

Development of Wildlife Resources on Private Lands

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Preface

During the past 2 years, numerous groups have discussed recreational and other commercial uses of wildlife and land resources by farmers and ranchers. For example, in 1986, the Texas Agricultural Experiment Station conducted the International Ranchers Roundup in Kerrville, Texas. At this meeting, several speakers presented papers on the marketing of wildlife and rangeland resources, some discussed specific habitat management, and still others spoke about the complexities of managing resources for use by livestock, domestic wildlife and exotic species. In 1987, the Southern Rural Development Center conducted a regional symposium to explore alternative farming opportunities in the South. Included among these alternatives was the recreational use of farmland. This report has evolved from such past activities and discussions, and we hope it will be a useful guide for farmers, ranchers and others.

Our goal was not to produce a conventional "how to do it" report. Often such reports can create a false sense of security or over-confidence in the procedures, techniques or practices they advocate. When conditions change, a particular technique may no longer be appropriate or useful. The development and management of natural resources for recreation depends on too many complex ecological, socioeconomic and demographical conditions to guarantee success. Therefore, we have proposed a general process by which farmers and ranchers can evaluate recreational and other wildlife-based enterprises and the types of information and data required to make such an evaluation. In this report we present an inventory of questions and issues that should be addressed in this process. The investigative process should lead to information on the types and sizes of enterprises desired by the public, and indicate whether such enterprises could be practical and profitable.

This report also should be useful to companies in the forest industry interested in increasing their revenue by providing public access to wildlife-based and other recreation. The investigative process for such companies is the same as that for individual landowners.

We believe that the information contained here, and that to be obtained from a systematic investigative process, can aid in decision making and minimize financial risk.

Introduction

Private landowners provide a major source for hunting and other outdoor recreational activities demanded by the public. In the past, many farmers and ranchers have leased their land for recreation to produce supplemental income, and occasionally alternative income, for their agricultural operations. Others have informally provided "free access" to friends and relatives for hunting and fishing. Today, because of problems with agricultural profitability and increasing demand for recreational sites, there are many new opportunities for landowners to commercially develop wildlife, fish and habitat resources.

The purpose of this report is to examine the marketing and management practices that affect the commercial use of wildlife and fish resources.

To begin, we should define several terms. The first of these is the distinction between "consumptive" and "nonconsumptive" recreation. Consumptive recreation means removing, withdrawing or eliminating a particular natural resource. Hunting and fishing are consumptive activities. Nonconsumptive recreation is passive and observational. Birdwatching, hiking and nature photography are examples. These two types of recreation offer different economic incentives to landowners and require different management of resources.

The second term to be defined is "commercial resource use." Wildlife and fish resources can be used in two different ways to produce a profit. Wildlife resources may be used for recreation as described above, or they can be treated as commodities, which are bred, managed and sold for the commercial value of their meat, fur, skin or other parts.

The third important term is "landowner." Although our report is primarily for farmers and ranchers, there are other private landowners in Texas who may be interested in developing commercial uses of wildlife. In Texas, almost 96 percent of the land is privately owned (27). In this report we shall use the term "landowner" to include individuals, partnerships and corporations.

Consumer Marketing Considerations

One of the most serious mistakes a landowner can make when considering the business of selling hunting leases is to assume that his product is wildlife, or the lease itself. These are the raw materials or resources, but the product the landowner is marketing is really the recreational experience. And research shows that this is what hunters value most (23).

Landowners must address several questions in their marketing of this product.

What are the market segments?

It is important that landowners identify, by market research, the segments of the general public which constitute potential consumers of their product — the recreational experience (11). Each segment has its own preferences and expectations regarding a recreational experience.

Information on these market segments can come from several sources. One option is for landowners to fund custom designed studies either individually or collectively

through cooperatives. Secondly, they can obtain county and statewide data from the Agricultural Extension Service, Agricultural Experiment Station and other state agencies which have conducted recreational studies. Lastly, they can obtain general socioeconomic data from the National Survey of Fishing, Hunting, and Wildlife-Associated Recreation, which is conducted every 5 years.

Data in Tables 1 through 4 are from the 1985 national survey, and provide valuable market information for Texas and five other southern states. The data are based on those 16 years of age and older. Table 1 shows the level of dependence on internal markets in each state (percentage of hunters and fishermen who are residents). Tables 2 and 3 give further information on the activities of hunters and fishermen. From the national survey, landowners also can learn about the economics of the hunting and fishing industries, particularly lease-incurred expenditures (see Table 4).

Information such as this can help landowners identify market segments, determine the recreational preferences of each segment and define the geographical boundaries of their markets so that they can effectively target advertising and promotions.

What activities and services are to be provided?

