Wildlife-related Recreation Impacts on Rural Land Values

W. Daryl Jones, Department of Wildlife, Fisheries and Aquaculture, Box 9690, Mississippi State, MS 39762

Jerry Brashier, 1309 Rosemont Street, Gautier, MS 39553 Jeanne C. Jones, 1323 Singleton Church Road, Louisville, MS 39339 Ian A. Munn, College of Forest Resources, Box 9680, Mississippi State, MS 39762 Stephen C. Grado, Department of Forestry, Box 9681, Mississippi State, MS 39762

Abstract: We conducted a survey to evaluate 2003–2008 sales of private rural lands in Mississippi that were purchased for wildlife-related recreational uses. Land parcels purchased (*n*=800; totaling 102,611 ha) were predominately forested (45%), followed by agricultural lands (26%), early successional habitats and recently planted pine forests (25%), and other lands (>3%). Hunting (99%) and motorized vehicle use (65%) were common uses reported on properties. Wildlife-related recreation accounted for an estimated 34% (US\$1,566/ha) of overall value of rural lands sold. Cover types such as forests, and amenities, such as lodging and roads, increased potential recreational use and prices paid for rural properties. We speculate that demand and prices paid for managed, high-quality properties that support wildlife populations for recreational use will increase with time. To better estimate value of rural lands with habitats supporting wildlife species, we recommend Extension-based training seminars on the topic of rural lands valuation for bankers and appraisers. Our findings can be used to better estimate in economic terms the ecological benefits that imperiled wildlife habitats provide on a rural land base, thereby strengthening environmental regulatory decision-making and land use planning.

Key words: wildlife- and fisheries-related recreation, hunting, land valuation, Mississippi

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Hunting, fishing, wildlife-watching, and other wildlife-related activities generate demand for quality habitats, which in turn is reflected in rural land prices (Jones et al. 2006). This is particularly true for those properties with quality habitats for game and nongame wildlife species with recreational potential, ponds for fishing, and scenic sites for home construction. Due to an increasing demand for privately-owned rural properties that can provide quality recreational pursuits such as hunting, land buyers and investors are often interested in land tracts that offer a diversity of habitats and land covers (i.e., forests) that support game and nongame wildlife species for recreational opportunities (Henderson and Moore 2005, Jones et al. 2006). In contrast, outdoor recreationalists (i.e., hunters, anglers, bird watchers, etc.) who do not own land visit public lands, such as national wildlife refuges, national forests, and state wildlife management areas to enjoy outdoor pursuits. Due to this popularity in visitation, public lands and waters are readily visited and enjoyed by outdoor enthusiasts across the United States (Sexton et al. 2012). However, on occasion, high use on some public lands can lead to potential user conflict issues, and increased hunting pressure on wildlife game species can impact the quality of outdoor experiences of other recreationalists (Ewert et al. 2006). The purchase of private rural lands for recreation can allow land buyers to enjoy outdoor pursuits, such as recreational

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hunting on tracts without seeing or interacting with other recreationalists and thereby increase the quality of their outdoor experiences. Therefore, land tracts that contain high quality habitats and land covers that support game and nongame wildlife species might be more readily demanded in the marketplace by potential buyers seeking more private outdoor experiences. Purchases of land for private outdoor recreational use may affect land use and thereby impact conservation decision-making in the future (Henderson and Moore 2005, Jones et al. 2006).

A number of studies have examined the relationship between recreational use and land values. Jones et al. (2006) showed that the potential for wildlife-related recreation on rural lands increased the purchase prices of these lands. Henderson and Moore (2005) reported that the majority (57%) of agricultural bankers in the Kansas City Federal Reserve District believed that recreational demand was a contributing factor in farmland value gains in December 2004, up from 44% in December 2002. The same authors reported that farmland values in Texas were higher in counties with higher hunting lease rates and had greater wildlife-related recreational income potential for farmers. Furthermore, the number of Texas farms generating wildlife-related recreational income was positively associated with land values and, on average, hunting recreation accounted for 25% of farmland market values (Henderson and Moore 2005). In a study of Mississippi rural land values, recreational use accounted for US\$808/ha (26%) of the total value per hectare (Jones et al. 2006). Land cover types, particularly naturally occurring hardwood and mixed pine-hardwood forests, were primary determinants for sale values of these tracts. Additionally, attributes indicating active management to improve wildlife habitats, such as supplemental plantings for wildlife, resulted in higher tract prices. In Oklahoma, higher hunting lease rates and wildlife-related recreational income resulted in higher agricultural land values (Guiling et al. 2007). Baird (2010) found that agricultural lands in Montana often sold at prices that exceeded a property's abilities to produce farm-related commodities and income; property amenities, such as scenic view-sheds, fly-fishing opportunities, and access to trophy deer hunting accounted for the surplus. Tuttle and Heintzelman (2013) found that local and non-local land buyers paid higher prices for rural properties that had less human activity impact. The authors suggested that tract buyers were searching for outdoor recreational opportunities and remote locations that would facilitate rest and relaxation. Public lands, including national wildlife refuges, national forests, national parks/parkways, state wildlife management areas, public lakes and reservoirs, and interstate and state highways, can influence the value of adjacent rural lands with potential for use for outdoor recreation (Outdoor Industry Association 2012).

