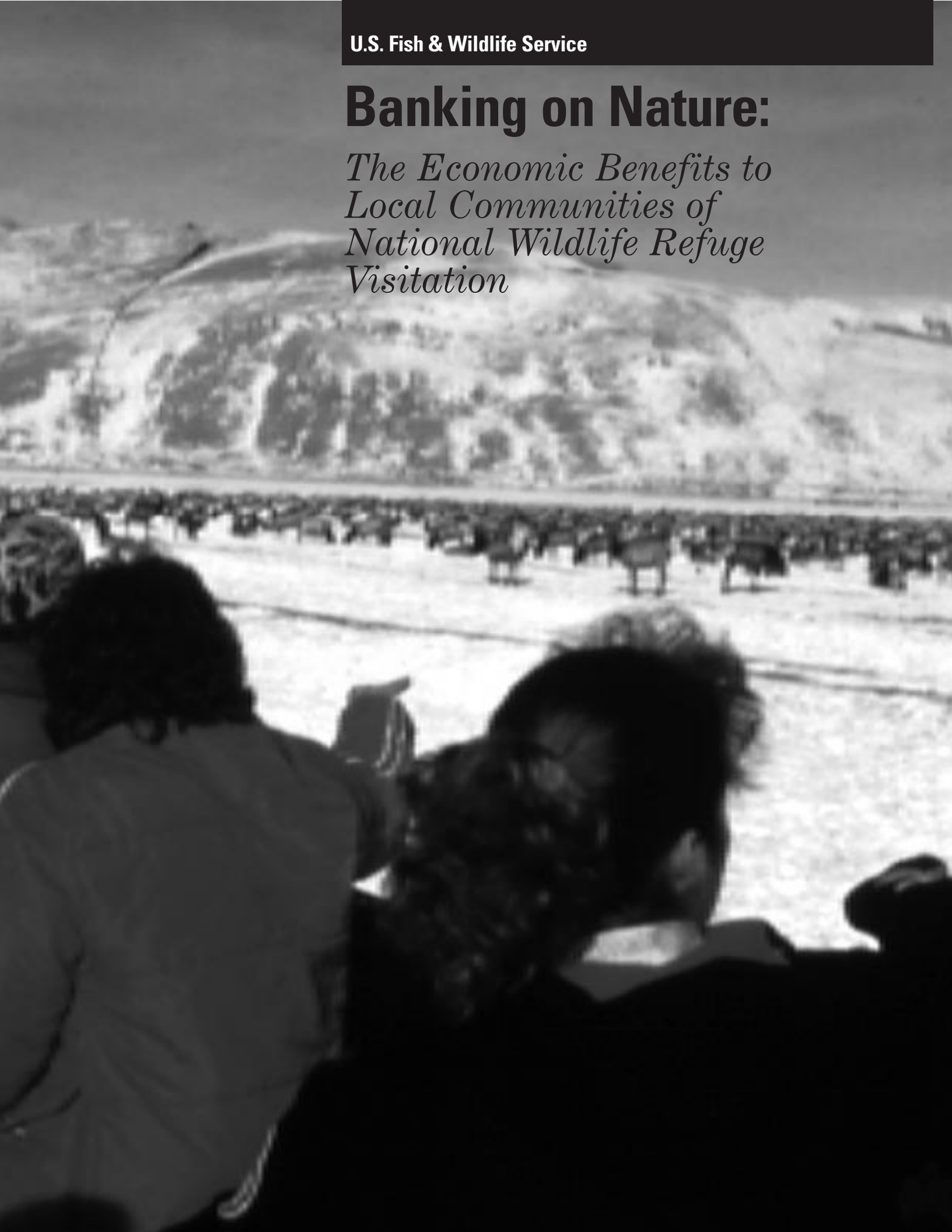
U.S. Fish & Wildlife Service

Banking on Nature:

The Economic Benefits to Local Communities of National Wildlife Refuge Visitation



"The mission of the National Wildlife Refuge System is to preserve a national network of lands and waters for the conservation and management of fish, wildlife and plant resources of the United States for the benefit of present and future generations."

Executive Order 12996
March, 1996

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The Economic Benefits to Local Communities of National Wildlife Refuge Visitation

"In a world where money talks, the environment needs value to give it a voice."

Frances Cairncross
Costing the Earth

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Banking on Nature: The Economic Benefits to Local Communities of National Wildlife Refuge Visitation

An enormous molten ball shoulders its way up over the edge of the sea, illuminating a golden pathway from the horizon to a lonely beach. The only witnesses are a young couple with an infant who have come to gaze in awe at a piece of the world that still looks much as it did 10,000 years ago. In a small pond behind the sand dunes, a great blue heron patiently stalks a small green frog. A mile inland, two waterfowlers tense in their thatched blind as a small band of surf scoters appear in the distance. And at the opposite end of the sprawling salt marsh, a group of students and teachers gather for a class on wetlands ecology.

National wildlife refuges enrich people in a great variety of ways. Some benefits are relatively easy to quantify—to attach a value to—and some are not. How much does that young couple value their beachfront sunrise? Or the duck hunters their excitement? Can a dollar figure—a price tag, if you will—be attached to people's dawning understanding of the marvelous workings of the natural world? What's it worth to maintain and preserve the habitat vital to the survival of the endangered jaguar, or any of the other endangered or threatened or migratory creatures nurtured by refuges?

In today's increasingly complex society, it is important to be able to discover and clearly express the economic values of things, even such things as human experiences and "existence values" that benefit society as a whole. For that reason, the U.S. Fish and Wildlife Service has initiated a multi-phase study to determine the impact of national wildlife refuges on their local economies.

Banking on Nature: The Economic Benefits to Local Communities of National Wildlife Refuge Visitation is the first installment of that broader study.

This report focuses on the income and employment effects recreational visitors to refuges have on the economies of local regions. In addition to the economic effects of refuge hunting and fishing programs in local communities, it measures the economic impact of "ecotourism," the relatively recent phenomenon of large numbers of people traveling substantial distances to take part in non-consumptive uses of the natural environment. Ecotourism is one way to derive economic benefits from the conservation of wildlife and habitat. Many refuges were established to protect waterfowl hunting opportunities, but as public interests have expanded beyond consuming wildlife to emphasize watching and photographing wildlife, the role of refuges has

National wildlife refuges enrich people in a great variety of ways.

A Great Blue heron patiently stalking its meal. ©Photodisc.

There are two elements in the value of any commodity: what you pay for it and the additional benefit you derive from it over and above what you pay for it.

also evolved. The economic effects of ecotourism are determined to assist refuge planning and to facilitate the interaction of refuges and local communities.

This report has four main sections. An Introduction details the study's overall rationale, outlines its economic concepts, and describes the methods and data sources used. The second section presents 15 sample refuge descriptions, highlighting the recreational activities enjoyed at each refuge, analyzing the regional economic factors involved, and putting the results of this analysis into perspective. A National View section discusses the overall results for the sample refuges and extrapolates them to a nationwide estimate. Finally, appendices provide background detail on the economic models used for the refuge estimates and the nationwide aggregation.

One way to understand the economics of national wildlife refuges is to ask the questions: "If a given refuge did not exist, what would the region's economy be like? What would life there be like?" The answers involve how people come to acquire things they need or want. For the purposes of this study, those needs/wants are recreational opportunities. There are two elements in the value of any commodity: what you pay for it and the additional benefit you derive from it over and above what you pay for it. Surveys show people are almost always willing to pay more for recreation than they actually spend. Economists call this additional value "consumer surplus."

Refuge visitors pay for recreation through entrance fees, lodging near the refuge, and purchases from local businesses for items to pursue their recreational experience. That spending generates economic activity throughout the local economy. Some of that money "leaks" out of the local area (thus called "leakage"), and some is recycled through the local economy (the "multiplier effect").

Spending by non-residents must be separated from spending by local refuge visitors. In this study, total visitor spending is evaluated to show its significance to the local economy.

There are two major sources for the information presented in this report: the Fish and Wildlife Service's National Survey of Fishing, Hunting, and Wildlife-Associated Recreation (NSFHWR), and the Division of Refuge's Refuge Management Information System (RMIS). Combining data from these sources allows the creation of a profile of refuge visitors' spending in local communities.

The NSFHWR, conducted every five years, asks detailed questions about recreational travel and expenses. Almost all of the visitation data in this study comes from RMIS information, which is reported by personnel at each refuge and varies with each refuge's unique situation. For example, there is only one entrance road into Chincoteague National Wildlife Refuge (NWR) in Virginia, so virtually everyone who enters can be counted. At other refuges, there are multiple access points, so a variety of methods must be used to estimate the number of visitors. Three common methods are car counts, foot counts, and parking-lot audits.

Information is also tallied on the time visitors spend on a given refuge (usually expressed in RVDs or recreation visitor days) and on the activities in which they

participate. Refuge officials estimate the average lengths of stay from the activities available and the typical behavior pattern of visitors.

The NSFHWR is the source of daily visitor expenditures, which were generated in four categories: food, lodging, transportation, and other (including guide fees, land-use fees, equipment rental, etc.). An input-output computer model called IMPLAN was used to generate the effect of visitors' spending on the local economy (for purposes of this study, a region is defined as the area within 30 miles of a refuge).

Daily expenditures were developed in the four categories for six activities, calculated for both residents and non-residents. Visitor days were factored in, and the total expenditures by category of spending for each activity were determined. Then these expenditures were allocated to industries. Food, for example, is allocated at 35 percent to restaurants and 65 percent to grocery stores for residents, and at 65 percent to restaurants and 35 percent to groceries for non-residents. IMPLAN then worked out the final effects of these expenditures on the local economies.

The 15 refuges selected for this study (Table 1) were not chosen randomly. They were selected to be representative of distinct, recognizable types so that people interested in a particular refuge could find a similar refuge in the study and apply its findings to his or her own favorite.

Of more than 500 national wildlife refuges, 369 allow visitors. This group was evaluated based on five variables:

1. Number of visitor days
2. Number of visitor days to the visitor center
3. Number of visitor days using nature trails
4. Number of hunting days for all game species on the refuge
5. Number of freshwater fishing days

The 15 refuges selected for this study were not chosen randomly.

Table 1. Study Sites for Economic Benefits of Refuges

Name	*Cluster*	*FY 1995 Visits # in thousands*
Chincoteague, VA	High Use - Visitor Center/Non-Consumptive	1,384
National Elk Refuge, WY	High Use - Visitor Center/Non-Consumptive	661
Crab Orchard, IL	High Use - Fishing	839
Eufaula, AL	High Use - Fishing	245
Charles M. Russell, MT	High Use - Hunting	111
Umatilla, OR	Medium Use - Hunting	56
Quivira, KS	Medium Use - Hunting	38
Mattamuskeet, NC	Medium Use - Fishing	137
Upper Souris, ND	Medium Use - Fishing	47
San Francisco Bay, CA	Medium Use - Non-consumptive	281
Laguna Atascosa, TX	Medium Use - Non-consumptive	107
Horicon, WI	More Than 50,000 Visitation	134
Las Vegas, NM	More Than 50,000 Visitation	70
Tule Lake, CA	More Than 50,000 Visitation	197
Tensas River, LA	Low Visitation	18

This report spotlights each of the sample refuges, detailing its physical landscape, main mission, wildlife, uses, and activity levels.

A technique called cluster analysis was applied, aimed at sorting out groups of refuges with recognizably similar characteristics. Those refuges with unusual features or intractable measurement problems were excluded. Table 1 shows the sample refuges and their use categories. The results of the analysis of these 15 refuges are expanded to the other refuges in the same cluster to develop national estimates.

This report spotlights each of the sample refuges, detailing its physical landscape, main mission, wildlife, uses, and activity levels. The economy of the local surrounding area is evaluated in such categories as population growth, major industries, and per-capita income. A Regional Economic Analysis section presents findings of 1) Visitor Recreation-Related Expenditures, 2) Economic Effects Associated with Refuge Visitation, and 3) Summary of Economic Effects of Refuge Visitation.

The economic analysis of the 15 sample refuges facilitates a look at the big picture: an estimate of the national impact of wildlife refuges on their regional economies. The process used to progress from 15 individual refuges to their national implications is called "regression analysis." It is a statistical procedure that finds relationships among characteristics of data points. In any group of people, for example, there is a relationship between their height and their weight. If you know someone's height, you can use a regression equation to estimate or predict his weight. Using the 15 refuges as data points, and factoring in visitation information, refuge location, etc., regression analysis yields an equation that predicts total final demand for all goods, employment income, and jobs generated by visits to each refuge. It is obvious that many variables affect a refuge's economic impact on its region. Some relate to the refuge and its public-use program, others to the economy of the region. This report's National View section reviews the detailed refuge case studies to highlight the differences among the sample refuges. Table 48, for example, shows the role played by time spent on a refuge, activities enjoyed, and residence of the visitors. The National Elk Refuge is on a heavily traveled tourist route between Jackson Hole and Yellowstone National Park in Wyoming. Non-consumptive use is very high—many visitors make a short stop to take a break from the drive—but time spent is short and economic results small.

On the Charles M. Russell NWR, activities are the key. Though it gets only about one-sixth the number of visitors of the National Elk Refuge, its visitors are primarily long-stay hunters and anglers who produce more than twice the economic activity.

Table 50 shows the sample refuges' net economic values, reflecting the total value people place on the use of a refuge, over and above what they actually pay for that use. The figures are arrived at by multiplying the RVDs (recreation visitor days) spent in each activity by the average amount that people in each refuge's state said they would be willing to pay to continue to participate in that activity. The National View section concludes by taking a look at how the findings for the 15 sample refuges apply to six of seven U.S. Fish and Wildlife Service geographical regions (Alaska is the subject of a separate study). For example, Region 4, the Southeastern U.S., had the most visits in FY 1995 and was

responsible for generating the highest number of jobs. It contains popular refuges such as Pea Island, Ding Darling, and Okefenokee. High non-consumptive and hunting use imply high "final demand" (total spending by final consumers on all goods) per visitor and thus large numbers of jobs and high job income. In Regions 3 and 4, the Midwest and Southeast, almost one-third of the "consumer surplus"—the value people place on their experience above what they paid for it—came from fishing.

So, in the final analysis, how important is wildlife refuge-based recreation in the mix of federal outdoor opportunities? Here are some of this study's findings:

• *Recreational visits to national wildlife refuges generate substantial economic activity.* In FY 1995, people visited refuges more than *27.7 million times* for recreation and environmental education. Their spending generated *$401.1 million of sales in regional economies.* As this spending flowed through the economy, *more than 10,000 people were employed and $162.9 million in employment income was generated.*

• In some areas, *refuge visitors are major stimuli to the local economy.* Visitors to Chincoteague National Wildlife Refuge, for example, generate almost 3 percent of Accomack County, Virginia's earned income. Within the Chincoteague zip code, more than one-third of the jobs are attributable to refuge visitation.

• *Non-consumptive use of wildlife at refuges generated far more economic activity than hunting and fishing.* Although non-consumptive wildlife users usually stay for shorter periods of time and spend less, their numbers at many refuges far exceed those of hunters and anglers and more than compensate for lower spending per person.

• Surveys show refuge visitors would have been willing to pay more for their visit than it actually cost them. The difference between what they were willing to pay and what they actually paid is their net economic value or "consumer surplus." *Visitors enjoyed a consumer surplus of more than $372.5 million in FY 1995.* Over $245 million of this amount accrued to non-consumptive visitors.

The above results include only refuge visitation in the contiguous United States. The case-study results were expanded to encompass the Refuge System in 48 states. Spending and employment by the refuges themselves, payments in lieu of taxes, commercial activities on refuges, and many other economic effects of refuges on local economies were not considered.

Banking on Nature is the first of a multi-volume study. Future reports will examine direct Refuge System economic contributions to local communities, including spending from construction and employment by Refuge System units, payments in lieu of taxes, commercial activities, and effects on local land values.

Non-consumptive use of wildlife at refuges generated far more economic activity than hunting and fishing.

Introduction

National wildlife refuges provide many services to people. A complete economic analysis of the refuge system would include not only the value of all the forms of recreation enjoyed but also the payrolls of refuge employees and the values of maintaining endangered species, preserving wetlands, educating future generations, and adding stability to our ecosystem. All of these services are of value to society, whether or not they result in some form of market transaction. To understand the economics of refuges, we need to ask not only "What would a region's economy be like if the refuge did not exist?" but also "What would *life* be like if the refuge did not exist?"

That last question points up many often-ignored aspects of wildlife refuges. As land preserved either in its natural state or intensively managed to simulate "natural" habitats, a refuge provides services to the ecosystem of which it is a part. Wetlands slow runoff and allow silt to settle. Trees provide nesting and roosting sites for birds. Many refuges maintain habitat critical for the survival of endangered species whose ultimate value to society is unknown. An economic value may be placed on these ecosystem services by considering the cost of providing substitutes for them, such as building diversion dams, artificial settling ponds, and nest sites. However, such an approach can provide only a partial value assessment because it does not take into account the value people place on the ecosystem in its natural state. Endangered species are especially valued because of the possibility of their permanent loss. Some people gain value simply from knowing that wild places and unique species still exist. These "existence values" are very hard to measure empirically.

This report focuses on only one of the values generated by national wildlife refuges: how recreational visitors impact local income and employment. Travel to participate in non-consumptive uses of the natural environment has been called "ecotourism." It has been promoted as a way to derive economic benefits from the

Some people gain value simply from knowing that wild places and unique species still exist. These "existence values" are very hard to measure empirically.

Birders. Ted Heuer/USFWS.

Almost always, respondents are willing to pay more than they are currently paying for recreational opportunities.

preservation of wildlife and habitat. Many refuges were established to protect waterfowl-hunting opportunities. But as public interest expands beyond consuming wildlife to include preserving it in the wild, the role of refuges must also expand. Ecotourism broadens the mission of refuges.

Because natural sites are drawing more and more tourists, there has been a growing interest in quantifying their impact. Such information can help in refuge planning and decision-making, and facilitate the interaction of refuges and local communities. However, refuge benefits other than recreation may be larger and more relevant to the refuges' mission. It would be a mistake, for example, to increase recreational opportunities at a refuge at the expense of resource preservation goals just because the added benefits could be measured by the methods used here. This analysis should be seen as only the first part of a much larger study that will encompass all the benefits outlined above.

This part of the larger study analyzes the visitation records of 15 sample refuges around the country to develop estimates of the economic role that refuge visitors play in regional economies. The sample refuges are also used to estimate the impact of refuge visitors on regional economies nationwide. Readers interested in a particular refuge not among the samples should be able to find one of these 15 case studies that is comparable to their favorite.

The next section of this Introduction explains some of the economic theory behind benefit estimation and regional impact analysis. The concepts of consumer surplus, household production, leakage, and multipliers are addressed in plain English. And a Glossary makes it easy to double-check the meanings of economic terms used throughout this report.

The following section of the Introduction explains the details of how data was collected for this study. It covers selection of sample refuges, gathering of visitation information, data cleaning, and expenditure estimation.

The last section tells how the data is combined to generate estimates of economic activity. The assumptions and limitations of the results are emphasized.

Following the Introduction are 15 Sample Refuge Descriptions, highlighting the activities enjoyed at each one, analyzing the regional economic factors involved, and putting the results of this analysis into perspective.

The report's final section, titled National View, describes how the results for the sample refuges may be used to estimate nationwide effects from refuge visitation and discusses the nationwide estimates.

Technical appendices are available that provide background detail on the economic models used for the refuge estimates and the nationwide aggregation.

Recreational Economics

Recreation as a good

Economics is about the distribution of resources. How do people come to acquire the things they need or want? Be it a Chinese dinner or a new species for their life list of birds, anything people desire can be characterized economically and a value placed on it. By knowing the "economic cost and value" of things, we can compare individuals' choices in one area with their

choices in another. Knowing the cost of a home-cooked meal may tell us something about how to price restaurant meals or grocery items that make food preparation easier. Knowing how much people spend on home-cooked meals also tells us about choices in the community. What will people do if food prices rise? If restaurants must pay the minimum wage, what will happen to meal prices and how high can they rise before people will eat at home? It might be interesting to know the amount of economic activity in a community generated by home cooking. The same can be said about bigger things—wildlife refuge recreation, for example.

There are two components to the value of any commodity—what you pay for it and the additional benefit you derive from it over and above what you paid for it. If there were no additional benefit, you would not buy it since you could spend your money on an alternative good that would give some additional benefit. Surveys of the general population bear this out: Almost always, respondents are willing to pay more than they are currently paying for recreational opportunities. Economists call the additional benefit "Consumer Surplus" (or "Net Economic Value") and illustrate it with an individual's demand curve, as shown in Figure 1. The curve shows the price a person would pay for an additional unit of a given good. The person would be willing to pay price R for the first unit of the commodity. Once he had one unit, he would probably be *willing* to pay somewhat less for the second unit, even less for the third, etc. If he were able to actually buy the good at price P, the person would save the amount R-P—the difference between what he'd have been willing to pay and what he actually paid for the first unit. R-P is his consumer surplus for the first unit. Figure 1 shows that at price P, the person would buy 4 units of this good, and would have to pay 4 times P dollars. P times 4 is the area of rectangle A. The commodity's benefit that the person *does not pay for* is represented by stepped triangle C. Triangle C is the total consumer surplus for this good.

The ultimate good consumed is produced by individuals combining their time with purchased inputs to produce something else. A home-cooked meal, for example, requires food bought at the grocery store, gas for the stove, kitchen space, and the time of the homemaker. The "economic cost" of the meal includes all of these inputs to its production. This is called the household production approach. To find the total cost of a meal, an economist must add up the price times the quantity of each input. For inputs that are not traded in markets, such as the homemaker's time, prices are not available. Prices paid for similar inputs, like a hired maid, may be substituted, or the price for the next best use of the unpriced input (the opportunity cost), like the wage the homemaker could have earned outside the home, can be used to approximate the unknown price.

Recreation is a special kind of good. Recreationists at a refuge pay for their recreation not only in entrance fees but in the costs of traveling and staying near the refuge and taking time away from other activities. In Figure 1, all of the recreationist's costs to obtain recreation compose rectangle A. His recreational enjoyment that is over and above what he pays is triangle C, his consumer surplus.

Time is an unusual good. Spending it, outside of paid work, does not result in a flow of money from one

Recreationists at a refuge pay for their recreation not only in entrance fees but in the costs of traveling and staying near the refuge and taking time away from other activities.

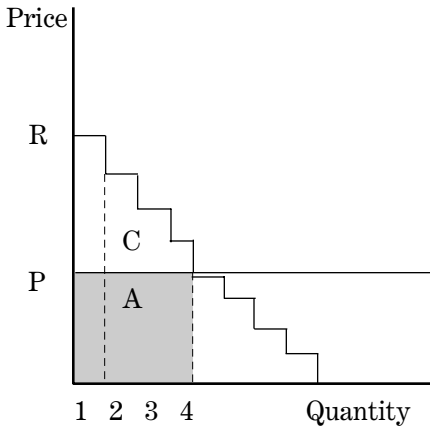


Figure 1. Individual Demand Curve

. . . the concept still holds that the regional economy can't grow without importing some income from outside the region.

person to another. No one pays you to watch television, for example. Similarly, refuge visitors' opportunity cost of time, although it is an important component in the cost of recreation, has little to do with the impact of recreation on the local economy. For this reason, the costs of time will be not be estimated in this analysis.

Visitors' spending generates economic activity throughout the local economy. Much of the analysis in this report deals with visitor spending related to refuge activities. This is only a small part of the benefits visitors receive from traveling to a given area, but it is relatively easy to quantify and important to the regional economy. This analysis will also estimate the consumer surplus derived from refuge recreation to find the total benefits derived from visits to the refuge.

Birding

Expenditures and the Regional Economy

It is hard to do anything without spending money and thereby affecting economic activity. Whether it is gas to drive somewhere, feathers with which to tie flies, shotgun ammunition, or movie tickets, something is purchased to pursue the recreational experience. For the regional economy, it matters where the spending comes from. If the expenditure is from outside the region, it generates increased economic activity. If it is from within the region and would have occurred in the region anyway, it does not increase economic activity but is important for local businesses. To illustrate this idea, imagine a town consisting of one store and one citizen, an employee of the store. All of the store's expenses involve buying stock from an out-of-town wholesaler and paying the lone employee. When the employee is paid he buys his groceries at the store. Part of the purchase price goes to buy more stock, and the rest goes to the employee's next paycheck. For the employee ever to get back more than he spent someone from out of town must buy something at the store. The real workings of a modern, interconnected regional economy are far more complex, but the concept still holds that the regional economy can't grow without importing some income from outside the region.

Thus it is important to separate spending by people from outside the refuge's economic region from spending by those who live locally. Local residents would probably have spent their recreation money in the local economy with or without the refuge. If they couldn't go birding, they might go bowling. In contrast, non-residents may have been attracted to the

area by the refuge. They would have gone elsewhere except for its presence, *and* their spending is a stimulus to the economy. Non-resident spending generates new income and new jobs. It has an economic *impact* on the region. We evaluate it to show the gain to the region from having the refuge. We evaluate total spending, by both residents and non-residents, to show the *significance* of the refuge to the local economy. Significance shows how large a part of the local economy is connected to refuge activities but should not be interpreted as income that would be lost if the refuge were not there.

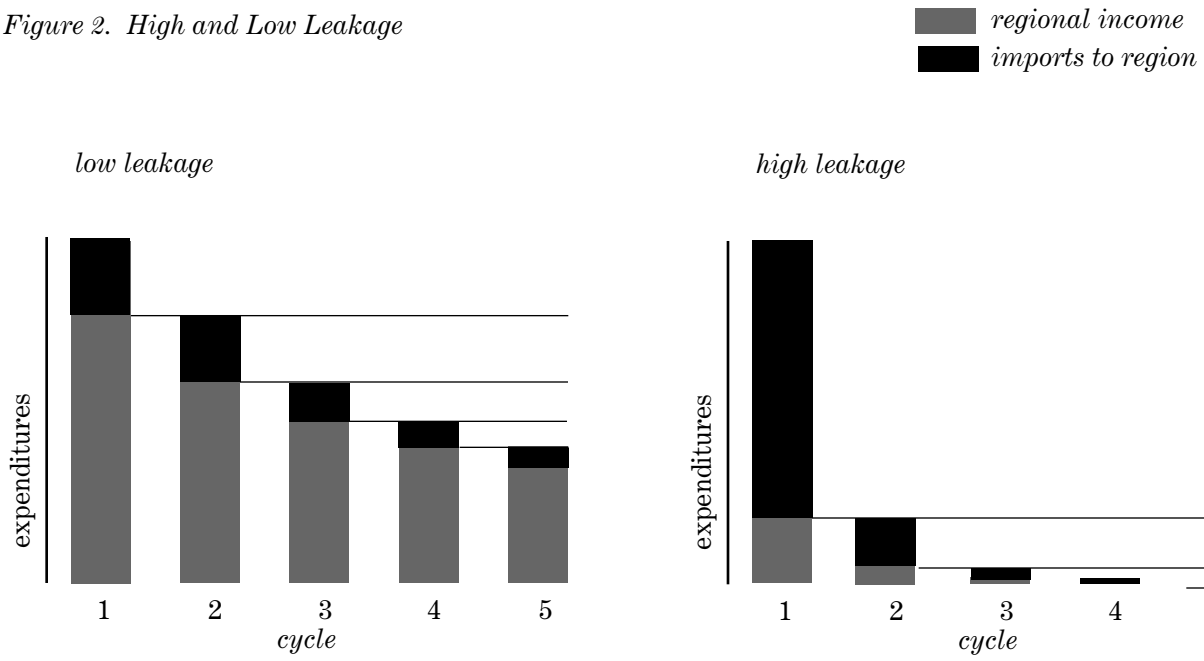
Leakage and Multipliers

The one-store town also illustrates the idea of "multipliers" and "leakage" from a regional economy. Each time the employee is paid and spends his income, new income is generated. Whatever the amount of the first purchase, the subsequent purchases add to the employee's income again. To the employee, it seems like his income is several times his income from the first purchase. This recycling through the local economy is called "the multiplier effect." The multiplier is the sum of the employee's income stream divided by his income from the original purchase. In Figure 2, the multiplier is then the total area of the grey "Regional Income" rectangles in cycle 2 and later, divided by the area of the Regional Income rectangle in cycle 1. It shows how much local income each dollar of new spending generates as it circulates through the economy.

