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## CORRIDOR MANAGEMENT FOR OCELOTS IN THE SOUTHERN UNITED STATES AND NORTHERN MEXICO

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**Abstract:** The northernmost documented population of ocelots (*Felis pardalis*) occurs in the Lower Rio Grande Valley (LRGV) of the United States (Tewes and Schmidly 1987). Habitat fragmentation and interpatch barriers created difficult and marginal conditions for population persistence. Consequently, we believe that corridor ecology and management are important to the survival of ocelots in the LRGV. Most of the results and management recommendations given here derive from several ecological studies covering different subpopulations of ocelots in the LRGV spanning the last 12 years (Tewes 1986, Tewes and Miller 1987). We described ocelot use of corridors and management strategies that will promote ocelot conservation.

**Resumen:** El extremo norte de la población de ocelotes (*Felis pardalis*) se encuentra en el Lower Rio Grande Valley (LRGV) de los Estados Unidos. La fragmentación del hábitat y barreras entre fragmentos de terreno crean condiciones difíciles y marginales para la perseverancia de esta población. Como consecuencia, se cree que la ecología y administración de corredores biológicos es importante para la supervivencia de los ocelotes en el LRGV. La mayoría de los resultados y las recomendaciones administrativas que aquí se presentan fueron derivadas de varios estudios ecológicos cubriendo distintas subpoblaciones de ocelotes en el LRGV a través de los últimos 12 años. Aquí describimos el uso de los corredores por los ocelotes y las estrategias administrativas que promueven la conservación de ocelotes.

**Key words:** corridor, corridor management, *Felis pardalis*, fragmentation, habitat restoration, Lower Rio Grande Valley, metapopulation.

The northernmost population of ocelots (*Felis pardalis*) documented by researchers occurs in the Lower Rio Grande Valley (LRGV) of the United

States (Tewes and Schmidly 1987). Habitat fragmentation and interpatch barriers have reduced ocelot populations in this region and created difficult conditions for population persistence. Consequently, corridor ecology and management are important to the survival of the ocelot metapopulation in the LRGV.

For the past 12 years, we have conducted various ecological studies covering different subpopulations of ocelots in the LRGV (Tewes 1986, Tewes and Miller 1987). Many of the results and management strategies described herein emerged from this previous research. Our objective is to describe ocelot use of corridors and management strategies that will promote ocelot conservation.

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### METHODS

The LRGV is in the central portion of the Tamaulipan Biotic Province of south Texas (U.S.) and northern Tamaulipas (Mexico) (Jahrsdoerfer and Leslie 1988). Fertile alluvial soils of the Rio Grande delta provided substrate for dense woody communities preferred by ocelots. Most ecological research on ocelots has occurred in eastern Cameron County and northern Willacy County of south Texas.

Tewes and Schmidly (1987) described study techniques of ocelots. Captured ocelots were radio-collared and tracked, and this paper was based on information collected from both radio-telemetry and direct observation.

### RESULTS

Seventy-five ocelots were captured 148 times since research began in 1981. Ocelots selected sites with dense screening cover, particularly dense mixed-thornshrub communities in the LRGV. This community type was not common in south Texas (Tewes and Everett 1986).

### Corridor Types

Ocelots used the following corridor types in the LRGV: resaca, river, irrigation canal, irrigation drain, natural drainages (e.g., ramadero), shoreline, fence-line, road, and other man-made corridors. Resacas are former channels of the Rio Grande that represent important geophysical and ecological corridors in the LRGV. Resaca corridors within and

adjacent to the Laguna Atascosa National Wildlife Refuge were used extensively by radio-collared ocelots. Fertile soil types and beneficial soil-water relationships along resacas, rivers, natural drains, irrigation canals, and drains promoted development of plant communities with the dense woody structure apparently preferred by ocelots.

We identified shoreline corridor types during this study. Ocelots used a corridor along the bank of a large lake. Other radio-collared ocelots used woody corridors that paralleled the Laguna Madre Coast in south Texas and the Gulf of Mexico Coast in central Tamaulipas. Ocelots use vegetation corridors associated with overgrown fences, roadsides, and narrow strips of woody cover that remained following extensive brush clearing by landowners.

### Corridor Uses

Different social classes of ocelots used corridors for several activities and behaviors. Resident ocelots used corridors for intra-territorial and extra-territorial movements, foraging, resting, and for placement of natal dens. Individuals moving between habitat patches within their home range traveled along corridors, often avoiding shorter but more open travel routes. Several male ocelots used corridors that extended beyond their normal home range boundaries, possibly to monitor the reproductive status of nearby female ocelots or territorial intrusions by male ocelots. Female ocelots established natal dens in corridors, after other territorial ocelots had saturated the limited number of optimal habitat patches. Dispersing and transient ocelots used corridors for a variety of purposes, particularly for resting and foraging.

### DISCUSSION

Corridors served an important ecological role for ocelots in the LRGV. Most ocelots used  $\geq 1$  corridor type during their daily movements and many used multiple corridor types for different ecological activities. Because ocelots avoided open areas and were forced to depend on only a few habitats, their choices were limited. Thus, the absence of habitat connectivity may jeopardize population persistence (Noss 1987).

Ocelots often used corridors to secure access to widely distributed habitat patches. We judged these corridors marginal or suboptimal habitat. Occasionally, corridors were intermittent and lacked continuous woody cover. However, in some instances, poor quality corridors represented the best cover alternatives for ocelots to achieve access to proximate or satellite habitat fragments.

