

Wildlife Enterprises on Mississippi Private Lands

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Abstract: We conducted a survey of nonindustrial private (NIP) landowners in Mississippi during the 1996–97 and 1997–98 hunting seasons to determine revenues collected and expenditures incurred for fee hunting on their properties. We mailed the survey to random samples of landowners who owned ≥ 16.4 ha within statewide and Mississippi Delta counties during 1996–97 and statewide and Mississippi Gulf Coastal counties during 1997–98. Questionnaires mailed over the two hunting seasons totaled 6,966 and resulted in 2,283 respondents. Game species pursued on lands committed to fee hunting included deer, waterfowl, turkey, quail, dove, and “other” game. Respondents reported expenditures for overhead items and wildlife management activities related to fee hunting on their lands. Two hundred thirty-six respondents reported gross revenues from fee hunting ranging from US\$2,964 to \$5,254 on average per landowner or \$7.50 to \$14.28 per ha, depending upon the region. Net revenues averaged from \$1,539 to \$3,244 per respondent or \$3.90 to \$9.54 per ha. Predictors of gross revenues from fee hunting in statewide data were forested and agricultural ha committed to the activity, waterfowl as the featured game species, and overhead expenditures incurred. We found that Mississippi nonindustrial private (NIP) landowners can diversify incomes derived from their properties through the development of fee hunting enterprises.

Key words: fee-access recreation, hunting leases, landowner income, outfitters, wildlife recreation

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In the southeastern United States, 4.9 million private landowners own approximately 77.1 million ha of forestlands (Birch 1997). Currently, Mississippi has approximately 7.6 million ha in forestland (Rosson 2001). Of those lands, 69% are owned by nonindustrial private forest (NIPF) landowners, 20% by industry, and 11% by the public sector (Mississippi Forestry Association 2004). Because of cover types, preponderance, and distribution across the landscape, privately-owned forestlands

provide important wildlife habitat throughout the Southeast (Yarrow and Yarrow 1999). Although these lands are important for wildlife conservation, undeveloped private lands are rapidly being lost to urbanization and commercial development (National Research Council 2000).

For forestlands to be retained in private ownership, incentives may be required. For example, most NIPF lands are owned by individuals seeking to generate income through avenues such as timber production (Baird et al. 1988) while 15% of NIPF owners view recreation as a primary reason for owning forest land (Birch 1997). Generating income through sustainable timber management and agriculture and other income sources, such as fee-access ecotourism, hunting, and angling can further diversify revenue sources for private landowners who wish to maintain their lands in natural ecosystems (Yarrow and Yarrow 1999). For example, Yarrow and Yarrow (1999) reported that prices for hunting leases ranged from US\$5/ha to \$17/ha annually with higher lease values sometimes exceeding \$45/ha. Several economic impact studies of outdoor recreation in natural areas have focused on revenues generated in local and statewide economies by recreationists who pursue a specific game or nongame species, species group, or type of recreational activity (Schorr et al. 1995, Burger et al. 1999, Grado et al. 2001). Henderson et al. (2003) reported activities and earnings of hunting guides and outfitters in Mississippi; however, we found no studies that investigated income earned by landowners who were involved in fee-access hunting arrangements. Thus, our objectives were to estimate the percentage of Mississippi landowners who receive hunting-related revenues from their land (fee hunting); estimate gross revenues, expenses, and profits from fee hunting in Mississippi; identify wildlife species featured in fee access arrangements; identify wildlife habitat management practices used; and identify predictors of gross revenues collected in fee hunting enterprises to identify key elements of a enterprise that would most likely lead to a successful landowner venture.

