

**Thick-billed Parrot (*Rhynchopsitta pachyrhyncha*)  
Draft Recovery Plan Addendum**

**La adición al “Programa de Acción para la Conservación de las Especies:  
Cotorras Serranas (*Rhynchopsitta* spp.)”**



Photo by Jim Rorabaugh

**Including the English translation of the PACE  
published by the National Commission of Protected Areas (CONANP), 2009  
U.S. Fish and Wildlife Service  
Southwest Region, Albuquerque, New Mexico**

**June 2012**

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## ACKNOWLEDGEMENTS

The USFWS is grateful to Mexico's National Commission of Protected Areas (CONANP) for the opportunity to adopt the Mexican recovery plan for the thick-billed parrot, "Programa de Acción para la Conservación de las Especies: Cotorras Serranas (*Rhynchopsitta* spp.)" (PACE).

The USFWS gratefully acknowledges the contributions of the following individuals in developing the draft addendum for the thick-billed parrot: Javier Cruz-Nieto, Citlali Cortés-Montaña, Erin Fernandez, Larry Jones, Melinda Fisher, Sara Dechter, and Christopher Stetson.

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Additional thanks go to the following for their technical assistance and review and editing of this document: Julie McIntyre, Wendy Brown, Francisco Abarca, Tabata Reyna, and Jennifer Smith-Castro.

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## EXECUTIVE SUMMARY

Current Status of the Species: The thick-billed parrot (*Rhynchopsitta pachyrhyncha*) is listed as endangered throughout its range, including Mexico and the United States (U.S.). Historically the thick-billed parrot's range in the U.S. extended as far north as the mountains of southeastern Arizona and possibly southwestern New Mexico. This temperate parrot species is now extirpated in the U.S., with the last confirmed sighting of a naturally occurring flock made in 1938 in the Chiricahua Mountains of Arizona. Extirpation of the thick-billed parrot in the U.S. was likely caused by excessive unregulated shooting. The parrot's current range is limited to high elevations of the Sierra Madre Occidental of Mexico, extending from northwestern Chihuahua and northeastern Sonora into Durango and continuing southward into Jalisco, Colima, and Michoacán. The northern-most breeding area is Mesa de las Guacamayas, located approximately 80 kilometers (km) (50 miles [mi]) of the U.S./Mexico border. The recovery priority number is a 5C, indicating a high degree of threat, a low recovery potential, and the taxonomic classification of a species. Critical habitat has not been proposed for the thick-billed parrot.

Although recovery of endangered species is the fundamental goal of the ESA, the USFWS has limited resources and little authority to address the threats to listed species outside of the U.S. Mexico's National Commission of Protected Areas (CONANP) published a recovery plan for thick-billed parrots in 2009, entitled the "Programa de Acción para la Conservación de las Especies: Cotorras Serranas (*Rhynchopsitta* spp.)" (hereafter cited as PACE) to guide recovery of the parrot throughout its current range in Mexico. We are adopting Mexico's PACE for thick-billed parrot recovery and adding an addendum to meet the statutory requirements of the ESA. The PACE represents the best available scientific information on thick-billed parrots, and the USFWS supports the strategy for recovering the species set forth in the PACE (Appendix B). Together, the PACE and the USFWS addendum form the U.S. draft recovery plan for the thick-billed parrot.

This draft addendum to the PACE addresses the species' historical occurrence in the U.S. and presents additional information required by U.S. recovery planning policy. Our recovery actions are focused primarily on conservation within the current range of this species in Mexico and to a lesser degree on the potential for expansion into areas of its historical range. We also summarize information from scientific literature and U.S. and Mexican biologists regarding the status of and threats to the thick-billed parrot, and recommend actions for addressing these threats and evaluating recovery.

Habitat Requirements, Threats, and Other Limiting Factors: Thick-billed parrots are long-lived, gregarious, and form social groups; therefore, parrots revisit preferred forest areas over time. Furthermore, thick-billed parrots migrate seasonally from their primary breeding (summering) grounds in Chihuahua to wintering areas farther south, possibly travelling  $\geq 1,000$  kilometers (621 miles) between areas and requiring suitable conditions at migratory sites. As of 2011, the population of thick-billed parrots in the wild was estimated at 1760 individuals, across 5 breeding areas; however, this is likely an underestimate. The small populations of parrots

concentrated in a handful of sites, combined with the low number of breeding pairs in the remaining old-growth forests, have made thick-billed parrots vulnerable to catastrophic events.

The thick-billed parrot has experienced significant historical declines, corresponding to a drastic loss of high elevation mixed conifer forests, with only one percent of the old-growth forests remaining in the Sierra Madre Occidental. Loss of habitat has been primarily driven by extensive logging of large mature pines since the early 1940s, removal of nesting snags, and to a lesser degree, stand-replacing forest fires. Large areas of old-growth forest are no longer found in the Sierra Madre Occidental, and as the average age of trees and conifer forest decreases, so do parrot nesting sites and food resources. Thick-billed parrots are obligate cavity nesters, thus removal of large-diameter pines and snags of these mature forests has reduced nest site availability for the thick-billed parrot. Seeds of several pine species are the primary food source for thick-billed parrots, with acorns and terminal buds of pine trees eaten at times. Conversion of mature high elevation pine forests to younger forest stands (which produce smaller cone crops) results in a diminished food supply for parrots. For thick-billed parrots, habitat destruction and fragmentation remain major threats.

These mature old-growth forests evolved with frequent surface fire regimes, but by the mid-20th century these fires had been disrupted in most areas mainly due to heavy livestock grazing. Lack of frequent fires and increased fuel loads may lead to atypical high-intensity wildfires, such as those experienced from 2004 to 2008, when 3,947 hectares (9,753 acres) of forest habitat crucial to thick-billed parrots were destroyed by wildfire. Climate change may be a threat to the parrot, by not only interacting with fire frequency and intensity, but also via projected warmer and drier conditions which may negatively impact available habitat and food resources. The removal of birds from the wild for the illegal pet trade has been and remains a threat to the species. In 2008, Mexico banned the capture and export of all native parrots, and the species is listed in CITES Appendix I.

Recovery Strategy: Because the thick-billed parrot has been extirpated from the U.S. and now only occurs in Mexico, the primary focus of recovery conservation for the thick-billed parrot must be within Mexico. In adopting Mexico's PACE to guide recovery and provide the best available scientific information on thick-billed parrots, the USFWS's approach with this addendum is as follows: summarize information on thick-billed parrots extirpated from the U.S.; synthesize or reference information (when feasible) from the PACE to formulate recovery planning components as required by the ESA; incorporate supplemental information received from Mexico partners since publication of the PACE in 2009; identify broad actions necessary to address conservation of the species within its U.S. historical range; and identify partnerships to facilitate recovery of extant populations.

Long-term protection of old-growth and mature forests used by thick-billed parrots is key to recovery. Strategies for minimizing the threat of stand-replacing fires are needed to reduce this threat, including restoring frequent surface fires (through integrated fire management) and protecting large diameter trees and snags to achieve structural characteristics needed by thick-billed parrots. Actions in the U.S. include maintaining forested habitat in southeastern Arizona and southwestern New Mexico for potential use by parrots dispersing north from the Sierra Madre Occidental and preventing illegal trade of thick-billed parrots into this country. To the degree practicable, the USFWS will offer technical expertise and financial opportunities through

established programs working to restore habitat and support the persistence and expansion of Mexican thick-billed parrot populations. Recovery will be monitored and recovery tasks may be revised by the USFWS in coordination with Mexican partners as new information becomes available.

**Recovery Goals:** The intermediate goal of this recovery plan addendum is to downlist the thick-billed parrot from endangered to threatened. The long-term goal is to recover and delist the thick-billed parrot once more biological information is obtained and we can develop appropriate delisting recovery criteria.

**Recovery Criteria:** Recovery criteria for downlisting focus on protecting breeding habitat, and locating and protecting wintering habitat in Mexico. Recovery criteria for delisting are difficult to establish due to the lack of information. Much more research is needed to recommend specific recovery tasks and measures, and to determine whether the species is no longer in danger throughout all or a significant portion of its range (downlisted to threatened), no longer likely to become endangered in the foreseeable future (delisted, or recovered), and no longer requires the protection of the ESA. Some general preliminary recommendations are outlined below. As additional data are obtained, more specific delisting recommendations could be developed.

**Downlisting Criteria:** The downlisting criteria were based on the recovery actions in the PACE, with additional contributions from Mexican and U.S. biologists. Some of the criteria provide more specificity and address more than one recovery action in the PACE. The thick-billed parrot should be considered for downlisting to threatened status when all of the following conditions have been met.

***Demographic Criteria:***

- 1) Maintain a self-sustaining population of thick-billed parrots sufficient to ensure the species' survival and to address threats of inadequate foraging, breeding, and wintering habitat; small population size; and climate change.
  - a) Using a statistically sound and peer reviewed monitoring protocol, at least 15 years of systematic surveys document a stable or increasing trend in at least 5 known wild thick-billed breeding populations including Mesa de las Guacamayas, Madera, Tutuaca, Papigochic, and Campo Verde. Minimum viable population size and number of breeding colonies are to be established through research and modeling, including better understanding of non-reproductive groups.
- 2) Preserve and restore sufficient thick-billed parrot habitat (patch size, distribution, forest composition and structure) to ensure the species' survival despite environmental stochasticity and the threat of climate change.
  - a) A long-term thick-billed parrot habitat protection plan and map are completed, based on sound science and species expert knowledge. The Mexican plan provides goals for a) the location, size, and distribution of thick-billed parrot habitat; and b) forest composition and structure.

- b) Habitat is protected and managed according to the long-term habitat protection plan.

***Threats-based Criteria (as related to the five listing factors addressed in section 1.7 on page 22 and section 2.4 on page 35):***

- 1) Home ranges and migration patterns of reproductive and non-reproductive thick-billed parrot groups are identified and habitat use and availability are evaluated. (Factors A, E).
- 2) Breeding areas are effectively conserved for the foreseeable future through protected status designation, land purchase, long-term conservation easements, acquisition of lumbering rights, or other mechanisms. (Factors A, D, E).
  - a) Core Areas (nesting, drinking, roosting, and perching sites) for at least five known breeding areas including Mesa de las Guacamayas, Madera, Tutuaca, Papigochic, and Campo Verde are permanently protected, encompassing 15,600 total hectares (10 percent of each breeding area, ranging from 700 to 4,000 hectares).
  - b) Other known breeding areas are assessed, including Sierra el Nido, Cerro de Mohinora, Guanacevi-El Vergel (including El Vergel, La Medalla and La Lagunita in southern Chihuahua), and Namiquipa. Suspected breeding localities are verified as feasible.
  - c) Technical studies are completed for at least two other breeding areas, such as Sierra el Nido, Cerro de Mohinora, Guanacevi-El Vergel (including El Vergel, La Medalla and La Lagunita in southern Chihuahua), and Namiquipa to justify their consideration for designation as federal Protected Areas of Flora and Fauna or other appropriate designation.
- 3) Wintering ranges for at least the five breeding populations including Mesa de las Guacamayas, Madera, Tutuaca, Papigochic, and Campo Verde are verified and mapped, and conservation needs assessed. (Factors A, D, E).
  - a) Thick-billed Parrot anecdotal and casual observations reported for protected areas in the wintering range [such as Michilia (Durango), Sierra de Manantlan, Nevado de Colima (Jalisco and Colima), El Jabali (Colima), and Pico de Tancitaro (Michoacan)] are verified and updated through a comprehensive inventory. Other known or suspected wintering areas in Durango (such as Las Bufas, California, and San Miguel de las Cruces) are also surveyed. Extent of occupied habitat is mapped and conservation needs assessed.
  - b) Currently designated protected areas within the winter range (with significant numbers of verified thick-billed parrot occurrence) in the states of Durango, Jalisco, Colima, and Michoacán are effectively protected, restored, and managed. Forest Management Plans that incorporate species needs are developed and implemented.

- c) Technical studies are completed for at least two other wintering areas with thick-billed parrot occurrence (such as Las Bufas, California, and San Miguel de las Cruces in Durango or newly discovered sites) to justify consideration for designation as federal Protected Areas of Flora and Fauna or other appropriate designation.
- 4) Forest management plans are developed and implemented for at least five known breeding areas including Mesa de las Guacamayas, Madera, Tutuaca, Papigochic, and Campo Verde. The forest management plans incorporate habitat and foraging needs, including longer rotational cycles and maintenance of mature trees [e.g., pines (*Pinus*), spruces (*Picea*), Douglas-fir (*Pseudotsuga*) and firs (*Abies*)], snags required for nesting, integrated fire management, and forest health. (Factors A, D, E).
- 5) The potential for the U.S. to support naturally dispersing or actively relocated thick-billed parrots is assessed, including a review of U.S. historical habitat, current habitat management, and habitat connectivity with Mexico. The need and efficacy of translocating parrots are included in the assessment. (Factors A, C, E).
- 6) Measures to reduce illegal collection and poaching of thick-billed parrots for the pet trade are assessed and implemented. (Factors B, D).
- 7) Measures to reduce illegal harvesting, clearing, and fires in thick-billed parrot habitat are assessed and implemented. (Factors A, D, E).