Leakage is the local spending that leaves, or leaks out of, the region. In the example, the stock bought from an out-of-town wholesaler is a leakage from the region's economy. Less leakage implies that

Leakage is the local spending that leaves, or leaks out of, the region.

Figure 2. High and Low Leakage



National Wildlife Refuges maintain extensive data on public visitation.

more spending stays in the local economy. If there were no leakage at all, the economy would be self-perpetuating and could stay in a steady-state forever. Let's say the cost of restocking the store in the example was only 1 percent of sales. From $100 in sales, the employee would receive $99. He could spend his income and receive about $98 in wages from his second round of purchases. The original $100 purchase would recycle many times before it all left the economy. Alternatively, say the leakage is large and restocking costs 80 percent of sales. The employee would receive only $20 from the first-round purchase and only $4 in the second round. The multiplier would be very small. Figure 2 illustrates high and low leakage processes.

Leakage and the size of the multiplier depend on the degree to which the local economy provides for its own needs. Different industries have different needs, and so they import varying amounts of inputs from other regions. Thus it is important to identify the commodities that new spending will buy and know where they are manufactured. Most small or rural regions import many products and so have a great deal of leakage and small multipliers.

Economists use statistics on employment, production, and earnings in the region, as well as information about flows of goods between industries nationwide, to develop estimates of the degree of integration of a regional economy. County-level data is used in this report. Information on larger regions can be assembled by aggregating data from several counties.

Data and Assumptions

Data Sources

National Wildlife Refuges maintain extensive data on public visitation. Every 5 years the Fish and Wildlife Service conducts the National Survey of Fishing, Hunting, and Wildlife-Associated Recreation (NSFHWR). NSFHWR asks detailed questions about recreational travel and expenses. By combining information from these two sources, a profile of refuge visitors' spending in local communities may be developed. Information from refuge staff, regional tourism agencies, and other recreation providers was also used in this study. Collection of new public data was avoided by using these existing data sources.

Almost all of the visitation data used in this study comes from the Division of Refuges' Refuge Management Information System (RMIS). It is reported by public-use specialists at each refuge. The methods used to collect data vary with each refuge's unique situation. For example, many refuges have tightly controlled hunts. Detailed information about these hunting visits is included in the RMIS. At Las Vegas NWR, for example, goose hunters must register when they arrive and check out when they leave their assigned pit blind. Some refuges collect fees at main entrances. There is only one road into Chincoteague NWR, for example, so virtually everyone who enters can be counted and included in the RMIS data. Refuges with multiple access points or highways through refuge lands cannot count each visitor, so other methods must be adopted to estimate the number of visitors. Three common methods are car counts, foot counts, and parking-lot audits.

Car counts involve counting automobiles that pass some point on refuge roadways. A pneumatic tube attached to a counting device is placed across the road. Sophisticated counters record the time each vehicle crosses, and information is saved in a computer file to be downloaded later. This system facilitates analysis of the time of day of refuge use. Other counters simply record the number of axles crossing the tube and must be read periodically. It is easy to derive the number of vehicles crossing the tube. Observations at each refuge allow estimates to be made of the number of people entering. If a car counter is installed on an auto tour route, clear estimates can be made of the number of people using the route. If the car counter is placed at a foot-trail parking lot, the estimate may represent trail users. If several uses are available at the site, some observation of how many people do each activity may allow the refuge staff to estimate visitation for each use. Foot counters follow the same idea as car counters. Usually they record the number of times a light beam is blocked. These devices are often used at visitors centers and may be used at trail heads.

Many refuges are accessible from public highways. Often visitors simply pull off the roadway to enter the refuge. Refuge personnel know the favorite pull-off points in their area and the activities people may pursue from that location. In hunting season, for example, hunters park along the side of Route 49 at Horicon NWR. Counting these cars and knowing that hunters usually visit in pairs or

Often visitors simply pull off the roadway to enter the refuge.

Key Deer and visitor, Key Deer NWR. John and Karen Hollingsworth/USFWS.

Preferences were given to refuges where some additional survey information was known to exist.

threes allows the public-use officials to estimate the number of hunters on the refuge. Anglers also have favorite parking spots around the refuge and usually fish alone or in pairs.

Although these methods are somewhat ad hoc they provide the best visitation information available without extensive additional data collection. The raw RMIS figures may provide the only estimate available of total refuge visitation. Because of collection efforts used, the data are not an exact count. We believe data-collection bias is small and have used several techniques to generate the most conservative estimates possible.

Sample Selection

The Fiscal Year 1995 RMIS data and professional judgment were used to select 15 refuges for this study. The Division of Economics does not have the resources to study all 508 refuges in detail. So our focus was narrowed to those 369 that allow visitors. This group was then stratified based on five variables:

1. Number of visitor days
2. Number of visitor days to the visitor center
3. Number of visitor days using nature trails
4. Number of hunting days for all game species on the refuge
5. Number of freshwater fishing days

Cluster analysis on these variables suggested nine clusters in the RMIS data. The 15 refuges picked for detailed analysis were selected so that each cluster is represented and because they are recognizably similar to other refuges. Preferences were given to refuges where some additional survey information was known to exist. Refuges with unusual features or intractable measurement problems were excluded. Upper Mississippi NWR, for example, was excluded because it would have been impossible to extract the Fish and Wildlife Service contribution to the individual's recreation experience from the Army Corps of Engineers' contribution. Table 1 shows the sample refuges and their categories. The cluster assignments for all 369 refuges with any visitation are listed in Appendix 4. The results of the analysis of these 15 refuges are expanded to the other refuges in the same cluster to develop national estimates.

Table 1. Study Sites for Economic Benefits of Refuge Visitation

Name	*Cluster*	*FY 1995 Visits in thousands*
Chincoteague, VA	High Use - Visitor Center/Non-Consumptive	1,384
National Elk Refuge, WY	High Use - Visitor Center/Non-Consumptive	661
Crab Orchard, IL	High Use - Fishing	839
Eufaula, AL	High Use - Fishing	245
Charles M. Russell, MT	High Use - Hunting	111
Umatilla, OR	Medium Use - Hunting	56
Quivira, KS	Medium Use - Hunting	38
Mattamuskeet, NC	Medium Use - Fishing	137
Upper Souris, ND	Medium Use - Fishing	47
San Francisco Bay, CA	Medium Use - Non-consumptive	281
Laguna Atascosa, TX	Medium Use - Non-consumptive	107
Horicon, WI	More Than 50,000 Visitation	134
Las Vegas, NM	More Than 50,000 Visitation	70
Tule Lake, CA	More Than 50,000 Visitation	197
Tensas River, LA	Low Visitation	18

Figure 3. Sample Refuges' Locations

It is useful for management to understand how many people are using each refuge service, but for economic estimation purposes we would prefer to count each visitor only once.

RMIS Data Adjustments

Because RMIS visitor counts are based on several different counting methods, one visitor may be counted several times as he or she uses the refuge. If he drives an auto tour route, he may be counted by a car counter. If he stops to walk a trail, a trail counter may count him again. If he goes into the visitor center, a third counter may count him yet again. It is useful for management to understand how many people are using each refuge service, but for economic estimation purposes we would prefer to count each visitor only once. Along with the counts by activity, RMIS provides an overall tally of individuals believed to have visited the refuge. Many refuge managers said this figure was a better estimate of refuge use than the figures for each individual activity. To avoid double counting, we allocate a total visitor number to each activity based on the proportion of visitors who participated in the activity. For example, a refuge may have reported 90,000 non-consumptive use visits, 60,000 fishing visits, and 100,000 total visitors. This method would allocate the 100,000 visitors based on the proportion that 90,000 and 60,000 are of their total, 150,000. So, the method would show 60,000 non-consumptive visits (100 x (90/150)), and 40,000 fishing visits (100 x (60/150)). To distinguish them from actual counts the calculated visitation figures are called "proportioned visits." The method gives more weight to those activities that tend to be double counted but ensures that the total number of visitors does not exceed the most reliable number available. Where the refuge had more precise information, such as for

Fishing at Crab Orchard NWR.

tightly controlled hunts, the more precise information was used and the other estimates adjusted accordingly.

People pursue many different activities while traveling. Their visit to a national wildlife refuge may be part of a longer trip or just a stop on their way to somewhere else. Urban refuges, such as Don Edwards San Francisco Bay NWR, and refuges along major tourist routes, such as the National Elk Refuge, are particularly likely to have many visitors spending short periods of time on the refuge. Counting these brief visits as full recreation days would vastly overstate the visitor spending attributable to the refuge. The U.S. Forest Service uses the concept of a recreation visitor day (RVD) to take account of this distortion. The agency considers a recreation day as 12 hours long. However, unlike national forest activities, almost all refuge uses are daylight activities. So in this study a full recreational day is considered 8 hours rather than 12. Thus, a visitor who spends 4 hours at a refuge has spent half of an RVD, and half of their expenditures for the day will be attributed to the refuge. In this study, the average length of time visitors spend doing each activity is used to find the number of RVDs for that activity. If a typical non-consumptive wildlife use day is 4 hours, the number of RVDs for the refuge would be the number of proportioned non-consumptive use visits multiplied by 4/8. Refuge public-use officers estimate the average lengths of stay from the activities available on the refuge and the typical behavior pattern of visitors. An average does not mean all visitors to the refuge spend precisely that amount of time. Some will spend more and some less. Those spending much longer will be balanced by those spending shorter periods. The time used represents the average of all visitors pursuing that activity. The data and assumptions for each sample refuge are shown in Appendix 1.

Expenditure and Consumer Surplus Data

Daily expenditure information for this study was extracted from the NSFHWR trip expenditures section (U.S. Department of the Interior, 1993). Each respondent who said she or he had participated in an activity was asked about the trips she had taken to pursue the activity in the reporting period. A migratory bird hunter, for example, would be asked in what states he had hunted. For each state a series of questions would reveal how many days he had hunted chiefly for migratory birds and how much he had spent or his share of spending during those days in that state. To convert this individual state total to expenditures per day of trip, the total was divided by the number of days the respondent said he had pursued chiefly that activity. Respondents were asked to state expenditures in nine categories which were then reduced to these four categories for analysis:

Food:
- Food, drink, and refreshments

Lodging:
- At motels, cabins, lodges, or campgrounds

Transportation:
- Public transportation, including airplanes, buses, and car rentals
- Round-trip cost of transportation by private vehicle

Other:
- Guide fees
- Pack trip or package fees
- Public land-use or access fees
- Private land-use or access fees, not including leases
- Equipment rental

Each respondent who said she or he had participated in an activity was asked about the trips she had taken to pursue the activity in the reporting period.

Estimating the benefits people derive from recreation over and above what they spend—called consumer surplus or net economic value—is very difficult.

Respondents were classified as non-residents if their state of residence differed from the state where spending took place. Mean expenditures were calculated for each Fish and Wildlife Service region. Smaller geographic breakdowns left too few respondents in some categories for reliable averages. A few very high expenditure observations for some items can greatly change the average expenditure for that item. To avoid this bias, the highest 1 percent of observations for each item was removed from the calculation of the mean. These expenditure estimates are shown in Appendix 3.

Lodging expenditures appear very low in this data; often they are only a few dollars per day. In the NSFHWR, a trip does not necessarily begin at the respondent's residence. If someone were visiting relatives, for example, and spent a day of that visit hunting at a refuge, only the expenditures related to the time spent hunting would be included. The trip would be a one-day trip from the relatives' home and would have no lodging costs associated with it, even though the hunter had made an extensive trip away from his home. Hunting would be the primary purpose of the side trip but not of the entire trip away from home. Many people also camp or own recreational vehicles or own hunting cabins and so have minimal lodging costs that may be spread among several individuals.

Estimating the benefits people derive from recreation over and above what they spend—called consumer surplus or net economic value, area C in Figure 1 —is very difficult. Consumer surplus estimates were derived from a valuation question in the NSFHWR. Bass anglers, for example, were asked this question: "Fishing expenses change over time. For example, gas prices rose dramatically during the 1970s, fell somewhat during the early 1980s, and rose again in the late 1980s. Would you have taken any trips to fish primarily for bass during 1991

Bass fishing, Mattamuskeet NWR. Dr. E. Hester/USFWS

if your total bass fishing costs were X dollars more than the amount you just reported?" X was a different random amount for different respondents. The responses were analyzed statistically to estimate values. Though controversial, such methods are often used to derive individuals' willingness to pay for some good that, as explained above, is the heart of consumers' surplus. The aggregate consumer surplus estimates for this study were derived by multiplying the number of RVDs for each activity by the net economic value per day found by the NSFHWR for that activity in that state (Waddington, Boyle and Cooper, 1994).

Economic Modeling

Input-Output

Input-output modeling is a statistically and arithmetically demanding task that was not routinely undertaken before the wide availability of computers. In addition to balancing and inverting matrices of numbers, the basic statistics for each area of analysis must be discovered and made consistent. Regional impact analysis has been greatly facilitated by the development of integrated modeling software that contains both consistent databases and appropriate generalized algorithms for computing multipliers and impacts. One of these software tools is IMPLAN (Minnesota IMPLAN Group, Inc., 1994). IMPLAN was developed for the U.S. Forest Service by the University of Minnesota to aid in the forest planning process. It uses regional information to modify a standard input-output framework of the U. S., developed by the Department of Commerce, Bureau of Economic Analysis, to describe local conditions. This study uses IMPLAN to generate the local economic effects from visitors' spending.

A region (and its economy) is defined as the area within 30 miles of a refuge. IMPLAN is based on county data, so the region is stretched or shrunk to fit the available data. It is important that the region include most of the day-to-day economic activities of nearby residents and likely shopping places of refuge visitors. With the counties to be included defined, IMPLAN can calculate the multipliers for each industry.

From the NSFHWR data, daily expenditures were developed in four object categories for six activities for residents and non-residents in each Fish and Wildlife Service region. That provides 12 separate budgets for each region. (These budgets are shown in Appendix 3). Multiplying each budget by the number of visitor days for that activity from the adjusted RMIS data yields the total expenditures by category of spending for each activity. These are totaled and the expenditures are allocated to industries. Food, for example, is allocated 35 percent to restaurants and 65 percent to grocery stores for residents, and 65 percent to restaurants and 35 percent to groceries for non-residents. Transportation is allocated to gas and oil, car repairs, and airline tickets. Total expenditure for each commodity is the input to the IMPLAN model. IMPLAN then works out the amount of leakage and the implied multipliers, direct expenditures, earnings, employment, and output. IMPLAN calculates the direct, indirect, and induced effects of the new expenditure. Direct effects are a measure of leakage—the net amount of the expenditure that stays in the region after the first round of spending. Indirect effects

Regional impact analysis has been greatly facilitated by the development of integrated modeling software that contains both consistent databases and appropriate generalized algorithms for computing multipliers and impacts.

In each refuge summary in this study, we report the total effects on final demand, jobs, and job income in thousands of 1995 dollars.

estimate the impact of the expenditures as they cycle through the local economy. Induced effects are a result of changes in employment, population, and income from the new spending. These effects can be summed to show the total effect. In each refuge summary in this study, we report the total effects on final demand, jobs, and job income in thousands of 1995 dollars.

"Final demand" is simply the total spending by the final consumers of all goods. The amount reported is the change in spending by all final consumers in the region attributable to refuge visitation.

IMPLAN's definition of "jobs" is very broad. For each industry, there is some proportion of output that goes to employee earnings (i.e., job income). In turn, there is some amount of earnings that represents one job. Dividing earnings by the job-cost constant yields an estimate of the number of jobs stimulated by visitors' spending. In the restaurant industry, for example, 75 percent of sales may go to employee earnings and $15,000 may be equivalent to one job. So $20,000 in sales implies $15,000 in job income, and one job. IMPLAN counts full-time, part-time, temporary, and seasonal jobs equally. Therefore, job income is a better indicator of the employment effects of new spending than the jobs figure IMPLAN generates.

Visitation on Wildlife Drive. Al Milliken/USFWS

Generating National Estimates

Economic Significance

One goal of this research is to generate estimates of the national impact of refuges on their regional economies. Ideally, an IMPLAN model and the necessary visitation information would be developed for each refuge and the results summed to produce a national estimate. Such a process would be prohibitively expensive. As an alternative, the results from the 15 case studies can be treated as data points. "Regression analysis" is a statistical procedure that finds relationships among characteristics of data points. Taking individual people as data points, for example, there is a relationship between their height and their weight. Regression analysis finds an equation that quantifies such relationships. If you know someone's height, you can use the regression equation to predict his weight. Using the 15 sample refuges as data points, and factoring in visitation information and characteristics of the refuge location, regression analysis yields an equation that predicts final demand, employment income, and jobs generated by visits to each refuge. The total of these refuge estimates is a national estimate. The process is explained in more detail in Appendix 2.

Several adjustments were made to the data to ensure consistency. The regression equation did not adequately handle refuges that had low visitation or were far from urban areas. To avoid adding these errors to the national results, all refuges with fewer than 1,500 visits and those in Alaska, Hawaii, and the U.S. Territories were deleted from the calculations. This eliminated more than 100 refuges but relatively few visits. A separate study is addressing the special economics of Alaska's refuges.

The regression method left no opportunity to adjust visits by length of stay. Since the model applied the average length of stay for the sample refuges to all refuges, this was felt to be problematic only for the Upper Mississippi Refuge, which records extremely high visitation, much of it only loosely attributable to the refuge. To adjust for this, the final demand for Upper Mississippi was reduced to one-eighth of the calculated value (1 hour of a recreational day). Even so, this refuge showed the fourth highest final demand, below only Wichita Mountain, Pea Island, and Chincoteague.

The regression technique produced estimates of final demand, employment income, and jobs created by all visitor spending at each refuge. Just as predicting someone's weight from his or her height may not be very reliable, comparison of these predictions with the case-study results showed that the estimates could be very wide of the mark. However, the predicted values were both too high and too low, so it appeared that the deviations would balance each other when applied to groups of refuges. For this reason, only regional and national aggregates are reported.

Several adjustments were made to the data to ensure consistency.

Addressing visitors at Don Edwards San Francisco Bay NWR.

Refuge management is an imperfect balancing of multiple goals. This report highlights only one . . .

Consumer Surplus

Consumer surplus was estimated for the sample refuges by multiplying recreational visitor days by the consumer surplus value for that activity in that state. Essentially the same process was followed for the refuges outside the sample. Outside the sample, detailed information was not available on the amount of time spent in each activity on a refuge. This was not a problem for hunting and fishing, as it had been assumed that these were full-day activities for the most part. Non-consumptive use was adjusted to recreational visitor days using the average length of time such visitors stayed at the sample refuges—about 3 hours. For states with too few observations to measure the net economic value, the national mean was substituted.

The national estimates and refuge case studies provide a rough scale of the economic significance of refuge recreation to local communities. Whenever other studies were available, we compared those results with our results. In general, our results agree with previous estimates fairly well. These results are broadly descriptive. They are not intended to provide policy direction or performance measures. Refuge management is an imperfect balancing of multiple goals. This report highlights only one component.

Fishing counted as a full-day refuge activity.

Glossary

Activity: What visitors do at a refuge. In this study, visitor activities are grouped into hunting, fishing, and non-consumptive uses.

Consumer Surplus: The difference between the total value people receive from the consumption of a particular good and the total amount they pay for the good.

*Employment Income (*see *Job Income)*

Final Consumers: The people who finally use the product. Contrast final consumers with intermediate consumers who buy goods in order to sell them again.

Final Demand: The total spending by final consumers on all goods. The amount reported in this study is the change in spending by final consumers in the region attributable to refuge visitation. Final demand includes spending by people who earn income from refuge visitors' activities as well as spending by refuge visitors themselves.

Impact: The new economic activity generated in a region as a refuge attracts non-residents to the area. This figure represents economic activity that would be lost if the refuge were not there.

IMPLAN: An economic modeling software package that applies input-output analysis techniques to regional economies.

Job Income: Income to households from labor including wages and salaries. Job income excludes returns to property and proprietorship income.

Leakage: Money lost from a regional economy by payments to suppliers outside the region.

Multiplier: Multipliers show the regional economic effects resulting from changes in final demand for a commodity or group of commodities.

Net Economic Value (see Consumer Surplus)

Non-Consumptive Use: Recreational activities that "use" wildlife without consuming it, such as birding, photography, picnicking, etc. Non-consumptive use contrasts with consumptive uses such as hunting, trapping, and fishing.

NSFHWR: National Survey of Fishing, Hunting, and Wildlife-Associated Recreation.

NWR: National Wildlife Refuge

Recreational Visitor Day: A unit of measure equal to 1 person spending 1 full day (in this study, 8 hours) recreating at a particular site. RVDs allow comparisons between visitors who stay for only short periods of time and those who stay longer.

Resident/Non-Resident: People living more than 30 miles from the refuges were considered non-residents for this study.

RMIS: Refuge Management Information System.

Significance: The total economic activity in a region that is related to a refuge. Significance shows a refuge's role in the regional economy. The portion of this activity attributable to residents most likely would have occurred in the region anyway and so does not represent an incremental contribution to the regional economy. Contrast significance with impact.

Chincoteague National Wildlife Refuge

It is one of the most heavily used refuges in the system with 1.4 million visits a year.

Description

Chincoteague NWR is a 14,014-acre refuge on the Maryland-Virginia border. It encompasses the southern end of Assateague Island, a mid-Atlantic, coastal barrier island, and includes several other units on other islands in the vicinity. The refuge was established in 1943 to provide wintering and migration habitat for migratory birds. Its mission now includes preservation of endangered species, maintenance of indigenous species, and wildlife-oriented public use. The area is a popular tourist destination for birding, wildlife, sandy beaches, and wild horses like those featured in the "Misty" books. It is within a short drive of the Baltimore-Washington metro area and several beach resorts. It is one of the most heavily used refuges in the system with 1.4 million visits a year.

The refuge encompasses ocean beach, dune, maritime forest, tidal marsh, and freshwater moist soil habitats. Its diverse biota presents unique management challenges. About 400,000 visitors come to enjoy the beach and its wildlands aspects. The National Park Service operates the recreational beach section of the refuge. An auto route is closed to automobiles part of each day to permit use by bicyclists and pedestrians. Several nature trails are available. Off-road vehicles are tightly restricted but are permitted on parts of the beach in some seasons. Surf casting is a popular activity and freshwater fishing is permitted in a refuge impoundment. Limited hunts for sika (a small, oriental elk species introduced to the island) and waterfowl occur in the fall and winter.

Area Economy

The town of Chincoteague, in Accomack County, Virginia, is the gateway to the refuge. Like many Atlantic seaside towns, it has outgrown its Main Street in recent years. The road to the refuge is lined with restaurants, motels, and gift shops. The town's economy is dominated by tourism and so is highly seasonal. Away from the oceanside, the region is largely agricultural, with the exception of N.A.S.A.'s Wallops Island Flight Center. Accomack County's population has grown only 9 percent since 1970. The largest industries are non-durable goods manufacturing and services. The population of neighboring Worcester County, Maryland, has increased 45 percent in the last 25 years. Much of this development has been in the northern part of the county around Ocean City. Worcester County's economy is dominated by the retail trade and services sectors. Growth in per-capita personal income in both counties has outpaced state and national rates over the last 10 years.

Activity Levels

Since the late 1980s visitation to Chincoteague has been level, with approximately 1.4 million visits each year. More than half of these visitors come during June, July, and August; less than a tenth during December, January, and February. Summer weekend crowds occasionally overwhelm parking and other facilities. Chincoteague is a fee area. Its location on an island simplifies the collection of entrance fees at a toll booth on the only bridge to the island. Overall visitation data is excellent. A 1986 study showed that though most visitors spend 1 day on the site, the mean length of stay in the area is 3.6 days. As the

refuge is the largest attraction in the area, we assume non-consumptive use visitors spend 6 hours of their day there. For the purposes of this analysis, non-consumptive visits are converted to refuge visitor days, defined as 8 hours of recreation activity per day. In summer, most visitors come from more than 30 miles away. This is balanced by more local visitation during the winter months. Refuge staff estimates that 90 percent of visitors are non-residents.

The sika hunt is tightly monitored. In 1995, 313 hunters harvested 264 animals. Waterfowl hunting areas are allocated to guides by sealed-bid auction. Public hunting for waterfowl and rails is permitted in some areas, but hunters must obtain special permission. The sika hunt attracts local residents and non-residents equally. Each sika hunter is permitted to hunt two days; the RMIS data records the actual number of days hunted.

Surf fishing is very popular in the area. Much saltwater fishing occurs in the Off Road Vehicle Area. Only 18 ORVs are allowed in the area during the spring and summer, 48 at other times of the year. Recreational clamming is also popular. Although many non-resident visitors "wet a line," many of the local residents are avid surf anglers and have much greater access to the refuge throughout the year. So, 70 percent of saltwater fishing visitation is assumed to be by local anglers. All fishing is assumed to use a whole recreational day.

Swans Cove is open for freshwater fishing. White perch are caught in the spring and early summer. This activity is assumed to be split equally between residents and non-residents.

Regional Economic Analysis

Table 2 shows visitor recreation expenditures for FY 1995. Non-consumptive-use visitors to Chincoteague spent over $30 million in the region. Saltwater anglers spent an additional $2 million. Hunters' spending was a relatively modest $41,000. Clearly, non-consumptive users are major contributors to the regional economy.

Refuge staff estimates that 90 percent of visitors are non-residents.

Table 2. Chincoteague NWR: Visitor Recreation-related Expenditures (1995 $ in thousands)

Activity	*Resident*	*Non-Resident*	*Total*
Non-consumptive	$1,061.9	$29,315.6	$30,377.5
Hunting	$7.3	$33.3	$40.6
Fishing	$1,034.9	$1,215.2	$2,250.1
Total	$2,104.1	$30,564.1	$32,668.2

Residents add only another $2.1 million in spending to the total. So Chincoteague's visitation is highly important to the local economy.

Because of the area's isolation, less than half of the total amount stayed in the local economy. Table 3 summarizes the total economic impacts associated with refuge visitor spending. The high leakage led to a very low multiplier effect; only $21.2 million in total final demand was generated through recycling non-resident spending in the economy. This is the total monetary value of economic activity generated in the area by non-resident refuge visitor spending. Nevertheless, this meant more than $9 million in new employee compensation and 545 new jobs (full-time, part-time, and seasonal). This result implies that income brought into the region by visitors to Chincoteague is responsible for 2.7 percent of Accomack County's earnings base.

