

CATTLE RANCHING AND BIODIVERSITY CONSERVATION AS ALLIES IN SOUTH AMERICA'S FLOODED SAVANNAS

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ABSTRACT—Cattle ranching in Latin America supports wildlife conservation. Ranching probably represents one of the few land uses in which we can advance conservation goals. The approximately 950,000 km² of Bolivian, Brazilian, Paraguayan, Colombian, and Venezuelan savannas that are privately owned and dedicated to meat production provide a model for conservation programs. We present a geographic and historical description that covers several centuries and ends with descriptions of seven successful cattle ranches (three in the Venezuelan Llanos and four in the Brazilian Pantanal) where cattle ranching, ecotourism, and wildlife conservation coexist. These three activities support each other: tourism creates additional income for cattle ranchers while promoting protection of natural heritage and wildlife research.

Key Words: cattle ranching, Neotropical savannas, tourism, wildlife conservation

INTRODUCTION

Conserving wildlife in the seasonally flooded savannas of Venezuela, Colombia, Bolivia, Brazil, and Paraguay involves complex social and ecological issues that include at least three factors: (1) private landownership, (2) livestock as the predominant land use for at least the last two centuries, and (3) lack of reserved areas sufficiently large, properly managed, and heterogeneous to sustain biodiversity. The objective of this paper is to provide a historic review of the coexistence of wildlife with livestock, then present seven case studies of representative commercial, privately owned ranching enterprises located in the Venezuelan Llanos and the Pantanal in Brazil, in which cattle ranches have developed successful tourism based on wildlife observation, enjoying nature, and conservation programs to protect biodiversity. We

focus on the revenues produced by livestock and tourism, highlighting the additional tourism income as a positive incentive to make conservation efforts profitable.

Study Area and Background

The Llanos refers to a tropical ecosystem with continuous herbaceous vegetation composed of grasses and *Cyperaceae* that may or may not contain trees, depending on the soil type and water availability (Ponce et al. 1994). The lowland savannas in the Neotropics include the eastern Llanos in Colombia (150,000 km²) and the western Llanos in Venezuela (210,000 km²) (Behling and Hooghiemstra 1999). Vegetation is characterized by herbaceous species with shrubs and shrubby trees and by gallery forests along the rivers. For more information see Huber (1987) and Vareschi (1980). Climate in the Llanos is seasonal, with marked dry periods that can last four to

five months (November to March). Precipitation varies from 1,200 to 2,000 mm/yr in the northern Llanos and 2,000 to 2,500 mm/yr in the southern Llanos. Mean annual temperature is 26° to 27°C, with daily variation of 10° to 15°C (Sarmiento and Monasterio 1983).

The Pantanal is an alluvial floodplain in the upper Paraguay River basin in southwestern Brazil, defined as the largest wetland in the world and covering some 140,000 km². The basin is part of a subsidence zone formed at the time of the Andean orogenesis, and it stretches from the Llanos in Colombia into the Chaco area. Vegetation is often referred to as the “Pantanal complex,” a mixture of plant communities composed of species from surrounding biome regions of the Amazonian rainforest, including the Brazilian Cerrado (tropical savanna ecoregion of Brazil) and Chaco (semiarid lowland region of the Rio de la Plata basin, divided between eastern Bolivia, Paraguay, northern Argentina, and a portion of the Brazilian state of Mato Grosso). Further vegetation characteristics can be found in Pott and Pott (1994). Climate is seasonal with three to four dry months. During the rainy season, from November to April, precipitation averages 1,000 to 1,400 mm/year. Mean temperature is 25°C, but temperatures vary between 0°C to 40°C. The rivers that border the Pantanal and flow into the Paraguay River inundate their banks yearly during the second half of the rainy season and deposit sediments on the floodplains (Dubs 1994). One characteristic that makes the Pantanal unique to wildlife is that local people do not normally consume bush meat (except for fish, feral hogs, and feral water buffalo). This is a seminal difference from the rest of Latin America, where bush meat is part of the cultural heritage and in some places also supplies the main source of protein intake.

Llanos and Pantanal soils are nutrient-poor. With a high content of aluminum and iron, minerals necessary for plant growth have been leached away (Ponce et al. 1994). Land cleared for agriculture may yield one or two good crops before exhausting the soil. Traditionally, people used the land for extensive stock farming, primarily cattle ranching, over the last two centuries. In general, stocking levels range from 1 to 0.25 head of livestock/ha. Today, Brazil supports the largest numbers of cattle in the world. Between 1998 and 2002, meat production in Brazil increased from 6.2 million metric tons/year to 7 million metric tons/year. Meat exports increased from 189,000 tons to 890,000 metric tons (228% growth) (Anonymous 2003). Ninety-five percent of the Pantanal remains in private hands and the livestock industry uses 80% of this land (Seidl et al. 2001).

