APPENDIX I

Economic Impact Assessment

PURDUE UNIVERSITY

DEPARTMENT OF
AGRICULTURAL ECONOMICS

December 16, 1998

Forest Clark
U.S. Fish and Wildlife Service
620 South Walker Street
Bloomington, IN 47403

Dear Forest:

The attached comments serve as a response to public comments forwarded to us regarding the Economic Impact Assessment for the Proposed Grand Kankakee Marsh National Wildlife Refuge. Please contact me if you require further assistance.

Sincerely,

Gerald E. Shively

1145 KRANNERT BUILDING • WEST LAFAYETTE, IN 47907-1145

Third, if one were to assume that land used to establish the proposed refuge would have instead been developed by new businesses and industries that could not locate elsewhere within the study area, then establishment of the refuge could indeed adversely impact local economic growth. This assumption, however, does not seem realistic given the various land types that have been targeted for the proposed refuge. The assumption that underlies the analysis is that the land most appropriate for restoration would be that least suitable for commercial development.

Issue 3: *Estimated value of agricultural output and income.*

Concerns have been raised regarding the estimates used to value agricultural land to be taken out of production. In particular, it has been suggested that (1) using the value of corn production as an estimate of agricultural land understates the contribution of specialty crops in the regional agricultural economy, and (2) agricultural incomes in the area are likely to rise over time due to advancements in agricultural technology.

Regarding the first concern, it is true that a number of specialty crops are produced in the region. These include mint, seed corn, seed beans, tomato, popcorn, amylose corn, waxy corn, and other vegetables and fruits. Estimates suggest the total acreage represented by these crops is 1-5 per cent of total crop area in the region. Many of these crops have economic value on a per acre basis that greatly exceeds that of corn.

The economic impact assessment assumed that area taken out of production would be corn production for two primary reasons. One, the acreage represented by corn, soybeans, wheat, and hay represents 97 percent of the region's cropland (table II-6, page 13). As corn constitutes the largest share of area, it was assumed land that would come out of crop production would be corn. Two, the economic impact assessment relied upon the assumption that land taken out of agricultural use would be sold to the Federal Government by willing sellers. The assumption used in the economic assessment is that owners would sell land from which they earned the lowest return, i.e. their least productive land. High-value land, well suited to production of specialty crops, need not be sold. Furthermore, if farms currently used for specialty crop production were sold to the federal government to become part of the proposed refuge, it is assumed that producers would move production of the specialty crop to other land within the Kankakee watershed area. Under this assumption, the opportunity cost of the converted land remains that of its lower-value use, namely corn production.

The price estimate for corn used in the analysis is $2.25 per bushel, the 1994 average corn price in Indiana. The 10-year average corn price for Indiana for the 1987-1996 period was $2.26 per bushel. For comparison, the current USDA forecast of the 1998 price of corn is $2.05 per bushel.

Yield estimates used in the economic assessment are based on 1994 corn yields for corn acres harvested, based on an average for the 10 Indiana counties in the watershed area (table IV-1, page 29). In the baseline analysis and sensitivity analysis B, yields were adjusted downward to reflect the flooding propensity of the land targeted for the proposed refuge. It was assumed that over a five-year period flooding would reduce corn yields by 20 per cent on average. Sensitivity analysis A assumed no loss in production due to flooding.

PURDUE UNIVERSITY

DEPARTMENT OF
AGRICULTURAL ECONOMICS

July 15, 1998

William Hartwig, Regional Director
U.S. Fish and Wildlife Service
Bishop Henry Whipple Federal Building
1 Federal Drive
Fort Snelling, MN 55111-4056

Attn: Tom Magnuson

Dear Mr. Hartwig:

The attached comments serve as a response to public comments forwarded to us regarding the Economic Impact Assessment for the Proposed Grand Kankakee Marsh National Wildlife Refuge. Please contact us if you require further assistance.

Sincerely,

Kevin T. McNamara

Gerald E. Shively

cc: Dave Hudak, USFWS Bloomington Field Office

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Response to public comments on Economic Impact Assessment for the Proposed Grand Kankakee Marsh National Wildlife Refuge

Issue 1: *Assumptions and overall results of the economic study.*

The Economic Impact Assessment provides a baseline estimate of potential impacts of the proposed refuge under a range of scenarios. Considering the 30-year time horizon and the level of uncertainty regarding several aspects of potential recreation demand and economic impact, it seems unwise to rely on any *single* forecast of potential impacts of a project of this type. For this reason, the economic analysis provides a benchmark assessment, as well as two sensitivity analyses based on modifications of the most important assumptions driving the analysis. These findings suggest a range of potential impacts, both in aggregate and over time. Analysis shows that the aggregate change in economic output associated with establishment of the refuge could fall into a broad range. For the complete 30-year time horizon considered in the analysis this range extends from a drop in economic output of 69.1 million (scenario A, wetland option) to an increase in economic output of 69.6 million (scenario B, hybrid option) (see Table V-4, undiscounted figures). Estimates of the aggregate change in personal income associated with establishment of the refuge range from a reduction of 3.2 million (scenario A, wetland option) to an increase of 39.8 million (scenario B, hybrid option). For comparison, total personal income in the 13-county region was $21 billion in 1990. This suggests the estimated aggregate impacts of the proposed refuge would be small in relation to the overall economy of the study area.

Issue 2: *Impacts of future economic development in the region.*

Documenting historical growth and incorporating projected patterns of future growth for the region was beyond the scope of the analysis. Furthermore, projections of future growth patterns would likely raise questions regarding the assumptions used in deriving those projections. The analysis relies on an assumption that is standard for studies of this type, and employs a "no change" scenario as the "without refuge" comparison.

Future economic growth in the Kankakee regional economy could influence the total economic impacts associated with creation of the proposed refuge in at least three ways.

First, to the extent the regional economy experiences future growth in the retail and service sectors, the local economy might be better equipped to capture expenditures made by out-of-region visitors to the refuge. In this case, the actual expenditure capture share could be larger than we assume (see Section D, pages 48-49). A larger expenditure capture share would increase the economic impacts associated with recreational use of the proposed refuge.

Second, to the extent regional economic development leads to larger incomes within the study region, local demand for recreational activity (which tends to rise with per-capita incomes) could be higher than we have estimated. Again, this would tend to increase the economic impacts (output, incomes, and employment) associated with recreational use of the proposed refuge.

Economic Impact Assessment of the Proposed Grand Kankakee Marsh National Wildlife Refuge in Indiana and Illinois

Submitted to:

U.S. Fish and Wildlife Service

February 1998

by

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Kevin McNamara, Ph.D.

with

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Executive Summary

Establishment of the proposed Grand Kankakee Marsh National Wildlife Refuge would involve federal purchase, easement, or lease of up to 30,000 acres of land in a 13-county area of northwestern Indiana and northeastern Illinois*. Approximately one-half of the land to be acquired would be farmland. Parcels would be acquired from willing sellers over a period of approximately 30 years.

This economic impact assessment investigates four alternative plans for refuge development that have been identified by the U.S. Fish and Wildlife Service. These management plans are a Wetland Alternative, a Grassland Alternative, a Threatened and Endangered Species Alternative, and a Hybrid Alternative. Potential economic impacts of these management alternatives are examined in this report. This report does not identify exact areas that would be acquired by the U.S. Fish and Wildlife Service, nor does it discuss the potential impacts of the proposed refuge on specific areas or counties.

This report focuses on direct, indirect and induced economic impacts arising from changes in land use that would accompany the proposed refuge. The report considers only changes in expenditures and economic activities in the economic study area associated with refuge development. Reallocation of existing expenditures is not considered. For purposes of comparing "with refuge" and "without refuge" scenarios, the analysis assumes that in the absence of the

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* The 13 counties are: Jasper, Kosciusko, Lake, La Porte, Marshall, Newton, Porter, Pulaski, St. Joseph and Starke in Indiana; and Iroquois, Kankakee and Will in Illinois. Four of these counties – Kosciusko, Pulaski, St. Joseph and Will – have no land targeted for acquisition under any of the management alternatives.

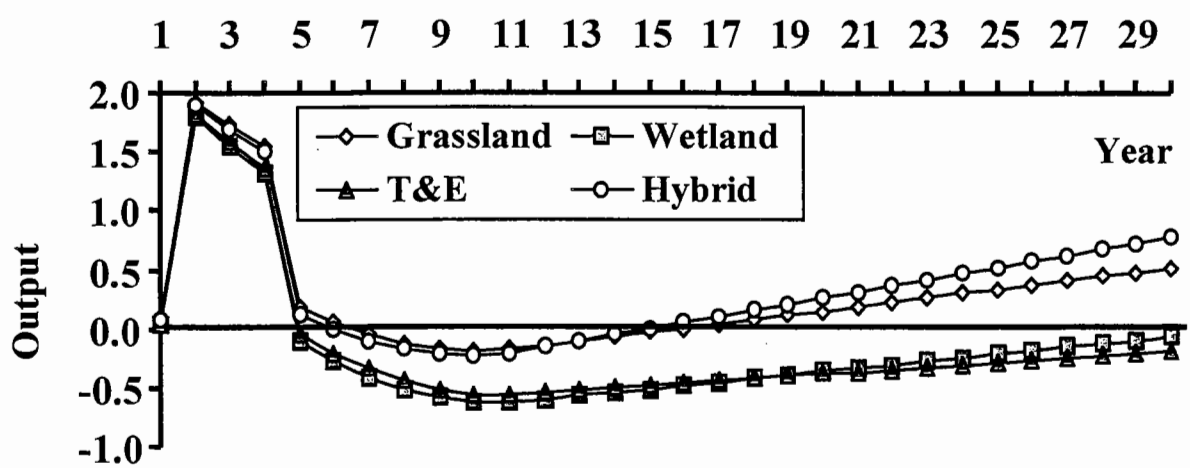
proposed refuge, the characteristics of the economic study region would be unchanged and that the level of economic activity in the study region would remain constant.

This analysis assumes that establishment of the proposed refuge would have three broad stages of impact over the 30-year period. The initial stage (years 1-5) would involve facility construction and modest land acquisition and restoration. In the second stage of the project (years 6-15) the cumulative amount of land acquired by FWS for the refuge would increase, as would employment by FWS. However, during this second stage the local economic impacts derived from recreational activities taking place in the refuge are expected to be modest. During the third stage of the project (years 16-30) economic impacts from recreational activities are projected to increase as the refuge becomes fully established and the economic study area develops economic infrastructure to capture expenditures in the study area.

Analysis is conducted for a Baseline Scenario and two alternative scenarios that differ with respect to assumptions regarding visitation rates, the value of agricultural land, and the share of recreational expenditures captured in the local economy. Results from the Baseline Scenario indicate that refuge establishment would result in an increase in net personal income and employment over 30 years. Net economic output would increase under the Hybrid and Grassland Management Alternatives but would decline under the Wetland and Threatened and Endangered Species Alternatives.

Projected refuge impacts on economic output in the study area are illustrated in Figure 1. As the figure indicates, economic output is projected to increase initially due to expenditures by FWS. Subsequent impacts reflect reductions in agricultural output — as land is taken out of production — and increases in recreational activities. The largest changes in economic output occur in the Hybrid and Grassland Alternatives.

Figure 1. Projected Refuge Impact on Output in Study Area, Baseline Scenario



Projected impacts of the proposed refuge on personal income in the study area are illustrated in Figure 2. Under baseline assumptions, the proposed refuge is expected to increase personal income in the study area under all scenarios. The largest changes in personal income are again associated with the Hybrid and Grassland Management Alternatives.

Figure 2. Projected Refuge Impact on Personal Income in Study Area, Baseline Scenario

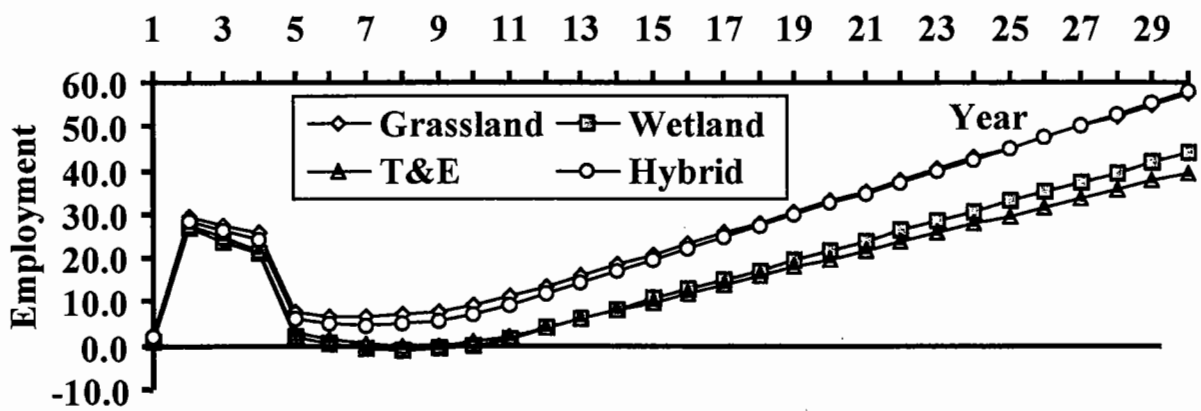
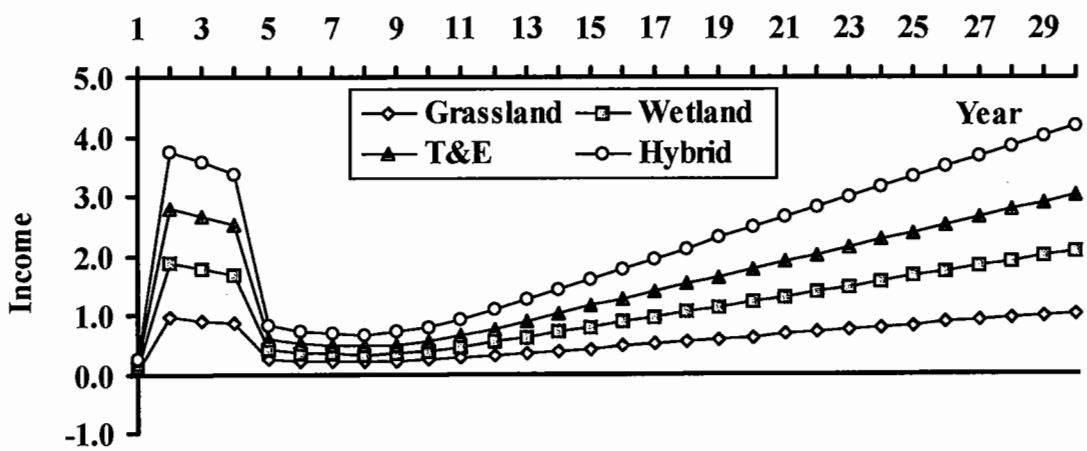


Figure 3 illustrates projected refuge impacts on employment under the Baseline Scenario. Under baseline assumptions, the proposed refuge is expected to increase employment in the study area under all scenarios. The largest change in employment is associated with the Hybrid Management Alternative.

Figure 3. Projected Refuge Impact on Employment in Study Area, Baseline Scenario



Data illustrated in Figures 1-3, which are based on findings from the analysis of the Baseline Scenario, are discussed in detail in the main report. Based on a real discount rate of 3.6%, the projected aggregate impacts of the proposed refuge can be summarized as follows:

- Over the 30-year time horizon considered in this study, the proposed refuge would result in changes in economic output ranging from a loss of $1.23 million (in the Threatened and Endangered Species Alternative) to a gain of $6.60 million (in the Hybrid Alternative).

- The proposed refuge is estimated to increase personal income in the study area under all management alternatives. The estimated changes in personal income range from $8.58 million (in the Threatened and Endangered Species Alternative) to $10.44 million (in the Hybrid Alternative).

- The proposed refuge is projected to result in an increase in employment in the study area. The estimated change in average annual employment ranges from 17.0 jobs (in the Threatened and Endangered Species Alternative) to 27.9 jobs (in the Grassland Alternative).

- Differences in outcomes for the four management alternatives examined in this report reflect differences in the amount of agricultural land projected to be acquired and differences in the types and amounts of recreational activity supported by the management alternatives. Overall, the Hybrid Management Alternative would result in relatively less agricultural land being acquired. The Hybrid Alternative would also allow more recreational activity than other alternatives considered.

Key parameters influencing the magnitude of projected changes illustrated in Figures 1-3 are (1) the potential number of visitors to the refuge, (2) the productivity of acquired land, and (3) the

extent to which expenditures by refuge visitors are captured within the regional economy. To gauge the sensitivity of the results to changes in these assumptions, analysis was also conducted using two alternative scenarios. Compared with the Baseline Scenario, Scenario A assumed lower recreational visitation rates, higher productivity on acquired agricultural land, and a lower rate of expenditure capture by the local economy. Compared with the Baseline Scenario, Scenario B assumed higher recreational visitation rates, the same degree of productivity on acquired agricultural land, and a higher rate of expenditure capture by the local economy. Results for these alternative scenarios are discussed in detail in the main report. In summary, results for Scenario A indicate a reduction in output and employment for all management alternatives, and a reduction in personal income in two out of four management alternatives. Impacts on output and employment are greatest in the Wetland and T&E Alternatives. An increase in personal income is projected for the Grassland and Hybrid Alternatives. Results for Scenario B indicate an increase in employment and personal income in all management scenarios, and an increase in output for the Grassland and Hybrid Alternatives. Impacts are projected to be greatest under the Hybrid Alternative.

It is important to note that this report draws attention to, but does not specifically address three potentially important aspects of the proposed refuge that have received local attention. These are (1) impacts on the property tax bases of communities in the watershed; (2) potential impacts on flooding or flood control on farms adjacent to the refuge; and (3) potential impacts on downstream surface water quality.

If established, the refuge would result in changes in land use and land ownership. These changes would be accompanied by changes in property tax bases of communities in the economic study area. The federal government has a policy of making compensating payments to local communities based on both the amount of acreage occupied by a national wildlife refuge and the

underlying value of occupied land. Lack of information regarding the exact location of land that may be acquired for the proposed refuge precluded an assessment in this study of the specific local impacts of the proposed refuge on property tax receipts. Likewise, lack of detailed hydrological information precluded an assessment of potential economic impacts due to flooding or improved flood control in the area. In general, state and federal laws restrict the FWS from engaging in activities that would negatively impact adjacent landowners. Section 404 of the federal Clean Water Act requires hydrological studies and permits to be issued whenever wetland restorations are undertaken. Finally, although improvements in downstream water quality through protection of existing wetlands and restoration of drained wetlands are possible as a result of the refuge, these have not been considered in this report.

Economic Impact Assessment of the Proposed Grand Kankakee National Wildlife Refuge in Indiana and Illinois

I. Introduction

A. Purpose of report

This report presents results from an economic analysis of the potential regional economic impact of the proposed Grand Kankakee Marsh National Wildlife Refuge (GKMNWR). Establishment of the proposed refuge would involve federal purchase, lease, or easement of approximately 30,000 acres of land in five to ten contiguous segments within a 13-county area of northwestern Indiana and northeastern Illinois. The 30,000 acres targeted for acquisition would be drawn from a total watershed area of over 3.3 million acres. Land acquisition is projected to take place over an approximate 30-year time period. Land would be acquired only from willing sellers and would be managed by the U.S. Fish and Wildlife Service (FWS). Management goals would include protecting and enhancing fish and wildlife habitat as well as providing recreational opportunities for local residents and non-resident visitors.

This report assesses a series of four alternative plans for refuge development that have been identified by the FWS. The possible economic consequences associated with each management alternative are examined. The report represents a *limited* economic study. It is limited in three ways. One, it is limited in coverage. It focuses only on the 13-county region that would be directly affected by refuge establishment. For purposes of this report this 13-county region will be referred to as the *economic study area*. The economic study area includes all

counties that contain some proportion of land that lies within the Kankakee watershed. This study does not examine potential impacts on properties or businesses outside the economic study area. Two, the study is limited in scope. It focuses on economic impacts related to land use changes within the economic study area. It also includes estimates of the economic impact of direct spending by the FWS on construction and maintenance of refuge facilities. However, the study does not include an assessment of actions that would mitigate the impact of the proposed refuge on the economic study area. Neither does it attempt to predict and assess the potential responses of residents to the economic changes discussed. Three, the report is limited by requirements of measurement. The report focuses on direct, indirect, and induced economic impacts that could be quantified easily. Other impacts might arise that are less easily quantified than those examined here. Section VI of this report draws attention to some of these other impacts but due to lack of reliable information on their potential economic impacts the report does not explicitly incorporate them into the analysis. Although these impacts fall outside the parameters of the formal analysis, they could have important effects on the economy of the economic study area that are not quantified in this study.

All economic impacts described in this study are estimated on the basis of land use changes and expenditures that have been identified as *possible* by the FWS. Actual land allocation would depend, at least in part, on congressional budget allocations. This report assumes that the refuge would reach its maximum projected size of 30,000 acres in 30 years. A slower pace of land acquisition is likely. Prospective land use changes and expenditures have been used to estimate changes in agricultural, recreational and other activities. Both consumptive

and non-consumptive recreational uses are examined in this report. Estimated levels of recreational use have been combined with estimates of expenditure patterns of potential refuge visitors and operation and maintenance expenditures by the FWS to construct a profile of changes in the scope and composition of the economy of the economic study area as a result of the proposed refuge. Data on economic changes are used in conjunction with the IMPLAN model to estimate overall economic impacts in the regional economy of the economic study area. IMPLAN is a county-level input-output model of the U.S. economy that was developed by the U.S. Forest Service. This model is widely used by researchers and planners to estimate the regional impacts of changes in economic conditions. It is important to point out that this report does not pinpoint exact areas that would be considered for acquisition by the FWS, nor does it forecast the potential impacts of the proposed refuge on specific areas or counties. The IMPLAN model uses a database calibrated to 1994 values. Therefore, unless otherwise noted, all monetary measures reported in this document are expressed in 1994 dollars.

This report discusses four management alternatives identified by the FWS. These management alternatives are compared in terms of their potential economic impacts on the economic study area over a 30-year time period. All economic sectors represented by the regional economy are examined in this study. However, two sectors – agriculture and recreation – are the primary focus of the report. Secondary impacts on related businesses also are examined. Due to the long time horizon associated with refuge development, impacts would be expected to occur gradually. The underlying and simplifying assumption used in this analysis is

that without the refuge, the economy of the study area would remain unchanged from its present form.

Methods used in this study were chosen to provide a realistic appraisal of consequences of alternative actions. The study relies on secondary data. Field visits were undertaken by the authors, but the study did not collect any primary data in the watershed. In this study, extreme estimates of "best case" or "worst case" alternatives have been avoided. It is important to point out that parameters used in this analysis are uncertain. The condition of the general economy over the next 30 years, the timing and pattern of land acquisitions, the level of recreational activity, and potential local responses to the proposed refuge are all uncertain. For this reason, results from this study should not be regarded as a prediction of what will invariably happen if the proposed refuge is established. Instead, the projections contained in this report should be viewed as information to inform, guide and improve public debate surrounding the refuge proposal. A complete investigation of all alternatives and consequences was beyond the scope of the study.

B. Setting of the project and the report

The U.S. Fish and Wildlife Service (FWS) currently manages a system of more than 500 National Wildlife Refuges and wildlife areas nationwide (FWS 1997). These areas consist of over 93 million acres of land. Wildlife refuges exist in all 50 states. This includes two National Wildlife Refuges in Indiana and seven National Wildlife Refuges in Illinois. Wildlife conservation, enhancement, and management are the primary goals of the refuge system.

Recreation and education are also important aspects of the National Wildlife Refuge system, and many refuges contain visitor centers. In 1996 approximately 30 million people visited National Wildlife Refuges.

Due to its unique habitat and setting, the Grand Kankakee Marsh is considered a desirable location for a wildlife refuge. Before European settlement, the Grand Kankakee Marsh covered more than 500,000 acres of land in northern Indiana and Illinois. It is purported to have been one of the most productive wildlife habitats on this continent. It was especially important as a breeding ground and a staging area for waterfowl migration. By the early part of this century, large portions of the Kankakee River had been channelized, the marsh had been virtually drained, and former wetlands had been converted to agricultural production. An interesting description of the early history of the Kankakee River and the draining of the marsh is provided in *The Lacrosse Centennial* (1963). Despite the changes that have occurred in its makeup, the fact that the area was once marshland is apparent. Flood protection is one of the most pressing concerns for farmers operating within the watershed. Spring flooding in 1996 destroyed more than 13,000 acres of crops in Starke County alone (USDA 1996). According to accounts by local farmers, fields are frequently flooded and pumping has become a necessary cost of preparing fields for spring planting. Estimates made by the authors during field visits in the area suggest that the electricity costs alone for pumping fields in the spring are $10-15 per acre. Costs of constructing and maintaining dikes and drainage channels are substantial also.