**Delisting Criteria:** Delisting criteria for the thick-billed parrot are difficult to establish due to the lack of information concerning its population status, biology, and specific habitat requirements. More research is needed to recommend specific recovery tasks and delisting criteria. Considering the loss of suitable habitat, and length of time needed for forest regeneration to attain suitability, low percentage of breeding pairs, and need for habitat protection, downlisting is unlikely to be reached before year 2050. It is unrealistic to predict the environmental conditions and threats to the species that will prevail at that time. Additional information is also needed regarding the conservation biology of small populations, including impacts of stochastic and catastrophic events on survival. Delisting criteria will require the establishment of a population target with a high level of confidence. Without knowledge of a minimum population size needed to ensure species survival, it would be unreasonable to provide delisting criteria. With additional knowledge regarding the elements of a population model, such as reproductive capacity, natality and mortality rates, migration patterns and survivorship, or genetic information, we would be more prepared to determine whether the species is no longer in danger throughout all or a significant portion of its range (downlisted to threatened) and no longer likely to become endangered in the foreseeable future (delisted, or recovered). New information gathered through recovery actions will be incorporated into additional population viability assessments as the population approaches its downlisting goals. Delisting criteria will be established at that time, and the overall recovery strategy and actions will be revised as appropriate. Future revisions of this recovery plan are anticipated, and a goal for removing the thick-billed parrot from the List of Threatened and Endangered Species will be set prior to downlisting anticipated in 2050.

Some preliminary recommendations are outlined below, which include more specific tasks than the general recovery actions in the PACE and additional contributions from Mexican and U.S. biologists. Some of the Actions Needed address more than one recovery action in the PACE.

**Actions Needed** (organized by Listing Factor)

*A= Habitat modification or loss*

- Home ranges and migration patterns of reproductive and non-reproductive thick-billed parrot groups are identified and habitat use and availability are evaluated.
- Predictive parrot occurrence models are developed and occurrence sites are verified, evaluated, and quantified.
- The habitat requirements of thick-billed parrots are characterized based on all aspects of the species' life history, and a habitat suitability model is developed to understand and manage habitat areas and features for the parrot.
- Studies are conducted on the relationship between food availability and thick-billed parrot movement and nesting.
- A range-wide long-term thick-billed parrot habitat protection plan (with map) is completed and implemented that provide goals for a) the location, size, and distribution of thick-billed parrot habitat; and b) forest composition and structure.
- Core areas (nesting, drinking, roosting, and perching sites) are permanently protected.
- Technical studies are completed in unprotected occupied breeding and wintering habitat to justify their consideration for designation as federal Protected Areas of Flora and Fauna or other appropriate designation.
- Wintering range is verified and mapped, and conservation needs assessed.
- Currently designated protected areas within the winter range (with significant numbers of verified thick-billed parrot occurrence) are effectively protected, restored, and managed.
- An assessment of forest health at occupied sites is conducted by silviculturists and ecologists, and management recommendations are developed and implemented.
- Site-specific Forest Management Plans are developed and implemented that incorporate habitat and foraging needs, including longer rotational cycles and maintenance of mature trees, snags required for nesting, integrated fire management, and forest health.
- Prescribed burns are planned and implemented where needed to manage thick-billed parrot habitat.

*B= Overutilization*

- Illegal collection and poaching of thick-billed parrots is reduced by enforcing existing environmental laws, regulations, plans, and policies for parrot protection.

*D=Inadequacy of regulations*

- Existing laws, regulations, plans, and policies to protect thick-billed parrot habitat from illegal harvesting, clearing, and fires are enforced.

*E= Other natural or manmade factors*

- A population viability assessment is conducted to determine the size and number of populations necessary to meet the minimum population standards, and these data are incorporated into recovery criteria as appropriate.
- A statistically sound and peer reviewed parrot monitoring protocol is developed and implemented to document the population trend.

### **Total Estimated Cost of Recovery**

Costs per \$1,000. Priorities defined on pages 49-50.

<b>Year</b>	<b>Priority 1</b>	<b>Priority 2</b>	<b>Priority 3</b>	<b>Total*</b>
<b>2013</b>	629	114	54	797
<b>2014</b>	898	118	59	1075
<b>2015</b>	800	115	53	968
<b>2016</b>	695	105	55	855
<b>Total*</b>	\$4,282	\$536	\$362	<b>\$5,180</b>

\*Annual costs do not add up to Total costs because some tasks continue beyond 2016. These additional costs are included in the Total.

### **Date of Recovery**

The date of recovery for the thick-billed parrot is unknown at this time. Habitat regeneration is a long-term process and 100 to 300 years may be needed to fully restore habitat. Time estimates for these actions are presented in the Implementation Schedule. Estimated time to delisting is contingent upon results obtained during the downlisting recovery period. Success in the creation and protection of habitat during the downlisting period will help determine the remaining effort necessary to reach recovery.

### **RESUMEN EJECUTIVO**

Estado Actual de la Especie: La cotorra serrana occidental (*Rhynchopsitta pachyrhyncha*) está clasificada como en peligro de extinción en todo su rango de distribución, abarcando México y los Estados Unidos (EEUU). Históricamente, el rango de distribución de la cotorra serrana occidental en los EEUU se extendía hacia el norte hasta las montañas del sureste de Arizona y posiblemente a las montañas del suroeste de Nuevo México. Esta especie de cotorra (de bosques templados de coníferas) esta extirpada de los EEUU, con el último avistamiento confirmado de una parvada de origen natural en el 1938 en las montañas Chiricahuas de Arizona. La extirpación de la cotorra serrana occidental en los EEUU fue probablemente causada por la cacería excesiva no regulada. El rango de distribución actual de la cotorra esta limitado a las elevaciones altas de la Sierra Madre Occidental de México, extendiéndose del noroeste de Chihuahua y el noreste de Sonora hacia Durango y continuando hacia el sur hasta Jalisco, Colima, y Michoacán. El área de anidación más norteña es la Mesa de Guacamayas, ubicada aproximadamente a 80 kilómetros Km. (50 millas [mi]) de la frontera entre EEUU y México. El número de prioridad para la recuperación es 5C, indicando un grado alto de amenaza, un

potencial bajo para la recuperación, y la clasificación taxonómica como especie. No se ha propuesto Hábitat Crítico para la cotorra serrana occidental.

Aunque la recuperación de una especie en peligro de extinción es la meta fundamental del Acta de Especies en Peligro de Extinción (ESA por sus siglas en inglés), el Servicio de Pesca y Vida Silvestre (USFWS por sus siglas en inglés) tiene recursos limitados y poca autoridad para abordar las amenazas a las especies enlistadas fuera de los EEUU. La Comisión Nacional de Áreas Naturales Protegidas (CONANP) de México publicó un plan de recuperación para la cotorra serrana occidental en el 2009 con el título “Programa de Acción para la Conservación de las Especies: Cotorras Serranas (*Rhynchopsitta* spp.)” (de aquí en adelante citado como PACE) para guiar la recuperación de la cotorra por todo su rango de distribución actual en México. Estamos adoptando el PACE de México para la recuperación de la cotorra serrana occidental y anexando una adenda para cumplir con los requisitos legales del ESA. El PACE representa la mejor información científica disponible sobre las cotorras serranas occidentales, y el USFWS apoya la estrategia para recuperar la especie descrita en el PACE (Apéndice A). Juntos, el PACE y la adenda del USFWS forman el borrador del plan de recuperación para la cotorra serrana occidental.

Este borrador de la adenda al PACE aborda la ocurrencia histórica en los EEUU y presenta información adicional requerida por la política del USFWS sobre los planes de recuperación. Nuestras acciones de recuperación están enfocadas principalmente en la conservación dentro del rango de distribución actual de esta especie en México y en menor parte en el potencial de una expansión hacia áreas dentro de su rango de distribución histórico. También, resumimos la información de la literatura científica y de biólogos de los EEUU y de México con respecto al estado de la cotorra serrana occidental y sus amenazas, y hacemos recomendaciones de acciones para enfrentar estas amenazas y para evaluar su recuperación.

Requerimientos de Hábitat, Amenazas, y Otros Factores Limitantes: Las cotorras serranas occidentales son longevas, gregarias y forman grupos sociales; por lo consiguiente, las cotorras vuelven a visitar los bosques preferidos con el tiempo. Además, las cotorras serranas occidentales migran estacionalmente de sus áreas de anidación (áreas de verano) en Chihuahua hacia áreas invernales más al sur, posiblemente viajando  $\geq 1,000$  kilómetros (621 mi) entre ambas áreas y requieren condiciones adecuadas en los sitios de migración. En el 2011, se estimó que la población de cotorras serranas occidentales silvestres contaba con 1,760 individuos abarcando 5 áreas de anidación; sin embargo, este dato probablemente está subestimado. Las pequeñas poblaciones de cotorras concentradas en pocos sitios, combinado con el número bajo de parejas anidantes en los bosques antiguos restantes, significa que las cotorras serranas occidentales están vulnerables a eventos catastróficos.

La cotorra serrana occidental ha experimentado declives históricos significantes, correspondiendo a una pérdida drástica de bosques de coníferas mixtas de elevación alta, con solo un uno por ciento de los bosques antiguos restantes en la Sierra Madre Occidental. La pérdida de hábitat ha sido principalmente impulsado por el talado extensivo de árboles maduros de pino desde los principios de la década de los 1940s, remoción del arbolado muerto en pie para la anidación, y en menor parte, incendios forestales que remplazan parcelas de bosques. Grandes áreas del bosque antiguo ya no se encuentran en la Sierra Madre Occidental, y según las edades promedio de los árboles y del bosque de coníferas van disminuyendo, así también disminuyen

los sitios de anidación y la disponibilidad de alimento. Las cotorras serranas occidentales anidan en cavidades, así que la remoción de pinos de diámetro grande y los árboles muertos en pie de estos bosques maduros ha reducido la disponibilidad de sitios de anidación para la cotorra serrana occidental. Las semillas de varias especies de pinos son la alimentación principal de la cotorra serrana occidental, y a veces come bellotas y los brotes terminales de los pinos. La conversión de los bosques maduros de pinos de elevación alta a bosques más jóvenes (los cuales producen una cosecha menor de conos) resulta en un suministro alimenticio disminuido para las cotorras. Para las cotorras serranas occidentales, la destrucción y fragmentación de hábitat siguen presentes como amenazas mayores.

Estos bosques antiguos evolucionaron con regímenes de frecuentes incendios superficiales, pero a partir de mediados del siglo 20, estos incendios han sido perturbados en la mayor parte de las áreas debido principalmente al pastoreo de ganado extensivo. La falta de incendios frecuentes y el aumento de cargas de combustible pueden conducir a incendios forestales atípicos de alta intensidad, como los experimentados desde 2004 a 2008, cuando 3,947 hectáreas (9,753 acres) de hábitat arbolado, que es crucial para las cotorras serranas occidentales, fueron destruidas por un incendio forestal. El cambio climático puede ser una amenaza para la cotorra, no solo por interactuar con la frecuencia e intensidad de los incendios, sino también por presentar condiciones más calurosas y más secas, que pueden impactar de manera negativa el hábitat y la disponibilidad de alimento para las cotorras serranas occidentales. La remoción de aves silvestres para el comercio ilegal de mascotas ha sido y sigue como una amenaza a la especie. En 2008, México prohibió (Ley General de Vida Silvestre Decreto 60 Bis 2) la captura y exportación de todas las cotorras nativas, y la especie esta enlistada en el Apéndice 1 del CITES.

Estrategia de Recuperación: Como la cotorra serrana occidental ha sido extirpada de los EEUU y ahora solo ocurre en México, el enfoque principal para la recuperación y conservación de la cotorra serrana occidental debe de estar dentro de México. En adoptar el PACE de México para guiar la recuperación y proveer la mejor información científica disponible sobre la cotorra serrana occidental, el método del USFWS con esta adenda es el siguiente: resumir la información sobre las cotorras serrana occidentales extirpadas de los EEUU; sintetizar o hacer referencia a la información (cuando sea factible) del PACE para formular los componentes de los planes de recuperación requeridos por el ESA; incorporar información suplementaria recibida de los socios en México desde la publicación del PACE en 2009; identificar acciones amplias para abordar la conservación de la especie dentro del rango histórico de la especie en los EEUU; e identificar alianzas para facilitar la recuperación de las poblaciones existentes.