Residents add only another $2.1 million in spending to the total. So Chincoteague's visitation is highly important to the local economy.

Table 4 shows total economic effects (total final demand plus net economic value) compared with the refuge budget for FY 1995. The Fish and Wildlife Service spent $1.07 million to operate Chincoteague during FY 1995. This spending provides additional jobs and income to area businesses. Visitors also derive value from their activity at the refuge. The figure for net economic value shown in Table 4 is derived by multiplying net economic values for hunting, fishing, and non-consumptive recreation use per day by estimated refuge visitor days for that activity. The net economic value is $42.7 million, more than $40 million of which was attributable to non-consumptive users. This figure is combined with the estimate of total final demand

Table 3. Chincoteague NWR: Economic Effects Associated with Refuge Visitation (1995 $ in thousands)

	Non-Residents	*Total*
Final Demand	$21,241.2	$22,868.1
Jobs	545	590
Job Income	$9,411.3	$10,115.3

Table 4. Chincoteague NWR: Summary of Economic Effects of Refuge Visitation (1995 $ in thousands)

	FY 1995 Budget	*Final Demand*	*Net Economic Value*	*Economic effects per $1 budget expenditure*
Chincoteague NWR	$1,075	$22,868.1	$42,715.7	$61.01

and divided by the refuge budget for FY 1995. The overall ratio of economic effects per dollar of budget expenditures is very high, reflecting intensive public use and highly accessible natural amenities. The ratio is overstated to some extent because the budget figure does not include National Park Service operations at the recreational beach. This ratio is provided only for the purpose of broadly comparing the magnitude of the economic effects resulting from refuge visitation to total budget expenditures and should not be interpreted as a benefit-cost ratio.

The overall ratio of economic effects per dollar of budget expenditures is very high, reflecting intensive public use and highly accessible natural amenities.

Monitoring waterfowl. Chincoteague NWR. John and Karen Hollingsworth/USFWS

Crab Orchard National Wildlife Refuge

The capacity and utilization of the marinas and boat ramps are known, so it is simple to derive accurate estimates of fishing visits.

Description

Crab Orchard NWR is a 43,500 acre, highly developed national wildlife refuge in southern Illinois. Though much of it is closed to public use to provide wildlife habitat, the balance of the refuge supports campgrounds, marinas, agriculture, and industry. Three lakes provide wetlands habitat and premier bass fishing opportunities. Bald eagles nest in the area. The refuge is a major stopover point on the Mississippi flyway.

Munitions plants were built in the town of Marion during World War II. When the land was converted to a national wildlife refuge in 1947, the munitions plants continued to operate. Today military ammunition is both made and recycled on refuge land. Other industries have also moved into the industrial space available on the refuge. Over 700 people are employed by private industries on leased refuge land. The refuge also has an active cemetery. A sewage-treatment plant on the refuge serves the Marion federal prison and refuge industries.

As a result of the industrial development, polychlorinated biphenyls (PCBs) have polluted soil on the refuge. Announcement of the PCB contamination and related fishing advisories discouraged use of Crab Orchard Lake for some time. Only the lowest level of advisories, applying to pregnant women and nursing mothers, is in effect at this time. Planned heat treatment of the affected soils is a controversial topic in the area.

The refuge is traversed by two state highways—Route 13, a major commercial thoroughfare between Marion and Carbondale, and Route 148, a commuter route. The refuge visitor center and observation tower are directly along Route 148. Interstate 57 lies on the eastern edge of the refuge. These routes and several county roads provide many access points to the refuge, so visitor counts are subject to some inaccuracies. Employees of refuge industries are removed from visitor counts.

Area Economy

The Crab Orchard region has a stable population and a diversified rural economy. Carbondale is home to the University of Southern Illinois. Marion has an active airport, a Veterans Administration hospital, a federal prison, and an industrial park. Much of the surrounding land is agricultural or forested. The Williamson County Tourism Bureau is co-located with the refuge visitor center and promotes the refuge's fishing and hunting opportunities at regional sportsmen's shows. Concessionaires operate refuge marinas and campgrounds and also promote tourism in the area.

Activity Levels

Crab Orchard volunteers conduct a weekly survey of public use. Visitation estimates are derived from car and trail counters, parking-lot counts, and boat counts. The capacity and utilization of the marinas and boat ramps are known, so it is simple to derive accurate estimates of fishing visits. More than 225,000 fishing days were recorded in the refuge in FY 1995. Six-hundred boats are moored at marinas on the refuge lakes, so many local anglers make repeated visits.

Deer and goose hunting are tightly controlled on most of the refuge. Estimates of this use have been added in to the RMIS data. About

2,600 visitors hunted deer and upland game; most of these hunters are from the local area. More than 7,000 visitors hunted waterfowl. The refuge's goose hunting is actively promoted in the Chicago area and other Midwest markets. A 1991 survey of goose hunters found that 75 percent were from outside the local area. About 9 percent of waterfowl hunting in the local four-county area occurred on the refuge.

Non-consumptive use is very difficult to measure because of Crab Orchard's many access points and industries. The RMIS figure was proportioned to compare with other uses, and it was assumed that non-consumptive use visitors spent an average of 2 hours on the refuge. More than 350,000 visitors were recorded on the refuge in FY 1995. Crab Orchard is one of the most heavily visited sites in the refuge system.

Regional Economic Analysis

Crab Orchard NWR lies in the southwest corner of Williamson County. It borders Union and Jackson counties and is only a few miles from Johnson and Franklin counties. Most services are available in the cities of Carbondale (Jackson County) and Marion (Williamson County). So the local economic area is considered to be all 5 counties.

Table 5 shows visitor recreation expenditures for the refuge during FY 1995. Non-residents' spending was 56 percent of the total. Residents and non-residents pursued different activities on the refuge. Residents spent two-thirds of the non-consumptive dollars and 40 percent of the fishing dollars but only 15 percent of the hunting dollars. This finding highlights Crab Orchard's role as a destination for goose hunting and fishing but primarily a local amenity for non-consumptive uses.

Table 6 summarizes the total economic impacts associated with refuge visitor spending. Total final demand associated with visitor spending is $6.1 million. Non-resident visitor spending provided a $3.29 million stimulus to the Marion region's economy. Because of leakage effects, this translated to $3.2 million in additional final demand and $1.1 million in added employee compensation, responsible for 76 additional jobs.

Residents spent two-thirds of the non-consumptive dollars and 40 percent of the fishing dollars but only 15 percent of the hunting dollars.

Table 5. Crab Orchard NWR: Visitor Recreation-related Expenditures (1995 $ in thousands)

Activity	*Resident*	*Non-Resident*	*Total*
Non-consumptive	$829.9	$407.2	$1,237.1
Hunting	$41.1	$222.0	$263.1
Fishing	$1,765.4	$2,664.2	$4,429.6
Total	$2,636.4	$3,293.4	$5,929.8

The refuge is a significant player in the regional economy.

The refuge is a significant player in the regional economy. All visitors' recreational spending of $5.9 million meant $2.1 million to regional payrolls—almost half of one percent of the entire $517 million Williamson County economy.

Table 7 shows total economic effects (total final demand plus net economic value) compared with the refuge budget for FY 1995. Payrolls, operations, and maintenance on the refuge added $977,000 to the local economy. In addition, visitors derive consumer surplus benefits from their recreation on the refuge. These net economic values were $11.9 million in FY 1995.

Table 6. Crab Orchard NWR: Economic Effects Associated with Refuge Visitation (1995 $ in thousands)

	Non-Residents	*Total*
Final Demand	$3,162.9	$6,081.8
Jobs	76	147
Job Income	$1,134.3	$2,152.3

Table 7. Crab Orchard NWR: Summary of Economic Effects of Refuge Visitation (1995 $ in thousands)

	FY 1995 Budget	*Final Demand*	*Net Economic Value*	*Economic effects per $1 budget expenditure*
Crab Orchard NWR	$977	$6,081.8	$11,933.2	$18.44

Curtis Carley/USFWS

National Elk Refuge

Description

The National Elk Refuge lies in the Jackson Hole area of northwestern Wyoming. On August 10, 1912, Congress established the refuge to acquire, preserve, and manage lands for wintering elk. The refuge is within Teton County and is bounded on the north by Grand Teton National Park, on the east by Bridger-Teton National Forest, and on the south by the town of Jackson.

Much of the refuge consists of grassy meadows and marshes on the valley floor; sedges, bluegrasses, and brome grass are important components of the habitat. The refuge provides critical winter range for an elk herd of about 8,500. Elk are supplementally fed about 75 days most winters when natural forage is not available. Shiras moose, mule deer, bighorn sheep, pronghorn antelope, bison, and coyotes also roam the refuge. Nearly 175 species of birds have been observed. Two major streams, the Gros Ventre River and Flat Creek, flow through the refuge and fly fishing for the native Snake River cutthroat trout is especially popular.

Area Economy

The area's economy is centered around the city of Jackson (population 4,472) in Teton County. In 1994, the county population was 13,200, an increase of 31 percent from 1985. Teton is one of the most affluent counties in the state and the nation as well. Per-capita income in 1994 was $37,427, compared with $20,347 for the state of Wyoming and $21,696 for the nation. Adjusted for inflation, per-capita income in 1994 showed

The refuge provides critical winter range for an elk herd of about 8,500.

Herd of elk

Total employment in the county increased by 79 percent from 1985 to 1994.

an increase of 26 percent from 1985. The average annual growth rate for the same time period was 8.1 percent.

Total employment in the county increased by 79 percent from 1985 to 1994. Business and consumer services, government (federal, state, and local), and retail sectors accounted for 70 percent of total employment in 1994. The number of people employed in these sectors in 1994 represented a 73 percent increase from 1985. Manufacturing employment increased by 104 percent and agriculture decreased 5.5 percent from 1985 to 1994. Total wages and salaries paid increased from $135.8 million in 1985 to $294.5 million in 1994, an increase of 116.8 percent (adjusted for inflation).

Activity Levels

The refuge recorded 660,510 visitors during FY 1995. Most of them came for nature interpretation and observation—562,441 visits, including 200,566 stops at the visitor center and 327,564 visitors using wildlife-observation facilities such as towers, platforms, and auto turnouts. A significant portion of these visits occurred on paved turnouts on the west side of the refuge along U.S. Highway 26 leading to Grand Teton and Yellowstone National Parks. Other non-consumptive recreation activities such as picnicking and hiking accounted for 93,419 visitors. Fishing visits, primarily for trout, totaled 2,568, and big-game hunting, primarily for elk, accounted for 1,311 visits.

Refuge staff estimated that 70 to 75 percent of non-consumptive visitors were non-residents (defined as living more than 30 miles from the refuge). Residents accounted for 90 percent of the anglers and 85 percent of the hunters. The typical non-consumptive visitor spent an average of 30 to 45 minutes per day per visit on the refuge.

For the purposes of this analysis, non-consumptive visits are converted to refuge visitor days, defined as 8 hours of non-consumptive recreation activity per day. Non-consumptive refuge visitor days totaled 15,390 for residents and 46,169 for non-residents.

Regional Economic Analysis

The economic base area for the refuge is defined as Teton County. It is assumed that refuge visitor

Table 8. National Elk Refuge: Visitor Recreation-related Expenditures (1995 $ in thousands)

Activity	*Resident*	*Non-Resident*	*Total*
Non-consumptive	$188.9	$2,201.7	$2,390.6
Hunting	$19.3	$14.1	$33.4
Fishing	$31.3	$14.2	$45.5
Total	$239.5	$2,230.0	$2,469.5

expenditures occur primarily in this county.

Table 8 shows visitor recreation expenditures for the refuge during FY 1995. Total expenditures were $2,469,500, with non-residents accounting for more than 90 percent of the total. Non-consumptive recreation expenditures were 97 percent of the total.

Table 9 summarizes the total economic impacts associated with refuge visitor spending. Total final demand associated with visitor spending was $1,557,900. This is the total monetary value of economic activity generated in Teton County by refuge visitor spending. In turn, this final demand generated 41 jobs (both full and part-time) with a total employment income of $662,500.

Table 10 shows total economic effects (total final demand plus net economic value) compared with the refuge budget for FY 1995. For an individual, net economic value is that person's total willingness to pay for a particular recreation activity minus his or her actual expenditures for that activity. The figure for Net Economic Value is derived by multiplying net economic values for hunting, fishing, and non-consumptive recreation use (on a per-day basis) by estimated refuge visitor days for that activity. This is combined with the estimate of total final demand and divided by the refuge budget for FY 1995. The $3.20 means that for every $1 of budget expenditures, $3.20 of total economic effects are generated. This ratio is provided only for the purpose of broadly comparing the magnitude of the economic effects resulting from refuge visitation to total budget expenditures and should not be interpreted as a benefit-cost ratio.

For an individual, net economic value is that person's total willingness to pay for a particular recreation activity minus his or her actual expenditures for that activity.

Table 9. National Elk Refuge:
Economic Effects Associated with Refuge Visitation (1995 $ in thousands)

	Non-Residents	*Total*
Final Demand	$1,401.7	$1,557.9
Jobs	37	41
Job Income	$598.9	$662.5

Table 10. National Elk Refuge:
Summary of Economic Effects of Refuge Visitation (1995 $ in thousands)

	FY 1995 Budget	*Final Demand*	*Net Economic Value*	*Economic effects per $1 budget expenditure*
National Elk Refuge	$1,070	$1,557.9	$1,889.9	$3.20

Eufaula National Wildlife Refuge

Fishing and boating were the most popular activities with 107,637 and 95,820 visits, respectively.

Description

Eufaula NWR was established in 1964 on the Walter F. George Reservoir (Lake Eufaula) in cooperation with the U.S. Army Corps of Engineers. The reservoir resulted from the impoundment of the Chattahoochee River as it runs between Alabama and Georgia. The 11,184 acres of the refuge were once heavily forested, but past land-use practices changed the land cover and habitat. The refuge is 40 percent open water, with bordering wetlands and upland timberland and cropland. An intensive management program has been established at the refuge to meet the needs of migrating waterfowl, wintering ducks and geese, and nesting wood ducks. The native vegetation in some upland areas is being restored, in contrast to surrounding industrial woodlands and agricultural lands.

The George Reservoir is a popular recreation area. The Corps of Engineers maintains boat ramps to the lake, and two state parks border the refuge. Many visitors combine a visit to the refuge with activities at these other facilities. A large number approach the refuge by boat. Fishing for bass, crappie, bream, and catfish is popular in refuge waters, but alligators must be avoided. On the landward side, the refuge maintains a wildlife drive and several foot trails. Controlled hunting for deer, dove, rabbit, and waterfowl is permitted on the refuge. The nearby state park provides swimming, camping, and similar activities.

Area Economy

The refuge has lands in four counties, Barbour and Russell in Alabama, and Stewart and Quitman in Georgia. Columbus, Georgia, the nearest large city, provides most services to the region. The local economy is dominated by nearby Fort Benning; the largest industries are durable-goods manufacturing followed by state and local government. The area's population has been stable since 1960. Aside from Fort Benning, per-capita personal income has been less than 70 percent of the national average.

Birding atop a marsh overlook. Richard G. Kaiser

Activity Levels

The Refuge Management Information System (RMIS) showed 322,632 visits to Eufaula NWR during FY 1995. Fishing and boating were the most popular activities with 107,637 and 95,820 visits, respectively. Both of these pursuits tend to be time-consuming and so account for much of the visitor expenditures from the refuge. Most anglers were not local residents. About half of the boaters were local residents. The refuge is an active participant in the "Hooked on Fishing" program and hosts several fishing derbies a year. A far smaller number of visitors, 4,143, hunted, mostly for deer. Most were from outside the local area.

The auto tour route attracted 74,660 motorists, a small majority of them from outside the local area. A small proportion of these people walked the nature trails or used the observation platform. These visits are relatively short.

Regional Economic Analysis

Table 11 shows visitor recreation expenditures in the refuge region during FY 1995. The local region was defined broadly to include the cities of Eufaula and Columbus. Non-resident visitors to the refuge spent $5.8 million in the local area in FY 1995.

Table 12 summarizes the total economic impacts associated with refuge visitor spending. Non-resident visitor spending generated $4.4 million in new final demand, $1.9 million in new earnings, and 115 new jobs as it flowed through the local economy.

Much of the water recreation on the refuge is enjoyed by local residents, so the significance of the refuge is considerably higher than the impact. Total spending by all refuge visitors related to their refuge recreation was $6.7 million. This resulted in $5.3 million in local final demand, $2.2 million in earnings, and 140 jobs attributable to refuge visitation. This is three-quarters of 1 percent of Barbour County's annual earnings.

Table 13 shows total economic effects (total final demand plus net economic value) compared with the refuge budget for FY 1995. Refuge visitors derived consumer surplus benefits of $7.1 million. Government expenditures to operate Eufaula NWR were $315,000 in FY 1995. Eufaula is a significant component in the region's recreational opportunities. It provides many benefits at a very low cost in government resources.

Eufaula is a significant component in the region's recreational opportunities.

Table 11. Eufaula NWR: Visitor Recreation-related Expenditures (1995 $ in thousands)

Activity	*Resident*	*Non-Resident*	*Total*
Non-consumptive	$553.9	$2,002.1	$2,556.0
Hunting	$11.9	$151.4	$163.3
Fishing	$380.3	$3,614.5	$3,994.8
Total	$946.1	$5,768.0	$6,714.1

Table 12. Eufaula NWR: Economic Effects Associated with Refuge Visitation (1995 $ in thousands)

	Non-Residents	*Total*
Final Demand	$4,430.9	$5,350.4
Jobs	115	140
Job Income	$1,858.3	$2,243.7

Table 13. Eufaula NWR:
Summary of Economic Effects of Refuge Visitation (1995 $ in thousands)

	FY 1995 Budget	*Final Demand*	*Net Economic Value*	*Economic effects per $1 budget expenditure*
Eufaula NWR	$315	$5,350.4	$7,143.5	$39.66

Studying wildlife. Steve Hillebrand/USFWS

Don Edwards San Francisco Bay National Wildlife Refuge

Description

The Don Edwards San Francisco Bay National Wildlife Refuge was established in 1972 to preserve and protect critical habitat and associated wildlife, to aid migratory waterfowl, and to provide an opportunity for wildlife-oriented recreation and nature study. The refuge currently encompasses 19,000 acres in San Mateo, Alameda, and Santa Clara counties at the southern end of San Francisco Bay in northern California. It is surrounded by an urban population of over 7 million people, making it the largest urban wildlife refuge in the world. The refuge has an extensive environmental education outreach, with a variety of programs geared toward school children, teacher education, and the general public.

The refuge is comprised of a variety of habitats including mudflats, salt marshes, open water, and salt ponds. This range of habitat supports a large variety of wildlife including five endangered species. The refuge provides major habitat for the endangered California clapper rail and salt-marsh harvest mouse. San Francisco Bay is a key wintering area for diving ducks along the Pacific Flyway; the south bay is used primarily by scaup, surf scoters, and ruddy ducks. The south bay wetlands support hundreds of thousands of shorebirds along with the largest wading-bird rookery in San Francisco Bay.

The refuge has a visitor center at its administrative headquarters in the city of Fremont, and an environmental education center in Alviso on the southeastern edge of the refuge. Boating is a popular activity on the Bay, and a number of launch facilities are adjacent to the refuge. Hiking trails are numerous throughout the refuge. Wildlife observation, fishing, and waterfowl hunting are popular activities.

Area Economy

The refuge is spread out across three counties, San Mateo, Santa Clara, and Alameda, which had a total population of slightly over 3.5 million in 1994, a 10 percent increase from 1985.

The area is highly urbanized and relatively affluent. Total wage and salary employment totaled 1.7 million people in 1994, an increase of 6.4 percent from 1985. Total wages increased by 17.4 percent during the same period, and earnings per job increased by 10.5 percent.

The service, government (local, state, and federal), and retail sectors accounted for 66 percent of total employment in the area (1994). Manufacturing accounted for 11 percent and agriculture 0.2 percent Business and consumer services have been the fastest growing economic sectors in the area, growing by 33 percent from 1985 to 1994. The government and retail sectors increased by 6 and 7 percent, respectively, while total manufacturing employment actually decreased by 13 percent. Agricultural employment increased by 6.5 percent.

The per-capita income for the area is substantially greater than state and national averages. Alameda County has a per-capita income of $25,121 in 1994; San Mateo and Santa Clara county incomes were $32,712 and $28,250, respectively. This compares with the state average of $22,345 and the national average of $21,696.

Non-consumptive use recreation visits accounted for $1.36 million in spending . . . while hunting and fishing accounted for about $215,000.

Wildlife photography.
Curtis Carley/USFWS

Activity Levels

The refuge recorded 281,151 visitors during FY 1995. Of this number, 93,717 used the nature trails, 46,859 used photo blinds and observation platforms, 37,148 used the visitor center, 6,000 fished, and 3,900 hunted waterfowl. Other non-consumptive recreation uses, such as wildlife observation, birding, hiking, and photography, accounted for 98,405.

The refuge staff estimated that about 85 percent of refuge visitors were non-residents (defined as living more than 30 miles from the refuge). Most came from the three-county area, but a substantial number came from across the United States and overseas. The refuge is adjacent or relatively close to (20 miles or less) a number of major cities, including San Jose, San Francisco, Berkeley, Oakland, and Hayward. Major access highways include Interstate 880 northeast of the refuge, connecting San Jose and Oakland, and Highway 101 southwest of the refuge, running from San Jose to San Francisco.

For the purposes of this analysis, non-consumptive visits are converted to refuge visitor days, defined as 8 hours of non-consumptive recreation activity per day. Non-consumptive refuge visitor days totaled 57,641 for residents and 10,172 for non-residents. This finding is based on an average of 2 hours per visit for non-consumptive recreation activities.

Regional Economic Analysis

The economic area for the refuge is defined as the counties of Santa Clara, Alameda, and San Mateo. It is assumed that refuge visitor expenditures occur primarily within this three-county area. Table 14 shows visitor recreation expenditures for the refuge for FY 1995. Total expenditures were $1.58 million, with residents accounting for $1.02 million. Non-consumptive use recreation visits accounted for $1.36 million in spending (including both residents and non-residents) while hunting and fishing accounted for about $215,000.

Table 15 summarizes the total economic impacts associated with refuge visitor spending. Total final demand associated with visitor spending was almost $1.8 million. This is the total monetary value of

Table 14. Don Edwards San Francisco Bay NWR: Visitor Recreation-related Expenditures (1995 $ in thousands)

Activity	*Resident*	*Non-Resident*	*Total*
Non-consumptive	$883.9	$479.0	$1,362.9
Hunting	$52.9	$25.9	$78.8
Fishing	$84.2	$52.2	$136.4
Total	$1,021.0	$557.1	$1,578.1

economic activity generated in the three-county area by refuge visitor spending. In turn, this final demand generated 36 jobs (both full-time and part-time) with total employment income of $827,600.

Table 16 shows total economic effects (total final demand plus net economic value) compared with the refuge budget for FY 1995. For an individual, net economic value is that person's total willingness to pay for a particular recreation activity minus his or her actual expenditures for that activity. The figure for net economic value is derived by multiplying net economic values for hunting, fishing, and non-consumptive recreation use (on a per-day basis) by estimated refuge visitor days for that activity. This is combined with the estimate of total final demand and divided by the refuge budget for FY 1995. The $2.60 means that for every $1 of budget expenditures, $2.60 of total economic effects are generated. This ratio is provided only for the purpose of broadly comparing the magnitude of the economic effects resulting from refuge visitation to total budget expenditures and should not be interpreted as a benefit-cost ratio.

In turn, final demand generated 36 jobs with total employment income of $827,600.

Table 15. Don Edwards San Francisco Bay NWR: Economic Effects Associated with Refuge Visitation (1995 $ in thousands)

	Non-Residents	*Total*
Final Demand	$546.1	$1,787.9
Jobs	10	36
Job Income	$257.4	$827.6

Table 16. Don Edwards San Francisco Bay NWR: Summary of Economic Effects of Refuge Visitation (1995 $ in thousands)

	FY 1995 Budget	*Final Demand*	*Net Economic Value*	*Economic effects per $1 budget expenditure*
SF Bay NWR	$1,832	$1,787.9	$2,947.6	$2.60

Tule Lake National Wildlife Refuge

The vast majority of its recreational use is associated with wildlife observation.

Description

Established in 1928, the Tule Lake National Wildlife Refuge is located in Modoc and Siskiyou counties in extreme northern California approximately 6 miles west of Tulelake, California. Klamath Falls, Oregon, is 15 miles northwest of the refuge. The refuge, one of six within the Klamath Basin NWR complex, encompasses 39,116 acres. It is a varied mix of shallow marshes, open water, and croplands used by marsh birds and waterfowl.

The Tule Lake Refuge, as part of the Klamath Basin complex of refuges, is internationally famous for its abundance and diversity of wildlife. Over 400 species occur there. Large concentrations of waterfowl occur during spring and fall migration periods. The area is also host to one of the largest concentrations of wintering bald eagles in the contiguous United States, with over 500 typically present in January and February.

Tule Lake is the most popular of the six refuges in the complex. The vast majority of its recreational use is associated with wildlife observation. The refuge has a 14-mile auto tour and a two-mile canoe tour. Wildlife photography, birding, and waterfowl hunting are popular activities.

Area Economy

Although Tule Lake Refuge is located in Siskiyou and Modoc counties in northern California. Klamath Falls in Klamath County, Oregon, is the economic center of the area. The three-county area had a population of 114,000 in 1994, over half of it in Klamath County. The area's population has remained relatively stable, increasing 4.4 percent from 1985 to 1994.

Total employment was 54,151 in 1994, an increase of 13.2 percent over 1985. Services, government, and retail trade employed the greatest number of people for all three counties in 1994, making up 60 percent of the total workforce.

Bald eagle release. USFWS

Agriculture accounted for 16.2 percent of the workforce in Modoc County in 1994, a decrease of 3.7 percent from 1985. Agricultural employment accounted for 7.5 percent of the total workforce in Klamath County (0.4 percent decrease from 1985) and 6.4 percent in Siskiyou County (1.4 percent decrease from 1985).

In 1994, per-capita income was $16,419 in Klamath County, a 7.9 percent increase from 1985 (adjusted for inflation); $17,118 in Siskiyou County (7.7 percent increase from 1985); and $15,588 in Modoc County (2.4 percent increase from 1985). Average 1994 per-capita income was $20,471 for Oregon and $21,696 for the United States as a whole.

Activity Levels

The Tule Lake Refuge recorded 196,544 visitors in FY 1995. Of this number, 18,353 used the nature trails including the auto tour, 4,979 hunted migratory waterfowl, and 180,762 engaged in various types of wildlife observation activities. Visitation during the year is fairly spread out, with the spring and fall seasons getting a substantial amount of use. Non-consumptive users are estimated to spend about a half hour on the refuge per visit; hunters spend about 6 hours per day per visit.

