



Regional Economic Effects of Current and Proposed Management Alternatives for Sand Lake National Wildlife Refuge

By Lynne Koontz and Heather Lambert



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Lynne Koontz and Heather Lambert, U.S. Geological Survey

Introduction

The National Wildlife Refuge System Improvement Act of 1997 requires all units of the National Wildlife Refuge System to be managed under a Comprehensive Conservation Plan (CCP). The CCP must describe the desired future conditions of a Refuge and provide long range guidance and management direction to achieve Refuge purposes. Sand Lake National Wildlife Refuge (NWR), located 27 miles northeast of Aberdeen, South Dakota, is in the process of developing a range of management goals, objectives, and strategies for the CCP. The CCP for Sand Lake NWR must contain an analysis of expected effects associated with current and proposed Refuge management strategies.

Special interest groups and local residents often criticize a change in Refuge management, especially if there is a perceived negative impact to the local economy. Having objective data on income and employment impacts may show that these economic fears are drastically overstated. Quite often, residents do not realize the extent of economic benefits a Refuge provides to a local community; yet at the same time overestimate the impact of negative changes. Spending associated with Refuge recreational activities such as wildlife viewing and hunting can generate considerable tourism activity for the regional economy. Refuge personnel typically spend considerable amounts of money purchasing supplies in the local lumber and hardware stores, repairing equipment and purchasing fuel at the local service stations, as well as reside and spend their salaries in the community.

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

Sand Lake NWR is currently managed to improve and maintain habitat for nesting and resting waterfowl and other migratory birds, such as diving and puddle ducks, geese, grebes, herons, egrets, gulls, and terns. There are three alternatives evaluated in the draft CCP. Alternative 1, the No Action alternative, would continue Refuge management at current levels and would not involve extensive restoration of cropland, grassland, and wetland habitat or improvements to roads, interpretive, and administrative facilities. No new funding or staff levels

would occur and programs would follow the same direction, emphasis, and intensity as they do at present. Alternative 2 would maximize the biological potential of the refuge for species of grassland-nesting birds. This would be accomplished through intense management of upland habitat for nesting migratory birds, minimal management for resident species, and minimization of public use that may interfere with migratory bird production. The third alternative takes an integrated approach, with management practices that would serve to maximize the biological potential of Sand Lake for migratory birds.

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

Regional Economic Setting

Sand Lake NWR is located in Brown County, northeast of Aberdeen, South Dakota. Brown County is part of the Glacial Lakes and Prairies Region of South Dakota and is sometimes called the heart of the Prairie-Pothole Region of North America. The County offers such attractions as the Dacotah Prairie Museum, Centennial Village, Pari-Mutual Horse Racing, Brown County Fair, and the Richmond Lake Youth Camp (Brown County, SD, 2004). Brown County has a total area of 1,713 mi² (1,096,320 acres). Aberdeen, the third largest city in South Dakota, is the county seat and the center of commerce for the region.

Aberdeen was nicknamed the "Hub City" because it served as an important intersection for many busy railroad lines. Today's "Hub City" has grown into a diverse, regional trade center with service and manufacturing industries, attractive retail shopping opportunities, convention facilities, a private college, a state university and two large medical centers (Aberdeen Area Chamber of Commerce, 2004). For the purposes of an economic impact analysis, a region (and its economy) is typically defined as all counties within a 30–60 mile radius of the impact area. Only spending that takes place within this local area is included as stimulating the changes in economic activity. The size of the region influences both the amount of spending captured and the multiplier effects. Based on the relative self-containment in terms of retail trade and distance to other communities, Brown County was assumed to comprise the economic region for this analysis.

Population, Employment, and Income

The 2000 Census estimated Brown County's population at 35,460 persons (U.S. Census Bureau). Approximately 70% of the County's residents reside in Aberdeen (Discover Aberdeen, SD, 2004). While the state of South Dakota experienced a 7.8% population increase from 1990 to 2000, Brown County's population decreased 0.4% over the same time frame (U.S. Census Bureau). In 2000, Brown County averaged 21 persons per square mile, the state average was 10 persons per square mile.