Methods

We identified NIP landowners owning ≥ 16.4 ha in Mississippi from 1995 property tax records (unpub. data, Social Science Research Center, Mississippi State University). We mailed surveys to randomly-selected landowners from that group. We selected the minimal property size to eliminate suburban property owners from the sample population. We developed a mail questionnaire based upon input from our multi-disciplinary team of forestry, wildlife, social science, and resource policy professionals. We conducted four independent surveys consisting of a regional and statewide survey for the 1996–97 and 1997–98 hunting seasons. The 1996–97 regional survey targeted Issaquena, Sharkey, Warren, and Washington counties in the southern portion of the Mississippi River Alluvial Valley (Delta) and the 1997–98 regional survey targeted Jackson, Harrison, Hancock, Pearl River, Stone, and George counties along Mississippi's Gulf Coast (Gulf Coast). We selected these regional survey areas to assess fee access activities in different physiographic regions with differing major land uses. For example, the Delta was comprised primarily of bottomland

hardwood forests and agriculture while the Gulf Coast region was dominated by pine forests managed for timber production (Rosson 2001). The statewide surveys sampled the entire state and did not exclude respondents from the regional survey areas. Therefore, summaries of statewide surveys represent the entire state, not just the portions of the state outside the regional survey areas.

In March 1997, we mailed 1,363 questionnaires to a random sample of Mississippi landowners statewide and 1,293 questionnaires to a random sample of Delta landowners for the 1996–97 hunting season. We sent landowners who did not return the questionnaire a second questionnaire within six months. In March 1998, we mailed 2,030 questionnaires to a random sample of Mississippi landowners and 2,280 questionnaires to a random sample of Gulf Coast county landowners. In the second year, we increased the size of the original mailing and eliminated the follow-up mailing due to time and budgetary constraints. We requested landowners to confine responses to the period between 1 March of the previous year and 30 April of the present year to gain information on activities related to the 1996–97 and 1997–98 Mississippi hunting seasons.

The survey instruments included questions on land ownership (e.g., property size, location, predominant cover type, land use); types of and expenditures on wildlife management activities; and revenues and expenditures associated with fee hunting activities. We asked respondents to report land ownership in “forested, agriculture, wetlands, and other” land categories. We asked landowners who sold hunting privileges on their property to report the payment method offered, such as hunting leases, permit hunting, and agreements with outfitters or guides. We defined payment methods for landowners as follows: 1) hunting leases were contractual and provided a group of hunters the sole right to hunt specified portions of the landowner’s property for ≥ 1 year; 2) permit hunting allowed individual hunters the right to hunt a specified portion of the landowner’s property for ≤ 1 day in exchange for a permit or gun fee; and 3) outfitter or guide arrangements provided outfitters with exclusive access for hunting or guiding hunts on a specified portion of the landowner’s property in exchange for an annual fee or a percentage of the outfitter’s gross revenue. For each payment method, we asked landowners to report the wildlife species included in the agreement and acreage dedicated to fee hunting by land type. To estimate net monetary returns, landowners were asked about hunting-related operational, overhead, and wildlife management expenditures. Overhead expenditures included manager or caretaker wages, liability insurance premiums, personal supervision, trespass prevention and property posting expenses, and guest accommodation costs. Wildlife management included vegetation management practices, wildlife food and cover plantings, blind and tree stand placement, and plantings and water management for waterfowl.

We used a multiple linear regression model to determine significant predictors of gross revenues from fee hunting in the 1996–97 statewide survey, 1997–98 statewide survey, and pooled data over the state for both study years. We conducted this analysis to identify key elements in fee hunting enterprises, such as land types committed to fee hunting arrangements, game species featured, and expenditures related to enterprise operations and wildlife management practices, that potentially in-

fluence gross revenues collected by landowners. Gross revenues per respondent (GR) was our response variable and explanatory variables included forested fee hunting lands (FORAC), agricultural fee hunting lands (AGAC), wetlands allocated to fee hunting (PWET), type payment method (PAY), featured game species pursued in fee hunting arrangements (deer (DEER), waterfowl (WATERFOWL), turkey (TURKEY), quail (QUAIL), dove (DOVE), and other game (OTHERGAME), overhead expenditures (OH), and wildlife management expenditures (WL). Due to the small sample size of respondents involved in outfitter and permit arrangements, payment method was designated as a binary response variable, lease or not lease. Wildlife species featured also were entered as binary variables. The full regression model with variable abbreviations was:

$$\text{Gross revenues (GR)} = a + b_1 (\text{FORAC}) + b_2 (\text{AGAC}) + b_3 (\text{OTHAC}) + b_4 (\text{PWET}) + b_5 (\text{PAY}) + b_6 (\text{DEER}) + b_7 (\text{WATERFOWL}) + b_8 (\text{TURKEY}) + b_9 (\text{QUAIL}) + b_{10} (\text{DOVE}) + b_{11} (\text{OTHER GAME}) + b_{12} (\text{OH}) + b_{13} (\text{WL}).$$

We used bivariate and Pearson's correlation analyses to test for relationships between explanatory variables and gross revenues and to test for relationships between explanatory variables at ($P < 0.05$; Myers 1990, SAS 1994). If two variables were highly correlated ($r > 0.75$), the variable with the least accuracy was omitted in the regression model.