The refuge staff estimated that about 95 percent of all hunters are non-residents (defined as living more than 30 miles from the refuge). About 80 percent of non-consumptive users come from outside the local area. Klamath Falls is 60 miles east of Interstate 5, the major north-south highway on the Pacific coast. A significant number of visitors come from the San Francisco, Portland, and

Seattle areas. Travel along Highway 395 in eastern California and eastern Oregon also provides some refuge visits. Lava Lands National Monument is only 12 miles south of the refuge. A significant number of refuge visitors also visit the Monument.

For the purposes of this analysis, non-consumptive visits are converted to refuge visitor days, defined as 8 hours of non-consumptive recreation activity per day. Non-consumptive refuge visitor days totaled 2,395 for residents and 9,578 for non-residents in FY 1995.

Regional Economic Analysis

The economic area for the refuge is defined as the counties of Klamath, Modoc, and Siskiyou. Though Klamath Falls in Klamath County is the economic hub of the area, smaller towns in Modoc and

Visitation during the year is fairly spread out, with the spring and fall seasons getting a substantial amount of use.

Table 17. Tule Lake NWR: Visitor Recreation-related Expenditures (1995 $ in thousands)

Activity	*Resident*	*Non-Resident*	*Total*
Non-consumptive	$36.7	$451.1	$487.8
Hunting	$3.9	$208.7	$212.6
Total	$40.6	$659.8	$700.4

The figure for net economic value is derived by multiplying net economic values for hunting and non-consumptive recreation use (on a per-day basis) by estimated refuge visitor days for that activity.

Siskiyou counties are also affected by refuge visitation and associated spending.

Table 17 shows visitor recreation expenditures for the Tule Lake Refuge for FY 1995. Total expenditures were $700,400, with non-resident expenditures accounting for $659,800. Non-consumptive spending accounted for almost 70 percent of total expenditures.

Table 18 summarizes the total economic impacts associated with refuge visitor spending. Total final demand associated with visitor spending was $683,600. This is the total monetary value of economic activity generated in the three-county area by refuge visitor spending. In turn, this final demand generated 19 jobs (both full and part time) with total employment income of $273,900.

Table 18. Tule Lake NWR: Economic Effects Associated with Refuge Visitation (1995 $ in thousands)

	Non-Residents	*Total*
Final Demand	$653.2	$683.6
Jobs	18	19
Job Income	$216.6	$273.9

Table 19 shows total economic effects (total final demand plus net economic value) compared with the refuge budget for FY 1995. For an individual, net economic value is that person's total willingness to pay for a particular recreation activity minus his or her actual expenditures for that activity. The figure for net economic value is derived by multiplying net economic values for hunting and non-consumptive recreation use (on a per-day basis) by estimated refuge visitor days for that activity. This is combined with the estimate of total final demand and divided by the refuge budget for FY 1995. The $1.50 means that for every $1 of budget expenditures, $1.50 of total economic effects are generated. This ratio is provided only for the purpose of broadly comparing the magnitude of the economic effects resulting from refuge visitation to total budget expenditures and should not be interpreted as a benefit-cost ratio.

Table 19. Tule Lake NWR: Summary of Economic Effects of Refuge Visitation (1995 $ in thousands)

	FY 1995 Budget	*Final Demand*	*Net Economic Value*	*Economic effects per $1 budget expenditure*
Tule Lake NWR	$625	$683.6	$238.8	$1.50

Mattamuskeet National Wildlife Refuge

Description

Mattamuskeet NWR encompasses 50,180 acres of Hyde County in coastal North Carolina. The landscape is dominated by 40,000-acre Lake Mattamuskeet, the largest natural lake in the state. Other habitats include marsh, timber, and croplands. Mattamuskeet lies in the middle of the Atlantic Flyway and provides staging and wintering areas for migratory birds. It hosts one-third to one-half of the flyway's tundra swan population each winter. The refuge is managed primarily to support waterfowl. The complex of diverse habitats provides for over 240 avian species and a variety of mammals, reptiles, and amphibians.

Most visitors to the refuge drive the 6-mile wildlife road, which provides outstanding wildlife viewing, especially in winter. Several points along State Highway 94 also provide excellent waterfowl-watching opportunities. Waterfowl hunting is permitted on the refuge. Although the lake is only 2 to 2.5 feet deep, fishing is a popular activity from March to November. Bass and white perch are the most common quarries.

Area Economy

The population of Hyde County has remained largely unchanged since 1960. Primary industries are farming, seafood, and state and local government. Per-capita personal income is in the lowest 20 percent for the state and 77 percent of the national average.

Hyde County ranked 99th among North Carolina's 100 counties in population. Neighboring Beaufort

The refuge is managed primarily to support waterfowl.

Wood ducks. Tim McCabe/SCS

Non-resident spending at Mattamuskeet is primarily associated with non-consumptive recreation.

County contains the city of Washington and so is somewhat more populous. Southern Tyrell County is within a few miles of the refuge along Route 94. These 3 counties were considered the local economic region for this study.

Activity Levels

RMIS reports 137,108 visitors to Mattamuskeet during FY 1995. The refuge is mostly water, so there are relatively few opportunities for land-based recreation. Most visitors spend about an hour driving the auto tour route. As a result, only one-eighth of a visitor day's expenditures are attributable to the refuge. This limits the economic impact of refuge visitors. The refuge is a 1.5 to 2-hour drive from the popular Outer Banks. Unfortunately, it is most impressive during the winter months, when relatively few tourists are on the islands. A "Swan Days" celebration at the refuge in December has drawn some visitors but has yet to become a major attraction. Most non-consumptive wildlife users are non-residents.

An annual waterfowl hunt on the refuge hosts over 600 hunters. The most commonly bagged species are northern pintail, green-winged teal, and black duck. Most waterfowl hunters are not residents of the region. About 22,000 visitors fish in the refuge lake and canals. The culverts along Route 94 are popular spots for local residents to stop and fish for short periods.

Regional Economic Analysis

Table 20 shows visitor recreation expenditures for the refuge during FY 1995. Non-resident spending at Mattamuskeet is primarily associated with non-consumptive recreation. Hunting is also largely a non-resident activity. Fishing expenditures are almost equally divided between residents and non-residents.

Table 21 summarizes the total economic impacts associated with refuge visitor spending. Non-resident visitors spent $600,700 while visiting Mattamuskeet. Because of leakage, this added only $388,000 to final demand and $155,000 to regional payrolls. It supported 11 new jobs and provided more than a quarter of 1 percent of the total earnings of Hyde County residents.

Table 20. Mattamuskeet NWR: Visitor Recreation-related Expenditures (1995 $ in thousands)

Activity	*Resident*	*Non-Resident*	*Total*
Non-consumptive	$21.1	$486.1	$507.2
Hunting	$0.4	$35.8	$36.2
Fishing	$77.4	$78.8	$156.2
Total	$98.9	$600.7	$699.6

Factoring in resident spending of almost $100,000 adds $69,000 to final demand and two more jobs.

Table 22 shows total economic effects (total final demand plus net economic value) compared with the refuge budget for FY 1995. The net economic value people derive from recreating on the refuge amounted to $556,000. So the total economic activity from refuge recreation is $1,014,000. The Fish and Wildlife Service spent $613,000 to operate and maintain Mattamuskeet in FY 1995. Although small by global standards, ecotourism at Mattamuskeet has the potential to attract visitors from nearby vacation centers and contribute to improving the region's economic condition.

Although small by global standards, ecotourism at Mattamuskeet has the potential to attract visitors from nearby vacation centers and contribute to improving the region's economic condition.

Table 21. Mattamuskeet NWR: Economic Effects Associated with Refuge Visitation (1995 $ in thousands)

	Non-Residents	*Total*
Final Demand	$388.8	$457.7
Jobs	11	13
Job Income	$155.3	$180.6

Table 22. Mattamuskeet NWR: Summary of Economic Effects of Refuge Visitation (1995 $ in thousands)

	FY 1995 Budget	*Final Demand*	*Net Economic Value*	*Economic effects per $1 budget expenditure*
Mattamuskeet NWR	$613	$457.7	$556.7	$1.70

Horicon National Wildlife Refuge

Horicon NWR was selected for this study because it is representative of refuges with moderate levels of public use and some fishing and hunting in the north-central states.

Photographer at Horicon NWR. Richard A. Coon

Description

Horicon NWR encompasses the northern two-thirds of Horicon Marsh, a 32,000-acre internationally recognized wetland in central Wisconsin. Sometimes called the "Everglades of the North," Horicon Marsh is the largest freshwater cattail marsh in the United States. The refuge includes 16,956 acres of wetlands and 4,309 acres of upland habitat. It is managed to provide habitat for nesting and migrating waterfowl.

The primary recreational activity on the refuge is wildlife watching. The refuge has several miles of hiking trails, a floating boardwalk, and a 3.2-mile auto tour route. Most visitors come in the fall to see the vast flocks of migrating waterfowl and the changing foliage. Public use facilities are designed to handle this peak flow of visitors. Large parking lots are easily accessible from state highways, and hiking trails are well marked. Visitation information is collected by car counters on the two major parking lots and foot-traffic counters on the major trails.

Fishing, as well as deer and small-game hunting, are permitted in some areas. Hunting areas are accessible from many small parking lots off local roads. Vehicle counts at these lots during hunting season are the source for hunting visitation data. Waterfowl hunting is not permitted on the refuge, but the southern third of the marsh, which is managed by the Wisconsin Department of Natural Resources, is a premier waterfowl hunting area. Horicon NWR was selected for this study because it is representative of refuges with moderate levels of public use and some fishing and hunting in the north-central states.

Area Economy

The population of Dodge and Fond du Lac counties has been stable over the last 30 years. The economy of the region is highly diversified. Much of the land is devoted to dairy farming for cheese production, but there is also a strong industrial and government services base. Mayville hosts several metal fabrication plants. Horicon is the home of John Deere's lawn tractor factory. Waupun houses several prisons. In addition, the area is an hour away from Milwaukee and Madison, so many people commute to work in these cities and their suburbs. Tourism is promoted by the Dodge County Tourism Council; wildlife and antiques are major selling points. Several small businesses serve ecotourists, including a boat tour operator and a private nature center.

Activity Levels

The Refuge Management Information System (RMIS) recorded 133,810 visitors during FY 1995. Of this number, 80,724 used the nature trails, 2,079

hunted, and 284 fished. More than half of this use occurred in September. Non-consumptive users and anglers were estimated to average 4 hours per visit. Hunters were estimated to average 6 hours on the refuge.

Refuge staff estimate that 90 percent of non-consumptive use visitors live more than 30 miles from the refuge, many of them in the cities of Milwaukee and Madison, which are within a 1-hour drive. Little public hunting land is available in this area of Wisconsin, so hunters travel some distance to reach the refuge. The refuge staff estimate that 60 percent of hunters are local residents. About 95 percent of the fish harvested on the refuge are small bullheads, which are popular with local anglers but probably do not attract non-resident anglers from other sites in the area. All anglers are assumed to be local residents.

Regional Economic Analysis

The refuge lies on the border of Dodge and Fond du Lac counties. Seventy-nine percent of the workers residing in these counties also work in them (REIS Journey to Work, 1990). Most of the remainder (14 percent) commute to neighboring Washington, Jefferson, Winnebago, or Waukesha counties. The cities of Fond du Lac, Beaver Dam, and Waupun within the two counties provide basic retail, business, and health care services for the local population. So for this analysis the local economic region is defined as Dodge and Fond du Lac counties.

The fall influx of non-resident, non-consumptive visitors generates most of the spending from Horicon visitation. Table 23 shows visitor recreation expenditures for the refuge during FY 1995. Non-resident refuge visitors spent about $1.8 million in the region. When all of the spending had cycled though the economy, the refuge generated $1.4 million in final demand, $582,000 in employee compensation, and 41 jobs.

Most of the refuge visitors are non-residents, so the significance differs only slightly from the impact. In total, refuge visitors spent $1.9 million in the region. The total effect of this spending was $1.53 million in final demand, $616,000 in employee compensation, and 44 jobs, as shown in Table 24.

Table 23. Horicon NWR:
Visitor Recreation-related Expenditures (1995 $ in thousands)

Activity	*Resident*	*Non-Resident*	*Total*
Non-consumptive	$70.8	$1,772.9	$1,843.7
Hunting	$11.9	$37.3	$49.2
Fishing	$1.5	----	$1.5
Total	$84.2	$1,810.2	$1,894.4

Clearly, each dollar spent to maintain public recreation at Horicon generates a large multiple in benefits.

These results compare fairly well with Heinrich and Craven's results from a 1986 survey of goose viewers. They found that 140,000 goose viewers spent $2.1 million in the area. When adjusted to 1995 dollars, this figure is $2.8 million, which compares to the $1.8 million of expenditures by non-consumptive users found in this study. Considering the contrasting methods used to reach these results, the fact that the findings are within 36 percent of each other lends credence to both estimates. Heinrich and Craven found a somewhat larger multiplier effect when they applied the IMPLAN model. They may have made different assumptions about the flow of income in the region or the distribution of expenditures.

Table 25 shows total economic effects (total final demand plus net economic value) compared with the refuge budget for FY 1995. Fish and Wildlife Service spending for payrolls, operations, and maintenance of Horicon was $333,000 in FY 1995. This spending is an additional stimulus to the local economy that was not included in the impact calculations. In addition to their spending, visitors derive other benefits from visiting the refuge. These consumer-surplus rewards, as determined from information about Wisconsin wildlife users, are valued at $1.84 million. Clearly, each dollar spent to maintain public recreation at Horicon generates a large multiple in benefits.

The region's total final demand in 1995 was $6.22 billion. Refuge recreation is 0.02 percent of total final demand and 0.06 percent of total earnings. Although it is a small part of the regional economy, the refuge and the marsh it protects define the region's character and are important for the promotion of a diverse regional economy.

Table 24. Horicon NWR: Economic Effects Associated with Refuge Visitation (1995 $ in thousands)

	Non-Residents	*Total*
Final Demand	$1,445.6	$1,529.9
Jobs	41	44
Job Income	$582.4	$616.7

Table 25. Horicon NWR: Summary of Economic Effects of Refuge Visitation (1995 $ in thousands)

	FY 1995 Budget	*Final Demand*	*Net Economic Value*	*Economic effects per $1 budget expenditure*
Horicon NWR	$333	$1,529.9	$1,840.2	$10.12

Charles M. Russell National Wildlife Refuge

Description

Located in north-central Montana, Charles M. Russell NWR is a 1.1-million-acre refuge that contains native prairies, forested coulees, river bottoms, badlands, and the 250,000-acre Ft. Peck Reservoir. Refuge wildlife include mule and white-tailed deer, elk, bighorn sheep, antelope, coyote, bobcat, beaver, sharp-tailed grouse, and numerous other species.

The refuge is spread across 6 counties: Fergus, Phillips, Petroleum, Garfield, Valley, and McCone. Paved highway access to the refuge is available on the western portion only where State Highway 191 crosses the Missouri River, and in the eastern portion in certain areas around Ft. Peck Reservoir. Gravel and dirt roads provide access to most of the recreation facilities within the refuge. Eight of those facilities are administered by the Army Corps of Engineers, two by the state of Montana, one by the U.S. Bureau of Land Management, and two by the U.S. Fish and Wildlife Service. Nine of these facilities provide boat-launching ramps.

Area Economy

The economic base area for the refuge is defined as the 6-county area identified above. It is assumed that most of the visitor expenditures take place within this area.

The area's population decreased by 10.8 percent from 1985 to 1994. Total employment was 10,065 in 1994, an increase of 13.2 percent from 1985. Business and consumer services, government (federal, state, and local), and retail sectors provided 50 percent of the jobs in the area in 1994. Manufacturing provided 3.7 percent and agriculture 16.9 percent of total jobs.

Business and consumer services, government (federal, state, and local), and retail sectors provided 50 percent of the jobs in the area in 1994.

Immobilized coyote being released.
Pedro Ramirez/USFWS

The refuge staff estimates that about two-thirds of all hunters and about 50 percent of anglers are non-resident.

Per-capita personal income increased by 20.1 percent from 1985 to 1994, adjusting for inflation. Garfield County had the area's highest per-capita income at $19,857; Petroleum County had the lowest at $13,428. The state of Montana had an average per-capita income of $17,794. The U.S. national average in 1994 was $21,696.

Activity Levels

The Charles M. Russell NWR recorded 110,540 visitors during FY 1995, over 96 percent of them for the purposes of hunting and fishing. Only 4,232 visits were primarily for non-consumptive recreation. Hunting accounted for 62,608 visits, fishing for 43,700 visits. The refuge has a national reputation for elk and mule deer. In 1995, 24 outfitters were permitted to operate on the refuge during the hunting season. Each outfitter serves approximately 30-100 clients during the season. Outfitters typically charge about $200 per day per client.

The refuge staff estimates that about two-thirds of all hunters and about 50 percent of anglers are non-resident (defined as being outside the 6-county area). For non-consumptive use, about two-thirds of visitors are non-resident.

Regional Economic Analysis

Table 26 shows visitor recreation expenditures for the Charles M. Russell NWR for FY 1995. Total expenditures were $4,842,000, with non-resident expenditures accounting for about 87 percent of the total. Total hunting expenditures were $3,296,200 and total fishing expenditures $1,507,700.

Table 27 summarizes the total economic impacts associated with refuge visitor spending. Total final demand associated with visitor spending was $3,481,000. This is the total monetary value of economic activity generated in the 6-county area by refuge visitor spending. In turn, this final demand generated 102 jobs (both full-time and part-time) with total employment income of $1,186,600.

Table 26. Charles M. Russell NWR: Visitor Recreation-related Expenditures (1995 $ in thousands)

Activity	*Resident*	*Non-Resident*	*Total*
Non-consumptive	$4.3	$33.8	$38.1
Hunting	$352	$2,944.2	$3,296.2
Fishing	$296	$1,211.7	$1,507.7
Total	$652.3	$4,189.7	$4,842.0

Table 28 shows total economic effects (total final demand plus net economic value) compared with the refuge budget for FY 1995. For an individual, net economic value is that person's total willingness to pay for a particular recreation activity minus his or her actual expenditures for that activity. The figure for net economic value is derived by multiplying net economic values for hunting, fishing, and non-consumptive recreation use (on a per-day basis) by estimated refuge visitor days for that activity. This is combined with the estimate of total final demand and divided by the refuge budget for FY 1995. The $5.60 means that for every $1 of budget expenditures, $5.60 of total economic effects are generated. This ratio is provided only for the purpose of broadly comparing the magnitude of the economic effects resulting from refuge visitation to total budget expenditures and should not be interpreted as a benefit-cost ratio.

This ratio is provided only for the purpose of broadly comparing the magnitude of the economic effects resulting from refuge visitation to total budget expenditures and should not be interpreted as a benefit-cost ratio.

Table 27. Charles M. Russell NWR: Economic Effects Associated with Refuge Visitation (1995 $ in thousands)

	Non-Residents	*Total*
Final Demand	$3,053.4	$3,481.0
Jobs	89	102
Job Income	$1,045	$1,186.6

Table 28. Charles M. Russell NWR: Summary of Economic Effects of Refuge Visitation (1995 $ in thousands)

	FY 1995 Budget	*Final Demand*	*Net Economic Value*	*Economic effects per $1 budget expenditure*
Charles M. Russell NWR	$1,211	$3,481	$3,281.2	$5.60

Laguna Atascosa National Wildlife Refuge

The refuge is home to 5 endangered and 2 threatened species.

Description

Laguna Atascosa is considered a "hotspot" by several birding guidebooks. Its location near the southern tip of Texas is the northern extreme of the range of many southern species and the southern extreme of many northern species—resulting in unusual levels of biodiversity. The 45,187-acre coastal plain refuge is essentially flat landscape interspersed with lakes, shallow wetlands, slow creeks, and low ridges. These features create several diverse habitats. The refuge is home to 5 endangered and 2 threatened species. It is managed to preserve 2 endangered cat species, the ocelot and the jaguarundi, and to provide habitat for migratory waterfowl and other species. Most of the nation's red-headed duck population winters on the refuge.

The refuge offers a 15-mile auto tour route, visitor center, and several trails. Most visitors come in the winter, when the weather is pleasant and northern birds are wintering in the area. Many visitors are "winter Texans" who move into the area's campgrounds and trailer parks to avoid the cold weather farther north. Summer temperatures often reach 100°F with high humidity.

A strip of refuge land along the Arroyo Colorado waterway has been intensively developed as a county park. The park is operated by the Cameron County Park System and offers boat ramps, fishing piers, and camping facilities. These activities are not related to the refuge mission and so are not counted in the economic analysis.

Area Economy

The population of Cameron County, where most of the refuge lies, has grown rapidly in the last 20 years. The city of Harlingen and its suburbs have over a quarter-million people. Willacy County and the part of Cameron County near the refuge are active cotton-growing areas. The refuge is a short drive from Brownsville, where many of the local users reside. Although Harlingen is

Redhead pair. Glen Smart/USFWS

removed from the maquilladora development at the Mexican border, much of its economy is driven by industrial development in Brownsville and McAllen. The regional chamber of commerce actively promotes the area to "winter Texans" and birders. An annual birding festival featuring the two national wildlife refuges in the area draws about 1,500 people each year.

Activities

Laguna Atascosa is almost exclusively a non-consumptive-use refuge. A limited deer and feral hog hunt is allowed each year, with about 100 participants spending 390 visitor days on the refuge. In contrast, over 100,000 visitor days were recorded by people watching wildlife and using the trails. Fishing is not permitted on the refuge, because it would interfere with the shorebirds. Ninety percent of visitors are assumed to be non-residents.

Regional Economic Analysis

Table 29 shows visitor recreation expenditures for the refuge during FY 1995. Ninety-seven percent of spending by visitors to Laguna Atascosa is by non-resident, non-consumptive users. It is indeed a birding destination "hotspot."

Non-residents spend more than $3.5 million related to their visits to Laguna Atascosa. Through the multiplier effect, $3.2 million in new economic activity is thus created, generating 79 new jobs and $1.3 million in payroll.

Most visitors are not residents of the area so total spending is similar to non-resident spending—$3.6 million. After the multiplier effect, this spending is responsible for $1.3 million in employee compensation and 81 jobs.

Table 31 shows total economic effects (total final demand plus net economic value) compared with the refuge budget for FY 1995. Government spending for Laguna Atascosa NWR in FY 1995 was $797,000. The net economic value visitors derived from their use of the refuge was $1.675 million. Almost $5 million in benefits was derived from maintaining public use of this refuge.

Through the multiplier effect, $3.2 million in new economic activity is thus created, generating 79 new jobs and $1.3 million in payroll.

Table 29. Laguna Atascosa NWR: Visitor Recreation-related Expenditures (1995 $ in thousands)

Activity	*Resident*	*Non-Resident*	*Total*
Non-consumptive	$72.5	$3,509.3	$3,581.8
Hunting	$7.8	$3.4	$11.2
Total	$80.3	$3,512.7	$3,593.0

Table 30. Laguna Atascosa NWR:
Economic Effects Associated with Refuge Visitation (1995 $ in thousands)

	Non-Residents	*Total*
Final Demand	$3172.2	$3,243.6
Jobs	79	81
Job Income	$1,278.9	$1,307.4

Table 31. Laguna Atascosa NWR:
Summary of Economic Effects of Refuge Visitation (1995 $ in thousands)

	FY 1995 Budget	*Final Demand*	*Net Economic Value*	*Economic effects per $1 budget expenditure*
Laguna Atascosa NWR	$797	$3,243.6	$1,675.8	$6.17

Las Vegas National Wildlife Refuge

Description

Las Vegas NWR encompasses 8,672 acres at the western edge of the Great Plains near the base of the Sangre de Cristo Mountains in New Mexico. At 6,500 feet, the high plains grassland is cut by steep, timbered canyons leading down to the Gallinas River and Vegosa Creek, which border the refuge. More than 40 lakes and ponds on the refuge provide habitat for wintering and migrating waterfowl. Irrigated farming provides cover and food for wildlife. The refuge is a popular place to view pronghorn antelope, diverse waterfowl, marsh and shorebirds, and many species of songbirds. Wintering bald eagles and other raptors may also be seen.

Lake McAllister, near the center of the refuge, is a state wildlife area owned and managed by the New Mexico Department of Game and Fish. It is a popular rainbow trout fishery open for sport fishing from March through October. Duck hunting is permitted on McAllister from October through January. All refuge lakes are closed to fishing.

There is a tightly controlled goose hunt each year. Hunters must participate in a drawing for permits. Hunting is allowed from established pit blinds only. As many as 18 hunters may be accommodated at one time. About 15 hunters take advantage of lands opened for dove hunting each year. The refuge has a 7-mile auto tour route, which also provides access to and from the McAllister Lake fishing area. Refuge staff distinguish anglers from non-consumptive wildlife users via sample counts and the refuge visitor log. A nature trail skirts a small canyon in the southwest corner of the refuge.

Area Economy

Las Vegas, New Mexico, is a small city 60 miles east of Santa Fe. The area is thinly populated. Ranching and government services are the major industries. The city provides ample shopping, medical,

The refuge is a popular place to view pronghorn antelope, diverse waterfowl, marsh and shorebirds, and many species of songbirds.

Hiking in Las Vegas NWR. Ward Feurt

From an analysis of the visitor log, the refuge staff estimates that 28 percent of these visitors were merely passing through the refuge on the way to McAllister Lake.

and other personal services. The county population has been growing slowly over the last 20 years. The unemployment rate has tended to be above the national average. It reached 14.1 percent in June 1996. Per-capita personal income is $12,294, 56.7 percent of the national average.

Activity Levels

The RMIS data indicates 70,063 visitors to Las Vegas NWR during FY 1995. From an analysis of the visitor log, the refuge staff estimates that 28 percent of these visitors were merely passing through the refuge on the way to McAllister Lake. The remaining 50,445 non-consumptive-use visitors were estimated to spend an average of 2 hours on the refuge. This includes about 500 users of the Gallinas Nature Trail. Of those who signed the visitor log, 18 percent gave a Las Vegas address. Because local people often do not sign visitor logs, another one-third was added to their total, making residents 24 percent of all visitors. Forty-six percent were from New Mexico.

A total of 108 waterfowl hunting days and 15 mourning dove hunting days were counted at the refuge in FY 1995. All hunters were believed to be New Mexico residents.

Table 32. Las Vegas NWR: Visitor Recreation-related Expenditures (1995 $ in thousands)

Activity	*Resident*	*Non-Resident*	*Total*
Non-consumptive	$41.2	$416.0	$457.2
Hunting	$2.1	----	$2.1
Total	$43.3	$416.0	$459.3

Regional Economic Analysis

San Miguel County is fairly remote but self contained, so it is assumed to represent the refuge's local area. Table 32 shows visitor recreation expenditures for the refuge during FY 1995. Non-resident visitors to the area spent $416,000 in the local economy in FY 1995. San Miguel County produces only a small array of products, so many goods are imported to the region. As a result, leakage of expenditures from the regional economy is unusually large. The total effect of non-resident spending is $236,000 in final demand, seven new jobs, and $88,000 in new employee compensation.

Because most visitors are non-resident and residents spend less, the significance is only $28,000 more than the impact from the refuge. The total effect of this in the local economy is $264,800 in total demand, eight jobs, and $98,000 employee compensation.

