

Executive Summary

Banking on Nature 2006: The Economic Benefits of National Wildlife Refuge Visitation to Local Communities

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 jaguarundi, or any of the other endangered or threatened 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.

This report focuses on final demand, employment, income and tax revenue 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 method 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 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 80 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* or *net economic value*.

Refuge visitors pay for recreation through entrance fees, lodging near the refuge, and purchases from local businesses for items to pursue their recreational experience. This 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) (2007), and the Division of Refuge’s Refuge Annual Performance Plan (RAPP) (2006 data). Combining data from these sources creates a profile of refuge visitors’ spending in local communities.

Daily visitor expenditures for both residents and non-residents were developed in four categories (food, lodging, transportation, and other expenses) for six activities (freshwater fishing, saltwater fishing, migratory bird hunting, small game hunting, big game hunting, and non-consumptive activities). Visitor days were factored in, and the total expenditures by category of spending for each activity were determined. These expenditures were allocated to industries, and IMPLAN calculated the final effects of these expenditures on the local economies.

This report spotlights each of the sample refuges, giving a brief overview of each refuges' main mission, wildlife, uses, and activity levels. The economy of the local surrounding area is characterized by population growth, employment, and per-capita income. The 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.

One goal of this research is to generate estimates of the national impact of refuges on their regional economies. To remain consistent with past studies, refuges located outside the continental United States and refuges with less than 1,500 visitors are excluded from the national estimate. The National View section concludes by examining how the findings for 71 of the 80 sample refuges apply to six of seven U.S. Fish and Wildlife Service geographical regions. Consequently, the national estimates discussed in this section reflect refuge visitation and economic impacts *only* for the lower 48 states and for refuges with more than 1,500 visitors. The economic analysis of sample refuges facilitates a look at the big picture: an estimate of the national impact of wildlife refuges on their regional economies. Many variables affect a refuge’s impact on its local economy. Some relate to the refuge and its public-use program, others to the size of the region’s economy. This report’s National View section reviews the detailed refuge case studies to highlight the differences among the sample refuges.

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

- * Recreational visits to national wildlife refuges generate substantial economic activity. In FY 2006, 34.8 million people visited refuges in the lower 48 states for recreation. Their spending generated almost \$1.7 billion of sales in regional economies. As this spending flowed through the economy, nearly 27,000 people were employed and \$542.8 million in employment income was generated.
- * About 82 percent of total expenditures are generated by non-consumptive activities on refuges. Fishing accounted for 12 percent and hunting 6 percent. Local residents accounted for 13 percent of expenditures while visitors coming from outside the local area accounted for 87 percent.

- * Refuge recreational spending generated about \$185.3 million in tax revenue at the local, county, state and Federal level.

- * 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 nearly \$860 million in 2006. Over \$664 million of this amount (77 percent of total net economic value) accrued to non-consumptive visitors.

The above results include 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 in this analysis.

Introduction

National wildlife refuges and management districts 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 or management district did not exist?” but also “What would *life* be like if the refuge or management district did not exist?”

The last question refers to many aspects of wildlife refuges and management districts. As land is preserved in its natural state, a refuge provides services to the ecosystem of which it is a part. Wetlands mitigate flooding, improve water quality, and provide nursery habitat. Trees provide nesting and roosting sites for birds. Many refuges maintain habitat critical for the survival of endangered species. 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 account for 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 difficult 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 preservation of wildlife and habitat. Many refuges were established to protect waterfowl-hunting opportunities. Ecotourism broadens the mission of refuges.

Because natural sites are drawing increasingly more recreationists, there has been a growing interest in quantifying their impact. Such information can help in refuge planning and decision-making, and facilitate the interaction between refuges and local communities. However, refuge benefits other than recreation also exist (such as habitat preservation) and are more relevant to the National Wildlife Refuge System’s 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 one part of the benefits that the National Wildlife Refuge System provides.

This part of the larger study analyzes the visitation records of 80 sample refuges around the country to estimate 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 80 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. Also, a Glossary is included at the end of the Introduction.

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

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

Following the Introduction are 80 Sample Refuge and Management District 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 a subset of 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 World Cup soccer tickets or a new species for their life lists of birds, anything people desire can be characterized economically with a dollar value. 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 (cost of ingredients, preparation time, etc.) may help explain how to price restaurant meals. 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 prices increase before people will choose to eat at home instead? It might be interesting to know the amount of economic activity in a community generated by home cooking. The same can be said about other things such as wildlife refuge recreation.