Results

Response Rates

A total of 2,283 respondents returned questionnaires over the two-year study period with 1,220 and 1,063 surveys returned in 1996–97 and 1997–98, respectively. Response rates were 48% and 28% for the two years, respectively.

Types of Hunting

Most respondents ($N = 1,505$) allowed hunting of some type on their land. Over the two-year survey period, the percentage of respondents allowing hunting ranged from 50% ($N = 254$) in the Gulf Coast to 77% ($N = 555$) statewide during the 1997–98 season. Forty-four percent ($N = 224$) of respondents allowed free hunting in the Gulf Coast while 68% ($N = 377$) statewide allowed free hunting in 1997–98. Free hunting privileges were generally extended to family and friends by >40% of respondents. A total of 270 respondents reported charging for hunting in 1996–97 and 1997–98 with 236 respondents completing all questions on fee access activities; these data were used in analyses of revenue generation and expenditures.

Ownership Size and Composition

In the two statewide surveys, forests accounted for 56% and 60% of the average ownership, consistent with the proportion of forestland on NIPF ownerships in Mississippi as reported by Rosson (2001). For Delta counties where agriculture predominates, forests accounted for 32% of the average ownership, also consistent with forestland proportions in Mississippi NIPF ownerships as reported by Rosson

Table 1. Average hectares committed to fee hunting by Mississippi respondents involved in hunting leases and permit hunting during the 1996–97 and 1997–98 hunting seasons.

	State 1997	SE	Delta 1997	SE	State 1998	SE	Gulf Coast 1998	SE
<i>N</i> respondents								
Leasers	56		60		64		38	
Permitters	10		9		12		2	
Ha owned								
Leasers	437	58	573	98	473	71	667	200
Permitters	748	110	724	245	466	124	675	207
Ha committed (%)								
By leasers	64		52		62		73	
By permitters	33		68		49		47	
Ha leased								
Forested	220	42	213	44	242	41	473	183
Agricultural	30	10	41	15	38	12	2	1
Other	29	12	46	24	12	6	15	12
Ha permitted								
Forested	216	49	368	195	145	38	315	221
Agricultural	19	10	108	49	78	40	4	2
Other	14	8	19	14	7	4	—	—
Permits sold	9	3	50	31	17	5	26	14

(2001). In contrast for Gulf Coast counties, forests accounted for 78% of the average ownership. Average ownership sizes for respondents engaged in fee hunting were 590 ha in Delta counties and 652 ha in Gulf Coast counties, as compared to < 300 ha for respondents not engaged in fee hunting in both regions. Statewide respondents engaged in fee hunting owned on average 505 ha, as compared to 141 ha owned by those not engaged in fee hunting. Forest ownership was more prevalent among fee-hunting landowners compared to landowners not participating in the activity. For example, forests represented 91% of the average ownership of respondents engaged in fee hunting in the Gulf Coast 1997–98 survey, compared to 69% for coastal landowners not participating. Forests accounted for 54% of the average ownership among Delta respondents engaged in fee hunting and 26% for Delta landowners not participating.

Payment Methods

Hunting leases were the most common payment method used for fee hunting (Table 1). In contrast, fewer respondents sold individual hunting permits or had agreements with guides or outfitters (< 3%; Table 1). Respondents who leased dedicated > 50% of their total ownership to hunting leases with forests representing most leased lands regardless of the region (Table 1). Over 90% of respondents who leased lands for hunting featured white-tailed deer (*Odocoileus virginianus*). Wild turkey (*Meleagris gallopavo*) was featured by > 70% of the respondents statewide, 64% of respondents in the Delta, and 79% of respondents in the Gulf Coast. Waterfowl were

more common in Delta leases (52%) than other regions. Northern bobwhite (*Colinus virginianus*), mourning dove (*Zenaidura macroura*), and other game were included by 22% to 45% of respondents.

