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Economic Impacts of White-tailed Deer Hunting in Mississippi

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Abstract: We conducted a five-year study during the 2001–2005 hunting seasons to determine the economic impacts of white-tailed deer (*Odocoileus virginianus*) hunting in Mississippi. Activity days for state residents ranged from 2,390,619 to 3,181,957 and for non-residents, 265,103 to 357,253. Total economic impacts ranged from US \$761 million to \$1.03 billion (in 2007 dollars). Over the five years, number of full- and part-time jobs supported by deer hunting activities ranged from 26,489 to 37,888. Aggregated economic sectors benefiting the most were services, manufacturing, and trade. State-wide economic multipliers were low (from 1.63 to 1.65) compared to other types of recreation expenditures but nevertheless represent a \$1.63 to \$1.65 return on every dollar spent on white-tailed deer hunting in Mississippi. Our results suggested that white-tailed deer hunting and its associated economic impacts were the largest for hunting of any species in Mississippi and is important to the state economy. We recommend that our results, which provide a measure of importance to white-tailed deer, be used by wildlife managers in the southeastern United States to help facilitate the assessment and prioritization of wildlife management decisions on issues related to research endeavors, habitat management, clientele expectations and satisfaction, and controversial issues such as baiting and wildlife diseases.

Key words: economic impacts, deer hunting, Mississippi, white-tailed deer, wildlife economics

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Recreational hunting of white-tailed deer (*Odocoileus virginianus*) contributes to the economy in Mississippi and the United States. In 2001, there were 10.3 million white-tailed deer hunters in the United States, which is more than four times greater than the number of hunters of eastern wild turkey (*Meleagris gallopavo*), the second most hunted species (USDI and USDC 2002). In the same year, approximately 357,000 hunters devoted 8.4 million recreational days to white-tailed deer hunting in Mississippi (USDI and USDC 2002). Approximately one-third of hunters were from other states and their trip-related expenses in Mississippi exceeded \$71.9 million. In comparison, resident hunting trip-related expenses in Mississippi exceeded \$288.3 million.

There have been a number of biological studies of white-tailed deer in the United States (Rooney 2001, Tremblay et al. 2004) and Mississippi (Ford et al. 1997, Strickland and Demarais 2000). While there have been a few studies that quantified economic impact assessments of hunting for species such as northern bobwhite (*Colinus virginianus*, Burger et al. 1999), eastern wild turkey (Grado et al. 1997), and waterfowl (*Anas* spp., Grado et al. 2001), collecting economic impact data on white-tailed deer hunting in Mississippi has been non-existent.

Economic analyses can provide information necessary for assessing and prioritizing wildlife management decision-making.

With increasing demands on natural resources, wildlife management agencies must effectively measure harvests, hunter utilization, hunter satisfaction, and economic values. These measures are useful in setting regulations (e.g., licensing, funding initiatives) and evaluating past and future management practices. Land-use planners, the business community, and policy makers also can use this information to identify wildlife values for multiple-use resource planning, the initiation of business opportunities, and marketing (Grado et al. 2001). Land-use policies that might affect white-tailed deer and services, businesses, and industries that depend on it also can be evaluated.

Economic assessments centering on input-output analysis describe: 1) how hunting activities impact an economy, 2) the value of hunting to the participant, and 3) how hunting-related expenditures benefit services and other businesses that cater to hunters as well as the overall economy (Olson and Lindall 2000). Residents tied to local businesses, directly or indirectly benefit from hunting-related expenditures, especially in rural areas where hunting activities occur and other sources of income may be limited (Powell et al. 1994, Marsinko et al. 1998). Leonard (2004) reported that white-tailed deer hunters per capita spent more than two to three times the amount on land purchases, ownership, and leasing compared to non-white-tailed deer hunters.

Economic impact studies provide information to states and regions about the social and economic impacts of proposed projects and programs (Loomis and Walsh 1997). Several studies have taken hunting trip and long-term expenditures (e.g., weapons, equipment) and generated economic impacts. For example, Grado et al. (2001) assessed the economic impact of waterfowl hunting in Mississippi and reported that the estimated economic impact was \$27.4 million (in 1999 dollars), with 512 full- and part-time jobs supported. With these findings, waterfowl managers in Mississippi were able to justify and allocate resources to manage waterfowl and create off-site accommodations and services for hunters, thus potentially enhancing economic impacts.

Economic impact studies of white-tailed deer hunting in Mississippi could help create a reliable database for management of the state's most important game species. Additionally, while studies on white-tailed deer hunting expenditures have looked at a economic activity from a single year (e.g., Leonard 2004), more long-term data sets are needed to make reliable conclusions on economic impact. This information would be useful because it quantifies the monetary value of white-tailed deer which can be used in assessing and prioritizing decisions on land-use policies and resource allocation. In addition, resource managers need economic impact estimates to support allocation of funds to adequately combat potential wildlife health concerns such as chronic wasting disease (CWD) in white-tailed deer.