Table 34 shows total economic effects (total final demand plus net economic value) compared with the refuge budget for FY 1995. Las Vegas NWR spent $319,000 on operations and maintenance in FY 1995. In addition to spending money in the area, visitors to the refuge derived pleasure from their stay. For Las Vegas visitors this net economic value is estimated to be $638,700. Las Vegas returns more than twice as many recreation benefits as the Fish and Wildlife Service spends to maintain it.

Las Vegas returns more than twice as many recreation benefits as the Fish and Wildlife Service spends to maintain it.

Table 33. Las Vegas NWR: Economic Effects Associated with Refuge Visitation (1995 $ in thousands)

	Non-Residents	*Total*
Final Demand	$236.4	$264.8
Jobs	7	8
Job Income	$88.3	$98.7

Table 34. Las Vegas NWR: Summary of Economic Effects of Refuge Visitation (1995 $ in thousands)

	FY 1995 Budget	*Final Demand*	*Net Economic Value*	*Economic effects per $1 budget expenditure*
Las Vegas NWR	$319	$264.8	$638.7	$2.83

Umatilla National Wildlife Refuge

Umatilla NWR is intensively managed to meet its wildlife objectives: producing Great Basin Canada geese during spring and fall migrations, and providing habitat for other migratory birds.

Description

The Umatilla National Wildlife Refuge consists of approximately 23,000 acres of upland, marsh, and open water along the Columbia River between Irrigon, Oregon, and Crow Butte State Park, Washington. The refuge was officially established on July 3, 1969, to mitigate the loss of flooding of wildlife habitat caused by the construction of the John Day Lock and Dam by the U.S. Army Corps of Engineers. Dam construction raised the level of the river 25 feet, creating Lake Umatilla between the John Day and McNary dams.

The refuge is divided into 6 units, 2 in Oregon, 3 in Washington, and 1 in mid-river. Portions of the McCormack and Whitcomb Island units are cooperatively farmed; the other units are managed as wildlands.

Umatilla NWR is intensively managed to meet its wildlife objectives: producing Great Basin Canada geese during spring and fall migrations, and providing habitat for other migratory birds. Waterfowl populations peak in mid to late November, when 200,000 mallards and 33,000 Canada geese visit the refuge.

Area Economy

The Umatilla NWR is located in Morrow County in northeastern Oregon and in Benton County in southeastern Washington. Franklin County, Washington, is also included in the refuge's economic area since a significant number of refuge anglers live there. The area had a population of 180,600 in 1994, an increase of 15 percent from 1985. Total employment increased by 35.9 percent from 1985 to 1994. Total wages and salaries paid increased by 34 percent during the same period. Business and consumer services, government (local, state, and federal), and retail sectors comprise 65 percent of employment in the area. Manufacturing and agriculture account for 6 and 9 percent respectively. Since 1985, service-sector employment has grown by 87 percent, and government and retail sectors by 35 and 38 percent, respectively. Manufacturing has declined by 49 percent while agriculture has increased by 31 percent.

Per-capita personal income increased in Benton County by 17 percent from 1985 to 1994, adjusted for inflation. Per-capita income increased by 15.5 percent in Franklin County and decreased by 5.6 percent in Morrow County. In 1994, per-capita income was $22,053 for Benton County, $16,999 for Franklin County, and $16,213 for Morrow County. This compares with $22,526 for the state of Washington, $20,471 for the state of Oregon, and a national average of $21,696.

Activity Levels

The refuge recorded 55,459 visits during FY 1995. Non-consumptive uses, including boating, wildlife photography and observation, hiking, and picnicking, totaled 16,309. Fishing accounted for 23,437 visits, waterfowl hunting for 14,188 visits, and upland and big-game hunting for 1,525 visits.

The refuge staff estimates that about 70 percent of non-consumptive users and anglers are residents of the area (defined as living within a 30-mile radius of the refuge). Migratory waterfowl hunters are comprised of 70 percent non-residents, big-game hunters are 90 percent non-residents, and small-game hunters are 40 percent non-residents.

The refuge staff also estimated the number of hours visitors spend on the refuge for different activities. Anglers typically spend about 3 hours per day per visit; non-consumptive users range from one-half hour to 3 hours per day, depending on the activity; waterfowl hunters spend about 6 hours, and upland and big-game hunters about 3 and 4 hours, respectively.

A number of small towns are close by the refuge, including Paterson and Plymouth on the Washington side and Boardman, Irrigon, and Umatilla on the Oregon side. These towns benefit from recreation expenditures on food, gas, lodging, sporting goods, and other items.

For the purposes of this analysis, non-consumptive visits are converted to refuge visitor days, defined as 8 hours of non-consumptive recreation activity per day. Non-consumptive use visitor days totaled 2,005. Non-residents totaled 612 days and residents 1,393 days.

Regional Economic Analysis

The economic area for the refuge is defined as Morrow County in Oregon and Benton and Franklin counties in Washington. It is assumed that refuge visitor expenditures occur primarily within this 3-county area.

Table 35 shows visitor recreation expenditures for the refuge for FY 1995. Total expenditures were $1,280,500, with non-residents accounting for $907,000, 71 percent of the total. Expenditures on fishing accounted for 53 percent of the total, hunting 43 percent, and non-consumptive use 4 percent.

Table 36 summarizes the total economic impacts associated with refuge visitor spending. Total final demand was $853,700. This is the total monetary value of economic activity generated in the 3-county area by refuge visitor spending. In turn, this final demand generated 23 jobs (both full-time and part-time) with total employment income of $338,100.

Table 37 shows total economic effects (total final demand plus net economic value) compared with the refuge budget for FY 1995. For an individual, net economic value is that person's total willingness to pay for a particular recreation activity minus his or her actual expenditures for that activity. The figure for net economic value is derived by multiplying net economic values for hunting,

Table 35. Umatilla NWR: Visitor Recreation-related Expenditures (1995 $ in thousands)

Activity	*Resident*	*Non-Resident*	*Total*
Non-consumptive	$21.4	$28.8	$50.2
Hunting	$81.1	$470.7	$551.8
Fishing	$271.0	$407.5	$678.5
Total	$373.5	$907.0	$1,280.5

fishing, and non-consumptive recreation use (on a per-day basis) by estimated refuge visitor days for that activity. This figure is combined with the estimate of total final demand and divided by the refuge budget for FY 1995. The $3.84 means that for every $1 of budget expenditures, $3.84 of total economic effects are generated. This ratio is provided only for the purpose of broadly comparing the magnitude of the economic effects resulting from refuge visitation to total budget expenditures and should not be interpreted as a benefit-cost ratio.

Table 36. Umatilla NWR: Economic Effects Associated with Refuge Visitation (1995 $ in thousands)

	Non-Residents	*Total*
Final Demand	$579.0	$853.7
Jobs	15	23
Job Income	$230.3	$338.1

Table 37. Umatilla NWR: Summary of Economic Effects of Refuge Visitation (1995 $ in thousands)

	FY 1995 Budget	*Final Demand*	*Net Economic Value*	*Economic effects per $1 budget expenditure*
Umatilla NWR	$735	$853.7	$1,965.6	$3.84

Upper Souris National Wildlife Refuge

Description

The Upper Souris National Wildlife Refuge is situated in the drift prairie region of north-central North Dakota, on the western arm of the Souris River Loop. Entering the U.S. from Canada 28 river miles north of the refuge, the Souris River flows through the refuge for 69 miles before heading for Minot and the J. Clark Salyer NWR.

Upper Souris NWR covers 32,092 acres of the Souris River valley in Ward and Renville counties. Wildlife habitat on the refuge includes 17,504 acres of native grasslands, 40 acres of introduced grasses, 733 acres of dense nesting cover, 812 acres of woodlands, 12,643 wetland acres (river, lake, and shallow marshes), and 360 acres of administrative area. The landscape includes a narrow band of river-bottom woodlands, fertile floodplains, rolling hills, and steep brush-covered coulees.

The refuge receives considerable public use due to its nearness to the city of Minot and the Minot Air Force Base. An auto tour route, hiking trails, canoe routes, observation points, and grouse observation blinds provide many opportunities for the visitor to view wildlife.

Area Economy

The economic center of the area is the city of Minot (population 35,000). Ward County is economically diverse, serving as the finance, banking, retail, and health-care center for the surrounding areas. Both Minot State University and Minot Air Force Base are located in the county. Renville County is predominantly agricultural.

The 2-county area had a population of 60,800 in 1994, a 6 percent drop from 1985. The population of Renville County decreased from 3,600 to 2,900 from 1985 to 1994, a drop of 19.4 percent. Total employment in the area increased from 34,947 to 38,705, or 10.8 percent, from 1985 to 1994. In Ward County, business and consumer services, government (federal, state, and local), and retail sectors comprised 74 percent of total wage and salary employment. In Renville County, these sectors accounted for 47 percent of employment. Manufacturing contributed 3 percent of total jobs in Ward County and 1.7 percent in Renville County. Agriculture accounted for 3.5 percent of total employment in Ward County and 31 percent in Renville County.

Per-capita personal income increased by 12.5 percent in Ward County and 6.5 percent in Renville County from 1985 to 1994, adjusting for inflation. This amounts to an annual growth rate of 5.2 percent for Ward County and 4.8 percent for Renville County. Ward County had a per-capita income of $18,640 in 1994; Renville County's was $20,228. This compares with the North Dakota state average of $18,738 and the national average of $21,696.

Activity Levels

The refuge recorded 46,828 visitors during FY 1995. Of this number, 40,000 visits were for the primary purpose of fishing, 6,393 were for non-consumptive recreation such as birding, photography, wildlife observation, auto-tours, canoe tours, hiking, and picnicking; and 435 were for hunting upland and big game. The 1995 visitor numbers are about half of what the refuge experienced in the late 1980s and early 1990s. Low water

The refuge receives considerable public use due to its nearness to the city of Minot and the Minot Air Force Base.

Anglers and hunters typically spend 4 or more hours per day per visit on the refuge; non-consumptive users typically spend about 2 hours per day per visit.

has significantly affected the fishing on the refuge. With the return of more normal water levels in 1996, the refuge staff projects that visitor levels will increase to over 100,000 for FY 1996 and 1997.

The staff estimated that about 85 percent of anglers and hunters are residents (people who live within 30 miles of the refuge). About 95 percent of non-consumptive users are residents. Anglers and hunters typically spend 4 or more hours per day per visit on the refuge; non-consumptive users typically spend about 2 hours per day per visit.

For the purposes of this analysis, non-consumptive visits are converted to refuge visitor days, defined as 8 hours of non-consumptive recreation activity per day. Non-consumptive refuge visitor days totaled 1,518 for residents and 80 for non-residents.

Regional Economic Analysis

The economic base area for the refuge is defined as Ward and Renville counties. It is assumed that refuge visitor expenditures occur primarily within this area.

Table 38 shows visitor recreation expenditures for the refuge for FY 1995. Total expenditures were $909,300, with residents accounting for slightly over 50 percent. Fishing-related expenditures accounted for over 96 percent of the total.

Table 39 summarizes the total economic impacts associated with refuge visitor spending. Total final demand associated with visitor spending was $1,028,700. This is the total monetary value of economic activity generated in the 2-county area by refuge visitor spending. In turn, this final demand generated 32 jobs (both full-time and part-time) with total employment income of $419,900.

Table 40 shows total economic effects (total final demand plus net economic value) compared with the refuge budget for FY 1995. For an individual, net economic value is that person's total willingness to pay for a particular recreation activity minus his or her actual expenditures for that activity. The figure for net economic value is derived by multiplying net economic values for hunting,

Table 38. Upper Souris NWR: Visitor Recreation-related Expenditures (1995 $ in thousands)

Activity	*Resident*	*Non-Resident*	*Total*
Non-consumptive	$18.6	$3.8	$22.4
Hunting	$5.7	$4.1	$9.8
Fishing	$433.5	$443.6	$877.1
Total	$457.8	$451.5	$909.3

fishing, and non-consumptive recreation use (on a per-day basis) by estimated refuge visitor days for that activity. This is combined with the estimate of total final demand and divided by the refuge budget for FY 1995. The $9.71 means that for every $1 of budget expenditures, $9.71 of total economic effects are generated. This ratio is provided only for the purpose of broadly comparing the magnitude of the economic effects resulting from refuge visitation to total budget expenditures and should not be interpreted as a benefit-cost ratio.

. . . for every $1 of budget expenditures, $9.71 of total economic effects are generated.

Table 39. Upper Souris NWR: Economic Effects Associated with Refuge Visitation (1995 $ in thousands)

	Non-Residents	*Total*
Final Demand	$504.3	$1,028.7
Jobs	16	32
Job Income	$210.3	$419.9

Table 37. Upper Souris NWR: Summary of Economic Effects of Refuge Visitation (1995 $ in thousands)

	FY 1995 Budget	*Final Demand*	*Net Economic Value*	*Economic effects per $1 budget expenditure*
Upper Souris NWR	$244	$1,028.7	$1,340.3	$9.71

Quivira National Wildlife Refuge

The natural and developed marshes on the refuge provide resting and feeding areas for spring and fall migrating waterfowl and wintering habitat for mallards and Canada geese.

Description

Quivira NWR is located in Stafford, Rice, and Reno counties in south-central Kansas. Its establishment was approved by the Migratory Bird Conservation Commission on May 3, 1955, and acquisition of the 21,820 acres was completed in 1969. The natural and developed marshes on the refuge provide resting and feeding areas for spring and fall migrating waterfowl and wintering habitat for mallards and Canada geese. In addition, thousands of shorebirds and sandhill cranes use the refuge during migration in the spring and fall. Whooping cranes, bald eagles, and interior least terns use the refuge as well. Summer residents include white pelicans, gulls, various hawks, avocets, egrets, and many others. Ring-necked pheasants, bobwhite quail, wild turkey, white-tailed deer, prairie dogs, and coyotes are commonly seen.

The refuge has 21 miles of canals through which water is diverted to over 30 wetlands ranging in size from 10 to 1,500 acres and totaling over 5,000 acres. Hunting and fishing are permitted on 8,000 acres of the refuge in accordance with state seasons. The refuge is an excellent birding area.

Area Economy

The refuge's economic base is defined as the counties of Stafford, Reno, and Rice in south-central Kansas, plus Barton County to the northwest of the refuge. Hutchinson (population 40,000) in Reno County, about 20 miles from the refuge, is the largest town in the area. About 500,000 people live within a 1´-hour drive of the refuge. This larger area includes the cities of Wichita (304,000 population), Salina (42,000), Great Bend (15,500), McPherson (12,422), Newton (16,700), and Pratt (6,800).

Total employment in the 4-county area was 64,987 in 1994, a decrease of 2.7 percent from 1985. During the same period, and adjusting for inflation, total wages and salaries paid declined by 1.1 percent. Business and consumer services, government (federal, state, and local), and retail sectors accounted for 58 percent of total jobs in the area in 1994. From 1985 to 1994, total jobs in these three sectors increased by 12 percent, agricultural employment decreased by 16.6 percent, and manufacturing employment decreased by 11.8 percent.

Per-capita personal income increased by 4.3 percent in the 4-county area from 1985 to 1994, adjusting for inflation. Stafford County had the area's largest per-capita income at $21,136 (a 17.5 percent increase from 1985), followed by Reno at $19,503 (7.1 percent), Barton at $19,256 (2.0 percent), and Rice at $18,427 (4.3 percent). Average 1994 per-capita income for Kansas was $20,760, and the national average was $21,696.

Activity Levels

The Quivira NWR recorded 38,427 visits during FY 1995. Non-consumptive recreation, such as birding, auto-touring, wildlife photography, and observation, totaled 23,531 visits. Hunting of migratory birds accounted for 10,238 visits, upland game hunting for 4,443 visits.

The refuge staff estimated that about 80 percent of all hunters were non-residents (defined as living more than 30 miles from the refuge). About 60 percent of non-consumptive visits are by non-residents. Non-consumptive use visitors typically spend 2 to 3 hours

per visit, hunters about 5 hours.

For the purposes of this analysis, non-consumptive use visits are converted to refuge visitor days, defined as 8 hours of non-consumptive recreation activity per day. Non-consumptive refuge visitor days totaled 3,530 for residents and 5,295 for non-residents in FY 1995.

Regional Economic Analysis

Table 41 shows recreation-related expenditures by refuge visitors for FY 1995. It is assumed that most of the expenditures for refuge visits occurs within the 4-county area. Total expenditures were $975,400, with non-residents totaling $891,600. Non-consumptive recreation expenditures were $295,800. Hunting expenditures totaled $674,900.

Table 42 summarizes the total economic impacts associated with refuge visitor spending. Total final demand associated with visitor spending was $1,046,900. This is the total monetary value of economic activity generated in the 4-county area by refuge visitor spending. In turn, this final demand generated 24 jobs (both full-time and part-time) with total employment income of $361,600.

. . . this final demand generated 24 jobs (both full-time and part-time) with total employment income of $361,600.

Table 41. Quivira NWR:
Visitor Recreation-related Expenditures (1995 $ in thousands)

Activity	*Resident*	*Non-Resident*	*Total*
Non-consumptive	$43.3	$252.5	$295.8
Hunting	$38.2	$636.7	$674.9
Fishing	$2.3	$2.4	$4.7
Total	$83.8	$891.6	$975.4

Table 42. Quivira NWR:
Economic Effects Associated with Refuge Visitation (1995 $ in thousands)

	Non-Residents	*Total*
Final Demand	$940.7	$1,046.9
Jobs	22	24
Job Income	$327.1	$361.6

Table 43 shows total economic effects (total final demand plus net economic value) compared with the refuge budget for FY 1995. For an individual, net economic value is that person's total willingness to pay for a particular recreation activity minus his or her actual expenditures for that activity. The figure for net economic value is derived by multiplying net economic values for hunting, fishing, and non-consumptive recreation use (on a per-day basis) by estimated refuge visitor days for that activity. This is combined with the estimate of total final demand and divided by the refuge budget for FY 1995. The $3.99 means that for every $1 of budget expenditures, $3.99 of total economic effects are generated. This ratio is provided only for the purpose of broadly comparing the magnitude of the economic effects resulting from refuge visitation to total budget expenditures and should not be interpreted as a benefit-cost ratio.

Table 43. Quivira NWR: Summary of Economic Effects of Refuge Visitation (1995 $ in thousands)

	FY 1995 Budget	*Final Demand*	*Net Economic Value*	*Economic effects per $1 budget expenditure*
Quivira NWR	$454	$1,046.9	$764.1	$3.99

Hunting for migratory birds contributes revenue to the local economy.

Tensas River National Wildlife Refuge

Description

Tensas River NWR is a 63,925-acre island of forest in a sea of agricultural land. It was established in 1980 to preserve the largest privately owned tract of bottomland hardwood habitat remaining in the Mississippi delta. The refuge is home to the threatened Louisiana black bear and American alligator. Human activities affect this environment tremendously. The Tensas River is polluted by agricultural runoff of pesticides and fertilizers. Oil and gas production activities penetrate the refuge.

Hunting and fishing are the largest public-use programs on the refuge. Deer, squirrel, raccoon, turkey, and waterfowl are hunted with bow and arrow, muzzleloaders, and other weapons. Special permits and training are required to hunt on the refuge. Bass and crappie are popular quarries for anglers. Several lakes are open for fishing year-round.

Much of the refuge is difficult to access on foot, limiting non-consumptive use. A hiking trail loop around Rainey Lake and a boardwalk to an observation platform receive most of the land-based attention. A primitive canoe-launch site provides water access to the river. All-terrain vehicles (ATVs) are permitted on designated trails. The refuge has a strong environmental education program. Teacher-training workshops and environmental summer camps are hosted annually.

Area Economy

Tensas River NWR is about 25 miles west of Vicksburg, Mississippi, in the Madison, Tensas, and Franklin parishes of Louisiana. Population in the area has declined more than 25 percent since 1960. Farming is the largest industry, providing 30 percent of local earnings. Per-capita personal income in the area is more than 27 percent below the national average.

Activity Levels

RMIS data shows 18,313 visitors to Tensas River NWR in FY 1995. More than half of them hunted or fished. Tensas River was included in this study to represent refuges in the South that have relatively low visitation and a high proportion of hunting recreation. Some 7,000 visitor days were attributed to big-game hunting. Only 20 percent of big-game hunters were from the adjacent parishes. Small-game hunters spent 1,400 visitor days pursuing squirrels and raccoons. Thirty percent of small game hunters lived in the area. Migratory bird hunters and anglers spent 300 and 715 days, respectively, at the refuge. About half of each group was believed to reside in the area.

Most non-consumptive wildlife users were from outside the local area. They took part in several different activities on the refuge, so each visitor was counted several times. Most users of the boardwalk trail, for example, pause at the observation platform at the end and so are counted twice. More than 33,000 activity visits were recorded.

Regional Economic Analysis

The refuge touches 3 Louisiana parishes — Tensas, Madison, and Franklin. Richland and East and West Carroll parishes are within a few miles, so they are also included in the local region. Vicksburg, Mississippi, is the business center for the area, so it too is included.

Tensas River was included in this study to represent refuges in the South that have relatively low visitation and a high proportion of hunting recreation.

This money also contributes to the regional economy as both payrolls and other expenses are income to local people and businesses.

Table 44 shows visitor recreation expenditures for the refuge during FY 1995. Non-resident visitors spent $541,700 in the region. The largest contributors were non-resident big-game hunters. As it flowed through the regional economy, this spending increased final demand by $473,500, added $140,500 to employee compensation and resulted in 10 new jobs. When resident spending is included, job income totals $153,000. This is about 0.3 percent of Tensas Parish's annual earnings.

Table 46 shows total economic effects (total final demand plus net economic value) compared with the refuge budget for FY 1995. As explained earlier, people derive benefits over and above what they pay for recreation. This consumer surplus is estimated to be $549,100 for Tensas River. The refuge spent $802,000 for personnel, maintenance, and operations during FY 1995. This money also contributes to the regional economy as both payrolls and other expenses are income to local people and businesses. For every $1 spent for the refuge, $1.33 in recreational benefits accrue. All the other benefits of the refuge (habitat preservation, flood control, etc.) are in addition to this amount.

Table 44. Tensas River NWR:
Visitor Recreation-related Expenditures (1995 $ in thousands)

Activity	*Resident*	*Non-Resident*	*Total*
Non-consumptive	$25.2	$248.5	$273.7
Hunting	$20.7	$286.8	$307.5
Fishing	$1.6	$6.4	$8.0
Total	$47.5	$541.7	$589.2

Table 45. Tensas River NWR:
Economic Effects Associated with Refuge Visitation (1995 $ in thousands)

	Non-Residents	*Total*
Final Demand	$473.5	$517.0
Jobs	10	11
Job Income	$140.5	$153.2

Table 46. Tensas River NWR:
Summary of Economic Effects of Refuge Visitation (1995 $ in thousands)

	FY 1995 Budget	*Final Demand*	*Net Economic Value*	*Economic effects per $1 budget expenditure*
Tensas River NWR	$802	$517.0	$549.1	$1.33

An Overview of Sample Refuges

This section recapitulates the results from the detailed case studies to highlight the differences among the sampled refuges.

The refuges discussed in this study are not a random sample of national wildlife refuges. They were selected to be representative of distinct, recognizable types so that people interested in a refuge not included in the study could find a similar refuge in the study and apply the results.

Many variables affect a refuge's economic impact on its region. Some relate to the refuge and its public use program; others relate to the economy of the region. This section recapitulates the results from the detailed case studies to highlight the differences among the sampled refuges. This information is not intended as a "rating" of refuges. Refuges serve many different purposes — a refuge with no public use, for example, could be vital to the survival of an endangered species. Each refuge must be viewed in light of its individual goals and how it achieves them.

A close look at Table 47 shows how differences in refuge use result in different economic results. Time spent, activities enjoyed, and residence of visitors all have a role in refuge recreation economics. The National Elk Refuge, for example, is on a heavily traveled tourist route between Jackson Hole and Yellowstone National Park in Wyoming. Many visitors stop for a short break from the drive, so non-consumptive user visitation is very high but time spent on the refuge is relatively short. The number of recreational visitor days is lower than on other refuges with similar visitation and so the economic results are smaller.

Charles M. Russell NWR highlights the importance of visitors' activities. Although it receives only about one-sixth the number of visitors of the National Elk Refuge, they produce more than twice the economic activity (see Figure 4).

