GULF COAST JAGUARUNDI RECOVERY PLAN
(*Puma yagouaroundi cacomitli*)

DRAFT FIRST REVISION
Original version part of Listed Cats of Texas and Arizona, 1990

Photo Credit: Feline Research Center/CKWRI

Southwest Region
U.S. Fish and Wildlife Service

Albuquerque, New Mexico

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The Endangered Species Act of 1973 (ESA), as amended (16 U.S.C. 1531 et seq.), requires the development of recovery plans for listed species, unless such a plan would not promote the conservation of a particular species. Recovery plans delineate such reasonable actions as may be necessary, based upon the best scientific and commercial data available, for the conservation and survival of listed species. Plans are published by the U.S. Fish and Wildlife Service (FWS), sometimes prepared with the assistance of recovery teams, contractors, State agencies and others. Recovery plans do not necessarily represent the views, official positions or approval of any individuals or agencies involved in the plan formulation, other than FWS. They represent the official position of FWS only after they have been signed by the Regional Director. Recovery plans are guidance and planning documents only; identification of an action to be implemented by any public or private party does not create a legal obligation beyond existing legal requirements. Nothing in this plan should be construed as a commitment or requirement that any Federal agency obligate or pay funds in any one fiscal year in excess of appropriations made by Congress for that fiscal year in contravention of the Anti-Deficiency Act, 31 U.S.C. 1341, or any other law or regulation. Approved recovery plans are subject to modification as dictated by new information, changes in species status, and the completion of recovery actions. Please check for updates or revisions at the website below before using.

The Gulf Coast jaguarundi (*Puma yagouaroundi cacomitli*) is listed throughout its range, which is limited to southern Texas in the United States and eastern Mexico as far south as Veracruz. The United States contains only a small portion of the Gulf Coast jaguarundi's range and habitat. Recovery of endangered species is the fundamental goal of the ESA, and recovery planning is addressed in Section 4(f)(1) of the ESA. However, the FWS has limited resources and little authority to address the major threats (habitat destruction and fragmentation) to the Gulf Coast jaguarundi outside the U.S. Also, our knowledge regarding the status of the species in much of its range is very limited, and we lack the resources and authority to coordinate large-scale international research and recovery for the entire subspecies. Therefore, it is not practicable to establish site-specific management actions or cost estimates throughout the subspecies' entire range. However, we have established site-specific management actions and cost estimates on the subspecies' range in the U.S. We have an established relationship with Mexico to address a number of issues of mutual concern, including managing cross-border populations of rare and endangered species. Because the FWS's limited resources are better applied to planning and on-the-ground implementation of conservation actions within the boundaries of the U.S., we focus this plan primarily on conservation within the historical range of this subspecies in Texas. We also summarize information available in scientific literature regarding the status and threats to the Gulf Coast jaguarundi throughout its range, and recommend general actions for addressing these threats and evaluating range-wide recovery that may be applied, or refined, in the future.

The Sinaloan jaguarundi (*Puma yagouaroundi tolteca*) was originally listed under the ESA at the same time as the Gulf Coast subspecies (June 14, 1976; 41 FR 24062). Because all of the

current information indicates that the *tolteca* subspecies occurs entirely outside the U.S. and has never been confirmed within the U.S., the Sinaloan jaguarundi was exempted from recovery planning on June 7, 2011.

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Chief, Division of Endangered Species
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P.O. Box 1306
Albuquerque, NM 87103

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22817 Ocelot Rd.
Los Fresnos, TX 78566

Recovery plans can be downloaded from the FWS website:
http://www.fws.gov/endangered/species/recovery-plans.html

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The primary author of this plan is:

Karen Anderson
Endangered Species Program
U.S. Fish and Wildlife Service
Arlington, VA

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Executive Summary

Draft Gulf Coast Jaguarundi Recovery Plan

Current Status of the Species

The Gulf Coast jaguarundi (*Puma yagouaroundi cacomitli*) is listed as endangered throughout its range where it is distributed from southern Texas into the eastern portion of Mexico in the States of Coahuila, Nuevo Leon, Tamaulipas, San Luis Potosi, and Veracruz. The Gulf Coast jaguarundi is also listed as endangered by the State of Texas, and is considered threatened in Mexico. The last confirmed sighting of this subspecies within the U.S. was in April 1986, when a roadkill specimen was collected two miles east of Brownsville, Texas, and positively identified as a jaguarundi (USFWS 2012). Numerous unconfirmed sightings have been reported since then, including some sightings with unidentifiable photographs, but no U.S. reports since April 1986 have been confirmed as jaguarundi. The closest known jaguarundis to the U.S. border are found approximately 95 miles southwest in Nuevo Leon, Mexico.

In Mexico, jaguarundis have been photographed through the use of remotely-triggered cameras in central and southern Tamaulipas as recently as 2010 (Tewes and Caso, unpublished data). However, current population size in Tamaulipas is unknown. Little or no information is known about jaguarundi presence or numbers in the remaining portions of the subspecies' range in Mexico.

Habitat Requirements, Threats, and Other Limiting Factors

The Gulf Coast jaguarundi is found in the Tamaulipan Biotic Province, where it uses dense, thorny shrublands or woodlands and bunchgrass pastures adjacent to dense brush or woody cover. Caso (1994) found that 3 radio-collared jaguarundis spent up to 50% of their time in tall, dense grass habitats that were adjacent to dense brush or woody cover. But the jaguarundis immediately retreated to the dense brush or woody cover if disturbed or threatened. Primary known threats to the Gulf Coast jaguarundi are habitat destruction, degradation, and fragmentation associated with agriculture and urbanization, and, to some extent, border security activities. Mortality from collisions with vehicles is also a threat. Competition with bobcats may be a potential limiting factor in the northern portion of the jaguarundi's range (Sanchez-Cordero et al. 2008). Increases in temperature and decreases in precipitation resulting from climate change may also affect Gulf Coast jaguarundi populations through impacts on their habitat.

Recovery Strategy

The strategy for recovery involves: assessing, protecting, reconnecting, and restoring sufficient habitat to support viable populations of the Gulf Coast jaguarundi in the borderlands of the U.S. and Mexico; further monitoring existing habitat to determine the existence of the Gulf Coast jaguarundi in the U.S.; reducing the effects of human population growth and development on fragmentation, degradation, and destruction of habitat; assuring the long-term viability of jaguarundi conservation through partnerships, the development and application of incentives

for landowners, application of existing regulations, and public education and outreach; reducing the risk of road mortality; investigating the relationship between bobcats and jaguarundis; evaluating the use of reintroduction of the Gulf Coast jaguarundi in suitable habitat within the historical range in south Texas; using adaptive management, in which recovery is monitored and recovery tasks are revised by the FWS as new information becomes available; and supporting international efforts to ascertain the status of and conserve the Gulf Coast jaguarundi in Mexico.

Recovery Goals

The long-term goal of this revised recovery plan is to recover and delist the Gulf Coast jaguarundi, with downlisting from endangered to threatened status as an intermediate goal.

Recovery Criteria

Reclassification from endangered to threatened may be considered when:

1. We have sufficient scientific information on the Gulf Coast jaguarundi to show that 3 or more separate populations with a combined total of at least 250 individuals rangewide are stable or increasing for at least 10 years and there is sufficient interchange between those populations to maintain genetic variability.

2. Threats from habitat loss, degradation, and fragmentation, have been reduced such that the Gulf Coast jaguarundi is no longer in danger of extinction. Total protected habitat area should include at least 2,200 km^2 (850 mi^2) of suitable habitat to support jaguarundi populations for the foreseeable future, and potential corridors and mechanisms must be identified to restore habitat connectivity between populations if necessary. Populations can include those found in Mexico, any newly discovered populations in southern Texas, a population that re-establishes in southern Texas through natural expansion, or a population established in southern Texas through translocation or reintroduction.

The Gulf Coast jaguarundi should be considered for removal from the list of threatened and endangered species when:

1. We have sufficient scientific information on the Gulf Coast jaguarundi to show that 3 or more separate populations with a combined total of at least 500 individuals rangewide are stable or increasing for at least 20 years and there is sufficient interchange between those populations to maintain genetic variability.

2. Threats from habitat loss, degradation, and fragmentation, have been reduced such that the Gulf Coast jaguarundi is no longer in danger of extinction. Total protected habitat area should include at least 4,400 km^2 (1,700 mi^2) of suitable habitat to support jaguarundi populations for the foreseeable future, and potential corridors and mechanisms must be identified to restore habitat connectivity between populations if necessary. Populations can include those found in Mexico; any newly discovered populations in southern Texas; a

population that re-establishes in southern Texas through natural expansion; or a population established in southern Texas through translocation or reintroduction.

Actions Needed

- Assess, protect, and enhance potential Gulf Coast jaguarundi habitat and connectivity in the U.S.
- Develop more effective survey techniques for jaguarundis;
- Support efforts to ascertain the status, better understand ecological and conservation needs, and promote conservation of the Gulf Coast jaguarundi and its habitats in Mexico;
- Reduce the effects of human population growth and development on potential Gulf Coast jaguarundi habitat in the U.S.;
- Assure the long-term success of Gulf Coast jaguarundi conservation through partnerships, landowner incentives, community involvement, application of regulations, and public education and outreach;
- Reduce the risk of jaguarundi mortality from vehicle collisions;
- Determine the relationship between bobcats and jaguarundis; and
- Practice adaptive management in which recovery is monitored and recovery tasks are revised by FWS as new information becomes available.

Total Estimated Actual Cost of Recovery (in U.S. dollars)[1]

Year	Priority 1	Priority 2
2012	365,000	388,000
2013	275,000	308,000
2014	285,000	328,000
2015	250,000	285,000
2016	215,000	235,000
2017	205,000	192,000
2018+	215,000	192,000

[1]Priorities can be found on page 40 of this plan.

Date of Recovery

If recovery efforts are fully funded and carried out as outlined in this plan, recovery criteria for downlisting could be met by 2030. Based on continued recovery actions outlined and implemented into the future, we estimate that delisting for the Gulf Coast jaguarundi could be initiated by 2040.

Resumen Ejecutivo

Plan Preliminar de Recuperación del Jaguarundi del Golfo (*Puma yagouarundi cacomitli*)

Estado actual de la especie

El jaguarundi del Golfo (*Puma yagouarundi cacomitli*) está entre la lista de especies en peligro de extinción en toda el área donde se encuentra y distribuye. Su área de distribución ocurre desde el sur de Texas hasta la porción oriental de México en los estados de Coahuila, Nuevo León, Tamaulipas, San Luis Potosí y Veracruz. En el estado de Texas, el jaguarundi también aparece como especie en peligro de extinción; en México, es considerado como especie amenazada. El último registro de jaguarundi de esta subespecie dentro de los Estados Unidos fue en abril de 1986, cuando un animal atropellado fue recogido en una carretera a dos millas al este de Brownsville, Texas; y más tarde fue identificado como un ejemplar del jaguarundi del Golfo (USFWS 2012). Desde entonces, numerosos casos de jaguarundi se han reportado pero ninguno ha sido confirmado. También se han tomado numerosas fotografías, sin embargo ningún reporte Estadounidense desde abril de 1986 ha sido confirmado como jaguarundi. Los registros del jaguarundi más cercanos a la frontera con los Estados Unidos se encuentran aproximadamente a 150 km al suroeste, en Nuevo León, México.

En México, se han tomado fotografías usando trampas-cámara del jaguarundi y estas son provenientes del centro y sur de Tamaulipas. Las ultimas fotografías fueron tomadas en 2010 (Tewes y Caso, datos no publicados). Sin embargo, el tamaño de la población existente en Tamaulipas es desconocida. Muy poco se sabe acerca de la presencia y del número de jaguarundis en el área geográfica del rango de distribución de esta subespecie en México.