Perhaps surprisingly, domestic animals brought by European settlers adapted easily to the savanna conditions of South America. From a paleontological perspective the Americas supported such species as mammoths, primitive horses, Xenarthrans of great size (including megatheriums, mylodonts, and glyptodonts), and a whole series of camelids. Why these species became extinct remains debated, with many anthropologists suggesting that the Paleolithic hunters who arrived in America around 12,000 BC decimated these populations (Flynn and Wyss 1998). When Spaniards arrived, domestic ungulates had few natural enemies or herbivore competitors. The first European domestic animals arrived with Columbus in 1493 to Hispaniola (Dominican Republic). Pigs adapted first. By 1514 Cuba alone contained over 30,000 pigs (Crosby 1991). Horses, dogs, cats, geese, chickens, and donkeys proliferated and many became feral. From Hispaniola people brought domestic animals to other Caribbean islands and then to the Llanos. By the end of the 17th century cattle outnumbered every other large mammal in South America. Trade in meat represented a small market; more important was the commercial value of the hides and the fat (Crosby 1991).

In Brazil, cattle arrived with Martin Alfonso de Sousa in 1531. These animals were too valuable to eat. Brazil owes much of its growth as a nation to cattle. Cattle provided the energy as draft animals to make sugar mills work, transported miners to the mines of the state of Minas Gerais, and supported the *bandeirantes*, who defied the Tordesilla treaty and defined Brazil's current boundaries in their quest for land and wealth. Brazil's expansion was similar in many ways to the U.S. expansion into the American West. Wildlife and domestic animals introduced from Europe profitably coexisted for the last 400 years.

Profitable cattle production has been disturbed in many ways; the two most important are the constant increase in livestock production costs and the decrease in meat prices (Avellaneda 2004). As a result land has been abandoned, deforested, and used for intensive agriculture, destroying a way of life and introducing threats, such as agrochemical contamination and serious siltation. Brazil ranks as the second-largest exporter of soybeans (Food and Agriculture Organization 2004). In Venezuela, political instability, coupled with the constant threat of invasion and confiscation, have resulted in many ranchers abandoning their business and land. In the last two decades ranchers developed the need to introduce private security services to reduce cattle theft, poaching, loss of goods (posts, wire, windmills, water pumps, etc.), and