La protección a largo plazo de los bosques maduros y antiguos utilizados por las cotorras serranas occidentales es la clave para la recuperación. Estrategias para disminuir la amenaza de incendios forestales que remplazan parcelas de bosques son necesarias para reducir esta amenaza, incluyendo la restauración de frecuentes incendios superficiales (por medio del manejo integral de incendios) y la protección de árboles de diámetro grande y árboles muertos en pie para lograr las características estructurales necesarias para las cotorras serranas occidentales. Las acciones en los EEUU incluyen el mantenimiento de hábitat arbolado en el sureste de Arizona y el suroeste de Nuevo México para el uso potencial de las cotorras dispersándose hacia el norte de la Sierra Madre Occidental y la prevención del comercio ilegal de las cotorras serranas occidentales en este país. Cuando sea factible, el USFWS ofrecerá conocimiento técnico y oportunidades financieras por medio de programas existentes que trabajan para

restaurar el hábitat y apoyar la persistencia y expansión de las poblaciones de la cotorra serrana occidental.

Meta de Recuperación: La meta intermedia de esta agenda al plan de recuperación es de reclasificar a la cotorra serrana occidental de en peligro de extinción a amenazada. La meta a largo plazo es de recuperar la cotorra serrana occidental y removerla de la lista de especies en peligro de extinción, una vez que tengamos más información biológica y podamos desarrollar criterios de recuperación apropiados.

Criterios de Recuperación: Los criterios de recuperación para reclasificar a la especie como amenazada se enfocan en proteger el hábitat de reproducción y la localización y protección de hábitat invernal en México. Los criterios de recuperación para remoción de la especie de la lista son difíciles de establecer debido a la falta de información. Se necesita mucha más investigación para recomendar tareas y medidas específicas para la recuperación, y para determinar si la especie ya no está en peligro de extinción a lo largo de todo su rango o en una parte significativa de su rango (reclasificada a amenazada), y de ser probable no encontrarse en peligro de extinción en el futuro inmediato (removerla de la lista, o recuperada), y ya no requerir de la protección del ESA. Se resumen algunas recomendaciones generales preliminares abajo. Según se obtengan datos adicionales, se podrán desarrollar recomendaciones más específicas para remover la especie de la lista.

**Los criterios de recuperación para reclasificar a la especie como amenazada:** Los criterios de recuperación para reclasificar a la especie como amenazada fueron basados en las acciones de recuperación del PACE, con contribuciones adicionales de biólogos de México y de los EEUU. Algunos de los criterios proveen más especificidad y se dirigen a más de una acción de recuperación en el PACE. La cotorra serrana occidental debe considerarse para reclasificación al estado de amenazada cuando se cumplan todas las siguientes condiciones:

***Criterios demográficos:***

- 1) Mantener una población auto-sustentable de cotorras serranas occidentales suficiente para asegurar la sobrevivencia de la especie y enfrentar las amenazas de hábitat inadecuado que incluye el hábitat de forraje, reproducción e invernal; pequeño tamaño de población, y cambio climático.
  - a) Usando un protocolo estadísticamente comprobado y revisado por expertos, por lo menos 15 años de muestreo sistemático documentan una tendencia estable o en aumento en por lo menos 5 conocidas poblaciones silvestres y reproductivas incluyendo Mesa de las Guacamayas, Madera, Tutuaca, Papigochic, y Campo Verde (PACE 2009). El tamaño mínimo de una población viable y el número de colonias reproductivas se establecerán por medio de investigación y modelos, incluyendo un mejor entendimiento de los grupos no reproductores.
- 2) Preservar y restaurar suficiente hábitat (tamaño de parcela, distribución, composición y estructura del bosque) de la cotorra serrana occidental para asegurar la sobrevivencia de la especie a pesar de la estocasticidad ambiental y la amenaza del cambio climático.

- a) Un plan de protección del hábitat de la cotorra serrana occidental a largo plazo y un mapa están listos, en base a ciencia sólida y el conocimiento de los expertos en la especie. El plan mexicano provee metas para a) la ubicación, tamaño, y distribución del hábitat de la cotorra serrana occidental; y b) composición y estructura del bosque.
- b) El hábitat esta protegido y manejado según el plan de protección de hábitat a largo plazo.

***Crterios basados en amenazas (relacionados a los cinco factores de enlistado mencionados en la página 35):***

- 1) Se identifican los territorios y los patrones de migración de los grupos reproductores y no reproductores de cotorras serranas occidentales y el uso y disponibilidad de hábitat están evaluados (Factores A, E).
- 2) Las áreas de anidación están efectivamente conservadas para el futuro previsible por medio de la designación oficial de un estado de protección, compra de terrenos, servidumbres para la conservación a largo plazo, adquisición de los derechos de talado, u otros mecanismos. (Factores A, D, E).
  - a) Áreas Claves (sitios de anidación, perchas, bebederos, y dormideros) para al menos cinco áreas de anidación conocidas incluyendo Mesa de las Guacamayas, Madera, Tutuaca, Papigochic, y Campo Verde están permanentemente protegidas, incluyendo un total de 15,600 total hectáreas (10 por ciento de cada área de anidación, con un rango desde 700 a 4,000 hectáreas).
  - b) Otras áreas de anidación conocidas son asesoradas, incluyendo Sierra el Nido, Cerro de Mohinora, Guanacevi-El Vergel (incluyendo El Vergel, La Medalla y La Lagunita en el sur de Chihuahua), y Namiquipa. Las localidades que se sospechan como áreas de anidación son verificadas, según sea factible.
  - c) Los estudios técnicos justificativos están completados para por lo menos otras dos áreas de anidación, como Sierra el Nido, Cerro de Mohinora, Guanacevi-El Vergel (incluyendo El Vergel, La Medalla y La Lagunita en el sur de Chihuahua), y Namiquipa, para justificar su consideración para la designación como áreas federales de protección de flora y fauna u otra designación apropiada.
- 3) Los rangos invernales para al menos cinco poblaciones reproductoras incluyendo Mesa de las Guacamayas, Madera, Tutuaca, Papigochic, y Campo Verde están verificados y registrados en mapa, y las necesidades de conservación están asesoradas. (Factores A, D, E).
  - a) Las observaciones casuales de la cotorra serrana occidental registradas dentro de las áreas protegidas en el rango invernal [como Michilia (Durango), Sierra de Manantlan, Nevado de Colima (Jalisco y Colima), El Jabalí (Colima), y Pico de Tancitaro (Michoacán)] están verificadas y actualizadas por medio de un inventario

- comprendido. Se hacen muestreos en otras áreas conocidas o que se sospechan como áreas invernales en Durango (como Las Bufas, California, y San Miguel de las Cruces). La extensión de hábitat ocupado está registrado en mapa y las necesidades de conservación están asesoradas.
- b) Las áreas actualmente designadas como protegidas dentro del rango invernal (con cantidades significantes de ocurrencia de la cotorra serrana occidental) en los estados de Durango, Jalisco, Colima, y Michoacán están protegidas, restauradas, y manejadas efectivamente (PACE 2009). Se desarrollan e implementan Planes de Manejo Forestal que incorporan las necesidades de la especie.
  - c) Los estudios técnicos justificativos están completados para por al menos otras dos áreas invernales con ocurrencia de la cotorra serrana occidental (como Las Bufas, California, y San Miguel de las Cruces en Durango o sitios recién descubiertos) para justificar su consideración para la designación como áreas federales de protección de flora y fauna u otra designación apropiada.
- 4) Se desarrollan e implementan planes de manejo forestal para al menos cinco áreas de anidación conocidas incluyendo Mesa de las Guacamayas, Madera, Tutuaca, Papigochic, y Campo Verde. Los planes de manejo forestal incorporan las necesidades de hábitat y de forraje, incluyendo ciclos rotacionales más largos y mantenimiento de árboles maduros [p.e. pinos (*Pinus*), piceas (*Picea*), y abetos (*Pseudotsuga* y *Abies*)], árboles muertos en pie requeridos para anidación, el manejo integral de incendios, y la salud del bosque. (Factores A, D, E).
  - 5) El potencial de los EEUU para apoyar a las cotorras serranas occidentales que se dispersen naturalmente o que sean activamente trasladadas es asesorado, incluyendo una revisión del hábitat histórico de los EEUU, el manejo actual de hábitat, y la conectividad de hábitat con México. La necesidad y efectividad de translocaciones de cotorras es incluida en la evaluación. (Factores A, C, E).
  - 6) Se evalúan e implementan medidas para reducir la colección y la captura ilegal de cotorras serranas occidentales para el comercio de mascotas. (Factores B, D).
  - 7) Se evalúan e implementan medidas para reducir la cosecha, talado, e incendios forestales en el hábitat de las cotorras serranas occidentales. (Factores A, D, E).

**Los criterios para remoción:** Los criterios de recuperación para remoción (de la lista de especies en peligro de extinción) de la cotorra serrana occidental son difíciles de establecer debido a la falta de información relacionada con el estado de la población, la biología, y los requisitos específicos de hábitat. Se necesita más investigación para recomendar tareas específicas y los criterios para remoción. Considerando la pérdida de hábitat adecuado, y la duración necesaria para regeneración del bosque para lograr condiciones adecuadas, el porcentaje bajo de parejas anidantes, y la necesidad de protección de hábitat, la remoción no será probable hasta al menos el año 2050. No es realista predecir las condiciones ambientales y amenazas a la especie que prevalecerá en ese tiempo. También se requiere información

adicional con respeto a la biología de la conservación de pequeñas poblaciones, incluyendo los impactos en la sobrevivencia de los eventos estocásticos y catastróficos. Los criterios para remoción requerirán establecimiento de una meta poblacional con un grado alto de confianza. Sin conocimiento del tamaño mínimo de una población viable para asegurar la sobrevivencia de la especie, no sería razonable proveer criterios de remoción. Con conocimiento adicional sobre los elementos de un modelo poblacional, incluyendo capacidad reproductiva, tasas de mortalidad y natalidad, patrones de migración y sobrevivencia, o información genética, estaríamos mas preparados para determinar si la especie ya no esta en peligro de extinción a lo largo de todo su rango o por una parte significativa de su rango (reclasificada a amenazada), y ya no de ser probable de encontrarse en peligro de extinción en el futuro inmediato (remoción de la lista, o recuperada). Nueva información recopilada por medio de las acciones de recuperación será incorporada en las evaluaciones de viabilidad de poblaciones según la población vaya acercando las metas para reclasificar la especie como amenazada. Se establecerán criterios para remoción en ese tiempo y se revisara la estrategia de recuperación y las acciones como sea apropiado. Revisiones futuras de este plan de recuperación son anticipadas y se establecerá una meta para la remoción de la cotorra serrana occidental del Acta de Especies en Peligro de Extinción antes de la reclasificación anticipada en el 2050.

Se resumen algunas recomendaciones preliminares abajo, incluyendo tareas más específicas que las acciones generales en el PACE y contribuciones adicionales de los biólogos de México y de los EEUU. Algunas de las acciones necesarias abordan más de una acción para la recuperación en el PACE.

#### **Acciones Necesarias** (organizado por Factores de Enlistado)

##### *A= Modificación o perdida de hábitat*

- Los territorios y patrones de migración de grupos reproductores y no reproductores de cotorras serranas occidentales están identificados y el uso y disponibilidad de hábitat esta evaluado.
- Se desarrollan modelos de ocurrencia de cotorras y los sitios de ocurrencia están verificados, evaluados, y cuantificados.
- Los requisitos de hábitat de las cotorras serranas occidentales están caracterizados en base a la historia natural de la especie, y un modelo de idoneidad de hábitat está desarrollado para entender y manejar las áreas de hábitat y rasgos para la cotorra.
- Se conducen estudios de la relación entre la disponibilidad de alimento y el movimiento y la anidación de la cotorra serrana occidental.
- Un plan de protección de hábitat a largo plazo para todo el rango de distribución de la cotorra serrana occidental (con un mapa) esta completado e implementado lo cual provee metas para a) la ubicación, tamaño, y distribución del hábitat de la cotorra serrana occidental; y b) la composición y estructura del bosque.
- Las áreas claves (sitios de anidación, perchas, bebederos, y dormideros) están protegidos permanentemente.
- Los estudios técnicos justificativos están terminados para áreas no protegidas de hábitat ocupado en zonas invernales y de anidación para justificar su consideración para designación como áreas federales de protección de flora y fauna u otra designación apropiada.

- El rango invernal esta verificado y registrado en mapa y las necesidades de conservación están evaluadas.
- Las áreas actualmente designadas como protegidas dentro del rango invernal (con cantidades significativas de ocurrencia de la cotorra serrana occidental) están protegidas, restauradas, y manejadas efectivamente.
- Se conduce una evaluación de la salud del bosque en los sitios ocupados por silviculturitas y ecólogos, y se desarrollan e implementan recomendaciones de manejo.
- Se desarrollan e implementan Planes de Manejo Forestal para sitios específicos que incorporan las necesidades de hábitat y forraje, incluyendo ciclos rotacionales más largos y mantenimiento de árboles maduros, árboles muertos en pie requeridos para anidación, el manejo integral de incendios, y la salud del bosque.
- Se planifican e implementan los incendios controlados donde sea necesario para manejar el hábitat de la cotorra serrana occidental.

