows there is not one full job in any industry that is directly attributed to Refuge visitation. The largest employment impacts by non local Refuge visitors are for almost three fourths of a job in the eating & drinking industry job and one half of a job in the hotel industry.

Table 14. Impact of Current Refuge Visitation on Ajo Employment by Industry.

Industry	Direct Impact	Indirect & Induced Impact	Total Impact
Wholesale Trade	0.1	0.1	0.2
Food Stores	0.1	0.1	0.2
Automotive Dealers & Service Stations	0.1	0.0	0.1
Eating & Drinking	0.6	0.1	0.7
Miscellaneous Retail	0.1	0.0	0.1
Banking	0.0	0.1	0.1
Hotels and Lodging Places	0.4	0.0	0.5
Federal Government - Non-Military	0.1	0.0	0.1
State & Local Government - Education	0.0	0.1	0.1
State & Local Government - Non-Education	0.0	0.1	0.1
<b>Total Jobs</b>	<b>1.5</b>	<b>0.6</b>	<b>2.2</b>

*Statewide Economic Impacts*

The current level of Refuge recreational visitor days accounts for \$233,041 of regional spending annually by nonresident visitors in the State of Arizona. Regional spending includes all spending by nonresidents in the Ajo area and the amount spent in Arizona en route to the Ajo area but excludes spending by non local Arizona residents in the Ajo area. Table 15 shows the economic impacts associated with the expected levels of nonresident Refuge visitation by alternative for the state of Arizona. The table shows the direct impact, the indirect impact (e.g., the multiplier effect), and the summed total impact of income and jobs. Current Refuge nonresident visitation accounted for \$140,764 in personal income and 5 jobs in the state of Arizona, representing well less than one percent of total local income and employment. Because the economic impacts associated with current Refuge visitation represent such a trivial impact on the regional economy, even a substantial change from the current visitation will not have significant impacts.

Table 15. Economic Impacts of Nonresident Visitor Spending in the State of Arizona.

State of Arizona	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
<b>Direct Effects</b>					
Income (\$/year)	\$71,311	\$70,986	\$70,986	\$75,188	\$79,065
Jobs	2.9	2.9	2.9	3.1	3.2
<b>Indirect and Induced Effects</b>					
Income (\$/year)	\$69,453	\$69,137	\$69,137	\$73,228	\$77,005
Jobs	2.1	2.1	2.1	2.2	2.4
<b>Total Effects</b>					
<b>Income (\$/year)</b>	<b>\$140,764</b>	<b>\$140,123</b>	<b>\$140,123</b>	<b>\$148,416</b>	<b>\$156,070</b>
<b>Jobs</b>	<b>5.0</b>	<b>5.0</b>	<b>5.0</b>	<b>5.3</b>	<b>5.6</b>
<i>% Total State Income</i>	<i>0.0001%</i>	<i>0.0001%</i>	<i>0.0001%</i>	<i>0.0001%</i>	<i>0.0001%</i>
<i>% Total State Employment</i>	<i>0.0002%</i>	<i>0.0002%</i>	<i>0.0002%</i>	<i>0.0002%</i>	<i>0.0002%</i>

*Spending by Refuge Hunters*

The Refuge offers a very limited number of hunting permits for bighorn sheep. Nine respondents of the visitor survey (Burkardt et al. 2003) indicated that their visit to the Refuge was for hunting bighorn sheep. Table 16 illustrates the average amount spent locally in Ajo and Yuma by Refuge hunters. The average expenditures reported in each category were divided by the average number of persons in each group sharing the expenses (2.33 persons) and then divided by the average number of days (11 days) spent in the local area to determine the average spending per hunter per day. As for the town purchases are primarily made in, two of the nine hunters indicated Ajo was where they made purchases, two made purchases in Yuma, two made purchases in Tacna, and one primarily made purchases in Gila Bend. Because there are so few hunters (average 8 permits per year) and only two indicated spending money in Ajo, the total amount of spending by hunters in Ajo totals approximately \$1,035 per year. This amount is too small to calculate the economic impacts with the IMPLAN model. Only one hunter was a nonresident, therefore the regional economic impacts are too small to calculate as well.