In the land sales marketplace, landowners interested in selling land have to decide on an asking price for the tract, and this process may involve obtaining an appraisal. To assess land tract values, an experienced individual will conduct an appraisal or opinion as to the parcel's value. As Gwartney (1999) stated, "An assessment or appraisal is an organized procedural analysis of data about tract attributes to determine its economic value." This assessment involves determining the tract's highest and best use, estimating value through application of appraisal theory, and finally, extrapolating a final value for the parcel. Appraisers primarily use three standard methods of land assessment: cost approach, sales approach, and income approach (Vrooman 1978). Routinely, in the assessment and sale of rural properties the sales method is used-where prices paid in actual market transactions of similar properties are used to approximate the value of land tracts being assessed (Gwartney 1999). However, it is difficult to use standard land assessment techniques to accurately determine the monetary value or value gain from wildlife-related recreational potential on a given land tract. To address this issue, we used expert opinion (i.e., bank lenders who initiated loans to buyers for land purchases) to evaluate what wildlife-related recreational potential might bring to the overall monetary value of rural lands.

Empirical studies examining the potential influence of wild-

life-related recreation on recent land sales in the United States are limited. Additionally, no current studies have examined how land features such as cover types, featured wildlife species as game, and physical amenities on properties affect recreational contributions on rural land sales. We conducted this study in Mississippi with the long-term goal of defining ways to better determine the economic value that wildlife-related recreation has had on rural land sales in Mississippi and to possibly expand this study to other Southeastern states. Thus, our objectives were to examine the potential impact of wildlife and fisheries-related recreation on rural land sales by clearly identifying 1) potential land cover types that can support wildlife populations on properties purchased for recreation, 2) the presence of potential wildlife species and recreational amenities on properties, and 3) the proximity of tracts to public land bases that may influence sales of properties used for recreational purposes. These potential findings can be used as one approach in the economic valuation of wildlife and fisheries populations and of lands and waters that support wildlife as habitats and refugia. Placing economic value on wildlife and their habitats can enhance land use planning, foster natural resource conservation, and be applied in regulatory and land-use decision-making affecting imperiled lands, such as wetlands.

Methods

We collected data on sales of rural properties that occurred during 2003–2008 in 81 of 82 Mississippi counties from financial lenders and appraisers in Mississippi who either financed or assessed values on tracts sold. To collect rural land sales information, we designed and used a questionnaire (2008 Mississippi Rural Land Value Survey) that grouped questions to lending and real estate respondents in the following categories:

1. Property location by county, section, township, and range in Mississippi

2. Importance of wildlife-related recreation in sale of property.

3. Quantity of acreage or area of tract sold divided out by agricultural lands—row crops, pasture or fallow field, impoundments/ ponds, and orchards; forests—cutover/recently harvested, planted pines, natural pines, upland hardwoods, bottomland hardwoods, and mixed pine-hardwoods; and other land uses—permanent water either human-made or naturally occurring (i.e., beaver wetlands, streams), power line rights of way, and wildlife supplemental plantings.

4. Presence of conservation easement recordings on property

5. Enrollments by acreage or land area in Farm Bill Programs or other governmental cost-share assistance programs including the contracted annual dollar payment received per enrolled hectare.

6. Actual or potential recreational uses on property [i.e., hunt-

ing, fishing, wildlife watching, horseback riding, motorized travel (e.g., all-terrain vehicle, off-road motorcycle, boat, and jet ski), nature-based tourism (e.g., camping, hiking, swimming, etc.), and any other recreational uses as identified from lender/appraiser knowledge].

7. Past history of leasing of property for recreational use and funds collected (in U.S. dollars) for such.

8. Road access to and on property by regular vehicles, fourwheel drive vehicles, or all-terrain vehicles—information taken from loan portfolios on parcels.

9. Wildlife species [(e.g., white-tailed deer (*Odocoileus virginianus*), eastern wild turkey (*Meleagris gallopavo silvestris*), waterfowl, mourning dove (*Zenaida macroura*), etc.] and game fish perceived to be abundant on property as determined from lender/ appraiser knowledge.

10. Purchase price of tract including lender's/appraiser's estimation of tract value if wildlife-related recreation was not a consideration.

11. Proximity of property to public lands—national wildlife refuge, national forest, state wildlife management area, public lake, etc. as identified from lender/appraiser knowledge.

12. Existing structures and amenities on property—house, cabin, lodge, barn, storage building, water well, electricity, levee system, etc., as referenced in loan portfolios.

Survey development and procedures followed Dillman (2000). We interviewed lenders in scheduled appointments from June 2008 through June 2009 to obtain property sales information directly from lender interviews and loan portfolios of tract acquisitions. Participating respondents were: Land Bank of South Mississippi in Poplarville and Brookhaven, Mississippi; Land Bank of North Mississippi in Tupelo and Starkville, Mississippi; Mossy Oak Properties, Inc., in West Point, Mississippi; and Rutledge Investment Company, in Memphis, Tennessee.