The Kankakee watershed remains an important source of fish and wildlife habitat. Several areas in the watershed are currently managed as wildlife habitat by state, local, and

private interests. Most of the recreational activities that are examined in the following discussions – such as hunting, fishing, or bird watching – already take place within the watershed.

The FWS, in conjunction with other public and private conservation groups, is seeking to protect and restore approximately 100,000 acres of wildlife habitat in the watershed (FWS 1996). This constitutes three percent of the watershed and approximately two percent of the 13-county area. The FWS would seek to restore and preserve approximately 30,000 acres through a combination of voluntary partnerships, easements, and land acquisition. Federal funding would be provided by a combination of the Land and Water Conservation Fund and the Migratory Bird Fund. The FWS proposal calls for using a combination of voluntary partnerships, easements, and land acquisition to restore and preserve approximately 30,000 acres of land in the Kankakee River watershed. The FWS goal is to connect and expand existing patches of habitat to provide protected areas and movement corridors for FWS Trust Resources, including migratory birds and threatened and endangered species. Some of the land identified in focus areas is currently used for agricultural row crop production and would require restoration. As highlighted above, much of this agricultural land is vulnerable to seasonal flooding. Some of the land identified in focus areas is currently unused or used as pasture or woodland.

The acquisition of land for the proposed refuge would be a gradual process. It is expected that land acquisition for the proposed refuge would span at least 30 years. This long horizon, combined with the fact that land would be acquired only from willing sellers means that it is difficult for the FWS to formulate a comprehensive management plan in advance. The

difficulty inherent in developing a management plan in advance necessarily limits the scope of this study for predicting the potential economic impacts of the proposed refuge. For this reason, many of the findings from this study rely on assumptions about land acquisition and land use that reflect not only the predictions of the FWS, but also the experiences that have been observed at other refuges or in similar settings.

C. Organization of this study and report

A logical sequence of steps was followed in estimating the economic impacts of the proposed refuge. The steps undertaken in the analysis are listed in Figure I-1. This sequence of steps was carried out chronologically. That is, the results from Step 1 were used as input into Step 2, and so forth. It is important to note that each step in the analysis required a unique set of data and a series of simplifying assumptions. These data and assumptions are described and discussed in detail in subsequent parts of the report. Given a different set of data, and a different set of simplifying assumptions, the same steps could be followed, but results would likely change. To address this issue, this report first recounts results from a Baseline Scenario using best estimates of key parameters. A sensitivity analysis is then conducted using alternative assumptions regarding levels of recreation, values of agricultural production, and rates of expenditure capture in the regional economy. The sensitivity analysis consists of two sets of model results.

This report has seven parts. Part II describes the economy of the economic study area and discusses important regional economic trends that are likely to influence the economy of the economic study area in the near future. Part III outlines land use changes that would result from

refuge establishment. Part III focuses on steps one and two of the economic impact assessment and describes and outlines the characteristics of each management alternative. This includes descriptions of patterns of land acquisition, land conversion, and land management. Part IV reports the sources of data, the methods, and the assumptions used in the analysis. Part V reports the main findings of the study and compares the potential impacts of the proposed refuge under each management alternative. Part V also reports results from the sensitivity analysis. Part VI highlights important changes and influences that are likely to occur as a result of refuge development, but which could not be quantified for use in this study. Part VII summarizes the results of the economic impact assessment and raises questions for further consideration and study.

Figure I-1. Flow of steps for estimating economic changes

Step 1

Estimate land use changes associated with refuge development
(by management alternative).

⇓

Step 2

Estimate the increase in amount of land available for recreation
and the decrease in amount of land available for agriculture
(by management alternative).

⇓

Step 3

Estimate baseline number of refuge visitors
(by management alternative and usage category).

⇓

Step 4

Estimate expenditures associated with
refuge visitors and direct expenditures by FWS.

⇓

Step 5

Use IMPLAN to generate baseline measures of the likely economic changes
arising from an increase in recreation and a decrease
in farming, taking into account regional interactions and multiplier effects.

⇓

Step 6

Use IMPLAN to conduct a sensitivity analysis using alternative
assumptions regarding levels of recreation, value of agricultural production,
and rates of expenditure capture in the regional economy.

II. Kankakee Watershed Area

A. Location

Establishment of the proposed Grand Kankakee Marsh National Wildlife Refuge would involve the acquisition and restoration of up to 30,000 acres of land near the Kankakee River in northwestern Illinois and northeastern Indiana. This area, and its relationship to the Chicago Metropolitan Area, is illustrated in Figure II-1. The area lies within the boundaries of ten Indiana counties and three Illinois counties. These counties are listed in Table II-1. The area is an irregularly-shaped swath of land, defined by the Kankakee River watershed. It begins at the Michigan border of St. Joseph County, Indiana, and occupies most of that county. It also occupies large portions of La Porte, Marshall and Starke Counties in Indiana. A small portion of the watershed extends eastward into Kosciusko County, Indiana. It also includes the southern portions of Lake and Porter Counties, and the northern portions of the Indiana counties of Jasper and Newton. In Illinois, it covers most of Kankakee and Iroquois Counties and includes smaller portions of southern Will County.

Figure II-1. Map of Indiana and Illinois indicating location of economic study area

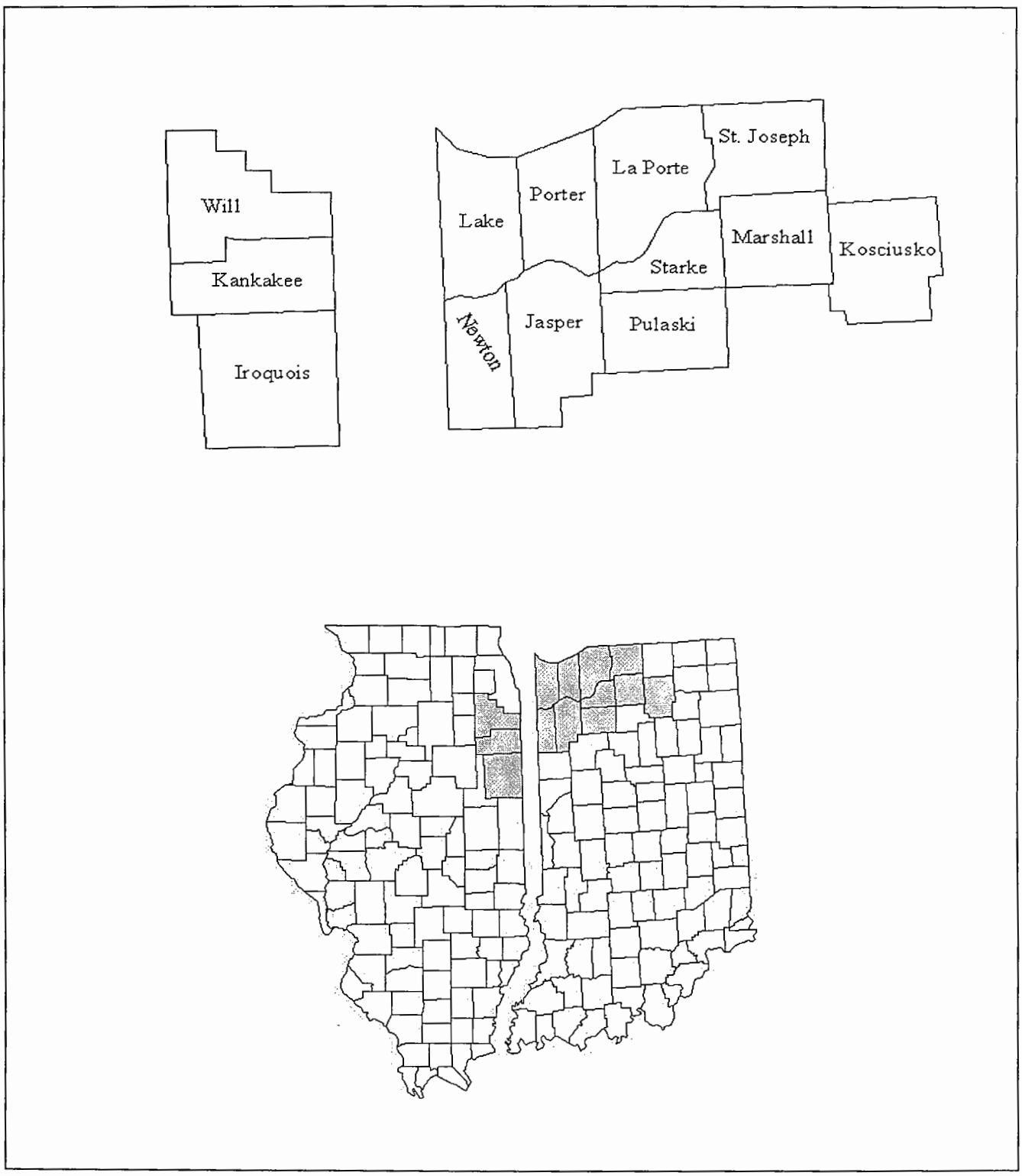


Table II-1. Counties contained in the economic study area

Indiana	Illinois
Jasper	Iroquois
Kosciusko	Kankakee
Lake	Will
La Porte	
Marshall	
Newton	
Porter	
Pulaski	
St. Joseph	
Starke	

B. Grand Kankakee Area

The 13-county area considered in this report consists of 7,300 square miles or approximately 4.7 million acres. Of this amount, approximately 3.3 million acres falls within the boundary of the Kankakee watershed. The original Grand Kankakee Marsh covered an area of more than 500,000 acres along the Kankakee River. The economic study area considered in this analysis is the entire 13-county region. Roughly two-thirds of this area falls within Indiana and one-third falls within Illinois. In this report, the economic study area is taken to include the entire area and economy of thirteen Indiana and Illinois counties listed in Table II-1. These counties each contain at least some part of the Kankakee River watershed. As pointed out previously, the Kankakee River watershed covers a large portion of some counties and only a small portion of

others. The proposed refuge is expected to occupy 30,000 acres at multiple sites in this thirteen-county area. The area that would potentially contain the refuge constitutes less than one percent of the total acreage of the economic study area.

The economic study area lies immediately south of the Chicago Metropolitan Area. Within an approximate 100-mile radius of the watershed, there are a number of large and small population centers. An urban corridor exists north and just outside of the watershed where Interstate 80 connects Chicago, Gary, Michigan City, South Bend and Elkhart. These cities along the northern edge of the economic study area exert a strong influence on the regional economy and would play a key role in providing visitors to the proposed refuge. Other urban centers that lie within 200 miles of the economic study area are Ft. Wayne and Detroit (to the east), Logansport, Lafayette, Champaign-Urbana, and Indianapolis (to the south), and Peoria (to the west).

Lake and Will Counties, both part of the Chicago Metropolitan Statistical Area, are the most populous counties in the economic study area. Lake County has the highest population density, with 970 people per square mile. All of the counties in the northern tier of the economic study area have larger populations and higher population densities than those of the southern tier. Iroquois County, with 28 people per square mile, is the most sparsely populated county in the economic study area. Pulaski County, with 30 people per square mile, is the second most sparsely populated county. As of 1995, the average population density in the economic study area as a whole was 236 people per square mile.

In 1995 the economic study area population was approximately 1.7 million (Table II-2). This population represents a seven-percent increase over the 1985 population. Over the same time period the Indiana and Illinois populations grew by six percent and four percent, respectively. Thus, over the last decade, the counties of the economic study area experienced somewhat faster population growth than their respective states. At 20 percent, population growth in Will County was the most rapid of the 13 counties. Much of the growth in population in the area has been attributed to urban encroachment from the Chicago area. Only two counties in the economic study area – Lake and Iroquois – experienced a decline in population during this time. Appendix Table A.1 contains area and population figures by county.

Table II-2. Acreage and population in the economic study area

Area (Sq. mi.)	Area (Acres)	1985 Population	1995 Population	% Growth 1985-1995
7,288	4,690,741	1,609,385	1,716,995	6.7

Source: BEA: REIS

C. Structure of employment

Table II-3 summarizes the employment of the economic study area by sector. Total employment in the economic study area increased by nearly one-fourth between 1974 and 1994. As the data in Table II-3 illustrate, three sectors – services, retail and manufacturing – dominate the local economy. Together they account for nearly two-thirds of total employment. These sectors are key to the economic study area's past and future economic growth. The service sector alone accounts for more than one-fourth of total employment in the economic study area. The number

of people employed in this sector doubled between 1974 and 1994. Retail and manufacturing each employ 18 percent of economic study area workers. The retail sector's growth has been more modest than that of the service sector. Retail and service are both low-wage sectors. Manufacturing's share of employment decreased by a third over the two decades. The highest growth sector was agricultural services/forestry/fishing. Employment in this sector nearly tripled between 1974 and 1994, but still represented less than one-percent of total employment in the region. Farm employment decreased by more than one-third during the period 1974-1994, a trend that is consistent with national trends.

Lake County employed more than one-fourth of all workers in the economic study area in 1994. Its share of employment has been decreasing, however. In 1974, over a third of area jobs were located in Lake County. Will County, also part of the Chicago Metropolitan Area, employed 18 percent of economic study area workers in 1994. Its share of employment increased from 13 percent in 1974. St. Joseph County, where South Bend is located, employed another 18 percent of economic study area workers. Its share of economic study area employment remained steady between 1974 and 1994.

Porter County experienced the highest growth in total number employed. Employment there increased by 72 percent between 1974 and 1994. Will County employment grew by over half during this period, as did employment in Marshall County. One county – Lake – experienced a decrease in employment between 1974 and 1994. During this time it lost three percent of its jobs. Starke and Newton were the only other counties to experience less than double-digit growth during this time.

Marshall and Kosciusko counties, side-by-side in the southeastern end of the economic study area, are dominated by the manufacturing sector. Manufacturing claimed over a third of all employees in 1994 in both counties. Manufacturing was also the largest employer in Newton and Pulaski, counties, supplying about one-fourth of all jobs. Retail was the largest employer in Jasper and Starke Counties. Both are largely rural counties with major interstate highways running through them. The northern tier counties in Indiana and all three Illinois counties were dominated by the service sector. Appendix Table A.2 contains 1994 employment figures by county.

Table II-3. Employment by economic sector

	1974	**1984**	**1994**	**% Change 1974-1994**
Total Employment	657,906	658,063	812,898	24
% Farm	3.6	3.0	1.8	-39
% Ag. Svc., For., Fish.	0.3	0.6	0.9	277
% Mining	0.2	0.1	0.1	-16
% Construction	5.1	4.9	6.6	61
% Manufacturing	32.0	23.1	17.9	-31
% Transp. & Pub. Util.	5.5	5.3	5.4	20
% Wholesale Trade	3.2	3.8	4.3	65
% Retail Trade	15.9	17.9	18.3	42
% Fin., Ins., Real Est.	5.7	5.6	5.4	17
% Services	16.6	23.0	27.5	105
% Government	12.0	12.6	11.8	22

Source: BEA: REIS

D. Structure and distribution of income

Income figures for the economic study area are presented in Table II-4. The 1994 per capita income of the economic study area ($20,027) was lower than the state averages for Indiana ($20,273) and Illinois ($23,611) (Income per capita for the U.S. as a whole in 1994 was $21,696). In terms of earnings, the largest economic sectors in the area are manufacturing and services. Although the service sector employs more people, manufacturing still supplies more earnings. The retail sector, which is responsible for approximately one-fifth of the jobs in the economic study area, provides only 10 percent of earnings.

Counties are ranked by 1994 per-capita income in Table II-5. Leading counties were Porter County, Indiana ($21,845) and Will County, Illinois ($21,165). Starke County, Indiana had the lowest per capita income ($14,439). Appendix Table A.3 contains 1994 income figures by county.

Table II-4. Income levels for the economic study area, 1994

Type of Income	($000)	% of total Earnings
Total Personal Income	34,150,356	--
Per Capita Income	$20,027	--
Total Earnings	21,573,988	--
Farm	312,115	1
Ag. Svc., Forestry., Fish.	123,753	1
Mining	24,859	0
Construction	1,790,802	8
Manufacturing	6,280,098	29
Transp. & Pub. Util.	1,576,145	7
Wholesale Trade	1,176,691	5
Retail Trade	2,057,139	10
Fin., Ins., Real Est.	801,176	4
Services	4,933,197	23
Government	2,498,013	12

Source: BEA: REIS

Table II-5. Income rankings for counties in the economic study area, 1994

County	Per capita Income (1994)
Porter, IN	$21,845
Will, IL	$21,165
St. Joseph, IN	$20,584
Kosciusko, IN	$20,571
Iroquois, IL	$19,626
Lake, IN	$19,504
Kankakee, IL	$18,939
Marshall, IN	$18,738
La Porte, IN	$18,583
Pulaski, IN	$17,329
Jasper, IN	$16,789
Newton, IN	$16,537
Starke, IN	$14,439

Source: BEA: REIS

E. Agriculture

Historically, agriculture has been an important part of the regional economy of northern Indiana and Illinois. Agriculture remains vibrant and important in the area. Corn and soybeans are the largest crops in terms of acres harvested. Despite the importance of agriculture, however, both the number of farms and the acreage devoted to farming have decreased in the economic study

area during the past decade (Table II-6). At the same time, average farm size increased. This pattern is consistent with national trends toward concentration in the agricultural sector. At the same time area in farmland decreased, harvested cropland increased. Harvested corn acreage increased by nearly one-fourth between 1987 and 1992. Overall, farming is directly responsible for two percent of jobs and one percent of earnings in the economic study area. Appendix Tables A.4 and A.5 contain agricultural figures by county.

Table II-6. Characteristics of the agricultural sector in the economic study area

	1987	**1992**	**% Change 1987-92**
Number of Farms	11,873	10,268	-13
Land in Farms (acres)	3,552,190	3,431,195	-3
Avg. Farm Size (acres)	299	334	12
Value of Products Sold (nominal $000's)	1,043,504	1,142,602	9
Harvested Cropland (acres)	2,619,381	2,924,417	12
Corn (acres)	1,287,358	1,599,331	24
Soybeans (acres)	1,108,922	1,130,647	2
Wheat (acres)	60,578	33,710	-44
Hay (acres)	85,008	75,089	-12

Source: Census of Agriculture

F. Summary

Most of the economic trends in the economic study area are consistent with state and national trends. However, the area is typical neither for Indiana nor for Illinois. It combines highly urban

areas – dominated by Chicago – and largely rural counties. The population of the economic study area has grown at a slightly faster rate than the population of either Indiana or Illinois, and per capita incomes have remained below those of surrounding counties. The northern tier counties tend to have higher population densities and higher per capita incomes than counties in the southern portion of the watershed. The service sector is the dominant source of jobs in the area, but the manufacturing sector still supplies the largest share of earnings. The agricultural sector is becoming more concentrated in the area, and the area devoted to farming is decreasing.

In summary, the economy in the economic study area is very diverse. It is difficult to draw conclusions about the conditions in any one county based on the summary statistics for the whole area. The counties in and adjacent to the Chicago Metropolitan Area will experience continued growth pressure in the form of suburban and semi-urban expansion. Maintaining and attracting employment will continue to be a high priority in the more remote, rural Indiana counties. How the proposed refuge might affect a given county depends, in part, on the response of a local community to the refuge and to refuge visitors.

III. Description of Proposed Refuge and Management Alternatives

The assessment of economic impacts provided in this study relies on a series of land acquisition and management alternatives defined by FWS staff. Using these management alternatives a series of profiles of land use "with" and "without" the refuge was created. This exercise constitutes Steps 1 and 2 of the analysis as outlined in Figure I-1. The pictures that emerge from a comparison of these profiles of land use are the basis for estimating changes in economic activities, expenditures, business activities, employment, and personal incomes within the watershed.

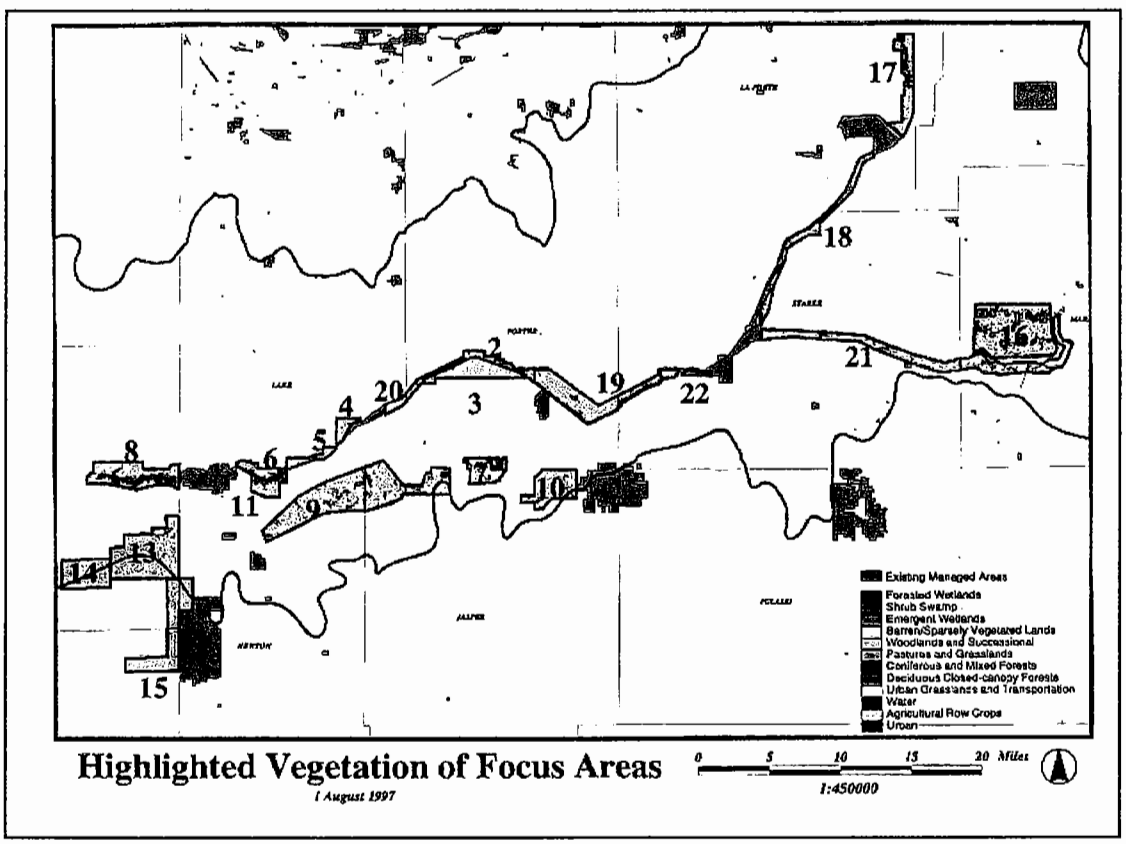
It is important to note that some changes in land use have already been occurring in the area and are likely to continue even in the absence of refuge development. For example, the downward trend in area devoted to agricultural row crops (identified in section III.E) will likely continue because of urban and suburban growth. For this reason, impacts (such as decrease of farmland) that are attributed to refuge development in this study could occur even if the proposed refuge is not established.

Land-use changes used in this analysis were identified by the FWS Bloomington Field Office, using GIS-based gap analysis and other data. Gap analysis is a U.S. Geological Survey, Biological Resources Division program conducted at the state level and designed to answer questions about the protection of biological diversity and habitat. The refuge design analysis began with satellite images of vegetation and land characteristics in the Kankakee watershed. These satellite images were used to develop a profile of 12 *land cover classifications* contained

in the Kankakee watershed. These land cover classifications are listed and briefly described in Table III-1. The table also contains information on the likely existing use of this land and the possible recreational activities that the land would support.