The 2000 Census reported 0.7% of the county population consisting of persons of Hispanic or Latino origin, 95.1% of white persons not of Hispanic/Latino origin, 0.3% of Black or African American persons, 2.7% of American Indian and Alaska Native Persons, and 0.4% of Asian persons. Approximately, 86% of the county population 25 years and older were high school graduates, and 24% were college graduates (US Census Bureau). There are two colleges in Aberdeen, Northern State University and Presentation College.

According to the Discover Aberdeen website, the major employers in Aberdeen are hospital/health service, education, manufacturing, hotel reservations, agriculture, higher education, call center, and support services. South Dakota's major exports include computers and electronic production, machinery manufactures, processed foods, and crop production (U.S. Department of Commerce, 2002). Local and state employment is shown in Table 1. In 2000, 83.5% of County jobs were in private wage and salary employment (people who work for someone else) as compared to 79.2% for the State of South Dakota.

Table 1. Industry breakdown of full time and part time employment for 2000.

Industry	Brown County		State of South Dakota	
	# of jobs	% of county total	# of jobs	% of state total
Total farm	1,205	4.5	37,659	7.2
Total nonfarm	25,650	95.5	483,677	92.8
Private	22,431	83.5	412,957	79.2
Agricultural services, forestry, and fishing	282	1.1	7,705	1.5
Mining	(L)	---	1,552	0.3
Construction	1,416	5.3	27,956	5.4
Manufacturing	2,483	9.2	52,030	10.0
Transport/utilities	939	3.5	22,727	4.4
Wholesale trade	1,393	5.2	21,652	4.2
Retail trade	5,148	19.2	89,412	17.2
Insurance/real estate	1,897	7.1	42,523	8.2
Services	8,868	33.0	147,400	28.3
Government	3,219	12.0	70,720	13.6
Total full-time and part time employment	26,855		521,336	

Source: U.S. Department of Commerce, Bureau of Economic Analysis, Regional Economic Information System, 2002. *(L) less than 10 jobs, but the estimates for this item are included in the totals.

Hunting, fishing, camping, boating, cross-country skiing, bird watching, biking, and snowmobiling are important tourism activities in Brown County. Most jobs pertaining to the recreation and tourism industry are found in the retail trade (spending on supplies, souvenirs, restaurants, and grocery stores) and service (spending on hotels, gas stations, amusement, and recreation activities) sectors in an economy. As shown in Table 1, service and retail trade industries account for 33% and 19% of total County employment respectively.

As shown in Table 2, County per capita personal income was \$28,421 in 2000, which was \$2,606 higher than the state average (U.S. Department of Commerce, 2002). Total personal income was just over 1.0 billion for Brown County in 2000 (Table 2). In 2000, non farm personal income for Brown County totaled almost \$960 million which accounted for 5.2% of total statewide non farm personal income, while Brown County farm related income accounted for 4.5% of total statewide farm income.

Table 2. Personal income for Brown County and South Dakota, 2000.

	Brown County	State of South Dakota
Personal income	\$1,005,276,000	\$19,510,589,000
Nonfarm personal income	\$958,962,000	\$18,475,437,000
Farm income	\$46,314,000	\$1,035,152,000
Per capita personal income	\$28,421	\$25,815

Source: U.S. Department of Commerce, Bureau of Economic Analysis, Regional Economic Information System, 2002.

Economic Impacts of Current and Proposed Management Activities

Economic impacts are typically measured in terms of number of jobs lost or gained, and the associated result on income. Economic input-output models are commonly used to determine how economic sectors will and will not be affected by demographic, economic, and policy changes. The economic impacts of the management alternatives for Sand Lake NWR were estimated using IMPLAN, a regional input-output modeling system developed by the USDA Forest Service (Minnesota IMPLAN Group, 2002).

IMPLAN is a computerized database and modeling system that provides a regional input-output analysis of economic activity in terms of 10 industrial groups involving as many as 528 sectors (Olson and Lindall, 1996). The year 2000 Brown County IMPLAN data profile was used in this study. IMPLAN estimates for employment include both full time and part time workers which are measured in total jobs. The IMPLAN county level employment data estimates were comparable to the US Department of Commerce, Bureau of Economic Analysis, Regional Economic Information System data at the 1 digit Standard Industrial Code level for the year 2000.

