Potential Impacts of International Bridges on Ocelots and Jaguarundis Along the Rio Grande Wildlife Corridor

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Abstract

The endangered ocelot (*Leopardus pardalis*) and jaguarundi (*Herpailurus yaguarondi*),occupy the Lower Rio Grande Valley of extreme southern Texas. The passage of the North American Free Trade Agreement has resulted in the proposal or construction of several international bridges linking Texas and Mexico. However, these bridges may be a significant barrier to wildlife movements across the federally designated Rio Grande Wildlife Corridor. Our understanding of the landscape ecology of ocelots is discussed to better describe the possible significance of the coastal corridor with the Rio Grande Wildlife Corridor. We identify potential direct and indirect impacts of the bridge-roadway systems upon felid populations, habitats, and landscapes. A recently completed study of bobcat (*Lynx rufus*) spatial patterns near international bridges suggests possible confinements of individual felids. Conservation strategies that can be incorporated into bridge projects include "cat underpasses", development of corridor networks, restoration of key habitat tracts, and application of screens for audio and visual disturbances. Finally, the Port of Brownsville International Bridge is used as a model for resolving a potentially difficult conflict between endangered cats and construction of an international bridge.

Background

The ocelot (*Leopardus pardalis*) and jaguarundi (*Herpailurus yaguarondi*) are two endangered cats with highly limited distributions in the United States. Less than 100 ocelots remain in Texas and jaguarundis have not been documented in the United States since 1986. However, one of the primary regions of occupancy by these cats is the Lower Rio Grande Valley (LRGV) of extreme southern Texas (Tewes and Everett 1986).

The LRGV is an important agricultural, urban, and commercial region shared by the United States and Mexico. Agriculture and international trade are important factors to the LRGV economy. Citrus, sugar cane, vegetables, cotton, sorghum, and many other crops dominate this landscape. In addition, a rapidly increasing human population in the LRGV is expanding the municipalities parallel to the Rio Grande. This population expansion is generating a concomitant growth of infrastructure and support services (Ramos 1997).

The agricultural and urban land use that dominate the LRGV reduce the capacity for natural processes to operate. These land uses have resulted in the conversion of greater than 95% of the native rangelands into cropland and urban areas, primarily during the past 60 years (Purdy 1983). Only a few habitat fragments remain within this fertile delta. Yet this region also provides many important biological values. Several peripheral vertebrates extend their northern range to the subtropical region of the LRGV (Blair 1950). Also, the Central Flyway funnels a diverse assemblage of neotropical migrants and shorebirds to this region. Income from ecotourism and bird watching are increasing in the LRGV (Jahrsdoerfer and Leslie 1988).

In 1979, the U.S. Fish and Wildlife Service (USFWS) initiated the Rio Grande Wildlife Corridor Project. The purpose of this long-range program is to develop a wildlife corridor on the north bank of the Rio Grande that links many of the remnant woody tracts proximate to the river. Also, restoration of natural communities on abandoned farm fields near the north bank of the Rio Grande is intended to support the wildlife corridor. By linking several small reserves less than 500 acres along the Rio Grande Wildlife Corridor, the USFWS intends to increase the persistence of wildlife populations, including the endangered cats.

The planning and construction of several new international bridges between Texas and the states of northeast Mexico is one consequence of increased trade associated with the passage of the North American Free Trade Agreement. These bridges structurally interrupt the wildlife corridor and probably cause some level of impact on free-ranging cat populations. Herein, we will identify possible impacts these bridge systems may have upon the movement of free-ranging cats along the Rio Grande and discuss strategies to improve ecological problems associated with these bridges. Finally, we will describe the approach that we designed in 1993 regarding the Port of Brownsville (POB) International Bridge and describe the utility of this model for mitigating some of the negative consequences of international bridges upon the conservation of free-ranging felids.

Landscape Issues

The potential importance of the Rio Grande for ocelot conservation must be explained using a landscape context (Fig. 1). The primary ocelot population occurs in the eastern coastal region of the LRGV (eastern Cameron and Willacy counties). Although ocelots only occupy habitat fragments within this area, the natural coastal ecosystem provides a better matrix for interpatch movements than the agricultural ecosystem farther inland. Consequently, a "coastal corridor" seems to provide a north-south zone of ocelot occupation and movement. Few successful ocelot movements have been documented from this coastal corridor inland through the agricultural matrix.

The Rio Grande may provide a significant landscape feature that permits some movement of ocelots from the coastal corridor westward toward small habitat tracts protected along the Rio Grande. However, the cumulative effect of agricultural and urban developments as well as existing and proposed international bridges may restrict ocelot use of the Rio Grande Wildlife Corridor. Substantial use of the Rio Grande system by ocelots has yet to be documented. Use of this corridor has only been documented for one radio-collared ocelot at Santa Ana National Wildlife Refuge and possibly one jaguarundi photographed east of Brownsville, near the Rio Grande during the 1980s.