Lenders identified property sales for inclusion in this study based on their personal knowledge that these tracts had been purchased for wildlife-related recreation as one purpose for acquisition. We divided land sales data into state regions and included properties sold from 2003–2008 in the Mississippi Delta in 21 counties, North Mississippi in 30 counties, and South Mississippi in 30 counties. We defined these regional groupings based on similarities of soil compositions and physiographic areas (Kushla and Oldham 2017). Respondents did not report any land sales transactions in Smith County; therefore, Smith County was not included in our analyses. We used descriptive statistics to summarize survey responses statewide and within regions. We employed Independent—Samples T Tests to test for statistical differences between response variables (proportion of properties for recreational uses and wildlife occurrence; areas for land cover) across regions and for the variables—recreational value of tracts with and without lodging accommodations after a review of variable frequency distributions revealed potential differences. Variables showing statistical differences across regions were reported.

To test for influence of property proximity to adjacent public land bases, the Mississippi Automated Resource Information System software program was used to convert section, township, and range of each property sold to latitude and longitude (Mississippi Automated Resource Information System 2014). After conversion, the DeLorme Topo USA 7.0 software program was used to measure distance in kilometers from each property parcel to the nearest public land designation and state and US highways (Delorme Topo 2000).

Multiple linear regression models were used in the following formula, $\hat{y} = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \ldots + \beta_{k-1} x_{k-1} + \beta_k x_k$ where the dependent variable predicted was the calculated recreational values of land tracts collected in this study. All data for model variables was collected in survey forms completed by lending officers of financial institutions and appraisers in the land brokerage firm participating in the study. Potential explanatory variables on properties sold included, but were not limited to, land covers, lands enrolled in Farm Bill Programs, lands leased for recreation, recreational activities, wildlife game species perceived by bank lenders and appraisers to be abundant on tracts, amenities (i.e., roads, housing accommodations, and levee systems), and property location. These variables were compared to calculated recreational values of properties at the univariate level using Pearson correlation coefficients. Only explanatory variables showing P values ≤ 0.05 were included in regression models to predict wildlife-related recreational property values. This precaution was taken to avoid potential model loading issues that could result from insignificant (P > 0.05) variable inclusions (Norusis 2011). We compared Pearson correlation coefficients of explanatory variables to avoid multicollinearity effects, using a cutoff level of < 0.65. Lastly, we evaluated partial correlation coefficients of statistically significant explanatory variables in model results to determine relative weights of variables in predicting dependent variable-wildlife-related recreation monetary value of parcels.

Results

We collected information for 800 property sales selected and reported by financial lenders and land appraisers who completed our rural land value questionnaire. All information reported about tracts and used in statistical analyses was taken from questionnaire responses.

Cover types and land features	Tract covers (n)	Total area (ha)	Areal range (ha)	Mean ha (± SE)	Area (%)	
Forests						
Natural pine forests	74	3,453	3-698	47 (± 11)	3.4	
Upland hardwoods	95	7,332	2-1,043	77 (± 13)	7.1	
Btmland hardwoods	131	24,181	2-4,438	185 (± 45)	23.5	
Pine-hardwoods	124	11,410	3-1,200	92 (± 14)	11.1	
Wetlands - emergent	1	41	0	41	0.04	
Area total		46,417			45.2	
Early succession habitats and tree plantations						
Cutovers (<5 years)	54	2,368	10-534	111 (± 88)	2.3	
Planted pine forests	154	10,685	3-4,586	171 (± 33)	10.4	
Woodlands-saplings ^a	309	13,389	3-1,408	106 (± 10)	13.0	
Area total		26,443			25.7	
Agricultural lands						
Row crops	130	15,811	2-1,011	123 (± 3)	15.4	
Pastures/fallow fields	192	7,146	1-563	37 (± 4)	7.0	
Planted grasslands	65	2,766	2-237	43 (± 6)	2.7	
Aquaculture ponds	19	1,443	2-268	76 (± 15)	1.4	
Farm ponds	19	57	1–8	3 (± 0.5)	0.1	
Area total		27,222			26.6	
Other features						
Roads	254	2,082	1 - 381	8 (± 2)	2.0	
Wildlife food plots	25	246	1-43	10 (± 2)	0.2	
Lakes	11	125	2-4	11 (± 2)	0.1	
Ponds ^b	33	129	1 – 12	4 (± 0.5)	0.1	
SMZs	12	116	2-44	10 (± 3)	0.1	
Rights of ways	2	9	2-8	5 (± 3)	0.01	
Area total		2,707			2.5	
Total and percent - statewide		102,789			100	

 Table 1. Land cover types and land feature metrics for estimating recreational value contributions

 on total sale value of rural properties sold in Mississippi 2003–2008.

a. Comprised primarily of tree saplings of <15 years of age that remained after previous forest harvests b. Includes surface area of human-made impoundments excluding permanent lakes, farm ponds/stock ponds, and aquaculture impoundments

Land Cover Types

Tract sizes of properties ranged from 4 to 4,817 ha, totaling 102,611 ha (Table 1). Of these, 47% (n = 377) were ≤ 50 ha in size; 38% (n = 300) ranged in size from >51 to 202 ha; and 15% of properties (n = 123) were >202 ha. Sixty-one percent of tracts, based on areal coverage, were located in the Delta region, followed by 25% in North and 14% in South regions of the state.

