

Review of Exotic Ungulates: A Case Study in Florida

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Abstract: Little is known about exotic ungulates in Florida. This study evaluated the status of this industry in Florida and its potential for detrimental impacts on native wildlife. The exotic ungulate industry in Florida was surveyed by mail questionnaires to exotic ungulate permittees, phone interviews, interviews with exotic ungulate owner/managers, interviews with law enforcement wildlife inspectors, review of permit application forms on file with the Florida Game and Fresh Water Fish Commission, and review of the International Species Inventory System list. There were 64 wildlife exhibits, game farms, and hunting preserves that maintained >6,000 exotic hoofed-animals representing 103 species and subspecies. The number of new game farms with exotic ungulates has increased dramatically in the past 10 to 15 years. The most common species are fallow (*Cervus dama*), axis (*Axis axis*), and sika (*C. nippon*) deer. These species are known to compete with native white-tailed deer (*Odocoileus virginianus*) in other states. The greatest concern is the potential transmission of diseases and parasites to native species. The exotic ungulate industry should be monitored closely.

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Exotic ungulates present a challenge to natural resource managers. While considering the potential economic values of these animals, care must be taken to consider how exotic ungulates may interact with native wildlife and domestic livestock (Demarais and Osborn 1989). Because potential for harm to native animals and habitats is great, wildlife agencies must develop strict requirements for their husbandry (Teer 1991).

Little is known about exotic ungulates in Florida. The objective of my study was to evaluate the status of this industry in Florida and its potential for detrimental impacts on native wildlife.

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Methods

Hunting preserve permit holders are required to submit annual harvest reports to the FGFWFC. Reports for the 1987–88 to 1990–91 hunting seasons were reviewed to determine which hunting preserves had exotic ungulates. Also, permit lists were reviewed to identify hunting preserves, game farms, and wildlife exhibits possibly holding exotic ungulates. Questionnaires requesting information on property and facilities, native and exotic stock present, and management issues were mailed to 70 permit holders identified as potentially maintaining exotic ungulates. Questionnaires were followed by phone interviews with respondents that had exotic ungulates and non-respondents.

Five hunting preserves and 11 game farms with exotic deer that might compete with native white-tailed deer were visited, and the owners interviewed. Permit applications on file with the FGFWFC and the International Species Inventory System (ISIS) list were reviewed for further information on owners of exotic ungulates, number of species, and number of animals within Florida. This information was summarized by type of operation (hunting preserve, game farm, or wildlife exhibit).

Results

Compiling all available information, I determined that 64 (2%) of the 3,649 wildlife exhibits, game farms, and hunting preserves in Florida maintained exotic ungulates. These included 31 of 432 (7%) game farms, 5 of 95 (5%) hunting preserves, and 28 of 3,124 (1%) wildlife exhibits. Completed questionnaires were obtained either through the mail or by personal interview for 12 (39%) game farms, 5 (100%) hunting preserves, and 9 (32%) wildlife exhibits with exotic ungulates.

More than 6,000 exotic hoofed-animals representing 103 species and subspecies were maintained in Florida. An unknown number are moved through the state with travelling exhibits or are temporarily kept in Florida during winter by out-of-state operators. Fallow, axis, and sika deer, sheep (various hybrids),

Spanish goat (*Capra* sp.), blackbuck antelope (*Antilope cervicapra*), and American bison (*Bison bison*) comprise approximately 60% of these exotic ungulates. These species make up 94%, 76%, and 23% of the exotic ungulates found on hunting preserves, game farms, and wildlife exhibits, respectively. Wildlife exhibits maintained a larger number of species, but a smaller average number of animals per species (26) than did game farms (54) or hunting preserves (75).

Number of new exotic ungulate operations per year has increased dramatically in the past 10 to 15 years with most of the annual increase attributed to game farms (Fig. 1). Based on the 26 responses, 92% of the game farms with exotic ungulates acquired them after 1980. These trends apparently affected responses to the question: "Do you think the demand and market for exotic ungulates is expanding, stable, or decreasing?" Seventy-eight percent of wildlife exhibit respondents had no opinion, hunting preserve respondents were evenly divided between expanding and stable, and 75% of game farm respondents believed the demand and market were expanding.

The average game farm comprised 2,808 ha ($N = 10$, $SD = 7,211$, range = 4–24,300, median = 83) with 57 ha ($N = 11$, $SD = 66$, range = 3–223, median = 32) devoted to exotic ungulates. The average hunting preserve comprised 1,105 ha ($N = 5$, $SD = 1,021$, range = 162–2,714, median = 486) with 343 ha ($N = 5$, $SD = 214$, range = 122–689, median = 259) devoted to exotic ungulates. The average wildlife exhibit comprised 58 ha ($N = 9$, $SD = 77$, range = 3–235, median = 50) with 17 ha ($N = 9$, $SD = 19$, range = 0.02–49, median = 26) devoted to exotic ungulates.