Using this set of land cover classifications and a set of specific management goals and targets, the FWS identified a series of 20 focus areas for possible land acquisition (see GKMNWR Environmental Assessment). In addition the FWS gleaned information from public meetings, written and verbal comments and input from conservation partners. These focus areas, which are illustrated in Figure III-1, consist of contiguous parcels of land of a given cover type that would be considered for land acquisition. However, not all land identified as focus area would be acquired under the proposed refuge plan. Furthermore, not all land identified as focus area is agricultural.

Figure III-1. Focus areas within which land acquisition might occur



The ability of the FWS to acquire any specific parcel is uncertain. Specific acquisition of parcels would depend on the existence of willing sellers, FWS budgetary approval, previous patterns of land acquisition, continued analysis of specific parcels and the evolution of management goals within the FWS. To address FWS priorities and the uncertainty surrounding potential land acquisition and management, a series of four management alternatives were outlined by FWS staff. These management alternatives are intended to provide management clarity, and hence narrow the focus for the development of the proposed refuge. The four alternatives are identified as W*etland Alternative*, G*rassland Alternative*, T*hreatened and Endangered Species Alternative*, and H*ybrid Alternative*. The FWS staff identified 30-60,000 acres per management alternative as focus areas. These areas exceed the 30,000 acres that constitute the total area targeted for acquisition. For the purposes of this economic analysis, the total area identified as focus area was reduced proportionately. Thus the results of this analysis reflect the impact of acquiring 30,000 acres that possess the characteristics of the entire focus area. Scaling was done in such a way that the relative shares of land in each land classification category are the same as in the focus area as a whole. Similarly, the 30,000 acres used in this analysis are distributed among counties in the same proportion as in the aggregated focus areas.

The *Wetland Alternative* focuses on protecting and restoring wetlands, with the goal of expanding habitat for migratory waterfowl and other fish and wildlife. The *Grassland Alternative* focuses on restoring land to native grassland, pasture, and savanna with the goal of expanding tallgrass prairie and compatible adjacent land. Prairie is the rarest major habitat type in Indiana, comprising less than one percent of the surface area of the state. Tallgrass prairie

constitutes important nesting and breeding habitat for numerous bird species, as well as habitat for other terrestrial vertebrates. The *Threatened and Endangered Species Alternative* focuses on protecting and restoring both wetlands and woodlands for the purpose of protecting and enhancing a number of state and federally-listed threatened and endangered species. Under this management alternative, land acquisition and land management would be especially sensitive to the habitat needs of threatened and endangered species. The *Hybrid Alternative* combines these management goals. It would focus on acquiring existing wetlands, woodlands, and grassland as well as restoring existing agricultural and pastureland to these categories.

Each management alternative reflects a different conservation goal and emphasizes a different constellation of focus areas. The focus areas and management alternatives were developed on the basis of biological and ecological criteria, and were chosen without regard to economic conditions or county or state boundaries. For the purposes of the impact analysis it was necessary to aggregate focus area information to the county level. Aggregate changes in land use – in terms of the share of projected total area for acquisition – for each management alternative are listed in Table III-2. Projected changes in row-crop acreage for each county are listed in Table III-3. Each management alternative targets slightly different focus areas within the watershed. As a result, the geographical distribution of land acquisition would depend upon the goals of land management. As the table indicates, the implication of refuge development for a county differs according to the management alternative under consideration. The FWS, when deciding the allocation of land for each alternative, did not take political borders into account. Their concern was with natural landforms and the needs of wildlife. Four counties – Kosciusko,

Pulaski, St. Joseph and Will – are not projected to have land acquisition in any management alternative. These counties are included in the study because they are still part of the economic area within which the Kankakee watershed lies, and because it is possible that the FWS could identify acquisition sites in one or more of these counties at a later date. Some amount of land acquisition has been projected for each of the remaining counties in the economic study area. The actual amount of land to be acquired would depend on the land needs attendant with a particular management goal and the presence of willing sellers.

Table III-1. Land use categories

Land use category	Description
Forested wetlands	Wetlands with trees, often along rivers or streams
Shrub swamp	Wetlands with shrubs like willows or buttonbush, often in areas too wet for trees.
Emergent wetlands	Wetlands or marshes dominated by grasslike plants such as cattails.
Barren/sparsely vegetated land	Category corresponding to non-vegetated land including recently plowed agricultural fields, disturbed areas for building sites, etc.
Woodlands and successional forest	Areas where trees are either spaced far apart or trees are very young – in the economic study area this could be savanna or old fields.
Pastures and grassland	Any area dominated by grass. Could be hay, pasture or native grasses.
Coniferous and mixed forests	Closed canopy upland forest with an evergreen component
Deciduous closed-canopy forests	Closed canopy upland forest without an evergreen component
Urban grasslands and transportation	Lawns, city parks, sports fields, schools and highway corridors
Water	Streams, rivers, lakes, and ponds
Agricultural row crops	Any row-cropped ground (typically corn and/or soybeans)
Urban	Cities and subdivisions

Source: FWS Bloomington field office

Table III-2. Share of land acquisitions by county by management alternative (%)

County	Wetland Alternative	Grassland Alternative	T & E Alternative	Hybrid Alternative
Jasper	8	30	1	13
Kosciusko	0	0	0	0
Lake	8	0	11	8
La Porte	7	0	18	13
Marshall	32	0	13	0
Newton	3	27	0	6
Porter	15	0	20	14
Pulaski	0	0	0	0
St. Joseph	0	0	0	0
Starke	16	0	22	5
Iroquois	0	8	0	7
Kankakee	12	35	16	34
Will	0	0	0	0
% total	**100%**	**100%**	**100%**	**100%**
Total acres purchased	**30,000**	**30,000**	**30,000**	**30,000**

Source: FWS Bloomington field office.

Each management alternative is described in greater detail below. For each, the current configuration of land use (without the refuge) is described. Then the management target, the projected land-use configuration with the refuge, and the economic climates of component

counties to be affected are discussed. Estimates of affected row crop acreage are based on non-accuracy assessed classification of Landsat Thematic Mapper™ images taken between November 1, 1990 and May 10, 1993.

Table III-3. Projected reduction in row crop acreage

County	Land in Farms (1992)	Harvested Cropland (1992)	Wetland Alternative	Grassland Alternative	T & E Alternative	Hybrid Alternative
Jasper	301,962	251,579	-1,987	-5,440	-29	-2,428
Kosciusko	251,603	192,885	0	0	0	0
Lake	144,305	112,190	-1,456	0	-1,990	-1,408
La Porte	267,695	225,617	-1,054	0	-2,961	-2,096
Marshall	219,402	174,005	-5,909	0	-2,334	0
Newton	206,885	180,048	-479	-4,838	0	-1,177
Porter	142,482	121,941	-2,979	0	-4,072	-2,882
Pulaski	242,777	204,381	0	0	0	0
St. Joseph	172,348	143,636	0	0	0	0
Starke	134,960	105,299	-3,030	0	-4,141	-793
Iroquois	662,629	597,863	0	-1,490	0	-1,298
Kankakee	358,920	326,603	-1,157	3,779	-1,582	-3,452
Will	325,227	288,370	0	0	0	0
Area Total	**3,431,195**	**2,924,417**	**-18,050**	**-15,547**	**-17,108**	**-15,536**

Source: FWS Bloomington field office and Census of Agriculture

A. Wetland Alternative

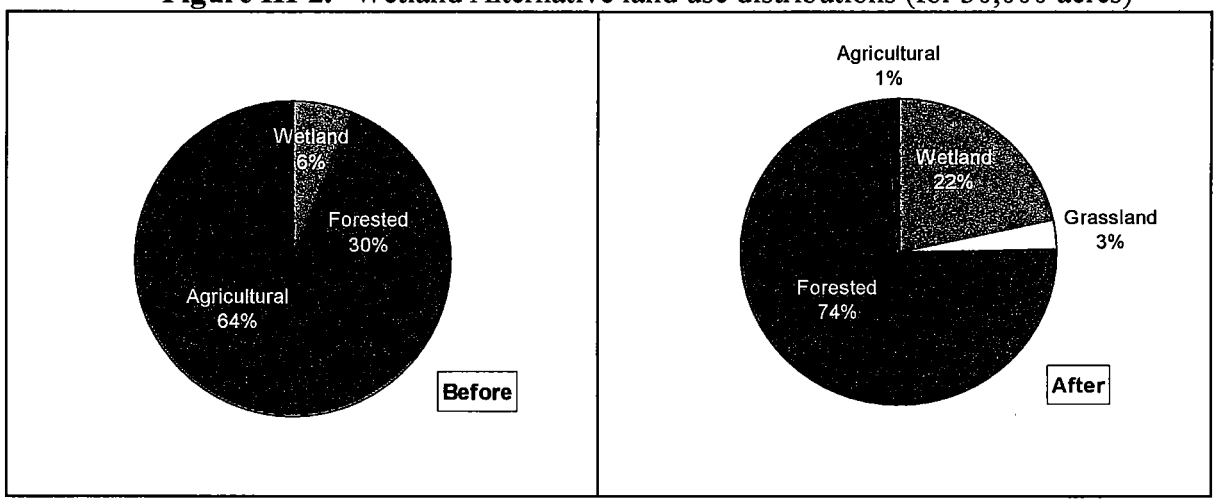
The Wetland Alternative targets 19,147 acres of agricultural land and 10,853 acres of other land in eight counties. The goal of this alternative is to protect, expand, and restore natural wetlands

for the increase of waterfowl, shorebirds, wading birds, furbearers, native fish species, and endangered species. The Wetland Alternative assumes that over 60 percent of all land targeted for acquisition would be agricultural row-crop land, primarily on flood-prone hydric soils. Approximately two-thirds of this targeted row-crop acreage would be restored to forested wetlands. The remainder would be restored to emergent wetlands and successional woodlands. For most of the focus areas, the conversion rate would be 80 percent forested wetland and 20 percent emergent wetland. Successional woodlands would account for approximately 10 percent of all land restored. Recreational activities associated with this management alternative include goose and duck hunting, fishing, bird watching, photography, canoeing, and nature study.

The eight counties that would be directly affected by land use changes are Jasper, Kankakee, Lake, La Porte, Marshall, Newton, Porter and Starke counties. These counties would be affected at widely differing rates. Lake, La Porte, and Porter counties are in the northern tier of the economic study area. All have large, dense populations, though Lake County's is by far the largest and densest population in the economic study area. Porter County has the highest per capita income in the economic study area. Starke County, just to the southeast, has the lowest per capita income in the economic study area. The majority of employment in Starke County is in the retail sector. Starke and Marshall counties share a common border in the southeastern part of the economic study area. Employment in Marshall and Newton Counties is dominated by the manufacturing sector. More than a third of the jobs in those counties are manufacturing jobs. Lake, La Porte and Porter counties rely on the service sector for one fourth of their jobs. Jasper, Marshall and Porter counties experienced double-digit growth in employment between 1990 and

1994, while employment in Lake and Newton counties grew by only one percent. Porter County experienced double-digit growth in population between 1985 and 1995 while Lake County's population decreased by two percent.

Figure III-2. Wetland Alternative land use distributions (for 30,000 acres)



B. Grassland Alternative

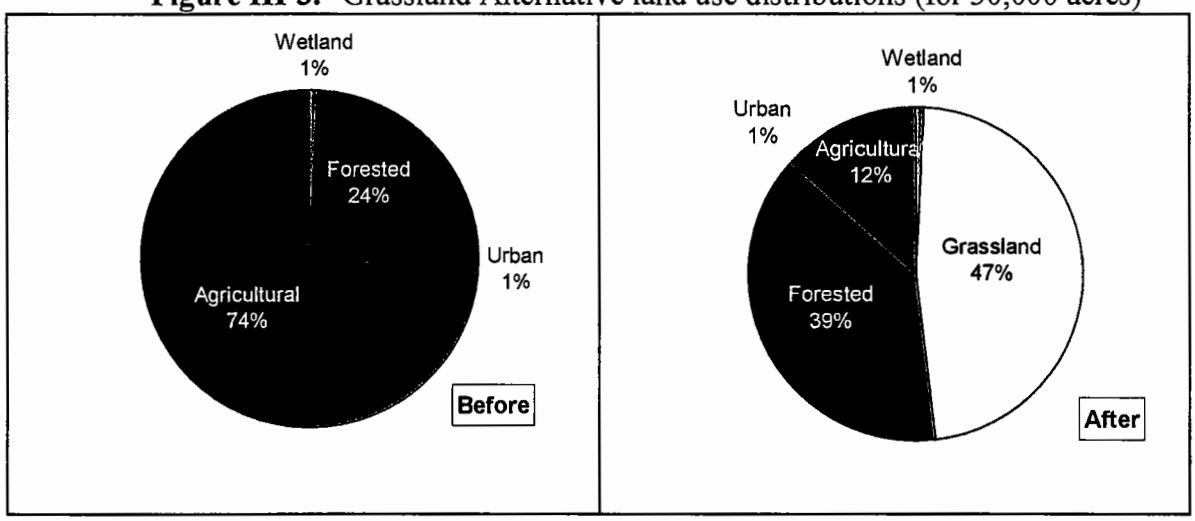
The Grassland Alternative targets approximately 21,986 acres of agricultural land and 8,104 acres of other land in Iroquois, Jasper, Kankakee and Newton counties. Of the total amount of agricultural land targeted, 71 percent would be agricultural row crop and the remaining 29 percent would be pasture. The Grassland Alternative assumes that this land would be acquired and restored to grassland and savanna, possibly with some pasture as buffer, and would be managed as wildlife habitat. The goal of the Grassland Alternative would be to restore tallgrass prairie that is important breeding habitat for numerous species of birds.

This study assumes that approximately 75 percent of acquired land would be restored to native grassland and pasture. The remaining 25 percent would be restored to savanna. It is further assumed that 20 percent of land restored to native grassland and pasture would be available as pasture for agricultural grazing, and would be leased by the FWS from farmers, rather than purchased. Recreational activities associated with this management alternative would include deer, duck, goose, and upland small game hunting; bird watching; photography; hiking; and nature study.

Four counties would be directly involved in land acquisition under this management alternative: Iroquois, Kankakee, Jasper, and Newton. These counties are located in the southwestern portion of the economic study area. Iroquois County, in Illinois, is a rural farming county. It has the lowest population density of the thirteen counties in the economic study area, and is one of two counties in the economic study area that experienced a population decline between 1985 and 1995. Iroquois County has the largest number of farms of the counties in the economic study area, and has more acreage devoted to farming. Fourteen percent of employment in Iroquois County is farm employment. Per capita income in Iroquois County is slightly below the economic study area average. Kankakee County lies just north of Iroquois County. It has three times the population of Iroquois County and four times its population density. Three percent of the county's employment is in the agricultural sector. In both counties, the service sector is the dominant employer. Manufacturing is the primary source of jobs in Newton County, Indiana, located directly across the state line from Iroquois. Newton County, like Iroquois County, is sparsely populated. Eleven percent of its employment is in the farming sector. Newton

County has the second lowest per capita income in the economic study area. Jasper County, just to the east of Newton County, has the third lowest per capita income in the economic study area. It is also sparsely populated. Employment is dominated by the retail sector. Interstate 65 bisects the county from north to south.

Figure III-3. Grassland Alternative land use distributions (for 30,000 acres)



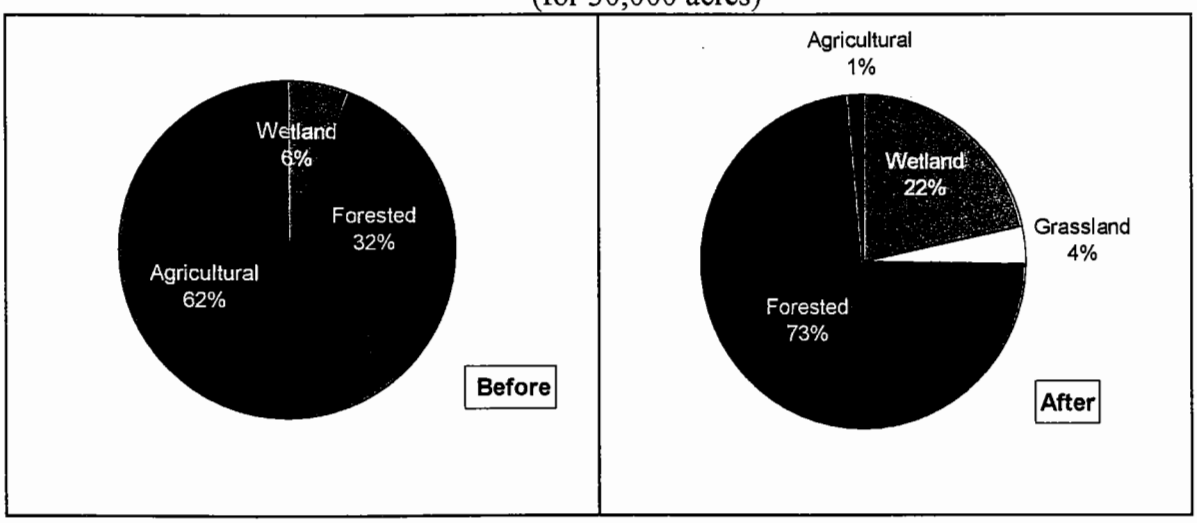
C. Threatened and Endangered Species Alternative

The Threatened and Endangered Species Alternative targets 17,108 acres of agricultural row crop, 1,397 acres of pasture, and 11,496 acres of other land in seven counties for acquisition. The management target for this alternative is protecting threatened and endangered species. Land currently used for row-crop production would be restored to forested wetland, emergent wetland, successional woodland and shrub swamp. As in the Wetland Alternative, most restoration (approximately 50 percent) would focus on forested wetland. Another fourth of the land would be restored to emergent wetland. Focus areas of nearly 500 acres each, in La Porte County,

would be targeted for shrub swamp and successional woodland. Another 500-acre area in Kankakee County would be restored to savanna. Under this management alternative access to restored land would likely be more restrictive in order to afford maximum protection to threatened and endangered species. For this reason, consumptive recreational activities such as hunting would be somewhat restricted, and secondary agricultural uses, such as grazing, would be largely absent.

This management alternative involves land in seven of the eight counties discussed in the Wetland Alternative: Jasper, Kankakee, Lake, La Porte, Marshall, Porter and Starke.

Figure III-4. Threatened and Endangered Species Alternative land use distributions (for 30,000 acres)



D. Hybrid Alternative

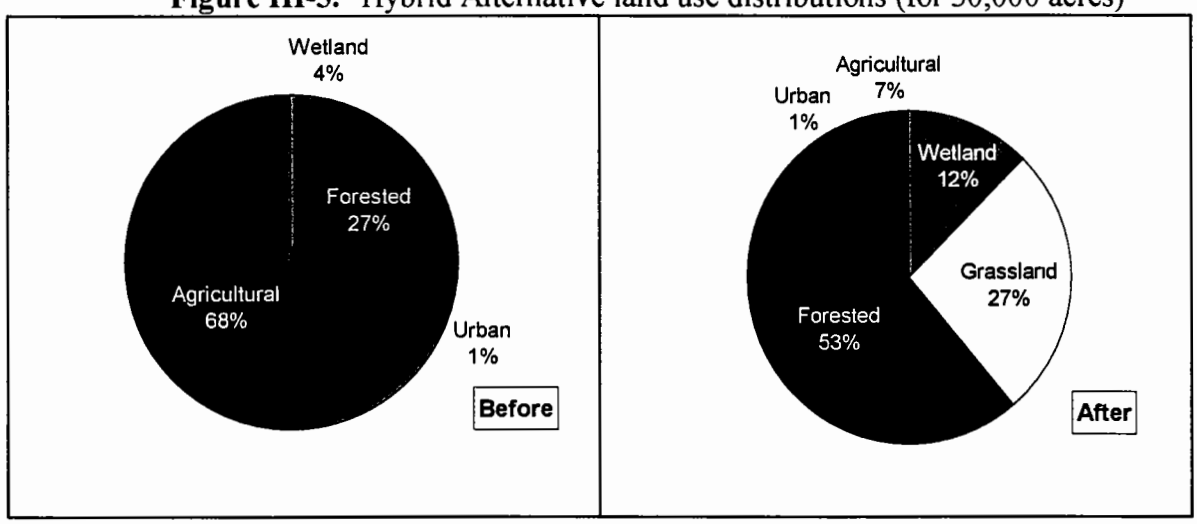
The Hybrid Alternative targets nearly 20,427 acres of agricultural land, including 15,536 acres of row crops and 4,891 acres of pasture in eight counties. Agricultural land represents 68 percent of the land targeted for restoration and preservation. Agricultural land likely to be targeted would

be mostly flood-prone. This alternative combines management goals. The Hybrid Alternative assumes that land currently in row crop production would be restored to a wide range of categories including forested wetlands, pasture and grasslands, savanna, emergent wetlands and shrub swamp. Approximately one third of the row crop acreage would be restored to forested wetlands and another third to pasture and grasslands. Savanna and emergent wetlands would comprise most of the last third. One 500-acre plot in La Porte County would be restored to shrub swamp.

The Hybrid Alternative would allow for the most varied use of refuge property. As much as 2,000 acres could be available for grazing. The mixture of wetland, grassland, and forested areas would support nearly all categories of recreational use, including goose and duck hunting, deer hunting, fishing, bird watching, photography, hiking, canoeing, and nature study.

The Hybrid Alternative directly involves eight counties: Iroquois, Jasper, Kankakee, Lake, La Porte, Newton, Porter and Starke. All of these counties have been discussed in previous management alternatives.

Figure III-5. Hybrid Alternative land use distributions (for 30,000 acres)



E. Timing of land acquisition

Based on the most reliable budget projections available from the FWS, the assumption used in this analysis is that complete acquisition of 30,000 acres would occur over 30 years. An additional assumption is that land would be acquired at a constant rate of 1,000 acres per year, in each of 30 years. For this analysis, economic impacts are assessed over this 30-year time period. Clearly, however, once established, impacts from the proposed refuge would extend beyond this initial 30-year period.

No attempt is made to distinguish the sequence of land acquisitions, either by type or location. In other words, the assumption used in the analysis is that in each year a portion of land is acquired that is representative of the total land targeted for acquisition, and that the types of impacts generated by this acquisition pattern are the same in each year. However, the *magnitude* of impacts associated with land-use changes are assumed to differ according to whether they occur early or late in the 30-year time line of acquisition. This subject is discussed in detail in section IV.A below.

F. Summary

Because the four management alternatives focus on different goals, the implications for the economic study area vary with each. The Wetland Alternative would acquire land in eight counties, but would acquire less agricultural land than the Grassland Alternative. Overall, less than one percent of acquired land would be available for continued agricultural use in the form of pasture, however. This alternative would lead to an increase in recreational activities. Expanded wetlands would attract waterfowl hunters, bird watchers, photographers and canoers, among others.

The Grassland Alternative targets more agricultural land than the other alternatives, but also allows for the greatest continued use of agricultural land, in the form of pasturing on approximately 12 percent of the land. The Grassland Alternative involves land acquisition in only four counties. This alternative is likely to support a wide-range of recreational uses.

The Threatened and Endangered Species Alternative targets land in eight counties. It targets the fewest acres of row crops of any alternative under consideration. At the same time, however, it would be the most restrictive alternative for consumptive recreational activities and would restrict secondary agricultural uses to less than 1 percent of the land.

The Hybrid Alternative directly affects eight counties. It combines management goals, and would therefore allow for some of each use. As much as 2,000 acres of land could be available for grazing. Wetland and grassland areas would support a wide range of wildlife and recreational activities such as hunting, bird watching, photography, hiking, canoeing, and nature study.

IV. Impact Analysis, Data, and Methods

A. Overview of Economic Impact Analysis

Part V of this report presents results from the economic impact analysis. As a preview to the presentation of these results, this part of the report outlines the framework used to identify and quantify economic outcomes associated with changes in the regional economy of the study site. Here the methods, data, procedures, and assumptions used in estimating the economic impact of the proposed refuge are presented. In terms of the sequence of steps outlined in Figure I-1, this part of the report addresses Steps 3-5.

This section presents an overview of the economic impact analysis. Section B contains estimates of direct expenditures by the FWS on refuge development, operation, and maintenance. Section C presents estimates of the number of refuge visitors under each management alternative. Section D presents estimates of expenditure patterns for these visitors. Section E describes the IMPLAN model.