Respondents who sold individual hunting permits dedicated between 33% and 68% of their ownership to permit hunting with forests accounting for most lands (>60%) dedicated to this arrangement. Over 70% of respondents selling permit hunts reported deer as the target species. Of 2,283 respondents, six reported financial arrangements with guides and outfitters with four respondents being Delta landowners who dedicated 51% of landholdings to this arrangement. Forests accounted for 77% of the total lands available to outfitters and guides.

Overhead Expenditures

Mean overhead expenditures per landowner statewide were \$290 (SE = 102) in the 1996–97 season and \$199 (SE = 81) in 1997–98 seasons. Mean overhead expenditures averaged \$1,981 (SE = 740) in the Delta for the 1996–97 season and \$863 (SE = 339) in the Gulf Coast during 1997–98. Statewide, these expenditures averaged \$0.73/ha (SE = 0.25) in 1996–97 and \$0.59/ha (SE = 0.24) in 1997–98. Overhead expenditures averaged \$5.38/ha (SE = 2.01) among Delta respondents and \$1.72/ha (SE = 0.67) among Gulf Coast landowners. Highest expenditure categories among statewide respondents were liability insurance payments (\bar{x} = \$44; SE = 15) and road/trail construction and maintenance (\bar{x} = \$48; SE = 26). Payments to land managers constituted the highest overhead expenditure among Delta and Gulf Coast respondents, \$645 (SE = 337) and \$244 (SE = 140), respectively.

Wildlife Management Expenditures

Respondents reported expenditures incurred on wildlife management practices for fee hunting and/or personal use purposes in the 1996–97 surveys because the year's survey design did not allow segregation of fee hunting and personal use related expenditures. To address this issue, only fee hunting respondents were asked to report wildlife management expenditures related to their fee hunting operations in 1997–98. Thus, the responses provided in the 1997–98 population represented wildlife habitat management activities strictly for fee hunting on lands dedicated to fee hunting.

Twenty-three percent of statewide and Delta respondents ($N = 1,220$) in 1996–97 reported expenditures on wildlife management practices while 19% of statewide and Gulf Coast respondents ($N = 108$) engaged in fee hunting in the 1997–98 season actively managed for wildlife (Table 2). Vegetation management and wildlife food and cover plantings were the most common management practices statewide for both fee hunting and personal land uses (Tables 2, 3). Waterfowl habitat management, including water management and plantings, was more common among Delta landowners than other regions (Tables 2, 3). During 1996–97, Delta landowners outspent on average statewide respondents in wildlife management expenditures while Gulf Coast and statewide respondents incurred similar expenditures in 1997–98 (Table 3).

Table 2. Mean wildlife management expenditures per respondent and per hectare for Mississippi NIP landowners engaged in wildlife management during the 1996–97 and 1997–98 hunting seasons.

Management practice	State 1997 ^a		Delta 1997 ^a		State 1998 ^b		Gulf Coast 1998 ^b \$ (N)	
	\$ (N)	SE	\$ (N)	SE	\$ (N)	SE		SE
Vegetation management	1,125 (135)	255	1,020 (103)	176	1,244 (13)	400	346 (5)	95
Food and cover	1,027 (134)	264	1,938 (110)	415	866 (11)	216	2,276 (6)	917
Stands and blinds	542 (76)	122	738 (82)	104	1,258 (6)	411	840 (5)	301
Waterfowl management	1,485 (15)	496	1,813 (52)	152	0 (0)	—	0 (0)	—
Expenditures per respondent	2,332 (151)	442	3,504 (135)	524	2,556 (13)	813	2,798 (7)	1,252
Expenditures per ha	7.64	1.45	5.62	1.17	1.18	0.55	1.00	0.58

a. Includes wildlife management expenditures for fee hunting lands and lands for personal use of landowners.

b. Includes wildlife management expenditures for fee hunting lands only.