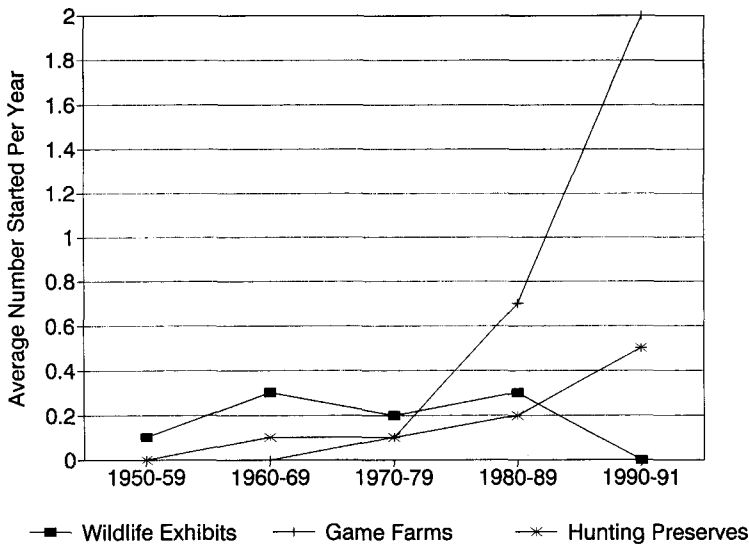


Figure 1. Average number of exotic ungulate operations started per year in Florida by type (based on 26 questionnaire respondents).

Sixty percent of hunting preserves, 33% of wildlife exhibits, and 25% of game farms reported exotic ungulate escapes. Most animals that escaped from hunting preserves and game farms were baited back into the pen, but those not recaptured were shot by the owner or locals. Escapees from most wildlife exhibits and some game farms remained within a perimeter fence and were herded back into their pens.

Most (73%) operations did not mark exotic ungulates. The 7 operations that marked animals were intensively managed game farms (4) and wildlife exhibits (3). Ear tags, color coded collars, tatoos, and implantable transponders were used. These 7 operations also were the only respondents that supported a regulation requiring all exotic ungulates be permanently marked.

No major problems with parasites or diseases were reported. One game farm had been quarantined from a suspected tuberculosis case that was false-positive. Sixty percent of hunting preserves, 64% of game farms, and 100% of wildlife exhibits had a consulting or staff veterinarian. Quarantine facilities were present on 36% of game farms, 40% of hunting preserves, and 67% of wildlife exhibits. Two operators reported depredation by dogs and coyotes (*Canis latrans*), 2 reported problems with depredation by bald eagles (*Haliaeetus leucocephalus*), and one reported losing exotic ungulates to Florida panthers (*Felis concolor coryi*). Seven operations reported problems with poaching and vandalism.

Many exotic ungulate operations in Florida developed from the landowner's personal interest in exotics, followed by the necessity to dispose of surplus animals. Most surplus animals are sold through commercial sport hunting and sale of live animals for breeding stock, with the remainder sold for meat or other by-products.

Average annual harvest of exotic ungulates per hunting preserve (1987–88 through 1990–91) was: 67 sheep (SD = 5.6, range = 62–75), 63 fallow deer (SD = 13.0, range = 53–81), 36 goats (SD = 7.4, range = 28–46), 26 axis deer (SD = 8.3, range = 17–37), 16 blackbuck antelope (SD = 5.4, range = 9–22), 8 sika deer (SD = 0.8, range = 7–9), 1 bison (SD = 0.8, range = 0–2), and 1 elk (*Cervus canadensis*) (SD = 0.5, range = 0–1). Prices were: \$150 to \$360 for goats; \$250 to \$1,500 for sheep, depending on species and variety; \$750 to \$1,000 for fallow, axis, and sika deer and blackbuck antelope; \$1,500 to \$3,500 for elk; and \$2,000 for bison. Prices included field dressing, skinning, preparation of the trophy for taxidermy, and preparation of meat for the cooler. Lodging and guide fees ranged from \$75 to \$150 per person per day. Hunting was conducted on a "guaranteed basis," with the hunter paying for what was harvested.

The market for exotic ungulate meat in Florida is limited. One game farm operator provided fallow deer venison to a local restaurant, and one hunting preserve/game farm operator had plans to produce jerky, slim-jims, and summer sausage using exotic ungulate meat. Live fallow deer were sold for \$650 to \$750.

White-tailed deer were reported as occurring on 80% of hunting preserves, 75% of game farms, and 22% of wildlife exhibits. Of 7 operations in which

white-tailed deer were reported as sharing habitat with exotic ungulates, 4 (57%) white-tailed deer populations were estimated by the respondent to be lower than those on surrounding land and 3 (43%) had populations estimated the same as surrounding land. Of 8 operations in which white-tailed deer were not reported to share habitat with exotic ungulates, 4 white-tailed populations were reported to be higher than surrounding land and 4 were similar.