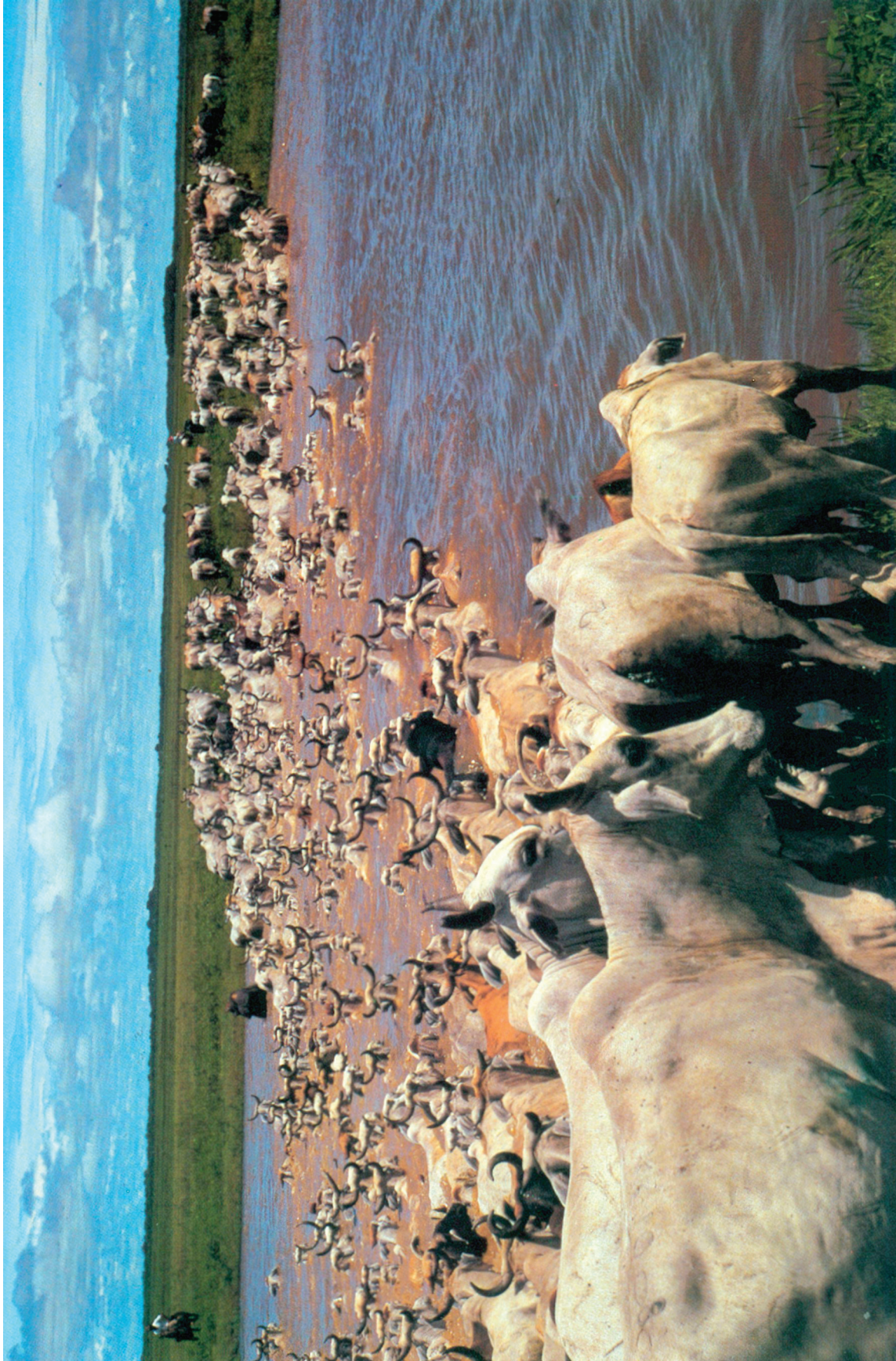


Plate 4. Cattle and horsemen crossing a river during a round-up in the Llanos region (Apure State) of Venezuela. Photo by Rafael Hoogesteijn.



Figure 1. The location of seven privately owned ranches used as case studies (A-G). Each ranch raises livestock, contains a tourism facility, and floods seasonally. Letters A-G correspond to ranches in Tables 1 and 2.

kidnappings. Wildlife have benefited from these private security services, since poachers' access is diminished by the constant surveillance of ranch boundaries by private guards. Because of this protection system, many ranches today support larger populations of wildlife than those found in national parks, where animals have been poached and systematically hunted to extirpation (Silva and Strahl 1995).

METHODS

We approached our topic from a social sciences perspective. Our research design follows the case study approach, which is useful when investigating a phenomenon within its real-life context because it provides depth and quality of data (Yin 1994). The ranches we chose (see Fig. 1) to examine as cases studies were required to fulfill

three main criteria. Each ranch must (1) breed and raise cattle, (2) contain a tourism facility, and (3) have ecologies dominated by flooded savannas. From the many ranches characterized by the above criteria, we selected three in the Venezuelan Llanos and four in the Brazilian Pantanal. These seven ranches form a representative sample of the different ranching systems present in the areas of study, covering different sizes, intensities of cattle management, levels of tourism, and extents of wildlife conservation programs.

We obtained information and data using open-ended, partially structured interviews with stakeholders, owners, and managers and by direct observation of the ranches. Twelve informants supplied formal information for this paper through prearranged interviews from 2007 to 2009. Of these, seven were ranch owners and five were workers on the ranches. In addition, we undertook site visits to

TABLE 1
GEOGRAPHIC AND MANAGEMENT CHARACTERISTICS OF SEVEN RANCHES
WITH TOURISM FACILITIES IN THE VENEZUELAN AND BRAZILIAN PANTANAL

Ranch	Size (km ²)	Number of livestock	Land that is legally recognized reserve (%)	Cattle management	Pastures	Wildlife harvest	Income sources and percentages ^a
A	660	16,000 cows 6,000 heifers	50	Health program	Natural	Capybara Spectacled caiman	Cattle 80% Wildlife 10% Tourism 10%
B	750	8,700-9,100 cows	40	Breeding season, health, genetic and reproductive programs Keep records	Natural = 180 km ² Introduced = 150 km ²	Capybara Spectacled caiman until 1980	Cattle 80% Tourism 20%
C	14.5	500 chickens	100	NA	Natural	No	Pasture rental 65%-78% Research 5%-7% Tourism 12%-18% Aviculture 5%-7%
D	148	5,506 cattle	47	Breeding season, health, genetic and reproductive programs Keep records Feedlot	Natural and introduced	No	Rice 80% Cattle 15% Tourism 5%
E	145	7,900 cattle	20	Health program Salt supplementation	Natural and introduced	No	Cattle 94% Tourism 6%
F	345	4,800 cattle	81	Breeding season and health programs	Natural	No	Cattle Tourism
G	43.5	1,500 cattle	20	Health program	Natural	No	Cattle Tourism

^aPercentages are missing where information is unavailable.
Note: NA = not applicable.

all ranches as technical advisors for cattle management and predation control, where we held numerous discussions with staff and made observations opportunistically. Throughout this process we maintained anonymity of participants.

RESULTS

Venezuelan ranches were located in the states of Cojedes and Apure. Brazilian ranches were located in the state of Mato Grosso do Sul. Descriptions of the ranches follow, and we summarize ranching and tourism characteristics in Tables 1 and 2. Although all ranches practice a no-hunting policy, they all suffer from occasional poaching problems due to lack of law enforcement and/or geographical isolation. None of the ranches engages in any specific wildlife management practices. Fences do not impede wildlife. Wild animals move freely, causing economic losses to ranchers in agriculture and livestock. Ranches do not provide supplemental food or any health management for wildlife.

Ranch A

Water. Ranch A contains a water retention system that covers approximately 70% of the ranch's surface. The ranch is bordered by two rivers, and encompasses six oxbows that flood 80% of the savanna in the rainy season (two of them navigable all year).