After identifying market preferences and expectations, the landowner can decide which recreational activities and services he will provide and to which groups he will make them available. If a landowner is primarily interested in leasing to hunters, his product "package" may vary from simply permitting access to existing wildlife to providing improved roads, lodging, dogs, habitat management, mixed-game management, hunting blinds and harvest dressing and

Table 1. Hunters and fishermen in selected southern states, 1985.^a

State	Total population (000's)	Percent who hunted or fished	Hunters			Fishermen		
			Total (000's)	Resident (%)	Nonresident (%)	Total (000's)	Resident (%)	Nonresident (%)
Alabama	3,013	32	444	78	22	1,126	76	24
Florida	9,080	28	294	95	5	3,950	62	38
Georgia	4,579	32	527	85	15	1,396	88	12
Louisiana	3,238	37	538	92	8	1,237	85	15
Mississippi	1,942	41	490	81	19	1,018	67	33
Texas	12,006	30	1,488	95	5	3,156	92	8
U.S.	181,095	28	16,684			46,186		

^aBased on persons 16 years of age and older.

Game type and state	Hunters		Hunting days		
	Number (000's)	Percent of all hunters	Number (000's)	Percent of all hunting days	Average number of days per hunter
Big Game^b					
Alabama	313	75	4,934	51	16
Florida	244	76	3,750	52	17
Georgia	407	77	6,049	60	15
Louisiana	299	56	4,318	33	14
Mississippi	357	73	5,502	50	15
Texas	1,131	76	10,923	45	10
U.S.	12,520	75	131,330	39	10
Small Game^c					
Alabama	288	65	3,187	33	11
Florida	133	45	1,785	25	13
Georgia	293	56	2,518	25	9
Louisiana	417	78	5,575	43	13
Mississippi	337	69	3,957	36	12
Texas	715	48	8,506	35	12
U.S.	10,831	65	132,263	40	12
Migratory Birds^d					
Alabama	165	37	1,151	12	7
Florida	125	43	1,496	21	12
Georgia	189	36	1,156	11	6
Louisiana	278	52	2,426	19	8
Mississippi	154	31	971	9	6
Texas	691	46	4,877	20	7
U.S.	5,036	30	41,682	12	8

^aBased on persons 16 years of age and older.
^bBig game included deer, elk, antelope, moose, bear, wild turkey, mountain goat and mountain sheep.
^cSmall game included rabbits, quail, grouse, squirrel and pheasant.
^dMigratory birds included geese, ducks, doves and other game birds.

State	Number of freshwater fishermen	Total number of fishing days (000's)	Days of freshwater fishing	Percent of total fishing days	Average number of days per fisherman
Alabama	1,059	22,679	20,740	90	20
Florida	1,902	79,839	39,173	86	21
Georgia	1,348	29,265	27,901	94	21
Louisiana	1,050	27,075	23,907	95	23
Mississippi	926	16,863	15,231	88	16
Texas	2,462	54,278	39,618	94	16
U.S.	38,228	976,564	774,213	90	20

^aBased on persons 16 years of age and older.

State	Hunting		Fishing	
	Total ^b	Leases	Total ^c	Leases
Alabama	\$ 371,928	\$ 15,007	\$ 536,807	\$ 2,639
Florida	245,024	6,157	2,706,919	86,000
Georgia	390,246	13,833	1,056,924	28,179
Louisiana	326,954	37,359	597,828	1,837
Mississippi	207,419	3,524	386,773	730
Texas	1,067,493	210,018	2,058,097	73,771
U.S.	10,134,004	943,694	28,222,303	885,979

^aBased on persons 16 years and older.
^bExpenditures were for food, lodging, travel, equipment, magazines, licenses (tags, permits and stamps), lease fees.
^cIncludes fresh- and saltwater fishing.

storage facilities (13, 21, 20). Some of these same services could also be provided to nonconsumptive recreationists.

How should the recreational product be promoted?

Landowners have traditionally relied on word-of-mouth as their primary means of promotion. However, this can be ineffective and inefficient, particularly when large lease operations are developed with substantial cash and noncash (e.g. equipment depreciation, landowner's labor, opportunity costs, etc.) investments. Such operations will require active marketing and advertising strategies in order to obtain enough clients to be profitable and stable businesses. Advertising can be expensive relative to other costs, depending on the size of the geographic area from which a landowner wants to draw his clientele, the method of advertising chosen and the frequency of advertising.

Particular attention should be paid to the method of advertising (e.g., newspapers, specialty magazines, radio, television, computer mail networks, trade shows). Studies indicate that consumer and nonconsumer recreational groups differ not only in their background characteristics but also in their preferences for different forms of media and sources of information (23). Therefore, the methods of advertising chosen should coincide with the preferences of the market segments the landowner hopes to reach, and should effectively present the recreational services being offered.

What are the various types of land access?

Landowners should be quick to realize that recreationists can gain access to land and wildlife resources by several means. A 1982 survey of whitetailed deer hunters in Texas showed that 33 percent used land owned by a friend or relative, 15 percent hunted on their

own land, 14 percent used land leased by a friend or relative, 10 percent hunted on company owned/leased land and 8 percent hunted on public land. Of the 1723 deer hunters in the survey (75 percent of the total number of respondents), only 39 percent purchased a lease (24). This compares to 35 percent for javelina, 24 percent for duck, 19 percent for quail and 15 percent for dove. These percentages suggest there is much informality in the hunting market and that a landowner's market share could be quite small given the small population of hunters who lease. The market might be larger, however, for other forms of recreation.