Table 3. Mean wildlife management expenditures per respondent and per hectare for Mississippi NIP landowners engaged in fee hunting during the 1996–97 and 1997–98 hunting seasons.

Management practice	State 1997 ^a		Delta 1997 ^a		State 1998 ^b		Gulf Coast 1998 ^b	
	\$ (N = 60)	SE	\$ (N = 68)	SE	\$ (N = 69)	SE	\$ (N = 39)	SE
Vegetation management	740	393	398	137	164	43	44	22
Food and cover	182	65	513	197	133	52	350	205
Stands and blinds	119	46	309	110	104	65	108	66
Waterfowl management	94	58	213	80	0	—	0	—
Expenditures per respondent	1,135	438	1,433	425	401	145	502	284
Expenditures per ha	2.87	0.86	3.86	0.97	1.18	0.43	1.01	0.57

a. Includes wildlife management expenditures for fee hunting lands and lands for personal use of landowners.

b. Includes wildlife management expenditures for fee hunting lands only.

Table 4. Mean gross revenues per respondent and per hectare for Mississippi NIP landowners by fee hunting payment method during the 1996–97 and 1997–98 hunting seasons.

Payment arrangement	State 1997		Delta 1997		State 1998		Gulf Coast 1998 \$ (N)	
	\$ (N)	SE	\$ (N)	SE	\$ (N)	SE		SE
Leases	2,645 (56)	540	4,007 (60)	1,246	3,646 (64)	1,115	3,908 (38)	926
Permits	2,954 (10)	859	8,339 (9)	2,562	2,655 (12)	788	4,100 (2)	3,573
Outfitters/guides	175 (1)	—	10,450 (4)	7,905	0	—	0	—
Mean revenue per respondent	2,964 (60)	500	5,254 (68)	1,335	3,844 (69)	1,063	4,018 (39)	1,077
Mean revenue per ha	7.50	1.27	14.28	3.63	11.30	3.12	8.01	2.15

Table 5. Mean net revenues per Mississippi landowner engaged in fee hunting during the 1996–97 and 1997–98 hunting seasons.

Cash flows	State 1997		Delta 1997		State 1998		Gulf Coast 1998	
	\$(N = 60)	SE	\$(N = 68)	SE	\$(N = 69)	SE	\$(N = 39)	SE
Gross revenues	2,964	500	5,254	1,335	3,844	1,063	4,018	1,077
Overhead expenditures	290	102	1,981	798	199	81	863	339
Wildlife management expenditures	1,135	438	1,433	425	401	145	502	284
Net revenues ^a	1,539	275	1,840	460	3,244	1,059	2,653	762
Net revenues per ha ^a	3.90	0.70	5.00	1.35	9.54	3.11	5.29	1.52

a. Net revenues for 1997 surveys are understated because the corresponding wildlife management expenditures include expenditures on lands for the personal use of landowners

Revenues

Annual gross revenues from fee hunting were greatest in Delta counties, averaging \$4,007 (SE = 1,246) for hunting leases, \$8,339 (SE = 2,562) for permit hunting, \$10,450 (SE = 7,905) for arrangements with outfitters and guides, and \$5,254 (SE = 1,335) overall (Table 4). Gross revenues from hunting leases were similar across all survey groups; however, gross revenues from permit hunting and outfitter and guide arrangements were greater in the Delta. Total gross revenues for the Gulf Coast and statewide surveys were at least \$1,000 less than revenues in the Delta. On a per ha basis, gross revenues averaged \$14.28 (SE = 3.63) in the Delta versus \$8.01 (SE = 2.15) in the Gulf Coast, and \$7.50 (SE = 1.27) and \$11.30 (SE = 3.12) for the 1996–97 and 1997–98 statewide seasons, respectively.

Annual net revenues for the 1997–98 surveys were greater than net revenues for the 1996–97 surveys (Table 5). However, expenditures in the 1996–97 season surveys included wildlife management expenditures related to personal use, which resulted in net revenues from fee hunting for this season being underestimated. Average net revenues for the 1997–98 season more accurately represent typical net revenues produced by fee hunting. For the 1997–98 season, average net revenues per landowner and ha were higher among statewide respondents than Gulf Coast landowners (Table 5).