The USFWS is emphatic that future development of international bridges over the Rio Grande minimize the possibility of harm for the endangered cat population of the LRGV.

Consequently, we were involved with four international bridge consultations during the early 1990s. We identified potential problems and developed solutions to minimize the potential impacts of international bridges on the endangered cats.

Potential Bridge Impacts

We can hypothesize a variety of direct problems for free-ranging cats or other wildlife populations with the international bridge-roadway systems. Potential impacts may include increased ocelot roadkills, removal of habitat, or disruption of movement patterns of individuals (Tewes and Miller 1987). Other problems may be related to fragmentation of populations, reserves, or habitats on the landscape scale.

From May 1995 to August 1996, bobcat spatial relationships with international bridges were examined to obtain possible insight on ocelot response patterns. Thirteen bobcats were trapped and radio-collared near two existing international bridges on the Rio Grande: the Hidalgo International Bridge and the Pharr International Bridge (Fischer and Tewes, unpubl. data). The Hidalgo International Bridge has a simple bank-to-bank span with considerable lighting under the bridge to allow surveillance by the U.S. Border Patrol that deters illegal Mexican immigration. The Pharr International Bridge is an elevated causeway that spans the floodway 2 miles from the Rio Grande to the flood levee. A similar span occurs on the Mexican side of the border. However, little vegetation occurs on the farm fields below the causeway, thereby reducing available cover for movements by free-ranging cats.

Although some of the bobcats during our study approached within 0.5 miles of a bridge, none were located on the opposite side of the bridge-roadway system. This lack of bridge passage by bobcats suggests possible population impacts. It also contrasts with a Florida study which demonstrated bobcat use of highway underpasses (Foster and Humphrey 1995).

Bobcats are habitat generalist, ecologically flexible, and use human-altered environments such as urban and agriculture landscapes. Consequently, the response of a habitat specialist such as the ocelot (Tewes and Schmidly 1987) to an international bridge and roadway is probably more restrictive relative to bobcat responses.

Indirect problems should be evaluated in a conservation assessment of international bridges. Other impacts could include subtle, indirect effects of heavy traffic volumes or human activities upon the behavior of endangered cats. Secondary residential and commercial developments often accompany construction of international bridges, but these effects are difficult to predict. These indirect impacts could be detrimental only to certain aspects of life history, such as dispersal, colonization, or disruption of mating or gene flow (Ruediger 1996).

Wildlife crossings or underpasses have used by bobcats and Florida panthers (*Puma concolor*) (Foster and Humphrey 1995). However, these structures may also yield negative effects. The focus of free-ranging cat movements to a singular underpass below a bridge or highway may also have potentially deleterious effects. Ocelots maintain intraspecific territoriality (Tewes 1986) that could inhibit or discourage movement by conspecifics through one or a few underpasses. Interspecific aggression from bobcats, coyotes (*Canis latrans*), or feral dogs (*Canis familiaris*) occupying the cat underpasses may also reduce their viability for felid passage or result with injuries or mortality. Finally, the focal attraction of these "funnel points" may increase the likelihood of disease transmission among endangered cats or by increasing their contact with infected bobcats or feral cats *(Felis catus)*. The likelihood of these deleterious effects has not been estimated, but probably occurs at a low level.

Conservation Strategies

Several conservation strategies may reduce potential impact of international bridges upon the endangered ocelot or jaguarundi. The utility of these strategies probably has a greater universe of application for other species and project types (e.g., highways).

1. Develop a comprehensive understanding of the proposed international bridge project and potential biological consequences. This comprehensive understanding may extend beyond the immediate project site, involving considerations at the population and landscape levels. Integrate the conservation assessment early in the scoping or planning process prior to completion of construction plans. Otherwise costly changes with less effective conservation benefits may be required later in the construction phase.

2. Develop strategies that increases the "permeability" of the bridge-roadway project for felid movements. A bridge or highway may serve as a filter or partial landscape barrier to dispersing cats. A bridge with a simple span from bank-to-bank across the Rio Grande and an associated roadway with high traffic levels can be an effective barrier to wildlife movements. Alterations of structural designs and operational plans of the international bridge should be evaluated in the context of various temporal and spatial scales reflecting the ecological needs of the endangered cats. 3. Maintain as many current habitat tracts, linkages, and other important landscape features as possible for use by resident, transient, and dispersing ocelots and ultimately to assist population persistence. Restoration of ocelot habitat is difficult and expensive to achieve because of the high cover requirements that must be reestablished. Consequently, maintenance of existing habitats is usually preferable.