Land cover types reported were in the following categories: forests, early successional habitats and planted pine forests, agricultural lands, and other lands including roads, water, and supplemental wildlife plantings (Table 1). Forests represented the majority of lands reported, followed by agricultural lands, early successional habitats and recently planted pine forests, and other lands. Bottomland hardwood forests dominated all forest stands in both number of properties reported and aerial size. Agricultural lands were comprised mostly of row crops, pastures, planted grasslands enrolled in Farm Bill programs, and aquaculture and farm/ stock ponds in descending order of magnitude. Other property features reported included roads, supplemental plantings for wildlife, ponds and lakes, streamside management zones, and utility rights-of-way.

From a regional perspective, Delta tracts were more heavily forested (50% coverage), followed by agricultural lands (36% coverage) dominated by row crop production. Tracts sold in the North region were predominately early successional tracts of harvested forests and planted pine forests (47% area coverage), followed by agricultural lands (27%) in mostly pastures or fallow fields and by hardwood and mixed pine-hardwood forests (24%). South region land sale tracts were comprised primarily of forests (46% area coverage), early successional habitats and planted pine forests (40% coverage), and agricultural lands (13%) with pastures and fallow fields.

No conservation easements were recorded on properties in our study. However, lands enrolled in Farm Bill programs where wildlife habitat management practices and tree plantings occurred were more common: 184 properties, totaling 11,509 ha, sold for recreation. Farm Bill Program-enrolled lands were partitioned in Conservation Reserve Program (CRP; 59% of enrolled hectares) and Wetlands Reserve Program (WRP; 41% of enrolled hectares). Reported annual payments were higher on CRP properties (\$837/ ha) when compared to lands enrolled in WRP (\$116/ha) with the former located in Delta and North regions while WRP tracts were more often located in Delta (94%). No CRP or WRP lands were reported in the South Region.

Recreational Pursuits and Wildlife Game Species Reported on Land Tracts

Hunting (99% of properties) and motorized vehicle use (65% of properties) were the most prevalent recreational activities pursued on tracts followed by fishing (12%), horseback riding (10%), wildlife watching (5%), and nature-based activities (e.g., camping, hiking; 1%; Table 2). The general trend of recreational activities was similar across regions; however, some specific activities differed across regions. Hunting was reported as slightly higher in the Delta and North regions (>99%; F=36.32, df=1, 522; P<0.001 and F=23.83, df=1, 423; P<0.001, respectively) as compared to the South Region (96%). Watching wildlife was more prevalent on tracts in the Delta Region (9%) as compared to <4% in North and South regions (F=42.89, df=1, 423; P<0.001 and F=45.72, df=1, 423; P<0.001, respectively). Similarly, motorized travel was higher

Table 2. Activities perceived to be conducted on properties purchased for wildlife-related recreation
within Mississippi and within three regions of the state 2003–2008.

	Statewide properties	Delta Region properties	North Region properties	South Region properties
Perceived	(<i>n</i> = 800)	(<i>n</i> = 276)	(<i>n</i> = 375)	(<i>n</i> = 149)
activities	(<i>n</i>)	(<i>n</i>)	(<i>n</i>)	(<i>n</i>)
Hunting	790	274	373	143
Fishing	96	30	45	21
Wildlife- watching	43	25	14	4
Motorized travel	520	183	232	105
Horseback riding	79	24	34	21
Nature tourism	7	4	2	1

Table 3. Game wildlife perceived to be on properties purchased for wildlife-related recreation within Mississippi and within three regions of the state 2003–2008.

	Statewide properties (n = 800)	Delta Region properties (n = 276)	North Region properties (n = 375)	South Region properties (n = 149)
Perceived wildlife	(<i>n</i>)	(<i>n</i>)	(<i>n</i>)	(<i>n</i>)
Deer	757	263	363	131
Turkey	683	226	346	111
Waterfowl	159	123	21	15
Squirrel	195	86	65	44
Rabbit	164	78	59	27
Dove	148	72	53	23
Quail	119	54	47	18
Gamefish	80	26	36	18

in occurrence on properties in the South Region (71%; F=5.35, df=1, 649; P=0.021) and on Delta tracts (66%; F=15.48, df=1, 522; P < 0.001) as compared to North Region tracts (62%).