Refuge Staffing and Budgeting

For the current conditions, (Alternative 1) staffing at the Refuge consists of 13 permanent and four temporary/seasonal employees. The current staff accounted for an annual payroll (including salaries and benefits) of \$910,600 in 2003. In addition to providing salaries and benefits, the Refuge purchased goods and services totaling \$165,200 in 2003, approximately 65% of which was spent locally in the Brown County economy.

For Alternative 2, the anticipated staffing and non salary expenditures are the same as current conditions. Under Alternative 3 staffing needs are expected to increase by six permanent employees and one permanent half time employee. Including salaries and benefits, annual funding needed for the proposed personnel/staffing for Alternative 3 is anticipated to cost \$1,171,250 (which is \$260,650 more than Alternative 1). Annual non salary expenditures for Alternative 3 are anticipated to cost \$398,600 annually (which is \$233,400 more than Alternative 1). For each alternative, it is assumed that approximately 65% of non salary expenditures will still be spent locally in the Brown County economy. Table 3 summarizes the anticipated annual expenditures by management alternative.

Table 3. Refuge staffing and budgeting expenditures by management alternative.

	Annual expenditures by alternative		
	Alt 1	Alt 2	Alt 3
Salary	\$910,600	\$910,600	\$1,171,250
Non-salary	\$165,200	\$165,200	\$398,600
Total	\$1,075,800	\$1,075,800	\$1,569,850

Because of the way industries interact in an economy, a change in the activity of one industry affects activity levels in several other industries. For example, an increase in funding could allow the Refuge to start new projects or hire additional staff members. This added revenue will directly flow to the businesses from which the Refuge purchases goods and services and to the new Refuge employees. As additional supplies are purchased or as new staff members spend their salaries within the community, local businesses will purchase extra labor and supplies to meet the increase in demand for additional services. The income and employment resulting from Refuge purchases and Refuge employees' spending of salaries locally represents the *direct* effects of Refuge management activities within Brown County. In order to increase supplies to local businesses, input suppliers must also increase their purchases of inputs from other industries. The income and employment resulting from these secondary purchases by input suppliers are the *indirect* effects of Refuge management activities within the county (Stynes, 1998). The input supplier's new employees use their incomes to purchase goods and services. The resulting increased economic activity from new employee income is the *induced* effect of visitor spending. The sums of the direct, indirect and induced effects describe the total economic effect of Refuge management activities in Brown County.

Table 4 shows the economic impacts associated with current and proposed management staffing. IMPLAN estimates for employment include both full time and part time workers which are measured in total jobs. The current level (Alternative 1) of Refuge personnel directly accounts for 14.6 jobs and almost \$584,000 in personal income. The associated indirect and induced effects generate an additional 7.6 jobs and \$174,000 in personal income throughout the Brown County economy for a total economic impact of 22.2 jobs and almost \$758,000 associated with the current level of Refuge personnel. For Alternative 2, the staffing levels and economic impacts are the same as for Alternative 1. Due to the increased staffing levels for Alternative 3 (Table 3), the associated economic effects generate more jobs and income than Alternative 1 and 2.

Table 5 shows the economic impacts associated with current and proposed management non salary spending in Brown County. For each alternative, it is assumed that 65% of the non salary expenditures reported in Table 3 are spent locally in the Brown County economy. The current level (Alternative 1) of Refuge non salary expenditures directly accounts for 4.1 jobs and almost \$51,000 in personal income. The associated indirect and induced effects generate an additional 1.3 jobs and almost \$32,000 in personal income throughout the Brown County economy for a total economic impact of 5.4 jobs and almost \$83,000 in personal income associated with the current level of Refuge non salary spending in the local economy. For Alternative 2, the non salary spending levels and economic impacts are the same as for Alternative 1. Due to the increased non salary spending levels for Alternative 3 (Table 3), the associated economic effects generate more jobs and income than Alternative 1 and 2.