Roads. Internally, the ranch maintains a network of dirt roads that connect the headquarters with outpost stations.

Wildlife. A biological station functions within the ranch's boundaries. This ranch harvested (1970-1980) capybaras (*Hydrochoerus hydrochaeris*) (up to 20,000/year) and spectacled caimans (*Caiman crocodilus*) (up to 2,000/year). Harvest revenues from wildlife paid for the operational costs of the ranch during the 1980s (Hoogesteijn and Chapman 1997). Eisenberg (1980) estimated that total animal biomass on the ranch was 22,405 kg/km² (224 kg/ha), composed primarily of 18,504 kg of domestic mammals, 171 kg of reptiles, and 3,730 kg of wild mammals. The carrying capacity of the flooded savannas exceeds that of the Pantanal (Schaller 1983) and five national parks

TABLE 2
CHARACTERISTICS OF TOURISM FACILITIES IN SEVEN RANCHES
IN THE VENEZUELAN AND BRAZILIAN PANTANAL

Ranch	Nearest airport	External support	Number of visitors/year	Number of beds	Daily fee, food included (US\$)	Number of employees	Conservation programs	Attraction
A	180 km; landing strip	NGOs International agencies Universities	2,800 visitors 300 students	20	200	10	Creole horse Orinoco caiman Giant river otter	Wildlife viewing Cattle roundups
B	Landing strip	Unknown	1,500 visitors 20 students	25	80-120	14	Jaguar	Bird watching Wildlife viewing
C	Landing strip at ranch B	Universities Nongovernmental organizations	—	16	80	4 owners 3 employees	Jaguar	Bird-watching Wildlife viewing Boat trips
D	256 km	None	8,000	42	35-50	3 owners 18 employees	Jaguar	Wildlife viewing Integration of cattle ranching, rice farming, and wildlife
E	Landing strip	None	Up to 40	12	130	4 owners 1 employee	No	Cattle ranching Motor biking
F	Landing strip	None	—	8	200	1 owner 4 employees	No	Horseback rides Fishing
G	340 km	None	480-700	47	171-199	15	No	Adventure tourism

Note: Dashes indicates no data available.

in Africa (Bourliere 1983). The flooded conditions of the savanna allow water birds to nest and molt there (Dallmeier 1991). An Orinoco crocodile (*Crocodilus intermedius*) conservation program has reintroduced 2,500 specimens.

Ranching. Staff move cattle throughout the ranch, and because of the water retention system, they can keep the cattle on green pastures even during part of the dry season. Another conservation program works to rescue Creole horses, and in 2008 the ranch contained a herd of 2,000 animals.

Tourism. A spectacular aggregation of wildlife encouraged development of tourism activities. Guest rooms contain two or three beds and a bathroom. The ranch offers two four-hour excursions per day. During the dry season tourists enjoy scenery and wildlife from specially conditioned four-wheel-drive vehicles. During the rainy season trips are made in boats.

Land protection and conservation programs. The biological station initiated the creation of a wildlife and fish refuge, a protective zone for the Caño Guaritico oxbow, in 1989. Many neighboring ranches signed onto this

refuge decree. Several organizations and nongovernmental organizations contributed to financing research and conservation activities. The biological station houses up to 300 students who conduct research on several subjects, such as ecology, animal husbandry, and environmental studies. Research programs have been extremely important and productive in this ranch.

The Venezuelan federal government confiscated this ranch under decree number 4805 as “fruitless and vast uncultivated or poorly cultivated land.” Its future remains uncertain, but several longtime workers were discharged. To our knowledge, cattle production and conservation projects continue. We were informed that cattle theft and poaching has increased, but the authorities have made no official comments on the subject.

Ranch B

Water. Ranch B does not contain a water retention system; however, it encompasses two oxbows, three rivers, and many water holes that keep cattle and wildlife

well supplied with water throughout the year. Savannas flood yearly during the peak of the rainy season.

Roads. Internally, the ranch maintains a network of dirt roads that connect the headquarters with outpost stations.

Wildlife. The ranch harvested capybaras and spectacled caimans during the 1980s. More recently, in an effort to reduce cattle losses, the ranch discontinued wild animal harvest to ensure that large predators such as jaguars (*Panthera onca*) and pumas (*Puma concolor*) had enough native prey. Wildlife protection started in 1953 and tourism began in 1985. This ranch supports an extensive variety of habitats and wildlife, including 342 species of birds, 49 species of mammals, 42 species of reptiles, 14 species of amphibians, 104 species of fish, and 850 species of plants. The ranch also developed a biological station in which nationals and foreign students at different levels conduct research on wildlife, cattle management, and ecology. Pioneering studies explored methods of cattle management to reduce predation by jaguars and pumas. Researchers also developed an extensive herbarium with more than 2,500 identified species, from which 180 are new for the state and five are new to science.