Our study had three objectives for quantifying and discussing the importance of economic impacts associated with white-tailed deer hunting in Mississippi. These were:

- 1) determining white-tailed deer hunting expenditures and activity days in Mississippi by residents and non-residents,
- 2) quantifying economic impacts and multipliers of white-tailed deer hunting on the Mississippi's economy from hunting-related expenditures, and
- 3) discussing the importance of these economic impacts and their management implications.

Methods

Mail Survey Process

Our economic impact analyses of white-tailed deer hunting activities in Mississippi used information provided by the annual "Survey of Mississippi Resident and Non-Resident Hunters" implemented by the Human Dimensions and Conservation Law Enforcement Laboratory (HDCLEL) at Mississippi State University covering the 2001 through 2005 hunting seasons. Since our sample population was geographically dispersed and we wanted respondents to recall, at their convenience, a typical hunting trip, the self-administered mail questionnaire was the best option. This

was also the best way to reach those who hunt exclusively on private lands where access by researchers may be more difficult.

The Mississippi Department of Wildlife, Fisheries, and Parks (MDWFP) provided a randomized listing of licensed hunter names and addresses. Five surveys composed by HDCLEL were used for our study. For 2001, we contacted 5,000 resident and 5,000 non-resident hunters. For 2002, we contacted 5,000 residents and 3,000 non-residents. For 2003, we contacted 3,000 residents and 3,000 non-residents. For 2004, we contacted 4,000 residents and 3,000 non-residents. For 2005, we contacted 4,000 residents and 4,000 non-residents.

For each season, the first mailing was sent with a cover letter, questionnaire, and postage paid return envelope. One week later a reminder postcard was sent to the entire sample, regardless of whether they returned a questionnaire or not. Two weeks after sending the postcard, a second survey mailing was sent to hunters that had not returned a questionnaire. Three weeks later, a third survey mailing was made.

Mail Survey Data

Our self-administered mail questionnaire collected information on hunter characteristics, trip characteristics, trip expenditures, and long-term expenditures from white-tailed deer hunters in Mississippi. A mail survey is the preferred method of collecting expenditure data versus on-site surveys (Dillman 1978). All questions and research procedures were approved by the Mississippi State University Institutional Review Board's Committee for the Protection of Human Subjects (Docket No. 03-162).

Our self-administered HDCLEL surveys gathered information on hunter expenditures (2001 only) and activity days for all seasons. An activity day is one hunter's participation in the hunting activity for some portion of a day. Economic data used to develop hunter expenditure profiles and resident and non-resident activity days was acquired from licensed hunters who completed and returned the questionnaire for statewide economic impact. Participants were asked how many days they hunted white-tailed deer using any of the following methods: archery, primitive weapon, or gun; both within and outside Mississippi. We also asked hunters if they hunted using more than one method on a particular day and, if so, to count a day for each method. The activity day data was then entered into SAS (2003) and a program written to calculate average effort. Averages were then extrapolated to the entire eligible licensed population of white-tailed deer hunters for that season.

To assist in meeting our first objective, we calculated expenditures related to a white-tailed deer hunting for use in an input-output model of the state economy. Equipment expenditures in

addition to total trip expenditures were collected for our study. Dollars spent per hunter per day were assessed from questionnaire data. First, the total amount of individual trip expenditures was itemized (e.g., by gasoline, food). These items were then divided by the average number of days of a typical hunt by the individual. Second, equipment-related items, purchased within the past year, were divided by the average number of days used during the hunting season. Of note, in the survey we asked hunters to provide information on leasing for all species without separating out for deer hunting leases; therefore, leasing expenses were not included in this profile. Resident and non-resident expenditure profiles (\$/hunter/day) were then developed by averaging these values and dividing them by the total number of hunters reporting expenditures.

We collected demographic information to establish who was making these expenditures and to pinpoint purchase locations. We asked respondents for their state and county of residence. A map of Mississippi was provided in the questionnaire so the respondent could circle the county where the hunting trip took place. Demographic questions in the questionnaire included education level, income, age, ethnic background, and gender.

Resident and non-resident non-respondent phone surveys were conducted after the 2001 survey to determine whether respondents and non-respondents significantly differed on a subset of items collected in the questionnaire. From a list of 200 resident non-respondents, 81 hunters agreed to participate in the follow-up phone survey; 88 of 200 non-resident non-respondents agreed. Non-respondents were asked to indicate their age, years hunted, and days deer hunted in Mississippi in the 2001 season, and whether they subscribed to hunting magazines, belonged to a national hunting organization, lived in a household with an all-terrain vehicle (ATV), and how hunting compared to their other outdoor activities. For variables with interval measurement (i.e., age, years hunted, days hunted), a Student's *t*-test was used for analysis. We tested the remaining variables using a chi-square test (i.e., income, education).