Table 4. Local economic impacts of refuge staffing expenditures.

Brown County	Alternative 1	Alternative 2	Alternative 3
<i>Salary Impacts (excludes benefits)</i>			
Direct effects (federal government sector)			
Income (\$/year)	\$583,596	\$583,596	\$770,398
Jobs	14.6	14.6	19.3
Indirect and induced effects (in Brown County economy)			
Income (\$/year)	\$174,181	\$174,181	\$229,935
Jobs	7.6	7.6	10.0
Total effects			
Income (\$/year)	\$757,777	\$757,777	\$1,000,333
Jobs	22.2	22.2	29.2

Table 5. Economic impacts of refuge non salary expenditures in Brown County.

Brown County	Alternative 1	Alternative 2	Alternative 3
<i>Non salary impacts (65% of total non salary expenditures spent locally)</i>			
Direct effects			
Income (\$/year)	\$50,882	\$50,882	\$122,771
Jobs	4.1	4.1	9.8
Indirect and induced effects (in Brown County economy)			
Income (\$/year)	\$31,738	\$31,738	\$76,577
Jobs	1.3	1.3	3.1
Total effects			
Income (\$/year)	\$82,620	\$82,620	\$199,348
Jobs	5.4	5.4	12.9

Table 6 presents the combined economic impacts associated with refuge staffing and non salary spending in Brown County. Refuge management activities currently generate 27.6 jobs and over \$840,000 in personal income in Brown County. This accounts for less than one-tenth of one percent (0.1%) of total employment in Brown County. Refuge management activities associated with Alternative 2 would generate the same as Alternative 1. The higher staffing and spending levels associated with Alternative 3 would generate more jobs and income than Alternative 1.

Table 6. Combined refuge staffing and non salary expenditures in Brown County.

Brown County	Alternative 1	Alternative 2	Alternative 3
Total refuge staffing and budgeting impacts <i>(salary and non-salary)</i>			
Direct effects			
Income (\$/year)	\$634,478	\$634,478	\$893,169
Jobs	18.7	18.7	29.1
Indirect and induced effects (in Brown County economy)			
Income (\$/year)	\$205,919	\$205,919	\$306,512
Jobs	8.9	8.9	13.1
Total effects			
Income (\$/year)	\$840,397	\$840,397	\$1,199,681
Jobs	27.6	27.6	41.2
% of total county income	0.08	0.08	0.12
% of total county jobs	0.10	0.10	0.15

Recreation Activities

The Refuge offers a wide variety of year round accessible recreational opportunities that are wildlife compatible. Wildlife observation, bird watching, education, photography, hunting and fishing are all popular activities. The Refuge is a nationally recognized wildlife sanctuary and offers opportunities for the big game hunter, upland game hunters, and waterfowl hunters. Pheasant hunting draws outdoorsmen from across the country each fall, and duck and goose hunters set decoys on the many small lakes and marshes that dot the prairie pothole country. Fishing is allowed year round at five locations on the Refuge.

Major visitor expenditure categories include lodging, food, and supplies. To determine the local economic impacts of visitor spending, only spending by persons living outside the local area (Brown County) are included in the analysis. The rationale for excluding local visitor spending is two fold. First, money flowing into Brown County from visitors living outside is considered new money injected into the Brown County economy. Second, if Brown County residents visit Sand Lake NWR more or less due to the management changes, they will correspondingly change their spending of their money elsewhere in Brown County, resulting in no net change to the local economy. These are standard assumptions made in most regional economic analyses at the local level.

In order to accurately estimate the amount of spending associated with Refuge visitation, visitors must be divided by type of activity and place of residence (local County residents, non local South Dakota residents, and nonresidents). Sand Lake NWR annual visitation was estimated based on the 2003 Refuge annual visitation estimates. The Refuge bases visitation estimates on visitors entering the Visitor Center/Office and general observation. Estimates on the percentage of visitors by place of residence were provided by Refuge personnel. Table 7 summarizes estimated Refuge visitation by type of visitor activity and percentage of visitors by place of residence.

Table 7. Estimated annual refuge visitation by visitor activity and place of residence.