Ranching. The ranch contains excellent natural savannas, infrastructure, and a well-developed livestock management program. Cattle graze 8,000 ha of native pasture in the dry season and 15,000 ha of pasture with introduced grasses in the rainy season.

Tourism. Most visitors stay at the ranch between two and four nights. The site is world renowned for birdwatchers interested in Neotropical savanna species. Most tourists make two trips per day, the first trip starting early in the morning and going until 1130 or 1200, and the other trip starting between 1600 and 1700 and lasting until at least 2100 hours to guarantee visitors observations of nocturnal species with spotlights. By request, groups of birdwatchers can organize night trips to observe more nocturnal avifauna. Tourists can combine this routine with horseback rides, trail hikes, or boat trips (depending on the season). Every trip is accompanied by a bilingual (Spanish-English) guide also knowledgeable about birds. We emphasize that tourism has operated on the ranch for many years, permitting workers in the tourism section to develop special skills that make the experience unique. This ranch is part of an organization created to protect jaguars. Although ranchers suffer considerable cattle losses due to these predators, they understand that the attraction these felines hold for tourists compensate the ranchers for the losses they suffer due to cattle predation.

Land protection and conservation programs. The ranch maintains 3,500 ha of its land as deciduous and

gallery forests for research, ecotourism, and as a wildlife refuge, where the presence of cattle is restricted.

Ranch C

Water. Ranch C does not contain a water retention system; however, it contains one oxbow and many water holes. Part of the savannas flood yearly during the peak of the rainy season.

Roads. Internally, the ranch maintains two dirt roads.

Wildlife. A neighbor of Ranch B, Ranch C shares many of the same ecological characteristics.

Ranching. In 1986 the ranch's owners were forced to sell their livestock to pay back bank credits and retain their land. From 1986 on, the ranch has continued to operate by renting pastures to other ranchers and through family-based tourism activity. The owners of Ranch C are experimenting by diversifying their activities. A small fowl production unit raises chickens without the use of concentrated commercial feed, allowing instead free-range foraging. So far this effort has produced promising results. Development on Ranch C has been slow since the owners want the business to expand without incurring debt, as not to risk family ownership.

Tourism. The main tourist attraction on the ranch is two daily trips in specially altered four-wheel-drive vehicles. Tourists are also encouraged to participate in hikes on the ranch and fishing trips to rivers of the region. The ranch hires local fishermen to guide the fishing trips; these trips have become very popular with the local community, which profits as well. Guests can also camp if they so desire, with the ranch offering clean places to camp, fresh water, and a meal a day.

Land protection and conservation programs. In 1992 the owners declared the land a private wildlife refuge; it was the first ranch in Venezuela to use this designation. In 2002 the ranch created a jaguar conservation program and center for wildlife management, "Manfauna," with a mission to incorporate new volunteers for conservation beyond the ranch's boundaries. Fourteen ranches (including Ranch B) are now part of this effort, for a total of 140,000 ha protected. Several national and international organizations support this initiative.

Ranch D

Water. This ranch contains an irrigation system to support rice production, an oxbow that carries water all year, a boundary river, and several water holes.

Roads. An extensive network of dirt roads allows easy access to the entire ranch.

Wildlife. The Pantanal lacks high species diversity and endemism; however, the region is famous for its high concentration of wildlife, with 124 species of mammals, 463 species of birds, 42 species of amphibians, 177 species of reptiles, and more than 260 species of fish. The Pantanal supports the largest populations of Pampas deer (*Ozotoceros bezoarticus*), marsh deer (*Blastocerus dichotomus*), giant river otters (*Pteronura brasiliensis*), and jaguars in the world. Many species are associated with the rice paddies, such as tapirs (*Tapirus terrestris*), swamp deer (*Blastocerus dichotomus*), water birds, and reptiles, capybaras, and whistling ducks (*Dendrocygna* spp.). The capybaras and ducks cause rice losses of approximately 4%. Yet many species that feed on rice are of special interest to the tourists and contribute to supporting a population of jaguars. Dogs were banned from the ranch so as not to scare wildlife.

Ranching and agriculture. Ranch D relies on three main economic activities: rice production, livestock ranching, and tourism. Rice cultivation occupies 35% of the ranch's area. The rice fields required an investment of US\$12 million, which included deforestation, soil grading, and installing a system of irrigation canals and dikes. Rice production also requires using pesticides and fertilizers and yields around 5,000 kg of rice/ha.

Livestock production occupies 42% of the ranch surface, primarily on pastures with introduced grasses. Livestock facilities are separated from the forest reserve to avoid predation problems. The ranch maintains a small feedlot facility to take advantage of the byproducts of rice cultivation. The ranch fattens cattle on these byproducts to their desired weight before slaughter.