Seven respondents suggested changes to present regulations dealing with exotic ungulates. Two respondents suggested that jurisdiction over deer and bison farming be transferred from FGFWFC to the Department of Agriculture and Consumer Services, 2 suggested that new applicants be better screened to exclude unqualified people, 1 suggested that AAZPA minimum care standards for each family of ungulates be adopted, 1 suggested that all exotic ungulates be permanently marked, and 1 recommended that no laws or regulations be passed legalizing exotic game farms and hunting preserves in Florida.

Discussion

Potential negative aspects of exotic ungulates in Florida include competition with native wildlife, especially white-tailed deer, and parasite and disease complications. Sika, axis, and fallow deer have been identified as major competitors of white-tailed deer (Keiper et al. 1984, Baccus et al. 1985, Keiper 1985).

Sika, axis, and fallow deer prefer browse rather than grass, and consume browse species similar to white-tailed deer. However, they readily adapt to grass when browse and forbs become scarce or unavailable (Armstrong et al. 1982, Butts et al. 1982, Sorola et al. 1982). Exotic deer are better able to digest grass (Henke et al. 1988), whereas white-tailed deer are physiologically stressed by nutritional deficiencies from a diet primarily of grass (Baccus et al. 1985). Therefore, competition between native deer and exotic deer may occur. However, Harlow and Jones (1965) stated that deer in Florida have access to an unlimited supply of food provided by a number of vegetation types and a variety of plant species. Competition between exotic deer and white-tailed deer, therefore, may not be as intense in Florida as in other states.

Our surveys indicate a concern among exotic ungulate owners about disease transmission. Populations of white-tailed deer coexisting with axis, fallow, and sika deer in Texas (Corn et al. 1989, Richardson and Demarais 1990), fallow deer in Kentucky (Davidson et al. 1985), sika deer in Maryland and Virginia (Davidson and Crow 1983), and sambar deer in Florida (Davidson et al. 1987) show that exotics can better withstand infectious diseases and parasitism than native species. A relationship between body condition, nutritional plane, and incidence of infectious diseases and parasites has been suggested (Davidson et al. 1987).

Six bacterial diseases, 8 viral diseases, and 8 parasites of commercial game ranch and game farm animals have been identified as major concerns to wildlife and agricultural agencies in the western states (Hillman 1991). One important

disease within the exotic ungulate industry is bovine tuberculosis (TB), and the disease is spreading rapidly through game ranches across North America (Merritt 1992). Intensively farmed cervids, particularly elk and deer, are very susceptible to TB (Merritt 1992). Native wildlife could be exposed by escaped exotics, by native deer entering game farm enclosures, and by nose-to-nose contact through fences. Possible ramifications of TB for free-ranging wildlife are relatively unknown. Standard operating procedures on hunting preserves and game farms should be to maintain healthy animals through good nutrition, quarantine of new animals to lessen chance of introducing disease or parasites into the operation, and routine veterinarian services to conduct a disease surveillance program (White 1987).

Escapes of exotic ungulates occur under the best of fencing and management conditions. In addition, exotic ungulates may be intentionally released following transfer of land ownership or after the novelty of ownership wears off (Ramsey 1968). Escaped exotic ungulates have a high probability of becoming established, increasing in numbers, spreading widely, and being difficult to control (Dasmann 1968). Aoudad (*Ammotragus lervia*) are so numerous in New Mexico that they can neither be adequately censused nor eliminated (Morrison 1988). Approximately 45% of exotic ungulates in Texas are not behind game-proof fencing (Traweek 1989).

Exotic ungulates exist in the wild in 3 areas of Florida; 2 of these are islands. Sika and sambar (*Cervus unicolor*) deer were introduced in 1908 to St. Vincent Island, a 5,003-ha barrier island. Blackbuck, eland (*Taurotragus oryx*), and 2 varieties of zebra (*Equus* spp.) were introduced in 1948 on the island. St. Vincent Island became a National Wildlife Refuge in 1968, and all exotic ungulates except the sambar deer either did not survive or were removed from the island (Lewis et al. 1990). Stable populations of approximately 175 sambar and 365 white-tailed deer are now maintained (Flynn et al. 1990). There is a 38% dietary overlap between the 2 species (primarily browse), but food items common to both are abundant. Furthermore, sambar forage mostly in marsh habitats and white-tailed deer in terrestrial habitats. Therefore, the island supports considerably more deer biomass than if only 1 of the species were present (Shea et al. 1990).