	Total # of visitors	Percentage (%) of local Brown County visitors	Percentage (%) of non local South Dakota Visitors	Percentage (%) of nonresident visitors (live outside of South Dakota)
Total estimated visitors	43,281			
Non-consumptive users				
Interpretation/observation	32,140	50	25	25
Environmental education	3,862	80	10	10
Hunting				
Migratory bird	3,200	40	30	15
Upland game	3,600	50	45	20
Big game	4,100	60	30	10
Fishing	2,900	90	9	1

A key step in estimating total visitor spending is the development of visitor spending profiles. Average daily travel related expenditure profiles for various recreation activities derived from the 1996 National Survey of Hunting, Fishing and Wildlife Related Recreation (U.S. Department of the Interior, 1996) by the U.S. Forest Service (Niccolucci and Winter, 2002) were used in this analysis. For each type of visitor activity, the Survey reports trip related spending of state residents and non residents for several different recreational activities. State resident and nonresident spending profiles for big game hunting, small game hunting, migratory bird hunting, and fresh water fishing were used for the Sand Lake NWR hunting and fishing related visitor activities. The state resident and nonresident spending profiles for non-consumptive wildlife recreation (observing, feeding, or photographing fish and wildlife) were used for interpretation/observation and environmental education visitors at Sand Lake NWR. For each visitor activity, spending is reported in the categories of lodging, food and drink, transportation, and other expenses. Total spending per day for state residents and nonresidents by visitor activity is reported in Table 8.

Table 8. Time spent on the refuge and spending per day for each visitor activity.

	Average state resident spending per day	Average nonresident spending per day
Interpretation/observation and environmental education	\$7	\$104
Waterfowl hunting	\$17	\$23
Upland game hunting	\$18	\$208
Big game hunting	\$20	\$31
Fishing	\$25	\$44

Source: Niccolucci and Winter (2002).

Visitor spending is typically estimated on an average per day (8 hours) or average per trip basis. In order to properly account for the amount of spending associated with each type of refuge visitor, it is important to determine the average length of trip. Refuge personnel estimate that visitors participating in interpretation/observation and environmental education activities

typically spend 4 hours on the Refuge, visitors participating in fishing activities spend 3 hours, waterfowl hunters usually spend a half day (4 hours), upland game hunters spend 6 hours, and big game hunters spend a day (8 hours) on the Refuge. Because the visitor spending profiles are for an 8 hour visitor day, the number of 8 hour state resident and nonresident visitor days for each visitor activity must be calculated. The current number of visitor days per activity is shown in Table 9.

Table 9. Annual number of non local visitor days per activity for Alternative 1.

	Number of non local South Dakota visitors	Number of nonresident visitors	Estimated time spent at Sand Lake NWR	Number of non local South Dakota resident visitor days¹	Number of nonresident visitor days¹
Interpretation/observation	8,035	8,035	4 hours	4,018	4,018
Environmental education	386	386	4 hours	193	193
Waterfowl hunting	960	480	4 hours	480	240
Upland game hunting	1,620	720	6 hours	1,215	540
Big game hunting	1,230	410	8 hours	1,230	410
Fishing	261	29	3 hours	98	11
Total				7,233	5,411

¹One visitor day = 8 hours.

Total visitor spending is determined by multiplying the total spending per day (Table 8) by the number of non local visitor days for each visitor activity (Table 9). Current Refuge visitors spend about \$655,500 annually in the Brown County economy. Table 10 shows the economic impacts associated with current visitation and anticipated changes in visitation by management alternative. The current level (Alternative 1) of visitor spending directly generates over \$152,000 in personal income and 9.4 jobs for local businesses accommodating visitors (hotels, restaurants, supply stores, and gas stations).

The associated indirect and induced effects generate an additional 4.3 jobs and over \$102,000 in personal income throughout the Brown County economy for a total economic impact of 13.7 jobs and over \$254,000 in personal income associated with the current level of Refuge visitation. For Alternative 2, Refuge personnel estimate visitation declining by 30% as compared to Alternative 1. For Alternative 3, visitation is anticipated to increase by 25% as compared to Alternative 1. The resulting economic impacts associated with Refuge visitation for Alternatives 2 and 3 are presented in Table 10.