There are two components to the value of any commodity—what you pay for the commodity and the additional benefit you derive over and above what you paid. If there were no additional benefit, you would most likely 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 has 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 \overline{RP} —the difference between what he'd have been *willing to pay* and what he *actually* paid for the first unit. \overline{RP} 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 time. 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 time needed to prepare the meal, 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.

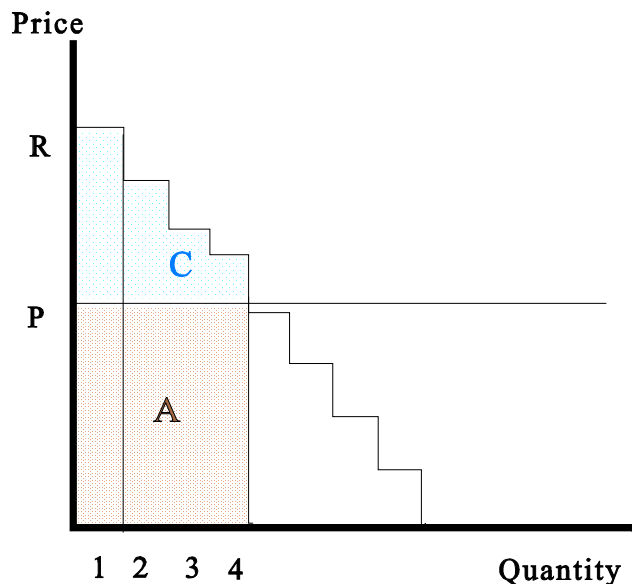
Recreation is a special kind of good. Recreationists at a refuge pay for their recreation not only in entrance fees but in the costs of traveling and staying near the refuge and taking time away from other activities. In Figure 1, all of the recreationist's costs to obtain recreation compose rectangle 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 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 not be estimated in this analysis.

Visitors' spending generates economic activity throughout the local economy. 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.

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.

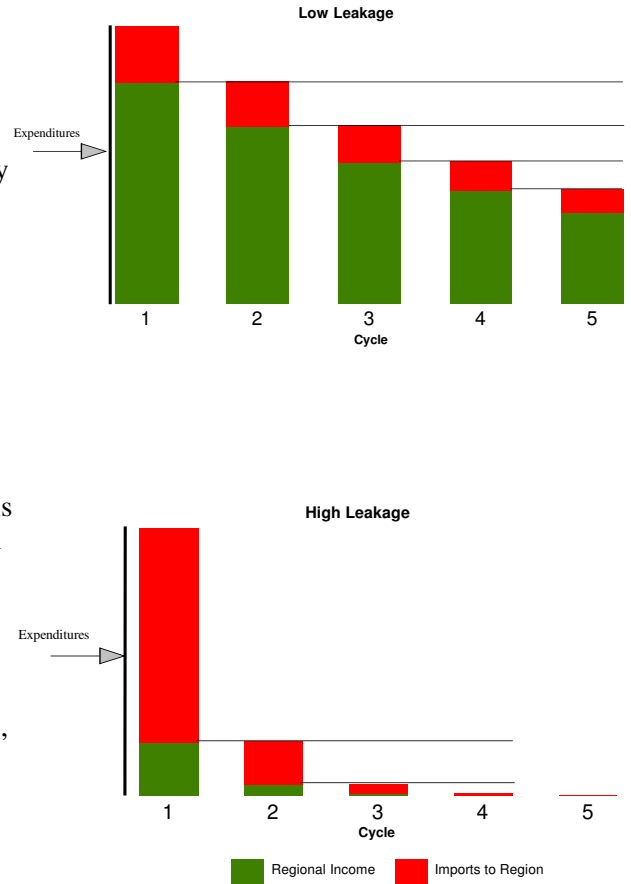
Thus it is important to separate spending by people from outside the refuge's economic region from spending by those who live locally. Local residents would probably have spent their recreation money in the local economy with or without the refuge. If they couldn't go birding, they might go bowling.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

Data for this study are compiled from the FWS National Survey of Fishing, Hunting, and Wildlife-Associated Recreation (NSFHWR) and the FWS Refuge Annual Performance Plan (RAPP). By combining information from these two sources, a profile of refuge visitors' spending in local communities may be developed. The data are further enhanced with information from refuge staff, regional tourism agencies, and other recreation providers. Refuge officials estimated the average lengths of stay from the activities available and the typical behavior pattern of visitors. This information is used to tally the number of hours visitors spend on a given refuge (usually expressed in recreation visitor days or RVDs) and on the activities in which they participate.