The goal of the economic impact analysis is to account for and measure the economic impacts arising from land use changes in the study site. An important requirement for this analysis is accounting for the interrelationships among businesses in the Grand Kankakee area. This is accomplished using an input-output model. Input-output analysis is discussed in more detail in the following pages. A general overview of the types of interrelationships considered in this study is illustrated by the following stylized example. Assume that a farmer within the watershed currently plants corn on his farm. Suppose he decides to voluntarily sell his land to the FWS and that it then becomes part of the proposed refuge. What is the potential impact of

this change in land use on the regional economy? This land sale has two impacts: first, land is taken out of agricultural production. This leads to a series of related economic changes in the regional economy. Second, the former farmland becomes refuge and thereby provides local and outside visitors a range of recreational opportunities. These recreational opportunities draw local residents and non-residents to the refuge. These individuals create new patterns of economic activity that, over time, replace some of the old patterns of economic activity that were associated with agricultural production. The kinds of economic changes that result from this change in land use depend on the nature of the changes and the ways in which local communities and businesses respond to changes in economic conditions.

To continue the example, suppose that when the farmer's land was planted in corn, the farmer purchased seed from a local supplier. If the supplier purchased seed from a local seed producer, and if a local business packaged the seeds, then the reduction in agricultural acreage will lead to a reduction in sales for the input supplier, the local seed producer, and the seed packager. These decreases can be traced further. The reduction in incomes for the input supplier, the seed grower, and the packager means that each of these individuals spends less money in the local economy. Such income effects would extend through the local economy to the grocery store, the gasoline station, the banker, and the insurance agent. Each impact gives rise to another set of economic changes. For example, if the reduction in agricultural activities results in less banking activity, the local banker will adjust his spending in response to reductions in his income. With each step away from the farmer, however, the magnitude of economic changes diminishes.

To measure the chain of economic events that results from the initial change in land use, economic multipliers are used. A multiplier is defined as a number that represents the total level of activity resulting from a unit of initial activity in the economy. There are several categories of multipliers. This study uses total income and total employment multipliers. A total income multiplier measures the degree to which an initial economic change leads to income changes in the local economy. In the same way, a total employment multiplier measures the degree to which an initial economic change leads to changes in the level of employment in the local economy.

As the example illustrates, a shift in land use from agriculture to refuge entails reductions in agricultural activities and – through multiplier effects – reductions in economic activities for related enterprises. At the same time, expenditures to establish the refuge and expenditures by refuge visitors generate increases in other economic categories. Many aspects of the proposed refuge could be expected to increase economic activity in the study region. For example, the refuge staff would spend money in the local economy; construction of a visitors' center would generate jobs and incomes for local construction firms; and hunters, fishers, bird watchers, and others who visit the refuge would require food, lodging, and other necessities.

The approach used to estimate the total economic change resulting from the establishment of the proposed refuge is input-output analysis. Input-output analysis is a method for tracing the interrelationships among economic activities. The input-output framework traces back all the inputs used in the production of the final good, and keeps track of the proportion that are local in order to elicit the total impact of changes to the local economy. Input-output analysis

estimates three different measures of economic impacts: direct, indirect, and induced. In this study direct effects include financial decreases due to land taken out of agricultural production and economic gains resulting from expenditures by recreation visitors. Indirect effects include changes in the purchasing power of individuals due to these direct economic changes. Induced effects are the changes in consumer spending that result from the direct and indirect effects on incomes.

B. Measuring impacts on agriculture in the economic study area

Economic impacts of the proposed refuge on agricultural activity are calculated as follows. First, changes in the amount of agricultural land are used to estimate changes in the annual value of agricultural production using historical data on yields and prices in the region. Then, based on those changes, the indirect and induced impacts of the proposed refuge are estimated using total income and employment multipliers for agricultural production in the regional economy.

Potential changes in the amount of land used in agriculture were provided by the FWS as outlined in Part III of this report. The possible reduction in area devoted to agricultural row crop ranges from 15,536 acres in the Hybrid Alternative to 18,050 acres in the Wetland Alternative. The expected increase in area devoted to pasture ranges from 175 acres in the Wetland Alternative to 3,540 acres in the Grassland Alternative. Smaller reductions in agricultural row crop acreage are possible. Estimates of land use with and without the refuge, by county and management alternative are provided in Appendix B.

For purposes of valuing agricultural production, this study relied on yield and price data

from the 1994-95 *Indiana Agricultural Statistics* (IASS 1995). Although some land near the Kankakee River is used for high-value crops, such as seed corn or mint, the vast majority of row-crop land in the economic study area is used for either corn or soybean production. For valuation purposes, this study assumes that all row-crop land taken out of production would have been used for corn production. Corn yields from 1994 for each of the 10 Indiana counties in the study are used to estimate the productivity of land. These figures, which are based on figures from the annual census of Indiana agriculture, are reported in column one of Table IV-1. In terms of rainfall and production in northern Indiana, 1994 was a normal year. Yields for the 10 counties were averaged, providing an estimate of expected yield on row-crop land of 142.1 bushels of corn per acre. This figure was then adjusted for the Baseline Scenario to reflect the widespread occurrence of flooding on fields along the river. The assumption used in the Baseline Scenario is that crop loss occurs in every fifth year. In other words, the expected yield is assumed to be 80 percent of 142.1 bushels per acre or 113.7 bushels per acre. Sensitivity analysis A examines the outcomes when yields are valued at 100 percent of the 10-year average. Sensitivity analysis B uses the same yield figures as the Baseline Scenario.

For both the Baseline Scenario and Scenarios A and B used in the sensitivity analysis, corn yields were valued at the 1994 average corn price in Indiana of $ 2.25 per bushel. The Indiana state-wide average corn price over the 10-year period 1986-87 to 1995-96 was $2.26 per bushel.

In the case of pasture, this study assumes that all affected pastureland would be associated with hay production. Hay yields from each of the 10 Indiana counties in the study are

reported in column two of Table IV-1. The average of these figures is 4.0 tons per acre. However, in recognition of the low-quality pasture expected in the area adjacent to the Kankakee River, a figure of 50 percent of this yield was used to calculate the expected yield of pastureland. The average price of (non-alfalfa) hay in 1994 was $ 69.50 per ton. The Indiana state-wide average price for the 10-year period ending in 1995-96 was $57.30 per ton. The per-acre values of agricultural production used in the Baseline Scenario and Scenarios A and B used in the sensitivity analysis are reported in Table IV-2.

Table IV-1. Corn and hay yields for 10 Indiana counties in economic study area, 1994

County	Corn (b/acre)	Hay (tons/acre)
St. Joseph	141.4	4.1
Starke	135.0	3.6
Pulaski	135.8	3.8
Porter	147.6	3.7
Newton	146.2	4.2
Marshall	139.3	4.4
La Porte	143.8	4.3
Lake	140.9	3.7
Kosciusko	140.1	3.9
Jasper	150.8	4.2
Average	142.1	4.0

Source: IASS 1995

Table IV-2. Assumed annual values of corn crops and pasture land

	Baseline		Scenario A		Scenario B	
	Corn (bushels)	Hay (tons)	Corn (bushels)	Hay (tons)	Corn (bushels)	Hay (tons)
Yield (units/acre)	113.7	2.0	142.1	2.0	113.7	2.0
Price (per unit)	2.25	69.5	2.25	69.5	2.25	69.5
Value (price/acre)	256	139	320	139	256	139

Source: Computed by authors based on IASS 1995

C. FWS development and operation expenditures

The FWS has identified three categories of direct expenditures that will take place in the economic study area. These are (1) construction expenditures (including expenditures for a refuge visitor center and roads); (2) operation and maintenance expenditures (including salaries for refuge employees or contract labor); and (3) expenditures for levee and dike construction on the refuge. This section identifies the magnitude of these expenditures and their timing.

1. Construction expenditures

The cost of constructing a visitor center at a National Wildlife Refuge varies considerably depending on its size, intended uses, and location. The newest visitor center, located at the Walnut Creek National Wildlife Refuge in Iowa cost approximately $10 million to build in 1995. A new visitor center at the Minnesota Valley National Wildlife Refuge cost $6.6 million. Smaller centers, such as those at the Muscatatuck National Wildlife Refuge in Indiana, or the Seney National Wildlife Refuge in Michigan cost between $1 and $2 million. Construction of a visitor center generally relies on local construction firms, contractors, and workers. For this reason, constructing a visitor center can lead to a temporary increase in local economic activity. For this study, the cost of constructing a visitor center was estimated by the FWS Bloomington staff to be $3 million (in 1997 dollars). It is assumed that this cost would be incurred in equal shares in years 2, 3, and 4 of refuge establishment. It is likely that, if established, the refuge would consist of multiple parcels of non-contiguous land. It is therefore possible that several smaller visitors facilities could be constructed in separate locations.

2. Operation and maintenance expenditures

Expenditures for operation and maintenance of the proposed refuge are estimated based on observed expenditures at the Sherburne National Wildlife Refuge (NWR) in Minnesota. In 1997 the budget for this facility was approximately $506,000, of which approximately $476,000 was identified as operation and maintenance. A representative operation and maintenance budget from the Sherburne NWR is presented in Table IV-3. As the table indicates, approximately 90 percent the operation and maintenance expenses at Sherburne NWR could be attributed to salaries.

In addition to the operation and maintenance budget, FWS staff estimated that approximately $300,000 would be allocated every three years for special projects, maintenance, or purchases of goods and services. For purposes of the analysis, this amount ($100,000 per year) was identified as outside contracts for goods and services.

Table IV-3. Estimated annual budget for Sherburne NWR (1997 dollars)

Program area	Annual Expenditure (1997 $)	Budget category
Salaries (8 people)	$400,000	Salary
General operations	$16,000	Contract goods and services
Maintenance	$30,000	Contract goods and services
Visitor services	$12,000	Salary
Volunteer Administration	$3,000	Salary
Fire Management	$10,000	Salary
Various Expenditures	$5,000	Salary
Total	**$476,000**	**All**

Source: UFFSW Bloomington Field Staff

3. Levee and dike construction expenditures

The final category of direct FWS expenditures is payments to "Partners for Wildlife." Approximately $30,000 per year was identified as the likely amount to be allocated for construction of dikes and levees on refuge property. This amount would be likely spent on contracted services provided by local firms.

4. Summary of direct FWS expenditure

Table IV-4 presents the estimated total FWS direct expenditures in the proposed refuge area (in 1994 dollars). The figures in the table reflect the expenditures outlined above, as well as an adjustment to account for the likely magnitude of expenditures in the early years of the project. For example, it is assumed that in year 1 expenditures on salary, operation and maintenance, and levee construction would be 25 percent of the budgeted level. In years 2, 3, and 4 it is assumed that the expenditures would rise to 50 percent of the budgeted level. In years 5-30 it is assumed that expenditures would occur at 100 percent of the budgeted level. As previously indicated, major facility construction is estimated to occur at equal levels in years 2, 3, and 4.

Table IV-4. Estimated direct FWS expenditures for proposed refuge (1994 dollars)

	Expenditure Category			
Years	**FWS Salary**	**Operations and Maintenance**	**Levee Construction**	**Facilities Construction**
1	98,805	33,548	6,893	0
2	197,610	67,095	13,787	919,118
3	197,610	67,095	13,787	919,118
4	197,610	67,095	13,787	919,118
5-30	395,221	134,191	27,574	0
Total	**10,967,381**	**3,723,799**	**765,178**	**2,757,354**

D. Estimates of recreational expenditures due to the proposed refuge

Visitors are expected to be drawn to the proposed Grand Kankakee Marsh National Wildlife Refuge for both consumptive and non-consumptive uses of refuge resources. Consumptive uses are those in which refuge resources (such as wildlife) are directly used. As a result, resources are not available to other visitors. Consumptive uses considered in this study include goose and duck hunting, deer hunting, fishing, and trapping. It is anticipated that a main attraction of the proposed refuge would be waterfowl hunting. The Kankakee watershed is already an important area for migratory waterfowl. As an unbroken corridor of avian habitat is developed, this area should attract more waterfowl. Goose and duck hunting already occur in the area, for the most part on private land. Fishing also has the potential to draw visitors.

Non-consumptive uses are those that can be shared, in the sense that one person's enjoyment of the resource does not prevent enjoyment by others. Non-consumptive uses considered in this study include bird watching, photography, nature study, canoeing, hiking. Based on national trends that indicate increases in non-consumptive recreational activities and decreases in consumptive recreational activities (Wiedner and Kerlinger 1990), it is assumed in this study that the majority of refuge-oriented activities would be non-consumptive.

An example of the potential economic impacts arising from non-consumptive activities can be taken from Pt. Pelee National Park in Ontario, Canada. This park, which occupies approximately 5,000 acres, is a major stop-over for migratory birds and attracts nearly 500,000 visitors each year. The park is well-known and visitors come from as far away as Europe. A 1987 study of bird-watchers in the Pt. Pelee National Park (Hvenegaard, Butler and Krystofiak

1989) demonstrated that bird-watchers alone spent over $3 million annually in the local economy. Most of the money was spent on food and lodging. Bird watchers tended to be older, better educated than average, and to have above average incomes. The average stay in the Pt. Pelee area was 3.4 days. Nearly all bird-watchers came to the park specifically to watch birds. For this study, estimates of both consumptive and non-consumptive resource-use are based on FWS management goals and comparisons made with existing parks and refuges in the two states, and in the region. Estimates of total recreational expenditures as a result of the proposed refuge are based on two pieces of information: (1) estimates of the number of refuge visitors; and (2) estimates of the expenditure patterns of refuge visitors. Each of these estimates is presented below.

1. Estimates of number of refuge visitors

Estimates of the number of refuge visitors were based on visitor information from reports from several existing refuges and parks offering recreational opportunities similar to those that would be available within the proposed refuge. Sites that were examined for this study include Crab Orchard and Rend Lake National Wildlife Refuges (located in Southern Illinois), DeSoto National Wildlife Refuge (located along the Missouri River in Iowa), Point Pelee National Park (located in southern Ontario), Horicon National Wildlife Refuge (located in central Wisconsin), and Quivira National Wildlife Refuge (located in southern Kansas). Data from use-estimates for the proposed Goose Pond Fish and Wildlife Area in Indiana (Southwick Associates, 1996) have also been included.

Visitation rates vary widely depending on distance from the refuge to major population centers, the types of habitats represented, and the types of amenities and recreational activities available. Observed data on refuge sizes and annual visitation rates are listed in Table IV-5. These data were used to construct estimates of potential visitors to the proposed refuge. When using visitation rates from other sites to estimate visitation rates for the proposed refuge, data on the number of visitors on specific supporting land types were used whenever available. Table IV-6 presents annual visitation rates that are assumed to prevail for this analysis. For waterfowl hunting the annual visitation rate assumed for modeling purposes is 0.70 visitors per acre per year. This value is equal to the average rate observed for those sites in Table IV-5 where waterfowl hunting occurred. For deer hunting a rate of 0.23 visitors per acre per year is assumed. This value is equal to the average rate observed for Crab Orchard, DeSoto, Goose Pond, and Horicon. For both waterfowl and deer hunting, it was assumed that 1/6 of visitors would be local and 5/6 would be non-resident visitors.

Establishment of the proposed refuge could result in increased opportunities for recreational fishing. Fishing opportunities might be enhanced for two reasons. One, establishment of the proposed refuge would increase public access to the Kankakee River. Two, changes in the structure of the river, such as the opening of ox-bows and increases in shallow spawning areas, could create conditions more favorable for fish and fishermen.
Although estimates of recreational fishing collected at other sites are reported in Table IV-5, most of these estimates come from recreation areas with lakes and therefore are not directly applicable to the proposed refuge. For this reason, estimates used in this analysis are based on a

study of recreational fishing in the Illinois portion of the Kankakee River (Graham, Larimore, and Dimond 1986). The study indicated that fishing effort during 1978 and 1979 averaged 3,823 angler-hours per year per km of river (or 3.823 angler-hours per year per meter). The study suggested that a significant constraint on fishing effort at the time of the survey was limited public access due to private ownership of land: sections of the river that received the greatest fishing effort were those located adjacent to state parks or other public lands. Based on these findings it could be assumed that rates of recreational fishing on the Kankakee would increase if refuge land provided public access to the river. However, survey data suggest that increases in rates of sport fishing can be linked to stocking efforts (Outdoor Illinois 1997). Currently, stocking is not planned by the FWS. For this analysis it was estimated that each acre of wetland would provide, on average, 25 feet (8.3 m) of river access, and that each acre of wetland would therefore generate an average of 4.7 days of recreational fishing per year. The Kankakee fishing survey identified fishing by both local and Chicago residents. Non-resident visitors from the Chicago metropolitan area accounted for approximately 61 percent of fishing-days in the study. Local residents accounted for approximately 39 percent of fishing days. The total number of visitor days used in the analysis is decomposed into local and non-local visitors according to these proportions.

As in the cases of other refuges, the nearby metropolitan area (in this case, Chicago) also is expected to be an important source of non-consumptive recreational visitors. For the analysis it is assumed that 1/6 of visitors would be local and 5/6 would be non-resident visitors. The rate of visitation for non-consumptive uses was assumed to be equal to the average observed for other

refuges listed in Table IV-5. For this analysis, a value of 19.62 non-consumptive visitors per acre per year is used.

Table IV-5. Annual per-acre visitor rates for seven recreation areas

Visitor category	Crab Orchard	Rend Lake	DeSoto NWR	Point Pelee	Goose Pond	Horicon NWR	Quivira NWR
Location	Illinois	Illinois	Iowa	Ontario	Indiana	Wisconsin	Kansas
Size (acres)	22,000	12,690	7,823	4,942	8,000	21,265	21,820
Survey Year	1990	1990	1990	1996	1996	1995	1995
Waterfowl Hunting	0.20	1.17	0.08	---	0.75	--	1.28
Deer Hunting	0.38	---	0.21	---	0.25	0.10	0.56
Fishing	11.10	---	4.77	---	---	0.01	--
Non-Consumptive	22.55	---	33.53	31.67	6.25	6.29	1.08

Source: various

Table IV-6. Assumed annual per-acre visitor rate for proposed refuge and supporting land types

Visitor category	Visitor rate used in model (visitors/acre/year)			Proportion non-resident	Applicable Land Categories
	Baseline	Scenario A	Scenario B		
Waterfowl Hunting	0.70	0.35	1.05	0.83	Wetland only
Deer Hunting	0.23	0.115	0.345	0.83	Forest and grassland only
Fishing	4.70	2.35	7.05	0.61	Riverine wetland only
Non-Consumptive	19.62	9.81	29.43	0.83	All but agricultural and urban

For this study it was necessary to link potential recreational activities to specific categories of land cover. Table IV-6 lists the categories of land types that are assumed to support the recreational activities examined in this study. For example, in the Baseline Scenario the visitation rate for waterfowl hunters is assumed to be 0.70 persons per acre per year. However, it is assumed that this activity would be supported only by refuge land in the wetland category. For example, if 5,000 out of 30,000 acres of refuge were wetland, the number of annual visitors in the waterfowl-hunting category would equal 5,000x0.70 or 3,500. It is assumed that deer hunting would be primarily supported by grassland and forest habitats only; it is assumed that fishing would be supported by rivers, streams, and other wetland habitat only; and it is assumed that non-consumptive uses would be supported by all categories except agricultural and urban land. To the extent that estimated visitation rates are derived from use estimates for entire refuges, the data used here may underestimate possible visitation rates. Table IV-6b contains estimates of the annual number of visitors for each activity for the Baseline Scenario. As is clear from the table, it is expected that most visitors would engage in non-consumptive activities.

Table IV-6b. Projected number of annual visitors, Baseline Scenario

	Activity				
Management Alternative	**Waterfowl hunting**	**Deer hunting**	**Fishing**	**Non consumptive**	**All visitors**
Grassland	168	5,868	1,134	510,806	517,976
Wetland	4,506	5,275	30,428	581,912	622,121
T&E	0	0	0	580,648	580,648
Hybrid	2,605	5,468	17,589	545,015	570,676

2. Estimates of refuge visitor expenditures

Visitor expenditures for consumptive and non-consumptive activities are derived from a wide-range of studies of recreational demand.

Expenditure profiles for consumptive and non-consumptive uses were drawn from previous studies of proposed or actual wildlife refuges. It is assumed that expenditure profiles would be similar to those in other refuge areas in the mid-west (Bowman, 1992; Hvenegaard et al., 1989, Southwick Associates, 1996; Williamson County Tourism Bureau, 1994). Expenditure estimates used here are consistent with the U.S. Department of Interior (USDI) Fish and Wildlife Service's 1991 National Survey of Fishing, Hunting, and Wildlife-Associated Recreation. This survey provides information at the state level, including estimates of the amount of money spent by recreational visitors in the states of Indiana and Illinois on wildlife-based recreation. Expenditure profile data for recreational activities associated with the proposed Grand Kankakee Marsh Refuge are listed in Table IV-7.

Table IV-7. Expenditure patterns by category and activity ($ per person per day, 1994 $)

Category	Activity	Transport	Food	Lodging	Total
Local residents	Waterfowl	1.85	1.06	--	2.91
	Upland Game	2.92	1.82	--	4.74
	Fishing	6.4	7.33	--	13.73
	Non-Consumptive	0.71	3.12	--	3.83
Non-resident visitors	Waterfowl	5.56	6.95	5.79	18.30
	Upland Game	5.67	5.91	3.32	14.90
	Fishing	9.83	10.24	5.76	25.83
	Non-Consumptive	5.56	6.95	5.79	18.30

Source: Various studies

E. IMPLAN

Visitation rates and expenditure patterns described in Table IV-7 can be combined to estimate the total impacts of the proposed refuge on output, employment, and personal income in the economic study area. Doing so requires that one estimate the direct and indirect effects of each dollar spent in the local economy. These direct and indirect effects of expenditures are measured using a county-level economic model of the U.S. economy called IMPLAN. The IMPLAN model (IMpact Analysis for PLANning) was originally developed by the USDA Forest Service in conjunction with the Federal Emergency Management Agency and the USDI Bureau of Land Management to assist the Forest Service in land resource management planning. The most recent version of the IMPLAN model includes data from 1994 describing economic activities and linkages for all counties in the United States (Minnesota IMPLAN Group, Inc. 1997). National income accounts serve as the empirical base for economic analysis performed with IMPLAN. National income accounts measure the productivity of the entire nation in terms of products and income generated by production of all goods and services in the U.S. economy. Because national income accounts are derived from county level data, it is possible to examine regional economic activity in terms of any combination of counties. Information required to conduct such an analysis with IMPLAN includes reliable data on expected expenditure changes in the economic study area.

When determining appropriate data for this analysis it was necessary to distinguish between new expenditures and expenditure reallocations. New expenditures occur when visitors spend money in the study site as a result of being drawn to the area by the proposed refuge. The

money spent by these new visitors represents a new flow of resources in the local economy that would not have occurred without the proposed refuge. Some of these new visitors may be local residents who formerly spent recreational dollars outside the region and who now spend money that is captured within the economic study area. For example, visitors to the proposed refuge who reside outside the economic study area would introduce new expenditures to the area that would not otherwise occur. For this reason money spent by non-resident refuge visitors represents revenues that would not exist without the proposed refuge. These expenditures increase demand for goods and services provided locally that are associated with outdoor recreation. For example, refuge visitors might purchase food in local restaurants, which increases restaurant business and also increases the number of restaurant jobs. New employees receive income that is spent in the local economy further expanding the impact of recreational spending.

Expenditure reallocations, on the other hand, are simply changes in money spending patterns in the area. The important point here is that these expenditures are reallocations of expenditures within the regional economy and do not add anything new to the local economy. This study considers the impacts of new expenditures only; expenditure reallocations are not considered economic impacts for purposes of this study.

It is important to note that when money is spent in the study site some of it is used to purchase goods and services that originate outside the study site. The proportion of money spent within the study site that remains inside the study site depends on the extent to which the local economy depends on goods imported from outside the economic study area. The IMPLAN

model accounts for the percentage of local input demand met by local producers using regional purchasing coefficients. These coefficients are used to determine the extent to which new expenditures lead to changes in output, employment, and income within the economic study area. Input data used for the IMPLAN model are reported in Appendix C.

F. Time-line of Proposed Refuge Impacts

The development of the proposed refuge would be a gradual process, dependent upon both federal budget allocations for land acquisition and patterns of voluntary sales of land in the watershed over time. Therefore, the economic impacts resulting from land use changes would begin slowly and would accumulate over time. The procedure for estimating the accumulated impacts is briefly described below.