Requerimientos de hábitat, amenazas y otros factores limitantes

El jaguarundi del Golfo se encuentra en la provincia biótica Tamaulipeca, y esta especie utiliza arbustos densos y espinosos, o bosques, y también pastizales de zacate cercanos a la maleza densa o bosques para poder esconderse. Caso (1994), encontró que 3 jaguarundis con radio-collar pasaron hasta un 50% de su tiempo en hábitats que contienen pastos densos y altos cercanos a malezas densas o bosques. Pero los jaguarundis se esconden inmediatamente en el bosque o maleza densa si son perturbados o amenazados. Las principales amenazas conocidas para el jaguarundi es la destrucción, degradación y fragmentación de su hábitat asociada con la agricultura y la urbanización, y en cierta medida, a las actividades de seguridad en la frontera. La mortalidad debido al atropellamiento por vehículos, es también un factor amenazante. La competencia con el gato montés (*Lynx rufus*) puede ser un factor limitante en las áreas del norte de su rango de distribución (Sanchez-Cordero et al. 2008). Incrementos en la temperatura y disminución en la precipitación resultado del cambio climático podrían también estar afectando la población del jaguarundi por medio de cambios en su hábitat.

Estrategia de recuperación

La estrategia de recuperación implica: la evaluación, protección, reconexión y restauración de su hábitat para que exista suficiente hábitat para mantener las poblaciones viables del

jaguarundi del Golfo en la frontera entre Estados Unidos y México; crear un mejor monitoreo para determinar la presencia del jaguarundi del Golfo en los Estados Unidos; reducir de los efectos causados por el crecimiento de la población humana y la fragmentación, degradación y destrucción de su hábitat; asegurar la supervivencia y conservación del jaguarundi a largo plazo a través de asociaciones, desarrollo y ofrecimientos de incentivos para los dueños de las tierras, aplicación de leyes existentes, y haciendo educación y divulgación pública; reducción del riesgo de mortalidad por atropellamiento en carreteras; investigación de la relación entre el gato montes (*Lynx rufus*) y el jaguarundi; estudio de la posibilidad de reintroducción del jaguarundi a un área donde el hábitat sea el adecuado y dentro del área histórica de la distribución del jaguarundi en el sur de Texas; establecer el manejo adecuado, en el cual la recuperación sea monitoreada y los trabajos de recuperación sean revisados por el FWS cuando exista nueva información; apoyar los esfuerzos internacionales para asegurar la conservación del jaguarundi del Golfo en México.

Metas de Recuperación

La meta a largo plazo de este este plan de recuperación es recuperar y retirar al jaguarundi de la lista de especies en peligro de extinción para Estados Unidos, y como meta intermedia, pasarlo del estatus de en peligro de extinción a amenazado.

Criterios de Recuperación

La reclasificación del estatus de en peligro a amenazado podría ser considerado cuando:

1. Tengamos suficiente información científica para demostrar que hay tres o más poblaciones separadas para un total de al menos 250 individuos y estas poblaciones estén estables o hayan aumentando durante 10 años y exista suficiente intercambio entre estas poblaciones para mantener la variabilidad genética.

2. Las amenazas de pérdida, degradación y fragmentación del hábitat, se hayan reducido de tal forma que el jaguarundi del Golfo ya no se considere que se encuentra en peligro de extinción. El área total de hábitat protegido debe de incluir por lo menos 2,200 km^2 (850 mi^2) de hábitat adecuado para apoyar a las poblaciones del jaguarundi para el futuro previsto, y corredores y mecanismos potenciales se deben identificar para restaurar la conectividad de hábitat entre las poblaciones si es que fuera necesario. Las poblaciones pudieran incluir los jaguarundi del Golfo que se encuentran en México, o cualquier población nueva encontrada en el sur de Texas; también las poblaciones que se restablezcan debido a la expansión natural, o cualquier población que se establezca en el sur de Texas a partir de la translocación o reintroducción.

El jaguarundi del Golfo debe ser considerado para exclusión de la lista de especies amenazadas y en peligro de extinción cuando:

1. Tengamos suficiente información científica para demostrar que hay tres o más poblaciones separadas para un total de al menos 500 individuos y estas poblaciónes estén estables o hayan aumentando durante 20 años y exista suficiente intercambio entre estas poblaciones para mantener la variabilidad genética.

2. Las amenazas de pérdida, degradación y fragmentación del hábitat, se hayan reducido de tal forma que el jaguarundi del Golfo ya no se considere que se encuentra en peligro de extinción. El área total de protección debe de incluir por lo menos 4,400 km^2 (1,700 mi^2) de hábitat adecuado para apoyar a las poblaciones del jaguarundi para el futuro previsto, y corredores y mecanismos potenciales se debe identificar para restaurar la conectividad de hábitat entre las poblaciones si es que fuera necesario. Las poblaciones pudieran incluir los jaguarundi del Golfo que se encuentran en México, o cualquier población nueva encontrada en el sur de Texas; también las poblaciones que se restablezcan debido a la expansión natural, o cualquier población que se establezca en el sur de Texas a partir de la translocación o reintroducción.

Acciones necesarias

- En los Estados Unidos, investigar, proteger y restaurar el hábitat y la conectividad del hábitat del jaguarundi del Golfo;
- Desarrollar técnicas de investigación más efectivas para la evaluación de las poblaciones del jaguarundi;
- Apoyar los esfuerzos necesarios para determinar el estado, mejor entendimiento ecológico y necesidades de su conservación y promover la conservación del jaguarundi del Golfo así como su hábitat en México;
- En los Estados Unidos, reducir los efectos del establecimiento y desarrollo de la población humana en las posibles regiones con hábitat adecuado para el jaguarundi del Golfo;
- Asegurar el éxito a largo plazo de la conservación del jaguarundi del Golfo mediante cooperación, incentivos a los dueños de tierras, apoyo comunitario, aplicación de las regulaciones, educación y diseminación al público;
- Reducción de mortalidad debido al atropellamiento de jaguarundis en carreteras;
- Determinar la relación existente entre el *Lynx rufus* y el jaguarundi; y
- Practicar una administración adaptativa en la cual la recuperación es monitoreada y los pasos de recuperación son revisados por el FWS cuando nueva información este disponible.

Estimación total de costos reales para la recuperación (en US dólares)[1]

Año	Prioridad 1	Prioridad 2
2012	365,000	388,000
2013	275,000	308,000
2014	285,000	328,000
2015	250,000	285,000
2016	215,000	235,000
2017	205,000	192,000
2018+	215,000	192,000

[1] Las prioridades pueden encontrarse en la página 40 de este plan.

Fecha de Recuperación

Si los esfuerzos de recuperación son financiados e implementados totalmente como se presentan en este plan, los criterios para reclasificación pueden alcanzarse en el año 2030. Basándonos en el seguimiento de las acciones de recuperación en este plan y su implementación en el futuro, estimamos que la exclusión de la lista del jaguarundi del Golfo de las especies en peligro de extinción podría ser iniciada en el año 2040.

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Background

Introduction

The Endangered Species Act of 1973 (ESA) calls for preparation of recovery plans for threatened and endangered species likely to benefit from the effort, and authorizes the Secretary of the Interior to appoint recovery teams to prepare the plans (U.S. Congress 1988). According to section 4(f)(1) of the ESA, recovery plans must, to the maximum extent practicable, describe site-specific management actions as may be necessary to achieve the plan's goals, incorporate objective and measurable delisting criteria, and estimate the time and cost required for recovery. A recovery plan is not self-implementing, but presents a set of recommendations that are endorsed by an official of the Department of Interior. Recovery plans also serve as a source of information on the overall biology, status, and threats of a species. It is the intent of the U.S. Fish and Wildlife Service (FWS) to modify this recovery plan in response to management, monitoring, and research data.

The first recovery plan for the jaguarundi, The Listed Cats of Texas and Arizona Recovery Plan (With Emphasis on the Ocelot), was completed in 1990 (USFWS 1990). The 1990 plan briefly addressed the jaguar, jaguarundi, and margay, and focused on the ocelot, primarily in Texas. However, this recovery plan, i.e. the 2012 Draft Gulf Coast Jaguarundi Recovery Plan, only applies to the gulf coast subspecies of jaguarundi.

Since 1990, little additional information has been obtained and since 1986 no new sightings of this subspecies in Texas have been confirmed. Some research on this subspecies in Tamaulipas, Mexico has taken place, but no information on current population size, distribution, or other parameters exists. In sum, our knowledge regarding the status of the subspecies is very limited. FWS lacks the resources and authority to coordinate international research and recovery for the subspecies. Therefore, site-specific management actions, recovery criteria, and cost estimates for recovery are limited in geographic scope and based on currently known information. However, we can establish the framework to better understand the status and conservation needs of the Gulf Coast jaguarundi by identifying research needs as outlined in the recovery actions of this plan. The FWS needs information on populations and threats internationally in order to evaluate whether its current listing status is appropriate. We will continue to work cooperatively with Mexico to gather needed information and support jaguarundi conservation and recovery. However, the FWS does not have the authority to address the major threats to the subspecies' recovery outside the U.S.

Overview

Common name:	Gulf Coast jaguarundi
Scientific name:	*Puma yagouaroundi cacomitli*
Listing Status:	Endangered; Listed June 14, 1976 (41 FR 24062)
State Status:	Texas - Endangered
Recovery Priority:	6
Five Year Review:	Five year review initiated February 11, 2009 (74 FR 6917)
Lead Regional Office:	Region 2 Southwest
Lead Field Station:	Laguna Atascosa National Wildlife Refuge

Status of the species

The Gulf Coast subspecies of jaguarundi was listed under the U.S. Endangered Species Act (ESA) as endangered in 1976. The entire species is considered threatened in Mexico (SEMARNAT 2010) and is currently categorized as "least concern" under the IUCN Red List (Caso et al. 2008). However, according to Caso et al. (2008), this species could already be Near Threatened (A3c), but there is not currently enough information to make this judgment. The North and Central American jaguarundi populations are included in Appendix I of the Convention on International Trade in Endangered Species (CITES) while all other populations are included in Appendix II. CITES aims to ensure that international trade in specimens of wild animals and plants does not threaten their survival. International commercial trade is allowed for species in Appendix II, but the amount of trade is monitored through permits and annual reports. International commercial trade is not allowed for species included in Appendix I. The jaguarundi is also listed as endangered in Texas (Campbell 2003).

Description and Taxonomy

The jaguarundi is a small cat, slightly larger than a house cat (*Felis catus*). With a slender build, long neck, short legs, small and flattened head, and long tail, it resembles a weasel (*Mustela* sp.) more than other felines (Tewes and Schmidly 1987, Oliveira 1998). Jaguarundis are not spotted and have two color phases – blackish to brownish gray or reddish yellow to chestnut. The two color phases were once thought to represent two separate species, the gray phase generally called jaguarundi and the red phase called eyra (Guggisberg 1985, Tewes and Schmidly 1987). We now know that red and gray kittens can be found in the same litter and the color phases are the same species. The long tails range in length from 11 to 24 inches (in) [28 to 61 centimeters (cm)] and standing height at the shoulder is typically 11 in (28 cm); total body length, including tail, of adult males is 42 in (107 cm) (TPWD 2011). The standing height at the

shoulder of the Gulf Coast subspecies is typically slightly smaller at 10 in (26 cm) (Caso and Tewes in prep). Weights range from 3.8 to 9 kilograms (kg) [8.4 to 19.8 pounds (lb)] with an average of 6 kg (13.2 lb) (Guggisberg 1985, Silva-Pereira et al. 2011), but the Gulf Coast subspecies weighs 6.6 kg (14.5 lbs) at most (Caso and Tewes in prep). Due to the similarity in size and color, a jaguarundi can easily be confused with a large feral black house cat.