Economic Impact Analysis

Economic impacts of recreational activities have been derived using various model software, one of which is the Impact Analysis for Planning (IMPLAN, Olson and Lindall 2000). This software, originally developed by the USDA Forest Service to evaluate impacts of their forest management plans, consists of both national and county level data for 509 industrial and commercial sectors. IMPLAN software uses economic data from an area of interest (e.g., the state of Mississippi or an aggregation of selected counties) to construct a model of its economy. To assist with our sec-

ond objective, an in-depth assessment of expenditures on this economy is essential when fully analyzing economic impacts. For example, while direct impacts (e.g., sales, salaries, wages, and jobs created) from retail goods (e.g., gasoline) are important, where the retail good is manufactured (an indirect impact) also is of interest. Secondary impacts, such as indirect impacts resulting from inter-industry trade within a defined economy, are important as well. Indirect impacts also include induced impacts or household consumption originating from employment tied to both direct and indirect activities (Grado et al. 2001).

To also assist in meeting our second objective, we used the most current data on the Mississippi economy (i.e., 2004) and the IMPLAN software to build a model of the Mississippi economy and generate direct and secondary impacts resulting from in-state participant expenditures. We developed itemized hunter expenditure profiles (\$/hunter/day) from our surveys as inputs in the IMPLAN model. We organized in-state expenditures made on behalf of white-tailed deer hunting activities into final demands on state industries and businesses where each item was entered separately and within the appropriate economic sector. For example, the lodging expense per hunter per day was affiliated with sector 479 in the IMPLAN model for Mississippi. For reporting purposes, economic impacts derived from the 509 industrial sectors were aggregated by the IMPLAN program into nine generally accepted categories.

To meet our second and third objectives, we derived multipliers from the economic impact analysis to assess relationships within economies of interest (Loomis and Walsh 1997). We used the Social Accounting Matrix (SAM) multiplier, which is the total impacts for a state or region divided by the direct impacts. The SAM multiplier illustrates the magnitude of direct impacts in promoting total economic impacts. For example, as hunters purchase goods and services during their trips, the money spent makes its way to other sectors of the economy; this extent is quantified by the SAM multiplier (Cooper et al. 2002). Leakages (i.e., dollar outflows of expenditures leaving the state economy to purchase unavailable goods or services) are illustrated by the strength or weaknesses of multipliers and were accounted for during the generation of model results.

In-state resident and non-resident (including Mississippi land-owners living outside the state) expenditures were used to measure economic impacts produced by white-tailed deer hunting. As a cautionary note, some researchers have discounted using all resident expenditures to derive economic impacts (Strauss et al. 1995, Grado et al. 2001). However, our study reported on all resident expenditures, because they translated into impacts with the understanding that they should be reduced in part. For non-

residents, dollars spent in the economy represent an influx of new money to the state industrial and commercial bases, and are considered impacts in the purest sense.

Results

Response rates for resident studies ranged from 41.2% to 50.3% across survey years. Non-resident response rates were greater than non-residents, and ranged from 53.4% to 65.2%. For 2001, response rates were 46.4% for residents and 53.4% for non-residents. Social and economic characteristics of respondents were relatively consistent across survey years. Resident hunters were primarily males in their early forties, with a median household income category of \$50,000–\$59,999 and having some college experience (Table 1). In general, non-resident hunters were predominately male (>97.0%), were slightly older, and had higher median household incomes compared to residents. Education levels between residents and non-residents were relatively consistent across studies (Table 1). Anglo-white hunters comprised over 97% of both resident and non-resident hunters in each survey year.

Resident and non-resident expenditure profiles were developed from reported expenditures for trip-related items and equipment divided by the total number of hunters reporting expenditures. Average expenditures incurred for various trip-related goods and services for residents and non-residents per day in Mississippi during the 2001 hunting season were \$49.97/hunter/day and \$90.27/hunter/day, respectively (Table 2). Average expenditures incurred for equipment and other long-term items for residents and non-residents in Mississippi during the 2001 hunting season were \$111.11/hunter/day and \$138.32/hunter/day, respectively (Table 3). We used the expenditure profiles for all five years of this study; however, activity days were determined for each hunting season. Activity days for state residents and non-residents during the 2001 hunting season were 3,065,770 and 357,253, respectively. For the 2002, 2003, 2004, and 2005 hunting seasons, activity days for state residents and non-residents were 3,181,957; 2,390,619; 2,759,000; 2,666,273 and 304,921; 271,140; 265,103; and 284,913, respectively.