Tourism. One of the major shareholders of the ranch owns and manages tourism activities. This shareholder uses the protected area. Early in the morning, groups of approximately 30 people come from the nearest big city by bus or by private car (the ranch can receive up to 80 people per day) to enjoy the scenery and take trips through the ranch in specially outfitted four-wheel-drive vehicles and trucks. A network of dirt roads allows trucks and other vehicles to drive around the ranch, and guides show people a variety of animals. Tourists also have a chance to visit the livestock area and observe how the ranch maintains and manages its cattle. The tourism enterprise constructed trails with boardwalks above the water in forests and savannas to offer comfortable walking independent of the season. Observation towers exist in which some tourists choose to stay overnight to watch nocturnal wild-

life. This ranch is one of the few places in the world where tourists in comfortable conditions have a high probability of seeing jaguars. After morning activities a traditional Pantanal lunch is served. People rest in mango-shaded areas with hammocks and comfortable chairs where they can observe birds that approach the facilities looking for fruit and other food supplied in conveniently located feeders. The afternoon trip is generally by boat through an oxbow that maintains water throughout the year. Tourists can fish for piranhas that they then feed to caimans. After beverages, most tourists return to the city. Some people choose to stay overnight, and for these people a night trip (maximum of 9 to 12 participants) is organized in which they use spotlights as to see nocturnal wildlife. For people who desire an extended stay, the ranch offers additional activities, such as bicycling, horseback, and kayak trips. When present, biologists working on the ranch offer a short lecture. Guests are mainly Brazilians (70%-85%), commonly families with children and occasionally school groups. Income received from this tourism activity exceeds income from livestock production.

Land protection and conservation programs. This ranch keeps a forest reserve that comprises 15% of the area of the ranch. It actively cooperates and supports several conservation studies on species such as jaguars and blue macaw (*Anodorhynchus hyacinthinus*) among others.

Ranch E

Water. This ranch contains a long oxbow, several water holes, and one boundary along a river. It experiences extreme seasonal flooding.

Roads. The ranch maintains a network of dirt roads.

Wildlife. Similar to Ranch D.

Ranching. Extensive cattle production occurs on Ranch E, including the complete production cycle (from birth to slaughter). This ranch developed its own system of ecological pasture formation (Hoogesteijn et al. 2005).

Tourism. The ranch manages tourists in small groups, generally by having them live with the owners of the ranch. The main attraction of this ranch is observing and participating in cattle ranching activities with the *pantaneiros* (local cowboys). Additionally, visitors can take one-day horseback rides to different parts of the ranch. To make the trips more interesting and varied, neighboring ranches are included. Four-wheel-drive spotlighting trips, boat trips, and motocross trips make up part of the organized activities, depending on the interests of the group visiting. Most visitors come from other countries.

Land protection and conservation programs. 15% of the land is a private reserve as defined by law.

Ranch F

Water. This ranch contains a long oxbow and several water holes that ensure a steady water supply all year. The ranch experiences severe flooding episodes.

Roads. Access to this ranch by land is only possible in the dry season. The rest of the year visitors can only reach the area by plane.

Wildlife. Similar to Ranch D. Cattle predation is a chronic problem; however, the owner is tolerant of the losses incurred by large felines since the frequent spotting of jaguars is one of the main attractions for which the ranch is famous.

Ranching. Extensive cattle production on native pastures occurs on Ranch F.

Tourism. High-end tourism activity focuses on horse enthusiasts. Tourists ride crossbred American quarter horses using Australian gear especially designed for long rides. Horse trips last a complete day, with a short lunch break. For some guests, the ranch organizes one-week safaris on horseback. Hikes and boat trips can also be organized. Neighboring ranches are included in these trips, and overnight stays utilize the eco-lodges of neighboring ranches. Fishing follows “catch and release” protocols. This specialized tourism fits with the remoteness of the area, where it is very difficult to access transportation, fuel, lubricants, mechanical parts, technical labor, and so on. All the logistical inconveniences of mechanical transport are avoided, which allows tourists to appreciate the scenery, cattle, wildlife, and Pantanal lifestyle to their full extent.

Land protection and conservation programs. Ranch F extends over 10,000 ha as a “private reserve of natural patrimony” (RPPN in Portuguese). A RPPN is recognized by the Brazilian government as a private nature reserve for flora and fauna. The ranch formed an alliance with neighboring ranches to prohibit hunting and deforestation next to rivers. Two neighboring ranches cover an additional 10,000 ha as a separate RPPN.

Ranch G

Water. The river Abobral flows a few meters from the inn and experiences seasonal flooding that renders the river unfit for navigation from August to November.

Roads. The ranch maintains a network of dirt roads.

Wildlife. Similar to Ranch D.

Ranching. Extensive cattle production of 1,500 head on natural pastures.

Tourism. Ranch G has the same conditions as the above-mentioned ranches, but its business has been so good that the owners are seriously considering eliminating livestock from the ranch. Ranch G offers 17 apartments with air conditioning and a minibar for visitors, including seven doubles, seven triples, and three apartments with four bedrooms. Other amenities include a swimming pool, tennis court, mini-fitness center, and living room with television, internet, table games, bar, and more. Ecological activities consist of walking in the forest, fishing, horseback riding, boat trips, kayaking, safaris in four-wheel-drive vehicles, and spotlighting. Cultural activities consist of working with cattle, cow milking, and wagon riding. Tourism on the ranch raises an estimated US\$70,000 to US\$154,000 annually in gross income, depending on the season and international economy.