The jaguarundi was originally included in the genus *Felis* and the Gulf Coast jaguarundi was originally listed under the ESA as *Felis yagouaroundi cacomitli* in 1976. Later, genus classification was changed from *Felis* to *Herpailurus* (Wozencraft 1993) and this widely accepted change was subsequently made to the ESA listing. Thus, this subspecies is currently listed under the ESA as *Herpailurus (=Felis) yagouaroundi cacomitli.* However, more recent genetic work assigns the jaguarundi to the genus *Puma* (Johnson and O'Brien 1997, Johnson et al. 2006) and this has become the generally accepted nomenclature (Wilson and Reeder 2005). Therefore, in keeping with this current information, we refer to the Gulf Coast jaguarundi subspecies as *Puma yagouaroundi cacomitili* throughout this recovery plan and we officially accept the new scientific name of the jaguarundi as *Puma yagouaroundi.*

In addition, the Sinaloan jaguarundi (*Puma yagouaroundi tolteca*) was originally listed under the ESA at the same time as the Gulf Coast subspecies (June 14, 1976; 41 FR 24062). Because all of the current information indicates that the *tolteca* subspecies occurs entirely outside the U.S. and has never been confirmed within the U.S., the Sinaloan jaguarundi was exempted from recovery planning on June 7, 2011 (USFWS 2011b).

The following subspecies are currently recognized by the scientific community (Johnson and O'Brien 1997, ITIS 2012): *P. y. ameghinoi*, *P. y. cacomitili*, *P. y. eyra*, *P. y. fossata*, *P. y. melantho*, *P. y. panamesisi*, *P. y. tolteca*, and *P. y. yagouaroundi*. However, little information exists for the basis of the delineation of the subspecies. Although there are ranges of measurements from various locations, it is not clear whether those differences inform the basis for subspecies. Likewise, we could not locate information for a genetic basis for delineating subspecies, though genetic information does exist for the genus. Nevertheless, this recovery plan only addresses the currently recognized *cacomitli* subspecies.

Population Trends and Historical and Current Distribution

The Gulf Coast jaguarundi's historical range is from the Lower Rio Grande Valley in southern Texas into the eastern portion of Mexico in the States of Coahuila, Nuevo Leon, Tamaulipas, San Luis Potosi, and Veracruz (Figure 1) (Nowak 1991, Oliveira 1998, Arroyo Rageb 2007, Caso et al. 2008, SEMARNAT 2010, NatureServe 2011, TPWD 2012). In Texas, jaguarundis historically were limited to the southern portion of the state including Cameron, Hidalgo, Willacy, and Starr counties (Bailey 1905, Davis 1974). In a boundary survey of the U.S. and Mexico, Baird (1859) notes that evidence of jaguarundi existing along the Rio Grande was established by a skull in the collection of Dr. Berlandiere. According to Dr. Berlandiere, "the animal was common in Mexico before the conquest, but is now rare…a few have been killed on the Rio Grande near Matamoros." Also, in this same survey (Baird 1859), there was a description of a skull in Dr.

Berlandiere's collection from *Felis eyra*, which we now classify as the Gulf Coast jaguarundi. Mabie (1983) noted that jaguarundi may have existed in the "big live oak area of east central Texas." However, there are no verified records of the subspecies beyond extreme southern Texas, and there is not enough information to determine how abundant the subspecies was historically (USFWS 2012). No historical records of jaguarundis have been documented north of the Rio Grande Valley of Texas (Tewes and Caso 2011). The last confirmed sighting of this subspecies within the U.S. was in April 1986, when a roadkilled specimen was collected two miles east of Brownsville, TX and positively identified by the Smithsonian National Museum of Natural History as a jaguarundi. Numerous unconfirmed sightings have been reported since then, some with unidentifiable photographs, but no reports have been confirmed as jaguarundi since 1986. There is a known population of jaguarundis approximately 130 miles south of the US border in Tamaulipas, Mexico (Caso 1994, USFWS 2012) and in 2000 there were at least four individuals detected approximately 95 miles southwest of the border (Carvajal et al. 2004) which are the nearest recent records of jaguarundis to the U.S.-Mexico border.

The Gulf Coast subspecies of jaguarundi is currently believed to occur in areas of northeastern Mexico, where suitable habitat exists, but no information on population size or trends exists (Tewes and Caso 2011). Jaguarundis have been photographed using remotely-triggered cameras in central and southern Tamaulipas as recently as 2012 (Illescas et al., unpublished data). The four records from 2000 (Carvajal et al. 2004) may be the northern distributional limit for jaguarundi in Tamaulipas and Nuevo Leon. While Caso (1994; Tewes and Caso 2011) has studied several jaguarundis on different ranches in Tamaulipas, there have been no consistent studies conducted over the range of the subspecies within Mexico. No population estimates or trend information are currently available.

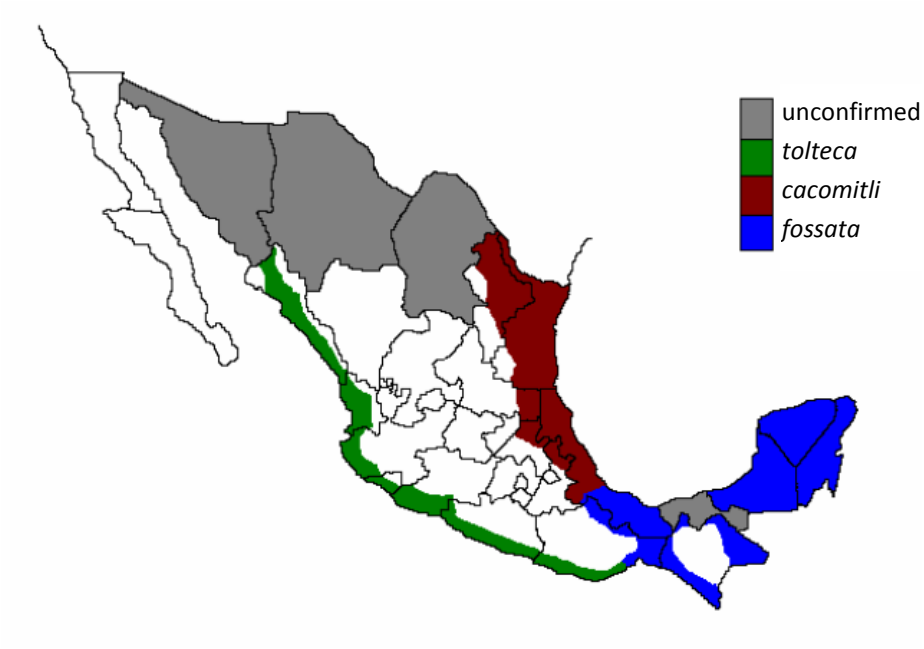

Figure 1. Geographic distribution of jaguarundi subspecies in Mexico: *P. y. tolteca*, *P. y. cacomitili*, and *P. y. fossata* (adapted from Arroyo 2007)

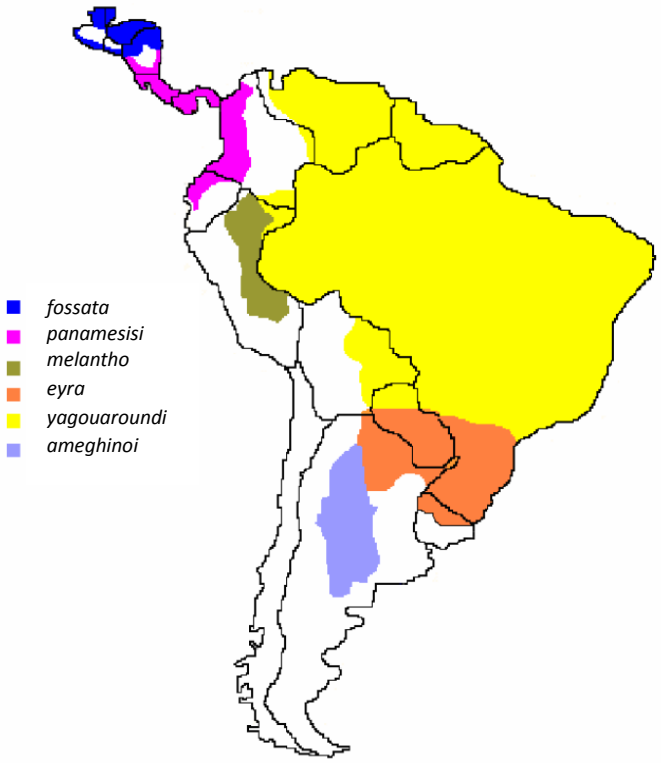

Figure 2. Geographic distribution of jaguarundi subspecies in Central and South America: *P. y. fossata*, *P. y. panamesisi*, *P. y. melantho*, *P. y. eyra*, *P. y. yagouaroundi*, and *P. y. ameghinoi* (adapted from Arroyo 2007)

Life History and Demography

Information on life history aspects of jaguarundi in the wild, including age of sexual maturity, minimum and maximum breeding age, and mating behavior, is limited (Tewes and Schmidly 1987, Caso 1994, TPWD 2012a). In a study of captive felids, Mellen (1993) reported the estrous cycle of the jaguarundi lasted 53.6 ± 2.4 days (n = 8). Hulley (1976) reported that a captive jaguarundi exhibited her first estrus at about two years of age and every six months thereafter. Gestation period of captive animals was 72 to 75 days. Reported litter size is one to four young, with a mean of 1.9 (Oliveira 1998). Jaguarundis may have two litters per year (Guggisberg 1985). Jaguarundis are solitary, except during mating season or when a female is raising kittens. The mating season in Mexico is November and December, while in the tropics it is year-round (Oliveira 1998, TPWD 2012a).

Jaguarundis prey mainly on birds, small mammals, and reptiles, with a mean prey mass of 380 grams (0.84 pounds) (Guggisberg 1985, Caso et al. 2008). However, larger-sized prey (> 1 kilogram [2.2 pounds]) are not unusual (Caso et al. 2008). Studies of jaguarundi diets in Belize, Brazil, and Venezuela show variation in the percentages of birds, mammals, and reptiles eaten but birds have been generally cited as the most common food item (Oliveira 1998, Tofoli 2009, Bianchi et al. 2011, Silva-Pereira et. al. 2011). While jaguarundis generally present little or no threat to game species (e.g. deer) or domestic livestock, they will occasionally visit chicken pens if they are near natural cover and can then become considered a nuisance (Tewes and Caso, 2011).

The jaguarundi is the only cat in northeastern Mexico which is primarily active during the day, whereas the other cats, such as ocelot, are primarily nocturnal. In his research in Tamaulipas, Mexico, Caso (1994) reported the activity pattern of jaguarundis to be 14.4 percent nocturnal and 85.6 percent diurnal and Sanderson (2012a) noted that in Suriname in areas where no people were present, jaguarundis were strictly diurnal. Likewise, Sanderson (2012a) observed them in Paraguay during the day. Jaguarundis are still difficult to observe because they prefer the cover provided by dense woody communities and bunchgrass pastures. The home range of jaguarundis in Tamaulipas was sometimes similar in size to ocelot home ranges—about 3.3 to 4.5 square miles (mi^2) (8.6 to 11.7 square kilometers [km^2]) (Caso and Tewes in prep). In Caso's (1994) Tamaulipas study, a male and female jaguarundi had home ranges of 8.54 km^2 (3.3 mi^2) and 8.8 km^2 (3.4 mi^2), respectively. However, home range sizes vary greatly, with reports of up to 100 km^2 (38.6 mi^2) (Konecny 1989).