*B= Sobreutilización*

- La colecta y captura ilegal de las cotorras serranas occidentales se disminuye por medio de la aplicación de las existentes leyes ambientales, normas, planes, y políticas de protección de la cotorra.

*D= Insuficiencia de Normas*

- Se aplican las existentes leyes ambientales, normas, planes, y políticas para proteger el hábitat de las cotorras serranas occidentales de cosecha, tala e incendios.

*E= Otros factores naturales o antropogénicos*

- Se conduce una evaluación de la viabilidad de la población para determinar el tamaño y numero de poblaciones necesarias para lograr los estándares mínimos poblacionales, y estos datos se incorporan en los criterios de la remoción como sea apropiado.
- Se desarrolla e implementa un protocolo estadísticamente comprobado y revisado por expertos para documentar la tendencia poblacional.

**Costo Total Estimado de la Recuperación**

Costos en \$1,000 USD. Las prioridades son definidas en las páginas 49-50

<b>Año</b>	<b>Prioridad 1</b>	<b>Prioridad 2</b>	<b>Prioridad 3</b>	<b>Total</b>
<b>2013</b>	629	114	54	797
<b>2014</b>	898	118	59	1075
<b>2015</b>	800	115	53	968
<b>2016+</b>	695	105	55	855
<b>Total</b>	<b>\$4,282</b>	<b>\$536</b>	<b>\$362</b>	<b>\$5,180</b>

Costos por año no suman a costos Totales porque algunas acciones sobrepasan el año 2016. Estos costos adicionales son incluidos en el Total.

## **Fecha de Recuperación**

No se conoce en este momento la fecha de recuperación para la cotorra serrana occidental. La regeneración de hábitat es un proceso a largo plazo y de 100 a 300 años pueden ser necesarios para la restauración completa del hábitat. Los estimados de duración para estas acciones están presentados en la Tabla de Implementación. El tiempo estimado para la remoción esta contingente en los resultados obtenidos durante el período de recuperación hasta la reclasificación. El éxito en la creación y protección de hábitat durante el período de reclasificación ayudará a determinar los esfuerzos necesarios para lograr la recuperación.

## **1.0. BACKGROUND**

### **1.1. Brief Overview**

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 for managers. 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 (USFWS) to modify this recovery plan in response to management, monitoring, and research data.

Our approach in this Thick-billed Parrot Draft Recovery Plan Addendum to Mexico's PACE (CONANP 2009), which we will use to guide recovery of the thick-billed parrot, is to address the status of biological information and habitat and to identify actions to conserve the species within its historical range in the U.S., and promote conservation for the thick-billed parrot within Mexico, where the species still occurs.

#### **1.1.1. Global and National Conservation Status**

Thick-billed parrots have been listed as endangered on the International Union for Conservation of Nature (IUCN) Red List of Threatened Species since 1994, with a currently decreasing population trend (BirdLife International 2012). The parrot also has been covered under the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) Appendix I since 1975, which includes species threatened with extinction and prohibition of trade except in exceptional circumstances, as well as under Appendix II, which also controls trade to ensure a species' survival (UNEP-WCMC 2012). The parrot is considered endangered in Mexico by the Norma Oficial Mexicana: NOM-059-SEMARNAT-2010 (Gobierno Federal 2010). The thick-billed parrot in the U.S. is listed as endangered under the authority of the ESA (74 FR 33958).

### **1.1.2. Recovery Priority Number**

The species has a recovery priority number of 5C, meaning that the species has a low potential for recovery, and faces a high degree of threat with a relatively high degree of conflict from development projects, such as construction, clearing for logging, cattle ranching, agriculture, and other economic uses. The degree of threat is high based upon the extensive loss and destruction of prime old-growth, high elevation forested habitat that will take generations to recover and faces continued threats of climate change and catastrophic fire, and the threat of low population numbers with extremely limited habitat availability and vulnerabilities to stochastic events. The potential for recovery is low due to intrinsic life history traits akin to a K-strategist including: long lifespan, relatively late sexual maturity, low percentage of pairs breeding, monogamy, highly social group behaviors, learned migratory patterns, and selectivity of obligatory tree cavity-nesting sites as well as pine seed specialization for diet; and extrinsic variables including fragmented and limited habitat facing continued human pressures, possible drought conditions from climate change, and illicit collection of parrots for the pet trade.

### **1.1.3. Mexico's Program of Action for Conservation of the Species**

The 2007 Mexican "Commitment to Conservation" is a series of programs to prevent the deterioration of Mexican ecosystems and biodiversity. The programs are being implemented through the Mexican National Commission of Protected Natural Areas (Comisión Nacional de Áreas Naturales Protegidas, CONANP). Under its Conservation Program for Species at Risk (PROCER), the objective is to design the framework, and coordinate, promote, and link the federal government's efforts to recover over 35 priority and endangered species with diverse sectors of society. More than 60 people from various public sectors participated in a comprehensive analysis to select the target species for the Program of Action for the Conservation of the Species, which has created and is in the process of producing recovery plans for each of the selected, rare species. Mexico then convened a group of parrot experts and in 2009 published a recovery plan (i.e., PACE) addressing both the maroon-fronted and thick-billed parrot species. The focus of the PACE (CONANP 2009) is on extant populations of the thick-billed parrot; it does not address extirpated thick-billed parrots or their historical range in the U.S.

A translated version of the thick-billed parrot PACE (CONANP 2009) is provided in Appendix I. The original Spanish document is available at <http://procer.conanp.gob.mx/>.

## **1.2. Description and Taxonomy**

Thick-billed parrots are members of the parrot family, Psittacidae. The genus *Rhychopsitta* is found only in Mexico, and the two members of the genus, *Rhychopsitta pachyrhyncha* (Swainson 1827), thick-billed parrot, and *R. terrisi*, maroon-fronted parrot, are similar in appearance. The genus is believed to be related to macaws, based on a similar body shape (Forshaw 1989). Each species has a green body with red shoulder patches, amber eyes, yellow eye-rings, and black beaks. The maroon-fronted parrot has a maroon cap on the forehead, while the thick-billed parrot has a bright red forehead cap. The thick-billed parrot is approximately 38 centimeters (cm) (15 inches [in]) in length, while the maroon-fronted parrot is slightly larger at between 40 and 45 cm (16-18 in) long (CONANP 2009). The appearance of females and males

is virtually identical in both species. The thick-billed parrot's long, tapered wings allow for fast flight and maneuvering, and they are excellent fliers (Snyder et al. 1999). More information is available in the PACE (Appendix B).

### **1.3. Distribution and Habitat Use**

#### *U.S. Historical Range*

Historically, the thick-billed parrot's range in the U.S. extended as far north as the mountains of southeastern Arizona and probably southwestern New Mexico (Snyder et al. 1999; see Maps in Appendix A). The now extinct Carolina parakeet (*Conuropsis carolinensis*) and the thick-billed parrot are the only parrot species with a known distribution that once ranged into the U.S. (Snyder et al. 1999). The thick-billed parrot is now extirpated in the U.S., with the last sighting of a flock made in 1938 in the Chiricahua Mountains of Arizona (Monson and Phillips 1981 in Snyder et al. 1999), and an unconfirmed 1964 report of a flock seen in New Mexico's Animas Mountains (Woodward 1980 in Snyder et al. 1999, NMBRC 2007, 2011). Extirpation of thick-billed parrots in the U.S. was very likely caused by excessive, unregulated hunting (Snyder et al. 1999).

There are no formal historical nesting records for the U.S., but thick-billed parrots were regular visitors in southeastern Arizona, and in some years big flocks were seen. Much of the ornithological literature concludes that parrots were not an established U.S. resident in historical times, due to the absence of historical nesting records and the irregular observation of large flocks (Snyder et al. 1999). Alternatively, Snyder et al. (1999) provides speculation for the likelihood that some parrots did breed in the U.S., as nesting evidence may have been overlooked by both the first thick-billed parrot observers who were not trained biologists looking for nests and by early ornithologists who did not conduct much work in southeastern Arizona, particularly in the Chiricahua Mountains. Other than loggers and prospectors, few residents of southern Arizona and New Mexico visited the high-elevation pine forests historically. Thick-billed parrot nests are aggregated in small, condensed areas in mid-summer to fall, a time when most ornithologists are not looking for nests. Thus, the lack of nest searches, combined with the parrot's high-elevation nesting habitat in condensed areas and late season breeding may explain the absence of nest records (Snyder et al. 1994). The thick-billed parrot's nearly annual presence in the Chiricahua Mountains of Arizona in the early 1900s suggests that it was an established breeder in this area and it seems likely that breeding occurred at least irregularly in the U.S. (Snyder et al. 1999). During the same time period, few nests were being reported from Mexico as well, even though parrots were breeding there, possibly offering another means of comparison for the lack of sightings.

There are historical reports of the species in New Mexico (Animas and Peloncillo Mountains), but no verified records or physical evidence exists (NMDGF 2011; NMBRC 2007, 2011). Throughout the early 1900s parrots were seen in several high elevation mountain ranges of southeastern Arizona, including the Chiricahua, Dragoon, Pinaleo, Galiuro, Santa Catalina, Whetstone, Huachuca, Patagonia, and Santa Rita Mountains; presence and number of birds varied by year and season (Phillips et al. 1964). Thick-billed parrot sightings were more common in the Chiricahua Mountains than any of the other mountain ranges. Incursions of thousands of parrots into the U.S., like the one documented in 1917-1918 by Wetmore (1935), occurred infrequently and were most likely the result of regional drought and the failure of the

seed crop in northern Mexico (Snyder et al. 1999). Historical thick-billed parrot occurrences in the U.S. might have been resident parrot populations accompanied by infrequent incursions of large numbers of parrots from Mexico (Snyder et al. 1999).

Although some of the more accessible pine forests of the parrot's U.S. range were historically impacted by timber production (Snyder et al. 1999), significant portions of the habitat in Arizona remain intact and in suitable condition (Snyder et al. 1995). Mature high-elevation conifer forests in southeastern Arizona exist on several mountain ranges, and virtually all of these areas are Federal lands, with most under the jurisdiction of the Coronado National Forest (U.S. Forest Service 2011). These forests face low development pressures as they are primarily managed for their recreation and watershed values, with no active timbering (Snyder et al. 1999).

This forested habitat above 2,000 m (6,562 ft) in elevation and up to 2,987 m (9,800 ft), in the area known as the Sky Islands (encompassing southeastern Arizona and southwestern New Mexico), consists of aspen (*Populus tremuloides*), spruce (*Picea* spp.), a variety of oak species (*Quercus* spp.), Chihuahua pine (*Pinus leiophylla*), Apache pine (*Pinus engelmannii*), Douglas-fir (*Pseudotsuga menziesii*), white fir (*Abies concolor*), Ponderosa pine (*Pinus ponderosa*), Arizona pine (*Pinus arizonica*), and southwestern white pine, also known as Mexican white pine (*Pinus strobiformis*) [= *P. ayacahuite*] (AZFireescape 2012). Wilderness and Wilderness Study Areas, with less disturbance and human influence, may provide more habitat characteristics compatible with thick-billed parrot occupancy than forested habitat with greater human use (U.S. Forest Service 2011). The Chiricahua Mountains, which were historically frequented by thick-billed parrots, include the 35,491-ha (87,700-ac) Chiricahua Wilderness (rising to an elevation of 2,986 m [9,797 feet]) and the 11,415-ha (28,207-ac) recommended Ku Chish Wilderness Area (U.S. Forest Service 2011).

No verifiable thick-billed parrot records exist for the Peloncillos or Animas Mountains of New Mexico, but their geographic proximity to the Sierra San Luis (Mexico's northernmost extension of the Sierra Madre Occidental) may provide potential habitat connectivity (Map 1 in Appendix A). Thick-billed parrot sightings have been reported for the Sierra San Luis (N. Snyder pers. comm. 2005 via Bodner et al. 2005), and this small range (running north-south with an elevation range of 1,310 - 2,530 m [4,300 - 8,300 ft]) is considered to contain suitable habitat (J. Cruz-Nieto, ITESM/Pronatura Noroeste, pers. comm. 2012). The Sierra San Luis is approximately 80 km (50 mi) north (slightly west) of Mesa de las Guacamayas, the northern-most thick-billed parrot breeding area (Snyder et al 1999). The southern portion of the Peloncillo Mountains (straddling the Arizona/New Mexico border) contains the 7,075 hectares (ha) (17,482 acres [ac]) Bunk Robinson Wilderness Study Area and the 4,407 ha (10,889 ac) Whitmire Canyon Wilderness Study Area (U.S. Forest Service 2011). The Animas Mountains extend north-south, with the southern range reaching an elevation of 2,600 m (8,531 ft) on Animas Peak. Most of this range is owned and managed by the Animas Foundation as part of the 129,904 ha (321,000 ac) Diamond A. Ranch (The Nature Conservancy 2012). The Animas Foundation is a partner in the Malpai Borderlands Group, a nonprofit, community-based, volunteer organization whose goal is to maintain and restore healthy ecosystems and preserve their ranching way of life (The Nature Conservancy, Malpai Boderlands Group 2012). Mixed-conifer habitats occur at the highest elevations of the Animas and Sierra San Luis mountains. Although no mixed conifer

habitat exist in the Peloncillos, foraging habitat may available (Bodner et al. 2005, Coronado Planning Partnership 2008).