Resident non-respondent surveys indicated that respondents had hunted more years on average than non-respondents, hunted more days for deer in the 2001 hunting season, were younger, and rated hunting as slightly more important to them as an outdoor recreation activity (Tables 4 and 5). There were no significant differences between resident respondents and non-respondents on whether they belonged to a hunting club or organization, subscribed to hunting magazines, or household ATV ownership (Table 5). Non-resident non-respondent surveys indicated no significant differences between respondents and non-respondents on any of

Table 1. Socio-economic characteristics of resident and non-resident white-tailed deer hunters responding to surveys of Mississippi resident and non-resident hunters, 2001 through 2005.

Survey season year	Resident ^a status	Gender (% male)	Average age	Median household income \$	Education level (% with at least some college)
2001	Resident	93.1	42.8	50,000–59,999	–
	Non-resident	97.7	46.6	70,000–79,999	–
2002	Resident	94.3	40.8	50,000–59,999	50.0
	Non-resident	98.0	48.3	70,000–79,999	44.6
2003	Resident	93.8	43.5	50,000–59,999	46.6
	Non-resident	97.3	47.2	60,000–69,999	45.4
2004	Resident	93.8	43.2	50,000–59,999	49.9
	Non-resident	97.0	47.7	60,000–69,999	49.1
2005	Resident	93.1	44.4	50,000–59,999	47.2
	Non-resident	97.6	47.6	80,000–89,999	49.0

a. "Residents" are citizens of Mississippi and "non-residents" live outside the state.

Table 2. Average expenditures incurred for goods and services for residents ($n = 1,211$) and non-residents ($n = 1,355$) per day by all hunters in Mississippi during the 2001 hunting season.

Expenditure item	Resident ^a	Non-resident ^a
Automobile transportation (e.g., fuel, rental car)	9.50	12.97
Other transportation (e.g., airplane)	1.91	3.31
Daily public land use permit	0.64	0.87
Daily private land use permit (not including hunting leases)	0.31	2.76
Boating (if used for hunting)	0.79	0.78
Lodging (e.g., hotel and hotel food, condo rental, camping)	4.79	9.61
Food, drinks, and ice (including restaurants)	10.49	19.56
Heating and cooking fuel	1.76	2.71
Guide fees or hunting package fees	2.04	12.67
Processing and taxidermy	14.04	9.34
Anything else for this trip in Mississippi	3.70	15.69
Total day expenditure	49.97	90.27

a. "Residents" are citizens of Mississippi and "non-residents" live outside the state.

Table 3. Average expenditures incurred for durable items for residents ($n = 1,237$) and non-residents ($n = 825$) in Mississippi during the 2001 hunting season.

Expenditure item	Activity day average	Resident ^a	Non-resident ^a
Guns and rifles	30	13.07	7.74
Bows, arrows, archery equipment	30	3.30	2.32
Ammunition	30	1.65	1.07
Decoys and calls	15	0.58	0.24
Boat and trailer	51	7.56	4.44
ATV and trailer	91	39.06	28.82
Hunting dogs and associated expenses	25	2.29	0.99
Binoculars, scopes, telescopes, etc.	20	4.57	2.76
Hunting clothing and boots	30	7.38	4.78
Total day expenditure		111.11	138.32

a. "Residents" are citizens of Mississippi and "non-residents" live outside the state.

Table 4. Comparisons of respondent and non-respondents on age, years hunted, and days deer hunted in the 2001 Mississippi white-tailed deer hunting season.

Variable	Residence status ^a	Sample size (respondent, non-respondent)	Respondent mean (SD)	Non-respondent mean (SD)	t-value	Significance
Age	Resident	1,984; 81	42.0 (12.1)	47.0 (12.2)	2.04	0.040
	Non-resident	2,297; 88	46.6 (11.9)	45.3 (12.1)	1.00	0.317
Years hunted	Resident	1,938; 81	29.5 (13.3)	25.5 (13.6)	2.62	0.008
	Non-resident	2,282; 88	31.3 (12.9)	30.8 (13.0)	1.40	0.162
Days deer hunted	Resident	1,943; 76	24.5 (31.3)	28.8 (22.3)	9.15	<0.001
	Non-resident	2,297; 80	17.1 (29.4)	16.7 (25.3)	0.12	0.904

a. "Residents" are citizens of Mississippi and "non-residents" live outside the state.

Table 5. Percent of respondents and non-respondents on hunting magazine subscription, hunting organization membership, household ATV ownerships, and how they rate^a hunting compared to other outdoor recreation activities in the 2001 Mississippi white-tailed deer hunting season.