Habitat Characteristics and Ecosystem

The jaguarundi is a lowland species, inhabiting forest and bush (Guggisberg 1985). The *cacomitli* subspecies is found in the Tamaulipan Biotic Province of northeast Mexico and south Texas (Caso 1994). Within Mexico it occurs in the eastern lowlands and has not been recorded in the Central Highlands (Tewes and Schmidly 1987). In southern Texas, jaguarundis used dense thorny shrublands. Typical habitat consists of mixed thornscrub species which include the

following: brasil (*Condalia hookeri*), desert yaupon (*Schaefferia cuneifolia*), wolfberry (*Lycium berlandieri*), lotebush (*Ziziphus obtusifolia*), amargosa (*Castela erecta*) , white-brush (*Aloysia gratissima*) , catclaw (*Acacia greggii*) , blackbrush (*Acacia rigidula*), lantana (*Lantana achyranthifolia*), guayacan (*Guajacum angustifolium*), cenizo (*Leucophyllum frutescens*), elbowbush (*Forestiera angustifolia*), and Texas persimmon (*Diospyros texana*). Trees that may be interspersed within the thornscrub include mesquite (*Prosopis* sp.), live oak (*Quercus* sp.), ebony (*Ebenopsis ebano*), and hackberry (*Celtis laevigata*). River and creek riparian habitat are also sometimes used (TPWD 2012a). Jaguarundis will use bunchgrass pastures if dense brush or woody cover is nearby. Consequently, patchworks of bunchgrass pastures with tracts of dense brush used by ocelots will also be used by jaguarundis (Caso 1994, Tewes and Caso 2011). Caso (1994, Caso and Tewes in prep.) has studied several ocelots and jaguarundis on different ranches in Tamaulipas. Both cats will occur in the same area, with jaguarundis using the combination of bunchgrass pastures and woody tracts while ocelots use the woody communities almost exclusively. In a study of Neotropical mammals in Costa Rica, jaguarundis were moderately sensitive to human impacts, requiring forest but frequently ranged outside of forest and did not depend on specific forest habitats (Daily 2003).

Reasons for Listing

The final rule (41 FR21062; June 14, 1976) that added the Gulf Coast subspecies of jaguarundi to the ESA's List of Endangered and Threatened Wildlife and Plants as an endangered species did not specify the reasons for its endangerment other than stating that each of the species that were listed through this final rule were in decline due to factors A, B, and D (outlined below). The species listed in 1976 were all included in the Appendix I of CITES due to threats from international trade.

Threats

Factor A - The Present or Threatened Destruction, Modification, or Curtailment of its Habitat or Range

The main threats to the jaguarundi throughout its range are habitat loss, degradation, and fragmentation. In the U.S., the habitat historically used by the Gulf Coast jaguarundi was once extensive throughout the Lower Rio Grande Valley (LRGV) but has been converted to agriculture and urban development (TPWD 2012a). In the LRGV of Texas, it has been estimated that over 95 percent of the dense thornscrub habitat that supported the Gulf Coast jaguarundi has been altered for agricultural and urban development (Jahrsdoerfer and Leslie 1988). In Cameron County, 91 percent of native woodlands were lost during the mid-1900s, primarily for agricultural uses (Tremblay et al. 2005). See also discussion under Factor E – Border Issues.

Currently, rapid population growth in the region is causing agricultural land to be converted to more urban development resulting in land and habitat fragmentation (Wilkins et al. 2000). The human population in the LRGV increased 39.8% from 1990 to 2000, compared to an increase of

22.8% in Texas and 13.2% in the U.S. during the same period (Murdock et al. 2002). Largely because of its relatively high birth rate, the LRGV population is expected to increase by more than 1 million, from 1.5 million in 1995 to 2.6 million in 2020 (Texas Comptroller 2012).

Roads - Fragmentation and Mortality

Roads may have two potential impacts on Gulf Coast jaguarundi populations. First, collisions with motor vehicles in Texas and in Mexico may be a source of mortality. While we only have one documented case of a jaguarundi being killed by a motor vehicle collision, collisions with motor vehicles are the leading cause of known mortality for ocelots in Texas (USFWS 2010). If jaguarundi populations were to expand into or be reintroduced to southern Texas, road mortality may be an issue. While some underpasses and culverts have been installed for ocelots in Texas, more are needed and correct size, design and placement is critical for them to be used by ocelots as travel corridors (USFWS 2010). If jaguarundi populations were once again found in Texas, these underpasses and culverts may also be useful in facilitating jaguarundi recovery. Second, roads can fragment habitat and decrease the probability of successful dispersal between patches of suitable habitat, thus increasing demographic and genetic isolation of populations. In their study on the effects of highway and associated wildlife mitigation features on bobcats in southern Texas, Cain et al. (2003) stated that projects to reduce the impacts of roads on wildlife should consider which impact, road mortality or habitat fragmentation, is likely to be the most detrimental and ensure that efforts to mitigate one impact do not increase the other. In addition, to the extent that jaguarundis might avoid areas of high road density, some otherwise suitable habitats may not be occupied by jaguarundis. Future recovery efforts would benefit from information on how jaguarundis locate home ranges relative to roads, or use culverts or underpasses to negotiate roads.

Factor B - Overutilization for Commercial, Recreational, Scientific, or Educational Purposes

Jaguarundis are not harvested for commercial fur trade, although they may be caught in traps set for commercially valuable species (Nowell and Jackson 1996). We have no information that indicates jaguarundis are collected for scientific or educational purposes. The information we have indicates that overutilization is not a known threat to this subspecies.

Factor C - Disease or Predation

We have no information on diseases or predation of jaguarundi that indicates these are threats to the subspecies.

Factor D - The Inadequacy of Existing Regulatory Mechanisms

The Gulf Coast jaguarundi is protected by the ESA in the United States. Critical habitat has not been designated for this subspecies. The Gulf Coast jaguarundi is also protected by the State Endangered Species Act in Texas which prohibits taking, possession, transportation, or sale, but this law does not provide for protection of habitat (TPWD 2012c). In Texas, most of the remaining potential jaguarundi habitat is on private lands. Due to landowner concerns about

the potential implications of having an endangered species on their property, much of the remaining habitat has not been surveyed. It is also mostly unprotected from development.

In Mexico, the jaguarundi is listed as threatened under Mexican Law (NOM-059-ECOL-2010) This law defines a threatened species as one that is found in danger of disappearing in the short or medium term, if the factors that adversely affect the species' viability continue to cause deterioration or modification of habitat or act directly to cause a reduction in the population size (SEMARNAT 2010a). While this law determines the status of the jaguarundi in Mexico, it does not convey habitat protection. However, the issuance of two other Mexican laws (the General Law on Ecological Balance and Environmental Protection [LGEEPA] which was passed in 1988, and the General Wildlife Law [LGVS] which was passed in 2000) established various protections for listed species and other wildlife (INE 2000, Valdez et al. 2006). The LGVS is the most comprehensive wildlife law in Mexican history and contains general provisions on the sustainable use of wildlife including incentives for land owners; cooperation among federal, state, and municipal governments and private individuals; ethical use of wildlife; restrictions on exotic species, wildlife research and rehabilitation centers; wildlife use by indigenous people; environmental education; species at risk and their critical habitat; reintroduction and translocation protocols; scientific collection permits; control of nuisance species; and law enforcement investigations and citations (INE 2000, SEMARNAT 2000). The federal Office of Wildlife within SEMARNAT is responsible for conserving and protecting the biodiversity of Mexico, and for the management and sustainable use of wildlife and their habitats, including listed species. Specifically, it issues permits and certifications for wildlife capture, collecting, research, production, possession, management, importation and exportation, and the shipment and transit within Mexico of all specimens and byproducts of native and exotic wildlife (INE 2000). However, the federal agency responsible for enforcing these wildlife laws (PROFEPA) is unable to adequately do so due to shortages of both staff and funding (Valdez et al 2006). In addition, some illegal hunting of the species appears to continue in some rural areas of Mexico (Caso et al. 2008, Garcia-Alaniz et al. 2010 [see discussion below under Factor E]).

The U.S. has little authority to implement actions needed to recover species outside its borders, especially when recovery requires the enforcement of foreign laws and regulations. In Mexico, key threats include the destruction and fragmentation of jaguarundi habitat. The powers that the FWS can employ in this regard are limited to prohibiting unauthorized importation of listed species into the U.S., prohibiting persons subject to U.S. jurisdiction from engaging in commercial transportation or sale of listed species in foreign commerce, and assisting foreign entities with education, outreach, and other aspects of conservation through our authorities in section 8 of the ESA. The "take" prohibitions of section 9 of the ESA only apply within the U.S., within the territorial seas of the U.S., and on the high seas. They do not apply in Mexico where the only populations of Gulf Coast jaguarundi are currently found. Section 7 of the ESA, which provides for all Federal agencies to utilize their authorities to carry out programs for the conservation of the species and to ensure that any action authorized, funded, or carried out by the agency is not likely to jeopardize the continued existence of listed species or adversely modify its critical habitat, is the primary tool within the ESA to address conflict with development or construction. The FWS has no section 7 authority outside the boundaries of

the U.S. Within the U.S., section 7 authority has been waived in a specific instance regarding construction of the border barrier pursuant to the Illegal Immigration Reform and Immigrant Responsibility Act of 1996 (Public Law 104–208) as amended by the Real ID Act (Public Law 109-13); for more details see below in Factor E.

Factor E - Other Natural or Anthropogenic Factors Affecting its Continued Existence

Competition with other small cats

Oliveira et al. (2010), in their synthesis of available data on ocelots (*Leopardus pardalis*) and other small cats in the lowlands of the Neotropics, along with data from a study of ocelots in Brazil, found that ocelots and other small cats, including jaguarundi, coexist within the same habitats. However, they postulated that the lower densities of the smaller felids may reflect intraguild predation by ocelots, or the threat of it. These researchers used the term, "ocelot effect", and believed this could be a key factor shaping the dynamics of the small felid community of the lowland Neotropics. However, Caso (1994, USFWS 2012) indicated that ocelot and jaguarundi were sympatric in his study area in Mexico. In a study of ocelots, jaguarundis, and coatis in Tamaulipas, Mexico, Caso (1994) found that jaguarundis were more active during the day (85.6 percent) and spent more of their time in pasture-grassland habitat (47 percent) compared to ocelots (38 percent and 2.4 percent, respectively). Different activity and habitat use patterns may allow these two species to avoid interaction.

Sanderson (2012b), in his camera trap study of wildlife in forests of Suriname, found that ocelot and jaguarundi active periods overlapped a small percentage, similar to the patterns in Caso's study. In their study of six wild cat species in Argentina, Di Bitetti et al. (2010) also found that four species (puma [*Puma concolor*], ocelot , oncilla [*Leopardus tigrinus*], and jaguar [*Panthera onca*]) alternated their peaks of activity in relation to the relative order of their body weights, i.e., the two larger species of cats (puma and jaguar) did not have the same peak activity times and the two smaller species of cats (ocelot and oncilla) also did not have the same peak activity times. The margay (*Leopardus wiedii*) and jaguarundi had the most contrasting patterns of activity, with jaguarundis being exclusively diurnal and margays being nocturnal. The researchers noted that jaguarundis, by being strictly diurnal, reduced the effect of interference competition or attacks from the larger and mostly nocturnal ocelot. In another study in the grasslands of southern Brazil, Silva-Pereira et al. (2011) found that three sympatric cat species, the ocelot, oncilla, and jaguarundi, all preyed on the same rodent species but due to the abundance of the prey, the three cat species were able to coexist without competing for food. Without any current information on jaguarundis within southern Texas, we cannot speculate whether the ocelots in that area would have a limiting effect (through competition for habitat or food) on the Gulf Coast jaguarundi, but historically ocelots and jaguarundis are thought to have coexisted in southern Texas along with bobcats (*Lynx rufus*), cougars, and jaguars, and available information seems to indicate that this is not generally a threat. However, should an attempt be made to reintroduce Gulf Coast jaguarundis into southern Texas, habitat use patterns and any interactions with ocelots and bobcats should be closely monitored.