Furthermore, landowners need to be aware that access conditions vary from state to state, particularly in the percentages of privately and publicly owned land. In Texas and elsewhere in the South, approximately 95 percent of the land is privately owned, whereas in western states most of the land is public. In states where public land is plentiful, private landowners have to compete against "free access" conditions, which affects lease marketing and pricing. Private landowners should therefore investigate the availability of public lands with which they would compete, as well as the access policies of the wildlife agencies within their states.

What are the types of leases and pricing?

Before landowners lease land for hunting and fishing, they must be familiar with state regulations. In many areas they are required to purchase hunting preserve permits. In Texas these permits cost from \$20 to \$60, depending on the size of the lease acreage.

There are four general types of leasing arrangements. The first and most common type is the annual or seasonal lease. Under this arrangement the land-

owner provides a hunter or group of hunters the privilege of hunting on the land for a full year or for a particular hunting season. Annual leases often allow the hunters to hunt several species within their respective seasons throughout the year. Seasonal leases generally are for hunting particular species during their seasons. With annual and seasonal leases, hunters and landowners agree on the services to be provided by the landowner and on the harvest quotas for the hunter (within the established state and county game regulations). Lease arrangements also may include the privilege of engaging in non-hunting activities such as photography, camping, horseback riding, etc. (23,17).

The second type of leasing arrangement is for day-hunting. Under this arrangement the landowner allows the hunter access to wildlife on a per day basis. Again, services provided by the landowner and harvest quotas are agreed upon beforehand.

There is a third type of leasing arrangement by which the landowner charges hunters for the animals bagged during a specified period of the season. Charges may differ according to the sex, size, antler development or other such characteristics. Often there will be a base per day or per season charge for access to the property and an additional fee for the animals taken. Where fee-fishing is involved, charges will be based on the pounds harvested.

The fourth type of leasing arrangement involves the landowner selling the rights to access his land for hunting or other recreational activities to an outfitter, a recreational or sportsman club or some other such organization. The organization then manages access to the land for a predetermined period of time and within an agreed upon set of conditions.

Under all leasing arrangements, the price of the lease depends on the services offered, the game species that can be hunted, the quality and quantity of wildlife, the aesthetic appeal of the land, the number of acres of land involved, the distance from metropolitan areas, economic conditions of the targeted market and tax laws. Some services that can be provided by the landowner are lodging, meals, guiding, tree stands, maps of the ranch, target ranges and campsites. Landowners interested in deer leasing also can build deer-proof fences around their property, provide supplemental feed to the wildlife, conduct population counts to assess the sex ratio or age distribution, establish populations of exotic game, or in other ways help provide a marketable wildlife resource to outdoor recreationists (17).

In 1982, costs of hunting leases in Texas ranged from \$1 to more than \$5,000 depending on the species hunted (1). The average cost of a white-tailed deer lease was \$393. Slightly more than 90 percent of the leases bought primarily to hunt white-tailed deer were annual or seasonal leases. The average cost of a mule deer lease was \$902;

average costs of duck and geese leases were \$626 and \$758, respectively. Leases cost an average of \$293 for squirrel and \$647 for quail, while the lease costs for turkey and javelina ranged between those two figures.

There are two useful sources of information about recreational land leasing, particularly for hunting. The first is an article by William Morrill (15) entitled "The Hunting Lease Primer," which appeared in the June 1988 issue of Texas Parks and Wildlife magazine. Morrill identifies ten questions that hunters should ask lessors. The information given in answer to these questions can be important to landowners in selling and marketing leases. The questions are listed below:

1. Where is the lease; what portion of the county is it in?
2. What type of hunting and fishing facilities are available?
3. How many acres comprise the ranch and how many hunters are allowed on it at one time?
4. What animals are available for hunters and how many may they harvest?
5. Is there a set fee or a graduated system of fees (according to game quality and type)?
6. Is the land under a game management program?
7. How many animals are planned for harvesting?
8. How many years has the lessor operated the leased land?
9. How much game was harvested last year?
10. What was the percentage of hunter success last season?

Morrill discusses each of these questions in detail.

The second source of information is a booklet prepared by the Real Estate Center at Texas A&M University (10). The author discusses what a hunting lease should contain, whether it be an oral or a written lease. In addition to many of the considerations listed previously, the subject of landowner's liability is covered. Fee-paying hunters (and other recreationists) are legally classified as "invitees." Landowners, therefore, are legally responsible for keeping their premises safe and for informing users of concealed and dangerous areas.