4. Develop structural designs and operational protocols that minimize impacts or enhances use by the target species. Construction of cat crossings or underpasses may provide alternative passages under the international bridges. The utility of these crossings has yet to be demonstrated by research, although some monitoring has been initiated. Maintenance of cat crossings, guiding fences, and corridors is a small expense relative to initial construction of the structure. Consequently, failure to maintain these structures may cause their utility for free-ranging cats to be lost and funds spent on the structures wasted. Development of corridors and fences to guide free-ranging cats toward protected crossings may be the only tactic to prevent simple felid passage over a road. The mere presence of an underpass probably will have limited value if other routes over a road are move convenient.

5. Often impacts of transportation projects (e.g., international bridges, highways) upon endangered species are indirect, vague, unpredictable, and often difficult to quantify for different temporal and spatial scales. One strategy to counter intangible impacts is through support of activities that augment recovery actions to offset possible negative consequences of the transportation project. Development of a comprehensive plan that contributes direct and indirect benefits to recovery of the endangered cats could be achieved where post-construction conservation value exceeds the pre-construction conservation value. For a project with serious consequences to endangered cat conservation, project sponsors may implement tasks that reduce the likelihood of onsite impact, and also implement an array of onsite and offsite enhancements that support ocelot recovery. Additional enhancements may provide the needed assurance to a regulatory agency that overall, the conservation benefits following project completion will be greater than pre-project conditions.

Port of Brownsville Bridge Model

The POB is developing an international bridge east of Brownsville, Texas to link the commerce of northeast Mexico with import/export shipping. The POB International Bridge incorporates many of the strategies described above. Consequently, the following details are provided to serve as a model for other project planners to examine (Figure 2).

Instead of building a bank-to-bank span of the POB Bridge, a 500 feet span from the center line of the Rio Grande over the north bank will allow wildlife movements to occur under the bridge adjacent to the river. The right-of-way (ROW) width will be no

greater than 80 feet including the vehicle and railway components of the bridge structure. The road and railway structures will be placed on fill above the 100 year floodplain, elevating the auditory and visual disturbances from ground-level.

An interconnected system of "upland corridors" will be developed parallel to and under the roadway leading north from the international bridge (Fig. 2). The purpose of this corridor network is to increase the "permeability" of the bridge-road structure for free-ranging cats using the landscape. This system will enable free-ranging cats to use alternative passage sites if the river corridor is blocked by territorial conspecifics, feral dogs, or other biological obstructions. Also, multiple corridors and crossings will increase the likelihood of successful felid passage (Tewes et al. 1993).

Ten east-west upland corridors will connect with 4' x 6' cement culverts (i.e., crossings) passing under the 80' ROW of the roadway and railway structure (Fig. 2). Each east-west upland corridor will be at least 33 feet wide and 300 feet long. Only native shrub communities will be developed and maintained by professional horticulturists or biologists.

A north-south upland corridor will connect the east-west corridors with the riparian corridor along the Rio Grande. These north-south corridors will be wider (66 feet) and longer (3,500 feet) because of their important linking function and to reduce the likelihood of biological blockages.

A 5-acre habitat tract will be developed on each side of the river corridor to serve as a staging area to provide cover for free-ranging cats prior to and during passage under the bridge (Fig. 2). Similarly, a 3-acre habitat tract will be developed in the upland corridor system on each side of the roadway to provide additional staging areas and movement around potential biological blocks. The 3-acre staging-area will be at least 2,400 feet north of the 5-acre staging areas and the Rio Grande.

Because thorn shrub communities have not developed naturally in the area proposed for the bridge-roadway project, top-soil will be transported to elevate the substrate above flood levels and provide for a fertile, low saline base for restoration of the staging areas and upland corridor system. Thorn shrub species characteristic of ocelot habitat will be planted on the staging-corridor network. Following completion of the POB International Bridge, the project site should contain a significantly improve network of habitat tracts and corridors that previously were absent.

The area used by the General Services Administration (GSA) facilities (e.g., buildings, fenced check-point) will be minimized (40 acres) and located away from the river corridor, the upland corridor network, staging areas, and crossings. Screening vegetation and earthen berms will be placed between the GSA facility and the crossing-corridor system to lessen potential behavioral disruption of the free-ranging cats.

Selected visual and noise barriers will be used to minimize behavioral impact of the endangered cats. Reflective shields will direct all lighting toward the bridge-road surface and away from the habitat and corridors below. Security fences will be installed between the bridge-roadway structure and the corridor network to minimize human intrusion and to encourage felid use of the crossings. The hours of operation will be restricted to 16 hours per day. Minimizing the level of disturbance at night should facilitate passage of the primarily nocturnal ocelot.