Variable	Residence status ^b	Sample size (respondent; non-respondent)	Response	Respondent	Non-respondent	X ² Value	Significance
Hunting magazine subscription	Resident	1,966; 81	Yes	59.5	55.5	0.48	0.488
			No	40.5	44.5	<0.01	0.975
	Non-resident	2,297; 88	Yes	44.0	44.3		
			No	56.0	55.7		
Club membership	Resident	1,929; 81	Yes	28.0	27.1	0.02	0.887
			No	72.0	72.9	0.52	0.478
	Non-resident	2,246; 88	Yes	52.7	48.3		
			No	47.3	51.7		
Household ATV ownership	Resident	1,941; 81	Yes	65.1	61.7	0.38	0.538
			No	34.9	38.3	0.07	0.791
	Non-resident	2,224; 88	Yes	66.6	64.8		
			No	33.4	35.2		
Rate hunting compared to other outdoor activities	Resident	1,947; 81	1	53.4	49.0	16.04	0.001
			2	19.4	17.5	1.55	0.601
			3	3.5	7.5		
			4	23.7	29.0		
	Non-resident	2,297; 88	1	65.0	62.5		
			2	16.9	15.9		
			3	2.5	4.5		
			4	15.6	17.1		

a. 1=most important outdoor activity; 2=second most important outdoor activity; 3=third most important activity; 4=only one of many outdoor activities

b. "Residents" are citizens of Mississippi and "non-residents" live outside the state.

the variables investigated (Table 4 and 5). Because resident respondents indicated they hunted more days for deer, results presented for resident deer activity days may be a slight overestimate of the actual number of activity days with subsequent effects on economic impacts. However, non-response bias likely did not affect estimates of non-resident activity days.

We derived the overall economic impact in 2007 dollars from white-tailed deer hunting expenditures from resident and non-resident expenditure profiles and activity days collected from survey data. For the 2001 hunting season, the total impacts were \$1.02 billion and supported 37,749 full- and part-time jobs (Table 6). The SAM multiplier was 1.65, indicating that for every dollar spent in-state on white-tailed deer hunting there was an economic impact return of \$1.65. For the 2002 hunting season, total impacts were \$1.03 billion and supported 37,888 full- and part-time jobs

(Table 6). The SAM multiplier was 1.64. For the 2003 hunting season total impacts were \$761 million, supporting 26,489 full- and part-time jobs (Table 7). The SAM multiplier was 1.63. For the 2004 hunting season, total impacts were \$892 million, supporting 32,866 full- and part-time jobs (Table 7). The SAM multiplier was 1.65. For the 2005 hunting season, the total impacts were \$874 million, supporting 32,325 full- and part-time jobs (Table 8). The SAM multiplier was 1.65. Our study results from 2001 to 2005 revealed that the largest sector generating economic impacts was service, with the next two largest sectors manufacturing and trade.

Discussion

We provided data on the annual statewide estimates of white-tailed deer hunting activity on public and private lands, expenditures (e.g., food, lodging, travel, equipment) by resident and

Table 6. Total economic impacts generated by the Impact Analysis for Planning (IMPLAN) model software from resident and non-resident^a white-tailed deer hunters in Mississippi during the 2001 and 2002 hunting seasons (in 2007 dollars).

Year	Industry ^{b,c,d}	Direct impacts \$1,000s	Secondary impacts \$1,000s	Total impacts \$1,000s	Value added \$1,000s	Indirect business taxes \$1,000s	Employee income \$1,000s	Jobs n
2001	Ag., forestry, and fisheries	39	6,483	6,523	2,814	202	449	60
	Mining	0	18,988	18,988	11,378	1,482	4,012	85
	Construction	0	84	84	10	0.598	6	0
	Manufacturing	362,567	193,919	556,486	319,924	62,257	168,198	10,159
	Trans., comm., and utilities	0	19,247	19,247	11,026	257	6,437	209
	Trade	49,027	22,980	72,007	28,858	550	11,696	467
	F.i.r.e.	0	7,729	7,729	3,692	96	2,694	163
	Services	205,993	129,691	335,684	245,394	9,146	219,935	26,606
	Institutions	164	0	164	0	0	0	0
	Totals	617,790	399,122	1,016,911	623,096	73,990	413,428	37,749
2002	Ag., forestry, and fisheries	40	6,544	6,584	2,841	204	454	60
	Mining	0	19,205	19,205	11,509	1,499	4,058	87
	Construction	0	85	85	10	0.603	6	0
	Manufacturing	369,041	195,945	564,985	324,837	63,281	170,902	10,332
	Trans., comm., and utilities	0	19,502	19,502	11,170	260	6,521	212
	Trade	50,235	23,328	73,563	29,445	561	11,897	475
	F.i.r.e.	0	7,812	7,812	3,732	97	2,722	165
	Services	205,656	130,751	336,407	245,757	9,211	219,835	26,557
	Institutions	167	0	167	0	0	0	0
	Totals	625,138	403,170	1,028,309	629,299	75,113	416,394	37,888

a. "Residents" are citizens of Mississippi and "non-residents" live outside the state.

b. Agriculture, forestry, and fisheries.

c. Transportation, communications, and utilities.

d. Finance, insurance, and real estate (F.i.r.e.).