Generally, there are two ways landowners can protect themselves from legal risk. First, they can purchase liability insurance which covers users' injuries; the cost of the insurance is recovered through the price of the lease. Second, they can obtain liability waivers from users. Such waivers release landowners from liability if users are injured. Waivers, however, must satisfy several requirements. First, landowners must ensure that users granting waivers do so with full knowledge and understanding of a landowner's duty toward them. Second, landowners must inform users that they are forfeiting their right to recover for injuries. Third, users granting waivers must do so intentionally without landowner fraud involved. Finally, the waiver should state whether or not its signing is re-

quired before access to the land will be granted. It is best for landowners to obtain legal advice regarding their rights, obligations and potential risks in conducting a lease-fee operation. They should then clearly and completely communicate the lease terms (those that are fixed and those to be negotiated) with users. And, lastly, they should obtain lease agreements in writing and provide copies to hunters and other users.

Regulations Governing Commercial Uses of Wildlife and Fish

Although landowners control habitat resources, state and county game regulations control licensed hunting, bag limits and seasonality. Hunters on private as well as public land are required to purchase licenses and comply with hunting regulations. The conditions of hunting leases are limited by these regulations. For example, landowners can sell hunting leases that allow for the hunting of does only to licensed hunters during regulated doe seasons (17). But such regulations do not apply if landowners breed these and other game animals for commercial hunting. In such cases they may have to obtain a game breeder's permit (about \$100 in Texas) and clearly mark, tag or brand their game livestock. When landowners breed game, they usually enclose their acreage to improve breeding and migratory control.

To identify the types and variety of hunting and fishing regulations across the nation, the authors conducted a survey of natural resource agencies in the 48 contiguous United States and Alaska. The survey was funded by the Texas Agricultural Experiment Station. All 49 states responded to the survey although the amount of information received varied.

Generally, authority for controlling state fish and wildlife resources lies within a selected governmental department and usually is delegated through a wildlife commission which has the power to promulgate any rules and regulations necessary to carry out and enforce state game laws. The degree of detail in the state laws varies. Some state codes are quite specific, while others contain more general language addressing the management of state wildlife and fish resources. It is noteworthy that a commission may regulate an activity concerning wildlife and fish even though that activity is not specifically mentioned in the state code.

The general framework of wildlife and fish laws is similar from state to state in that licenses or permits are required for activities such as hunting, fishing, trapping, propagating and importing. In all states, wildlife and fish resources are considered property of the state held for the benefit of all citizens until reduced to personal possession. The legal means of taking and possessing game are defined by each state.

A review of the responses from the 49 states led to the identification of four broad categories pertaining to the

commercialization and recreational use of wildlife, and two such categories for fish.

For wildlife, these areas include: 1) propagation and sale of live animals for stocking or propagating purposes; 2) selling natural and manufactured animal products; 3) selling the opportunity to hunt wildlife; and 4) exhibiting wildlife for a fee. Within these categories certain general restrictions are observed by all states, while some states have specific requirements relating to the regulated activity (Table 5).

The general categories pertaining to the regulation of fish include: 1) propagation and sale for both stocking and consumption; and 2) selling the opportunity to angle for fish (Table 6). Each area is regulated in some way by state statute or regulation.

Wildlife

Propagating wildlife is allowed in all states if the proper license or permit is obtained. In addition to state permits, federal permits are required to hold raptors and certain migratory game birds (such as waterfowl) in captivity. In general, all states prohibit the sale of wildlife and their parts except as specifically stated in the statutes, and the sale of any endangered or threatened species is prohibited unless by specific permit, which is commonly reserved for scientific or educational purposes. Proof of legal acquisition, in the form of an invoice or bill of sale, usually is required to show that the animals were not obtained illegally from the wild or imported contrary to state statutes. Propagating facilities also must be approved by a representative of the state game department before animals are received.

The sale of wildlife products was identified as a separate category since a different market exists for hides, pelts and meat as opposed to the market for live animals. Nevertheless, possessing, propagating and selling wildlife and their parts are covered under a breeder's permit in a majority of states. The seller is responsible for knowing that the buyer possesses required licenses or permits before receiving animals or their parts. When shipping products, the seller is also responsible for proper labeling of packages with the licensee's name and license number and the specific contents of the package. This labeling requirement applies to shipping live wildlife as well.

Many states include the propagation of fur-bearing animals in their game breeding permits. However, Idaho, Indiana and Wisconsin consider the raising of domestic fur-bearers to be an agricultural pursuit which may be governed, in part, by the state's department of agriculture as well as the game department. Similar situations appear in Montana and South Dakota when raising large game animals, and in North Carolina when raising quail for food purposes.

Every state except Alaska has statutes governing shooting preserves where hunters pay a fee for the opportunity to hunt. (Alaska has deemed these stat-

Table 5. State regulations regarding the commercial uses of wildlife.