1. Agricultural impacts over time

For agriculture and related sectors, it is assumed that the economic impacts from refuge development would accumulate at the same rate as land acquisition. For example, if a management alternative predicts a total reduction in agricultural row crop area of 15,000 acres over the 30-year period, then the assumption is that $15{,}000/30 \approx 500$ acres would be taken out of production in each year. For the first year of refuge development, the model estimates the impact of withdrawing these 500 acres from production. In the second year, it is assumed that an additional 500 acres would be taken out of production. For the second year of refuge development, therefore, the analysis indicates the total impact of cumulative land withdrawn

from production, i.e. 500 + 500 = 1,000 acres. Using this procedure, the amount of agricultural acreage withdrawn from production (and therefore the regional economic impact associated with reductions in agricultural production) is assumed to accumulate in a linear progression. The total impact of withdrawing the entire targeted amount of row-crop land would not be realized until year 30. In the intervening years the model predicts an impact proportional to the total amount of land withdrawn from production up to that point in time.

2. Direct FWS expenditures over time

In the case of direct FWS expenditures (on construction, operation and maintenance, and levee construction) a different time path of impacts is used. For these categories of expenditures it is assumed that an initial start-up phase would be associated with spending below the targeted amount, but that spending would rise to the full budgeted level within five years. The progression used in the analysis is outlined in Section IV.C and Table IV-4 and is illustrated in Figure IV-1.

3. Recreational expenditures over time

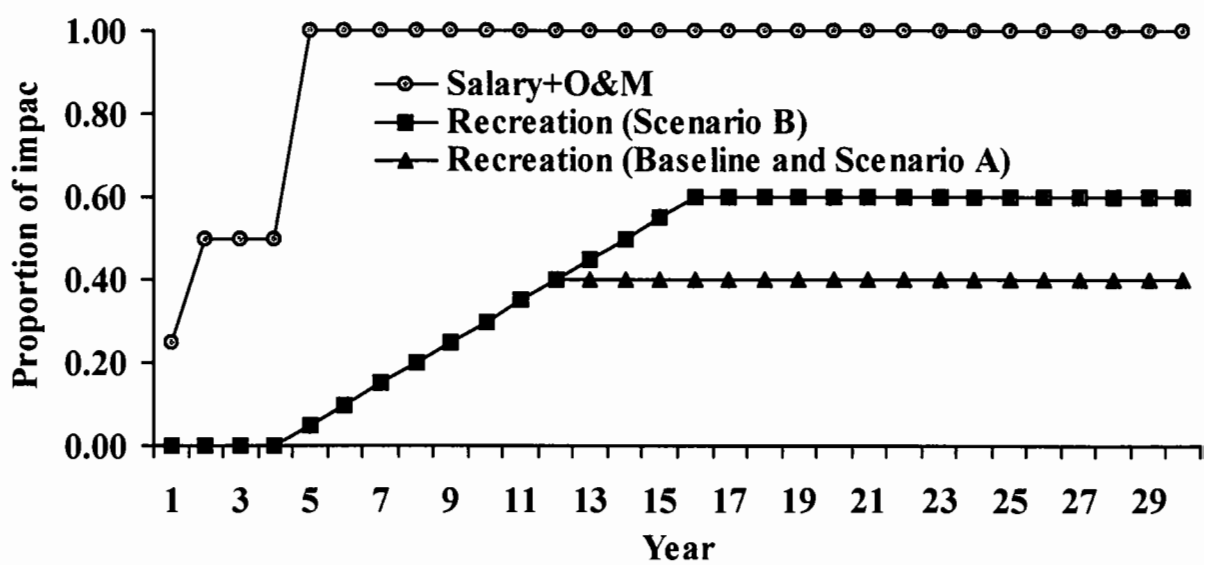
In determining the accumulated impact of recreational opportunities, the analysis addresses two important issues. One, in the early years of refuge establishment the number of refuge visitors could be expected to be less than the numbers listed for the Baseline Scenario in Table IV-6. This is because the total number of acres in the proposed refuge would be small and because public knowledge about the proposed refuge would be limited. Two, the ability of the local

economy to prosper from refuge visitors would be limited both in the early years of refuge establishment and in later years. In large part this is because amenities may be unavailable to visitors in neighboring business districts, and therefore some of the expenditures that would be made by refuge visitors would be made outside the economic study area. For example, a 1976 study of recreation in the Kankakee region in Indiana suggested that most recreational facilities in the area were being utilized at their maximum level, especially during peak periods (State of Indiana, 1976). This indicates that demand for recreation is high in the area, but that greater recreational activity would require establishment of infrastructure to support recreational activities. Both of these features suggest that the ability of the local economy to capture recreational expenditures could be low during the initial years of refuge operation.

For the purposes of the analysis, it has been assumed that during years 1-4, none of the expenditures made by refuge visitors would be captured by the economy of the economic study area. However, it has been assumed that over time existing local businesses and entrepreneurs would respond to opportunities afforded by the proposed refuge. Furthermore, it is assumed that the ability of the local economy to capture an increasing share of expenditures will increase over time. This assumption is consistent with those used in similar studies that have examined the ability of rural economies to capture expenditures by refuge visitors. It is assumed that starting in year 5 the economic study area would be able to capture 5 percent of expenditures made by refuge visitors. In the Baseline Scenario, this figure increases by 5 percent each year until year 12, at which time a cap of 40 percent of expenditures is reached. The Baseline Scenario assumes that beyond year 12, 60 percent of expenditures by refuge visitors would always accrue to

businesses outside the economic study area. Scenario A uses the same assumption. Scenario B assumes that the total cap on recreation expenditures captured locally would be 60 percent. These assumptions provide reasonable estimates of the ability of new and existing businesses in the economic study area to turn recreational activities in the refuge into economic gains. The time paths of these parameters are graphed in Figure IV-1.

Figure IV-1. Assumed time line for shares of FWS expenditures and recreation increases



V. Impact Assessment

A. Overview

Results from the economic impact assessment are presented in this part of the report in a series of summary tables and graphs. Additional details, including breakdowns of total economic impacts due to specific changes in agriculture, recreation and direct FWS expenditures, by year, are presented in a series of tables in Appendix D.

Three features of the analysis and results are noteworthy. One, although it may be tempting to judge the proposed refuge on the basis of direct impacts, analysis shows that indirect and induced impacts are very important, and in some cases equally important as direct impacts. In other words, the regional economy is complex, and the proposed refuge could have important implications far beyond the sectors that would be immediately affected by land use changes.

Two, while it is relatively easy to predict the economic impact of withdrawing land from agricultural production, it is more difficult to predict the impact of the proposed refuge on land not directly taken out of production, or on related issues such as flood control or water quality. These and other issues are discussed in greater detail in Part VI of this report.

Three, assumptions regarding visitation rates, visitor activities, and visitor expenditures are key elements for estimating economic impacts of the proposed refuge. In particular, given reasonable estimates of expenditure patterns by refuge visitors, assumptions about the number of refuge visitors have important implications for the analysis. To account for this issue and others, results are reported below for a Baseline Scenario and for two alternative scenarios that use different agricultural values and rates of expenditure capture by the local economy.

This part of the report is organized as follows. Section B presents results from the analysis derived from a set of baseline assumptions. Estimates of incremental changes in economic output, employment, and personal income are examined. These Baseline Scenario estimates are based on a 30-year time horizon of impacts. Economic impacts over time from each of the four management alternatives are compared in a series of graphs. Section C summarizes the data from section B and presents aggregate measures of changes in economic output, employment, and personal income for each management alternative. Results are presented in both discounted and undiscounted form. Section D presents results from a sensitivity analysis of the model. Sensitivity results are reported for two alternative scenarios (Scenarios A and B) which have been obtained under assumptions that visitation rates might differ from the baseline rates, that the value of agricultural production in the area might differ, and that the rate of expenditure capture in the local economy might differ. Results from these two sensitivity analyses are presented to provide some reasonable indication of possible deviations from the Baseline Scenario. Section E summarizes this part of the report.

B. Impacts of the proposed refuge

This analysis focuses on potential impacts of the proposed refuge on aggregate economic output, personal income, and employment. This study considers the impacts of new expenditures only; expenditure reallocations are not considered economic impacts for purposes of this study. Initial insights into the impacts of the proposed refuge on these measures can be gained by examining the impacts of refuge establishment that occur in each year of the 30-year time horizon. Data

summarizing these impacts are presented in a series of tables in Appendices D (containing annual impacts discounted at 3.6 percent) and E (containing undiscounted annual impacts). Each table contains data on annual impacts on output, employment and income for a specific management alternative. As an aide to interpreting the data contained in Appendices D and E, Figures V-1a, V-1b, and V-1c display the results of the economic impact assessment for economic output, annual employment, and personal income, respectively. The horizontal axis in each graph corresponds to time, and the vertical axis measures the variable of interest. Each line in the graph corresponds to a different management alternative.

Figure V-1a displays changes in economic output in the economic study area over time as a result of the proposed refuge. The shapes of the lines in the graph illustrate three features. First, during the early years of the project the impact of expenditures for construction of a visitor center and other facilities leads to an increase in aggregate economic output in the economic study area. The total amount of land taken out of agricultural production at this stage is low. As a result the total impact of the proposed refuge on agriculture is small and no economic impacts from refuge visitors can be expected. The main impact of refuge establishment is to increase economic activity in the early years of the project due to expenditures on construction. Second, construction expenditures end in year 5. As a result, the accumulating impact of agricultural land being taken out of production begins to outweigh direct FWS expenditures on operation and maintenance and economic output in the region declines. This decline reflects reductions in agricultural production and modest amounts of recreational demand. Third, increases in economic impacts from recreational activities begin to offset declines in agriculture. Beyond

year 10 the trend in economic output is upward for all management alternatives. However, economic output remains negative over the entire horizon for the Wetland and Threatened and Endangered Species Alternatives. For the Grassland and Hybrid Alternatives, the change in economic output is positive beyond year 15.

Figure V-1a. Refuge impact on annual economic output, Baseline Scenario (millions of 1994 $)

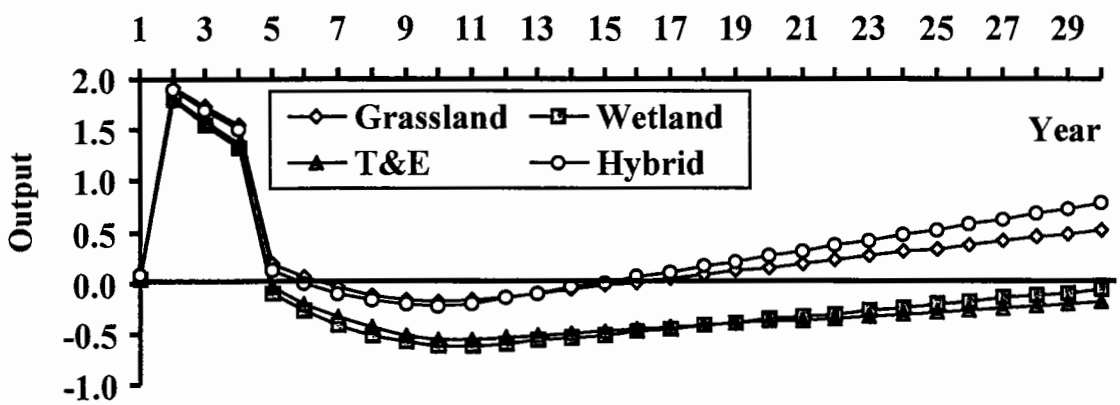
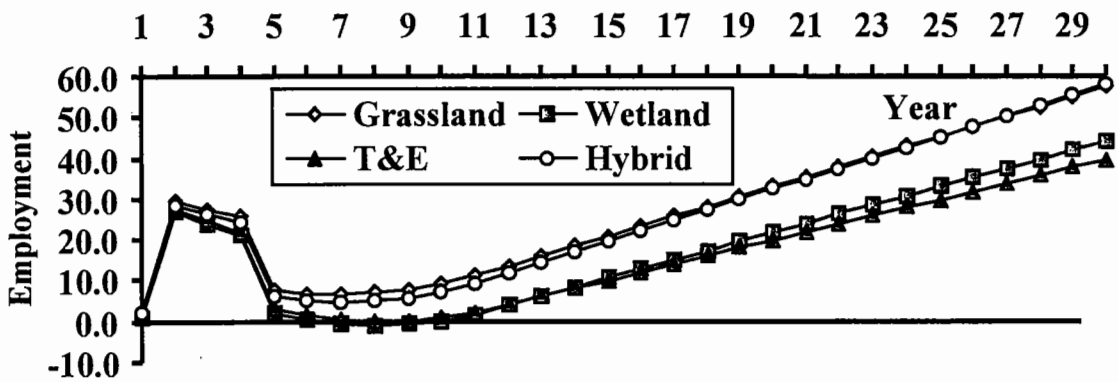


Figure V-1b displays changes in annual employment in the economic study area over time as a result of the proposed refuge. The shapes of the lines in the graph generally follow those of the graph of economic output. The initial rise in employment corresponds to construction expenditures during the establishment stage of the refuge. However, the upward trend in employment begins sooner than in the case of output and the incremental impact on

employment is positive over the 30-year period. As before, the Grassland and Hybrid Alternatives have the largest impacts.

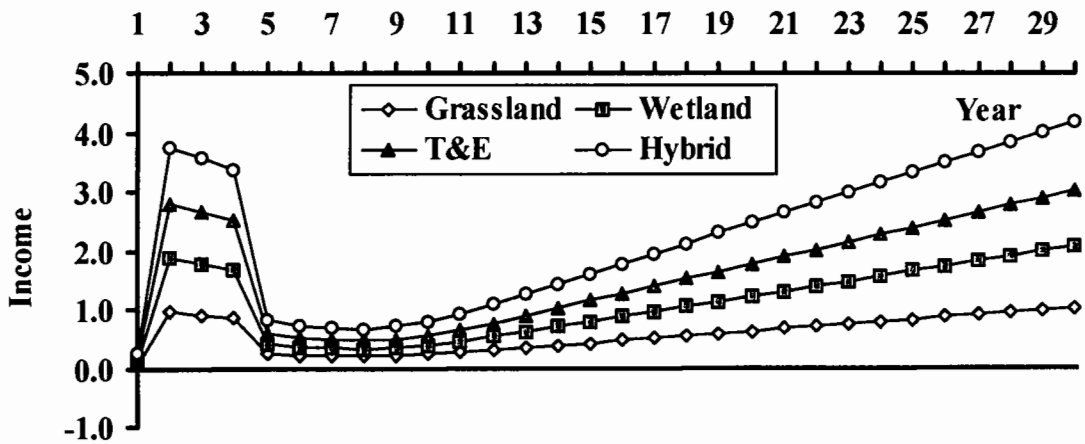
Figure V-1b. Refuge impact on annual employment, Baseline Scenario (number of jobs)



Finally, Figure V-1c displays changes in annual personal income in the economic study area over time. During the early years of the project, construction expenditures generate an increase in personal income in the economic study area. This reflects the fact that the total amount of land taken out of agricultural production at this stage is modest and construction activities are at their maximum. Construction expenditures end in year 5. As a result, the accumulating impact of agricultural land being taken out of production begins to outweigh direct FWS expenditures on operation and maintenance. The initial surge in personal income diminishes. Income in the area then begins to rise as recreational activities increase. The upward slope of the curve in years 7 through 30 reflects, in part, the upward path for recreational expenditure capture that was illustrated in Figure IV-1. In terms of changes in personal income,

the Hybrid Alternative generates the largest impact of the management alternatives and the Grassland Alternative generates the smallest impact.

Figure V-1c. Refuge impact on annual personal income, Baseline Scenario (millions of 1994 $)



C. Aggregate measures of economic impact

The graphs in section B display refuge impacts in the Baseline Scenario for each year of the 30-year horizon. As such, they provide an easily understood picture of how output, employment, and income could change if the refuge were established in accordance with the assumptions of the Baseline Scenario and the management plans under consideration. In this section, these annual impacts are aggregated to derive a measure of the expected total impact of the refuge over the 30-year period.

Before presenting estimates of total impact, it is important to point out that the graphs presented above were derived from undiscounted values of refuge impacts. That is, values were charted exactly as the model predicted for each year in the life of the proposed refuge. No special accounting was made for whether impacts occurred early or late in the planning horizon. In other words, results were reported in *current value terms*. In contrast, in this section measures of total impact are presented in discounted or *present value terms*. The process of discounting converts future values into present values. This procedure answers the question: what would be the total economic impact of the refuge, taking into consideration the fact that some economic impacts arise in the near term and some arise in the future? Discounting tends to affect the results in an important way, namely, those economic impacts that accrue in the later years of the project are given relatively smaller weight in the analysis than those that occur sooner. This is because income obtained today could be used productively during intervening years, for example to earn interest or a rate of return from alternative investments.[1]

In the case of the proposed refuge the impact of discounting is the following. First, when future values are discounted, the impact of construction expenditures tends to outweigh subsequent reductions in agricultural output. In addition, increases in economic activity that result from recreational activities near the end of the 30-year period are given a smaller weight in the analysis. The extent to which the weight of the analysis is shifted in favor of early impacts

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[1] Discounting is not the same as inflating or deflating to adjust for inflation. In this study, no adjustment is made for possible inflation during the life of the project. That is, all values are presented in real, not nominal, terms, in constant 1994 dollars.

depends on the discount rate used. Higher discount rates tend to emphasize early impacts compared with later impacts.

In this analysis undiscounted measures of refuge impacts (that is incremental net benefits associated with establishing the refuge) are compared with impacts discounted at *real* (i.e. net of inflation) rates of 3.6 percent and 7.0 percent. These rates are based on the federal Office of Management and Budget Circular A-94 (and updates). These guidelines recommend using a real discount rate of 3.6 percent to assess the cost effectiveness of projects of 30 years duration and 7.0 percent to conduct federal benefit-cost studies.

The projected economic impact of the proposed refuge under the Baseline Scenario is summarized in Table V-1. Each row in the table corresponds to a different management alternative. For each management alternative, the table lists the total and annual average impact of the proposed refuge on economic output and personal income. Pairs of columns in the table correspond to output and income impacts under three different discount rates (0.0, 3.6, and 7.0, respectively).

Analysis shows that the undiscounted total change in aggregate economic output resulting from the proposed refuge would range from - $4.93 million and - $4.86 million (for the Wetland and Threatened and Endangered Species Alternatives, respectively), to $8.25 million and $10.12 million (for the Grassland and Hybrid Alternatives, respectively). These impacts are similar but smaller when the values are discounted at a rate of 3.6%. At a discount rate of 3.6%, the impact of the proposed refuge on aggregate economic output ranges from - $1.56 million and - $1.23 million (for the Wetland and Threatened and Endangered Species Alternatives,

respectively), to $5.95 million and $6.60 million (for the Grassland and Hybrid Alternatives, respectively). At a discount rate of 7.0%, the pattern of results changes: the discounted value of economic output is estimated to be positive for all management alternatives. This shift reflects the fact that with a higher discount rate the early impacts of construction receive relatively greater weight in the analysis than later impacts due to changes in agriculture and recreation.

Table V-1. Total impact of proposed refuge on output and income over 30 years, Baseline Scenario (million 1994 $)

	Undiscounted		**Discount rate = 3.6%**		**Discount rate = 7.0%**	
Management Alternative	**Output**	**Income**	**Output**	**Income**	**Output**	**Income**
Wetland	-4.93	15.80	-1.56	8.93	.16	5.87
Grassland	8.25	17.40	5.95	9.99	4.97	6.64
T&E	-4.86	14.94	-1.23	8.58	.53	5.74
Hybrid	10.12	18.48	6.60	10.44	5.15	6.83

For all discount rates considered in the Baseline Scenario the total change in personal income is projected to be positive. The total change in undiscounted personal income is largest under the Hybrid Alternative ($18.48 million). The total change in personal income falls to $10.44 million and $6.83 million at discount rates of 3.6% and 7.0%, respectively. The smallest impact is associated with the Threatened and Endangered Species Alternative. Because much of the difference in impact among the management alternatives occurs in later years of refuge

development, discounting tends to reduce the differences between the alternatives and make them look more similar than they actually are.

Appendix F contains data on changes in output and personal income arising from component changes in direct FWS expenditures, recreation, and agriculture. These data show that direct FWS expenditures lead to an increase in output and personal income in the economic study area. Because the same pattern of FWS expenditures was assumed for each management alternative, the impact of FWS expenditures is the same in each management alternative. Over 30 years, direct expenditures by the FWS are expected to increase the undiscounted value of personal income by approximately $14 million in the economic study area, or about $500,000 per year on average.[2]

Recreational activities are expected to increase personal income in the economic study area. The largest increase would be associated with the Wetland Alternative. The smallest increase would be associated with the Grassland Alternative. These differences can be traced to three factors. One, restored land types differ across alternatives. Two, recreational activities depend on the type of land available. And three, expenditure patterns differ by recreational

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[2] Tables F.1 through F.3 break down changes in output and personal income into three categories corresponding to the source of economic change: (1) impacts arising from direct spending by FWS; (2) impacts arising from changes in recreational activities; and (3) impacts arising from changes in agriculture. When interpreting these data it is important to keep in mind that the impacts listed under each heading are those *associated* with the changes taking place in those sectors, and not necessarily changes taking place completely within the sector itself. For example, changes listed under agriculture will include changes in sectors as different from agricultural production as restaurants, banking, and computer supplies, provided the changes in these sectors' activities came about as a result of indirect or induced activities due to changes originating in the agricultural sector.

activity. As an example, the Wetland Alternative supports the widest range of recreational activities, including hunting, fishing and non-consumptive activities and thereby generates greater economic impact from recreation than other management alternatives.

Changes in agriculture are expected to reduce net personal income in the economic study area. The reduction in personal income is largest for the Wetland Alternative and smallest for the Grassland Alternative. These differences can be traced to the amount of row-crop land coming out of production in each alternative. For example, the Grassland Alternative targets approximately 18,000 acres of row-crop land for acquisition, more than any other management alternative.

As for changes in employment, as a result of the proposed refuge, expected outcomes are mixed. Results for the Baseline Scenario are presented in Table V-2. The Baseline Scenario predicts that employment would fall slightly in several years for two alternatives – Wetland and Threatened and Endangered Species. However, for all management alternatives the total impact of the refuge on employment in the economic study area over the 30-year horizon is expected to be a net increase in the number of jobs. The average number of jobs created ranges from 17 in the Threatened and Endangered Species Alternative to 28 in the Grassland Alternative.

Table V-2. Total impact of refuge on employment over 30 years, Baseline Scenario (average number of jobs per year)

Alternative	Average Number of New Jobs
Wetland	18.2
Grassland	27.9
T & E	17.0
Hybrid	27.0

D. Sensitivity analysis

Potential economic impacts of the proposed refuge described in section C were derived under the Baseline Scenario assumptions. In order to gauge the sensitivity of model predictions to the assumptions used, this section reports results based on the alternative assumptions set forth for Scenarios A and B.

In deriving results under an alternative set of assumptions, three major modifications to the model are made. These alternative assumptions were discussed in part IV of the report but are reviewed here for convenience. Modifications are as follows. One, visitor rates are assumed to differ from those used above. Specifically, in Scenario A, visitor rates are assumed to be 50% of the values in the Baseline Scenario. In Scenario B visitor rates are assumed to be 150% of the values in the Baseline Scenario. Scenario A can therefore be best thought of as a "low visitation" scenario and Scenario B can be best thought of as a "high visitation" scenario. Two, in Scenario A the value of corn production is raised from 80% of the 10-year average yield to 100% of the

10-year average yield. In Scenario B the value of agricultural production remains at the same value as in the Baseline Scenario, namely 80 percent of the 10-year average. Three, in Scenario B the ceiling on the expenditure capture rate is assumed to be 60 percent. The capture rate for Scenario B is assumed to increase in five-percent increments so that the 60 percent capture rate is realized during years 16 to 30. In Scenario A, the capture rate remains at the value of the Baseline Scenario, namely 40 percent. Assumptions used in the three scenarios are summarized in Table V-3. In terms of overall impact on the model, compared with the Baseline Scenario, Scenario A reduces the projected level of recreational activities and at the same time increase the value of corn production. Scenario B increases the projected level of recreational activities as well as the share of recreational expenditures captured within the economy of the study area. At the same time, Scenario B holds the value of corn production at the lower, baseline level.