Predictors of Gross Revenue

For the 1996–97 statewide survey, predictors of gross revenues collected were forested lands and agricultural lands committed to fee hunting, waterfowl as the featured game species hunted, and overhead expenditures. The regression equation was $GR = -2,631 + 2.23 (FORAC) + 7.24 (AGAC) + 2,975 (WATERFOWL) + 1.05 (OH)$; $P < 0.001$, $R^2 = 0.59$, $df = 70$. Partial correlation coefficients for significant explanatory variables were 0.560 (FORAC), 0.440 (AGAC), 0.396 (WATERFOWL), and 0.269 (OVERHEAD). Explanatory variables found to be more highly correlated were QUAIL and DOVE ($r = 0.771$) and WATERFOWL and DOVE ($r = 0.565$).

DOVE (Partial $r = -0.050$; $P = 0.707$) was omitted from the final model while QUAIL (Partial $r = -0.199$; $P = 0.127$) was retained in the model. For the 1997–98 state survey, forested and agricultural lands committed to fee hunting were significant predictors of gross revenues represented by $GR = -1,126 + 7.53$ (FORAC) + 4.59 (AGAC); $P < 0.001$, $R^2 = 0.61$, $df = 74$). Partial correlation coefficients for significant explanatory variables were 0.771 (FORAC) and 0.272 (AGAC). Explanatory variables found to be more highly correlated were QUAIL and DOVE ($r = 0.588$) and both variables were retained in the final model. In the pooled statewide data over both study years, forested and agricultural lands and waterfowl as the featured game species were significant predictors of gross revenues collected. The regression equation was $GR = -2,019 + 5.20$ (FORAC) + 5.03 (AGAC) + $2,328$ (WATERFOWL); $P < 0.001$, $R^2 = 0.54$, $df = 145$). Partial correlation coefficients for significant explanatory variables were 0.662 (FORAC), 0.312 (AGAC), and 0.185 (WATERFOWL). Explanatory variables found to be more highly correlated were QUAIL and DOVE ($r = 0.675$) and both variables were retained in the final model.

Discussion

Our response rates were typical for studies that investigated income and expenditures of individuals involved in recreational businesses (Grado et al. 2001). Henderson et al. (2003) reported a 28% response rate in a study of hunting guides and outfitters in Mississippi. We concede that several biases may have occurred in our surveys, including non-response, recall, and digit bias. However, we did not analyze non-response bias due to the homogeneity of the survey population. We surveyed respondents in March 1997 and 1998 following the close of the preceding fall hunting seasons to capitalize on landowners closing out annual accounting records in preparation for filing income taxes. Therefore, we did not believe recall and digit bias to be problematic in our study. However, researchers conducting these types of studies should be aware of potential sources of bias including recall and digit bias. Additionally, respondents may fail to provide certain types of information on surveys, especially sensitive socio-demographic and income data. We recommend researchers conduct follow-up phone or personal interviews to reduce potential biases, if feasible. Although these approaches were not feasible in our study, we qualitatively compared land ownership trends reported by our respondents to documented land ownership trends in Mississippi. Respondents of our study reported land ownership patterns that were similar to those reported by Rosson (2001). For example, in the two statewide surveys in 1997 and 1998, forests accounted for 56% and 60% of average ownership, which is consistent with the proportion of forest land owned in NIPP land ownerships in Mississippi (Rosson 2001).

Most respondents (90%) were not involved in fee hunting arrangements. However, landowners who sold access to their lands for hunting generally owned more forest land and committed two to four times the forested area to fee hunting arrangements as compared to other land types. Forest land committed to fee hunting arrangements was a significant predictor of increased gross revenues collected by landowners over the study period. Thus, the amount of forest land owned and committed to

fee hunting arrangements per respondent positively influenced gross revenues collected by landowners engaged in enterprises statewide. Thus, revenue potential from wildlife enterprise development on private lands could increase reforestation of marginal agricultural lands and encourage restoration of forested riparian corridors and bottomland hardwood forests within alluvial floodplains.