Regulated activity	Restrictions	State exemptions
Propagation and sale of wildlife	<p>Generally, the sale of wildlife is prohibited except as allowed in the statutes and regulations.</p> <p>The sale of recognized endangered and threatened wildlife species is generally not allowed.</p> <p>Importation of most any wild animal requires fish and game department approval.</p> <p>Species of raptors and migratory game birds require federal permits as well as state permits.</p>	<p>Raising large game animals in MT must comply with the Department of Livestock.</p> <p>TX and WI have specific permits for propagating white-tailed deer.</p> <p>ME prohibits the propagation of white-tailed deer.</p> <p>NE requires that live game be offered first to the Game and Parks commission before being exported.</p>
Sale of wildlife products	<p>Shipping and transportation requires proper labeling.</p> <p>Possession of certain animals, pelts and carcasses is generally prohibited during closed season.</p>	<p>FL, KY, VT, VA and WV allow the sale of certain wildlife products only during their respective open seasons.</p> <p>AL, AR, KY, MS, NC, SC and VA have specific permits dealing with the sale of quail.</p> <p>ID, IN, NC, SC and WI consider the propagation and sale of certain wildlife to be an agricultural pursuit.</p> <p>DE, FL, IN, MA, NH, NM, NC, ND, OH, OK, VT, VA, WV and WY specify that certain propagated game species may be sold for food purposes.</p> <p>AK, AR, CA, CO, DE, KS, MD, MA, MI, MS, NH, NJ, NY, ND, RI and WV appear not to require a fur dealer's license to purchase and sell hides and pelts of fur-bearers.</p> <p>CA, CO, FL, ID, IA, LA, ME, MA, MN, MS, MO, MT, NE, NH, NY, NC, PA, RI, TX, VT, WV and WI allow the sale of certain inedible parts of legally acquired wildlife.</p> <p>ME requires a permit to import live, dead or dressed pheasant.</p>
Hunting opportunities	<p>Minimum and maximum acreages usually specified.</p> <p>Preserve/resort boundaries need to be properly marked with signs.</p> <p>Wildlife should be properly tagged prior to release.</p> <p>Operating records must be maintained for reporting purposes.</p>	<p>Preserves/resorts are primarily for hunting game birds.</p> <p>Most licenses allow licensees to propagate their own game birds, but MS and NM require propagating permits in addition to preserve licenses.</p> <p>ND requires a permit to sell any surplus propagated game, and OH requires a commercial propagating permit for species not to be used for hunting purposes.</p> <p>AK deemed preserve regulations unnecessary because so few were operated in the state.</p> <p>AL, AK, AZ, AR, CO, ID, KY, MD, MN, MT, NV, NY, OR, UT and WY require licensing of guides and/or outfitters.</p> <p>OH requires that 12 pheasant or quail be offered to the game department for every 100 acres contained in a shooting preserve.</p>
Exhibiting wildlife	<p>Wildlife must be confined under humane and sanitary conditions.</p> <p>Cage construction should be adequate to ensure public, as well as animal, safety.</p>	<p>ID, MT and WI require additional permits to raise the progeny of exhibited wildlife.</p> <p>NE does not require a bona fide animal exhibit to obtain a permit to hold wildlife in captivity.</p>

Table 6. State regulations regarding the commercial uses of fish and other aquatic organisms.

Regulated activity	Restrictions	State exceptions
Propagation and sale of fish and other aquatics	<p>Importation of most any live fish, eggs, spawn or fry requires fish and game department approval, and generally a certificate of health.</p> <p>Artificial bodies of water for propagating are specified to prevent free access of fish from public waters.</p>	<p>LA, MS and SD consider domestic fish farming an agricultural pursuit.</p> <p>AK, FL, IL, NH, NJ, NM and WY specify that propagated fish may be sold for food purposes.</p> <p>CA prohibits catfish in any type of aquaculture within the state.</p> <p>AK, CA, CO, DE, KS, MS, MO, MT, NH, NJ, NC, SC, UT, WA and WV appear not to require a minnow or bait dealer's license to take or propagate and sell minnows for bait purposes.</p>
Fishing opportunities	Bodies of water should be separate from public water. If not, fish screening devices are needed.	Licensed bodies of water are generally not subject to fishing license, creel limit and season regulations.

utes unnecessary because so few preserves are operated in the state.) The preserves are mainly for hunting pen-raised game birds propagated on preserve grounds or purchased from licensed game breeders. Exotic and imported birds may be released if stated in the preserve license. All game must be properly marked with a toe clip or department issued tab prior to being released. Hunters are generally required to have hunting licenses but are not bound by regular seasons or bag limits. Each preserve may set its own bag limits and seasons, which vary from 5 months to all year.

The final area involving wildlife commercialization is the exhibition of wildlife to the public (e.g., "safari settings"). This is a minor area and does not appear to be widely regulated, but to ensure the safety and humane treatment of animals held in captivity, states do require that cage size and construction be adequate and appropriate for the specific animal. Licensees also must follow a regular feeding and cleaning schedule. When open to public viewing, proper safety precautions must be followed to keep humans and animals at safe distances.