Table V-3. Assumptions used in the sensitivity analysis

Assumption	**Baseline Model**	**Scenario A**	**Scenario B**
Agricultural yields	80% of 10 year average	100% of 10 year average	80% of 10 year average
Recreational visitation rates	100% of value in Table IV-6	50% of value in Table IV-6	150% of value in Table IV-6
Expenditure capture rate	40% of total expenditures	40% of total expenditures	60% of total expenditures

Figure V-3a. Aggregate economic output, Scenario B

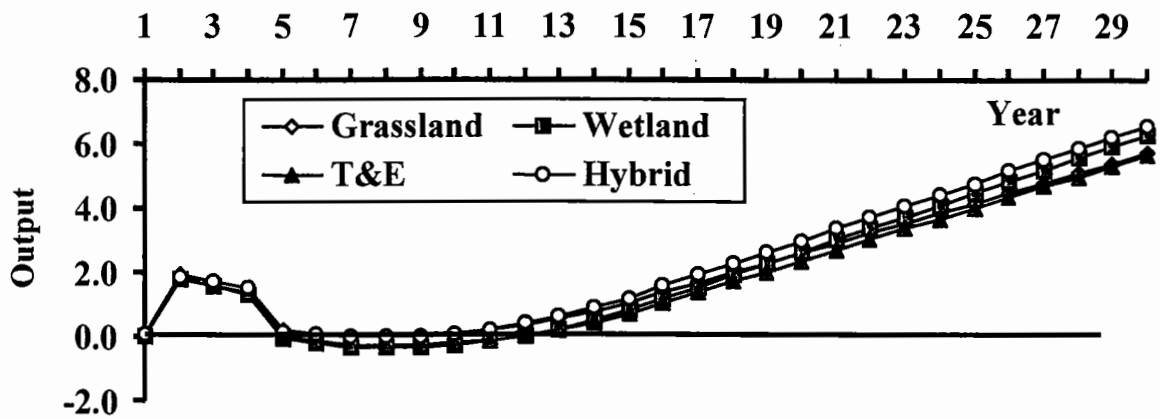


Figure V-3b. Employment, Scenario B

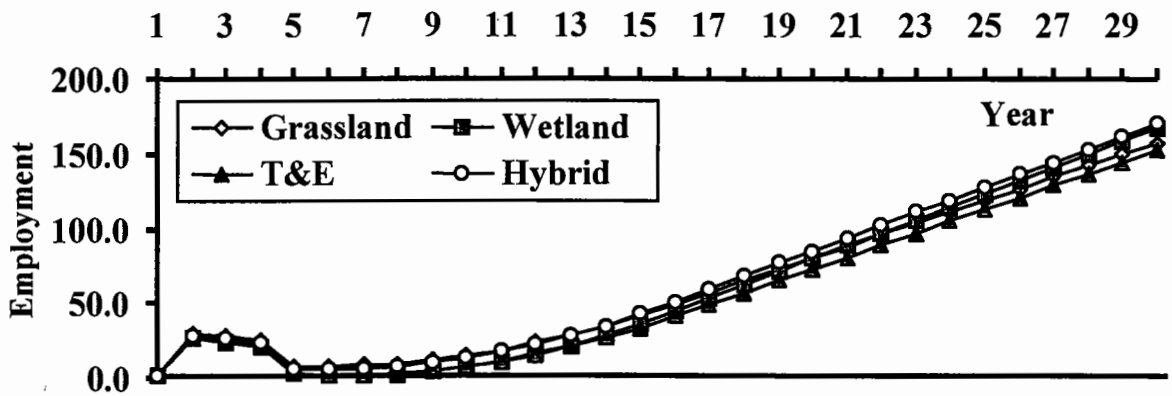
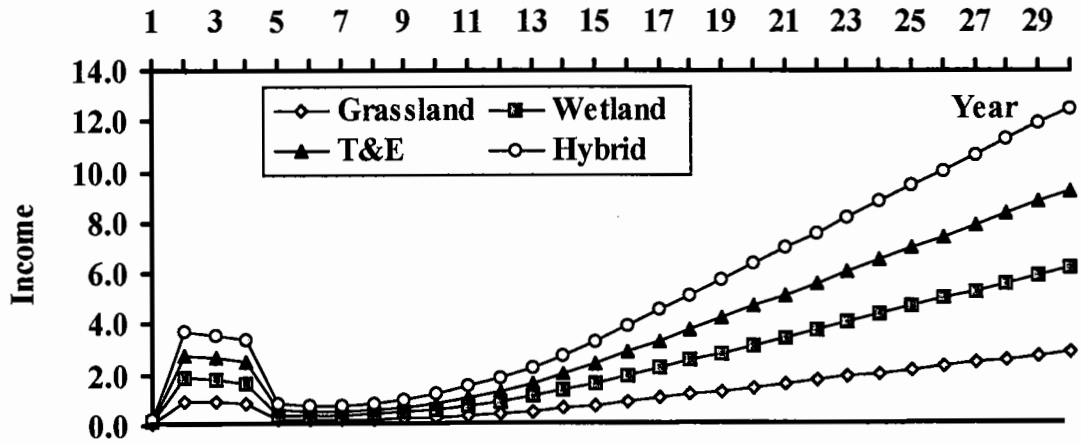


Figure V-3c. Personal income, Scenario B



To summarize the results of the sensitivity analysis, Scenarios A and B provide some indication of potential differences that arise in projected refuge impacts when key assumptions in the model are changed. Scenario A assumes 50 percent lower visitation rates than the Baseline Scenario and 25 percent higher values for corn production. Compared with the Baseline Scenario, at a discount rate of seven percent, total personal income would be 64 to 87 percent lower in Scenario A. Scenario B assumes 50 percent higher visitation rates and a 50 percent higher expenditure capture rate and the same values for corn production as the Baseline Scenario. Compared with the Baseline Scenario, at a discount rate of seven percent, total personal income would be 66 to 92 percent higher in Scenario B.

E. Summary of Impacts

Each of the four development alternatives indicates three stages of impact. During the initial stage output, income and employment increase as a result of refuge establishment. These increases reflect large expenditures for facility construction and modest land acquisition in the early years of the project. As the pace of land acquisition continues and the accumulated amount of land taken out of production increases, the proposed refuge leads to a reduction in economic activity in the economic study area. The second stage of the project indicates decreases to the study region due to reductions in agricultural production. These decreases reflect reductions in agricultural acreage and a lack of compensating recreational activities. In the third stage of the project recreational activities begin to generate income and employment in the regional economy. Whether the proposed refuge increases or decreases economic activity depends, in part, on the management alternative under consideration and assumptions regarding recreational demand and expenditure capture rates. In all alternatives, the proposed refuge is projected to increase personal income in the economic study area. Only the Wetland and Threatened and Endangered Species Alternatives generate employment gains over the 30-year period. From an economic perspective the consequences of the Threatened and Endangered Species and Wetland Alternatives suggest that if the proposed refuge becomes established, these management alternatives may generate smaller economic impacts than either the Grassland or Hybrid management options.

VI. Impacts not measured in this study

This study was limited to measurable and easily quantified impacts that would likely result from the establishment of the proposed Grand Kankakee National Wildlife Refuge. Several other potential impacts are difficult to measure but are nevertheless worthy of consideration. Some of these factors have been observed at other, similar refuges. Some of these issues have been discussed in public meetings focusing on the potential impacts of the proposed refuge. The issues are briefly discussed below.

A. Flooding

Farmland flooding is an important concern in the watershed. Flooding is caused by a number of factors. One important impact of the proposed refuge is that riverside land would be removed from agricultural production. Some of this land would be restored to seasonal or permanent wetland. This change in land use could have two effects on adjacent lands. One, new wetland could provide a flood buffer. By increasing the containment area for water, flooding on adjacent land might be reduced. Two, by increasing the amount of land under water, the refuge could raise the water table and increase waterlogging and flooding on adjacent farms. Assessing the potential impact of the proposed refuge on flooding of neighboring land is a question that requires more accurate hydrologic information than is available to date. For this reason assessing the potential impact of the proposed refuge on flood risk for adjacent farms has not been possible. If the refuge increased flooding on adjacent lands, or restricted the ability of adjacent landowners to pump water to clear land, then costs could increase or agricultural output

could decrease. Both state and federal legislation address these issues. Furthermore, under the Clean Water Act, FWS wetland restoration projects associated with the refuge would require review and issuance of section 404 permits by the U.S. Army Corps of Engineers.

B. Water quality

Flooding in the Kankakee River area currently poses a risk to households that rely upon near-surface wells for drinking water. These wells can be contaminated by flooding and septic system failure. If the proposed refuge influenced the frequency or degree of flooding, then it could have an impact on household water supplies . Numerous studies have examined the value of groundwater protection (for a review, see Crutchfield, Feather, and Hellerstein 1995). For example, a study assessing the perceived value to individuals of protecting groundwater from contamination by agricultural pollutants suggests that rural households would be willing to pay $165 to $1,452 per year to protect groundwater (Sun, Bergstrom and Dorfman 1992). The impact of the proposed refuge on local drinking water supplies would depend upon the impact of the refuge on the water table, flooding on adjacent farms, and septic systems.

As for potential improvements in surface water quality due to refuge establishment, it has been demonstrated that downstream surface water quality improves when natural vegetation separates agricultural crops from a river (Lowrance, Leonard & Sheridan 1985). Buffers can serve as filters that restrict pesticides, sediment, and/or nutrient loads in waterways. Buffers can lead to nutrient uptake, which can improve the river as a habitat and source of drinking water. These are potential impacts of replacing agricultural activities in the immediate vicinity of the

river with natural vegetation. A study of Conservation Reserve Program (CRP) land shows that the water quality benefits (due to reduced erosion and nutrient loading) of retiring cropland average $76 per acre, with a range of $36-117, in the corn belt (Ribaudo et al 1989). Some benefits could also be generated without total removal of row crops through agricultural best management practices and proper design and installation of riparian buffer strips.

Finally, a potential link has been hypothesized between nutrient runoff from eastern cornbelt farms and hypoxia and water quality degradation in the Gulf of Mexico (e.g. Anteweiler, Goolsby, and Taylor 1995; Cooper and Lipe, 1992). This concern underscores the need to consider water quality issues in assessing the merits of the proposed refuge.

C. Local property taxes and revenue sharing

Changes in land use and ownership could be accompanied by changes in the property tax bases of communities in the economic study area. The federal government has a policy of making payments to local governments to compensate for lost property tax revenues.

Specifically, the *Refuge Revenue Sharing Act* of 1935, as amended, provides for annual payments to local communities when land is occupied by a National Wildlife Refuge. Payments are based on both the amount of acreage occupied by the refuge and the underlying value of that land. Payments are typically made to either the county or the lowest unit of government that collects and distributes taxes. Funds for these payments come from two sources: (1) the National Wildlife Refuge Revenue Sharing Fund, and (2) annual Congressional appropriations. The National Wildlife Refuge Revenue Sharing Fund consists of annual receipts from the sale of

products obtained on all National Wildlife Refuge system lands in the US. This includes, for example, revenues from oil and gas leases, timber sales, and grazing fees. Annual Congressional appropriations, as authorized by a 1978 amendment, are intended to make up any difference between the net receipts from the Refuge Revenue Sharing Fund and the total amount payable to local units of government.

Payments are calculated based on a formula set out in the *Refuge Revenue Sharing Act* (Corn 1990). The formula specifies that a community should receive the largest of three amounts:

(1) $0.75 per acre;

(2) 25 percent of the net receipts collected from refuge lands in the county; or

(3) 3/4 of 1 percent of the appraised value of land occupied by the proposed refuge.

For existing refuges in the states of Illinois and Indiana, the FWS staff has estimated that 3/4 of one percent of the fair market value of land would likely bring the greatest return to local tax authorities. When this method of revenue sharing is used, land is re-appraised every five years.

In November and December 1994, the FWS studied revenue sharing patterns in all 141 counties of Region 3. This 8-state area includes Indiana and Illinois. Counties were surveyed and asked to estimate the amount of real estate tax that would have been received from refuge lands had they remained in private ownership. In Indiana, 2 of 3 counties that receive refuge revenue sharing payments responded to the survey. In Illinois, 8 of 18 counties responded to the

survey. Based on the responses to this survey, the FWS calculated that refuge revenue sharing was 164 percent of the private tax revenue level in Indiana, and 99 percent in Illinois.

Payments are typically made as a lump sum. The Refuge Revenue Sharing Act is the federal law that authorizes the FWS to make these payments. According to the Act,

> Each county which receives payments...shall distribute, under guidelines established by the Secretary, such payments on a proportional basis to those units of local government (including, but not limited to, school districts and the county itself in appropriate cases) which have incurred the loss or reduction in real property tax revenues by reason of existence of such area.

In other words, the Act directs the local unit of government to distribute refuge revenue sharing payments *in the same proportion* as it would for tax monies received. The impact of the proposed refuge on local property tax bases has not been considered in this analysis. In recent years Congress has not always fully appropriated amounts payable to local tax authorities. Changes in compensation methods to ensure fair payment to local governments have been proposed. Some of these proposed changes are detailed in Corn (1990).

E. Municipal services

Establishment of the proposed refuge could result in changes in demand for local municipal services. Although the undeveloped land in the refuge would not be expected to add to local school or services burdens, increased road and highway maintenance could be required to support traffic associated with refuge visitors. Roads within the refuge boundaries would be

maintained by the FWS. Potential direct impacts on municipal expenditures have not been considered in this analysis.

VII. Summary and Conclusions

This report presented results from an analysis of the potential regional economic impacts of the proposed Grand Kankakee Marsh National Wildlife Refuge. Establishment of the proposed refuge would involve federal purchase or lease of approximately 30,000 acres of land in a 13-county area of northwestern Indiana and northeastern Illinois. The economic study area lies immediately south of the Chicago Metropolitan Area. This and other nearby urban areas exert a strong influence on the Kankakee regional economy and would play a key role in supplying visitors to the proposed refuge.

Land acquisition for the refuge would occur over a 30-year time period. Land would be acquired only from willing sellers and would be managed by the FWS. Management goals would include providing and enhancing wildlife habitat as well as providing recreational opportunities for local residents and non-resident visitors.

This report assesses the output, employment, and income impacts of the proposed refuge under a series of four management alternatives and three scenarios. Management alternatives were outlined by FWS staff. The *Wetland Alternative* focuses on creating permanent and/or periodic natural wetlands, with the goal of expanding habitat for migratory waterfowl and other animal species. It would directly affect roughly 19,000 acres of cropland in eight counties. The *Grassland Alternative* focuses on restoring land to grassland, pasture, and woodland with the goal of expanding tallgrass prairie. It would directly affect about 16,000 acres of cropland in four counties. The *Threatened and Endangered Species Alternative* focuses on creating both wetlands and woodlands for the purpose of protecting and enhancing a number of state and

federally-listed threatened and endangered species. It would directly affect approximately 17,000 acres of cropland in seven counties. The *Hybrid Alternative* combines all of these management goals. It would directly affect nearly 16,000 acres of cropland in eight counties. Each management alternative reflects a different conservation goal and emphasizes a different constellation of land use changes. Four counties in the area – Kosciusko, Pulaski, St. Joseph and Will – are not projected to have land acquisition in any management alternative.

This study was limited to quantifiable economic impacts associated with a decline in agricultural activity as land is taken out of production and an increase in activity from FWS operation of the proposed refuge and visitor activity. The analysis focused on impacts related to land use changes within the economic study area, specifically those changes associated with a reduction in agricultural production and an increase in recreational activities. The analysis also included estimates of the impact of direct spending by the FWS on construction and maintenance of refuge facilities. The report focused on direct, indirect, and induced economic impacts that could be quantified. Prospective land use changes and expenditures were used to estimate changes in agricultural, recreational and other activities. Both consumptive and non-consumptive recreational uses were examined. Estimated levels of recreational use were combined with estimates of expenditure patterns of refuge visitors, and operation and maintenance expenditures by the FWS to construct a profile of potential changes in the scope and composition of the economy of the economic study area. These data on economic changes were used in conjunction with the IMPLAN input-output model of the 13-county regional economy to estimate overall economic impacts of the proposed refuge in this area. For each management alternative the total

and annual average impacts of the proposed refuge on output, employment and income were determined.

Analysis under the Baseline Scenario showed that the FWS expenditures for construction and operation of the refuge would increase economic output in the region. Recreational activities would also increase the total amount of local economic activity. However, the proposed refuge was found to reduce aggregate economic output under two management alternatives and to increase aggregate economic output in two management alternatives.

The refuge is projected to increase employment in the economic study area. Approximately 18 jobs would be gained due to construction, operation, and maintenance of the refuge. Between 39 and 48 jobs would be gained due to activities associated with recreational visitors. Between 29 and 48 jobs would be lost due to changes in agriculture. The total impact would be an increase of 17-28 jobs in the economic study area. The average net annual impact of the refuge on employment ranged from a net increase of 17 jobs (in the Threatened and Endangered Species Alternative) to a net increase of 28 jobs (in the Grassland Alternative).

Analysis indicated that expenditures by the FWS on refuge construction and operation would increase personal income in the economic study area. Over 30 years, direct expenditures by the FWS would increase personal income by approximately $14 million in the economic study area, or about $500,000 per year on average. Recreational activities would be expected to increase personal income in the economic study area. Increases were found to be largest for the Wetland Alternative, and smallest for the Grassland Alternative. These differences can be attributed to different patterns of land use changes and recreation. Personal income was found

to decrease as a result of changes in agriculture. Reductions ranged from $18-$24 million over 30 years. Differences in outcomes could be traced to the amount of row-crop land coming out of production in each alternative. For example, the Grassland Alternative targets approximately 16,000 acres of row-crop land for acquisition, more than any other management alternative. Overall, however, under the assumptions of the Baseline Scenario, the proposed refuge was found to increase personal income under all management alternatives. This projected increase in income ranged from $15 million (in the Wetland Alternative) to $18 million (in the Hybrid Alternative).

For comparison purposes results were reported for analyses based on alternative assumptions. In Scenario A aggregate economic output and employment were projected to decrease for all management alternatives, but personal income was projected to increase in the Grassland and Hybrid Alternatives. Scenario B assumed 50 percent higher recreation visitation rates than the Baseline Scenario and generated increases in output, employment and income for all management alternatives.

In summary, each development alternative indicated three stages of impact. During the initial stage, output, income and employment increased as a result of establishing the proposed refuge. These increases reflected large expenditures for facility construction and modest land acquisition in the early years of the project. As the pace of land acquisition continued and the accumulated amount of land taken out of production increased, economic output fell. In the second stage of the project decreases accrued to the study region due to reductions in agricultural production. These decreases reflected reductions in agricultural acreage and a lack of

compensating recreational activity. In the third stage recreational activities generated increases in income and employment in the region. Whether the proposed refuge would lead to an increase or decrease in economic activity and income depends, in part, on the alternative under consideration and the assumptions made regarding recreational demand. Under all sets of assumptions and all scenarios considered in this report, the Grassland and Hybrid Alternatives were projected to increase personal income in the economic study area. No unambiguous impacts on output or employment were found.

Several important questions remain regarding the potential economic impact of the refuge. Because riverside land would be removed from agricultural production and restored to seasonal or permanent wetland, adjacent lands may be affected. New wetland could provide containment and filtering areas for water and thereby reduce flooding on adjacent land and improve downstream water quality. Although the refuge could potentially raise the water table and increase waterlogging and flooding on adjacent farms, state and federal laws restrict the FWS from engaging in activities that would negatively impact adjacent landowners. Section 404 of the federal Clean Water Act requires hydrological studies and permits to be issued whenever wetland restorations are undertaken.

Another issue for consideration is the potential impact of changes in land use and ownership on property tax revenues in affected communities. Although the federal government has a policy of making compensating payments to local communities, congressional appropriations have fluctuated in the past. Historically, however, communities in Indiana and Illinois where other refuges are located have been fully compensated for lost tax revenue.

Several other important issues remain unresolved and should be taken into consideration by the public and by policy makers. A first issue is the extent to which goals of wildlife protection and habitat enhancement could be furthered in the Kankakee watershed through means other than a wildlife refuge. Federal acquisition of private land is one method for protecting habitat and improving water quality. Alternatives – such as establishing riparian buffers on private land or encouraging stewardship of land through economic incentives – might also achieve some of the environmental goals met by a refuge at a lower economic cost than the proposed refuge. However, it is important to recognize that from an environmental perspective, private measures are unlikely to fully substitute for the habitat protection afforded by a refuge.

A second issue to be taken into consideration in interpreting this analysis is the potential response of local communities to the refuge, if it were to become established. In some areas where refuges have been created, local communities have viewed a restored natural area as a valuable economic resource to spur local economic revitalization. However, while it is true that spending by refuge visitors can generate local income and employment, the extent to which increases might accrue to local communities depends, in part, on the response of local businesses and community leaders to changes in market forces that would accompany the proposed refuge.