### Mexico Range

The parrot's current range is limited to high elevations of the Sierra Madre Occidental of Mexico, extending from northwestern Chihuahua and probably northeastern Sonora into Durango and continuing southward into Jalisco, Colima, and Michoacán. Thick-billed parrots migrate seasonally from their primary breeding (summering) grounds in Chihuahua to wintering areas farther south. Birds arrive in Chihuahua by late May and have departed by early November, possibly migrating  $\geq 1,000$  km (621 mi) between their summering and wintering areas (Snyder et al. 1999, CONANP 2009).

There are accounts of birds being seen year-round in the Las Bufas area of western Durango (Lammertink et al. 1996), and in the winter of 1997-1998, many sightings were reported in western Chihuahua and northeastern Sonora (Snyder et al. 1999). The winter range mainly encompasses portions of southern Durango, Nayarit, Jalisco, Colima, and Michoacán (CONANP 2009, Snyder et al. 1999). Winter range observations are primarily historical, and the extent of occupied habitat is poorly understood (Schnell et al. 1974, Snyder et al. 1999, CONANP 2009). Parrots form large wintering flocks (12-120 individuals), and it is believed that they do not remain at one given site, but instead search across the landscape for suitable forest patches with abundant food resources (Schnell et al. 1974, Lammertink et al. 1996, Snyder et al. 1999). There are significant gaps in our understanding of the migratory patterns of this species, including 1) whether all populations migrate, 2) whether breeding populations form mixed flocks during migration or at wintering areas, 3) how habitat is used during migration, and 4) where in the winter range do the main breeding populations over-winter (Snyder et al. 1999, Guerra et al. 2008). Aside from their regular migration patterns between the breeding and wintering areas, the species is also known to make irregular nomadic excursions into areas beyond its normal range, responding to disruptions in food resources (Snyder et al. 1999).

### **1.4. Critical Habitat**

Critical habitat has not been proposed for the thick-billed parrot.

### **1.5. Life History**

The thick-billed parrot exhibits traits of a K-strategist, with a relatively long life-span in captivity of over 30 years. Behavior is highly social and the parrots are found in flocks while foraging, roosting, and migrating. Migration flocks number from 12 to over 100 individuals (Schnell et al. 1974), and historically, groups numbered as large as 1,500 individuals (Wetmore 1935). Guerra et al. (2008) theorized that individuals from the different breeding populations may intermix during migration. Young develop slowly, are cared for by both parents, remain dependent on their parents for over a year, and exhibit the learning of behaviors (Snyder et al. 1999). Foraging habits are nomadic depending on food and water availability, and thick-billed parrots are capable of flying distances from 3.6 to 15.8 km (2.2 to 9.8 mi), averaging 9.7 km (6 mi) per foraging trip, and totaling an average of 50 km (31 mi) in daily movements (Snyder et al. 1999). Productivity and nest success in the breeding populations are high, up to 80% (Monterrubio et al. 2002), but

only a small percentage of the individuals are breeding pairs (CONANP 2009). Approximately one-third of pairs using cavities do not produce eggs (Cruz-Nieto 1998 in Snyder et al. 1999, T. Monterrubio pers. comm. in Snyder et al. 1999). Recruitment rate is believed to be low (CONANP 2009), although the rate of mortality for juveniles or adults has not been quantified (Monterrubio et al. 2002).

### Food Resources

In the U.S., the thick-billed parrot primarily fed on seeds from cones of various pines, including Chihuahua pine, ponderosa pine, Arizona pine, and Apache pine (Snyder et al. 1999). Border piñon (*Pinus cembroides*) and Douglas-fir cones were also a source of food and to a lesser extent acorns and terminal buds of pine trees (Snyder et al. 1999). In Mexico, nesting above 2,000 m (6,562 ft) in elevation may be tied to the high elevation occurrence of Mexican white pine (*Pinus ayacahuite*), Arizona pine, and Durango pine. The seeds of these species are a major food source during the breeding season (Monterrubio et al. 2002). Conversion of mature high elevation pine forests to younger forest stands (which produce smaller cone crops) results in a diminished food supply for parrots (Beckman 1993).

### Breeding Habitat

As an obligate cavity nester, the thick-billed parrot requires large-diameter trees and snags; with pines, Douglas-fir, quaking aspen, and white fir used as nest-trees (Lanning and Shiflett 1983, Monterrubio-Rico and Enkerlin-Hoeflich 2004). The removal of large-diameter pines and snags through the intense logging of these mature forests has reduced nest site availability for the species (Monterrubio-Rico and Enkerlin-Hoeflich 2004). For example, seven pine nest-trees were removed at one nesting site during 1995-2007 (ITESM 2010). Selectivity has been demonstrated for nest size preferences, including the internal diameter of the cavity, entrance width, and entrance height above ground (Lanning and Shiflett 1983, Cruz-Nieto 1998 in Snyder et al. 1999).

Accompanying the loss of large-diameter trees is the loss of a primary cavity builder that historically provided at least some of the nest cavities for the parrot. The Imperial woodpecker (*Campephilus imperialis*), now believed to be extinct or nearly so (Lammertink et al. 2011), declined dramatically by the 1950s due to loss of old-growth trees and to a lesser extent shooting and poisoning.

Based on nesting patterns where tree species' availability changed over time, it appears that thick-billed parrots are opportunistic nesters. Following removal of pine nest trees between the early 1980s and 1996, thick-billed parrots nested in the remaining fir and aspen, as long as cavities within the preferred size range were available (Snyder et al. 1999).

Within the species' breeding range, nesting is primarily limited to just a few main areas in Chihuahua (Map 2 in Appendix A), with the five most important areas being Madera, Tutuaca, Mesa de las Guacamayas, Papigochic, and Vergel-Guanacevi (el Vergel, la Medalla, and La Lagunita) (Monterrubio-Rico and Enkerlin-Hoeflich 2004, ITESM 2011, J. Cruz-Nieto, ITESM/Pronatura Noroeste, pers. comm. 2012). There are also some recent breeding records in small fragmented forest patches in Central and Northern Durango (J. Cruz-Nieto, ITESM/Pronatura Noroeste, pers. comm. 2012). Madera and Tutuaca have the highest concentration of nest sites, with 82 nests reported for Madera in 2011 and 72 for Tutuaca

(Monterrubio-Rico and Enkerlin-Hoeflich 2004 2004, ITESM 2011). Madera (until recently the only known location where nesting occurred in aspen) has high nest site density and significant re-use of cavities, which may reflect a shortage of suitable nest-trees (Monterrubio-Rico and Enkerlin-Hoeflich 2004). The northern-most breeding area is Mesa de Guacamayas, located just within 80 kilometers (km) (50 [mi]) of the U.S. Border (Snyder et al. 1999). In 1997, a group of approximately 100 birds and 11 nests was documented (Snyder et al. 1999). For the 2011 breeding season, 13 nests (all in Douglas-fir trees) were documented at this location, along with a high count of 110 individuals (ITESM 2011).

As part of a comprehensive conservation program ongoing since the mid-1990s, several of these key breeding areas have recently been protected (CONANP 2009, Cruz-Maldonado 2010). Of the five most important breeding areas mentioned above, only the Vergel-Guanacevi area has not been designated as a protected area. The level of protection afforded to a given area depends on the type of official designation (Biosphere Reserve, Protected Area of Flora and Fauna, or Priority Region for Conservation) and whether core areas have been established. The latter effectively protects nesting, drinking, roosting, or perching sites through zoning, conservation easements, or other mechanisms (J. Cruz-Nieto, ITESM/Pronatura Noroeste, pers. comm. 2012). Concerns persist for long-term conservation in protected areas with inadequate protection (Guerra et al. 2008).

#### Wintering Habitat

The extent of occupied habitat in the wintering range is not known, and only a few wintering areas with thick-billed parrot occurrences have been documented (Snyder et al. 1999, CONANP 2009). Protected areas within the winter range (Map 2 in Appendix A) identified in the PACE as having thick-billed parrots are based primarily on historical records or anecdotal observations (Blake and Hanson 1942 in Snyder et al 1999, Schnell et al. 1974, J. Cruz-Nieto, ITESM/Pronatura Noroeste, pers. comm. 2012). The amount of suitable habitat within these protected areas in the winter range has not been quantified. Other known or suspected wintering areas in Durango include Las Bufas (birds are reported to occur here year-round; Lammertink et al 1996), California, and San Miguel de las Cruces (J. Cruz-Nieto, ITESM/Pronatura Noroeste, pers. comm. 2012).

### **1.6. Abundance and Trends**

#### Breeding Population

The parrot exhibits a patchy distribution across its vast range in Mexico and many of these areas are difficult to access because of their remoteness and potential danger, therefore accurately estimating range-wide population numbers for the species has been challenging (Snyder 1999, Monterrubio et al.2002). Estimates vary on the number of thick-billed parrots. Lammertink et al. (1996 in BirdLife International 2012) estimated between 1,000 and 4,000 birds. Key breeding areas are periodically surveyed, and parrot counts from 3 areas (including the 2 most important breeding sites of Madera and Tutuaca) in 2008 totaled close to 3,500 individuals (CONANP-Pronatura Sur 2008 in CONANP 2009). Systematic surveys in 2011 conducted at known drinking sites across 5 breeding areas (including Madera and Tutuaca) counted a total of 1760 individuals (ITESM 2011). However, this number may be a conservative estimate because not all known breeding areas are surveyed annually and other more remote or potential breeding

areas have not yet been inventoried (J. Cruz-Nieto, ITESM/Pronatura Noroeste, pers. comm. 2012). Productivity and nest success in the breeding populations are high (Monterrubio et al. 2002), but only a small percentage of the individuals are breeding pairs (CONANP 2009). In Chihuahua in 1995 and 1996, 5 of 18 and 28 of 58 pairs using cavities in respective breeding seasons did not produce eggs (J. Cruz-Nieto 1998 in Snyder et al. 1999). In Chihuahua in 1998, one-third of 160 pairs using cavities did not produce eggs (T. Monterrubio pers. Comm. in Snyder et al. 1999). Additionally, recruitment rate is believed to be low (CONANP 2009), although the rate of mortality for juveniles or adults has not been quantified (Monterrubio et al. 2002).

## 1.7. Threats

### Reasons for Listing/Threats

Section 4(a)(1) of the ESA outlines five factors to consider when a species is a candidate for listing as threatened or endangered. The following analysis considers these factors in contributing to the endangered status of the thick-billed parrots. Below, we address threats throughout the species range.

#### **Factor A. The present or threatened destruction, modification, or curtailment of its habitat or range**

##### Habitat Loss

The thick-billed parrot has experienced significant historical declines in Mexico, corresponding to loss of high elevation mixed conifer forests from extensive logging of large mature pines, removal of nesting snags (Snyder et al. 1999), and to a lesser degree, catastrophic forest fires (CONANP 2009). Only one percent of the old-growth forests are estimated to remain, and thick-billed parrots need forests that are an average of 326 years old for Southwestern white pine, also known as Mexican white pine, and Durango white pine (*Pinus durangensis*) for nesting and feeding (Lammertink et al. 1996, CONANP-Pronatura Sur 2008, CONANP 2009). Dominant tree species in occupied breeding habitat include Mexican white pine, Arizona pine, Durango pine, and Douglas-fir, and in some areas white fir and quaking aspen are also present (Monterrubio-Rico and Ernesto Enkerlin-Hoeflich 2004). Nesting occurs above 2,000 m (6,561 ft) and in more recent times more than 98 percent of nests found have been above 2,400 m (7,874 ft) (Snyder et al. 1999). Unlike Mexican forests, the rather inaccessible southeastern Arizona forests were not subjected to the same timber harvest pressure common to so many other forests in the 20th century. They are, however, vulnerable to large-scale loss to catastrophic wildfire after many years of fire suppression.