Fish and other aquatic organisms

The propagation of fish and other aquatic organisms are included in one category because the only marketable product is the meat for consumption. Fish includes game fish, nongame fish and minnows. Other aquatic organisms include species such as frogs, turtles, crayfish and mussels. As with wildlife, proper licenses or permits are required to propagate fish and aquatic species. Also, the importation of live fish or eggs usually requires a specific permit and some type of certification that the imported species are free of disease harmful to native fish. As can be seen in Table 6, Louisiana, Mississippi and South Dakota consider raising domestic fish an agricultural pursuit which may be partially regulated by the state's department of agriculture.

Generally, states do not allow the private propagation of fish in open waters stocked for public use. Instead, the licensee must use artificial bodies of water (e.g. tanks and ponds) that are wholly enclosed on his property. (If they are not wholly enclosed, proper screening is required to prevent the free mixing of fish.) This helps control the spread of disease should an outbreak occur in a propagating facility, and it keeps public and propagated fish from mixing freely in state waters.

States issue licenses or register bodies of water for fee-fishing enterprises. As with shooting preserves, creel limits and regular fishing seasons do not have to be followed, and a fishing license usually is not required.

This overview of state regulations regarding the commercial uses of wildlife and fish should give landowners an idea of the ways such regulations may affect the production process. The survey may also identify those wildlife and fish species which have potential commercial value.

Landowners should consult their state's natural resource agency to determine which regulations affect their recreational and commodity based enterprises. The Texas Parks and Wildlife Department has two divisions, one for the regulation and management of wildlife and the other for fish. Both can assist landowners.

Wildlife and Habitat Management Considerations

After landowners acquire an understanding of the potential market and pertinent government regulations, they should investigate the complexities of managing wildlife and its habitat. There is a definite

relationship among these factors that will affect wildlife management and, thus, game quality.

For management purposes, there are three types of wildlife: 1) resident native game; 2) resident-bred game (introduced by the landowner); and 3) migratory game. For each of these the landowner's legal relationship with the game and his control over it are different. With resident-native game, the landowner owns the land and water resources on his property and the state owns the wildlife. The migratory patterns of such game usually are limited to local areas. For example, a "management unit" for white-tailed deer is estimated to be 6,000 acres. Resident-bred game are the property of the landowner, who totally controls or confines their migratory behavior. Because of this he can control breeding quality and number, which is often difficult to do with native game. Where migratory game is concerned, the landowner controls only land and water resources; the state regulates the wildlife. Ownership is difficult to establish, particularly for migratory game such as waterfowl.

The management of these types of wildlife is the same in two major ways. First, the landowner must understand the characteristics of the game and the requirements for its sustenance. Second, the landowner must adopt appropriate habitat management methods.

What are several important game characteristics?

Game and wildlife quality depends on several interactive factors including: 1) size of populations; 2) food requirements; 3) variety and integration of wildlife; and 4) predation.

Excessive populations of grazing/browsing wildlife and livestock create competition that can result in lower body weights, less frequent breeding and fewer offspring. Consequently, landowners should conduct periodic wildlife and livestock population counts and, when possible, carefully control breeding patterns.

Food requirements vary among species, with some species being more adaptable than others. For example, cattle prefer grass, but they use some forbs and browse. White-tailed deer prefer forbs and browse, but use some grass. Fallow deer prefer browse, but use large amounts of grass and forbs. In comparison to cattle and deer, exotics (e.g., axis deer, mouflon sheep and other ungulates) are more adaptable and versatile feeders. They prefer to graze where herbage is the dominant forage, but can readily browse when herbage declines and/or attains maturity (22). Therefore, landowners should select wildlife species and livestock with their forage habits in mind in order to create and maintain a balanced and compatible forage demand system.

The potential impact of predation patterns on game populations is an important management consideration. For example, Andelt (5) reported that in June, during the fawning season, nearly 80 percent of coyotes' diets

consisted of white-tailed deer. Sargeant and his associates (19) reported high levels of red fox predation on various duck species. Any effective management plan will involve coping with or reducing such seasonal high levels of predation.

What kinds of information are important for habitat management?

After landowners acquire an understanding of live-stock and game characteristics, how they interact and their sustenance requirements, they should investigate the flora and water habitat conditions on their property (reference six contains a general discussion of the components of a habitat management plan). Along with estimating the number of animals by species per acre, landowners need to determine the type and acreage of various range sites and estimate the number of pounds of annual production by forage class (grass, forbs, browse) on each site. They can then use these data to estimate acreage carrying capacities and pounds of consumable forage (22).

Landowners can obtain range site guides from the Soil Conservation Service and general production estimates from their Agricultural Experiment Station and Agricultural Extension Service. Specific site surveys should be conducted to supplement this general information. Standing crop estimates by forage class should be made in mid-spring, early summer, mid-fall and mid-winter. If landowners do not have the time for such surveys, they can conduct a single vegetation survey of each site in mid-summer; however, this is a less accurate estimate of forage production (22).