Prevalent wildlife game species reported on properties statewide included white-tailed deer and eastern wild turkey (Table 3). White-tailed deer were reported on 95% of tracts while wild turkey were seen on 85% of properties. Squirrel species (*Sciurus spp.*) were reported on 24% of tracts, rabbit (*Sylvilagus spp.*) and waterfowl each occurred on 20% of properties, followed by mourning dove (19% of tracts) and northern bobwhite quail (*Colinus virginianus*; 15% of tracts). The rank order of prevalent game species reported was similar across regions to statewide estimates; however, prevalence of species differed among regions. For example, turkey occurrence reported on tracts was greater in the North Region (92%) as compared to prevalence in Delta Region (82%; *F* = 68.39, df = 1, 649; *P* < 0.001) and in South Region (74%; *F* = 120.92, df = 1, 522; *P* < 0.001). However, waterfowl was more frequently reported on Delta properties (47%) as compared to its occurrence in the North Region (6%; *F*=946.77, df=1, 649; *P* < 0.001) or in the South Region (10%; *F* = 426.18, df = 1, 423; *P* < 0.001). The latter observation might be explained due to prevalence of wetlands in the Delta and related to tracts' proximity to the Mississippi River Flyway (Black Duck Joint Venture Management Board 2008). Similarly, rabbit (28%), dove (26%), and quail (20%) were more commonly reported on Delta tracts as compared to North [<17%; (F = 59.88, df = 1, 649; P < 0.001); (F = 59.22, df = 1, 649; P < 0.001); and (F = 24.02, df=1, 649; *P* < 0.001), respectively] and South [<18%; (*F*=24.74, df=1, 423; P < 0.001); (F=29.58, df=1, 423; P < 0.001); and (F = 17.01, df = 1, 423; P < 0.001), respectively] properties. Squirrel was reported as more frequently hunted on Delta and South tracts (> 29%; *F*=66.78, df=1, 649; *P* < 0.001 and *F*=33.24, df=1, 522; P < 0.001, respectively) as compared to North properties (17%). Ponds or impoundments supporting gamefish for recreational angling were reported on approximately 10% of properties across regions and also statewide.

Properties Sold Which Were Already Under Lease for Hunting Recreation and Amenities

Of 800 properties sold, 123 had portions that were leased for recreation. Statewide, the mean tract size leased was 73 ha (ranging from 5-928 ha) with previous lease arrangements that averaged \$51.18/ha (±\$2.47/ha) with a price range of \$12-\$161/ha. In the Mississippi Delta, 87 tracts were leased and averaged \$53.18/ ha $(\pm$ 3.41/ha) and ranged in size from 6 to 928 ha. Delta tracts leased were 43% larger in size and earned \$4.77 more per hectare on average as compared to North Region tracts. In North Mississippi, 57 tracts were leased and averaged \$48.41/ha (±\$3.85/ha). Only one tract was leased in South Mississippi and consisted of 41 ha valued at \$37.05/ha. Cover types on tracts leased were predominately bottomland hardwood forests, mixed pine-hardwood forests, woodland forests, fallow fields and pastures, WRP and CRP acreage, and supplemental wildlife plantings. For comparison, leased Delta Region tracts contained over 30 times the area in bottomland hardwood forests (F = 36.07, df = 1, 119; P < 0.001) and WRP lands (F = 67.79, df = 1, 649; P < 0.001) as North Region properties, while leased North Region tracts had over 20 times the area in mixed pine-hardwood forests (F=23.35, df=1, 119; P <0.001) and in fallow fields and pastures (F=27.14, df=1, 119; P < 0.001) as Delta properties.

Regarding whether properties were accessible by vehicles, bank lenders reported that roads leading to properties that allowed access by cars or trucks were reported for 86% (n = 689) of properties statewide. Percentages of properties within regions that had road access were 86% (n = 237) in Delta, 87% (n = 325) in North, and 85% (n = 127) in South. Statewide, 254 properties were transected by improved dirt, gravel, or paved roads that allowed vehicle access and travel within property boundaries. Land buyers paid slightly higher prices for tracts (21/ha on average) that contained roads (n = 719).

A total of 330 properties statewide (41%) were reported to have buildings, utilities or other amenities present at the time of sale. Recreational value of tracts with lodging accommodations (e.g., house, cabin, lodge, or camp house) was higher on a per hectare basis (\$2,536/ha; n=149; F=21.19, df=1, 798; P < 0.001) when compared to tracts without overnight accommodations (\$1,526/ ha; n=651). Thirty-one properties (4%) contained housing, such as a cabin, house, or lodge, in addition to utilities (e.g., accessible piped water, electricity, and sewage) and outbuildings at time of sale. Piped or well water was available on 238 properties (30%) while septic or sewage treatment and natural gas or propane were present on 81 (10%). Barns and other outbuildings were reported on 180 properties (23%). Properties that exhibited no structural or utility amenities numbered 480 (60%).

Residency of Buyers

Bank staff supplied information on residency of 111 buyers of 800 properties sold during the study period. Of these, 79% were from Mississippi, 14% from Louisiana, 3% each from Alabama and Tennessee, and 1% from Georgia. Tennessee and Alabama buyers purchased land in North Mississippi; whereas, buyers from Louisiana and Georgia tended to purchase land in Mississippi Delta. One buyer from Louisiana purchased one property in South Mississippi.