Table 7. Total economic impacts generated by the Impact Analysis for Planning (IMPLAN) model software from resident and non-resident^a white-tailed deer hunters in Mississippi during the 2003 and 2004 hunting seasons (in 2007 dollars).

Year	Industry ^{b,c,d}	Direct impacts \$1,000s	Secondary impacts \$1,000s	Total impacts \$1,000s	Value added \$1,000s	Indirect business taxes \$1,000s	Employee income \$1,000s	Jobs n
2003	Ag., forestry, and fisheries	34	4,758	4,791	2,072	149	330	43
	Mining	0	14,182	14,182	8,506	1,108	2,998	64
	Construction	0	61	61	7	0.434	5	0
	Manufacturing	283,948	143,324	427,272	247,056	48,039	129,213	7,815
	Trans., comm., and utilities	0	14,548	14,548	8,321	193	4,855	158
	Trade	40,834	17,532	58,365	23,114	441	9,094	366
	F.i.r.e.	0	5,728	5,728	2,731	72	1,992	121
	Services	141,656	94,567	236,223	172,992	7,048	149,931	17,923
	Institutions	140	0	140	0	0	0	0
	Totals	466,611	294,701	761,312	464,798	57,049	298,419	26,489
2004	Ag., forestry, and fisheries	35	5,676	5,711	2,464	177	393	52
	Mining	0	16,662	16,662	9,982	1,300	3,520	75
	Construction	0	74	74	9	0.523	6	0
	Manufacturing	320,065	169,673	489,738	281,736	54,884	148,224	8,961
	Trans., comm., and utilities	0	16,870	16,870	9,688	226	5,656	184
	Trade	43,564	20,241	63,805	25,536	487	10,318	412
	F.i.r.e.	0	6,762	6,762	3,237	85	2,361	143
	Services	178,408	113,821	292,229	213,187	7,989	190,705	23,038
	Institutions	145	2	147	0	0	0	0
	Totals	542,217	349,781	891,997	545,839	65,147	361,183	32,866

a. "Residents" are citizens of Mississippi and "non-residents" live outside the state.

b. Agriculture, forestry, and fisheries.

c. Transportation, communications, and utilities.

d. Finance, insurance, and real estate (F.i.r.e.).

Table 8. Total economic impacts generated by the Impact Analysis for Planning (IMPLAN) model software from resident and non-resident^a white-tailed deer hunters in Mississippi during the 2005 hunting season (in 2007 dollars).

Year	Industry ^{b,c,d}	Direct impacts \$1,000s	Secondary impacts \$1,000s	Total impacts \$1,000s	Value added \$1,000s	Indirect business taxes \$1,000s	Employee income \$1,000s	Jobs n
2005	Ag., forestry, and fisheries	33,715	5,566	5,600	2,416	173	386	51
	Mining	0	16,317	16,317	9,778	1,273	3,448	73
	Construction	0	72	72	9,000	0.513	5,500	0
	Manufacturing	312,477	166,5668	479,042	275,412	53,622	144,843	8,753
	Trans., comm., and utilities	0	16,553	16,553	9,482	221	5,536	180
	Trade	42,384	19,781	62,164	24,899	474	10,077	403
	F.i.r.e.	0	6,640	6,640	3,172	83	2,314	140
	Services	175,962	111,282	287,244	209,919	7,844	187,973	22,725
	Institutions	141	0	141	0	0	0	0
	Totals	530,997	342,776	873,773	535,085	63,690	354,582	32,325

a. "Residents" are citizens of Mississippi and "non-residents" live outside the state.

b. Agriculture, forestry, and fisheries.

c. Transportation, communications, and utilities.

d. Finance, insurance, and real estate (F.i.r.e.).

non-resident deer hunters, measures of the economic impact to the economy (e.g., total economic impacts, employment, personal income, taxes generation, value-added) in Mississippi, and identified impacted sectors of the economy (e.g., lodging, wholesale and retail trade). While white-tailed deer hunters spend less per day than waterfowl (Grado et al. 2001) or northern bobwhite hunters (Burger et al. 1999), the sheer volume of activity days enables this activity to be the most important from an economic impact standpoint. Subsequently, from studies that have been completed for quail, turkey, and waterfowl (Burger et al. 1999, Grado et al. 1997, Grado et al. 2001), the indication is that its economic impact is greater than the collective total for all other hunted species in Mississippi. For example, annual economic impact estimates for northern bobwhite and waterfowl in Mississippi were \$8.4 million (in 1991 dollars) and \$27.4 million (in 1999 dollars), respectively.