Table 16. Hunter Spending

	<b>Hunter Spending</b>	
	\$ per Group per Trip	\$ Per Person per Day
<b>Non-Local Spending in Ajo and Yuma</b>		
Gasoline/related automobile costs	210.56	8.22
Hotels	22.24	0.87
Camping	1.21	0.04
Restaurants	31.01	1.21
Grocery Stores	106.13	4.14
Supplies	0.00	0.00
Hunting License	30.56	1.19
Taxidermy	111.11	4.34
Game Processing	22.02	0.87
Other Expenses	278.78	2.37
<b>Total Spending</b>	<b>813.62</b>	<b>23.25</b>

*Non Market Trip Values*

The wildlife and natural environments of the Sonoran Desert are of substantial value to visitors, hunters, and other individuals who value the idea that these resources are maintained in a viable state. Part of this value is reflected in the expenditures that Refuge visitors make for lodging, food, and other travel services. However, the main reason that visitors make the often long and expensive trip to this area is not primarily to eat in local restaurants or spend a night in a motel in Ajo. Visitors make these trips because the benefits of the trip exceed the dollar costs.

Benefit studies are concerned with the demand side of the tourism industry. Because visitors are charged only nominal or no fees for National Wildlife Refuge and National Park visits, trip values do not have market prices. The nonmarket value (values for items not exchanged in established markets) of visitor trips is measured by how much they would be willing to pay over and above the costs of the trip before they would choose to forego the trip (Loomis and Richardson, 2001). A recent summary of the economic values associated with wilderness areas by Loomis and Richardson (2001) determined the average net willingness to pay for visiting wilderness areas is \$40 per visitor day. In 2001, wilderness area visits to Cabeza Prieta National Wildlife Refuge totaled 7,806 visitor days. Thus the additional nonmarket value of Refuge recreation wilderness visits totals over \$312,000 annually.

*Passive Use Values*

The economic value of Cabeza Prieta National Wildlife Refuge resources is only partly measured by the demand for onsite use by visitors and hunters. Refuge lands preserve historic, cultural, and recreational resources for residents and visitors from around the world. The wilderness areas and habitat for the endangered Sonoran pronghorn provided by Cabeza Prieta National Wildlife Refuge are clearly a resource of national and even international significance. Many individuals value the idea that the wildlife and natural environments of the Sonoran Desert are being maintained in a viable state independent of whether they will actually themselves be able to visit the area. The value

of knowing the resource exists and is protected (existence value), having the opportunity for visits in the future (option value), and the motivation to provide the resource for future generations (bequest value) are often referred to as passive use values (Krutilla 1967).

Contingent Valuation (CV) surveys are often used to simulate what people would pay when a market does not exist (e.g. wilderness protection or wildlife preservation). A summary of the recent research on passive use values associated with wilderness areas by Loomis and Richardson (2001) estimated the average annual passive use value associated with wilderness areas is \$6.72 per acre of wilderness in the western United States. Cabeza Prieta National Wildlife Refuge comprises of approximately 803,413 acres of wilderness thereby yielding annual passive use values of over \$5.3 million.

The Sonoran pronghorn, an endangered species with international significance, ranges across the Sonoran desert in small, scattered bands. The Refuge has the lead role in Sonoran pronghorn recovery. While several CV studies have been conducted to measure the values associated with threatened and endangered species, no specific studies or welfare estimates exist for the Sonoran Pronghorn. Therefore, the passive use benefits associated with the Sonoran Pronghorn habitat protection on Refuge can not be measured. However, King et al. (1988) estimated an annual willingness to pay of \$12.36 for big horn sheep preservation by Arizona households. Given the international significance associated with the Sonoran Pronghorn, the associated passive use values would meet or exceed those associated with bighorn sheep preservation.

### **Summary and Conclusions**

Table 17 summarizes the direct and total economic impacts for all Refuge management activities by management alternative. Under current Refuge management (Alternative A), economic activity directly related to all Refuge operations generate an estimated 14.7 jobs and \$614,276 in the Town of Ajo. Including direct, indirect, and induced effects, all Refuge activities would account for 19.1 jobs and \$738,737 in personal income in Ajo. Current Refuge management activities account for 1.34% of total employment and 0.95% of total income in Ajo. Because of increases in staffing, Alternatives 2, 3, 4, and 5 would generate more jobs and income than Alternative 1. However, even though more jobs and income are generated, the overall impact on the Ajo economy is not significant.