Bull elk. National Park Service

Table 47. Sample Refuges' Visitation and Economic Significance

Refuge	*Visits*	*Recreational Visitor Days*	*Total Expenditures (mm$1995)*	*Non-Resident Expenditures (mm$1995)*	*Final Demand (mm$1995)*	*Jobs*	*Employee Income (mm$1995)*
Chincoteague	1,384,132	1,053,424	32.669	30.564	22.868	590	10.115
Crab Orchard	838,989	325,668	5.930	3.293	6.082	147	2.152
National Elk Refuge	660,510	65,438	2.469	2.230	1.558	41	0.663
Eufaula	322,632	206,717	6.714	5.768	5.350	140	2.244
San Francisco Bay	281,151	77,713	1.577	0.557	1.788	36	0.828
Tule Lake	196,544	16,952	0.700	0.660	0.655	18	0.250
Mattamuskeet	137,108	23,210	0.700	0.601	0.458	13	0.181
Horicon	133,810	67,960	1.895	1.810	1.530	44	0.617
Charles M. Russell	110,540	107,366	4.842	4.190	3.481	102	1.187
Laguna Atascosa	106,960	53,738	3.593	3.513	3.244	81	1.307
Las Vegas	63,918	12,702	0.459	0.416	0.265	8	0.098
Umatilla	55,459	41,155	1.280	0.907	0.854	23	0.338
Upper Souris	46,828	42,033	0.909	0.452	1.029	32	0.420
Quivira	38,427	23,720	0.975	0.892	1.047	24	0.362
Tensas River	18,313	8,432	0.589	0.542	0.517	11	0.153

Figure 4. Expenditures by Visitor Activity on the Refuge. ($ in millions)

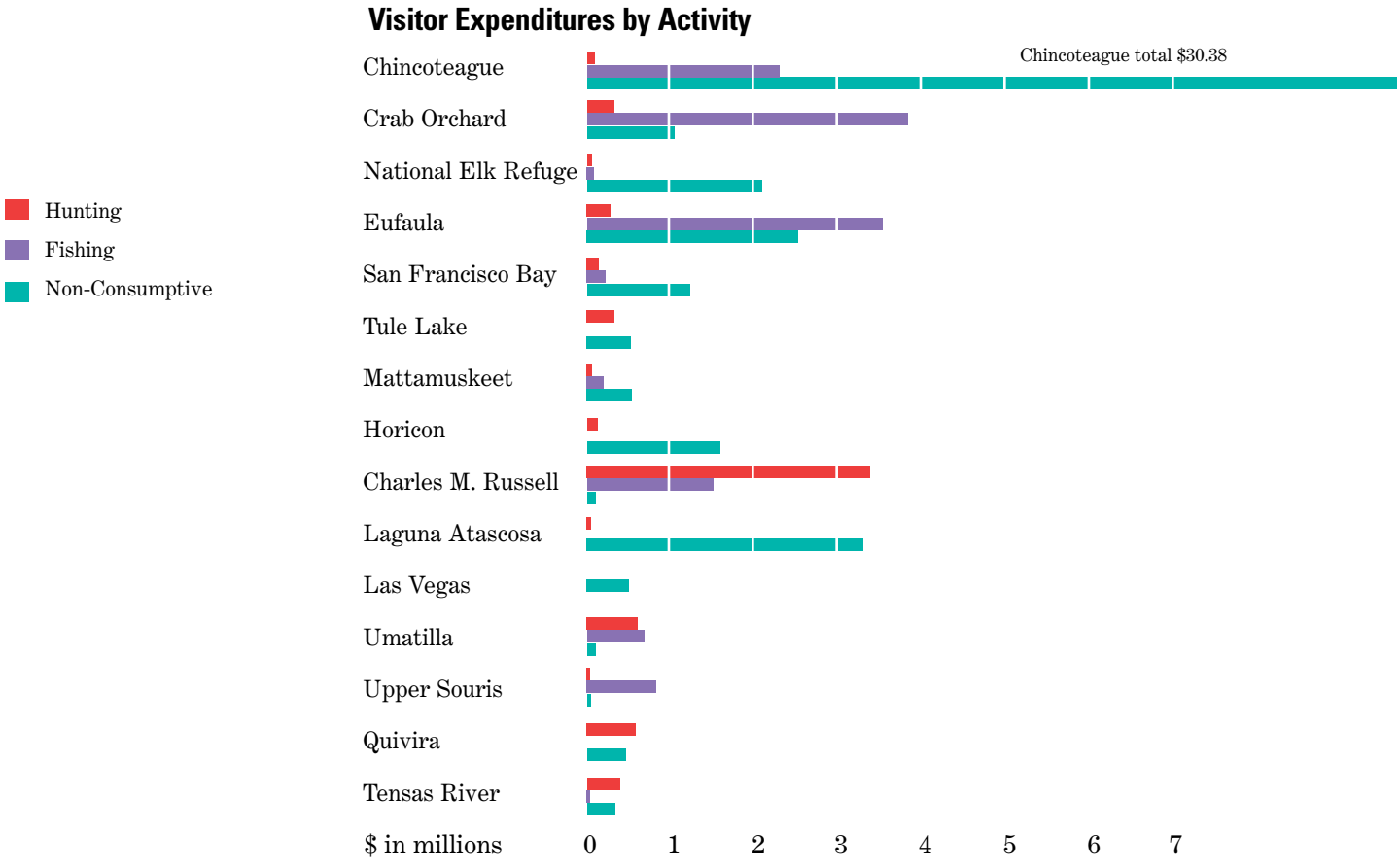
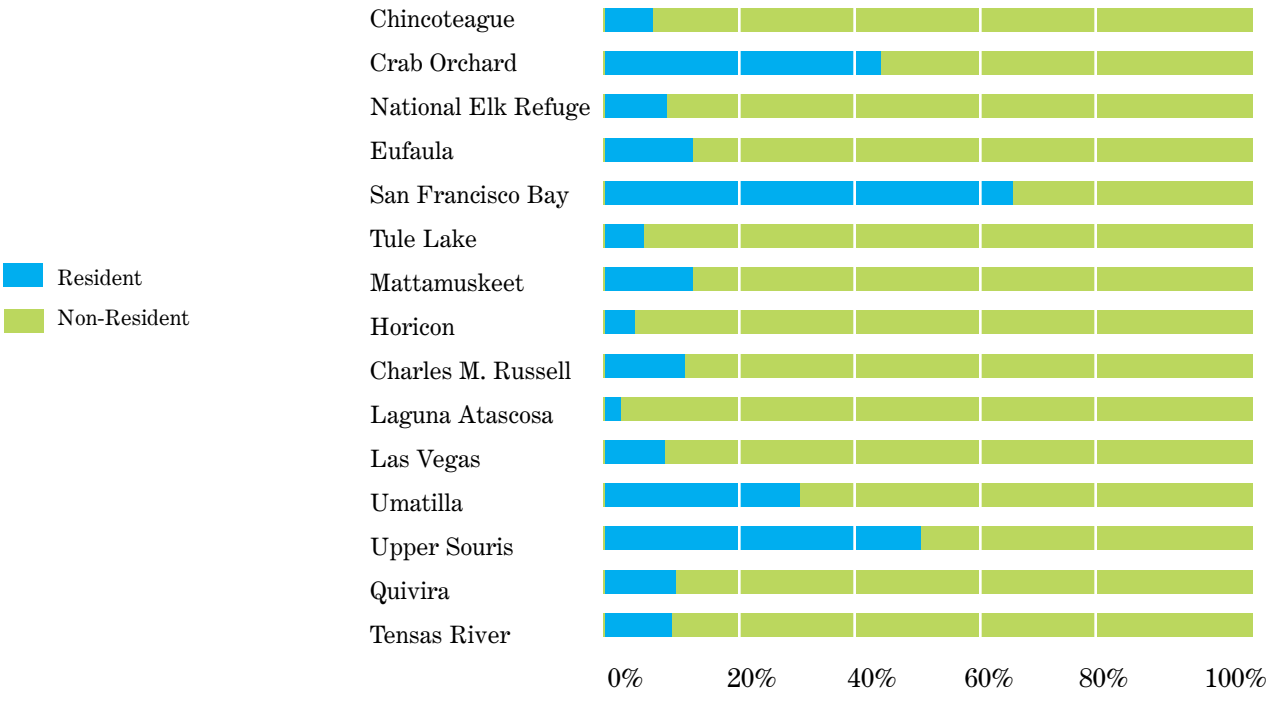


Figure 5. Expenditures by Visitor's State of Residence.



Charles M. Russell visitors are primarily hunters and anglers who stay in the area for long periods of time. The refuge is also very large, so it may take several hours to move from one area to another. A visit is almost always an all-day activity.

Crab Orchard NWR illustrates the importance of residence. Although it receives 40 percent of Chincoteague's number of recreational visitor days, Crab Orchard generates less than one-third of Chincoteague's economic activity. Much of Crab Orchard's visitation is by local anglers who do not spend as much as non-resident visitors (see Figure 5).

Certain ratios may shed more light on the differences among the sample refuges and their local economies. The differences in visitors' length of stay are shown by the Recreation Visitor Days per Visit ratio in Table 48 and Figure 6. Charles M. Russell's ratio is near 1 while the National Elk Refuge's ratio is only one-tenth of a day.

Final Demand, Jobs, and Employment Income per 1,000 visits are broad measures of the economic significance of a refuge's visitation to its neighborhood. These measures show the variation in the ultimate impact of the refuge when all of the factors are included. The broad range of change in Final Demand per 1,000 visits from $2,300 to $31,000 highlights how inaccurate any blanket assumptions about the value of refuge visitation may be. Taking any kind of average rate for impacts will clearly be inaccurate for any single refuge.

Final Demand per Expenditure is closely related to the multiplier.

These measures show the variation in the ultimate impact of the refuge when all of the factors are included.

Figure 6. Recreation Visitor Days per Visit.

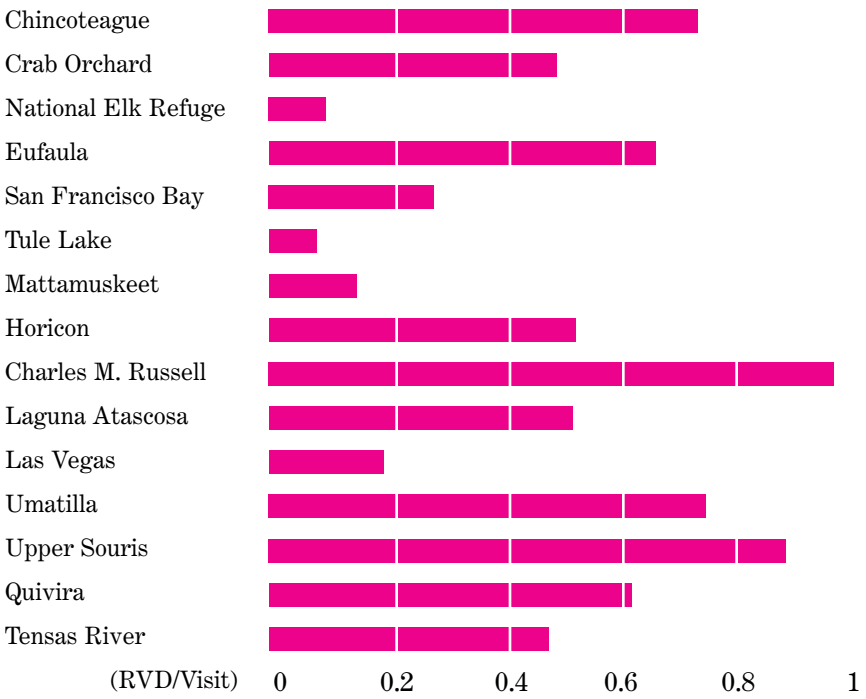


Table 48. Sample Refuges' Economic Ratios

	Final Demand/ 1,000 visits	*Jobs/ 1,000 visits*	*Employee Income/ 1,000 visits*	*Recreation Visitor Days/ Visit*	*Final Demand/ Expenditure*
Chincoteague	16,522	0.426	7,308	0.761	0.700
Crab Orchard	8,697	0.209	3,059	0.495	1.033
National Elk Refuge	2,359	0.062	1,003	0.099	0.631
Eufaula	16,584	0.433	6,954	0.641	0.797
San Francisco Bay	6,360	0.128	2,944	0.276	1.134
Tule Lake	3,332	0.092	1,273	0.086	0.935
Mattamuskeet	3,338	0.096	1,317	0.169	0.654
Horicon	11,433	0.328	4,608	0.508	0.808
Charles M. Russell	31,491	0.923	10,735	0.971	0.719
Laguna Atascosa	16,580	0.404	6,559	0.502	0.819
Las Vegas	4,141	0.129	1,540	0.199	0.577
Umatilla	15,393	0.415	6,096	0.742	0.667
Upper Souris	21,968	0.683	8,967	0.898	1.131
Quivira	27,244	0.625	9,410	0.617	1.073
Tensas River	28,231	0.601	8,366	0.460	0.878

Though not a perfect correlation, those refuges in urban areas with complete economies tend to have higher Final Demand per Expenditure ratios. Don Edwards San Francisco Bay and Crab Orchard are among the highest. Las Vegas with its relatively isolated location and high-import local economy has the lowest. In general, the ratios found in this study are lower than those found in similar regional economic studies. This difference can be attributed to the rural regions where refuges are usually located, the conservative assumptions used to define the refuges' regional economic areas, and improved estimates of regional imports in current IMPLAN software.

Net economic values reflect the value people place on their use of a refuge. The figures shown in Table 49 are not derived from market transactions but from asking people what they would be willing

to pay for the refuge experience. For each refuge, the number of RVDs spent in each activity is multiplied by the average amount people in the refuge's state said they would be willing to pay to continue to participate in that activity. That figure represents both the amount of benefit people in the state derive from the activity and the amount of the activity occurring at the refuge.

Table 49. Sample Refuges' Net Economic Values (1995 $ in thousands)

Refuge	*Non-Consumptive Use*	*Big Game Hunting*	*Upland Game Hunting*	*Migratory Bird Hunting*	*Freshwater Fishing*	*Saltwater Fishing*	*Total*
Chincoteague	40,758	46	0	0	262	1,651	42,716
Crab Orchard	2,898	53	72	360	8,550	0	11,933
National Elk Refuge	1,724	94	0	0	72	0	1,890
Eufaula	3,513	167	1	19	3,444	0	7,143
San Francisco Bay	1,967	0	0	189	792	0	2,948
Tule Lake	347	0	9	232	0	0	589
Mattamuskeet	401	0	0	24	131	0	557
Horicon	1,774	55	11	0	1	0	1,840
Charles M. Russell	22	2,103	145	5	1,005	0	3,281
Laguna Atascosa	1,652	24	0	0	0	0	1,676
Las Vegas	631	0	0	8	0	0	639
Umatilla	54	16	74	837	984	0	1,966
Upper Souris	16	13	11	0	1,300	0	1,340
Quivira	262	0	151	348	3	0	764
Tensas River	250	252	32	7	9	0	549
Total	*56,269*	*2,823*	*506*	*2,029*	*16,553*	*1,651*	*79,831*

Aggregate National Economic Effects

National wildlife refuges received more visitors in 1995 than Grand Canyon, Yosemite, Yellowstone, Acadia, Grand Teton, and Statue of Liberty national parks combined.

Fifteen refuges were studied in detail for this report. From the information developed for those 15, an effort was made to estimate the local economic effects of refuge visitation nationwide. The methodology for this aggregation, described in the Introduction, provides only a rough approximation at the refuge level. But in the regional totals shown here some of the errors for individual refuges will cancel out as they are added up, making the regional totals somewhat more reliable.

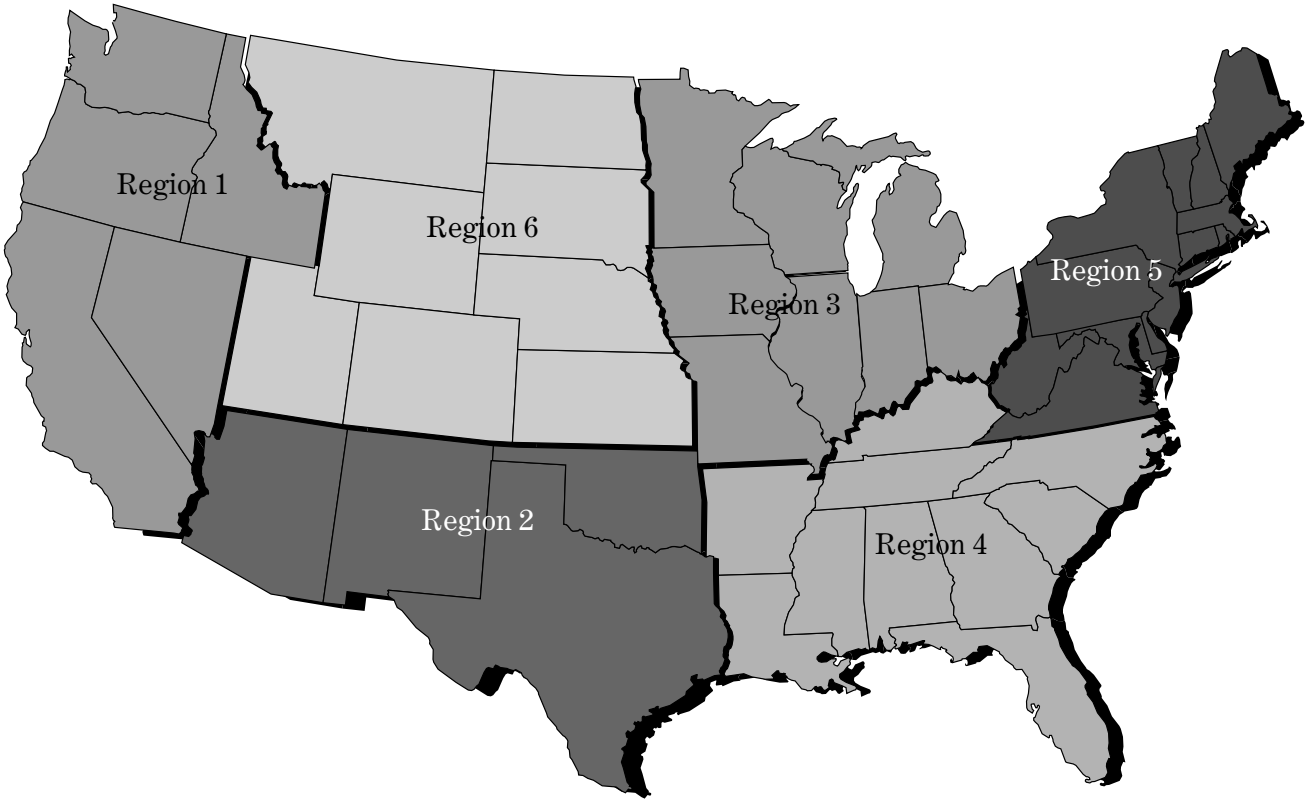
As shown in Table 50, Region 4 had the most visits in FY 1995 and was responsible for the highest number of jobs. The region contains several very popular refuges such as Pea Island, Ding Darling, Merritt Island, and Okefenokee. High non-consumptive and hunting use imply high final demand per visitor and thus large numbers of jobs and high job income. Because county area was a negative factor in the final-demand-per-visitor equation, the large size of counties in the West reduces final demand per visitor and leads to disproportionately fewer jobs in those regions.

National wildlife refuges received more visitors in 1995 than Grand Canyon, Yosemite, Yellowstone, Acadia, Grand Teton, and Statue of Liberty national parks combined (24.9 million vs. 21.9 million; U.S. Department of the Interior, 1996, pg. 14). The National Park system as a whole received 270 million visitors. In recent years, the National Forests have hosted 295 million visitor days and Bureau of Land Management lands about 69 million visitor days (U.S. Department of Commerce, 1995, Table 398). Although national wildlife refuges are used less intensively than the other federal lands, they are a major part of the mix of outdoor recreational opportunities in the United States.

Table 50. National Significance of Refuge Visitation by Fish and Wildlife Service Region

Fish and Wildlife Service Region	*Visits FY 1995*	*Final Demand (1995 $ in thousands)*	*Job Income (1995 $ in thousands)*	*Jobs*
1	2,621,148	27,468	10,769	690
2	3,088,714	79,989	34,326	1,939
3	4,964,723	47,065	18,727	1,194
4	8,392,525	163,008	65,524	4,207
5	3,959,153	59,974	25,007	1,490
6	1,860,811	23,623	8,554	649
Total	*24,887,074*	*401,127*	*162,907*	*10,169*

Fish and Wildlife Service Regions



Regional variation is caused by both differing levels of activity and different valuation of activities.

Net Economic Value

As explained in the Introduction, refuge visitors derive more benefits from their recreation than they pay for it. Surveys can measure the additional benefit by asking how much the costs of recreating would need to rise before the visitor would decide not to participate in the activity. These amounts have been estimated for each state. Multiplying the state value by the number of recreational visitor days spent pursuing that activity on a refuge yields a figure for the net economic value (or consumer surplus) of the activity. These values are summed by Fish and Wildlife Service region in Table 51.

Almost one-third of the consumer surplus in Regions 3 and 4, the Midwest and South, derive from fishing. Consumer surplus from consumptive recreation (hunting and fishing) exceeds non-consumptive consumer surplus only in region 6 (Rocky Mountains and Western Plains), where several refuges' activities are dominated by big-game hunting. Regional variation is caused by both differing levels of activity and different valuation of activities. Consumer surplus for fishing in California for example is $132 per day while in Iowa it is only $6 per day. Somewhat smaller ranges characterize the other activities.

Table 51. Net Economic Values from National Refuge Visitation by FWS Region

Fish and Wildlife Service Region	*Visits FY 1995*	*Non-Consumptive (1995 $ in thousands)*	*Hunting (1995 $ in thousands)*	*Fishing (1995 $ in thousands)*	*Total (1995 $ in thousands)*
1	2,621,148	17,391	5,053	8,952	31,396
2	3,088,714	39,885	1,721	11,808	53,414
3	4,964,723	28,387	6,122	15,863	50,372
4	8,392,525	84,071	16,733	43,917	144,721
5	3,959,153	66,909	2,288	3,808	73,005
6	1,860,811	8,488	6,432	4,770	19,690
Total	*24,887,074*	*245,131*	*38,349*	*89,118*	*372,598*

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Notes on Appendices

The following appendices are intended to provide technical background information on the data, methods, and assumptions used to produce "Banking on Nature: The Economic Benefits to Local Communities of National Wildlife Refuge Recreation." The appendices should be read in conjunction with the report, especially the Introduction. There is very little expository material in the appendices.

Appendix 1 - Sample Refuges Data and Assumptions
This appendix summarizes the economic base area, activity hours, residence, and public use data used to estimate the impact of each sample refuge.

Appendix 2 - Estimating Economic Impacts: General Methodology and Assumptions
This appendix explains the methodology and assumptions used to generate estimates of the sample refuges' impacts and the national aggregation of local impacts. It is intended for economists and others knowledgable in impact analysis.

Appendix 3 - Regional Recreation Expenditures
This appendix shows the expenditure function by Fish and Wildlife Service region, activity, and residence for four categories of expenditures (food, lodging, transportation, and other).

Appendix 4 - Refuge Categories
This appendix shows the categories from a cluster analysis of the 388 refuges with visitation in FY1995. These categories were used to help select the 15 sample refuges.

Appendix 1.

Sample Refuges Data and Assumptions

Chincoteague National Wildlife Refuge

1. *Economic Base Area.*
   a. Accomack County, Virginia
   b. Worcester County, Maryland

2. *Recreation Information*[1]*: activity hours and residents/non-residents.*

Activity	*Hours per person per visit*	*Resident as percentage of total visitors*	*Non-resident as percentage of total visitors*
Non-Consumptive	6	10	90
Hunting: Big Game	8	50	50
Fishing: Freshwater	8	50	50
Fishing: Saltwater	8	70	30

3. *Public use data for FY 1995.*

a. See Refuge Management Information System (RMIS) summary on following page.

[1] Information obtained from refuge personnel.

RMIS - Public Education & Recreation

Page View

Chincoteague NWR

Org. Code: 51570 Office type: NWR State(s): VA MD

This record summarizes 12 records from 10/1/94 through 9/30/95

---------- Visitation and Activities ----------

I. Total number of visitors	1,384,132
II. Interpretation & Nature Observation (on-site)	2,115,723
A. Staff/Volunteer Conducted Activities	20,967
1. Talks	7,385
2. Tours	157
3. Demonstrations	13,425
B. Visitor Centers	109,883
C. Administrative Office	960
D. Kiosks	636,000
E. Nature Trails	374,066
1. Foot	216,288
2. Boat	0
3. Auto	157,778
F. Observation Towers/Platforms/Photo Blinds	973,847
III. Environmental Education	9,427
A. Staff/Volunteer Conducted	1,868
1. Teachers participating in workshops	12
2. Students taught on-site	1,856
3. Students taught off-site	0
B. Non-staff Conducted	7,559
IV. Recreation	578,662
A. Hunting	1,382
1. Migratory Birds	1
a. Waterfowl	1
b. Other migratory birds	0
2. Upland Game	0
3. Big Game	1,381
B. Fishing	110,178
1. Fresh-water	15,066
2. Salt-water	95,112
C. Trapping	0
D. Beach & Water Uses	404,095
E. Other recreation	63,007
V. Education Outreach (off-site)	11,363
A. Group Presentations	388
B. Exhibits	2,975
C. Other off-site education outreach	8,000
VI. Special Events	43
A. Number of news releases	23
B. Number of radio/TV spots	7
C. Number of other special events	13

Crab Orchard National Wildlife Refuge

1. *Economic Base Area.*
   a. Williamson, Union, Jackson, Johnson, and Franklin counties, Illinois

2. *Recreation Information[2]: activity hours and residents/non-residents.*

Activity	*Hours per person per visit*	*Resident as percentage of total visitors*	*Non-resident as percentage of total visitors*
Non-Consumptive	2	85	15
Hunting: Upland Game	8	85	15
Hunting: Big Game	8	85	15
Hunting: Migratory Birds	8	25	75
Fishing	8	75	25

3. *Public use data for FY 1995.*

a. See Refuge Management Information System (RMIS) summary on following page.

[2] Information obtained from refuge personnel.

RMIS - Public Education & Recreation

Page View

Crab Orchard NWR

Org. Code: 33610 Office type: NWR State(s): IL

This record summarizes 2 records from 10/1/94 through 9/30/95

---------- Visitation and Activities ----------

I. Total number of visitors	838,989
II. Interpretation & Nature Observation (on-site)	256,667
A. Staff/Volunteer Conducted Activities	11,276
1. Talks	1,237
2. Tours	4,369
3. Demonstrations	5,670
B. Visitor Centers	28,870
C. Administrative Office	1,851
D. Kiosks	61,217
E. Nature Trails	115,287
1. Foot	21,060
2. Boat	400
3. Auto	93,827
F. Observation Towers/Platforms/Photo Blinds	38,166
III. Environmental Education	28,756
A. Staff/Volunteer Conducted	4,362
1. Teachers participating in workshops	619
2. Students taught on-site	685
3. Students taught off-site	3,058
B. Non-staff Conducted	24,394
IV. Recreation	830,457
A. Hunting	10,113
1. Migratory Birds	7,500
a. Waterfowl	7,500
b. Other migratory birds	0
2. Upland Game	1,500
3. Big Game	1,113
B. Fishing	209,612
1. Fresh-water	209,612
2. Salt-water	0
C. Trapping	1
D. Beach & Water Uses	105,553
E. Other recreation	505,178
V. Education Outreach (off-site)	470
A. Group Presentations	400
B. Exhibits	55
C. Other off-site education outreach	15
VI. Special Events	39
A. Number of news releases	13
B. Number of radio/TV spots	18
C. Number of other special events	8

National Elk Refuge

1. *Economic Base Area.*
   a. Teton County, Wyoming

2. *Recreation Information*[3]*: activity hours and residents/non-residents.*

Activity	*Hours per person per visit*	*Resident as percentage of total visitors*	*Non-resident as percentage of total visitors*
Non-Consumptive	.75	25	75
Hunting	8	85	15
Fishing	4	90	10

3. *Public use data for FY 1995.*

a. See Refuge Management Information System (RMIS) summary on following page.

[3] Information obtained from refuge personnel.

RMIS - Public Education & Recreation

Page View

National Elk Refuge

Org. Code: 61550 Office type: NWR State(s): WY

This record summarizes 2 records from 10/1/94 through 9/30/95

Visitation and Activities	
I. Total number of visitors	660,510
II. Interpretation & Nature Observation (on-site)	562,441
A. Staff/Volunteer Conducted Activities	29,703
1. Talks	5,229
2. Tours	24,474
3. Demonstrations	0
B. Visitor Centers	200,566
C. Administrative Office	4,608
D. Kiosks	0
E. Nature Trails	0
1. Foot	0
2. Boat	0
3. Auto	0
F. Observation Towers/Platforms/Photo Blinds	327,564
III. Environmental Education	750
A. Staff/Volunteer Conducted	0
1. Teachers participating in workshops	0
2. Students taught on-site	0
3. Students taught off-site	0
B. Non-staff Conducted	750
IV. Recreation	97,298
A. Hunting	1,311
1. Migratory Birds	0
a. Waterfowl	0
b. Other migratory birds	0
2. Upland Game	0
3. Big Game	1,311
B. Fishing	2,568
1. Fresh-water	2,568
2. Salt-water	0
C. Trapping	0
D. Beach & Water Uses	0
E. Other recreation	93,419
V. Education Outreach (off-site)	0
A. Group Presentations	0
B. Exhibits	0
C. Other off-site education outreach	0
VI. Special Events	29
A. Number of news releases	17
B. Number of radio/TV spots	10
C. Number of other special events	2

Eufaula National Wildlife Refuge

1. *Economic Base Area.*
   a. Barbour and Russell counties, Alabama
   b. Quitman, Stewart, Chattahoochee, and Muscogee counties, Georgia

2. *Recreation Information[4]: activity hours and residents/non-residents.*

Activity	*Hours per person per visit*	*Resident as percentage of total visitors*	*Non-resident as percentage of total visitors*
Non-Consumptive:			
Foot Trails	2	40	60
Boat Trails	5	40	60
Auto Trails	1	40	60
Observation Platforms	1	25	75
Beach/Water Use	4	50	50
Other Recreation	4	70	30
Hunting:			
Upland Game	8	75	25
Big Game	8	25	75
Migratory Birds	6	10	90
Fishing	8	30	70

3. *Public use data for FY 1995.*

a. See Refuge Management Information System (RMIS) summary on following page.