Regression analysis revealed that in addition to forest lands, agricultural lands committed to fee hunting arrangements, waterfowl as the featured game species, and landowner overhead expenditures in fee access operations were significant predictors of gross revenues collected. Agricultural lands were identified and leased by hunters for white-tailed deer, small game species, such as dove and quail, and waterfowl. Flooded agricultural lands managed as habitat for waterfowl in the Mississippi River Alluvial Valley of the Mississippi Delta region ranged from 8,197 ha in 1990 to 41,393 ha in 2001 (J. Holden, Jr., Ducks Unlimited, unpub. data). The occurrence of these game species on agricultural lands and the preponderance of grain crops, such as rice, on agricultural lands managed to attract waterfowl in the Mississippi Delta, contributed to the importance of agricultural lands and waterfowl on fee hunting revenue generation. Lastly, our model suggested that landowner overhead expenditures in fee hunting operations increased gross revenues collected. This finding implies that business planning and services provided by landowners within fee hunting arrangements increased landowner income potential and the value of fee hunting properties to hunters. However, we theorize that landownership size, land cover types, and featured species availability are more important predictors of gross revenues collected.

Ninety-two percent of the 236 landowners involved in fee hunting arrangements leased properties to paying clients. Income earned by respondents offering hunting leases was similar to earnings reported on Alabama forest lands (Yarrow and Yarrow 1999). Top game species featured in fee access arrangements listed in order of frequency of inclusion were white-tailed deer, wild turkey, mourning dove, and waterfowl. Although waterfowl ranked fourth in frequency of inclusion by landowners, this game category was a significant predictor of gross revenues collected, which indicates that landowners can collect more gross revenues per fee access arrangement when featuring waterfowl. The economic importance of waterfowl to Mississippi was reported by Grado et al. (2001) to be \$27.4 million. We submit that the importance of waterfowl in landowner income generation and economic impact locally and statewide can promote wetland conservation, wildlife management on agricultural lands, and reforestation of alluvial floodplains.

Management Implications

Based on our findings, NIPF landowners can earn income from fee hunting arrangements on both forested and agricultural lands. To supplement and diversify income, landowners can combine activities that enhance fee hunting opportunities with traditional forestry and agricultural management practices. For example, many forest management practices used to increase timber yields also can benefit wildlife populations (Yarrow and Yarrow 1999, Rohweder et al. 2000). Agricultural produc-

ers who manage field borders, protect riparian buffer strips, and leave unharvested crops such as cereal grains, corn, and soybeans in the field can increase game species on their properties for fee access recreation (Yarrow and Yarrow 1999). Additionally, involvement of private landowners in fee hunting could promote wildlife habitat conservation and compliment goals of incentive-based federal programs such as Wetland Reserve, Wildlife Habitat Incentives, and Conservation Reserve Programs (USDA 1996). Thus, landowner involvement in fee access recreation could increase their acceptance and participation in federal and state landowner assistance programs and increase recreational value of private lands in the Southeast (Guynn 1990, Yarrow 1990, Johnson 1995, Pease et al. 1997, Yarrow and Yarrow 1999). Additionally, landowners committing wetland and riparian lands to fee hunting arrangements because of suitable game habitats provided by these areas could reduce the need for regulatory measures, including Clean Water Act Section 404 permitting requirements enforced to protect these habitats (Jones 2002). Thus, income production from fee hunting in sensitive habitats could provide economic incentive to private landowners for protection of sensitive ecosystems, such as wetlands.

Diversification of income sources on private lands can also help NIP landowners retain possession of their properties during times of economic hardship and globally changing commodities markets. Landowners engaged in fee hunting can increase revenues earned from their properties from wildlife resources, and this income can supplement income earned from agricultural and forest commodities. Additionally, they can implement better control of trespassing, poaching, and damage to property due to unlimited access (Birch 1997; Yarrow and Yarrow 1999, unpub. data, Forest and Wildlife Research Center, Mississippi State University). Wildlife habitat management practices that increase featured game species and the occurrence of trophy animals on leased Mississippi lands can further increase revenues collected by landowners (Jones 2002). Future research should address why so few landowners sell hunting rights by examining motivations of landowners engaged in fee hunting and perceptions of landowners who do not. Relationships among expenditures on operational and wildlife management activities, featured species, and revenue production should be investigated further. Lastly, factors affecting the compatibility of fee hunting on agricultural and forest lands should be examined. With a better understanding of these factors, resource professionals can develop outreach activities focusing on marketing strategies and business plan development, cost-effective wildlife habitat management practices, and complimentary landowner assistance programs that promote income diversification, ecological stewardship, and wildlife conservation resulting from fee hunting enterprises on private lands.