Table 17. Economic Effects of Refuge Activities by Sector in the Ajo Economy.

<b>Sector and Type of Effect</b>	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
<b>Refuge Management</b>					
<i>Direct Effects</i>					
Personal Income (\$/year)	\$575,729	\$594,425	\$657,314	\$693,338	\$777,952
Employment (jobs)	13.0	13.5	14.9	15.8	18.0
<i>Total Effects</i>					
Personal Income (\$/year)	\$683,504	\$704,855	\$780,120	\$823,466	\$927,905
Employment (jobs)	16.9	17.4	19.3	20.5	23.3
<b>Recreation</b>					
<i>Direct Effects</i>					
Personal Income (\$/year)	\$38,547	\$38,372	\$38,372	\$40,640	\$42,741
Employment (jobs)	1.7	1.6	1.6	1.7	1.8
<i>Total Effects</i>					
Personal Income (\$/year)	\$55,233	\$54,983	\$54,983	\$58,233	\$61,243
Employment (jobs)	2.2	2.1	2.1	2.2	2.4
<b>Aggregate Effects</b>					
<i>Direct Effects</i>					
Personal Income (\$/year)	\$614,276	\$632,797	\$695,686	\$733,978	\$820,693
Employment (jobs)	14.7	15.1	16.5	17.5	19.8
<i>Total Effects</i>					
Personal Income (\$/year)	\$738,737	\$759,838	\$835,103	\$881,699	\$989,148
Employment (jobs)	19.1	19.5	21.4	22.7	25.7
<i>% of Total Ajo Income</i>	0.95%	0.98%	1.07%	1.13%	1.27%
<i>% of Total Ajo Employment</i>	1.34%	1.37%	1.51%	1.60%	1.81%

Table 18 summarizes the economic effects associated with management changes from Alternative A. All proposed alternatives will increase employment and personal income in the Town of Ajo primarily because of the proposed increases in staffing.

Table 18. Economic Effects Associated with Changing from Alternative 1.

<b>Sector and Type of Effect</b>	Alternative 2	Alternative 3	Alternative 4	Alternative 5
<b>Refuge Management</b>				
<i>Direct Effects</i>				
Personal Income (\$/year)	+ \$18,696	+ \$81,585	+ \$117,609	+ \$202,223
Employment (jobs)	+ 0.5	+ 1.9	+ 2.8	+ 5.0
<i>Total Effects</i>				
Personal Income (\$/year)	+ \$21,351	+ \$96,616	+ \$139,962	+ \$244,401
Employment (jobs)	+ 0.5	+ 2.4	+ 3.6	+ 6.4
<b>Recreation</b>				
<i>Direct Effects</i>				
Personal Income (\$/year)	-\$175	-\$175	+ \$2,093	+ \$4,194
Employment (jobs)	-0.1	-0.1	0	+ 0.1
<i>Total Effects</i>				
Personal Income (\$/year)	-\$250	-\$250	+ \$3,000	+ \$6,010
Employment (jobs)	-0.1	-0.1	+ 0	+ 0.2
<b>Aggregate Effects</b>				
<i>Direct Effects</i>				
Personal Income (\$/year)	+ \$18,521	+ \$81,410	+ \$119,702	+ \$206,417
Employment (jobs)	+ 0.4	+ 1.8	+ 2.8	+ 5.1
<i>Total Effects</i>				
Personal Income (\$/year)	+ \$21,101	+ \$96,366	+ \$142,962	+ \$250,411
Employment (jobs)	+ 0.4	+ 2.3	+ 3.6	+ 6.6

Although the economic impacts associated with current Refuge visitation are somewhat limited in terms of overall tourism activities in the area, Cabeza Prieta NWR plays an important part in the overall recreational opportunities and scenic open space that makes the Sonoran Desert a popular tourist destination. Any decrease in visitation associated with a change in Refuge management will not have a significant economic effect. An increase in the amount of time current visitors spend on the Refuge will increase the amount of daily spending that can be attributed to visiting the Refuge. An increase in both the length of stay on the Refuge (and in the Ajo economy) and the number of people visiting the Refuge could have a considerable impact on increasing the role Refuge visitors play in the Ajo economy.

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