The mature and old-growth forests in southeastern Arizona, extreme southwestern New Mexico, and northern Mexico evolved with frequent surface fire regimes. By the mid-20th century these fires had been disrupted in most areas mainly due to heavy livestock grazing that eliminated the fine fuels that carry the fires (Fule et al. 2005). Lack of frequent fires can impact the sustainability of these forests, as increased fuel loads may lead to atypical high-intensity wildfires (Fule et al. 2005). Where frequent fires once kept forests more open, increased tree density and woody debris make forests more vulnerable to large-scale catastrophic wildfire.

Combined with effects of climate change, current conditions allow high-severity wildfires to eliminate desired ecosystem components, intensify the spread of unwanted non-native species, and result in dramatically different effects on watersheds than what would have occurred with natural fire. Active fire suppression since the 1940s has corresponded with an increased demand for wildland fire suppression to protect life and property (AZFirescape 2012).

In southeastern Arizona, two recent catastrophic wildfires have occurred within the last decade, impacting historical habitat: the 1994 Rattlesnake Fire and the 2011 Horseshoe 2 fire. The 11,331 ha or 28,000-ac Rattlesnake Fire in the Chiricahua Mountains demonstrated the severe effects possible under such conditions (AZFirescape 2012). The 2011 Horseshoe 2 fire burned 90,226 ha or 222,954 ac (74 percent) of the Chiricahua Mountain Range. Within the forested portion of the burn perimeter, the vegetation burn intensity was moderate for 32 percent (26,080 ha or 64,444 ac) and high for 43 percent (35,058 ha or 86,631 ac) of the area. Post-burn tree loss is expected to continue if Douglas-fir beetle outbreaks are not controlled (Allen et. al. 2006).

In Mexico occupied habitat has also been impacted by catastrophic fires. For example from 2004 to 2008, 3,947 ha (9,753 ac) of forest habitat crucial to thick-billed parrots were destroyed by wildfire (CONANP-Pronatura Sur 2008 in CONANP 2009). Fires periodically destroy nesting trees; Cruz-Nieto (ITESM 2010) reported that for the 1995-2007 period, 12 quaking aspen were lost at the Madera breeding site, while several Douglas-fir at the Tutuaca (2) and Mesa de las Guacamayas (13) breeding sites were destroyed during the same period. A review of the fire histories at the Tutuaca and Mesa de las Guacamayas breeding areas noted that fires were frequent through the mid-20<sup>th</sup> century, followed by extended fire-free periods (Fule et al. 2005, Fule et al. in review in Cortés-Montaña 2011). Fule et al. (2005) observed that “frequent fire played a long-term role in the ecosystem, the pattern of fire occurrence has changed in recent decades, and it will be important for managers to develop strategies for managing future fires” (page 328). Strategies for managing these forests include restoring frequent surface fires (through integrated fire management) and protecting large diameter trees and snags to achieve structural characteristics needed by thick-billed parrots (Fule et al. 2005, Cortés-Montaña 2011).

### Forest Management

In the U.S., with the recognition that these heavy fuel loads need to be reduced, and fire needs to be reintroduced as a natural process to restore the ecological balance, the FireScape program (AZFirescape 2012) has taken a landscape-scale approach for fire management across multiple land ownerships in the mountains of southeastern Arizona including the Forest Service, The Nature Conservancy, the University of Arizona, Bureau of Land Management, National Park Service, and other southeastern Arizona land managers.

The 35,491 ha (87,700 ac) Chiricahua Ecosystem Management Area (EMA) and the 65,606 ha (87,985 ac) Peloncillo EMA (Chiricahua and southern Peloncillo mountains respectively; Map 1 in Appendix A) are close to the extant populations in Mexico and within the historical range of the thick-billed parrot in Arizona and possibly New Mexico. Within 10 years of the draft Coronado National Forest Plan approval and pending availability of resources, the vegetation on 20 percent of the landscape in the Chiricahua EMA and 35 percent of the landscape in the Peloncillo EMA are planned to be treated to create resiliency to un-natural disturbances (U.S. Forest Service 2011). The types of treatments include wildland fire (planned and unplanned ignitions), thinning, and mastication to reduce the probability of a catastrophic fire.

Some preventive fire activities including prescribed burns, forest thinning, manzanita mastication, fuelwood sales, and salvage sales have occurred in the Chiricahua Mountains within the last ten years. Some of the projects completed, of varying sizes, are as follows: 1) a prescribed burn treated about 5,868 ha (14,500 ac) in higher elevation pine and fir, with some oak in lower elevations; 2) thinning approximately 809 ha (2,000 ac), mostly oaks in and around administrative sites; 3) manzanita mastication in approximately 728 ha (1,800 ac); 4) public fuelwood sales of dead and down wood or standing snags near roads; and 5) a small salvage sale in 1994 conducted after the Rattlesnake Fire. A 2012 salvage harvest is planned to remove 30 ha (75 ac) of dead standing timber in the campground. Because the 2011 Horseshoe 2 fire has altered the mosaic of vegetation on the landscape, projects that were planned to be implemented through the Firescape program are being re-evaluated (M. Fisher, Coronado National Forest, pers. comm. 2012).

Sanitation/salvage has been performed since commercial logging first began prior to the 1900s. This type of intermediate treatment has declined in recent years; however, today salvage harvesting treatment is getting greater attention due to the increasing number of large, stand-replacing fires and increased insect-induced mortality in ponderosa pine and mixed conifer forests. Those treatments are generally located in high severity burned areas and areas of extensive beetle-killed trees. In addition, Forest Service salvage operations in Arizona and New Mexico generally involve no new road construction, logging only on slopes <30–40 percent, and removing only trees that are completely dead or determined to be dying (U.S. Fish and Wildlife Service 2011).

There is considerable controversy over the effects of salvage logging following stand-replacing fire, and most salvage projects are appealed and/or litigated in the courts (Karr et al. 2004 in USFWS 2011). Proponents of salvage logging believe that harvesting dead trees will reduce the need to harvest live trees and see the failure to log some of the dead trees as a waste of a valuable natural resource; many also see salvage logging as a way to help reduce future burn severity or provide biomass to the forest floor to help minimize erosion. Others think that the severe fire had already caused substantial environmental harm and that salvage logging may result in more environmental damage (e.g., Donato et al. 2006, Lindenmayer et al. 2009 in U.S. Fish and Wildlife Service 2011).

Habitat loss and modification continue to be the main threats to the species (CONANP 2009).

### **Factor B. Overutilization for commercial, recreational, scientific or educational purposes**

Disappearance of the thick-billed parrot from the U.S. has been attributed to excessive shooting. Various accounts from the early 1900s indicate that shooting of birds was probably a frequent occurrence (Wetmore 1935; Snyder et al. 1994, 1999). Accounts of shooting thick-billed parrots have been reported in the literature (Lusk 1900 and Smith 1907 in Snyder et al. 1994, Wetmore 1935). Flocks of noisy, gregarious, and relatively tame thick-billed parrots were likely an easy target. Wetmore (1935) reported seventy-five or possibly 100 thick-billed parrots were believed to be shot out of curiosity in one canyon of the Chiricahua Mountains in 1917-1918. In addition, many residents in the remote southeastern Arizona mountains in the late 1800s and early 1900s relied on subsistence-hunting and likely shot thick-billed parrots for food (Snyder et

al. 1994). Concern over the risk to the bird's long-term survival was even reported by Vorhies (1934 in Snyder et al. 1994). Arizona Game and Fish Department agent Ralph Morrow, who lived in the Chiricahua Mountains from 1903 to the mid-1970s, provided convincing testimony that shooting may have led to the thick-billed parrot's extirpation (Snyder et al. 1994). He observed widespread shooting of thick-billed parrots in the early 1900s and willingly participated by killing "many dozens of individuals." A 1904 National Park Service photograph from the Chiricahua Mountains provides some evidence of loss by shooting, showing armed soldiers with dead thick-billed parrots (in Snyder et al. 1994).

There is little indication that shooting has been much of a threat in Mexico (Lanning and Shiflett 1983). The trapping of adults, and on occasion the taking of nestlings, for the local pet trade has been more of a threat (Lanning and Shiflett 1983 in Snyder et al. 1999, Cantu-Guzman et al. 2007, CONANP 2009). In some areas mature nest trees have been cut down to access the nests, not only reducing the number of young from the population, but also the number of available nest trees (CONANP-Pronatura Sur 2008 in CONANP 2009). From 1984 to 1994 more than 1,000 thick-billed parrots were estimated to be captured and illegally smuggled into the U.S. for the pet market (Snyder et al. 1994; SEMARNAP-INE 2000). Although other parrot species are in much higher demand for the illegal U.S. pet trade, thick-billed parrots were eighth in a list of the top ten parrot species seized at the southern border by USFWS for the period 1995-2005, with 26 thick-billed parrots seized by authorities during these years (Cantu-Guzman et al. 2007). However, most of the illegal trapping of parrot species in Mexico is for the domestic trade, not for exporting to the U.S. (Cantu-Guzman et al. 2007). Mexico's General Wildlife Law (Decree 60 Bis 2) bans the capture and export of all native parrots (Gobierno Federal 2008), and the species is listed in CITES Appendix I (UNEO-WCMC 2012). The removal of birds from the wild for the illegal pet trade remains a threat to the population (CONANP 2009).

### **Factor C. Disease or predation**

#### Disease

Health assessments on wild thick-billed parrot populations have not been extensive (Snyder et al. 1999). A 1997 disease survey of 24 nestlings from 4 different sites resulted in negative tests for avian influenza, paramyxovirus (Newcastle disease), psittacid herpesvirus (Pacheco's disease) or polyomavirus (Stone et al. 2005). In 2009, 17 chicks were tested for the same pathogens (excluding polyomavirus), and for the presence of flaviviruses (including West Nile Virus), adenovirus, atoxoplasma, and haemoparasites (including haemoproteus, plasmodium, and leukocytozoon). All samples were negative for these pathogens (N. Lamberski, San Diego Zoo Safari Park, pers. comm. 2011). Captive-held parrots have tested positive for some diseases, including polyomavirus, *Chlamydochylia psittaci* and Pacheco's disease (Stone et al. 2005, Snyder et al. 1999).

Ectoparasites, including cimicid bugs (*Ornithocoris* sp.), fleas (*Psittipsylla mexicana*), and lice (*Heteromenopon* sp. and *Psittacobrosus* sp.), have been documented at nests and evidently have contributed to nest failures (Stone et al. 2005, Monterrubio et al. 2002). Chicks in parasitized nest exhibited severe anemia (Stone et al. 2005 in Monterrubio et al. 2002). Botflies have also been observed on some chicks (Monterrubio et al. 2002). The frequency of nest failures due to ectoparasites, predation, and other factors is relatively low, and the species exhibits high nest

success (approximately 80 percent) and productivity at known breeding sites (Monterrubio et al. 2002, ITESM 2011).

### Predation

Raptors, mainly red-tailed hawks (*Buteo jamaicensis*) and northern goshawks (*Accipiter gentilis*), are the primary source of mortality for wild-flighted birds. Ring-tailed cats (*Bassariscus astutus*) have been documented preying on adult parrots at roosts sites (Snyder et al. 1999). Less abundant than the ring-tailed cat in most of the parrot's range, the raccoon (*Procyon lotor*) is known to prey upon nestlings, based on a single record (Cruz-Nieto 1998 in Snyder et al. 1999). Predators at nests are an unusual occurrence; for example, Monterrubio et al. (2002) documented only a few (eight) predation events by ringed-tailed cats and avian predators. The parrot's highly social behavior may allow it to cope with the level of predation pressures exerted by raptors (Snyder et al. 1994).

The PACE does not identify disease or predation as major threats to the thick-billed parrot.

### **Factor D. The inadequacy of existing regulatory mechanisms**

The thick-billed parrot was listed as an endangered species on June 3, 1970 (35 FR 8491), pursuant to the Endangered Species Conservation Act (ESCA), the precursor of the Endangered Species Act. Based on the different listing procedures for foreign and domestic species under the ESCA, the thick-billed parrot was listed as a "foreign" species. When the Endangered Species Act replaced the ESCA, the thick-billed parrot was not carried forward onto the Federal List of Endangered and Threatened Wildlife and Plants for the United States due to an oversight, although the thick-billed parrot remained listed in Mexico. Subsequently, the parrot was proposed to be listed in the United States on July 25, 1980, wherein the proposed listing rule acknowledged that it was always the intention of the Service to list the thick-billed parrot as endangered in the United States (see 45 FR 49844, page 49845). In 2009, the U.S. Department of the Interior's Assistant Solicitor for Fish and Wildlife provided an explanation stating that the species has always been listed as endangered throughout its entire range (see 74 FR 33958). Today, the thick-billed parrot remains listed throughout its range, including Mexico and the United States; critical habitat has not been proposed for the thick-billed parrot. Mexico also lists the parrot as endangered in its Norma Oficial Mexicana: NOM-059-SEMARNAT-2010 (Gobierno Federal 2010).