Overall Recreational Value of Tracts

Properties we examined on average sold for \$4,631/ha across the state. Bank and real estate firm staffs, including 12 lenders and appraisers, were asked to estimate the value of each tract that sold without considering wildlife-related recreation as a sale component. Other contributing factors, such as timber values, agricultural values or rental rates, and commercial development potential were not specifically or individually identified but were included by respondents in property value determinations. Through this assessment, lenders and appraisers estimated these properties would have sold on average for \$3,065/ha without consideration of recreational values. Thus, the difference between these estimates or the mean value per hectare of tracts sold statewide due to wildliferelated recreation was \$1,566/ha. Therefore, wildlife-related recreation accounted for an estimated 34% of overall value of rural lands sold in Mississippi during this time period based on this method. Using a similar approach above, regional estimates per hectare due to wildlife-related recreation were \$1,662/ha in the

Delta (or 36% of overall value), \$1,267/ha in North (32% of overall value), and \$1,665/ha in South (30% of overall value). More recently purchased tracts in this study (2007–2008)—identified as having wildlife-related recreational value—averaged \$1,030 more per hectare as compared to parcels purchased in 2003–2004, indicating that such value is increasing.

Regression Models

Statewide model results indicated that statistically significant explanatory variables including land covers (ha) in mixed pine hardwood forests, bottomland hardwood forests, planted pine forests, natural pine forests, upland hardwood forests, and row crops; lodge accommodations on properties; road access to and on tracts; and distance (km) of tract from a major highway were predictors of the recreation dollar value of tracts (Table 4). Regional models differed from one another. However, regional models followed a general trend of explanatory variables that included types of forested, agricultural, and other land covers (ha), amenities (i.e., lodging), and recreational pursuits primarily influenced recreational value of lands (Table 4). Pearson correlation coefficient values between all explanatory variables included in regression models were < 0.65, indicating tolerable multicollinearity effects.

Discussion

Wildlife-related recreation accounted for an estimated 34% (or \$1,566/ha) of reported overall value of rural lands sold in Mississippi in our study. This was higher than similar estimates made by Henderson and Moore (2005) in Texas (25% of land value) and Jones et al. (2006) in Mississippi (26% of land value). Study findings revealed that buyers were interested and paid more for selective cover types or habitats that supported wildlife game species, including deer, turkey, waterfowl, and mourning dove when sold for wildlife-related recreation use. Regression analysis showed that property buyers in Mississippi were selecting lands to purchase with certain cover types (e.g., bottomland hardwood forests, mixed pine-hardwood forests, pastures/fallow areas, and agricultural lands) and with amenities for enjoyment of wildlife-related recreational activities. These property features influenced amounts paid for rural lands for recreation in Mississippi. Forests, specifically bottomland hardwood and mixed pine-hardwood forests, dominated land cover types of properties sold, representing 35% of total land area sold. This trend was more evident in the Mississippi Delta Region where wetland forests and mixed pine hardwood forests comprised an impressive 47% of land covers on properties sold despite forests only representing 31% of all land cover types within Delta counties (MIFI 2009). These forest types are important to wildlife game and nongame species [i.e., turkey and wood

Table 4. Regression models summaries predicting calculated recreational land values and associated
significant explanatory variables for rural land sales in Mississippi 2003–2008 ^a .

Independent variable	β	Std. error	Р	Partial correlations	
Statewide model (<i>n</i> = 800 properties)					
Constant	-24,900	37,970			
Mixed pine hardwood forests (ha)	1,692	108	< 0.001	0.322	
Bottomland hardwood forests (ha)	1,182	84.9	< 0.001	0.286	
Planted pine forests (ha)	1,830	135	< 0.001	0.278	
Natural pine forests (ha)	2,580	243	< 0.001	0.218	
Row crops (ha)	763	98.3	< 0.001	0.159	
Uplandhardwood forests (ha)	1,032	222	< 0.001	0.096	
Lodge on property (presence)	310,548	79,191	< 0.001	0.081	
Four-wheel drive vehicle access on property (presence)	37,990	16,433	0.021	0.047	
Four-wheel drive vehicle access to property (presence)	84,362	40,252	0.037	0.043	
Distance from tract to US highway (km)	-1,439	535	0.007	-0.055	
Model analysis summary $-R^2 = 0.764$ and adjust	sted $R^2 = 0$.	755			
Delta model (<i>n</i> = 276 properties)					
Constant	-2,727	37,715			
Mixed pine hardwood forests (ha)	2,247	215	< 0.001	0.522	
Bottomland hardwood forests (ha)	1,379	194	< 0.001	0.418	
Year sold (2003—2008; by year)	63,872	22,526	0.004	0.142	
Distance from tract to interstate highway (km)	3,630	1,497	0.027	0.122	
Model analysis summary $-R^2 = 0.530$ and adjust	sted $R^2 = 0$.	517			
North model ($n = 375$ properties)					
Constant	33,116	22,621			
Waterfowl hunting (occurrence)	237,2828	42,639	< 0.000	0.262	
Mixed pine hardwood forests (ha)	2,054	385	< 0.000	0.251	
Planted pine forests (ha)	1,775	336	< 0.000	0.249	
Woodland forests (ha)	738	191	< 0.000	0.182	
Pasture/fallow fields (ha)	621	263	0.019	0.111	
Levee system (presence)	196,964	100,166	0.050	0.093	
Model analysis summary $-R^2 = 0.464$ and adjust	sted $R^2 = 0$.	402			
South model (<i>n</i> = 149 properties)					
Constant	29,977	7,513	< 0.001	0.295	
Pasture/fallow fields (ha)	2,500	209	< 0.001	0.242	
Planted pine forests (ha)	1,651	169	< 0.001	0.095	
Lodge (presence)	380,248	98,583			
Upland hardwood forests (ha)	1,117	304	< 0.001	0.090	
Waterfowl hunting (occurrence)	127,407	47,504	0.008	0.066	
Model analysis summary – $R^2\!=\!0.935$ and adjusted $R^2\!=\!0.924$					