Finally, landowners need to assess water availability and the demand for it by species. Some ungulate species, such as eland, may have a minimal effect on water demand. Eland are indigenous to Africa and can subsist almost entirely on the water obtained from leaf browsing (14). Ranchers in the Southwest (for example the Y.O. Ranch in Kerr County, Texas) who are hard pressed by dwindling water supply, encroaching tree growth or over-grazing problems are experimenting with elands. Whether landowners introduce these or other exotics, or focus on indigenous species, they should estimate minimal water demand conditions for various herd sizes and forage situations.

Landowners interested in other game species such as waterfowl and fish may devote more attention to wetland and pond management than they would for ungulate game. Once waterfowl migration is underway, the only factor a landowner can control is the availability and suitability of wetland habitat. Moreover, Southern landowners along migratory flyways compete with each other in attracting birds and, depending on where these birds are in their migration, may provide different habitat and food conditions. In many areas of the South, most of the waterfowl prefer shallow water areas with some type of vegetation offering loafing and resting cover (9). Landowners can

select from several types of millet, smartweed and duckweed to provide aquatic food. Food quality will vary with the degree of water quality and a landowner's capability to adjust wetland water levels to enhance growth conditions. According to the work of Chamberlain (9), a landowner's ability to develop a profitable waterfowl hunting enterprise will depend on his having at least 1,000 acres of attractive habitat and a waterfowl population with a high fidelity to the area.

Although requiring less acreage than that used by waterfowl, farm ponds should receive the same careful attention when managed for fish and fishing recreation. To effectively manage farm ponds, landowners need to conduct three essential tasks.

First, they must control stocking rates and monitor specie balance. For example, bass, bluegills and channel catfish are the most popular fish for stocking ponds, especially those larger than 1 acre (8). However, Texans prefer to catch largemouth bass. Over-harvesting these bass can upset the balance of fish populations by eliminating this important predator in a pond's food chain. Conversely, over-stocking large-mouths increases predator competition and reduces fish quality and size.

Second, landowners need to control undesirable pond vegetation such as algae, submersed plants and others that can eventually "clog" a pond's ecosystem. Careful identification of these weeds is necessary for the selection of appropriate herbicides, which are the most often used method of controlling aquatic weeds. Finally, landowners should fertilize their ponds annually. Fertilization improves plankton growth, which improves the whole food chain for fish.

Detailed information on pond management is available from numerous sources. The Soil Conservation Service provides information regarding pond construction. The Fish Division of the Texas Parks and Wildlife Department has recommendations on stocking and sources of fingerlings. County Extension agents and wildlife and fisheries specialists employed by the Texas Agricultural Extension Service also can provide management information. Moreover, the Extension Service conducts, in collaboration with the Fish Farmers Association, the Fish Farmers Conference at Texas A&M University each January. Private consultants, such as the statewide Lake Management Services, also can provide valuable help. (Their addresses, if available, can be found in the yellow pages of telephone directories.) Most of these sources will provide information for free or for a small charge to cover the cost of publications.

Conclusion

In summary, there are several steps involved in properly developing a recreational enterprise involving wildlife and fish resources. The first step is to conduct a market study to identify various consumer groups and the services each group prefers. Landowners should then contact appropriate state and county agencies to learn about regulations and fees affecting their operations. With marketing and regulatory information in hand, landowners can assess the characteristics of indigenous and alternative wildlife to determine their compatibility with each other and with livestock. Next, they should assess existing land and water habitat conditions to determine the carrying capacities for different combinations of species. Finally, landowners should develop marketing and management strategies aimed at producing high quality game and providing a rewarding experience to consumers (20).

The amount of effort and the financial commitment landowners make in developing recreational alternatives (and supplements) to agriculture will determine their ultimate success. At one extreme, landowners can operate access-only enterprises in which they sell leases but provide little or no wildlife and habitat management and few support services to consumers. In this case, there will be short-term profits but long-term negative effects on the ecology of the land. At the other extreme, landowners can develop marketing strategies, carefully select and manage game species, enhance habitat and provide a variety of services. Profits will be delayed until startup costs have been recovered, but may be more sustainable because of a more satisfied clientele. Moreover, long-term impacts on the ecology of the land will be positive.

Some research on the economic returns of recreational leasing has been conducted in central and southwest Texas (20, 12). For an operation that provides no services, the break-even charges vary from 67 cents to \$1.88 per acre. When modest services are provided, the break-even charges range from \$3.36 to \$4.25 per acre. For intensively managed operations with multiple services, break-even charges vary from \$6.62 to \$9.37 per acre. All of these charges include cash and non-cash operating costs. Cash costs ranged from 12 to 40 percent of the break-even charges. Overall, these numbers indicate that financial risk exists. This risk could be compounded if the potential market is small because there would be fewer consumers to absorb higher lease costs. Moreover, the new tax laws and depressed economic climate in most of the South will cause a decline in potential hunting revenue. Therefore, thorough market research is essential to establish a viable enterprise.