Ocelots may experience risks while using corridors in the highly developed LRGV. Occasionally, we found coyotes (*Canis latrans*), feral dogs and feral cats in corridors used by ocelots. We suspect that coyotes and feral dogs are antagonistic to ocelots. Feral cats served as host to fatal diseases. Consequently, overly narrow corridors may pose the risk of focusing carnivore use into narrow strips of cover and increasing the probability of negative

interactions between ocelots and other carnivores. The risk factor increases with corridors located near urban areas or human dwellings. However, without corridors there may be no wild carnivores in intensively managed agricultural landscapes. Because ocelots depend heavily on corridors for survival, they are more susceptible to trapping by commercial trappers. We encountered better trapping success of ocelots when their daily activities were restricted to narrow strips of habitats.

### MANAGEMENT IMPLICATIONS

Several management techniques can enhance corridor quality for ocelots. Often thornshrub corridors used by ocelots in the LRGV interfaced abruptly with cultivated fields. To enhance prey populations we established grass-forb communities on previously barren agricultural strips located parallel to selected thornshrub corridors. Eastern cottontails (*Sylvilagus floridanus*), an important prey item for ocelots, foraged in these communities and sought cover in the thornshrub corridors periodically occupied by ocelots. Thus, we concluded that establishment of a grass-forb strip along either side of narrow woody corridors will increase cottontail populations and probably provide additional prey to ocelots travelling along the corridors. Additional management enhancements included restoration of thornshrub communities along barren portions of existing corridors. Increasing the width of narrow sections of corridors would appear to improve corridor quality and encourage ocelot use.

Several ecological and economic conditions need to be evaluated prior to committing resources to corridor restoration for ocelots, particularly the existence of proper soil types, local ocelot ecology, and the likelihood of restoration success. We believe that a comprehensive corridor restoration plan will likely reduce environmental impacts of many commercial or agency development projects upon endangered cats. Overall utility of corridor restoration to ocelot recovery and conservation is the principle that should guide management decisions. Although removal of potential competitors or antagonists (e.g., feral dogs and cats) from corridors may promote safer ocelot use and reduced mortality, only safe, selective removal techniques should be applied to prevent risks to the endangered cats.

Corridors near active roads, human dwellings, or urban facilities may receive increased human disturbances. A management tactic suitable for this problem is the development of buffers or the construction of vertical screens (e.g., earthen ridges) between the border of sensitive corridors and activity centers. Restoration of a woody plant community may buffer the corridor interior from disturbances associated with human activities. Plant species with rapid growth, high survival, and dense vertical cover during all seasons seem most desirable for restoration.

We also have developed management recommendations for irrigation canals and drains used by ocelots. In the past, some irrigation districts attempted

to minimize the amount of woody cover because of the possible impedance to water. Regardless dense woody communities often developed because of irregular maintenance and beneficial soil-water conditions. It seems to us that rather than achieving only partial success by periodically attempting to remove all woody vegetation, a better alternative is to remove woody cover only from one side of the canal or drain. This tactic would maintain basic corridor connectivity of the irrigation structure. Maintenance of the irrigation canal or drain often can be achieved by clearing a single lane for the heavy machinery or earth-moving equipment.

Because of the flat terrain, dikes and levees are distributed throughout the LRGV to facilitate irrigation and minimize the economic loss in the event of flooding. The levees and flood-control channels usually are maintained with short intensively-managed herbaceous vegetation. Establishment of woody communities along the outer banks of the levees and dikes will greatly enhance the corridor network in this agricultural landscape and promote ocelot conservation. The conservation value will be greatest for those corridor networks near ocelot subpopulations or core populations.

Prescribed burning of the borders of irrigation channels and farm fields frequently occurred in the LRGV to retard the growth of woody species and minimize insect populations that invaded croplands during spring and summer. Cooperative agreements may reduce burning and allow development of woody plant cover along the edges of farm fields. Benefits of corridors need to be distinguished at different spatiotemporal scales (Noss 1991). Corridor qualities and management requirements at the home range and local scale differ from the landscape and regional scale (Harris 1984).

A management plan needs to be developed that identifies, prioritizes, and enhances corridors located near core populations and peripheral subpopulations of ocelots in the LRGV. This plan would identify corridors that facilitate ocelot occupancy of satellite habitat fragments located at varying distances from the core population and identify objectives and action plans to enhance specific corridors. The relative value of different corridors to different social classes of ocelots (i.e., resident, transient, disperser) should be described. A regional conservation plan promoting corridor networks in the Tamaulipan Biotic Province should be formulated to encourage conservation of this northernmost ocelot population. It should describe major strategies for

corridor management the landscape and regional levels. A cost-benefit analysis based on site-specific data or well-founded inference is ideal (Simberloff and Cox 1987), but maintaining or restoring native connectivity poses far fewer risks than creating previously nonexistent connections (Shafer 1990). Ecological data collected for site-specific purposes were important in providing resource managers and individual landowners with information on corridor ecology and management for ocelots in the LRGV. Incentives and recognition should be provided to private landowners, irrigation districts, and governmental agencies. They should be encouraged to maintain strategic corridors and corridor networks on private lands, particularly those identified as important in the ocelot corridor management plan.

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