Other biologists (USFWS 2012) have also theorized that bobcats could play a role in limiting jaguarundi populations in the northern part of their range. In southern Texas, bobcats are fairly common. Further south in Tamaulipas, Mexico, where jaguarundi populations still occur, bobcats are not as common. In his studies of jaguarundis and other wild cats in Tamaulipas, Caso (Caso 1994; Tewes and Caso 2011; A. Caso 2012, pers. comm.), recorded 60 captures and recaptures of ocelots and 21 captures of jaguarundis, but only 3 captures of bobcats. If the density of bobcats was higher, a higher capture rate would have been expected. However, we cannot determine whether bobcats are indeed a limiting factor for Gulf Coast jaguarundis without additional research in areas where both species occur, such as certain parts of Tamaulipas. Interestingly, Sanchez-Cordero et al. (2008) in their research in Mexico on the competitive interactions between six felid species concluded that these interactions appear to limit the southern distribution of bobcat to the north of the Isthmus of Tehuantepec. Empirical evidence to suggest that reintroduction could be successful given the abundance of bobcats in southern Texas would be necessary prior to reintroduction. Likewise, if reintroductions of Gulf Coast jaguarundis into southern Texas occurred, monitoring and research would be necessary to evaluate interactions with bobcats and other species.

Border Issues

Increased border monitoring associated with illegal immigration, and homeland security, will impact future jaguarundi recovery efforts. Borderland factors that could impact Gulf Coast jaguarundis include urbanization (e.g. brush clearing for buildings, sewage dumped into the Rio Grande and its tributaries, and road construction and maintenance), water development (e.g. brush clearing, channeling, draining), agriculture (e.g. brush clearing, pesticide run-off), U.S. Border Patrol Operations (e.g. lighting; road construction and maintenance; tower construction and maintenance; brush clearing; human activity, including on and off-road vehicular activity) (Jahrsdorfer and Leslie 1988), and the construction of fences along the border (Defenders of Wildlife 2006 and 2012a,b; Gaskill 2011; McCorkle 2011). Also, there are nine existing international bridges, two additional bridges under construction, and three more bridges under consideration within Cameron, Hidalgo, and Starr Counties in Texas that act as east-west barriers for Gulf Coast jaguarundi movement. Barriers such as these affect regional biodiversity, including jaguarundis, by destroying, fragmenting, and degrading habitat; disrupting the social structure of wildlife populations; reducing access to resources and habitats; and isolating and fragmenting animal populations (List 2007).

In 2006, Congress passed the Secure Fence Act, mandating that 700 miles of physical fencing be installed along the U.S.—Mexico border by the end of 2008. The Real ID Act (Public Law 109-13) amended the Illegal Immigration Reform and Immigrant Responsibility Act of 1996, (Public Law 104–208), to give the Secretary of the Department of Homeland Security the ability to waive any law or treaty to erect the fence, including environmental laws such as the National Environmental Policy Act, Clean Water and Clean Air Acts, National Wildlife Refuge System Administration Act, Migratory Bird Treaty Act, and the Endangered Species Act. On April 8, 2008, Department of Homeland Security Secretary Michael Chertoff invoked his ability to waive these laws as well as approximately 30 other laws and continued construction without compliance (73 FR 19078). Approximately 70 miles of pedestrian fence in 21 sections have

been proposed in the LRGV and will directly and indirectly impact lands managed by the Lower Rio Grande Valley NWR, TPWD, The Nature Conservancy (TNC), and Audubon Sabal Palm Sanctuary. Of these 70 miles, 22 miles of flood control wall/fence were proposed in Hidalgo County that impedes potential north-south connectivity for the Gulf Coast jaguarundi. Construction on the flood control wall/fence in Hidalgo County began on July 21, 2008 and was completed in 2009. In Cameron County, 34 miles of fence were completed in 2010. In Starr County, 14 miles were slated for construction in 2013-2014.

Hunting

Hunting jaguarundi is not legal in Mexico or in the U.S. However, jaguarundis may be subject to low intensity hunting pressure around settlements (Nowell and Jackson 1996). In a study of hunting practices in the tropical forests of Calakmul, Mexico, researchers found that while jaguarundi were present in their study area, and may have been occasionally hunted, they were never recorded as hunted (Escamilla et al 2000). Inskip and Zimmerman (2009), reviewed and analyzed conflicts between people and felids worldwide and found a low level of conflict for jaguarundi (all subspecies), meaning there was some livestock depredation by jaguarundi, with no risk to humans, but with some retaliatory killing. Retaliatory killing typically consists of local farmers killing jaguarundi because they have killed poultry (Caso et al. 2008). In a study of human-felid interactions in three mestizo communities in Chiapas, Mexico, Garcia-Alaniz et al. (2010) found that jaguarundi appeared to be the most common wild felid (out of five species) preying on domestic animals. This may reflect a greater tolerance to human disturbance or just a greater abundance than the other four felid species in this study area. While jaguarundis are viewed as a nuisance species and are hunted when they cause damage to domestic livestock, this study did not investigate the correlation between hunting practices and the actual population abundance of felids. The authors did believe that small felids represent significant predators of domestic livestock and their populations are affected negatively by hunting. Overall, based on all of the available information, while localized hunting of jaguarundi takes place, it is not a major threat to the Gulf Coast jaguarundi.

Climate change

Our analyses under the Endangered Species Act include consideration of ongoing and projected changes in climate. The terms “climate” and “climate change” are defined by the Intergovernmental Panel on Climate Change (IPCC). The term “climate” refers to the mean and variability of different types of weather conditions over time, with 30 years being a typical period for such measurements, although shorter or longer periods also may be used (IPCC 2007a). The term “climate change” thus refers to a change in the mean or variability of one or more measures of climate (e.g., temperature or precipitation) that persists for an extended period, typically decades or longer, whether the change is due to natural variability, human activity, or both (IPCC 2007a).

Scientific measurements spanning several decades demonstrate that changes in climate are occurring, and that the rate of change has been faster since the 1950s. Examples include warming of the global climate system, and substantial increases in precipitation in some regions of the world and decreases in other regions. (For these and other examples, see IPCC 2007a,

and Solomon et al. 2007). Results of scientific analyses presented by the IPCC show that most of the observed increase in global average temperature since the mid-20th century cannot be explained by natural variability in climate, and is "very likely" (defined by the IPCC as 90 percent or higher probability) due to the observed increase in greenhouse gas (GHG) concentrations in the atmosphere as a result of human activities, particularly carbon dioxide emissions from use of fossil fuels (IPCC 2007a, Solomon et al. 2007). Further confirmation of the role of GHGs comes from analyses by Huber and Knutti (2011), who concluded it is extremely likely that approximately 75 percent of global warming since 1950 has been caused by human activities.

Scientists use a variety of climate models, which include consideration of natural processes and variability, as well as various scenarios of potential levels and timing of GHG emissions, to evaluate the causes of changes already observed and to project future changes in temperature and other climate conditions (e.g., Meehl et al. 2007, Ganguly et al. 2009, Prinn et al. 2011). All combinations of models and emissions scenarios yield very similar projections of increases in the most common measure of climate change, average global surface temperature (commonly known as global warming), until about 2030. Although projections of the magnitude and rate of warming differ after about 2030, the overall trajectory of all the projections is one of increased global warming through the end of this century, even for the projections based on scenarios that assume that GHG emissions will stabilize or decline. Thus, there is strong scientific support for projections that warming will continue through the 21st century, and that the magnitude and rate of change will be influenced substantially by the extent of GHG emissions (IPCC 2007a, Meehl et al. 2007, Ganguly et al. 2009, Prinn et al. 2011). Refer to IPCC 2007b for a summary of other global projections of climate-related changes, such as frequency of heat waves and changes in precipitation. Also see IPCC 2011 for a summary of observations and projections of extreme climate events.

Various changes in climate may have direct or indirect effects on species. These effects may be positive, neutral, or negative, and they may change over time, depending on the species and other relevant considerations, such as interactions of climate with other variables (e.g., habitat fragmentation) (IPCC 2007). Identifying likely effects often involves aspects of climate change vulnerability analysis. Vulnerability refers to the degree to which a species (or system) is susceptible to, and unable to cope with, adverse effects of climate change, including climate variability and extremes. Vulnerability is a function of the type, magnitude, and rate of climate change and variation to which a species is exposed, its sensitivity, and its adaptive capacity (IPCC 2007a; see also Glick et al. 2011). There is no single method for conducting such analyses that applies to all situations (Glick et al. 2011). We use our expert judgment and appropriate analytical approaches to weigh relevant information, including uncertainty, in our consideration of various aspects of climate change.

Although many species already listed as endangered or threatened may be particularly vulnerable to negative effects related to changes in climate, we also recognize that, for some listed species, the likely effects may be positive or neutral. In any case, the identification of effective recovery strategies and actions for recovery plans, as well as assessment of their results in 5-year reviews, should include consideration of climate-related changes and

interactions of climate and other variables. These analyses also may contribute to evaluating whether an endangered species can be reclassified as threatened, or whether a threatened species can be delisted.

Global climate projections are informative, and, in some cases, the only or the best scientific information available for us to use. However, projected changes in climate and related impacts can vary substantially across and within different regions of the world (e.g., IPCC 2007a). Therefore, we use "downscaled" projections when they are available and have been developed through appropriate scientific procedures, because such projections provide higher resolution information that is more relevant to spatial scales used for analyses of a given species (see Glick et al. 2011 for a discussion of downscaling). With regard to our analysis for the Gulf Coast jaguarundi, downscaled projections are available for the Rio Grande Valley area through Climatewizard (Climatewizard.org 2012). According to projections from an ensemble average of general circulation models, temperatures are expected to be 5.5^{o}F warmer (mid-value), on average and the average annual precipitation is expected to decrease about 5 percent by 2080 (Climatewizard.org 2012). These changes could result in increased frequency of drought and wildfires in the area. As a tropical species, the northern limits of the jaguarundi's range may be controlled by temperature. Thus, as temperatures warm, the northern limits of this species may move further north possibly even north of the historical range (Grigione et al. 2009).

We do not know whether the changes that have already occurred have affected Gulf Coast jaguarundi populations or distribution, nor can we predict how the species will be affected by the type and degree of climate changes forecasted by a range of models, particularly since we have no population estimates or trend information for this subspecies. But, ongoing and future changes in climate have the potential to affect the jaguarundi within the next 50 to 100 years. Stochastic threats such as drought and wildfires in jaguarundi habitat may make this species more vulnerable. Monitoring of habitat and populations will be needed to address the potential threat of climate change. Therefore, monitoring the species and its habitat is necessary and we will adapt our recovery and management strategies as needed to address the changing conditions.

Conservation Actions to Date

A number of conservation actions have been implemented to protect, enhance, or restore habitat for the jaguarundi in Texas and northern Mexico; while some of these actions were taken to specifically benefit ocelot, they also provide a benefit to jaguarundi:

- Laguna Atascosa National Wildlife Refuge (LANWR), located in Cameron and Willacy Counties, Texas, has grown from 18,287 ha in 1999 to 36,008 ha in 2012. These lands were acquired from willing sellers and acquisition of some of these tracts included habitats readily used by ocelots. LANWR has a Refuge Expansion Plan (USFWS 1999) and a Comprehensive Conservation Plan (USFWS 2011a) which approves the acquisition of up to 43,758 ha. LANWR and surrounding lands within 15 km of LANWR contain an estimated 7,500 ha of dense thornscrub habitat (Haines et al. 2005). Recent additions to the refuge provide protected habitat and buffers from incompatible land uses.