Economic multipliers, used to evaluate incremental contributions to the economy from changes in white-tailed deer hunting demand indicated that the state economy could develop low impact goods and services to accommodate hunters to increase economic impact. To illustrate this point, our multipliers were relatively low (1.63–1.65) compared to other recreation expenditure multipliers which usually range from 1.5 to 2.7 in the United States (Loomis and Walsh 1997). Multiplier size is related to the size of an area economy and its industrial and commercial development. Value-added and other impacts within a region have the potential to increase in unison with increases in these factors and, more than likely, a smaller proportion of expenditures would then be purchased outside the region (Loomis and Walsh 1997). Therefore, economy size and industrial and commercial development will lead to less dollar outflows (and larger multipliers) and more impacts for a given economy.

Management Implications

The potential for a multitude of ecosystem services on the land base associated with wildlife management practices are of great importance for both public and private land managers and owners in Mississippi and the United States. Considerable public pressure has been and continues to be exerted on the way our forest and water resources are managed (Douglas 2000). Also, resource demands are increasing for both consumptive and nonconsumptive outputs. Therefore, it is important for public agencies and private landowners as well as legislators and policy makers to develop economic measures comparable to those of salable outputs to make appropriate land use decisions. In general, this type of economic information as well as demographic data can aid agencies, conservation organizations, and other land managers seeking to understand their client base and the economic impacts from the white-tailed deer. Economic information concerning wildlife species is beneficial because it provides a measure of relative importance to species like white-tailed deer for assessing and prioritizing wildlife management decisions. With increasing demands on natural resources, wildlife management agencies realize the need to more effectively measure economic values as well as harvest, hunter utilization, and hunter satisfaction. These measures are useful to wildlife managers in setting regulations and evaluating past and future management practices. Furthermore, they are useful in identifying wildlife values for multiple-use resource planning (Grado et al. 2001). Additionally, they provide project proposals needed assessments on how their decisions will affect communities.

Economic information can also be used to evaluate land use policies that might affect the white-tailed deer and services, businesses, and industries that depend on it. For example, with prob-

lems such as CWD and other wildlife diseases potentially on the horizon, resource managers need sound economic and ecological assessments to justify funding and other resources to adequately research and take action to address this and similar problems. In this way, they can address ecological considerations, while keeping in mind the effects any actions may have on social and economic fabric of society. For example, in Mississippi there have been efforts to legalize hunting white-tailed deer over bait which could have short- and long-term impacts on the economy. In the short-term, baiting could cause an increase in hunter participation and added economic impacts. Winterstein (1992) estimated that in Michigan, over 13 million bushels of bait were used in 1991, with a net value in excess of \$50 million. Nevertheless, baiting deer may increase disease transmission, create hunter conflicts, or adversely impact other resources which can have long-term negative implications on participation, activity-days, expenditures and resultant economic impacts (Bishop 2004, Van Deelen et al. 2006).

It is recommended that habitat quality and area managed for white-tailed deer on public and private lands in Mississippi be increased and enhanced to benefit the white-tailed deer, its users, and communities whose economies depend on the resulting economic impacts. Other kinds of intense land use and development, however, will make this difficult. In the United States, where private land predominates, most wildlife management efforts have focused on publicly-owned land because of conflicting traditions of private property rights, public ownership of wildlife, and state regulation of wildlife (Daley et al. 2004). Increasing the amount of managed white-tailed deer habitat could attract residents and non-residents of Mississippi to hunt or hunt more often and compel policymakers to make more funds available for habitat improvement and biological studies of white-tailed deer. However, state and federal funds are not always available for private landowners. In recent years, private nongovernmental organizations (e.g., The Nature Conservancy) have worked along with state and federal agencies to improve management on private lands. Many of these private organizations preserve habitat through land acquisitions and conservation easements with private landowners (Daley et al. 2004). Reportedly, 92% of all hunters in Mississippi hunted on private land (USDI and USDC 2002). This is reasonable considering the southeastern United States leads the rest of the nation in acreage under hunting leases, primarily because over 91% of the land is privately owned (Yarrow 1998). Funds could be used for incentives to improve habitat quality to produce higher quality white-tailed deer, thus providing higher revenues for private landowners, lodges, and guided hunts. The result of these actions will contribute, from a broader perspective, to a more sustainable environment and economy in Mississippi.