The POB bridge project will implement several actions designed to address landscape and overall recovery issues. These duties include mapping the regional ocelot habitat in a 10-mile radius around the bridge site to better evaluate potential habitat use at the landscape level. A pre- and post-construction trap survey for endangered cats in this 10-mile region will attempt to identify resident or dispersing ocelots and jaguarundis. Finally, the POB will sponsor an education/information program to assist recovery of the endangered cats.

The extensive on-site modification as well as support for the recovery program is intended to produce post-construction conservation benefits that exceed the pre-construction benefit levels. Although this program is expensive, it probably enabled regulatory consent to an ecologically difficult project that otherwise might have been rejected.

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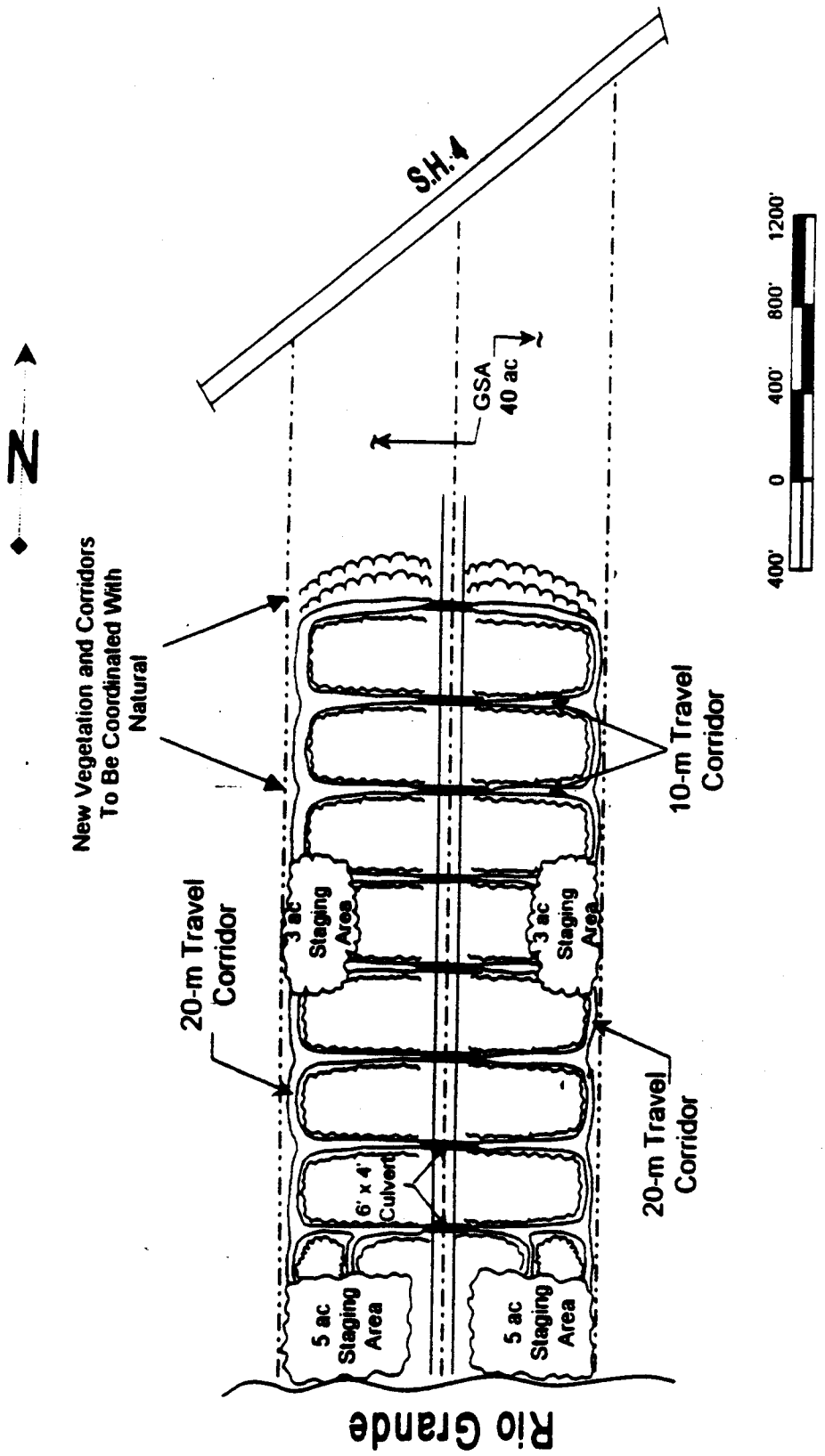

Figure 2.
Illustration of the upland corridor network planned for the Port of Brownsville International Bridge and roadway, Cameron County, Texas