Land protection and conservation programs. 15% of the land is a private reserve as defined by law.

Common Factors Relating to Tourism Success on the Ranches

We examined different types of recreational tourism on ranches for which the main business is or was cattle ranching. In all of our case studies, ranches developed tourism as a secondary income source to supplement established livestock businesses. Each ranch comprised a unique set of ecological and economic conditions. However, we observed several common factors that led to the development of tourism facilities:

1. All ranches contained spectacular scenery.
2. Wildlife populations on the ranches were abundant and relatively easy to spot. Maintaining easily spotted wildlife required substantial personnel training (to be knowledgeable about the culture, wildlife, and ecology of the region and to have good manners and communication with the tourists) and wildlife protection. We believe that such training is particularly important when new personnel are hired. In our experience, wildlife that is not hunted, chased by dogs, or harassed becomes relatively tame and easy to observe after 5 to 10 years. Disturbances by new staff who do not follow instructions can destroy many years of wildlife conditioning. We cannot stress enough the importance of ensuring that all people working in the ranch understand this principle.

Note that habituated wildlife is easier to poach; therefore, even greater surveillance is required. If ranchers perceive a need to harvest wildlife, managers should harvest animals in defined areas and not throughout the entire ranch to avoid disturbing all populations. Ranches can reduce poaching by slaughtering enough cattle for people working on the ranches (and also supplement with fish, spectacled caiman, capybara, feral pigs, sheep, or feral water buffalo).

3. All activities depended on water levels; therefore, ranches developed different activities for different seasons.
 4. The ranches provided well-trained, English-speaking guides, together with local guides who usually worked as chauffeurs and boatmen. It is important that all personnel, even if not directly involved with tourism activities, are courteous to guests.
 5. The ranches separated tourism from the livestock operations. Yet the tourist operations benefited from existing livestock infrastructure, such as roads, and made use of livestock activities as an attraction. Tourists were educated on cattle and agriculture management strategies that were ecologically harmonious.
 6. In four ranches, the owners of the ranch or people related to the family operated the tourism facilities, allowing younger generations to join the business without further dividing the land.
 7. Three ranches formed associations with neighbors to expand their use of resources.
 8. Some ranches operated under recently created government policies for private wildlife refuges. These new policies facilitated legal control of poaching and, in some cases, provided certain tax benefits that reduced operational costs.
 9. Five ranches contained a biological station in their premises, which allowed the ranch to obtain funding for research activities and biologists to interact with tourists for an added educational component. The experience was usually welcome and motivated young people to explore careers in biology. Results of the research activities generally benefited the productivity and sustainable use of resources on the ranch.
 10. All ranches approached tourism from the perspective of adventure or eco-tourism, underlining the nature experience. One ranch offered traditional amenities found in four-star hotels.
- Still, we believe there was no need to aim for those characteristics, as guests were flexible with respect to the accommodations and amenities they required. All ranchers emphasized that their guests wanted a certain degree of comfort (mosquito netting, sufficient water all year, and if possible, fans or air conditioning in hot climates). Otherwise, there was no need for fancy construction or decorations. Common areas for resting with comfortable chairs or hammocks were a plus.
11. All tourism managers agreed that safe and well-coordinated activities were of paramount importance. Activities should be well organized and coordinated by a tourism manager in advance to avoid friction or misunderstandings between the livestock and tourism activities and schedules. Tourists need to feel safe and comfortable with the leadership capacity of their guides (e.g., lifejackets for everyone, functional vehicles, restricted alcohol consumption, etc.). They also wanted guides knowledgeable of the area and environment. Good communication is necessary either by mobile phone or radio for logistics and emergencies. Ranches should adapt their activities to the type of visitor they expect; a group of eight senior birdwatchers is not the same as a group of 20 teenagers. Trails require a minimum of maintenance; they should be cleaned of dry leaves and branches so that tourists do not disturb wildlife when they walk.
 12. Ranchers tried to experiment with novel schemes to keep tourism facilities working during the low visitation season. Some ranches received university students (usually from North America) interested in Neotropical ecology. An ecology professor accompanied such student groups, and the students often received university credits. Universities also organized educational programs in collaboration with local researchers. Another popular tourism activity was channeled through nongovernmental organizations in which different research projects were offered to volunteers worldwide. Tourists paid a fee to the principal investigator or project for the opportunity to participate on a research project with their talent and help. The length of the stay was negotiated between the principal investigator and the tourist (see, for example, <http://www.earthwatch.org/expedition>).



Plate 5. Vaqueiro (horseman) wading through a flooded plain in the Pantanal region, Brazil. Photo by Almira Hoogesteijn.