a. Variables excluded from final models - Statewide model (P > 0.05): area enrolled in Farm Bill Programs, land leased for recreation, waterfowl hunting, game fishing, levee systems, mineral rights included in property sale, distance to interstate highway, distance to state highway, distance to national wildlife refuge, distance to national forest, sale year.

Delta model (P > 0.05): land leased for recreation, regular vehicle use on property, four-wheeled drive vehicle use on property, waterfowl hunting.

North model (*P* > 0.05): row crops (ha), bottomland hardwood forests (ha), permanent lake (presence), wildlife supplemental plantings (ha), area enrolled in Farm Bill programs, land leased for recreation (ha), regular vehicle use on property, four-wheeled drive vehicle use on property, all-terrain vehicle use on property, dow hunting on property, quail hunting on property, squirrel hunting on property, rabbit hunting on property, distance to U.S. highway, distance to national park, distance to state wildlife management area.

South model (P > 0.05): bottomland hardwood forests, permanent water bodies, wildlife watching, horseback riding, all-terrain vehicle use on property, regular vehicle use on property, four-wheeled drive vehicle use on property, house, cabin, storage building, barn, electricity, distance to city. thrush (*Hylocichla mustelina*)] providing critical habitats for mating and nesting, foraging, and refugia (Yarrow and Yarrow 1999, Rohnke et al. 2016).

Additionally, our study indicated that buyers may search for properties that have a combination of land cover types that provide diverse habitats for a suite of wildlife game species and potentially offer a multitude of hunting opportunities. Our regression models showed land cover variables were prevalent with higher associated partial correlation coefficient values as compared to other explanatory predictors of recreational land values we investigated (e.g., lodging accommodations and road access on properties). Our findings point out that properties have more value when they are comprised of flooded areas, row crops, forests, and pastures and/ or fallow fields that may offer diverse habitats which benefit a variety of wildlife species. These attributes appeared to increase recreational potential on tracts and subsequently may increase sales proceeds gained on tracts sold as shown in our regression results.

Tracts purchased that contained lands that had been leased for hunting recreation in the past were not numerous in our study (14% of tracts). However, these tracts demanded higher hunting lease prices per hectare when compared to other lands in the state with a leasing history that often times did not possess similar land covers or amenities as our study parcels did. For example, so-called 16th Section lands in Mississippi, used and managed at discretions of local school districts for support of public education, were often subjected to more intensive land-use practices such as clear-cutting timber harvests and agriculture. Sixteenth Section lands leased for hunting averaged \$29.62 less per ha (Rhyne et al. 2009) when compared to tracts leased in our study. Tracts in our study were managed routinely with conservation practices (e.g., forest management practices, wildlife vegetative plantings, and flooding areas for waterfowl) in association with agriculture and timber production. Also, a portion of leased tracts in our study possessed lodging accommodations (16%) that parcels typically leased for hunting often do not have which consequently increased leasing amounts collected. Overall, tracts in our study had been leased for higher prices for hunting recreation and subsequently were more valuable when sold primarily due to land covers that provided habitats for wildlife game species and for amenities, such as overnight accommodations on select parcels as indicated in regression results.

Delta tracts reported as already-leased were larger in size and were assessed at higher values compared to tracts in other regions. One possible explanation for higher lease prices is that soils of the Lower Mississippi River Alluvial Valley Delta Region are usually higher in soil fertility with a deeper topsoil horizon as compared to many soils in other regions of the state. Edaphic characteristics such as these often produce vegetation of greater nutritional value for wildlife and support higher quality hardwood forests with hard mast production that benefit numerous game species including waterfowl, white-tailed deer, and wild turkey (Kushla and Oldham 2017). White-tailed deer in the Delta Region of Mississippi are often larger in body mass and frequently produce superior antler quality when compared to trophy animals in other Regions of the state in part due to higher fertility soils and animal genetics (Michel et al. 2017). Another consideration is larger, leasable tracts for hunting, particularly in the Delta Region are highly desirable for leasing for wildlife-related recreation. These factors might help explain higher hunting lease prices collected on tracts in the Mississippi Delta Region.