- LRGVNWR, located in Starr, Hidalgo, Willacy, and Cameron Counties, Texas has grown from 5,526 ha in 1979 to 32,181 ha in 2012. The LRGVNWR Land Protection Plan (USFWS 1984) targets the acquisition of up to 53,621 ha. Several areas of the LRGVNWR have habitat suitable for jaguarundis, including the area around the Salt Lakes in Hidalgo and Willacy Counties and parts of eastern Cameron County.
- In 2009, South Texas Refuge Complex (STRC) developed a strategic acquisition plan and, in 2011, Lower Rio Grande Valley National Wildlife Refuge (LRGVNWR) developed a preliminary project proposal. Each of these plans focuses the growth of the Refuges on the acquisition of lands critical to conservation of trust resources, including the jaguarundi. The proposal requests an increase n the capacity of LRGVNR to grow, justifying it on the basis of maximizing the likelihood of conserving of trust resources.
- Both LANWR and LRGVNWR are restoring agricultural land to native thornscrub. LRGVNWR reforests about 300 ha/year through cooperative farming agreements (USFWS 1997). LANWR set aside about 400 ha of farmland in the 1980s where the planting of native shrubs and natural plant colonization from surrounding brushland occurred. A female ocelot was suspected of denning in one of those areas only about 10 years post-treatment (USFWS, unpubl. data).
- In 2012, LANWR finalized the Ocelot Habitat Restoration Plan that identified areas that could be improved to provide better ocelot habitat where it formerly occurred.
- A separate but parallel habitat restoration program, operated by the STRC, the Burned Area Emergency Response (BAER) provides funding for restoration of areas impacted by wildfires. From 2006 to 2009, 4 sites totaling 172 acres were treated with herbicide for invasive grass control and replanted with native brush species. This program currently has more than 570 acres in funded BAER plans for restoration. An additional 10 acres of retired oil and gas pads have been restored to native brushlands.
- The Nature Conservancy (TNC) has acquired thousands of acres in land to help protect dense brushland habitat and create corridors between existing habitats. In 2008-2009, TNC purchased conservation easements totaling about 2,000 acres on private lands in Willacy County.
- In 2012, TNC began restoring brushland habitat on part of their new easements with plans to put more areas into restoration every other year.
- In Mexico, the National Commission of Natural Protected Areas (known by its Spanish acronym CONANP) announced in April 2005 that a new Flora and Fauna Protected Area, Laguna Madre and Delta del Rio Bravo, was created in Tamaulipas, Mexico. It covers 572,808 ha of the Laguna Madre and adjoining coastline and will protect jaguarundi habitat. Since 2005, other protected areas have also been created within the range of the jaguarundi.
- In 2005, a new USDA-Natural Resources Conservation Service standard was written which describes how to establish thornscrub on cropland for the benefit of the ocelot (NRCS 2005). This new program will also create jaguarundi habitat. This standard is being employed under the Farm Services Agency practice CP4D (FSA 2008). This program provides a financial incentive for landowners to restore thornscrub habitat on their property.

Recovery

Recovery Goal

The long-term goal for this plan is to restore and protect the Gulf Coast jaguarundi and its habitat so that its long-term survival is secured and it can be considered for removal from the list of threatened and endangered species (delisted).

The Gulf Coast jaguarundi presents a significant challenge for recovery planning because, based on our current knowledge, it no longer occurs in the U.S. and, while it is known to still occur in Mexico, the status of the species in Mexico is largely unknown. Additionally, the FWS lacks the resources and authority to coordinate international research and recovery for this subspecies. However, we can establish a general framework to better understand the status and conservation needs of the Gulf Coast jaguarundi for recovery throughout its range. We can cooperate with our partners in Mexico to focus efforts within our respective jurisdictions to conserve Gulf Coast jaguarundi populations. And we can identify broad steps to minimize known threats to the jaguarundi and to protect, enhance, or restore jaguarundi habitat in southern Texas.

Recovery Strategy

Our approach for recovery in this revision to the Gulf Coast jaguarundi portion of the Listed Cats Recovery Plan (USFWS 1990) is as follows:

- To summarize what is known about the status of the Gulf Coast jaguarundi throughout its range.
- To identify primary information gaps and broad actions necessary to address the long-term conservation of this subspecies in the U.S. and in Mexico.

While we consider the Gulf Coast jaguarundi throughout its range, the FWS will necessarily focus its recovery actions in the U.S within South Texas. We recognize the conservation needs and challenges facing the Gulf Coast jaguarundi in Mexico and are committed to working with Mexico to conserve the species but the FWS has little authority to implement actions needed to recover species outside the U.S. borders. The management and recovery of listed species outside the U.S. borders, including the Gulf Coast jaguarundi, is primarily the responsibility of the countries in which the species occur, with the help of available technical and monetary assistance from the U.S. Thus, it is appropriate to focus our efforts and resources on conservation of the Gulf Coast jaguarundi in the northernmost portion of its range within the U.S. as our contribution toward a bi-national effort to conserve and recover the Gulf Coast jaguarundi rangewide.

It is believed that Texas once supported a population of Gulf Coast jaguarundis that was demographically linked to the State of Tamaulipas. Focusing recovery in southern Texas is logical because: 1) it encompasses the historical known U.S. range of the subspecies; 2) the U.S. population was likely historically contiguous with a larger regional population across the Rio Grande; 3) it has distinct habitat conditions that occur nowhere else in the subspecies' range;

and 4) peripheral populations can be important genetic resources and may be beneficial to the protection of evolutionary processes and the environmental systems that are likely to generate future evolutionary diversity (Lesica and Allendorf 1995, Lomolino and Channel 1995, Channel and Lomolino 2000). This may be particularly important considering the potential threats of global climate change (see Factor E above).

Recovery Objectives

Recovery objectives collectively describe the specific conditions under which the goals for recovery of the Gulf Coast jaguarundi will be met. These objectives apply to the recovery of the Gulf Coast jaguarundi throughout its range, and each is associated with one or more of the five listing factors. Recovery objectives include:

1) Support efforts to develop more effective survey techniques for jaguarundis and to ascertain the status, better understand ecological and conservation needs, and promote conservation of the Gulf Coast jaguarundi and its habitats throughout its range (Listing Factors A, B, D, E).
2) Assess, protect, and restore sufficient habitat and connectivity to support viable populations and genetic exchange of the Gulf Coast jaguarundi in southern Texas and in Mexico (Listing Factors A, E).
3) Reduce the effects of human population growth and development on potential Gulf Coast jaguarundi habitat and on the potential survival and mortality of jaguarundi (Listing Factors A, E).
4) Assure the long-term viability of jaguarundi conservation through partnerships, the development and application of incentives for landowners, application of existing regulations, and public education and outreach (Listing Factors A, D, E).
5) Practice adaptive management in which recovery is monitored and recovery tasks are revised by the FWS as new information becomes available.

Please see “Threats” for a description of the five Listing Factors.

Recovery Criteria

Recovery criteria are the objective, measurable criteria that if met, provide a basis for determining whether a species can be considered for reclassification (downlisting to threatened status or removing it from the list of threatened and endangered species [delisted]). Because the same five statutory factors must be considered in delisting as in listing, 16 U.S.C. § 1533 (a), (b),(c), the FWS, in designing objective, measurable criteria, must address each of the five statutory delisting factors and measure whether threats to the [species] have been ameliorated (see Fund for Animals v. Babbitt, 903 F. Supp. 96 [D.D.C. 1995]).

Recovery criteria for downlisting and delisting are difficult to establish given the lack of information that the Gulf Coast jaguarundi exists within the U.S. and the lack of information on the population viability of the subspecies in Mexico. Much more research is needed to

recommend specific recovery tasks. Some general preliminary recommendations are outlined below. As additional data are obtained, more specific downlisting and delisting recommendations could be developed. Recovery criteria and tasks outlined in the Draft First Revision of the Ocelot Recovery Plan (USFWS 2010) may also serve to increase the recovery opportunities for the Gulf Coast jaguarundi because the ocelot and jaguarundi use similar habitat.

Given that the Gulf Coast jaguarundi is listed as a subspecies, the criteria below were established for the Gulf Coast jaguarundi throughout the subspecies' range. If these are met, this subspecies could be considered for downlisting or delisting. We submit that the approach meets the statutory requirements of the ESA to the maximum extent practicable. As our knowledge of the Gulf Coast jaguarundi increases and as the recovery actions described in this plan are implemented, the plan may be revised and refined.

Downlisting Criteria

The Gulf Coast jaguarundi should be considered for downlisting to threatened status when:

1. We have sufficient scientific information on the Gulf Coast jaguarundi to show that 3 or more separate populations with a combined total of at least 250 individuals rangewide are stable or increasing for at least 10 years and there is sufficient interchange between those populations to maintain genetic variability.

Rationale for Downlisting Criterion 1: Recent research on the minimum viable population levels of various taxa support the idea that in most cases, populations of at least 500 individuals are necessary to maintain genetic variation and that 5000 individuals are needed to ensure long-term persistence and evolutionary potential (Thomas 1990, Frankham 1995, Reed et al. 2003, Traill et al. 2007, Traill et al. 2010). In this case, there are 8 subspecies of jaguarundi and this plan and these criteria pertain to only one of those subspecies. If all subspecies are considered, it is clear that the geographic extent of the Gulf Coast subspecies is a very small portion of the entire species range. It seems reasonable to conclude that the goal for the subspecies should be to maintain genetic variation and that a population of 5000 individuals is not realistic or feasible for the subspecies, but would be suitable for the species as a whole. Given that no current population size or demographic information exists for the Gulf Coast jaguarundi, a population of 250 individuals seems to be a reasonable criterion for ensuring a reduction in the risk of extinction. Likewise, for the purpose of this criterion, we consider the ocelot to be a reasonable proxy for the Gulf Coast jaguarundi because both species are small felids with similar, though not identical, life histories and habitat requirements. If we make the assumption that populations and demographics are sufficiently similar to the ocelot, we can consider the population viability analysis conducted for the ocelot (USFWS 2010) to be a reasonable approximation of the Gulf Coast jaguarundi. The PVA conducted for the ocelot indicates that a population of 200 individuals with no road mortality and relatively high reproductive success (70%) would lead to a probability of extinction of zero over 100 years. The high level of reproductive success along with no road mortality is not the most realistic or

likely scenario, therefore, the additional 50 individuals would serve to buffer against these realities. As we learn more about the subspecies, this criterion may be modified in the future.

2. Threats from habitat loss, degradation, and fragmentation, have been reduced such that the Gulf Coast jaguarundi is no longer in danger of extinction. Total protected habitat area should include at least 2,200 km^2 (850 mi^2) of suitable habitat to support jaguarundi populations for the foreseeable future, and potential corridors and mechanisms must be identified to restore habitat connectivity between populations if necessary. Populations can include those found in Mexico; any newly discovered populations in southern Texas; a population that re-establishes in southern Texas through natural expansion; or a population established in southern Texas through translocation or reintroduction.

Rationale for Downlisting Criterion 2: As is the case for downlisting criterion 1, this criterion was based on our very limited knowledge of the subspecies throughout its range. The only known home range sizes are approximately 8.8 km^2 (3.4 mi^2). Therefore, this home range size was used to calculate the minimum habitat area required to support 250 individuals (downlisting criterion 2). This is a conservative estimate based on the available information. As we learn more about the subspecies, this criterion may also be modified in the future.

Delisting Criteria

The Gulf Coast jaguarundi should be considered for delisting when:

1. We have sufficient scientific information on the Gulf Coast jaguarundi to show that 3 or more separate populations with a combined total of at least 500 individuals rangewide are stable or increasing for at least 20 years and there is sufficient interchange between those populations to maintain genetic variability.