Every 5 years the Fish and Wildlife Service conducts the NSFHWR, which gathers nationwide information about recreationists, their activities, and their expenses. This Survey is the data source for daily visitor expenditures, which are generated for four categories: food, lodging, transportation, and other expenses (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 sample 80 refuges' local economies. (For purposes of this study, a region is defined as the area within 30 miles of a refuge.)

The National Wildlife Refuge System maintains extensive data on public visitation. Nearly all the visitation data used in this study is derived from the RAPP information, which is reported by personnel at each refuge and varies with each refuge's unique situation. The methods used to collect data vary with each refuge's unique situation, location, and activities offered. For example, many refuges have tightly controlled hunts. 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 RAPP 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 visitor 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 threes allows the public-use officers 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.

In FY 2006, the Service issued a Visitor Estimation Handbook to offer guidance and tips to refuges for counting visitors. The handbook was developed with the input of numerous refuges and examines a variety of techniques, such as estimating visitation using entrance fees, patrols, traffic counters, hunting registration, trails and parking areas. The handbook is used by refuges to support data entered into the RAPP and contains a number of technical appendices examining the methods in greater detail.

Sample Selection

The Division of Economics does not have the resources to thoroughly study all 548 refuges. Refuges and Management Districts included in the study were selected by Regional Office refuge supervisors.

RAPP Data Adjustments

Because RAPP visitor counts are based on several different counting methods, one visitor may be counted several times. 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 purposes we would do not want to overestimate a visitor's impact to the local economy. Thus, each visitor should be counted only once for his or her primary activity.

People pursue many different activities while traveling. Their visits 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 overestimate the visitor spending attributable to the refuge. In this study, a full recreational day is considered as eight hours¹. 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. The average length of time visitors participate in each activity is used to determine the number of RVDs for that activity. If a typical non-consumptive wildlife use day is 4 hours at a particular refuge, the number of RVDs for the refuge would be the number of non-consumptive use visits multiplied by 4/8. Refuge public-use officers estimate the average lengths of stay for each activity available on the refuge and the typical behavior pattern of visitors.

Expenditure and Consumer Surplus Data

Daily expenditure information for this study was extracted from the NSFHWR trip expenditure database (U.S. Department of the Interior et al. 2007). 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

¹The U.S. Forest Service considers a recreation day as 12 hours long. However, unlike National Forest activities, almost all refuge uses are daylight activities.

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. Respondents were asked to determine expenditures in nine categories which were then aggregated to four categories for analysis. To convert this individual state total to expenditures per day per trip, the total was divided by the number of days the respondent said he had pursued chiefly that activity.

Four Categories

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

Respondents were classified as non-residents if their state of residence differed from the state where the activity occurred. Average daily expenditures were calculated for each Fish and Wildlife Service region. Smaller geographic breakdowns left too few respondents in some categories for reliable averages. These expenditure estimates are shown in Appendix 3.

Lodging expenditures appear very low in this data, ranging from \$0.36 per day to \$42 per day (in the lower 48 states). Often, lodging expenditures 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 is 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 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 (Kaval and Loomis, 2003).

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., 1998). 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 RAPP 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 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 2006 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 area attributable to refuge visitation. It should be noted that final demand is the amount of money which actually stays in the area after all leakages are accounted for.

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.

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 for a national estimate. Such a process would be prohibitively expensive. As an alternative, the results from 69 of the case studies can be treated as data points. (To remain consistent with past studies, refuges with less than 1,500 visitors or located outside the continental United States were not included in this model. Therefore, the number of data points is slightly less than the number of refuges in the detailed sample.) National estimates were derived using average ratios from the sample refuges. Ratios were derived for (1) final demand per recreation visit, (2) employment income per recreation visit, and (3) jobs per recreation visit. These ratios were then applied to estimate the economic impact of national wildlife refuges nationwide. This methodology is not the same as that used in earlier reports.

Several adjustments were made to the data to ensure consistency. The sample refuges' recreational visitation ranged from 522 to 6.3 million. Applying the ratios derived from this sample to refuges with very low visitation yielded very high estimates of final demand. To avoid adding these into the national results, all refuges with fewer than 1,500 visits were deleted from the calculations. This eliminated about 135 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 overall model did not capture well. The model applied the average length of stay for the sample refuges to all refuges.

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 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.

Net Economic Value

Net Economic Value (consumer surplus) was estimated for the sample refuges by multiplying recreational visitor days by the net economic value for that activity in that state or region. 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 2.8 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.