In Arizona the species is protected under Title 17 within the general provisions for native birds. Additionally, regulation R12-4-406 of the Arizona Game and Fish Commission classifies the species as "Restricted live Wildlife" which means it cannot be imported, exported, or possessed without a special license or lawful exemption (AAC Title 12). New Mexico's Statutes Annotated Chapter 17 also affords the species a level of protection (NMDGF 2012).

The U.S. has little authority to implement actions needed to recover species outside its borders, especially when recovery requires the employment of laws and regulations. The main threat to the parrot in Mexico is habitat destruction, with illegal capture for the pet trade being a secondary threat. The powers that the USFWS 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 thick-billed parrot occurs) or any other foreign country. Section 7 of the ESA, which provides for all Federal agencies to utilize their authorities to carryout 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 USFWS has no section 7 authority outside the boundaries of the U.S.

## **E. Other natural or manmade factors affecting its continued existence**

### Population Size

The parrot exhibits a patchy distribution across its vast range in Mexico (see Map 2 in Appendix A for recent verified records) and many of these areas are difficult to access because of their remoteness and potential danger, therefore accurately estimating range-wide population numbers for the species has been challenging (Snyder et al. 1999, Monterrubio et al. 2002). Estimates vary on the number of thick-billed parrots. Lammertink et al. (1996, in BirdLife International 2012) estimated between 1,000 and 4,000 birds. Key breeding areas are periodically surveyed, and parrot counts from 3 areas (including the 2 most important breeding sites of Madera and Tutuaca) in 2008 totaled close to 3,500 individuals (CONANP-Pronatura Sur 2008 in CONANP 2009). Systematic surveys in 2011 conducted at known drinking sites across 5 breeding areas (including Madera and Tutuaca) counted a total of 1760 individuals (ITESM 2011). However, this number may be a conservative estimate because not all known breeding areas are surveyed annually and other more remote or potential breeding areas have not yet been inventoried (J. Cruz-Nieto, ITESM/Pronatura Noroeste, pers. comm. 2012).

Productivity and nest success in the breeding populations are high (Monterrubio et al. 2002), but only a small percentage of the individuals are breeding pairs (CONANP 2009). In Chihuahua in 1995 and 1996, 5 of 18 and 28 of 58 pairs using cavities in respective breeding seasons did not produce eggs (Cruz-Nieto 1998 in Snyder et al. 1999). In Chihuahua in 1998, one-third of 160 pairs using cavities did not produce eggs (T. Monterrubio pers. comm. in Snyder et al. 1999). Additionally, recruitment rate is believed to be low (CONANP 2009), although the rate of mortality for juveniles or adults has not been quantified (Monterrubio et al. 2002). Reduced population size is considered a threat to the species, because the breeding populations are relatively small and concentrated in a handful of sites, which makes them vulnerable to catastrophic events (CONANP 2009). Large areas of old-growth forest are no longer found in the Sierra Madre Occidental and as the average age of trees and conifer forest decreases, so do parrot nesting sites and food resources. The reduced seed production in these younger forests is accompanied by an increase in the frequency of sterile cones, further exacerbating the inadequate food supply (Monterrubio-Rico and Enkerlin-Hoeflich 2004, Monterrubio-Rico et al. 2006). Thus, the thick-billed parrot is threatened by small population size and the low number of breeding pairs in the remaining old-growth and mature forests.

### 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 and Solomon et al. 2007). Further confirmation of the role of GHGs comes from analyses by Huber and Knutti (2011), who concluded that 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 built upon 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). (See 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).

Exactly how climate change will affect precipitation within the range of the thick-billed parrot in the Southwest is uncertain. However, consistent with recent observations of regional effects of climate change, the projections presented for the Southwest predict warmer, drier, and more drought-like conditions (Hoerling and Eischeid 2007, Seager et al. 2007). For example, climate simulations of the Palmer Drought Severity Index (PDSI) (a calculation of the cumulative effects of precipitation and temperature on surface moisture balance) for the Southwest for the periods of 2006 to 2030 and 2035 to 2060 show an increase in drought severity with surface warming. Additionally, drought still increases even during wetter simulations because of the effect of heat related moisture loss through evaporation and evapotranspiration (Hoerling and Eischeid 2007). Annual mean precipitation is likely to decrease in the Southwest, as is the length of snow season and snow depth (IPCC 2007b). Most models project a widespread decrease in snow depth in the Rocky Mountains and earlier snowmelt (IPCC 2007b).

Sky Islands in the Southwest and Mexico are already being affected by climate change, with increases in drought, fire, and invasive insects (Williams et al. 2010 in U.S. Forest Service 2011). By the end of the 21st century, the Southwest, including the Coronado National Forest, is likely to experience: temperature increases of five to eight degrees Fahrenheit (or about half a degree Fahrenheit per decade on average); an increase in the number of hot days, with summer heat waves lasting two weeks or longer; warmer winters with reduced snowpack; a later monsoonal season; a 10 percent drop in annual precipitation in Southern Arizona; and an increase in extreme flood events following an overall increase in tropical storms (U.S. Forest Service 2011). Based on projections of future climate change for the region, the Sky Islands of Arizona, New Mexico,

and northern Mexico are susceptible to decreases in plant productivity from water limitations and increased heat, effects on phenology and changes in the date of flowering and associated pollination and food-chain disruptions, long-term shifts in vegetation patterns including cold-tolerant vegetation moving upslope or disappearing in some areas and migration of some tree species to the more northern portions of their existing range; shifts in the timing of snowmelt (already observed) and increases in summer temperatures affecting the survival of fish species and efforts to reintroduce species into their historic range; increases in insect attacks, colonization of invasive species (including insects, plants, fungi, and vertebrates), longer and more severe fire seasons, and altered frequency, severity, timing, and spatial extent of disturbance events (e.g. droughts, flash floods, landslides, and wind storms) (Joyce et al. 2006, Westerling et al. 2006, IPCC 2007, Millar et al. 2007, Clark 1998, Swetnam et al. 1999 in U.S. Forest Service 2011).

Increases in drought and heat stress associated with climate change could alter the future composition, structure, and biogeography of forests (Allen et al. 2010), including old-growth forests thick-billed parrots depend on. Some forest ecosystems in different parts of the world may already be responding to climate change, raising concerns that forests may become increasingly vulnerable to higher tree mortality rates and die-off in response to future warming and drought (Allen et al. 2010). Large-scale tree mortality can occur abruptly when climate change exceeds species-specific physiological thresholds, or if climate triggers associated irruptions of insect pests in weakened forests (Allen et al. 2010). This could impact habitat for thick-billed parrots.

Sky Island forests could become even more fragmented in the future as forest habitats shift upward in elevation (U.S. Forest Service 2011). Temperature increases of as little as a few degrees could cause forest habitats to shift to higher elevations, reducing their area, altering phenologies of food availability, and potentially causing local extinction of endemic taxa and unique genetic and phenotypic diversity (Kupfer et al. 2005 in U.S. Forest Service 2011). A recent assessment of climate change in the Southwest found that many Sky Islands forest systems are among the most vulnerable to climate change because of the combination of most rapid recent temperature increases and a high number of species of conservation concern (Robles and Enquist 2010 in U.S. Forest Service 2011). We expect long-term climate trends associated with a hotter, drier climate to have an overall negative effect on the available habitat and food resources in the historical and current range of the thick-billed parrot.

## **1.8. Conservation Measures**

### **1.8.1. Reintroductions**

The IUCN (1998) defines a reintroduction as “an attempt to establish a species in an area which was once part of its historical range, but from which it has been extirpated or become extinct”, while a translocation is defined as the “deliberate and mediated movement of wild individuals or populations from one part of their range to another”. Reintroductions have been used as a conservation strategy for several threatened parrot species (White et al. 2012). For the thick-billed parrot, Snyder et al. (1999) included reintroductions in Mexico and the U.S. as one of several conservation measures. The PACE (CONANP 2009) briefly addresses reintroductions within the context of research needed to aid in conservation of the thick-billed parrot. More

specifically, it outlines research needs on the biological limitations and adaptability of the species to inform future reintroductions as well as the need to identify and evaluate potential areas for releases.

The Arizona Game and Fish Department, USFWS, and others, conducted a reintroduction program during 1986-1993 when 88 birds were released in the Chiricahua Mountains of southeastern Arizona (Snyder et al. 1994). These 88 individuals consisted of 65 presumed-wild (confiscated by USFWS and believed to be of wild origin from Mexico) and 23 captive-reared birds. These parrots were released in varying numbers over the 8 years and as the project progressed it became clear that a larger number of birds was needed to achieve success. A thorough review of this reintroduction program is presented by Snyder et al. (1994). In summary, the program did not succeed in the reestablishment of a viable wild population, primarily due to predation by northern goshawks, red-tailed hawks, and ring-tailed cats. Captive-bred birds had deficient survival skills and wild-caught birds were not available in sufficient numbers.

Snyder et al. (1994) conclude that establishment of a viable wild population using captive-bred birds would necessitate the rearing, training, and release of large numbers of individuals, perhaps in the thousands. Currently, the Association of Zoos and Aquarium facilities hold approximately 95 birds (S. Healy, Sacramento Zoo, pers. comm. 2012). Using wild-caught birds with wild behavioral skills intact would require less funding and fewer individuals.

The potential risk of spreading disease from birds in confiscation and captive-breeding facilities to wild parrots and other sympatric species must be evaluated as part of a reintroduction program (Snyder et al. 1994, 2000). The presence of pasteurilla (avian cholera), and possibly parrot wasting disease (psittacine pro-ventricular dilation syndrome) and Pacheco's disease among the released birds in Arizona may have also been a contributing factor to poor survival. More problematic is that diseases such as parrot wasting disease and Pacheco's disease cannot be reliably detected in carrier individuals even with extended quarantine periods (Derrickson and Snyder 1992).

Although this reintroduction effort was not successful, some results were encouraging, including: 1) wild-caught birds experienced higher survival rates, 2) some flocks established a migratory pattern within Arizona, and 3) several breeding attempts were documented, including the successful fledging of young by a pair that bred along the Mogollon Rim in central Arizona. Based on these results, Snyder et al. (1994, 2000) suggested that future reintroduction efforts should rely on birds removed from sustainable wild populations, and those that have been thoroughly vetted for any potential pathogens.

More recently (1999-2007), several small scale experimental translocations consisting of one or two pairs have been conducted within Mexico (Enkerlin et al. 2001, S. Ortiz Maciel, ITESM, pers. comm. 2007). The translocated pairs either joined the local population or returned to their original nesting site. In the most recent effort (June 2007), a joint ITESM/Pronatura Noroeste team moved two breeding pairs from Madera to the Mesa de las Guacamayas breeding site located approximately 140 km (87 mi) apart. Post-release monitoring indicated that both pairs had returned to Madera after 10 days (S. Ortiz Maciel, ITESM, pers. comm. 2007).

Results from both the reintroductions in Arizona and the experimental translocations in Mexico will help inform any future reintroduction efforts. Additionally, recent experiences with reintroductions of other parrot species (White et al. 2012) suggest new approaches or considerations when designing a reintroduction program including optimal release site selection, supplemental feeding, predator management, predator aversion training, and nest box placement. The PACE does not specifically identify reintroductions into the U.S. historical range as a specific action to assist with recovery of the species; rather, the focus is on protection of old-growth forests, and persistence and expansion of Mexican thick-billed parrot populations. The Canada/Mexico/U.S. Trilateral Committee for Wildlife and Ecosystem Conservation and Management has in the past endorsed reintroductions of thick-billed parrots within the species' historical range (Mexico and the U.S.) as one of several conservation strategies for the species. Significant portions of the habitat in Arizona remain intact and appear to be in suitable condition for supporting thick-billed parrots (Snyder et al. 1995). Although reintroductions are recognized as a conservation strategy, their feasibility, appropriateness, and possible approaches need further evaluation, particularly given the low populations of remaining wild thick-billed parrots, the importance of preserving the remaining old-growth habitat, the bird's social nature and minimum flock size necessary for success, predator avoidance, food availability, adaptive behavior to a novel location, past responses to relocation, and potential for spreading disease. Additionally, current Mexican law (General Wildlife Law Decree 60 Bis 2) bans the exportation of all parrot species, and it is not evident that an exemption exists under the legislation to allow for translocation of birds into the U.S. (Gobierno Federal 2008).

### **1.8.2. Conservation Efforts**

An overview of conservation measures to date is provided within the Background section of the PACE (CONANP 2009) (Appendix B). Some nesting sites have been designated as protected natural areas and efforts continue to increase the level of protection at these sites and to place other nesting, drinking, roosting, and perching sites in protected status.