DISCUSSION

Ranches have become important stakeholders for wildlife conservation in Latin America (Brockx 1984; Shaw 1991). Most land in the Llanos and Pantanal is privately owned. Wildlife protection on private lands is sometimes the only way to ensure healthy wildlife populations. While national parks are often large enough to facilitate conservation, insufficient management, poor protection, and inefficient law enforcement compromise the purpose of the park. Some species require large territories or are migratory. So, planned corridors between protected areas sometimes include private property. In Brazil, state and federal legislation benefits many owners who protect more than 2,618 km² of Pantanal under the legal umbrella of Private Reserves of Pantanal (REPAMS), established in 2002. REPAMS comprise 36% of the area officially protected by federal conservation units in the Paraguay River basin. This legal designation stimulates more ranchers to set aside land for conservation, promoting one of the most important conservation tools in the region. The change of attitude by ranchers and gradual increase in participation by the private sector gives an optimistic view for the long-term sustainable use of Pantanal resources (Harris et al. 2005).

Using wildlife as a source of income for private owners raises questions about the validity and legality of that use, especially since the law usually defines wildlife as property of a nation, which is responsible for managing it. A classical example of this situation arises with cattle predation, in which a jaguar that is property of the state and usually protected by law inflicts losses to private landowners by preying on cattle. Should the state pay for those losses? Traditionally, no state in Latin America has either the resources or the personnel capacity to address this situation. Similarly, no state in Latin America has a wildlife service that effectively controls poaching or a taxation system to charge ranchers for using wildlife.

In countries with a longer history of tourism and trophy hunting (e.g., several African nations), an interesting picture arises. Two main systems have developed: one in which the state manages everything related to wildlife, including tourism and trophy hunting (Emerton 1998; Sundaresan and Riginos, this issue), and another in which government policies allow private owners to control and manage wildlife on their property (Richardson 1998; Muir-Leresche and Nelson 2000). In Kenya, wildlife use generates 5% of the gross domestic product, and extractive activities (i.e., hunting) have been prohibited since 1970. Landowners do not benefit from the wildlife present

on their land. In recent years, declining wildlife populations have reached alarming levels, with more than a 50% decline in numbers since 1997. People have converted natural habitat into agriculture and livestock ranching, while poaching remains lucrative (Emerton 1998). In contrast, countries like Zimbabwe, Namibia, Botswana, and South Africa altered their governmental policies to give ranchers total control over wildlife use on their lands. Tourism and trophy hunting increased explosively, but so did wildlife populations. In Namibia, biomass increased by 80% between 1972 and 1992 (Richardson 1998; Krug 2001). In Zimbabwe, over 50% of the eland (*Taurotragus oryx*), kudu (*Tragelaphus strepsiceros*), sable antelopes (*Hippotragus niger*), impala antelopes (*Aepyceros melampus*), giraffes (*Giraffa camelopardalis*), and cheetahs (*Acinonyx jubatus*) live on private property (Muir-Leresche and Nelson 2000). In addition, large expanses of overgrazed land have recovered and land values have increased. Many conservationists argue that such measures bias conservation toward species with economic value. We believe that a major goal of conservation is to keep areas as large as possible out of monoculture agricultural production in which total deforestation, ground leveling, intensive use of agrochemicals, and loss of soil and vegetative cover have proven more detrimental to wildlife.

We conclude that the private sector plays an indispensable role in conserving biodiversity in Latin America and that private nature reserves can help protect critical habitat in many ecosystems. Such private reserves are usually well financed and better protected than national parks in South America, representing an important conservation tool that also increases economic benefits to owners, while avoiding the use of taxpayers' money. The lesson learned is that if landowners who shoulder the cost of conservation cannot profit from those efforts, they will not protect this asset. The situation becomes somewhat compromised when governments subsidize livestock production (but not wildlife conservation) with various forms of assistance, such as veterinary services and easily obtained credit.

Opportunities for the Great Plains

Tourism represents one of the largest areas of economic growth in many countries. By 1999 approximately 663 million travelers spent US\$453 billion, and the World Trade Organization estimates that in 2010 there will be more than 1 million international travelers (World Trade Organization 2000). People all over the world are willing to pay money and make voluntary contributions to ensure

the continued existence of unique species, biological communities, and landscapes. Ranches in the flooded savannas of Venezuela and Brazil and the Great Plains share several similarities. All of these grassland ecosystems undergo extreme seasonal changes. Ranching represents the principal means of income generation in each area, and it also encompasses a way of life and heritage that most ranchers want to retain even in the face of economic pressure. As ranchers split the property among their children, land division creates ranches too small to be productive on their own. Intensive agriculture represents an alternative land use that is more damaging to the environment than extensive cattle ranching, especially lately, given recent government policies that encourage biofuel crops. Both areas present a breathtaking landscape that many people are unaware exists, yet likely would spend money to get to visit and protect if opportunities arose. Many ranchers in the Llanos and Pantanal are capitalizing on the opportunities that this situation presents. Similarly, Great Plains ranchers might want to take advantage of the natural heritage they steward and increase the value of their land by diversifying land use to include recreational activities, for which they could realize considerable income.

Experience shows that tourism represents a mixed blessing given its limited potential and sometimes negative impacts (Isaacs 2000); however, it remains a good incentive to preserve natural areas on private property.

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