References

1. Adams, Clark E. and John K. Thomas. 1983. "Characteristics and opinions of Texas hunters." Proceedings of the Annual Conference of the Southeast Association of Fish and Wildlife Agencies. Vol. 37, p. 24.
2. Albrecht, Don E., Steve H. Murdock, Rita R. Harem and Kathy Schiflett. 1987. "The farm crisis in Texas: changes in the financial condition of Texas farmers and ranchers, 1985-86." College Station, Texas: Texas Agricultural Experiment Station, Department of Rural Sociology, Technical Report 87-3.
3. Albrecht, Don E., Steve H. Murdock, Rita R. Hamm and Kathy Schiflett. 1987. "Farm crisis: impact on producers and rural communities in Texas." College Station, Texas: Texas Agricultural Experiment Station, Department of Rural Sociology, Technical Report 87-5.
4. The Agricultural Task Force. 1986. "Agricultural technology: the Texas agenda." Austin, Texas: The Texas Science and Technology Council, the Technology and Transfer Committee (June).
5. Andelt, W. F. 1985. "Behavior ecology of coyotes in South Texas." Wildlife Monographs, No. 94.
6. Bentsen, Steve and Randy Simpson. 1986. "Private landowners' key to wildlife's future." Texas Parks & Wildlife, Vol. 44, p. 38.
7. Butts, G.L., M.J. Anderegg, W.E. Armstrong, D.E. Hormel, C.W. Ramsey and S.H. Sonola. 1982. "Food habits of live exotic ungulates on Kerr Wildlife Management Area, Texas." Austin: Texas Parks and Wildlife Department, Bulletin 7000-56.
8. Clay, William H. 1986. "How to manage a farm pond." Texas Parks & Wildlife, Vol. 44, p. 13.
9. Chamberlain, Patricia A. 1984. "Waterfowl and agriculture: an assessment of wintering waterfowl management and land-use economics on the Texas high plains." Doctoral dissertation. Lubbock, Texas: Texas Tech University.
10. Fambrough, Judon. 1987. "The Texas deer lease." College Station, Texas: Texas A&M University, Real Estate Center.
11. Gartner, William C. 1986. "Marketing the wildlife hunting experience." Proceedings of the International Ranchers Roundup. Texas A&M University. Kerrville, Texas, p. 305.
12. Glover, Michael and J. Richard Connor. 1988. "A model for selecting optional combinations of livestock and deer lease-hunting enterprises." Wildlife Society Bulletin, Vol 16, p. 158.
13. Gramann, James H. 1986. "A market analysis for hunting in Texas." Proceedings of the International Ranchers Roundup. Texas A&M University. Kerrville, Texas, p. 295.
14. Lambrecht, Frank L. 1983. "Game animals: a substitute for cattle?" Rangelands, Vol. 51, p. 22.
15. Morrill, William. 1988. "The hunting lease primer." Texas Parks and Wildlife, Vol. 46, p. 40.
16. O'Laughlin, Jay and Richard A. Williams. 1988. "Forests and the Texas economy." College Station, Texas: Texas Agricultural Experiment Station, Bulletin 8-1596.
17. Pope, C. Arden III, Clark E. Adams and John K. Thomas. 1984. "The recreational and aesthetic value of wildlife in Texas." Journal of Leisure Research (First Quarter), p. 53.
18. Pride, William M. and O.C. Farrell. 1977. *Marketing*. Dallas, Texas: Heighten Mifflin Co.
19. Sargeant, A.B., S.H. Alien and R.T. Eberhardt. 1984. "Fox predation on breeding ducks in midcontinental North America." Wildlife Monographs No. 99.
20. Steinbach, Don W., Michael K. Glover, Richard J. Conner and Jack M. Inglis. 1986. "Economic and operational characteristics of recreational leasing in the Edward's Plateau and Rio Grande Plains of Texas." Proceedings of the International Ranchers Roundup. Texas A&M University. Kerrville, Texas. p. 269.
21. Stribling, James C. 1986. "Marketing rangeland recreation resources." Proceedings of the International Ranchers Roundup. Texas A&M University. Kerrville, Texas. p. 194.
22. Stuth, Jerry W. and William J. Sheffield. 1986. "Determining carrying capacities for combinations of livestock, white-tailed deer and exotic ungulates." Proceedings of the International Ranchers Roundup. Texas A&M University. Kerrville, Texas. p. 241.
23. Thomas, John K. and Clark E. Adams. 1982. "An assessment of hunters' attitudes and preferences concerning Texas wildlife and wildlife regulatory policies." The Texas Agricultural Experiment Station. College Station, Texas.
24. Thomas, John K. and Clark E. Adams. 1985. "So-cioeconomic factors affecting land access to hunt white-tailed deer." Wildlife Society Bulletin, Vol. 13, p. 388.
25. U.S. Department of Agriculture. 1985. "Major uses of land in the United States." Washington, D.C.: Economic Research Service, AER535, June.
26. U.S. Departments of the Interior and Commerce. 1985. "National survey of fishing, hunting and-wildlife-associated recreation: Texas." Washington, D.C.
27. U.S. Bureau of the Census. 1987. "Statistical abstract of the United States: 1988." (108th Edition). Washington, D.C.