[4] Information obtained from refuge personnel.

RMIS - Public Education & Recreation

Page View

Eufaula NWR

Org. Code: 43560 Office type: NWR State(s): AL GA

This record summarizes 12 records from 10/1/94 through 9/30/95

Visitation and Activities	
I. Total number of visitors	322,632
II. Interpretation & Nature Observation (on-site)	188,574
A. Staff/Volunteer Conducted Activities	224
1. Talks	106
2. Tours	118
3. Demonstrations	0
B. Visitor Centers	0
C. Administrative Office	2,750
D. Kiosks	9,237
E. Nature Trails	173,490
1. Foot	3,010
2. Boat	95,820
3. Auto	74,660
F. Observation Towers/Platforms/Photo Blinds	2,873
III. Environmental Education	61
A. Staff/Volunteer Conducted	0
1. Teachers participating in workshops	0
2. Students taught on-site	0
3. Students taught off-site	0
B. Non-staff Conducted	61
IV. Recreation	160,990
A. Hunting	4,143
1. Migratory Birds	433
a. Waterfowl	263
b. Other migratory birds	170
2. Upland Game	10
3. Big Game	3,700
B. Fishing	107,637
1. Fresh-water	107,637
2. Salt-water	0
C. Trapping	0
D. Beach & Water Uses	26,325
E. Other recreation	22,885
V. Education Outreach (off-site)	341
A. Group Presentations	340
B. Exhibits	0
C. Other off-site education outreach	1
VI. Special Events	6
A. Number of news releases	2
B. Number of radio/TV spots	2
C. Number of other special events	2

Don Edwards San Francisco Bay National Wildlife Refuge

1. *Economic Base Area.*
   a. Santa Clara, San Mateo, and Alameda Counties

2. *Recreation Information[5]: activity hours and residents/non-residents.*

Activity	*Hours per person per visit*	*Resident as percentage of total visitors*	*Non-resident as percentage of total visitors*
Non-Consumptive	2	85	15
Hunting	6	85	15
Fishing	6	85	15

3. *Public use data for FY 1995.*

a. See Refuge Management Information System (RMIS) summary on following page.

[5] Information obtained from refuge personnel.

RMIS - Public Education & Recreation

Page View

San Francisco Bay NWR

Org. Code: 11640 Office type: NWR State(s): CA

This record summarizes 12 records from 10/1/94 through 9/30/95

---------- Visitation and Activities ----------

I. Total number of visitors	281,151
II. Interpretation & Nature Observation (on-site)	183,726
A. Staff/Volunteer Conducted Activities	2,752
1. Talks	943
2. Tours	504
3. Demonstrations	1,305
B. Visitor Centers	37,148
C. Administrative Office	0
D. Kiosks	3,250
E. Nature Trails	93,717
1. Foot	93,717
2. Boat	0
3. Auto	0
F. Observation Towers/Platforms/Photo Blinds	46,859
III. Environmental Education	10,334
A. Staff/Volunteer Conducted	3,194
1. Teachers participating in workshops	568
2. Students taught on-site	2,068
3. Students taught off-site	558
B. Non-staff Conducted	7,140
IV. Recreation	108,305
A. Hunting	3,900
1. Migratory Birds	3,900
a. Waterfowl	3,900
b. Other migratory birds	0
2. Upland Game	0
3. Big Game	0
B. Fishing	6,000
1. Fresh-water	0
2. Salt-water	6,000
C. Trapping	0
D. Beach & Water Uses	0
E. Other recreation	98,405
V. Education Outreach (off-site)	3,129
A. Group Presentations	1,117
B. Exhibits	2,000
C. Other off-site education outreach	12
VI. Special Events	7
A. Number of news releases	6
B. Number of radio/TV spots	1
C. Number of other special events	0

Tule Lake National Wildlife Refuge

1. *Economic Base Area.*
   a. Klamath County, Oregon; Modoc and Siskiyou counties, California.

2. *Recreation Information*[6]*: activity hours and residents/non-residents.*

Activity	*Hours per person per visit*	*Resident as percentage of total visitors*	*Non-resident as percentage of total visitors*
Non-Consumptive	.5	15	85
Hunting	6	5	95

3. *Public use data for FY 1995.*

a. See Refuge Management Information System (RMIS) summary on following page.

[6] Information obtained from refuge personnel.

RMIS - Public Education & Recreation

Page View

Tule Lake NWR

Org. Code: 11664 Office type: NWR State(s): CA

This record summarizes 4 records from 10/1/94 through 9/30/95

---------- Visitation and Activities ----------

I. Total number of visitors	196,544
II. Interpretation & Nature Observation (on-site)	30,316
A. Staff/Volunteer Conducted Activities	1,373
1. Talks	274
2. Tours	251
3. Demonstrations	848
B. Visitor Centers	8,742
C. Administrative Office	0
D. Kiosks	1,314
E. Nature Trails	18,353
1. Foot	1,903
2. Boat	105
3. Auto	16,345
F. Observation Towers/Platforms/Photo Blinds	534
III. Environmental Education	2,664
A. Staff/Volunteer Conducted	2,624
1. Teachers participating in workshops	24
2. Students taught on-site	1,655
3. Students taught off-site	945
B. Non-staff Conducted	40
IV. Recreation	185,741
A. Hunting	4,979
1. Migratory Birds	4,789
a. Waterfowl	4,789
b. Other migratory birds	0
2. Upland Game	190
3. Big Game	0
B. Fishing	0
1. Fresh-water	0
2. Salt-water	0
C. Trapping	0
D. Beach & Water Uses	0
E. Other recreation	180,762
V. Education Outreach (off-site)	3,197
A. Group Presentations	344
B. Exhibits	2,850
C. Other off-site education outreach	3
VI. Special Events	23
A. Number of news releases	20
B. Number of radio/TV spots	0
C. Number of other special events	3

Mattamuskeet National Wildlife Refuge

1. *Economic Base Area.*
   a. Hyde, Beaufort, and Tyrrell counties, North Carolina.

2. *Recreation Information[7]: activity hours and residents/non-residents.*

Activity	*Hours per person per visit*	*Resident as percentage of total visitors*	*Non-resident as percentage of total visitors*
Non-Consumptive:			
Nature Trails	1	5	95
Observation Platforms	.5	30	70
Beach/Water Use	.5	100	0
Other Recreation	2	40	60
Hunting - Migratory Birds	8	5	95
Fishing	3	80	20

3. *Public use data for FY 1995.*

a. See Refuge Management Information System (RMIS) summary on following page.

[7] Information obtained from refuge personnel.

RMIS - Public Education & Recreation

Page View

Mattamuskeet NWR

Org. Code: 42530 Office type: NWR State(s): NC

This record summarizes 7 records from 10/1/94 through 9/30/95

---------- Visitation and Activities ----------

I. Total number of visitors	137,108
II. Interpretation & Nature Observation (on-site)	109,961
A. Staff/Volunteer Conducted Activities	1,136
1. Talks	252
2. Tours	654
3. Demonstrations	230
B. Visitor Centers	0
C. Administrative Office	4,310
D. Kiosks	9,510
E. Nature Trails	93,635
1. Foot	12,000
2. Boat	335
3. Auto	81,300
F. Observation Towers/Platforms/Photo Blinds	1,370
III. Environmental Education	125
A. Staff/Volunteer Conducted	15
1. Teachers participating in workshops	0
2. Students taught on-site	15
3. Students taught off-site	0
B. Non-staff Conducted	110
IV. Recreation	32,729
A. Hunting	669
1. Migratory Birds	669
a. Waterfowl	669
b. Other migratory birds	0
2. Upland Game	0
3. Big Game	0
B. Fishing	21,900
1. Fresh-water	21,900
2. Salt-water	0
C. Trapping	0
D. Beach & Water Uses	10
E. Other recreation	10,150
V. Education Outreach (off-site)	50
A. Group Presentations	0
B. Exhibits	0
C. Other off-site education outreach	50
VI. Special Events	22
A. Number of news releases	4
B. Number of radio/TV spots	0
C. Number of other special events	18

Horicon National Wildlife Refuge

1. *Economic Base Area.*
   a. Dodge and Fond du Lac counties, Wisconsin.

2. *Recreation Information*[8]*: activity hours and residents/non-residents.*

Activity	*Hours per person per visit*	*Resident as percentage of total visitors*	*Non-resident as percentage of total visitors*
Non-Consumptive	4	10	90
Hunting: Upland Game	6	60	40
Hunting: Big Game	6	60	40
Fishing	4	100	0

3. *Public use data for FY 1995.*

a. See Refuge Management Information System (RMIS) summary on following page.

[8] Information obtained from refuge personnel.

RMIS - Public Education & Recreation

Page View

Horicon NWR

Org. Code: 32520 Office type: NWR State(s): WI

This record summarizes 12 records from 10/1/94 through 9/30/95

---------- Visitation and Activities ----------

I. Total number of visitors	133,810
II. Interpretation & Nature Observation (on-site)	129,450
A. Staff/Volunteer Conducted Activities	2,107
1. Talks	1,112
2. Tours	675
3. Demonstrations	320
B. Visitor Centers	2,335
C. Administrative Office	5,247
D. Kiosks	38,487
E. Nature Trails	80,724
1. Foot	64,838
2. Boat	0
3. Auto	15,886
F. Observation Towers/Platforms/Photo Blinds	550
III. Environmental Education	912
A. Staff/Volunteer Conducted	389
1. Teachers participating in workshops	17
2. Students taught on-site	197
3. Students taught off-site	175
B. Non-staff Conducted	523
IV. Recreation	4,591
A. Hunting	2,079
1. Migratory Birds	0
a. Waterfowl	0
b. Other migratory birds	0
2. Upland Game	339
3. Big Game	1,740
B. Fishing	284
1. Fresh-water	284
2. Salt-water	0
C. Trapping	34
D. Beach & Water Uses	0
E. Other recreation	2,194
V. Education Outreach (off-site)	375
A. Group Presentations	125
B. Exhibits	250
C. Other off-site education outreach	0
VI. Special Events	29
A. Number of news releases	23
B. Number of radio/TV spots	4
C. Number of other special events	2

Charles M. Russell National Wildlife Refuge

1. *Economic Base Area.*
 a. Fergus, Philips, Petroleum, Garfield, Valley, and McCone counties, Montana.

2. *Recreation Information*[9]*: activity hours and residents/non-residents.*

Activity	*Hours per person per visit*	*Resident as percentage of total visitors*	*Non-resident as percentage of total visitors*
Non-Consumptive	2	34	66
Hunting	8	34	66
Fishing	6	50	50

3. *Public use data for FY 1995.*

a. See Refuge Management Information System (RMIS) summary on following page.

[9] Information obtained from refuge personnel.

RMIS - Public Education & Recreation

Page View

Charles M. Russell NWR

Org. Code: 61520 Office type: NWR State(s): MT

This record summarizes 4 records from 10/1/94 through 9/30/95

---------- Visitation and Activities ----------

I. Total number of visitors	110,540
II. Interpretation & Nature Observation (on-site)	7,520
A. Staff/Volunteer Conducted Activities	1,446
1. Talks	757
2. Tours	156
3. Demonstrations	533
B. Visitor Centers	317
C. Administrative Office	2,003
D. Kiosks	586
E. Nature Trails	3,157
1. Foot	142
2. Boat	845
3. Auto	2,170
F. Observation Towers/Platforms/Photo Blinds	11
III. Environmental Education	845
A. Staff/Volunteer Conducted	741
1. Teachers participating in workshops	4
2. Students taught on-site	270
3. Students taught off-site	467
B. Non-staff Conducted	104
IV. Recreation	108,170
A. Hunting	62,608
1. Migratory Birds	148
a. Waterfowl	140
b. Other migratory birds	8
2. Upland Game	4,040
3. Big Game	58,420
B. Fishing	43,700
1. Fresh-water	43,700
2. Salt-water	0
C. Trapping	0
D. Beach & Water Uses	457
E. Other recreation	1,405
V. Education Outreach (off-site)	2,025
A. Group Presentations	465
B. Exhibits	1,360
C. Other off-site education outreach	200
VI. Special Events	25
A. Number of news releases	15
B. Number of radio/TV spots	10
C. Number of other special events	0

Laguna Atascosa National Wildlife Refuge

1. *Economic Base Area.*
   a. Willacy and Cameron counties, Texas.

2. *Recreation Information[10]: activity hours and residents/non-residents.*

Activity	*Hours per person per visit*	*Resident as percentage of total visitors*	*Non-resident as percentage of total visitors*
Non-Consumptive	4	10	90
Hunting: Big Game	8	90	10

3. *Public use data for FY 1995.*

a. See Refuge Management Information System (RMIS) summary on following page.

[10] Information obtained from refuge personnel.

RMIS - Public Education & Recreation

Page View

Laguna Atascosa NWR

Org. Code: 21550 Office type: NWR State(s): TX

This record summarizes 12 records from 10/1/94 through 9/30/95

---------- Visitation and Activities ----------

I. Total number of visitors	106,960
II. Interpretation & Nature Observation (on-site)	232,014
A. Staff/Volunteer Conducted Activities	84
1. Talks	51
2. Tours	33
3. Demonstrations	0
B. Visitor Centers	27,710
C. Administrative Office	1,200
D. Kiosks	60,650
E. Nature Trails	135,110
1. Foot	37,440
2. Boat	0
3. Auto	97,670
F. Observation Towers/Platforms/Photo Blinds	7,260
III. Environmental Education	2,555
A. Staff/Volunteer Conducted	490
1. Teachers participating in workshops	30
2. Students taught on-site	460
3. Students taught off-site	0
B. Non-staff Conducted	2,065
IV. Recreation	72,838
A. Hunting	388
1. Migratory Birds	0
a. Waterfowl	0
b. Other migratory birds	0
2. Upland Game	0
3. Big Game	388
B. Fishing	61,970
1. Fresh-water	0
2. Salt-water	61,970
C. Trapping	0
D. Beach & Water Uses	0
E. Other recreation	10,480
V. Education Outreach (off-site)	545
A. Group Presentations	545
B. Exhibits	0
C. Other off-site education outreach	0
VI. Special Events	28
A. Number of news releases	15
B. Number of radio/TV spots	11
C. Number of other special events	2

Las Vegas National Wildlife Refuge

1. *Economic Base Area.*
   a. San Miguel County, New Mexico.

2. *Recreation Information[110]: activity hours and residents/non-residents.*

Activity	*Hours per person per visit*	*Resident as percentage of total visitors*	*Non-resident as percentage of total visitors*
Non-Consumptive	2	24	76
Hunting: Migratory Birds	8	100	0

3. *Public use data for FY 1995.*

a. See Refuge Management Information System (RMIS) summary on following page.

[11] Information obtained from refuge personnel.

RMIS - Public Education & Recreation

Page View

Las Vegas NWR

Org. Code: 22580 Office type: NWR State(s): NM

This record summarizes 12 records from 10/1/94 through 9/30/95

---------- Visitation and Activities ----------

I. Total number of visitors	70,063
II. Interpretation & Nature Observation (on-site)	71,501
A. Staff/Volunteer Conducted Activities	5
1. Talks	5
2. Tours	0
3. Demonstrations	0
B. Visitor Centers	0
C. Administrative Office	801
D. Kiosks	0
E. Nature Trails	70,545
1. Foot	482
2. Boat	0
3. Auto	70,063
F. Observation Towers/Platforms/Photo Blinds	150
III. Environmental Education	2
A. Staff/Volunteer Conducted	0
1. Teachers participating in workshops	0
2. Students taught on-site	0
3. Students taught off-site	0
B. Non-staff Conducted	2
IV. Recreation	138
A. Hunting	138
1. Migratory Birds	138
a. Waterfowl	108
b. Other migratory birds	30
2. Upland Game	0
3. Big Game	0
B. Fishing	0
1. Fresh-water	0
2. Salt-water	0
C. Trapping	0
D. Beach & Water Uses	0
E. Other recreation	0
V. Education Outreach (off-site)	0
A. Group Presentations	0
B. Exhibits	0
C. Other off-site education outreach	0
VI. Special Events	9
A. Number of news releases	6
B. Number of radio/TV spots	0
C. Number of other special events	3

Umatilla National Wildlife Refuge

1. *Economic Base Area.*
   a. Morrow County, Oregon; Benton and Franklin counties, Washington.

2. *Recreation Information*[12]*: activity hours and residents/non-residents.*

Activity	*Hours per person per visit*	*Resident as percentage of total visitors*	*Non-resident as percentage of total visitors*
Non-Consumptive	1	70	30
Hunting: Small Game	3	60	40
Hunting: Big Game	4	10	90
Hunting: Migratory Birds	6	30	70
Fishing	3	70	30

3. *Public use data for FY 1995.*

a. See Refuge Management Information System (RMIS) summary on following page.

[12] Information obtained from refuge personnel.

RMIS - Public Education & Recreation

Page View

Umatilla NWR

Org. Code: 13580 Office type: NWR State(s): OR WA

This record summarizes 12 records from 10/1/94 through 9/30/95

---------- Visitation and Activities ----------

I. Total number of visitors	55,459
II. Interpretation & Nature Observation (on-site)	33,199
A. Staff/Volunteer Conducted Activities	90
1. Talks	0
2. Tours	60
3. Demonstrations	30
B. Visitor Centers	2,171
C. Administrative Office	900
D. Kiosks	1,367
E. Nature Trails	26,004
1. Foot	6,262
2. Boat	7,149
3. Auto	12,593
F. Observation Towers/Platforms/Photo Blinds	2,667
III. Environmental Education	50
A. Staff/Volunteer Conducted	50
1. Teachers participating in workshops	0
2. Students taught on-site	50
3. Students taught off-site	0
B. Non-staff Conducted	0
IV. Recreation	46,095
A. Hunting	15,713
1. Migratory Birds	14,188
a. Waterfowl	14,188
b. Other migratory birds	0
2. Upland Game	1,261
3. Big Game	264
B. Fishing	23,437
1. Fresh-water	23,437
2. Salt-water	0
C. Trapping	0
D. Beach & Water Uses	3,130
E. Other recreation	3,815
V. Education Outreach (off-site)	796
A. Group Presentations	796
B. Exhibits	0
C. Other off-site education outreach	0
VI. Special Events	13
A. Number of news releases	12
B. Number of radio/TV spots	0
C. Number of other special events	1

Upper Souris National Wildlife Refuge

1. *Economic Base Area.*
   a. Ward and Renville counties, North Dakota.

2. *Recreation Information*[13]*: activity hours and residents/non-residents.*

Activity	*Hours per person per visit*	*Resident as percentage of total visitors*	*Non-resident as percentage of total visitors*
Non-Consumptive	2	95	5
Hunting	6	85	15
Fishing	6	80	20

3. *Public use data for FY 1995.*

a. See Refuge Management Information System (RMIS) summary on following page.

[13] Information obtained from refuge personnel.

RMIS - Public Education & Recreation

Page View

Upper Souris NWR

Org. Code: 62680 Office type: NWR State(s): ND

This record summarizes 4 records from 10/1/94 through 9/30/95

---------- Visitation and Activities ----------

I. Total number of visitors	46,828
II. Interpretation & Nature Observation (on-site)	4,975
A. Staff/Volunteer Conducted Activities	240
1. Talks	135
2. Tours	105
3. Demonstrations	0
B. Visitor Centers	0
C. Administrative Office	600
D. Kiosks	1,500
E. Nature Trails	2,485
1. Foot	510
2. Boat	75
3. Auto	1,900
F. Observation Towers/Platforms/Photo Blinds	150
III. Environmental Education	35
A. Staff/Volunteer Conducted	35
1. Teachers participating in workshops	15
2. Students taught on-site	0
3. Students taught off-site	20
B. Non-staff Conducted	0
IV. Recreation	41,838
A. Hunting	435
1. Migratory Birds	0
a. Waterfowl	0
b. Other migratory birds	0
2. Upland Game	200
3. Big Game	235
B. Fishing	40,000
1. Fresh-water	40,000
2. Salt-water	0
C. Trapping	3
D. Beach & Water Uses	0
E. Other recreation	1,400
V. Education Outreach (off-site)	4,090
A. Group Presentations	90
B. Exhibits	4,000
C. Other off-site education outreach	0
VI. Special Events	58
A. Number of news releases	27
B. Number of radio/TV spots	20
C. Number of other special events	11

Quivira National Wildlife Refuge

1. *Economic Base Area.*
   a. Stafford, Reno, Rice, and Barton counties, Kansas.

2. *Recreation Information*[14]*: activity hours and residents/non-residents.*

Activity	*Hours per person per visit*	*Resident as percentage of total visitors*	*Non-resident as percentage of total visitors*
Non-Consumptive	2	40	60
Hunting	5	20	80
Fishing	3	80	20

3. *Public use data for FY 1995.*

a. See Refuge Management Information System (RMIS) summary on following page.

[14] Information obtained from refuge personnel.

RMIS - Public Education & Recreation

Page View

Quivira NWR

Org. Code: 64620 Office type: NWR State(s): KS

This record summarizes 12 records from 10/1/94 through 9/30/95

---------- Visitation and Activities ----------

I. Total number of visitors	38,427
II. Interpretation & Nature Observation (on-site)	32,006
A. Staff/Volunteer Conducted Activities	548
1. Talks	56
2. Tours	472
3. Demonstrations	20
B. Visitor Centers	6,613
C. Administrative Office	3
D. Kiosks	6,090
E. Nature Trails	15,408
1. Foot	1,823
2. Boat	0
3. Auto	13,585
F. Observation Towers/Platforms/Photo Blinds	3,344
III. Environmental Education	404
A. Staff/Volunteer Conducted	404
1. Teachers participating in workshops	0
2. Students taught on-site	232
3. Students taught off-site	172
B. Non-staff Conducted	0
IV. Recreation	14,896
A. Hunting	14,681
1. Migratory Birds	10,238
a. Waterfowl	9,478
b. Other migratory birds	760
2. Upland Game	4,443
3. Big Game	0
B. Fishing	215
1. Fresh-water	215
2. Salt-water	0
C. Trapping	0
D. Beach & Water Uses	0
E. Other recreation	0
V. Education Outreach (off-site)	306
A. Group Presentations	306
B. Exhibits	0
C. Other off-site education outreach	0
VI. Special Events	14
A. Number of news releases	9
B. Number of radio/TV spots	2
C. Number of other special events	3

Tensas River National Wildlife Refuge

1. *Economic Base Area.*
 a. West Carroll, East Carroll, Richland, Madison, Franklin, and Tensas parishes, Louisiana
 b. Warren County, Mississippi

2. *Recreation Information[15]: activity hours and residents/non-residents.*

Activity	*Hours per person per visit*	*Resident as percentage of total visitors*	*Non-resident as percentage of total visitors*
Non-Consumptive			
Foot Trails	3	20	80
Boat Trails	5	20	80
Auto Trails	2	20	80
Observation Platforms	2	30	70
Hunting			
Upland Game	5	30	70
Big Game	8	20	80
Migratory Birds	5	50	50
Fishing	3	50	50

3. *Public use data for FY 1995.*

a. See Refuge Management Information System (RMIS) summary on following page.

[15] Information obtained from refuge personnel.

RMIS - Public Education & Recreation

Page View

Tensas River NWR

Org. Code: 43690 Office type: NWR State(s): LA

This record summarizes 8 records from 10/1/94 through 9/30/95

Visitation and Activities

I. Total number of visitors	18,313
II. Interpretation & Nature Observation (on-site)	34,198
A. Staff/Volunteer Conducted Activities	44
1. Talks	16
2. Tours	28
3. Demonstrations	0
B. Visitor Centers	4,067
C. Administrative Office	1,272
D. Kiosks	1,600
E. Nature Trails	16,925
1. Foot	10,625
2. Boat	800
3. Auto	5,500
F. Observation Towers/Platforms/Photo Blinds	10,290
III. Environmental Education	809
A. Staff/Volunteer Conducted	629
1. Teachers participating in workshops	54
2. Students taught on-site	575
3. Students taught off-site	0
B. Non-staff Conducted	180
IV. Recreation	9,415
A. Hunting	8,700
1. Migratory Birds	300
a. Waterfowl	300
b. Other migratory birds	0
2. Upland Game	1,400
3. Big Game	7,000
B. Fishing	715
1. Fresh-water	715
2. Salt-water	0
C. Trapping	0
D. Beach & Water Uses	0
E. Other recreation	0
V. Education Outreach (off-site)	2,253
A. Group Presentations	753
B. Exhibits	1,500
C. Other off-site education outreach	0
VI. Special Events	27
A. Number of news releases	17
B. Number of radio/TV spots	4
C. Number of other special events	6

Appendix 2.

Estimating Economic Impacts: General Methodology and Assumptions

1. Model.

Economic impacts were estimated using IMPLAN, a regional input-output modeling system. For more information on IMPLAN and regional input-output economic analysis, see Taylor et. al. *Micro IMPLAN User's Guide.* U.S. Department of Agriculture - Forest Service. Fort Collins, CO, May 1993, and MIG, Inc. *Minnesota IMPLAN Group Technical Analysis Guide: A Guide to Analysis Using the MIG Dos Based IMPLAN Input-Output System*, Stillwater, MN, 1995

2. Data Set.

The 1992 IMPLAN data set was used for the analysis. All monetary impacts were adjusted to 1995 dollars.

3. Expenditure Data

Per-person per-day expenditure information is based on the 1991 National Survey of Fishing, Hunting and Wildlife Associated Recreation (NSFHWR). This survey is conducted every 5 years by the U.S. Fish and Wildlife Service. Expenditure categories include: (1) *food*, including food, drink, and refreshments; (2) *lodging*, which includes lodging at motels, cabins, lodges, or campgrounds; (3) *transportation*, which includes both public transportation and the round-trip cost of transportation by private vehicle; and (4) other, which encompasses guide fees, pack trip or package fees, public land use or access fees, private land use or access fees (not including leases), equipment rental, and miscellaneous retail expenditures.

NSFHWR respondents were classified as non-residents if their state of residence differed from the state where spending took place. Mean expenditures were calculated for each Fish and Wildlife Service region. Smaller geographic breakdowns left too few respondents in some categories for reliable averages. A few very high expenditure observations for some items had a large impact on the average expenditure for that item. To avoid this problem, the highest 1 percent of observations for each item was removed from the calculation of the mean.

Appendix 3 shows the per-day per-person expenditures for U.S. Fish and Wildlife Regions 1 through 6.