The second area where free-ranging exotic ungulates are maintained is Brahma Island in Lake Kissimmee. Spanish goats were introduced onto this 4,200-ha island around 1912. Exotic sheep, fallow deer, axis deer, and blackbuck were introduced in 1974. The island is managed by the Lightsey Brothers Cattle Company as a hunting preserve. There are no white-tailed deer on this island (C. Lightsey 1992, pers. commun.).

The only mainland area in Florida with free-ranging exotic ungulates is at Silver Springs, Marion County. This area is owned by Florida Leisure Acquisition Corporation (FLAC) and Florida Department of Environmental Protection (FDEP). The original owners of Silver Springs introduced fallow and sika deer in 1959 for hunting. Fallow deer have since been eliminated, but sika deer

maintain a relatively stable population of 15–25 animals. These animals do not appear to affect the white-tailed deer population in the area (S. Baer, FDEP, and L. Cheatom, FLAC, 1992, pers. commun.).

Strode (in Presnall 1958) reported a population of axis deer in Duval, Flagler, St. Johns, and Volusia counties that developed from pen escapees in the 1930s. He stated that they were not hunted and were no problem. No evidence of this population was found during the course of this study.

Exotic ungulate operations in Florida provide additional income to landowners, year-round hunting, a potential source of high-protein, low-fat meat, preservation of threatened and endangered species, and non-consumptive recreation. Increased human population densities, affluence, and leisure time and a decrease in available hunting areas have led to overcrowding on wildlife management areas. This has created pressures for new hunting experiences and opportunities (Attebury et al. 1977). Many hunters seek landowners who will grant exclusive use of an area for a fee (Morrill 1988). Exotic species offered by hunting preserves are viewed by some as 1 potential answer to their quest for more game and greater hunting opportunity (Bump 1968). In addition, the fall/winter hunting season for native game is only 72 days long, while exotics can be hunted year-round. A trip to a hunting preserve has many advantages over a foreign safari to some hunters. These include cost of the safari, transportation costs, common language, no need for passports, and less unaccustomed food or undrinkable water (Hulme 1985).

The primary income for exotic ungulate game farms in Florida is derived from sale of trophy bucks to hunting preserves and surplus females and immature males as breeding stock. A major obstacle to development of a meat market is the limited availability of venison. Not enough animals are produced to assure restaurant owners and grocers of a steady supply. Therefore, most are unwilling to carry the product. It is possible that with a larger supply and lower prices, there would be greater demand. However, given the limited success of buffalo-burgers and kangaroo meat in this country and the present novelty status of alligator meat in Florida, exotic venison may also remain a novelty item.

Exotic ungulate operations can provide protected gene pools for endangered species. For example, blackbuck antelope, in danger of extinction in their native land, are among the more popular species on American exotic ranches. There are probably more blackbuck antelope in Texas than in all of India (Jackson 1964, Putman 1975, Attebury et al. 1977). Species Survival Plans have been established to enrich the genetics of captive endangered ungulates. These plans have been developed through the efforts of the African Fund for Endangered Wildlife and Game Conservation International, the American Association of Zoological Parks and Aquariums, and game farms and ranches in the United States (Winckler 1985, Demaris et al. 1990). In Florida, the White Oak Conservation Center, operated by the Howard Gilman Foundation, is one of the foremost breeding centers in North America (Lukas 1991).

An infrequently expressed reason for maintaining exotic ungulates is for

the pleasure of viewing the animals. Several wealthy individuals have established exotic pens near their homes so that they may view species that strike their fancy and have "something different." Also, thousands of tourists annually visit wildlife exhibits with exotic ungulates to view and photograph these animals.

Conclusions and Recommendations

Florida has a small number of exotic ungulates compared to other states like Texas, which in 1988 had 164,000 exotic ungulates representing 67 species (Traweek 1989). However, the number of game farms in Florida appears to be growing rapidly. The FGFWFC needs to closely monitor this industry.

Game farms and hunting preserves maintain exotic deer that compete, in other states, with white-tailed deer for browse. Although competition may be less detectable in Florida, due to its mild climate and abundant and diverse vegetation, potential for disease outbreak does exist. FGFWFC should maintain jurisdiction over exotic ungulates and, as the lead agency, work closely with the Department of Agriculture and Consumer Services in developing regulations for the prevention and control of diseases and parasites that could be brought into the state with these animals. Recommendations developed at the 1991 Game Farming Symposium (Hillman 1991) should be considered when developing these regulations. These recommendations basically suggest that all exotic ungulates be tested for specific diseases within 30 days prior to entry into the state, and that exotics be accompanied by an official certificate of veterinary inspection that includes identification of each animal, results of required tests, certification information, and entry permit numbers. These animals should be quarantined on site for 30 to 180 days depending on need for further tests. Also, a necropsy examination, including histopathology of brain tissue, should be conducted on all exotic ungulates that die of unknown causes, and wildlife and exotic animal auctions should be prohibited until FGFWFC can assure that testing and other requirements are met prior to sale.

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