Lands and land covers (i.e., composition of forest stands) differ across the state due to edaphic, hydrological, geographic, and land-use factors that ultimately affect habitats and lands suitable for communities of wildlife species. Consequently, these land base conditions may influence human recreational activities and subsequent acquisitions of properties intended for wildlife-related recreation. For example, deer and turkey hunting were more commonly reported on properties purchased statewide most likely due to popularity of these game species. Waterfowl hunting and waterfowl habitat management activities were prevalent on tracts sold and were shown to increase per hectare recreational values in North and South regions as indicated in regression models. Additionally, hectares in mixed pine hardwood, planted pine, and woodland forests along with pasture and fallow fields increased tract values in the North Region while pastures and fallow fields and planted pine and upland hardwood forests hectares increased land sales values in the South Region. Tracts that contained lands enrolled in Farm Bill Programs were more numerous in the North and Delta Regions and were linked to wetlands and riparian area management activities supporting game species, particularly waterfowl. Thus, types of wildlife-related recreational activities along with associated land covers and wildlife habitat management activities, such as forest management practices and moist soil impoundment management for waterfowl influenced land sales values and were unique to Mississippi Regions as demonstrated in regional regression results.

Buyers were willing to pay more for properties that contained lodging accommodations and roads. Lodging allows hunters and other outdoor enthusiasts to stay overnight on recreational lands and thus provides extended periods of property use. Likewise, hunters can easily travel and change locations on tracts using roads that facilitate more hunting opportunities and other recreational uses.

Timber values were not evaluated on land sales in our study.

However, forest management practices, such as selective thinnings and prescribed fire implemented to increase timber quality and yields more often benefit habitats for wildlife species including white-tailed deer and turkey (Yarrow and Yarrow 1999) and enhance recreational opportunities on private lands (Rohweder et al. 2000). Our findings suggest importance of forests—particularly hardwood forests in terms of wildlife-related recreation and land values in Mississippi. This finding, coupled with merchantable value of saw log and veneer quality timber on private lands, emphasized the importance of sustainable management of older-age class hardwood forests for compatible, long-term recreational and timber uses.

Management Recommendations

Land buyers purchased rural properties in Mississippi for wildlife-related recreational uses. Selective cover types on properties, namely forests and value-added attributes, such as lodging accommodations and roads increased the potential recreational use and prices paid for lands in Mississippi. By examining similar research from other U.S. states (Henderson and Moore 2005, Guiling et al. 2007, Baird 2010, and Tuttle and Heintzelman 2013) and earlier studies in Mississippi (Jones et al. 2006), we speculated that demand and prices paid for managed, high-quality properties that support wildlife populations for recreational use may increase with time due to higher demand for quality tracts and fewer tracts available for purchase. Landowners interested in increasing their land values might also consider conserving native mature hardwood and mixed pine hardwood forests and implementing wildlife habitat management practices (e.g., forest thinnings and prescribed fire, supplemental wildlife plantings in forest openings, and moist soil management practices) to increase game species (e.g., whitetailed deer, turkey, and waterfowl) on their lands, to enrich recreational opportunities.

To facilitate value assessment of rural properties that possess recreational potential, we recommend formalized Extension-based training for financial institution lenders and appraisers, particularly in assessing value of selective land cover types along with property amenities and their correlated influences on recreational land sales based on study findings. For example, training for lenders and appraisers could include forest stand composition and age structure assessment and the potential enhancement by these features to wildlife game species habitats that can subsequently increase recreational land prices. Lenders and appraisers also could be taught basic identification of herbaceous plants that are readily used as food and cover by wildlife game species. Hence, the assessments of forest and vegetative covers could better enable lenders and appraisers to more accurately evaluate the potential presence of game species on tracts being sold for wildlife-related recreation. Additionally, metrics of explanatory variables (e.g., bottomland hardwood forest ha, mixed pine-hardwood forest ha, and road access to and on properties) used in regression models could then be adapted as tools for lenders and appraisers to more accurately estimate pricing increases due to wildlife-related recreational potential on subject tracts. With further development of recreational lands trainings and findings from similar studies conducted in the future, Extension services are available to deliver these types of trainings.

These findings can be used in valuation of wildlife habitats for potential use in regulatory decision-making related to threatened and endangered species and protection for imperiled habitats, such as wetlands. In state and federal regulatory decisions, agency professionals are required by law (i.e., Endangered Species Act of 1973, Federal Water Pollution Control Act of 1972, and similar state environmental laws) to place financial assessments on ecosystem benefits provided by wildlife and habitats related to societal values, such as in wildlife-related recreation, wetland-related groundwater recharge and storm/flood abatement, and recreational fisheries; Rouvalis 1988). In regulatory decision-making (i.e., federal wetland permitting), these financial benefits derived by local communities from these ecosystem services are then counterbalanced against commercial and economic values to be gained by permitting the proposed project's construction (i.e., resulting local job growth and potential increased commercial real estate values; Jones et al. 2006, Rouvalis 1988). Latter estimates are easier to acquire as compared to the difficulty often experienced by governmental regulators in obtaining economic valuation estimates for ecosystem benefits provided by naturally functioning ecosystems and wildlife habitats (Jones et al. 2006). Thus, these findings can assist in estimating economic values placed on wildlife and conserved habitats in Mississippi and in other parts of rural America. More research is needed in this area to better ascertain economic value derived from wildlife resources and habitats to assist in state and federal regulatory decision-making (i.e., wetland permitting) and land-use planning where imperiled wildlife habitats are under consideration for alternative land uses and development.

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