These expenditures were allocated to IMPLAN sectors and activities as follows (Table 2a):

Table 2a. Allocation of Expenditures to IMPLAN Categories

NSFHWR Survey Category	*IMPLAN Sector/ Activity Number*	*IMPLAN Activity/Sector*	*Percentage allocated to IMPLAN sector*[16]
Lodging	463	Hotels	100%
Food/drink	1111	food for off-site consumption	Residents: 35% Non-residents 65%
..	1120	purchased meals	Residents: 65% Non-residents: 35%
Transportation	8140	gas/oil	Residents: 90% Nonresidents: 85%
..	8130	car repairs	10%
..	8330	airline	residents: 0% nonresidents: 5%
Other	421	sporting goods	40%
..	1500	tobacco	1%
..	1112	alcohol	1%
..	2100	shoes	8%
..	2311	clothing: women	8%
..	2321	clothing: men	8%
..	2800	personal/misc.	8%
..	3100	toilet articles	8%
..	5900	telephone	6%
..	5917	postage	6%
..	991h	film development	6%

[16] Percentage of spending in NSFHWR category allocated to specified IMPLAN activity or sector.

4. Recreation Visits and Expenditures

(a) Visits to the refuge are assumed to be for the primary purpose of engaging in wildlife-dependent recreation activities.

(b) Visitor use data is based on information obtained from the U.S. Fish and Wildlife Service Division of Refuges' Refuge Management Information System (RMIS). FY 1995 data is used in this report. Appendix 1 shows typical visitor use reports.

(c) For the economic impact analysis, residents are defined as living within a 30-mile radius of the refuge; non-residents live outside of this area.

(d) Non-consumptive use is calculated by subtracting hunting and fishing visitors from total visitors. Visitor use data was further refined by discussions with refuge personnel to minimize the possibility of double-counting visitors who engage in more than one activity during a given visit.

(e) It is assumed that all expenditures related to refuge visits occur primarily in the economic base area defined for the refuge.

(f) Information on refuge visitors concerning trip destinations or the primary purpose of the trip is not currently available. To address the question of how much of total per-person per-day trip expenditures can be attributed to refuge visitation, several working assumptions were used for this study:

(i) On average, the more hours people spend on the refuge per trip, the higher the proportion of total daily trip expenditures that can be attributed to the refuge visit.

(ii) For hunting and fishing, it is assumed that refuge-related expenditures are the full amount of the NSFHWR per-person per-day trip expenditures for the specified activity in the given USFWS region. This seems appropriate since most hunting and fishing activities on refuges typically last 6 or more hours, making the refuge the probable primary destination for the day.

(iii) For non-consumptive activities, visits are converted to *refuge visitor days*, 8 hours per day of non-consumptive recreation activities (based on refuge-specific estimates of the average number of hours refuge visitors engage in non-consumptive activities per visit). Each refuge visitor day is then assumed to result in the full amount of the NSFHWR per-person per-day trip expenditures for non-consumptive recreation.

5. Economic Study Area

(a) In lieu of specific regional and local trade-flow information, IMPLAN economic study areas are defined as those counties adjacent or within the refuge which had a significant proportion of total refuge recreation expenditures. "Significance" was determined in consultation with refuge personnel and is based on estimates of where

refuge visitors spent money and the location of major travel corridors. Generally, a conservative approach was taken in identifying counties to be included in the study area. Only spatial expenditure patterns and major travel corridors were used as criteria for determining counties to be included in the study area for each refuge. Backward linkages were not explicitly considered. It was decided that, given the lack of site-specific information on spending and trade flows, it would be better to underestimate economic impacts by keeping the study area small than to overestimate impacts by including counties marginally affected by refuge spending.

6. National Aggregation

(a) Economic Significance - One goal of this research is to generate estimates of the national impact of refuges on their regional economies. Ideally, an IMPLAN model and the necessary visitation information would be developed for each refuge and the results summed for a national estimate. Such a process would be prohibitively expensive. As an alternative, the results from the 15 case studies can be treated as data points. Regression analysis finds the important characteristics of the refuge or its region that explain the differences in final demand, employment income, and jobs generated by visits to each refuge. Economic results for refuges not studied can be estimated from the regression coefficients and data already available for the refuge. The total of these refuge estimates is a national estimate. The process is explained in more detail below.

Basic visitation information about the refuges is available from the RMIS. The Fish and Wildlife Service has also collected miscellaneous information about the counties refuges are in from Census data and other sources. Various combinations of these variables were tested to see how well they predicted three dependent variables from the economic significance analysis:

1. Final Demand per thousand visitors
2. Ratio of Employment Income to Final Demand
3. Ratio of Jobs to Employment Income.

With predictions of these variables and visitation for each of the unstudied refuges, final demand, employment income, and jobs could be estimated. After testing several combinations of the available variables to predict these dependent variables, the equations in Table 2b were selected. These regressions show a reasonably good fit using independent variables that bear a logical relationship with the dependent variables. Each dependent variable is assumed to be a linear combination of the independent variables. Table 2b shows the coefficients.

Table 2b. Prediction Equations
(Unless otherwise noted, data is for FY1995.)

Variable	*Final Demand per 1,000 visitors*	*Employment Income/ Final Demand*	*Jobs/ Employment Income*
Intercept	84,639.000**	0.205*	103.589**
Natural Log of Visits	-6,368.006**	0.015*	-3.181*
Non-Consumptive Visits	0.025*		
Hunting Visits	0.387**		
Share Fishing Visits are of all visits	6428.902	0.040	
Area of County in Sq. Mi.	-1.367		
Share Big Game Hunting of all visits		-0.119*	
County Population, 1990		5.505E-8*	-1.613E-5*
Distance of nearest city > 50,000 population			0.048
F	8.425**	6.496**	8.357**
r^2	0.824	0.722	0.695

*Significant at the 5 percent confidence level.
**Significant at the 1 percent confidence level.

Refuge management is an imperfect balancing of multiple goals.

Several adjustments were made to the data to ensure consistency. The sample refuges' visitation ranged from 18 thousand to 1.3 million. Applying the equations derived from this sample to refuges with very low visitation yielded very high estimates of final demand per thousand visits. To avoid adding these into the national results all refuges with fewer than 1,500 visits were deleted from the calculations. This eliminated about 97 refuges but relatively few visits. Refuges in Alaska, Hawaii, and the U.S. Territories were also deleted from the calculations. These areas were considered to have very different local economies which this model did not capture well. The distance to the nearest city over 50,000 was over 1,000 miles for some Pacific island refuges, for example. A separate study is addressing the special economics of Alaska's refuges. This method left no opportunity to adjust visits by length of stay. Since the model applied the average length of stay for the sample refuges to all refuges, this was felt to be problematic only for the Upper Mississippi Refuge which records extremely high visitation much of which is only loosely attributable to the refuge. To adjust for this the final demand for Upper Mississippi was reduced to one eighth of the calculated value. Even so, it showed the fourth highest final demand behind Wichita Mountains, Pea Island, and Chincoteague. For the refuges included in the case studies, the values found in the detailed study were substituted in place of the values calculated from the prediction equations.

This technique produces estimates of final demand, employment income and jobs created by all visitor spending at each refuge. From comparison of these predictions with the case study results, it was clear that the estimates could be very wide of the mark. However, the predicted values were both too high and too low so it appeared that the deviations would balance each other when applied to aggregates of refuges. For this reason, the results for refuges outside of the study sample are not reported. Only regional and national aggregates are reported.

(b) Consumer Surplus - Consumer surplus was estimated for the sample refuges by multiplying recreational visitor days by the consumer surplus value for that activity in that state. Essentially the same process was followed for the refuges outside of the sample. Outside of the sample detailed information was not available on the amount of time spent in each activity on the refuge. This was not a problem for hunting and fishing as it had been assumed that these were full day activities for the most part. Non-consumptive use was adjusted to recreational visitor days using the average length of time such visitors stayed at the sample refuges, about 3 hours. For states with too few observations to measure the net economic value, the national mean was substituted.

The national estimates and refuge case studies provide a rough scale of the economic significance of refuge recreation in local communities. Whenever other studies were available, we compared these results with their results. In general, these results agree with previous estimates fairly well. These results are broadly descriptive. They are not intended to provide policy direction or performance measures. Refuge management is an imperfect balancing of multiple goals. This report highlights only one component.

Appendix 3.

Regional Recreation Expenditures

Table 3a. Region 1 Recreation Expenditures: Per Person Per Day, by Recreation Activity (1992 $).

	Non-consumptive		*Big Game Hunting*		*Small Game Hunting*		*Migratory waterfowl Hunting*		*Freshwater Fishing*		*Saltwater Fishing*	
Sector	Resident	Non-resident	Resident	Non-resident	Resident	Non-resident	Resident	Non-resident	Resident	Non-resident	Resident	Non-resident
Lodging	$0.00	$9.30	$0.00	$1.94	$0.00	$2.14	$0.00	$1.35	$0.00	$8.46	$0.00	$18.37
Food/drink	$8.20	$15.83	$9.57	$23.35	$8.13	$23.95	$7.04	$19.27	$8.88	$24.54	$14.54	$26.81
Transportation	$6.94	$20.10	$9.77	$19.49	$8.44	$13.82	$5.69	$21.26	$6.43	$23.12	$7.98	$48.42
Other	$0.20	$1.86	$0.09	$0.33	$1.31	$0.00	$3.01	$2.40	$1.20	$1.83	$2.43	$2.67
Totals	$15.33	$47.09	$19.43	$45.11	$17.87	$39.91	$15.75	$44.29	$16.52	$57.95	$24.94	$96.27

Region 1 includes California, Hawaii, Idaho, Nevada, Oregon, Washington, and the Trust Territories of the Pacific.

Table 3b. Region 2 Recreation Expenditures: Per Person Per Day, by Recreation Activity (1992 $).

	Non-consumptive		*Big Game Hunting*		*Small Game Hunting*		*Migratory waterfowl Hunting*		*Freshwater Fishing*		*Saltwater Fishing*	
Sector	Resident	Non-resident	Resident	Non-resident	Resident	Non-resident	Resident	Non-resident	Resident	Non-resident	Resident	Non-resident
Lodging	$0.00	$2.34	$0.00	$2.73	$0.00	$3.42	$0.00	$4.80	$0.00	$6.02	$0.00	$12.55
Food/drink	$6.27	$18.74	$8.89	$32.51	$8.61	$19.71	$8.36	$20.91	$7.53	$22.86	$12.38	$22.15
Transportation	$6.29	$19.01	$8.48	$30.42	$7.76	$28.93	$6.56	$16.68	$5.03	$21.21	$7.79	$35.30
Other	$0.08	$0.25	$0.46	$4.88	$0.28	$0.81	$1.09	$1.19	$1.46	$3.04	$4.85	$3.64
Totals	$12.64	$40.34	$17.83	$70.54	$16.65	$52.88	$16.00	$43.48	$14.02	$53.13	$25.03	$73.64

Region 2 includes Arizona, New Mexico, Oklahoma and Texas.

Table 3c. Region 3 Recreation Expenditures: Per Person Per Day, by Recreation Activity (1992 $).

	Non-consumptive		*Big Game Hunting*		*Small Game Hunting*		*Migratory waterfowl Hunting*		*Freshwater Fishing*	
Sector	Resident	Non-resident	Resident	Non-resident	Resident	Non-resident	Resident	Non-resident	Resident	Non-resident
Lodging	$0.00	$1.37	$0.00	$3.61	$0.00	$3.55	$0.00	$3.24	$0.00	$8.89
Food/drink	$5.54	$13.96	$5.02	$18.98	$3.73	$20.63	$4.44	$15.49	$5.09	$18.56
Transportation	$4.30	$12.08	$3.79	$16.64	$3.90	$19.84	$5.13	$13.99	$3.79	$13.92
Other	$0.18	$0.46	$0.13	$1.23	$0.21	$0.10	$0.96	$1.00	$0.84	$2.65
Totals	$10.02	$27.86	$8.94	$40.46	$7.83	$44.11	$10.52	$33.71	$9.72	$44.02

Region 3 includes Iowa, Illinois, Indiana, Minnesota, Missouri, Michigan, Ohio and Wisconsin.

Table 3d. Region 4 Recreation Expenditures: Per Person Per Day, by Recreation Activity (1992 $).

	Non-consumptive		*Big Game Hunting*		*Small Game Hunting*		*Migratory waterfowl Hunting*		*Freshwater Fishing*		*Saltwater Fishing*	
Sector	Resident	Non-resident	Resident	Non-resident	Resident	Non-resident	Resident	Non-resident	Resident	Non-resident	Resident	Non-resident
Lodging	$0.00	$6.75	$0.00	$3.64	$0.00	$0.57	$0.00	$4.44	$0.00	$7.78	$0.00	$25.50
Food/drink	$6.56	$15.08	$5.99	$19.36	$4.27	$17.44	$6.24	$23.74	$5.62	$17.34	$10.20	$23.84
Transportation	$5.14	$13.11	$4.92	$17.55	$3.86	$11.22	$4.69	$22.09	$3.71	$16.30	$5.26	$27.46
Other	$0.38	$0.63	$0.48	$2.77	$0.25	$1.70	$0.76	$2.10	$1.61	$3.17	$4.74	$4.65
Totals	$12.08	$35.57	$11.40	$43.33	$8.37	$30.92	$11.69	$52.36	$10.95	$44.58	$20.20	$81.45

Region 4 includes Alabama, Arkansas, Florida, Georgia, Kentucky, Louisiana, Mississippi, North Carolina, South Carolina, Puerto Rico, Tennessee and the Virgin Islands.

Table 3e. Region 5 Recreation Expenditures: Per Person Per Day, by Recreation Activity (1992 $).

	Non-consumptive		*Big Game Hunting*		*Small Game Hunting*		*Migratory waterfowl Hunting*		*Freshwater Fishing*		*Saltwater Fishing*	
Sector	Resident	Non-resident	Resident	Non-resident	Resident	Non-resident	Resident	Non-resident	Resident	Non-resident	Resident	Non-resident
Lodging	$0.00	$4.23	$0.00	$4.69	$0.00	$1.21	$0.00	$0.86	$0.00	$7.51	$0.00	$18.24
Food/drink	$5.42	$13.70	$5.40	$23.11	$3.88	$16.49	$4.82	$25.85	$4.81	$19.66	$15.58	$27.87
Transportation	$4.25	$12.20	$4.22	$16.01	$3.90	$15.13	$4.51	$36.15	$3.47	$15.09	$6.37	$14.36
Other	$0.26	$0.32	$0.21	$1.02	$0.25	$0.74	$1.24	$1.88	$0.81	$1.91	$4.48	$3.11
Totals	$9.93	$30.45	$9.83	$44.83	$8.03	$33.57	$10.58	$64.74	$9.10	$44.17	$26.43	$63.59

Region 5 includes Connecticut, Delaware, Massachusetts, Maryland, Maine, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, Virginia, Vermont, and West Virginia.

Table 3f. Region 6 Recreation Expenditures: Per Person Per Day, by Recreation Activity (1992 $).

	Non-consumptive		*Big Game Hunting*		*Small Game Hunting*		*Migratory waterfowl Hunting*		*Freshwater Fishing*	
Sector	Resident	Non-resident	Resident	Non-resident	Resident	Non-resident	Resident	Non-resident	Resident	Non-resident
Lodging	$0.00	$8.09	$0.00	$7.21	$0.00	$4.66	$0.00	$2.84	$0.00	$8.41
Food/drink	$5.91	$14.39	$8.00	$31.61	$5.52	$24.70	$5.81	$30.02	$7.10	$23.78
Transportation	$6.33	$24.49	$9.30	$30.05	$7.25	$20.91	$6.31	$21.44	$5.63	$21.75
Other	$0.03	$0.72	$0.03	$2.67	$0.21	$0.73	$0.92	$1.31	$0.81	$1.52
Totals	$12.27	$47.69	$17.33	$71.55	$12.97	$51.00	$13.04	$55.60	$13.55	$55.46

Region 6 includes Colorado, Kansas, Montana, North Dakota, Nebraska, South Dakota, Utah, and Wyoming.

Appendix 4.

Refuge Categories

Category Name	*Number of Refuges in Category*
Upper Mississippi Refuge	1
High Visitor Center and Non-Consumptive-Use Refuges	8
High Fishing-Use Refuges	7
High Hunting-Use Refuges	3
Medium Hunting-Use Refuges	10
Medium Fishing-Use Refuges	12
Medium Non-Consumptive-Use Refuges with or without Visitor Center	29
Refuges with more than 50k visitors Not Elsewhere Classified	36
Refuges with less than 50k visitors Not Elsewhere Classified	282
Total	388

Note: FY 1995 data. Categorization includes only refuges with some visitation recorded in RMIS.

Variables shown:

Visits5	Number of visitor days in thousands FY 1995
Visctr5	Number of visitor days at the refuge visitor center in thousands FY 1995
Natr5	Number of visitor days using nature trails in thousands FY 1995
Hunt5	Total number of hunting days for all quarry in thousands FY 1995
Fishfr5	Number of freshwater fishing days at the refuge in thousands FY 1995
Dis50	Distance to nearest city with population of 50,000 or more in statute miles

Variables used to create clusters: Visits5, Visctr5, Natr5, Hunt5, Fishfr5 (All scaled so that total FY 1995 use equals 1,000 to equalize weight in cluster analysis.)

Sample Refuges are indicated by three asterisks (***).

Upper Mississippi Refuge

OBS	STATION	STATE	VISITS5	VISCTR5	NATR5	HUNT5	FISHFR5	DIS50
1	Upper Mississippi River	WI	2473.8	5.5	131.1	92.7	1036.9	

High Visitor Center and Non-Consumptive Use Refuges

	OBS	STATION	STATE	VISITS5	VISCTR5	NATR5	HUNT5	FISHFR5	DIS50
	2	Pea Island NWR	NC	1845.0	50.9	962.9	0.0	0.0	91
	3	Wichita Mountains NWR	OK	1514.0	25.5	1691.1	0.3	95.2	13
***	4	Chincoteague NWR	VA	1384.1	109.9	374.1	1.4	15.1	77
	5	J.N. Ding Darling NWR	FL	671.5	190.4	664.8	0.0	0.4	99
***	6	National Elk Refuge	WY	660.5	200.6	0.0	1.3	2.6	171
	7	DeSoto NWR	IA	309.3	141.1	248.1	0.7	5.7	16
	8	Kilauea Point NWR	HI	182.2	130.0	164.8	0.0	0.0	105
	9	Santa Ana NWR	TX	175.6	122.0	112.8	0.0	0.0	13

High Fishing Use Refuges

	OBS	STATION	STATE	VISITS5	VISCTR5	NATR5	HUNT5	FISHFR5	DIS50
***	10	Crab Orchard NWR	IL	839.0	28.9	115.3	10.1	209.6	86
	11	Tennessee NWR	TN	575.6	0.0	111.2	1.9	370.3	61
	12	Havasu NWR	AZ	558.3	0.0	90.8	3.6	140.8	124
	13	Wheeler NWR	AL	485.7	31.3	242.0	10.9	201.0	25
***	14	Eufaula NWR	AL	322.6	0.0	173.5	4.1	107.6	43
	15	Kenai NWR	AK	291.3	32.0	130.0	7.0	98.4	60
	16	Felsenthal NWR	AR	244.5	1.9	15.2	24.9	201.4	39

High Hunting Use Refuges

	OBS	STATION	STATE	VISITS5	VISCTR5	NATR5	HUNT5	FISHFR5	DIS50
	17	Yukon Delta NWR	AK	210.9	0.1	0.0	115.8	180.5	435
	18	White River NWR	AR	175.4	0.0	10.2	112.9	54.0	
***	19	Charles M. Russell NWR	MT	110.5	0.3	3.2	62.6	43.7	158

Medium Hunting Use Refuges

	OBS	STATION	STATE	VISITS5	VISCTR5	NATR5	HUNT5	FISHFR5	DIS50
	20	Lower Suwannee NWR	FL	132.3	0.0	109.2	12.7	25.7	54
	21	Noxubee NWR	MS	122.5	0.0	124.8	20.3	9.8	68
	22	Kirwin NWR	KS	105.0	0.0	38.7	11.5	36.3	152
	23	Sequoyah NWR	OK	94.8	0.0	25.8	10.1	56.9	28
	24	Piedmont NWR	GA	74.0	37.4	16.9	29.9	5.2	10
***	25	Umatilla NWR	OR	55.5	2.2	26.0	15.7	23.4	68
***	26	Quivira NWR	KS	38.4	6.6	15.4	14.7	0.2	64
	27	Cache River NWR	AR	38.0	0.0	5.6	20.9	11.2	53
	28	D'Arbonne NWR	LA	31.8	0.0	1.5	27.2	5.2	6
	29	Atchafalaya NWR	LA	22.1	0.0	1.4	16.6	0.3	21

Refuges with More than 50,000 Visitors in FY 1995 Not Elsewhere Classified

	OBS	STATION	STATE	VISITS5	VISCTR5	NATR5	HUNT5	FISHFR5	DIS50
	71	Hanalei NWR	HI	361.7	0.0	9.0	0.0	0.6	108
	72	Oyster Bay NWR	NY	259.6	0.0	0.0	0.0	1.4	13
***	73	Tule Lake NWR	CA	196.5	8.7	18.4	5.0	0.0	174
	74	Tijuana Slough NWR	CA	168.0	11.2	35.6	0.0	0.0	7
	75	Lower Klamath NWR	CA	164.9	0.0	23.5	10.2	0.0	166
***	76	Horicon NWR	WI	133.8	2.3	80.7	2.1	0.3	35
	77	Necedah NWR	WI	124.4	0.0	57.8	8.3	6.8	75
	78	Fort Niobrara NWR	NE	120.6	3.5	92.5	0.0	0.0	191
	79	Dungeness NWR	WA	113.8	0.0	68.8	0.0	0.0	44
	80	Imperial NWR	AZ	112.4	5.7	5.2	2.3	10.1	137
	81	Mingo NWR	MO	111.2	12.6	21.4	5.9	28.8	117
	82	Nisqually NWR	WA	90.4	0.0	61.3	0.0	0.0	18
	83	Crystal River NWR	FL	89.5	0.0	100.0	0.0	3.5	56
	84	National Key Deer Refug	FL	82.2	0.0	63.4	0.0	0.0	98
	85	Lee Metcalf NWR	MT	81.9	0.0	76.5	2.5	0.6	147
	86	Ottawa NWR	OH	80.9	0.0	46.6	0.2	0.0	21
	87	Egmont Key NWR	FL	75.0	0.0	71.9	0.0	0.0	16
	88	Tamarac NWR	MN	71.4	6.6	17.8	9.6	6.7	58
***	89	Las Vegas NWR	NM	70.1	0.0	70.5	0.1	0.0	89
	90	Alaska Maritime NWR	AK	68.8	14.5	46.1	0.8	0.5	349
	91	Sherburne NWR	MN	68.0	0.0	48.7	4.8	0.3	34
	92	Cape Romain NWR	SC	67.5	0.0	13.1	0.8	0.0	37
	93	Shiawassee NWR	MI	66.3	5.9	17.8	2.7	3.1	9
	94	Reelfoot NWR	TN	65.8	2.3	43.4	1.3	8.5	96
	95	Elizabeth A. Morton NWR	NY	62.7	0.0	62.7	0.0	0.0	37
	96	Back Bay NWR	VA	61.6	3.8	51.3	0.0	1.7	17
	97	Malheur NWR	OR	60.8	12.0	44.0	2.5	7.7	149
	98	Hobe Sound NWR	FL	60.5	7.9	2.9	0.0	0.8	20
	99	William L. Finley NWR	OR	60.2	0.0	70.4	0.1	0.0	24
	100	Mackay Island NWR	NC	59.4	0.0	85.1	0.5	8.9	25
	101	Chautauqua NWR	IL	55.8	0.0	36.6	0.5	0.5	33
	102	Moosehorn NWR	ME	54.4	0.0	1.8	0.4	0.7	174
	103	Julia Butler Hansen Ref	WA	53.6	0.0	47.0	0.8	2.0	59
	104	John Heinz NWR at Tinic	PA	53.2	19.7	35.3	0.0	16.8	8
	105	Monomoy NWR	MA	51.3	4.0	76.1	0.0	0.1	48
	106	Carolina Sandhills NWR	SC	49.4	0.4	25.2	5.4	5.5	61

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	OBS	STATION	STATE	VISITS5	VISCTR5	NATR5	HUNT5	FISHFR5	DIS50
	71	Hanalei NWR	HI	361.7	0.0	9.0	0.0	0.6	108
	72	Oyster Bay NWR	NY	259.6	0.0	0.0	0.0	1.4	13
***	73	Tule Lake NWR	CA	196.5	8.7	18.4	5.0	0.0	174
	74	Tijuana Slough NWR	CA	168.0	11.2	35.6	0.0	0.0	7
	75	Lower Klamath NWR	CA	164.9	0.0	23.5	10.2	0.0	166
***	76	Horicon NWR	WI	133.8	2.3	80.7	2.1	0.3	35
	77	Necedah NWR	WI	124.4	0.0	57.8	8.3	6.8	75
	78	Fort Niobrara NWR	NE	120.6	3.5	92.5	0.0	0.0	191
	79	Dungeness NWR	WA	113.8	0.0	68.8	0.0	0.0	44
	80	Imperial NWR	AZ	112.4	5.7	5.2	2.3	10.1	137
	81	Mingo NWR	MO	111.2	12.6	21.4	5.9	28.8	117
	82	Nisqually NWR	WA	90.4	0.0	61.3	0.0	0.0	18
	83	Crystal River NWR	FL	89.5	0.0	100.0	0.0	3.5	56
	84	National Key Deer Refug	FL	82.2	0.0	63.4	0.0	0.0	98
	85	Lee Metcalf NWR	MT	81.9	0.0	76.5	2.5	0.6	147
	86	Ottawa NWR	OH	80.9	0.0	46.6	0.2	0.0	21
	87	Egmont Key NWR	FL	75.0	0.0	71.9	0.0	0.0	16
	88	Tamarac NWR	MN	71.4	6.6	17.8	9.6	6.7	58
***	89	Las Vegas NWR	NM	70.1	0.0	70.5	0.1	0.0	89
	90	Alaska Maritime NWR	AK	68.8	14.5	46.1	0.8	0.5	349
	91	Sherburne NWR	MN	68.0	0.0	48.7	4.8	0.3	34
	92	Cape Romain NWR	SC	67.5	0.0	13.1	0.8	0.0	37
	93	Shiawassee NWR	MI	66.3	5.9	17.8	2.7	3.1	9
	94	Reelfoot NWR	TN	65.8	2.3	43.4	1.3	8.5	96
	95	Elizabeth A. Morton NWR	NY	62.7	0.0	62.7	0.0	0.0	37
	96	Back Bay NWR	VA	61.6	3.8	51.3	0.0	1.7	17
	97	Malheur NWR	OR	60.8	12.0	44.0	2.5	7.7	149
	98	Hobe Sound NWR	FL	60.5	7.9	2.9	0.0	0.8	20
	99	William L. Finley NWR	OR	60.2	0.0	70.4	0.1	0.0	24
	100	Mackay Island NWR	NC	59.4	0.0	85.1	0.5	8.9	25
	101	Chautauqua NWR	IL	55.8	0.0	36.6	0.5	0.5	33
	102	Moosehorn NWR	ME	54.4	0.0	1.8	0.4	0.7	174
	103	Julia Butler Hansen Ref	WA	53.6	0.0	47.0	0.8	2.0	59
	104	John Heinz NWR at Tinic	PA	53.2	19.7	35.3	0.0	16.8	8
	105	Monomoy NWR	MA	51.3	4.0	76.1	0.0	0.1	48
	106	Carolina Sandhills NWR	SC	49.4	0.4	25.2	5.4	5.5	61

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