As shown in Table 10, the economic impacts associated with current Refuge visitation are limited in terms of contributing to the overall county income and employment. Any decrease in visitation associated with a change in Refuge management will not have a significant economic effect. An increase in the amount of time current visitors spend on the Refuge will increase the amount of daily spending that can be attributed to visiting the Refuge. An increase in both the length of stay on the Refuge (and in the local economy) and the number of people visiting the Refuge could have a considerable impact on increasing the role Refuge visitors play in the local economy.

Table 10. Economic impacts of Sand Lake NWR visitor spending by alternative.

Brown County	Alternative 1	Alternative 2	Alternative 3
Visitor spending impacts			
Direct effects			
Income (\$/year)	\$152,076	\$106,453	\$190,095
Jobs	9.4	6.6	11.8
Indirect and induced effects (in Brown County economy)			
Income (\$/year)	\$102,263	\$71,584	\$127,829
Jobs	4.3	3.0	5.4
Total Effects			
Income (\$/year)	\$254,339	\$178,037	\$317,924
Jobs	13.7	9.6	17.1
% of total county income	0.03	0.02	0.03
% of total county jobs	0.05	0.04	0.06

Summary and Conclusions

Table 11 summarizes the direct and total economic impacts for all Refuge management activities for each management alternative. Under current Refuge management (Alternative 1), economic activity directly related to all Refuge operations would generate an estimated 28.1 jobs and over \$786,500 in personal income in Brown County. Including direct, indirect, and induced effects, all Refuge activities would account for 41.3 jobs and \$1.09 million in personal income in Brown County (Table 11). Current Refuge management activities account for 0.15% of total county employment and 0.11% of county income.

Table 11. Summary of all refuge management activities by alternative.

Brown County	Alternative 1	Alternative 2	Alternative 3
Total refuge staffing and budgeting impacts			
Direct effects			
Income (\$/year)	\$634,478	\$634,478	\$893,169
Jobs	18.7	18.7	29.1
Total effects			
Income (\$/year)	\$840,397	\$840,397	\$1,199,681
Jobs	27.6	27.6	41.2
Recreation activities			
Direct effects			
Income (\$/year)	\$152,076	\$106,453	\$190,095
Jobs	9.4	6.6	11.8
Total effects			
Income (\$/year)	\$254,339	\$178,037	\$317,924
Jobs	13.7	9.6	17.1
Aggregate impacts			
Direct effects			
Income (\$/year)	\$786,554	\$740,931	\$1,083,264
Jobs	28.1	25.3	40.9
Total effects			
Income (\$/year)	\$1,094,736	\$1,018,434	\$1,517,605
Jobs	41.3	37.2	58.3
% of total county income	0.11	0.10	0.15
% of total county employment	0.15	0.14	0.22

Table 12 summarizes the economic effects associated with management changes from Alternative 1. Alternative 2 will slightly decrease employment by 4.1 jobs and personal income by \$76,000 in Brown County because of anticipated decreases in Refuge visitation. Alternative 3 will increase employment by 17 jobs and personal income by over \$422,000 in Brown County because of proposed increases in staffing, non salary expenditures and Refuge visitation.

Table 12. Economic effects associated with changing from Alternative 1.

Brown County	Alternative 2	Alternative 3
Total refuge staffing and budgeting impacts		
Direct effects		
Income (\$/year)	\$0	+\$258,691
Jobs	0	+10.4
Total effects		
Income (\$/year)	\$0	+\$359,284
Jobs	0	+13.6
Recreation activities		
Direct effects		
Income (\$/year)	-\$45,623	+\$38,019
Jobs	-2.8	+2.4
Total effects		
Income (\$/year)	-\$76,302	+\$63,585
Jobs	-4.1	+3.4
Aggregate impacts		
Direct Effects		
Income (\$/year)	-\$45,623	+\$296,710
Jobs	-2.8	+12.8
Total effects		
Income (\$/year)	-\$76,302	+\$422,869
Jobs	-4.1	+17.0

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