Literature Cited

- Baird, A. W., L. Doolittle, and R. Y. Burroughs. 1988. Harvesting decisions of nonindustrial private forest owners in Mississippi. Sociology Research Report, Mississippi State University, Starkville. Misc. Series 86–92.
- Birch, T. W. 1997. Private forest-landowners of the southern United States, 1994. Resource

- Bulletin NE-138. U.S. Department of Agriculture, Forest Service Northeast Forest Experiment Station, Radnor, Pennsylvania.
- Burger, L. W., D. A. Miller, and R. I. Southwick. 1999. Economic impact of northern bobwhite hunting in the southeastern United States. *Wildlife Society Bulletin* 27:1010–1018.
- 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.
- Guynn, Jr., D. C. 1990. Fee hunting on private lands in the South: synopsis, conclusions, and future directions. *In* D. C. Guynn, Jr. and G. K. Yarrow, editors. *Fee Hunting Proceedings 1990: Fee Hunting on Private Lands in the South*. Clemson University, Clemson, South Carolina. Pp. 149–154.
- Henderson, J. E., S. C. Grado, and I. A. Munn. 2003. Economic impact of commercial hunting outfitters and clientele. *Proceedings of the 2003 Southern Forest Economics Workshop*, 397–402. New Orleans, Louisiana.
- Johnson, R. 1995. Supplemental sources of income for southern timberland owners. *Journal of Forestry* 93: 22–24.
- Jones, W. D. 2002. Fee-based wildlife recreation: a non-regulatory, market-driven approach to environmental policy and conservation in Mississippi. Doctoral dissertation. Mississippi State University, Starkville.
- Mississippi Forestry Association (MFA). 2004. Mississippi Forestry Facts. <http://msforestry.net/forestryfacts.html>
- Myers, R. H. 1990. *Classical and modern regression with applications*. PWS-KENT, Boston, Massachusetts.
- National Research Council (NRC). 2000. *Compensating for wetland losses under the Clean Water Act*. Committee on Mitigating Wetland Losses, Board on Environmental Studies and Toxicology, Water Science and Technology Board, Division on Earth and Life Studies. Washington, D.C.: National Academy Press.
- Pease, J. L., M. L. Rankin, J. Berdon, and R. Reisz, ed. 1997. *Why landowners restore wetlands: a national survey*. Iowa State University Extension Service, Ames, Iowa.
- Rohweder, M. R., C. W. McKette, and R. A. Riggs. 2000. Economic and biological compatibility of timber and wildlife production: An illustrative use of production possibilities frontier. *Wildlife Society Bulletin* 28: 435–477.
- Rosson, J. F., Jr. 2001. *Forest resources of Mississippi, 1994*. Resource Bulletin, SRS-61. Asheville, North Carolina: U.S. Department of Agriculture, U.S. Forest Service, Southern Research Station.
- SAS Institute. 1994. *SAS statistics user's guide*. SAS Institute, Inc. Cary, North Carolina.
- Schorr, S. S., J. Sah, D. F. Schriener, M. R. Meador, and L. G. Hill. 1995. Regional economic impact of the Lake Texoma (Oklahoma-Texas) striped bass fishery. *Fisheries* 20:14–18.
- United States Department of Agriculture (USDA). 1996. *America's Private Land: A Geography of Hope*. Program Aid 1548, USDA/Natural Resources Conservation Service (NRCS). Washington, D.C.
- Yarrow, G. K. 1990. The role of landowner cooperatives in enhancing habitat and landowner income. *In*: D. C. Guynn, Jr. and G. K. Yarrow, editors. *Fee Hunting Proceedings 1990: Fee Hunting on Private Lands in the South*. Clemson University, Clemson, South Carolina. Pp. 21–23.
- _____ and D. T. Yarrow. 1999. *Managing wildlife*. Sweetwater Press, Birmingham, Alabama.