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Literature Cited

- Bishop, R. C. 2004. The economic impacts of chronic wasting disease (CWD) in Wisconsin. *Human Dimensions of Wildlife* 9:181–192.
- Burger, L.W., D.A. Miller, and R.L. Southwick. 1999. Economic impact of northern bobwhite hunting in the southeastern United States. *Wildlife Society Bulletin* 27:1010–1018.
- Conover, M.R. 1997. Monetary and intangible valuation of deer in the United States. *Wildlife Society Bulletin* 25:298–305.
- Cooper, A.B., F. Stewart, J.W. Unsworth, L. Kuck, T.J. McArthur, and J.S. Rachael. 2002. Incorporating economic impacts into wildlife management decisions. *Wildlife Society Bulletin* 30:565–574.
- Daley, S.S., D.T. Cobb, P.T. Bromley, and C.E. Sorenson. 2004. Landowner attitudes regarding wildlife management on private land in North Carolina. *Wildlife Society Bulletin* 32(1):209–219.
- Dillman, D.A. 1978. Mail and telephone surveys: the total design method. John Wiley and Sons, Inc., New York, New York.
- Douglas, R.W. 2000. Forest recreation. 5th edition. Waveland Press, Inc., Prospect Heights, Illinois.
- Ford, W.M., S.A., Johnson, and P.E., Hale. 1997. Influences of forest type, stand age, and weather on deer weights and antler size in the Southern Appalachians. *Southern Journal of Applied Forestry* 21:11–18.
- Grado, S.C., R.M. Kaminski, I.A. Munn, and T.A. Tullos. 2001. Economic impacts of waterfowl hunting on public lands and at private lodges in the Mississippi Delta. *Wildlife Society Bulletin* 29:846–855.
- , G.A. Hurst, and K.D. Godwin. 1997. Economic impact and associated values of the wild turkey in Mississippi. *Proceedings of the Annual Conference of the Southeastern Association of Fish and Wildlife Agencies* 51:438–448.
- Leonard, J. 2004. Deer hunting in the United States: an analysis of hunter demographics and behavior. U.S. Fish and Wildlife Service, Arlington, Virginia.
- Loomis, J.B., M. Creel, and J. Cooper. 1989. Economic benefits of deer in California: hunting and viewing values. Institute of Ecology Report No. 32. University of California, Davis.
- , and R.G. Walsh. 1997. Recreation economic decisions: comparing benefits and costs. 3rd edition. Venture Publishing, Inc., State College, Pennsylvania.
- Marsinko, A., D.C. Guynn Jr., and D.F. Roach II. 1998. Forest industry hunt-lease programs in the South: economic implications. *Proceedings of the Annual Conference of the Southeastern Association of Fish and Wildlife Agencies* 52:403–409.
- Olson, D. and S. Lindall. 2000. IMPLAN Professional. 2nd edition. MIG Co., Stillwater, Minnesota.
- Powell, D.S., J.L. Faulkner, D.R. Darr, Z. Zhu, and D.W. MacCleery. 1994. Forest resources of the United States, 1992. USDA Forest Service. Technical Report, RM-234, Rocky Mountain Forest and Range Experiment Station, Fort Collins, Colorado.
- Rooney, T.P. 2001. Deer impacts on forest ecosystems: a North American perspective. *Journal of Forestry* 74:201–208.

- SAS. 2003. SAS On-line Doc 9.1. SAS Institute, Inc. Cary, North Carolina.
- Strauss, C.H., B.E. Lord, and S.C. Grado. 1995. Economic impact of travel and tourism in Southwestern Pennsylvania during 1994. School of Forest Resources, Pennsylvania State University, University Park, Pennsylvania.
- Strickland, B.K. and S. Demarais. 2000. Age and regional differences in antler size and body mass of white-tailed deer in Mississippi. *Journal of Wildlife Management* 64:903–911.
- Tremblay, J.P., A.J. Hester, J. McLeod, and J. Huot. 2004. Choice and development of decision support tools for the sustainable management of deer-forest systems. *Forest Ecology and Management* 191:1–16.
- U.S. Department of Interior (USDI) and U.S. Department of Commerce (USDC). 2002. 2001 National Survey of Fishing, Hunting, and Wildlife-Associated Recreation, Mississippi. USDI Fish and Wildlife Service and USDC Bureau of Census. U.S. Government Printing Office, Washington, D.C.
- Van Deelen, T.R., B. Dhuey, K.R. McCaffery, and R.E. Rolley. 2006. Relative effects of baiting and supplemental antlerless seasons on Wisconsin's 2003 Deer Harvest. *Wildlife Society Bulletin* 34:322–328.
- Winterstein, S. 1992. Michigan hunter opinion surveys. Federal Aid in Wildlife Restoration Report W-127-R. Michigan Department of Natural Resources, Wildlife Division, Lansing, Michigan.
- Yarrow, G. 1998. Economic and conservation impacts of hunting leases. *Proceedings of the Annual Conference of the Southeastern Association of Fish and Wildlife Agencies* 52:9–17.