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Appendix A

Characteristics of economic study area

Table A.1 Acreage and population in economic study area

County	Area of county (Sq. mi.)	Area of County (Acres)	1985 Population	1995 Population	% Growth 1985-1995
Jasper, IN	560	358,749	25,800	27,800	7.7
Kosciusko, IN	538	344,330	62,100	68,500	10.3
Lake, IN	497	322,008	491,500	481,900	-1.9
La Porte, IN	598	385,893	107,300	109,700	2.2
Marshall, IN	444	287,641	41,100	44,500	8.3
Newton, IN	402	257,641	13,900	14,200	2.2
Porter, IN	418	268,504	124,300	139,200	12.0
Pulaski, IN	434	277,833	13,000	13,000	0
St. Joseph, IN	457	294,633	241,400	256,400	6.2
Starke, IN	309	199,618	21,200	22,400	5.7
Iroquois, IL	1,116	715,649	31,800	31,400	-1.3
Kankakee, IL	678	435,442	97,900	101,200	3.4
Will, IL	837	542,800	336,100	404,800	20.4
Total	**7,288**	**4,690,741**	**1,609,385**	**1,716,995**	**6.7**

Source: BEA:REIS

Table A.2 Employment for counties in economic study area, 1994

County	Farm employment	Nonfarm employment	Total employment
Jasper	974	12,254	13,228
Kosciusko	1,638	37,656	39,294
Lake	720	230,964	231,684
La Porte	1,147	55,261	56,408
Marshall	1,251	24,625	25,921
Newton	606	4,945	5,551
Porter	642	64,390	65,032
Pulaski	823	5,550	6,373
St. Joseph	1,076	149,793	150,869
Starke	534	6,240	6,774
Iroquois	2,154	13,156	15,310
Kankakee	1,374	48,839	50,213
Will	1,573	144,668	146,241
Area Total	**14,512**	**798,341**	**812,898**

Source: BEA:REIS

Table A.3 Population and income for counties in economic study area, 1994

County	Population	Total Personal ($000)	Farm ($000)	Per Capita
Jasper	27,400	459,603	21,690	$16,789
Kosciusko	68,000	1,397,936	26,299	$20,571
Lake	481,600	9,393,960	10,857	$19,504
La Porte	109,600	2,037,214	15,852	$18,583
Marshall	44,200	828,362	8,570	$18,738
Newton	14,100	233,688	10,591	$16,537
Porter	138,200	3,019,973	7,083	$21,845
Pulaski	13,000	225,331	12,393	$17,329
St. Joseph	255,400	5,257,844	17,923	$20,584
Starke	22,300	322,483	15,224	$14,439
Iroquois	31,400	616,799	72,255	$19,626
Kankakee	101,300	1,918,289	54,840	$18,939
Will	398,700	8,438,874	38,538	$21,165
Area Total	**1,705,200**	**34,150,356**	**312,115**	**$20,027**

Source: BEA:REIS

Table A.4 Farm statistics by counties in economic study area, 1992

County	# of Farms	% Farming Principle Occupation	Land in Farms (acres)	Avg. Farm Size (acres)	Value of Products Sold ($000)	Primary Agricultural Product
Jasper	716	67.2	301,962	422	98,065	Corn
Kosciusko	1,123	49.2	251,603	224	87,654	Poultry
Lake	482	56.2	144,305	299	33,570	Corn
La Porte	826	54.2	267,695	324	225,617	Corn
Marshall	956	52.3	219,402	203	58,118	Corn
Newton	390	71.3	206,885	530	66,862	Corn
Porter	496	53.2	142,482	287	34,689	Corn
Pulaski	630	61.9	242,777	385	75,282	Corn
St. Joseph	768	49.1	172,348	224	49,799	Corn
Starke	387	51.9	134,960	349	28,321	Corn
Iroquois	1,509	72.4	662,629	439	187,908	Corn
Kankakee	928	65.7	358,920	387	105,208	Corn
Will	1,057	56.4	325,227	308	91,509	Corn
Area Total	**10,268**	**59.0**	**3,431,195**	**334**	**1,142,602**	**Corn**

Source: BEA:REIS

Table A.5 Harvested corn acreage for counties in economic study area, 1992

County	Corn (acres)	Soybeans (acres)	Wheat (acres)	Harvested Cropland (acres)
Jasper	152,012	92,071	1,580	251,579
Kosciusko	104,136	65,797	6,267	192,885
Lake	64,854	50,112	737	112,190
La Porte	125,779	76,355	4,856	225,617
Marshall	92,307	60,840	5,259	174,005
Newton	107,819	68,762	486	180,048
Porter	63,827	49,911	2,322	121,941
Pulaski	115,557	71,734	979	204,381
St. Joseph	73,481	51,170	6,421	143,636
Starke	61,360	21,122	278	105,299
Iroquois	311,765	268,316	1,613	597,863
Kankakee	182,399	129,159	1,044	326,603
Will	144,035	125,298	1,868	288,370
Area Total	**1,599,331**	**1,130,647**	**33,710**	**2,924,417**

Source: BEA:REIS

Appendix B

Land cover classification by county, with and without proposed refuge

Note: Column totals may not sum exactly, due to rounding

Table B.1 Scaled land use without refuge – Wetland Alternative

County	Forest	Shrub	Emergent	Barren	Woodland	Pasture	Coniferous	Deciduous	Urban Grass	Water	Row Crop	Urban	Total
Jasper	229	0	9	0	1	56	1	43	2	37	1987	4	**2370**
Kankakee	1118	0	113	0	37	483	0	421	9	119	1157	15	**3474**
Lake	477	20	23	0	25	101	6	188	12	55	1455	17	**2383**
La Porte	476	8	162	0	5	75	37	194	1	36	1054	0	**2049**
Marshall	663	150	139	41	110	138	167	1750	2	437	5909	36	**9542**
Newton	243	4	40	0	35	53	1	134	0	26	479	4	**1020**
Porter	672	3	103	0	33	108	38	439	4	20	2979	0	**4402**
Starke	870	52	180	3	33	83	48	393	13	51	3030	1	**4759**
Total	**4748**	**238**	**773**	**44**	**282**	**1097**	**299**	**3565**	**45**	**782**	**18050**	**77**	**30000**

Table B.2 Scaled land use with refuge – Wetland Alternative

County	Forest	Shrub	Emergent	Barren	Woodland	Pasture	Coniferous	Deciduous	Urban Grass	Water	Row Crop	Urban	Total
Jasper	1818	0	406	0	1	56	1	43	2	37	0	4	**2370**
Kankake	1986	0	114	0	327	483	0	422	9	119	0	15	**3474**
Lake	1641	20	315	0	25	101	6	188	12	55	0	17	**2383**
La Porte	891	8	801	0	6	75	37	194	1	36	0	0	**2049**
Marshall	3429	150	1881	41	1511	138	167	1750	2	437	0	36	**9542**
Newton	483	4	41	0	275	53	1	134	0	26	0	4	**1020**
Porter	3056	3	700	0	34	108	38	440	5	20	0	0	**4402**
Starke	2883	52	1197	3	34	83	48	393	13	52	0	1	**4759**
Total	**16188**	**238**	**5454**	**44**	**2212**	**1097**	**299**	**3565**	**45**	**782**	**0**	**77**	**30000**

Table B.3 Scaled land use without refuge – Grassland Alternative

County	Forest	Shrub	Emergent	Barren	Woodland	Pasture	Coniferous	Deciduous	Urban Grass	Water	Row Crop	Urban	Total
Iroquois	19	0	5	0	19	615	1	79	0	37	1490	13	2279
Jasper	41	3	12	0	814	250	42	2260	51	11	5440	36	8961
Kankakee	51	0	34	0	222	5141	19	1101	81	55	3779	104	10586
Newton	286	5	51	0	658	432	54	1683	53	29	4838	87	8174
Total	**397**	**7**	**103**	**0**	**1713**	**6438**	**115**	**5123**	**185**	**131**	**15547**	**240**	**30000**

Table B.4 Scaled land use with refuge – Grassland Alternative

County	Forest	Shrub	Emergent	Barren	Woodland	Pasture	Coniferous	Deciduous	Urban Grass	Water	Row Crop	Urban	Total
Iroquois	19	0	5	0	392	1733	1	79	0	37	0	13	2278
Jasper	41	3	12	0	2174	4331	42	2260	51	11	0	36	8961
Kankakee	51	0	34	0	1167	7975	19	1101	81	55	0	104	10586
Newton	552	5	51	0	2000	3661	54	1683	53	29	0	87	8174
Total	**663**	**7**	**103**	**0**	**5733**	**17700**	**115**	**5123**	**185**	**131**	**0**	**240**	**30000**

Table B.5 Scaled land use without refuge – Threatened and Endangered Species Alternative

County	Forest	Shrub	Emergent	Barren	Woodland	Pasture	Coniferous	Deciduous	Urban Grass	Water	Row Crop	Urban	Total
Jasper	91	0	4	0	1	3	2	8	3	21	29	0	**162**
Kankakee	1528	0	155	0	52	660	0	576	12	163	1581	20	**4749**
Lake	652	27	33	0	34	139	9	258	17	75	1990	24	**3257**
La Porte	1018	33	453	0	48	321	71	632	21	101	2961	2	**5661**
Marshall	576	60	71	0	43	14	47	466	0	28	2334	0	**3639**
Newton	5	0	4	0	0	0	0	0	0	0	1	0	**10**
Porter	919	4	142	0	46	147	52	601	6	27	4072	0	**6017**
Starke	1189	71	246	4	46	114	66	537	18	70	4141	2	**6505**
Total	**5979**	**196**	**1107**	**4**	**271**	**1398**	**246**	**3079**	**77**	**486**	**17108**	**48**	**30000**

Table B.6 Scaled land use with refuge – Threatened and Endangered Species Alternative

County	Forest	Shrub	Emergent	Barren	Woodland	Pasture	Coniferous	Deciduous	Urban Grass	Water	Row Crop	Urban	Total
Jasper	114	0	9	0	1	3	2	8	3	21	0	0	**162**
Kankakee	2715	0	155	0	447	660	0	576	12	163	0	20	**4749**
Lake	2244	27	431	0	34	139	9	258	17	76	0	24	**3258**
La Porte	1966	33	1706	0	428	321	71	632	21	101	0	2	**5280**
Marshall	2443	440	538	0	43	14	47	466	0	28	0	0	**4019**
Newton	5	0	4	0	0	0	0	0	0	0	0	0	**9**
Porter	4177	4	956	0	46	147	52	601	6	27	0	0	**6017**
Starke	3941	71	1636	4	46	114	66	537	18	70	0	2	**6506**
Total	**17604**	**576**	**5435**	**4**	**1046**	**1398**	**247**	**3079**	**77**	**486**	**0**	**48**	**29999**

Table B.7 Scaled land use without refuge – Hybrid Alternative

County	Forest	Shrub	Emergent	Barren	Woodland	Pasture	Coniferous	Deciduous	Urban Grass	Water	Row Crop	Urban	Total
Iroquois	17	0	4	0	17	536	1	68	0	32	1298	11	1985
Jasper	93	2	9	0	311	99	7	1015	6	16	2428	0	3989
Kankakee	1125	0	117	0	193	3687	4	1241	79	160	3452	70	10129
Lake	461	19	23	0	24	98	6	182	11	53	1408	17	2306
La Porte	721	23	321	0	34	227	50	447	14	71	2096	1	4007
Newton	235	4	39	0	41	99	1	140	2	25	1177	3	1767
Porter	651	3	101	0	32	104	37	425	4	19	2882	0	4259
Starke	358	21	79	0	11	41	27	195	7	24	793	0	1557
Total	**3662**	**73**	**693**	**0**	**664**	**4891**	**134**	**3715**	**127**	**401**	**15536**	**103**	**30000**

Table B.8 Scaled land use with refuge – Hybrid Alternative

County	Forest	Shrub	Emergent	Barren	Woodland	Pasture	Coniferous	Deciduous	Urban Grass	Water	Row Crop	Urban	Total
Iroquois	17	0	4	0	341	1510	1	68	0	32	0	12	1985
Jasper	110	2	13	0	913	1905	7	1015	7	16	0	0	3989
Kankakee	1965	0	117	0	1056	5437	4	1241	79	160	0	70	10129
Lake	1588	19	305	0	24	98	6	182	12	53	0	17	2306
La Porte	1391	292	1208	0	303	227	50	447	15	71	0	2	4006
Newton	467	4	39	0	452	634	1	140	2	25	0	4	1768
Porter	2957	3	677	0	33	104	37	425	4	19	0	0	4259
Starke	595	21	635	0	11	41	27	195	8	24	0	0	1557
Total	**9090**	**342**	**2999**	**0**	**3133**	**9955**	**134**	**3715**	**127**	**401**	**0**	**103**	**30000**

Appendix C

IMPLAN input data for models presented in Part V

Table C.1 IMPLAN input data, Baseline scenario (values in 1994 $)

Category	IMPLAN Sector	Wetland Alternative	Grassland Alternative	T & E Alternative	Hybrid Alternative
Corn	11 and 12	-4,616,515	-396,421	-4,375,701	-3,973,527
Hay	13	24,369	492,055	38,234	276,761
Gas	451	3,109,519	2,476,802	2,766,481	2,804,532
Food	454	4,103,215	3,326,306	3,731,361	3,725,508
Lodging	463	2,939,598	2,475,743	2,790,422	2,708,562
Salary	488	395,221	395,221	395,221	395,221
O&M	56	134,191	134,191	134,191	134,191
Levees	49	27,574	27,574	27,574	27,574
Construction	49	919,118	919,118	919,118	919,118

Note: Values are IMPLAN input data corresponding to complete acquisition and restoration of 30,000 acres in accordance with the land use changes outlined for each management alternative in Part III of the report. Values for salary, operation and maintenance, and levee construction correspond to years 5-30 of the planning horizon. For amounts in years 1-4 see Table IV-4 in the text. Values for construction correspond to years 2, 3 and 4 of the planning horizon. Construction expenditures in other years are assumed to be 0.

Table C.2 IMPLAN input data, Scenario A (values in 1994 $)

Category	IMPLAN Sector	Wetland Alternative	Grassland Alternative	T & E Alternative	Hybrid Alternative
Corn	11 and 12	-5,770,644	-4,970,526	-5,469,626	-4,966,908
Hay	13	24,369	492,055	38,234	276,761
Gas	451	1,554,760	1,238,401	1,383,241	1,402,266
Food	454	2,051,608	1,663,153	1,865,680	1,862,754
Lodging	463	1,469,799	1,237,872	1,395,211	1,354,281
Salary	488	395,221	395,221	395,221	395,221
O&M	56	134,191	134,191	134,191	134,191
Levees	49	27,574	27,574	27,574	27,574
Construction	49	919,118	919,118	919,118	919,118

Note: Values are IMPLAN input data corresponding to complete acquisition and restoration of 30,000 acres in accordance with the land use changes outlined for each management alternative in Part III of the report. Values for salary, operation and maintenance, and levee construction correspond to years 5-30 of the planning horizon. For amounts in years 1-4 see Table IV-4 in the text. Values for construction correspond to years 2, 3 and 4 of the planning horizon. Construction expenditures in other years are assumed to be 0.

Table C.3 IMPLAN input data, Scenario B (values in 1994 $)

Category	IMPLAN Sector	Wetland Alternative	Grassland Alternative	T & E Alternative	Hybrid Alternative
Corn	11, 12	-4,616,515	-396,421	-4,375,701	-3,973,527
Hay	13	24,369	492,055	38,234	276,761
Gas	451	4,664,279	3,715,203	4,149,722	4,206,798
Food	454	6,154,823	4,989,459	5,597,041	5,588,262
Lodging	463	4,409,397	3,713,615	4,185,634	4,062,843
Salary	488	395,221	395,221	395,221	395,221
O&M	56	134,191	134,191	134,191	134,191
Levees	49	27,574	27,574	27,574	27,574
Construction	49	919,118	919,118	919,118	919,118

Note: Values are IMPLAN input data corresponding to complete acquisition and restoration of 30,000 acres in accordance with the land use changes outlined for each management alternative in Part III of the report. Values for salary, operation and maintenance, and levee construction correspond to years 5-30 of the planning horizon. For amounts in years 1-4 see Table IV-4 in the text. Values for construction correspond to years 2, 3 and 4 of the planning horizon. Construction expenditures in other years are assumed to be 0.

Appendix D
Impact analysis results by year and management alternative
(Baseline Scenario, dollar values discounted at 3.6 percent)

Table D.1 Economic output, Wetland Alternative (1994 $)

Year	FWS	Recreation	Agriculture	Total
	All	All	All	Impact
1	266233	0	-240396	25837
2	2195803	0	-464085	1731718
3	2119501	0	-671937	1447564
4	2045851	0	-864784	1181066
5	924447	29294	-1043417	-89676
6	892324	84827	-1208592	-231441
7	861316	163759	-1361027	-335951
8	831386	263448	-1501408	-406574
9	802497	381440	-1630390	-446454
10	774611	515459	-1748595	-458526
11	747694	663396	-1856617	-445527
12	721712	823299	-1955019	-410008
13	696633	971288	-2044341	-376420
14	672426	1107998	-2125095	-344671
15	649060	1234034	-2197768	-314674
16	626505	1349973	-2262824	-286345
17	604735	1456364	-2320705	-259606
18	583721	1553732	-2371831	-234379
19	563437	1642573	-2416602	-210591
20	543858	1723365	-2455397	-188174
21	524960	1796558	-2488578	-167061
22	506718	1862583	-2516488	-147187
23	489110	1921851	-2539454	-128493
24	472114	1974750	-2557785	-110921
25	455708	2021652	-2571775	-94414
26	439873	2062910	-2581705	-78921
27	424588	2098860	-2587839	-64391
28	409834	2129820	-2590429	-50775
29	395592	2156095	-2589715	-38028
30	381846	2177971	-2585922	-26105
Total	**22,624,093**	**34,167,300**	**-58,350,522**	**-1,559,129**
Average	**770,961**	**1,178,183**	**-2,003,797**	**-54,654**

Table D.2 Employment, Wetland Alternative (# jobs)

Year	FWS	Recreation	Agriculture	Total
	All	All	All	Impact
1	4.0	0.0	-3.0	1.1
2	31.7	0.0	-5.7	26.0
3	30.6	0.0	-8.3	22.3
4	29.5	0.0	-10.7	18.9
5	14.0	0.6	-12.9	1.7
6	13.5	1.6	-14.9	0.2
7	13.0	3.2	-16.8	-0.6
8	12.6	5.1	-18.5	-0.9
9	12.1	7.3	-20.1	-0.7
10	11.7	9.9	-21.6	0.0
11	11.3	12.8	-22.9	1.1
12	10.9	15.9	-24.2	2.6
13	10.5	18.7	-25.3	4.0
14	10.2	21.3	-26.3	5.2
15	9.8	23.8	-27.2	6.4
16	9.5	26.0	-28.0	7.5
17	9.1	28.0	-28.7	8.5
18	8.8	29.9	-29.3	9.4
19	8.5	31.6	-29.9	10.3
20	8.2	33.2	-30.3	11.1
21	7.9	34.6	-30.7	11.8
22	7.7	35.9	-31.1	12.4
23	7.4	37.0	-31.4	13.0
24	7.1	38.0	-31.6	13.6
25	6.9	38.9	-31.8	14.0
26	6.7	39.7	-31.9	14.5
27	6.4	40.4	-32.0	14.9
28	6.2	41.0	-32.0	15.2
29	6.0	41.5	-32.0	15.5
30	5.8	41.9	-31.9	15.8
Total	**338**	**658**	**-721**	**275**
Average	**11.5**	**22.7**	**-24.8**	**9.4**

Table D.3 Personal income, Wetland Alternative income (1994 $)

Year	FWS	Recreation	Agriculture	Total
	All	All	All	Impact
1	104845	0	-51976	52869
2	990450	0	-100341	890109
3	956033	0	-145281	810752
4	922812	0	-186977	735835
5	364057	10519	-225599	148977
6	351406	30460	-261312	120555
7	339195	58804	-294270	103729
8	327408	94601	-324622	97387
9	316031	136970	-352510	100492
10	305050	185095	-378067	112077
11	294449	238217	-401422	131244
12	284218	295636	-422698	157155
13	274341	348777	-442011	181107
14	264808	397868	-459471	203205
15	255606	443126	-475183	223549
16	246724	484758	-489249	242233
17	238151	522961	-501764	259348
18	229875	557925	-512818	274982
19	221887	589827	-522498	289216
20	214177	618838	-530886	302129
21	206735	645120	-538060	313795
22	199551	668829	-544094	324285
23	192617	690111	-549060	333668
24	185923	709107	-553023	342007
25	179463	725949	-556048	349363
26	173226	740764	-558195	355796
27	167207	753673	-559521	361359
28	161397	764791	-560081	366106
29	155788	774225	-559927	370087
30	150375	782081	-559107	373349
Total	**9,273,805**	**12,269,029**	**-12,616,070**	**8,926,763**
Average	**316,171.0**	**423,070.0**	**-433,244.6**	**305,996.4**

Table D.4 Economic output, Grassland Alternative (1994 $)

Year	FWS	Recreation	Agriculture	Total Impact
	All	All	All	
1	266233	0	-183480	82752
2	2195803	0	-354209	1841594
3	2119501	0	-512851	1606650
4	2045851	0	-660040	1385810
5	924447	23891	-796380	151958
6	892324	69184	-922448	39059
7	861316	133559	-1038793	-43918
8	831386	214863	-1145938	-99689
9	802497	311095	-1244383	-130791
10	774611	420399	-1334602	-139593
11	747694	541054	-1417049	-128301
12	721712	671468	-1492154	-98974
13	696633	792165	-1560328	-71530
14	672426	903663	-1621963	-45874
15	649060	1006456	-1677430	-21914
16	626505	1101014	-1727083	436
17	604735	1187784	-1771260	21259
18	583721	1267195	-1810282	40634
19	563437	1339653	-1844453	58637
20	543858	1405545	-1874063	75340
21	524960	1465240	-1899388	90811
22	506718	1519089	-1920691	105116
23	489110	1567426	-1938219	118317
24	472114	1610570	-1952210	130474
25	455708	1648823	-1962888	141643
26	439873	1682472	-1970467	151879
27	424588	1711792	-1975148	161232
28	409834	1737043	-1977125	169751
29	395592	1758472	-1976580	177484
30	381846	1776314	-1973685	184474
Total	**22,624,093**	**27,866,228**	**-44,535,592**	**5,954,729**
Average	**770,961**	**960,904**	**-1,529,383**	**202,482**

Table D.5 Employment, Grassland Alternative (# jobs)

Year	FWS	Recreation	Agriculture	Total Impact
	All	All	All	
1	4.0	0.0	-1.8	2.2
2	31.7	0.0	-3.5	28.2
3	30.6	0.0	-5.1	25.6
4	29.5	0.0	-6.5	23.0
5	14.0	0.5	-7.9	6.6
6	13.5	1.3	-9.1	5.7
7	13.0	2.6	-10.2	5.4
8	12.6	4.1	-11.3	5.4
9	12.1	6.0	-12.3	5.9
10	11.7	8.1	-13.2	6.7
11	11.3	10.4	-14.0	7.8
12	10.9	12.9	-14.7	9.1
13	10.5	15.3	-15.4	10.4
14	10.2	17.4	-16.0	11.6
15	9.8	19.4	-16.5	12.7
16	9.5	21.2	-17.0	13.6
17	9.1	22.9	-17.5	14.6
18	8.8	24.4	-17.9	15.4
19	8.5	25.8	-18.2	16.1
20	8.2	27.1	-18.5	16.8
21	7.9	28.2	-18.7	17.4
22	7.7	29.3	-18.9	18.0
23	7.4	30.2	-19.1	18.5
24	7.1	31.0	-19.3	18.9
25	6.9	31.8	-19.4	19.3
26	6.7	32.4	-19.4	19.6
27	6.4	33.0	-19.5	19.9
28	6.2	33.5	-19.5	20.2
29	6.0	33.9	-19.5	20.4
30	5.8	34.2	-19.5	20.5
Total	**338**	**537**	**-439**	**435**
Average	**11.5**	**18.5**	**-15.1**	**14.9**

Table D.6 Personal income, Grassland Alternative (1994 $)

Year	FWS	Recreation	Agriculture	Total
	All	All	All	Impact
1	104845	0	-38246	66599
2	990450	0	-73834	916616
3	956033	0	-106903	849130
4	922812	0	-137584	785227
5	364057	8573	-166004	206625
6	351406	24825	-192283	183948
7	339195	47924	-216535	170585
8	327408	77099	-238869	165638
9	316031	111629	-259389	168271
10	305050	150850	-278196	177704
11	294449	194144	-295381	193212
12	284218	240940	-311037	214121
13	274341	284250	-325248	233343
14	264808	324258	-338095	250971
15	255606	361143	-349657	267092
16	246724	395073	-360008	281789
17	238151	426208	-369216	295143
18	229875	454703	-377350	307228
19	221887	480703	-384473	318117
20	214177	504347	-390645	327878
21	206735	525767	-395924	336577
22	199551	545089	-400365	344275
23	192617	562434	-404018	351032
24	185923	577915	-406935	356903
25	179463	591641	-409161	361943
26	173226	603715	-410740	366201
27	167207	614236	-411716	369727
28	161397	623297	-412128	372565
29	155788	630986	-412015	374760
30	150375	637388	-411411	376352
Total	**9,273,805**	**9,999,136**	**-9,283,368**	**9,989,574**
Average	**316,171.0**	**344,797.8**	**-318,797.3**	**342,171.5**

Table D.7 Economic output, T&E Alternative (1994 $)

Year	FWS	Recreation	Agriculture	Total
	All	All	All	Impact
1	266233	0	-227098	39134
2	2195803	0	-438414	1757390
3	2119501	0	-634769	1484733
4	2045851	0	-816948	1228902
5	924447	26805	-985700	-34447
6	892324	77622	-1141737	-171792
7	861316	149849	-1285740	-274575
8	831386	241070	-1418357	-345900
9	802497	349039	-1540204	-388668
10	774611	471675	-1651870	-405585
11	747694	607046	-1753916	-399177
12	721712	753367	-1846876	-371797
13	696633	888785	-1931257	-345838
14	672426	1013883	-2007544	-321235
15	649060	1129213	-2076196	-297923
16	626505	1235304	-2137654	-275844
17	604735	1332658	-2192333	-254940
18	583721	1421755	-2240631	-235155
19	563437	1503050	-2282926	-216438
20	543858	1576979	-2319575	-198737
21	524960	1643955	-2350920	-182005
22	506718	1704372	-2377287	-166197
23	489110	1758605	-2398982	-151266
24	472114	1807011	-2416299	-137173
25	455708	1849930	-2429515	-123877
26	439873	1887683	-2438896	-111339
27	424588	1920579	-2444690	-99523
28	409834	1948910	-2447138	-88394
29	395592	1972952	-2446463	-77918
30	381846	1992971	-2442880	-68063
Total	**22,624,093**	**31,265,073**	**-55,122,815**	**-1,233,649**
Average	**770,961**	**1,078,106**	**-1,892,956**	**-43,889**

Table D.8 Employment, T&E Alternative (# jobs)