Rationale for Delisting Criterion 1: This is similar to Downlisting Criterion 1, except it was extended over a longer time frame to encompass 6 generations of jaguaurundis to ensure populations are sufficiently stable and the population size was increased to 500 individuals to ensure that there is sufficient genetic variation in the population. As we learn more about the subspecies, this criterion may be modified in the future.

2. Threats from habitat loss, degradation, and fragmentation, have been reduced such that the Gulf Coast jaguarundi is no longer in danger of extinction. Total protected habitat area should include at least 4,400 km^2 (1,700 mi^2) of suitable habitat to support jaguarundi populations for the foreseeable future, and potential corridors and mechanisms must be identified to restore habitat connectivity between populations if necessary. Populations can include those found in Mexico; any newly discovered populations in southern Texas; a population that re-establishes in southern Texas through natural expansion; or a population established in southern Texas through translocation or reintroduction

Rationale for Delisting Criterion 2: This is similar to Downlisting Criterion 2, except the quantity of protected habitat was increased to the amount presumably needed to sustain a population

of 500 individuals. As we learn more about the subspecies, this criterion may be modified in the future.

Outline and Narrative of Recovery Actions

1. Support efforts to develop more effective survey techniques for jaguarundis and to ascertain the status, better understand ecological and conservation needs, and promote conservation of the Gulf Coast jaguarundi and its habitats (Listing Factors A, B, D, E).

    1.1 Develop survey and monitoring plans for historical range in the U.S in southern Texas and in Mexico.
        1.1.1 Support research to develop effective jaguarundi survey techniques.
        1.1.2 Support studies to better understand jaguarundi habitat use and requirements.
    1.2 Conduct monitoring (via camera surveys and/or box trapping) for Gulf Coast jaguarundi presence on FWS properties in southern Texas and on other lands through partnerships.
        1.2.1 Develop agreements with researchers, State agencies, private landowners, or conservation organizations to survey on non-Federal land.
        1.2.2 Develop agreements with other Federal landowners (e.g. Immigration and Customs Enforcement, National Park Service) to survey non-USFWS land.
    1.3 Support population surveys and research efforts in Mexico.
        1.3.1 Support studies to determine the number, location, size, distribution, demographics, and genetic diversity of jaguarundi populations in Mexico.
        1.3.2 Support studies to examine dispersal and connectivity between populations in Mexico.
        1.3.3 Support studies that quantify road effects and road density threshold in Mexico.
        1.3.4 Support studies that quantify the level of retaliatory killing and its effects on populations in Mexico.
    1.4 Investigate the potential for re-establishing a population in southern Texas.
        1.4.1 Estimate the amount of area and habitat characteristics needed in southern Texas for a self-sustaining population.
        1.4.2 Estimate the minimum population size needed for a self-sustaining population in southern Texas.
        1.4.3 Determine the feasibility of translocation or reintroduction of jaguarundis into historical range in southern Texas.

2. Assess, protect, and restore sufficient habitat and connectivity to support viable populations of the Gulf Coast jaguarundi in southern Texas and in Mexico (Listing Factor A).

    2.1 Assess potential jaguarundi habitats in southern Texas and Mexico.

2.1.1 Map potential jaguarundi habitat in southern Texas. GIS maps of all remaining brushlands and adjacent grasslands in historic range in Texas should be developed to determine where potential suitable habitat remains, where populations could be reestablished, and where it may be feasible to establish habitat connectivity through restoration.

2.1.2 Support efforts to map jaguarundi habitat in Mexico.

2.2 Identify potential conservation lands in southern Texas through partnerships.

2.3 Protect potential habitat in the historical range in southern Texas through partnerships and incentive programs.

2.3.1 Foster partnerships with landowners.

2.3.2 Distribute habitat management and habitat restoration guidelines.

2.4 Maintain and enhance border thornscrub habitats and adjacent grasslands in southern Texas.

3. Reduce the effects of human population growth and development on potential Gulf Coast jaguarundi habitat in the U.S. and on the jaguarundi's potential survival and mortality (Listing Factors A,E).

3.1. Identify, install, and maintain potential and existing habitat linkages and crossing structures in southern Texas.

3.2. Minimize impacts of road projects to existing and potential habitat in southern Texas

3.3. Develop and install functional crossing structures.

3.4. Monitor function of wildlife crossings for jaguarundi

3.5. Identify potential future crossings of jaguarundi across the U.S.-Mexico border.

3.6. Reduce impacts of border infrastructure projects in jaguarundi habitat in the U.S.

3.7. Provide supplemental drinking water during periods of drought if a Gulf Coast jaguarundi population is discovered or re-established in southern Texas.

3.7.1. Conduct a freshwater resources assessment to determine the need for drinking water at specific locations.

3.7.2. Identify strategic well sites and install solar-powered pumps or rainwater catchment systems and restore freshwater wetlands.

4. Assure the long-term viability of jaguarundi conservation through partnerships, the development and application of incentives for landowners, application of existing regulations, and public education and outreach (Listing Factors A,D,E).

4.1 Develop and implement incentive programs for landowners to protect, enhance, or establish jaguarundi habitat.

4.2 Minimize impacts from other developments and human activities in areas with existing or potential jaguarundi habitat in the U.S.

4.3 Support interagency planning to minimize the effects of federal activities on existing or potential jaguarundi habitat in the U.S.

4.4 Foster partnerships and ensure compliance of oil, gas, and seismic operations in historical range in southern Texas.

4.5 Coordinate with Homeland Security and Border Patrol to minimize impacts of border security activities on jaguarundis or their habitat.

4.6 Develop and distribute education materials on jaguarundis and their habitat needs.

4.7 Work with the Ocelot Recovery Team on their efforts to restore thornscrub or other habitats that jaguarundis use and to implement other ocelot recovery actions that benefit jaguarundi recovery.

4.8 Support research on niche overlap with potential competitors (e.g., bobcat, ocelot).

4.9 Develop and sustain conservation partnerships with Mexico.

4.9.1. Partner with Mexican government agencies and private landowners to further Gulf Coast jaguarundi conservation.

5. Practice strategic habitat conservation and adaptive management in which recovery is monitored and recovery tasks are revised by the FWS as new information becomes available.

5.1 Monitor changes in jaguarundi habitat in the U.S.

5.2 Monitor recovery task implementation and effectiveness and revise recovery actions, objectives, or criteria, if necessary, as new information become available.

5.3 Ensure that management actions taken for surrogate and other priority species account for effects on jaguarundi and their habitats.

Threats Tracking Table

SUMMARY OF GULF COAST JAGUARUNDI LISTING FACTORS AND THREATS AND THE RECOVERY ACTIONS TO CONTROL THOSE THREATS			
Listing Factor	**Threats**	**Recovery Criteria**	**Recovery Actions**
ALL	All threat factors	1, 2	1.1 Develop survey and monitoring plans for historical range
		2	1.2 Monitor for species presence in southern Texas through partnerships
		1	1.2.1 Develop agreements with researchers, State agencies, private landowners, or conservation organizations to survey on non-Federal land
		1	1.2.2 Develop agreements with other Federal landowners to survey non-USFWS lands
		1, 2	1.3 Support population surveys and research efforts in Mexico
		2	1.3.1 Support studies to determine the number, location, size, distribution, demographics, and genetic diversity of populations in Mexico
		1, 2	4.9 Develop and sustain conservation partnerships with Mexico
		1, 2	4.9.1 Partner with agencies and landowners in Mexico to further recovery
		1, 2	5.2 Monitor recovery task implementation and effectiveness, and revise recovery actions, objectives, and criteria as new information becomes available
Factor A	Population and Habitat Loss	1	1.1.1 Support research to develop effective survey techniques
		1	1.2 Monitor for species presence in Texas
		1, 2	1.3 Support efforts to document status in Mexico
		1	1.3.1 Support studies to determine the number, location, size, distribution, demographics, and genetic diversity of populations in Mexico
		1, 2	1.4 Investigate the potential to re-

			establish a population in southern Texas
		2	1.4.1 Estimate area and habitat needed in southern Texas for a self-sustaining population
		1	1.4.2 Estimate the minimum population size needed for a self-sustaining population in southern Texas.
		1	1.4.3 Determine the feasibility of translocation or reintroduction in southern Texas.
		2	2.1 Assess potential habitats in southern Texas and in Mexico
		2	2.1.1 Map potential habitat in southern Texas
		2	2.1.2 Support efforts to map habitat in Mexico
		2	2.2 Identify potential conservation lands in southern Texas
		2	2.3 Protect potential habitat in southern Texas
		2	5.1 Monitor changes in potential habitat in southern Texas
Factor A	Habitat Modification (Management)-Degradation	2	1.1.2 Support studies to better understand jaguarundi habitat use and requirements
		1, 2	1.3.2 Support studies to examine dispersal and connectivity between populations
		2	2.2 Identify potential conservation lands
		2	2.3.1 Foster partnerships with landowners
		2	2.3.2 Distribute habitat management guidelines
		2	2.4 Maintain and enhance U.S.-Mexico border habitats
		2	4.1 Develop and implement incentive programs for landowners to protect, enhance, or establish jaguarundi habitat
		2	4.2 Minimize impacts from other developments and human activities in areas with existing or potential habitat in the U.S.
		2	4.3 Support interagency planning to

			minimize the effects of federal activities on existing or potential habitat in the U.S.
		2	4.4 Foster partnerships and ensure compliance of oil, gas, and seismic operations in historic range in southern Texas
		2	4.5 Coordinate with Homeland Security and Border Patrol to minimize impacts of border security activities
		2	4.6 Develop and distribute educational materials on jaguarundis and their habitat needs.
		2	4.7 Work with the Ocelot Recovery Team to restore thornscrub or other habitats that jaguarundis use and to implement other recovery actions that benefit jaguarundis
		2	5.1 Monitor changes in jaguarundi habitat in southern Texas
		2	5.3 Ensure that management actions taken for surrogate and other priority species account for effects on jaguarundi and their habitats.
Factor A	Road Fragmentation and Mortality	1, 2	1.3.2 Support studies to examine dispersal and connectivity between populations
		1, 2	1.3.3 Support studies that quantify road effects and road density threshold
		2	3.1 Identify, install, and maintain potential and existing habitat linkages and crossing structures in southern Texas
		2	3.2 Minimize impacts of road projects to existing and potential habitat in southern Texas
		2	3.3 Develop and install functional crossing structures
		2	3.4 Monitor function of wildlife crossings for jaguarundi
Factor D	Inadequacy of Regulation	2	4.1 Develop and implement incentive programs for landowners to protect, enhance, or establish jaguarundi habitat
		2	4.2 Minimize impacts from other developments and human activities in

			areas with existing and potential habitat in the U.S.
		2	4.3 Support interagency planning to minimize the effects of federal activities on existing and potential habitat in the U.S.
		2	4.4 Foster partnerships and ensure compliance of oil, gas, and seismic operations in historic range in southern Texas
Factor E	Competition	1	1.2.1 Develop agreements with researchers, State agencies, private landowners, or conservation organizations to survey on non-Federal land
		1	1.2.2 Develop agreements to survey on other (non-USFWS) Federal land
		2	4.8 Support research on niche overlap with potential competitors (e.g., bobcat, ocelot)
Factor E	Border Issues	1, 2	1.3.2 Support dispersal studies in Mexico
		2	2.4 Maintain and enhance thornscrub and adjacent grassland habitats in southern Texas
		2	3.5 Identify potential future crossings of jaguarundi across the U.S.-Mexico border.
		2	3.6 Reduce impacts of border infrastructure projects in jaguarundi habitat in the U.S.
		2	4.5 Coordinate with Homeland Security and Border Patrol
		1, 2	4.9.1 Partner with Mexican agencies and landowners to further jaguarundi conservation
Factor E	Hunting	1	1.3.4 Support studies on the level and effects of retaliatory killing of Gulf Coast jaguarundi in Mexico.
Factor E	Climate change and Drought	1	3.7 Provide supplemental drinking water during periods of drought if a Gulf Coast jaguarundi population is found or re-established in southern Texas
		1	3.7.1 Conduct a freshwater resources assessment to determine the need for

			drinking water at specific locations
		1	3.7.2 Identify strategic well sites and install solar-powered pumps or rainwater catchment systems and restore freshwater wetlands.
		2	5.1 Monitor changes in jaguarundi habitat in the U.S.

Implementation Schedule

The following implementation schedule outlines priorities, potential or responsible parties, and estimated costs for the specific actions for recovering the Gulf Coast jaguarundi. It is a guide to meeting the goals, objectives, and criteria from the RECOVERY section of this recovery plan. The schedule: (a) lists the specific recovery actions, corresponding outline numbers, the action priorities, and the expected duration of actions; (b) recommends agencies or groups for carrying out these actions; and (c) estimates the financial costs for implementing the actions. These actions, when complete, should accomplish the goal of this plan – recovery of the Gulf Coast jaguarundi.

The Service has identified agencies and other potential partners to help implement the recovery of these species. While these potential partners are called "responsible parties" in the table, this plan does not commit any partners to actually carry out a particular recovery action or expend funds. Likewise, this schedule does not preclude or limit other agencies or parties from participating in the recovery program.

The Implementation Schedule contains the estimated monetary needs for all parties involved in recovery for the first 10 years only. Estimated funds for agencies include only project specific contracts, staff, and operations costs in excess of base budgets. They do not include budgeted amounts that support ongoing agency staff responsibilities.

Under "Duration," the term "ongoing" is used to denote actions that are expected to require constant attention throughout the recovery process and have an indefinite duration during the recovery process.

Priorities in column one of the Implementation Schedule are assigned using the following guidelines:

Priority 1(a) - An action that must be taken to prevent extinction or to prevent the species from declining irreversibly in the foreseeable future.
Priority 1(b) - An action that by itself will not prevent extinction, but is needed to carry out a Priority 1(a) action.
Priority 2 - An action necessary to prevent a significant decline in species population/habitat quality, or some other significant negative impact short of extinction.
Priority 3 - All other actions necessary to meet the recovery objectives.

Actions and action numbers are taken from the Outline and Narrative of Recovery Actions.

The following abbreviations are used in the Implementation Schedule:
CBP = U.S. Customs and Border Protection
CKWRI = Caesar Kleberg Wildlife Research Institute
CONABIO = Comisión Nacional para el Conocimiento y Uso de la Bioversidad
CONANP = Comisión Nacional de Áreas Naturales Protegidas

DGVS = Dirección General de Vida Silvestre
DHS = Department of Homeland Security
FHWA = Federal Highways Administration
IEA = Instituto de Ecología y Alimentos
INE = Instituto Nacional de Ecología
NAT = Naturalia
PL = Private Landowners
PRNA = Pronatura
PROFEPA = Procuraría Federal de Protección del Ambiente
SCT = Secretaría de Comunicaciones y Transportes
SEM = Secretaría de Medio Ambiente y Recursos Naturales (SEMARNAT)
TNC = The Nature Conservancy
TPWD = Texas Parks and Wildlife Department
TXDOT = Texas Department of Transportation
UNAM = Universidad Nacional Autónoma de México
USDOT = U.S. Department of Transportation
USFWS = U.S. Fish and Wildlife Service

Priority Number	Action Number	Recovery Action Description	Recovery Criterion Number	Threats	Action Duration (years)	Responsible Parties	Is FWS Lead?	Total Cost ($1,000s)	Cost Estimate by Year (by 1000s)							Comments
									2012	2013	2014	2015	2016	2017	2018	
2	1.1.1	Support research to develop effective jaguarundi survey techniques.	1	All		FWS, TPWD, CKWRI										
1b	1.1.2	Support studies to better understand jaguarundi habitat use and requirements.	2	A, D, E	7	FWS, TPWD, CKWRI	NO	70	10	10	10	10	10	10	10	
2	1.2.1	Develop agreements and conduct surveys on non-Federal land	1	All	ongoing	FWS, TPWD, PL	NO	350	50	50	50	50	50	50	50	
2	1.2.2	Develop agreements and conduct surveys with other Federal landowners (e.g. Immigration and Customs Enforcement, National Park Service) to survey non-USFWS land.	1	All	ongoing	FWS, CBP, DHS, NPS, BLM, USFS	NO	210	30	30	30	30	30	30	30	
1a	1.3.1	Support studies to determine the number, location, size, distribution, demographics, and genetic diversity of jaguarundi populations in Mexico.	1	All	ongoing	FWS, SEM	NO	350	50	50	50	50	50	50	50	
2	1.3.2	Support dispersal studies in Mexico	1, 2	E	4	FWS, SEM	NO	210	60	50	50	50				
1b	1.3.3	Support studies that quantify road effects, road density threshold in Mexico	1, 2	E	4	FWS, SEM, SCT	NO	105	30	25	25	25				
2	1.3.4	Support studies that quantify the level of retaliatory killing and its effects on populations in Mexico.	1	D, E	3	FWS, SEM	NO	60	20	20	20					

Priority Number	Action Number	Recovery Action Description	Recovery Criterion Number	Threats	Action Duration (years)	Responsible Parties	Is FWS Lead?	Total Cost ($1,000s)	Cost Estimate by Year (by 1000s)							Comments
									2012	2013	2014	2015	2016	2017	2018	
2	1.4.1	Estimate areas needed in southern Texas for a self-sustaining population	2	A	1	FWS, TPWD, CKWRI	YES	20			20					
1b	1.4.2	Estimate minimum population size needed for a self-sustaining population in southern Texas	1	All	1	FWS	YES	20	20							
1b	1.4.3	Determine the feasibility of translocation or reintroduction into historic range in southern Texas	1	All	2	FWS	YES	40		20	20					
2	2.1.1	Map potential jaguarundi habitat in southern Texas.	2	A	1	FWS, TPWD, CKWRI	YES	70		70						
1b	2.1.2	Support efforts to map jaguarundi habitat in Mexico	2	A	2	FWS, CKWRI, SEM	YES	70		70						
3	2.2	Identify potential conservation lands in southern Texas	2	A	1	FWS, TPWD, CKWRI, PL	NO	25	25							
2	2.3.1	Foster partnerships with landowners	2	A	7	FWS, TPWD, PL	NO	35	5	5	5	5	5	5	5	
3	2.3.2	Distribute habitat management guidelines	2	A	1	FWS, TPWD	NO	14	2	2	2	2	2	2	2	
2	2.4	Maintain and enhance thornscrub habitats in south Texas	2	E	ongoing	FWS, TPWD, DHS, IBWC, TNC	NO	350	50	50	50	50	50	50	50	

Priority Number	Action Number	Recovery Action Description	Recovery Criterion Number	Threats	Action Duration (years)	Responsible Parties	Is FWS Lead?	Total Cost ($1,000s)	Cost Estimate by Year (by 1000s)							Comments
									2012	2013	2014	2015	2016	2017	2018	
2	3.1	Identify, install, and maintain potential and existing habitat linkages and crossing structures in southern Texas	2	A	ongoing	FWS, TPWD, CKWRI	NO	280	20	20	40	40	40	40	80	Some costs are high due to maintaining multiple highway crossings on FM 106
1b	3.2	Minimize impacts of roads on existing and potential habitat in southern Texas	2	E	7	FWS, USDOT, TXDOT, SCT	NO	105	15	15	15	15	15	15	15	
1b	3.3	Develop and install functional crossing structures	2	E	Ongoing`	FWS, FHWA, TXDOT, DHS, SCT	NO	143 00	50	14,0 00	50	50	50	50	50	2013 costs are high due to installation of multiple highway crossings on FM 106
1b	3.4	Monitor function of wildlife crossings for jaguarundi	1	E	Ongoing	FWS, USDOT, TXDOT, DHS, SCT	NO	210	30	30	30	30	30	30	30	
1b	3.5	Identify potential future crossings of jaguarundi across the U.S.-Mexico border.	2	E	1	FWS, TPWD, SEM	YES	70	10	10	10	10	10	10	10	
1b	3.6	Reduce impacts of border infrastructure in jaguarundi habitat in U.S.	2	E	Ongoing	FWS, USDOT, TXDOT, DHS, CBP	NO	210	30	30	30	30	30	30	30	
2	3.7	Provide supplemental freshwater for drinking	1	E	5	FWS, TPWD, PL	YES	215	43	43	43	43	43			
1b	4.1	Develop and implement incentive programs for landowners to protect, enhance, or establish jaguarundi habitat	2	A, D	Ongoing	FWS, TPWD	YES	105	15	15	15	15	15	15	15	

Priority Number	Action Number	Recovery Action Description	Recovery Criterion Number	Threats	Action Duration (years)	Responsible Parties	Is FWS Lead?	Total Cost ($1,000s)	Cost Estimate by Year (by 1000s)							Comments
									2012	2013	2014	2015	2016	2017	2018	
2	4.2	Minimize impacts from other developments and human activities in areas with existing or potential jaguarundi habitat in U.S.	2	A	ongoing	FWS, TPWD, USDOT, DHS, CBP	YES	350	50	50	50	50	50	50	50	
1b	4.3	Support interagency planning that affects potential jaguarundi habitat in U.S.	2	A, D	Ongoing	FWS, TPWD, USDOT, TXDOT, DHS, CBP	YES	70	10	10	10	10	10	10	10	
2	4.4	Foster partnerships and ensure compliance of oil, gas, and seismic operations within historical jaguarundi range in south Texas.	2	D	Ongoing	FWS, TPWD	YES	14	2	2	2	2	2	2	2	
1b	4.5	Coordinate with Homeland Security and Border Patrol to minimize impacts of border security activities on jaguarundis.	2	E	Ongoing	FWS, DHS, CBP	YES	35	5	5	5	5	5	5	5	
2	4.6	Develop and distribute education materials on jaguarundi and its habitat needs	2	A	7	FWS, TPWD, PRNA, NAT, SEM, AZA	NO	35	5	5	5	5	5	5	5	
3	4.7	Work with Ocelot Recovery Team to restore thornscrub habitat	2	A	7	FWS, TPWD	YES	35	5	5	5	5	5	5	5	
3	4.8	Support research on niche overlap with potential competitors	1	E	4	FWS, TPWD, CKWRI, UNAM	NO	205	60	50	50	45				

Priority Number	Action Number	Recovery Action Description	Recovery Criterion Number	Threats	Action Duration (years)	Responsible Parties	Is FWS Lead?	Total Cost ($1,000s)	Cost Estimate by Year (by 1000s)							Comments
									2012	2013	2014	2015	2016	2017	2018	
1a	4.9.1	Partner with appropriate Mexican government agencies and private landowners	1, 2	All	Ongoing	FWS, SEM, IEA, PL	YES	70	10	10	10	10	10	10	10	
2	5.1	Monitor changes in jaguarundi habitat in U.S.	2	E	7	FWS, TPWD	YES	70	10	10	10	10	10	10	10	
3	5.2	Monitor recovery task implementation and effectiveness	1, 2	All	7	FWS, TPWD, CKWRI	YES	35	5	5	5	5	5	5	5	
2	5.3	Ensure that management actions taken for surrogate and other priority species account for effects on jaguarundi and their habitats	2	A	Ongoing	FWS	Yes	35	5	5	5	5	5	5	5	

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