Year	FWS	Recreation	Agriculture	Total
	All	All	All	Impact
1	4.0	0.0	-2.8	1.2
2	31.7	0.0	-5.4	26.3
3	30.6	0.0	-7.8	22.8
4	29.5	0.0	-10.0	19.5
5	14.0	0.5	-12.1	2.4
6	13.5	1.5	-14.0	1.0
7	13.0	2.9	-15.8	0.1
8	12.6	4.6	-17.4	-0.2
9	12.1	6.7	-18.9	-0.1
10	11.7	9.1	-20.3	0.5
11	11.3	11.7	-21.5	1.5
12	10.9	14.5	-22.7	2.7
13	10.5	17.1	-23.7	3.9
14	10.2	19.5	-24.7	5.0
15	9.8	21.8	-25.5	6.1
16	9.5	23.8	-26.3	7.0
17	9.1	25.7	-26.9	7.9
18	8.8	27.4	-27.5	8.7
19	8.5	29.0	-28.0	9.4
20	8.2	30.4	-28.5	10.1
21	7.9	31.7	-28.9	10.7
22	7.7	32.8	-29.2	11.3
23	7.4	33.9	-29.5	11.8
24	7.1	34.8	-29.7	12.3
25	6.9	35.6	-29.8	12.7
26	6.7	36.4	-30.0	13.1
27	6.4	37.0	-30.0	13.4
28	6.2	37.6	-30.1	13.7
29	6.0	38.0	-30.1	13.9
30	5.8	38.4	-30.0	14.2
Total	**338**	**602**	**-677**	**263**
Average	**11.5**	**20.8**	**-23.3**	**9.0**

Table D.9 Personal income, T&E Alternative (1994 $)

Year	FWS	Recreation	Agriculture	Total
	All	All	All	Impact
1	104845	0	-49056	55790
2	990450	0	-94702	895748
3	956033	0	-137117	818916
4	922812	0	-176469	746342
5	364057	9617	-212921	160752
6	351406	27847	-246627	132627
7	339195	53760	-277733	115222
8	327408	86486	-306379	107515
9	316031	125221	-332700	108552
10	305050	169217	-356821	117446
11	294449	217783	-378864	133369
12	284218	270277	-398944	155550
13	274341	318859	-417171	176030
14	264808	363739	-433650	194898
15	255606	405115	-448480	212242
16	246724	443176	-461755	228145
17	238151	478103	-473566	242687
18	229875	510067	-483999	255943
19	221887	539232	-493135	267984
20	214177	565755	-501052	278880
21	206735	589783	-507823	288695
22	199551	611458	-513518	297491
23	192617	630915	-518205	305327
24	185923	648281	-521945	312259
25	179463	663678	-524800	318341
26	173226	677223	-526826	323623
27	167207	689025	-528078	328153
28	161397	699188	-528607	331978
29	155788	707814	-528461	335141
30	150375	714996	-527687	337683
Total	**9,273,805**	**11,216,615**	**-11,907,090**	**8,583,330**
Average	**316,171.0**	**386,779.8**	**-408,897.7**	**294,053.1**

Table D.10 Economic output, Hybrid Alternative (1994 $)

Year	FWS	Recreation	Agriculture	Total
	All	All	All	Impact
1	266233	0	-194108	72125
2	2195803	0	-374725	1821078
3	2119501	0	-542556	1576946
4	2045851	0	-698270	1347581
5	924447	26659	-842507	108599
6	892324	77197	-975877	-6356
7	861316	149029	-1098960	-88615
8	831386	239750	-1212312	-141175
9	802497	347129	-1316458	-166833
10	774611	469093	-1411903	-168199
11	747694	603723	-1499124	-147708
12	721712	749242	-1578580	-107625
13	696633	883920	-1650703	-70150
14	672426	1008332	-1715907	-35149
15	649060	1123031	-1774587	-2496
16	626505	1228541	-1827116	27930
17	604735	1325363	-1873852	56245
18	583721	1413971	-1915134	82558
19	563437	1494822	-1951284	106975
20	543858	1568346	-1982609	129595
21	524960	1634955	-2009402	150513
22	506718	1695041	-2031938	169822
23	489110	1748978	-2050481	187607
24	472114	1797119	-2065282	203950
25	455708	1839802	-2076579	218932
26	439873	1877349	-2084596	232625
27	424588	1910065	-2089549	245103
28	409834	1938240	-2091641	256433
29	395592	1962151	-2091064	266679
30	381846	1982060	-2088002	275904
Total	**22,624,093**	**31,093,907**	**-47,115,106**	**6,602,894**
Average	**770,961**	**1,072,204**	**-1,617,965**	**225,199**

Table D.11 Employment, Hybrid Alternative (# jobs)

Year	FWS	Recreation	Agriculture	Total
	All	All	All	Impact
1	4.0	0.0	-2.2	1.9
2	31.7	0.0	-4.2	27.6
3	30.6	0.0	-6.0	24.6
4	29.5	0.0	-7.7	21.8
5	14.0	0.5	-9.3	5.2
6	13.5	1.5	-10.8	4.2
7	13.0	2.9	-12.2	3.7
8	12.6	4.6	-13.4	3.8
9	12.1	6.7	-14.6	4.2
10	11.7	9.0	-15.6	5.1
11	11.3	11.6	-16.6	6.3
12	10.9	14.4	-17.5	7.9
13	10.5	17.0	-18.3	9.3
14	10.2	19.4	-19.0	10.6
15	9.8	21.6	-19.7	11.8
16	9.5	23.7	-20.2	12.9
17	9.1	25.5	-20.8	13.9
18	8.8	27.2	-21.2	14.9
19	8.5	28.8	-21.6	15.7
20	8.2	30.2	-22.0	16.5
21	7.9	31.5	-22.3	17.2
22	7.7	32.6	-22.5	17.8
23	7.4	33.7	-22.7	18.4
24	7.1	34.6	-22.9	18.9
25	6.9	35.4	-23.0	19.3
26	6.7	36.2	-23.1	19.7
27	6.4	36.8	-23.1	20.1
28	6.2	37.3	-23.2	20.4
29	6.0	37.8	-23.2	20.6
30	5.8	38.2	-23.1	20.8
Total	**338**	**599**	**-522**	**415**
Average	**11.5**	**20.7**	**-17.9**	**14.2**

Table D.12 Personal income, Hybrid Alternative (1994 $)

Year	FWS	Recreation	Agriculture	Total
	All	All	All	Impact
1	104845	0	-41195	63650
2	990450	0	-79527	910923
3	956033	0	-115145	840888
4	922812	0	-148192	774620
5	364057	9570	-178803	194824
6	351406	27713	-207108	172011
7	339195	53499	-233229	159465
8	327408	86067	-257285	156190
9	316031	124615	-279388	161258
10	305050	168398	-299644	173804
11	294449	216729	-318155	193023
12	284218	268968	-335017	218169
13	274341	317316	-350324	241333
14	264808	361978	-364162	262625
15	255606	403154	-376615	282145
16	246724	441031	-387764	299991
17	238151	475788	-397682	316257
18	229875	507598	-406443	331030
19	221887	536622	-414115	344394
20	214177	563016	-420764	356430
21	206735	586928	-426450	367213
22	199551	608498	-431232	376817
23	192617	627861	-435168	385309
24	185923	645143	-438309	392757
25	179463	660465	-440706	399222
26	173226	673944	-442408	404763
27	167207	685689	-443459	409437
28	161397	695804	-443903	413297
29	155788	704387	-443781	416395
30	150375	711534	-443131	418778
Total	**9,273,805**	**11,162,316**	**-9,999,104**	**10,437,017**
Average	**316,171.0**	**384,907.5**	**-343,376.2**	**357,702.3**

Appendix E

Table E.1 Summary of annual refuge impacts, Wetland Alternative (undiscounted)

	Baseline			Scenario A			Scenario B		
Year	**Output**	**Employment**	**Income**	**Output**	**Employment**	**Income**	**Output**	**Employment**	**Income**
1	25837	1.1	52869	-34567	0.3	39790	25837	1.1	52869
2	1794060	26.9	922153	1673252	25.4	895996	1794060	26.9	922153
3	1553664	23.9	870177	1372452	21.7	830942	1553664	23.9	870177
4	1313268	21.0	818200	1071652	18.0	765887	1313268	21.0	818200
5	-103304	1.9	171616	-422197	-2.2	100165	-86430	2.2	177675
6	-276210	0.2	143874	-689251	-5.3	47227	-225587	1.2	162052
7	-415370	-0.8	128250	-939433	-8.0	349	-314126	1.2	164606
8	-520785	-1.2	124744	-1172743	-10.4	-40471	-352044	2.1	185336
9	-592454	-0.9	133355	-1389180	-12.5	-75233	-339344	4.0	224243
10	-630379	0.1	154083	-1588744	-14.3	-103935	-276024	6.9	281327
11	-634558	1.6	186929	-1771435	-15.8	-126579	-162085	10.7	356588
12	-604992	3.9	231892	-1937254	-16.9	-143164	2473	15.6	450025
13	-575426	6.1	276856	-2103073	-18.0	-159749	217651	21.4	561639
14	-545860	8.3	321819	-2268892	-19.1	-176334	483448	28.1	691430
15	-516294	10.5	366782	-2434711	-20.3	-192919	799864	35.9	839398
16	-486728	12.8	411746	-2600530	-21.4	-209504	1166899	44.6	1005542
17	-457162	15.0	456709	-2766349	-22.5	-226089	1533935	53.3	1171686
18	-427596	17.2	501672	-2932168	-23.6	-242674	1900970	62.1	1337830
19	-398030	19.4	546636	-3097987	-24.7	-259259	2268005	70.8	1503975
20	-368464	21.7	591599	-3263806	-25.9	-275844	2635041	79.5	1670119
21	-338898	23.9	636562	-3429625	-27.0	-292429	3002076	88.2	1836263
22	-309332	26.1	681526	-3595444	-28.1	-309014	3369112	97.0	2002407
23	-279766	28.4	726489	-3761263	-29.2	-325599	3736147	105.7	2168552
24	-250200	30.6	771452	-3927082	-30.4	-342184	4103182	114.4	2334696
25	-220634	32.8	816416	-4092901	-31.5	-358769	4470218	123.1	2500840
26	-191068	35.0	861379	-4258720	-32.6	-375354	4837253	131.9	2666984
27	-161502	37.3	906343	-4424539	-33.7	-391939	5204289	140.6	2833129
28	-131936	39.5	951306	-4590358	-34.9	-408524	5571324	149.3	2999273
29	-102370	41.7	996269	-4756177	-36.0	-425109	5938359	158.1	3165417
30	-72804	43.9	1041233	-4921995	-37.1	-441694	6305395	166.8	3331561
Total	**-4,925,295**	**528**	**15,800,936**	**-69,053,068**	**-516**	**-3,222,009**	**60,476,829**	**1,788**	**39,285,993**
Average	**-170,729**	**18**	**543,037**	**-2,379,948**	**-18**	**-112,476**	**2,084,517**	**62**	**1,352,866**

Table E.2 Summary of annual refuge impacts, Grassland Alternative (undiscounted)

	Baseline			Scenario A			Scenario B		
Year	Output	Employment	Income	Output	Employment	Income	Output	Employment	Income
1	82752	2.2	66599	30723	1.6	55334	82752	2.2	66599
2	1907891	29.2	949614	1803834	27.9	927084	1907891	29.2	949614
3	1724411	27.4	911368	1568325	25.5	877572	1724411	27.4	911368
4	1540931	25.6	873122	1332816	23.0	828061	1540931	25.6	873122
5	175050	7.6	238025	-98854	4.1	176762	188812	7.9	242963
6	46614	6.8	219530	-306841	2.1	137126	87897	7.6	234344
7	-54300	6.6	210911	-501067	0.5	102428	28266	8.2	240538
8	-127693	6.9	212167	-681532	-0.9	72668	9917	9.6	261545
9	-173563	7.8	223299	-848237	-2.1	47846	32852	11.7	297366
10	-191911	9.1	244307	-1001180	-2.9	27962	97070	14.7	348001
11	-182738	11.0	275190	-1140362	-3.5	13015	202571	18.5	413449
12	-146042	13.5	315949	-1265783	-3.9	3006	349354	23.0	493710
13	-109346	15.9	356708	-1391204	-4.2	-7002	537421	28.4	588785
14	-72651	18.3	397466	-1516625	-4.5	-17011	766771	34.5	698673
15	-35955	20.8	438225	-1642046	-4.9	-27020	1037403	41.5	823374
16	741	23.2	478984	-1767467	-5.2	-37029	1349319	49.2	962889
17	37436	25.6	519743	-1892888	-5.6	-47038	1661235	56.9	1102404
18	74132	28.1	560501	-2018309	-5.9	-57046	1973151	64.7	1241919
19	110828	30.5	601260	-2143730	-6.2	-67055	2285066	72.4	1381434
20	147523	32.9	642019	-2269151	-6.6	-77064	2596982	80.1	1520949
21	184219	35.4	682778	-2394572	-6.9	-87073	2908898	87.9	1660464
22	220915	37.8	723537	-2519993	-7.3	-97082	3220814	95.6	1799979
23	257611	40.2	764295	-2645415	-7.6	-107090	3532729	103.3	1939494
24	294306	42.7	805054	-2770836	-7.9	-117099	3844645	111.1	2079010
25	331002	45.1	845813	-2896257	-8.3	-127108	4156561	118.8	2218525
26	367698	47.5	886572	-3021678	-8.6	-137117	4468476	126.5	2358040
27	404393	49.9	927331	-3147099	-8.9	-147125	4780392	134.3	2497555
28	441089	52.4	968089	-3272520	-9.3	-157134	5092308	142.0	2637070
29	477785	54.8	1008848	-3397941	-9.6	-167143	5404224	149.7	2776585
30	514480	57.2	1049607	-3523362	-10.0	-177152	5716139	157.5	2916100
Total	**8,247,610**	**812**	**17,396,911**	**-45,339,251**	**-56**	**1,611,477**	**61,585,258**	**1,840**	**36,535,867**
Average	**281,547**	**27.9**	**597,597**	**-1,564,482**	**-2.0**	**53,660**	**2,120,776**	**63.4**	**1,257,561**

Table E.3 Summary of annual refuge impacts, T & E Alternative (undiscounted)

	Baseline			Scenario A			Scenario B		
Year	**Output**	**Employment**	**Income**	**Output**	**Employment**	**Income**	**Output**	**Employment**	**Income**
1	39134	1.2	55790	-18119	0.5	43393	39134	1.2	55790
2	1820656	27.3	927995	1706150	25.8	903203	1820656	27.3	927995
3	1593557	24.5	878940	1421798	22.3	841751	1593557	24.5	878940
4	1366459	21.7	829884	1137447	18.8	780299	1366459	21.7	829884
5	-39682	2.8	185181	-341387	-1.1	117660	-24243	3.1	190720
6	-205022	1.2	158281	-594859	-4.0	67287	-158704	2.0	174898
7	-339484	0.1	142460	-832892	-6.6	22452	-246848	1.9	175694
8	-443067	-0.3	137717	-1055486	-8.9	-16844	-288673	2.7	193107
9	-515771	-0.1	144052	-1262640	-11.0	-50600	-284179	4.4	227137
10	-557596	0.7	161464	-1454355	-12.7	-78818	-233368	7.0	277784
11	-568542	2.1	189955	-1630630	-14.1	-101497	-136238	10.4	345048
12	-548609	4.0	229524	-1791466	-15.2	-118636	7210	14.8	428929
13	-528677	6.0	269093	-1952302	-16.3	-135776	196977	20.0	529428
14	-508744	8.0	308662	-2113137	-17.5	-152915	433062	26.1	646543
15	-488811	10.0	348231	-2273973	-18.6	-170055	715465	33.2	780275
16	-468879	11.9	387800	-2434809	-19.7	-187194	1044186	41.1	930625
17	-448946	13.9	427369	-2595645	-20.8	-204334	1372907	49.0	1080975
18	-429013	15.9	466938	-2756481	-22.0	-221473	1701629	56.9	1231324
19	-409081	17.8	506507	-2917317	-23.1	-238613	2030350	64.8	1381674
20	-389148	19.8	546076	-3078153	-24.2	-255753	2359071	72.8	1532023
21	-369215	21.8	585645	-3238988	-25.3	-272892	2687793	80.7	1682373
22	-349282	23.7	625214	-3399824	-26.5	-290032	3016514	88.6	1832722
23	-329350	25.7	664783	-3560660	-27.6	-307171	3345236	96.5	1983072
24	-309417	27.7	704352	-3721496	-28.7	-324311	3673957	104.4	2133422
25	-289484	29.7	743920	-3882332	-29.8	-341450	4002678	112.4	2283771
26	-269552	31.6	783489	-4043168	-30.9	-358590	4331400	120.3	2434121
27	-249619	33.6	823058	-4204003	-32.1	-375730	4660121	128.2	2584470
28	-229686	35.6	862627	-4364839	-33.2	-392869	4988842	136.1	2734820
29	-209754	37.5	902196	-4525675	-34.3	-410009	5317564	144.0	2885169
30	-189821	39.5	941765	-4686511	-35.4	-427148	5646285	152.0	3035519
Total	**-4,864,445**	**495**	**14,938,967**	**-64,465,751**	**-472**	**-2,656,665**	**54,978,802**	**1,648**	**36,408,252**
Average	**-169,089**	**17**	**513,213**	**-2,222,332**	**-16**	**-93,105**	**1,894,471**	**57**	**1,253,533**

Table E.4 Summary of annual refuge impacts, Hybrid Alternative (undiscounted)

	Baseline			Scenario A			Scenario B		
Year	Output	Employment	Income	Output	Employment	Income	Output	Employment	Income
1	72125	1.9	63650	20134	1.2	52393	72125	1.9	63650
2	1886637	28.6	943716	1782655	27.3	921203	1886637	28.6	943716
3	1692529	26.4	902522	1536557	24.5	868751	1692529	26.4	902522
4	1498422	24.3	861327	1290458	21.7	816299	1498422	24.3	861327
5	125102	6.0	224430	-150207	2.4	162634	140457	6.2	229943
6	-7586	5.0	205284	-365596	0.2	121206	38479	5.9	221821
7	-109564	4.6	197163	-565630	-1.7	85291	-17435	6.4	230236
8	-180832	4.8	200066	-750309	-3.3	54888	-27283	7.8	255188
9	-221391	5.6	213993	-919633	-4.6	29997	8933	10.1	296676
10	-231240	7.0	238944	-1073602	-5.6	10619	91213	13.2	354701
11	-210378	9.0	274921	-1212216	-6.4	-3247	219559	17.3	429263
12	-158808	11.6	321921	-1335475	-6.8	-11601	393969	22.2	520361
13	-107237	14.2	368922	-1458734	-7.2	-19955	614444	28.1	627996
14	-55666	16.8	415922	-1581994	-7.7	-28310	880984	34.8	752167
5	-4095	19.3	462923	-1705253	-8.1	-36664	1193588	42.4	892876
16	47476	21.9	509923	-1828512	-8.5	-45018	1552257	50.9	1050120
17	99047	24.5	556924	-1951771	-9.0	-53372	1910926	59.4	1207365
18	150618	27.1	603924	-2075031	-9.4	-61726	2269595	67.9	1364610
19	202189	29.7	650925	-2198290	-9.8	-70080	2628264	76.4	1521855
20	253760	32.3	697926	-2321549	-10.3	-78434	2986933	84.9	1679100
21	305331	34.8	744926	-2444808	-10.7	-86788	3345602	93.4	1836345
22	356901	37.4	791927	-2568067	-11.1	-95142	3704271	101.9	1993590
23	408472	40.0	838927	-2691327	-11.6	-103496	4062940	110.4	2150834
24	460043	42.6	885928	-2814586	-12.0	-111850	4421609	118.9	2308079
25	511614	45.2	932928	-2937845	-12.4	-120204	4780278	127.4	2465324
26	563185	47.8	979929	-3061104	-12.8	-128558	5138947	135.9	2622569
27	614756	50.3	1026929	-3184364	-13.3	-136912	5497616	144.4	2779814
28	666327	52.9	1073930	-3307623	-13.7	-145266	5856285	152.9	2937059
29	717898	55.5	1120931	-3430882	-14.1	-153621	6214954	161.4	3094304
30	769469	58.1	1167931	-3554141	-14.6	-161975	6573623	169.9	3251548
Total	**10,115,105**	**785**	**18,479,612**	**-46,858,744**	**-147**	**1,471,062**	**69,630,723**	**1,931**	**39,844,958**
Average	**346,310**	**27**	**635,033**	**-1,616,513**	**-5**	**48,920**	**2,398,572**	**67**	**1,371,769**

Appendix F

Table F.1 Present value of component output and income impacts of proposed refuge over 30 years, discount rate = 0.0% (million $)

	Output			Income		
Baseline	**FWS**	**Recreation**	**Agriculture**	**FWS**	**Recreation**	**Agriculture**
Wetland	34.78	72.08	-111.78	14.09	25.88	-24.17
Grassland	34.78	58.79	-85.32	14.09	21.09	-17.78
T&E	34.78	65.96	-105.60	14.09	23.66	-22.81
Hybrid	34.78	65.60	-90.26	14.09	23.55	-19.16
Scenario A	**FWS**	**Recreation**	**Agriculture**	**FWS**	**Recreation**	**Agriculture**
Wetland	34.78	36.04	-139.87	14.09	12.94	-30.25
Grassland	34.78	29.39	-109.51	14.09	10.55	-23.02
T&E	34.78	32.98	-132.22	14.09	11.83	-28.57
Hybrid	34.78	32.80	-64.47	14.09	11.77	-24.39
Scenario B	**FWS**	**Recreation**	**Agriculture**	**FWS**	**Recreation**	**Agriculture**
Wetland	34.78	137.48	-111.78	14.09	49.37	-24.17
Grassland	34.78	112.12	-85.32	14.09	40.23	-17.78
T&E	34.78	125.80	-105.60	14.09	45.13	-22.81
Hybrid	34.78	125.11	-90.26	14.09	44.91	-19.16

Table F.2 Present value of component output and income impacts of proposed refuge over 30 years, discount rate = 3.6% (million $)

	Output			Income		
Baseline	**FWS**	**Recreation**	**Agriculture**	**FWS**	**Recreation**	**Agriculture**
Wetland	22.62	34.17	-58.35	9.27	12.27	-12.62
Grassland	22.62	27.87	-44.54	9.27	1.00	-9.28
T&E	22.62	31.27	-55.12	9.27	11.22	-11.91
Hybrid	22.62	31.09	-47.11	9.27	11.16	-1.00
Scenario A	**FWS**	**Recreation**	**Agriculture**	**FWS**	**Recreation**	**Agriculture**
Wetland	22.62	17.08	-73.01	9.27	6.13	-15.79
Grassland	22.62	13.93	-57.16	9.27	5.00	-12.02
T&E	22.62	15.63	-69.02	9.27	5.61	-14.92
Hybrid	22.62	15.55	-59.73	9.27	5.58	-12.73
Scenario B	**FWS**	**Recreation**	**Agriculture**	**FWS**	**Recreation**	**Agriculture**
Wetland	22.62	64.05	-58.35	9.27	23.00	-12.62
Grassland	22.62	52.23	-44.54	9.27	18.74	-9.28
T&E	22.62	58.60	-55.12	9.27	21.02	-11.91
Hybrid	22.62	58.28	-47.11	9.27	20.92	1.00

Table F.3 Present value of component output and income impacts of proposed refuge over 30 years, discount rate = 7.0% (million $)

	Output			Income		
Baseline	**FWS**	**Recreation**	**Agriculture**	**FWS**	**Recreation**	**Agriculture**
Wetland	16.52	17.95	-34.31	6.85	6.44	-7.42
Grassland	16.52	14.64	-26.19	6.85	5.25	-5.46
T&E	16.52	16.43	-32.41	6.85	5.89	-7.00
Hybrid	16.52	16.33	-27.70	6.85	5.86	-5.88
Scenario A	**FWS**	**Recreation**	**Agriculture**	**FWS**	**Recreation**	**Agriculture**
Wetland	16.52	8.97	-42.93	6.85	3.22	-9.28
Grassland	16.52	7.32	-33.61	6.85	2.63	-7.07
T&E	16.52	8.21	-40.58	6.85	2.95	-8.77
Hybrid	16.52	8.17	-35.12	6.85	2.93	-7.49
Scenario B	**FWS**	**Recreation**	**Agriculture**	**FWS**	**Recreation**	**Agriculture**
Wetland	16.52	33.03	-34.31	6.85	11.86	-7.42
Grassland	16.52	26.94	-26.19	6.85	9.67	-5.46
T&E	16.52	30.23	-32.41	6.85	10.84	-7.00
Hybrid	16.52	30.06	-27.70	6.85	10.79	-5.88