## **2.0. RECOVERY STRATEGY, GOAL, OBJECTIVES, CRITERIA**

### **2.1. Recovery Strategy**

The thick-billed parrot has been extirpated from the U.S. for over 70 years and now only occurs in Mexico, thus the focus of recovery conservation for the thick-billed parrot must be within Mexico. Since the mid-1990s, conservation organizations and the Mexican government have been implementing a major conservation program focused on research, monitoring, and protection of key breeding areas. Furthermore, as part of a federal initiative, Mexico convened a group of parrot experts and in 2009 published a recovery plan (e.g., PACE) addressing both the maroon-fronted and thick-billed parrots. The focus of the PACE (CONANP 2009) is on extant populations of the thick-billed parrot; it does not address thick-billed parrots extirpated from the U.S. or their historical range in the U.S.

Therefore, our approach in this Addendum to the PACE is as follows:

- Summarize information on thick-billed parrots extirpated from the U.S.;

- Synthesize or reference information (when feasible) from the PACE to formulate recovery planning components as are required by the ESA;
- Incorporate supplemental information received from Mexico partners since publication of the PACE;
- Identify broad actions necessary to address conservation of the species within its U.S. historical range;
- Identify partnerships to facilitate recovery of extant populations.

## **2.2. Recovery Goal**

The goal of this Addendum (and as reflected in the PACE) is to recover and protect the thick-billed parrot and its habitat to assure its long-term survival in the wild, with the objective of removing it from the list of threatened and endangered species (delisting).

## **2.3. Recovery Objectives**

Recovery objectives are discreet components, which collectively describe the conditions necessary to achieve the recovery goal of the thick-billed parrot. Mexico's Recovery Plan presents six programmatic conservation strategies with their corresponding objectives. Those objectives, restated here as recovery objectives, are linked to the five listing factors. Recovery objectives 1 through 13 were derived from the PACE (CONANP 2009), unless indicated otherwise. Those PACE objectives that address how to implement the PACE are not repeated because, although they are important, they are not included in the body of a U.S. recovery plan. We also establish objectives 14 through 16 to more specifically address the species' historical U.S. range. Because all extant populations of the species occur in Mexico, long-term cooperation of the two nations is necessary to recover the species.

### **Recovery objectives, as derived from the PACE**

1. Strengthen or implement protection measures in parrot nesting and dispersal areas, and establish new areas for protection.
2. Educate the various government entities and the public on the importance of enforcing existing laws and regulations to protect parrots.
3. Increase surveillance and prevent illegal activities related to poaching and illegal trade of parrots, and illegal modification of parrot habitat.
4. Develop and implement actions to protect the habitat necessary to support viable parrot populations. Maintain mature trees and snags with characteristics that provide nesting and feeding areas.
5. Develop monitoring and management guidelines that promote population increases of parrots.
6. Restore suitable habitat that has been degraded or eliminated within the historical range of the species.

7. Prevent (minimize) destructive anthropogenic activities such as fires, erosion, and deforestation that result in habitat loss and degradation.
8. Compile and verify information on the current distribution of the parrot, including areas used for nesting, feeding, migration, and wintering.
9. Promote the development of research on the parrot and its habitat that leads to effective protection, management, and recovery actions.
10. Monitor parrots and habitat to assess population trends and habitat conditions.
11. Promote a culture of conservation for the parrot and its habitat through outreach efforts and active public participation.
12. Implement outreach campaigns that allow the public to understand the conservation status of the species and actions necessary conserve it.
13. Seek collaborations with communities, associations, institutions, and other stakeholders to facilitate species and habitat conservation through training and capacity building.

#### **Additional Recovery Objectives for U.S.**

14. Assure the long-term viability of thick-billed parrot conservation by cooperating with partners in Mexico and providing any available technical or financial support for implementing recovery actions.
15. Preserve and enhance U.S. historical habitat and augment cross border connectivity of habitat.
16. Evaluate the need and efficacy of conducting translocations of individuals into historical and potential habitats as part of a comprehensive conservation strategy.

#### **2.4. 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 [delisting]). The definition of an endangered species is a species that is in danger throughout all or a significant portion of its range. A threatened species is one likely to become endangered in the foreseeable future (Section 3 ESA). Because the same five statutory factors must be considered in delisting as in listing, 16 U.S.C. § 1533 (a),(b),(c), the USFWS, 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.C1995)).

The listing and delisting factors are:

Factor A: The present or threatened destruction, modification, or curtailment of its habitat or range.

Factor B: Overutilization for commercial, recreational, scientific, or educational purposes.

Factor C: Disease or predation.

Factor D: Inadequacy of existing regulatory mechanisms.

Factor E: Other natural or manmade factors affecting the continued existence of the species.

The criteria below were established for the thick-billed parrot throughout its range, as it is listed by the ESA. If these are met, this species could be considered for downlisting or delisting. These criteria meet our statutory requirements to the maximum extent practicable. As our knowledge of the thick-billed parrot increases and as the recovery actions described in this plan are implemented, the plan may be revised and refined.

### **Downlisting Criteria**

The downlisting criteria were based on the recovery actions in the PACE (CONANP 2009), with additional contributions from Mexican and U.S. biologists. Some of the criteria provide more specificity and address more than one recovery action in the PACE (CONANP 2009). The Thick-billed parrot should be considered for downlisting to threatened status when all of the following conditions have been met.

#### ***Demographic Criteria:***

1. Maintain a self-sustaining population of thick-billed parrots sufficient to ensure the species' survival and to address threats of inadequate foraging, breeding, and wintering habitat; small population size; and climate change.
  - a) Using a statistically sound and peer reviewed monitoring protocol, at least 15 years of systematic surveys document a stable or increasing trend in at least 5 known wild thick-billed breeding populations including Mesa de las Guacamayas, Madera, Tutuaca, Papigochic, and Campo Verde (PACE 2009). Minimum viable population size and number of breeding colonies are to be established through research and modeling, including better understanding of non-reproductive groups.

Justification: Thick-billed parrots are long-lived (exceeding 30 years in captivity), breed in forests that average 326 years old, are known from a small number of breeding populations (5 main populations), do not breed until 3 to 5 years old, and produce only 1 or 2 young per year (Lammertink et al. 1996, Snyder et al. 1999, CONANP-Pronatura Sur 2008, PACE 2009). Although nest success is greater than other parrot species (80%) (Monterrubio et al. 2002), ITESM 2011), not all parrots exhibiting nesting behavior actually breed. In Chihuahua in 1995 and 1996, 5 of 18 and 28 of 58 pairs using cavities in respective breeding seasons did not produce eggs (J. Cruz-Nieto 1998 in Snyder et al. 1999). In Chihuahua in 1998, one-third of 160 pairs using cavities did not produce eggs (T. Monterrubio pers. comm. in Snyder et al. 1999). Reasons why a large proportion of parrot pairs do not breed in a given year

are not understood, and due to the long lifespan and late development of some reproductive traits, at least 15 years of data would be needed to capture response of a truly increasing trend. Five breeding populations have demonstrated stability over a few decades, therefore maintaining this baseline without a loss of breeding populations over at least 15 years would indicate a continuing stable trend in population group number.

2. Preserve and restore sufficient thick-billed parrot habitat (patch size, distribution, forest composition and structure) to ensure the species' survival despite environmental stochasticity and the threat of climate change.
  - a) A long-term thick-billed parrot habitat protection plan and map are completed, based on sound science and species expert knowledge. The Mexican plan provides goals for a) the location, size, and distribution of thick-billed parrot habitat; and b) forest composition and structure.
  - b) Habitat is protected and managed according to the long-term habitat protection plan.

Justification for 2a and 2b: With habitat loss, degradation, and fragmentation as the primary threat to thick-billed parrots, preserving the remaining habitat as quickly and effectively as possible could thwart future parrot declines. The development of a long-term habitat protection plan would direct the evaluation of habitat availability and use for thick-billed parrots, and would guide habitat restoration for the species. A long-term habitat protection plan is needed because: the level of protection at some occupied breeding habitat is inadequate; not all breeding sites are known or surveyed; some wintering habitat has not been confirmed to be occupied; migration routes from breeding areas to wintering areas are unknown; and the extent of foraging habitat in breeding areas and forest characteristics in wintering area is unknown.

### ***Threats-based Criteria:***

1. Home ranges and migration patterns of reproductive and non-reproductive thick-billed parrot groups are identified and habitat use and availability are evaluated (Factors A, E).

Justification: More information is needed on habitat use (e.g. home range) of non-breeding, breeding, migrating, and wintering parrots. Population movement of non-reproductive groups within the breeding range needs to be better understood to evaluate the population structure and use of habitat.

2. Breeding areas are effectively conserved for the foreseeable future through protected status designation, land purchase, long-term conservation easements, acquisition of lumbering rights, or other mechanisms.(Factors A, D, E)
  - a) Core Areas (nesting, drinking, roosting, and perching sites) for at least five known breeding areas including Mesa de las Guacamayas, Madera, Tutuaca, Papigochic, and Campo Verde are permanently protected, encompassing 15,600 total hectares (10 percent of each breeding area, ranging from 700 to 4,000 hectares).

- b) Other known breeding areas are assessed, including Sierra el Nido, Cerro de Mohinora, Guanacevi-El Vergel (including El Vergel, La Medalla and La Lagunita in southern Chihuahua), and Namiquipa. Suspected breeding localities are verified as feasible.
- c) Technical studies are completed for at least two other breeding areas, such as Sierra el Nido, Cerro de Mohinora, Guanacevi-El Vergel (including El Vergel, La Medalla and La Lagunita in southern Chihuahua), and Namiquipa to justify their consideration for designation as federal Protected Areas of Flora and Fauna or other appropriate designation.

Justification for 2a - c: Breeding areas need to be effectively protected to prevent further loss from logging, disturbance, overgrazing, and catastrophic wildfire.

3. Wintering ranges for at least the five breeding populations including Mesa de las Guacamayas, Madera, Tutuaca, Papigochic, and Campo Verde are verified and mapped, and conservation needs assessed. (Factors A, D, E).
  - a) Thick-billed Parrot anecdotal and casual observations reported for protected areas in the wintering range [such as Michilia (Durango), Sierra de Manantlan, Nevado de Colima (Jalisco and Colima), El Jabali (Colima), and Pico de Tancitaro (Michoacan)] (CONANP 2009) are verified and updated through a comprehensive inventory. Other known or suspected wintering areas in Durango (such as Las Bufas, California, and San Miguel de las Cruces) are also surveyed. Extent of occupied habitat is mapped and conservation needs assessed.
  - b) Currently designated protected areas within the winter range (with significant numbers of verified thick-billed parrot occurrence) in the states of Durango, Jalisco, Colima, and Michoacán are effectively protected, restored, and managed (CONANP 2009). Forest Management Plans that incorporate species needs are developed and implemented.
  - c) Technical studies are completed for at least two other wintering areas with thick-billed parrot occurrence (such as Las Bufas, California, and San Miguel de las Cruces in Durango or newly discovered sites) to justify consideration for designation as federal Protected Areas of Flora and Fauna or other appropriate designation.

Justification for 3a - 3c: Wintering areas for birds from each of the five main breeding populations are unknown. Condition and extent of wintering habitat is unknown. Occupied wintering areas need effective habitat protection.

4. Forest Management Plans are developed and implemented for at least five known breeding areas including Mesa de las Guacamayas, Madera, Tutuaca, Papigochic, and Campo Verde. The Forest Management Plans incorporate habitat and foraging needs, including longer rotational cycles and maintenance of mature trees [e.g., pines (*Pinus*)],

spruces (*Picea*), and firs (*Pseudotsuga* and *Abies*)], snags required for nesting, strategic fire management, and forest health. (Factors A, D, E).

Justification: Habitat loss is the major factor currently threatening the persistence of the thick-billed parrot. The development and implementation of Forest Management Plans will address the threats of logging, grazing, and wildfire, provide a long-term vision for the species' recovery, and direct actions on the ground to control these factors. Managing forests to maintain existing habitat, restore logged habitat, and prevent catastrophic stand-replacing fire, insect and disease damage, and human-caused habitat loss is necessary to recover this species. Healthy forest conditions will be indicated by tree stocking levels and fuel load conditions such that fire can be allowed to burn naturally across the landscape without risking the loss thick-billed parrot habitat (including mature trees and snags).

5. The potential for the U.S. to support naturally dispersing or actively relocated thick-billed parrots is assessed, including a review of U.S. historical habitat, current habitat management, and habitat connectivity with Mexico. The need and efficacy of translocating parrots are included in the assessment. (Factors A, C, E).

Justification: Evaluating U.S. habitat availability is needed to determine the potential for thick-billed parrots to colonize and survive in the Sky Islands of southeastern Arizona and southwestern New Mexico.

6. Measures to reduce illegal collection and poaching of thick-billed parrots for the pet trade are assessed and implemented. (Factors B, D).

Justification: Loss of thick-billed parrots from the breeding population limits recovery progress.

7. Measures to reduce illegal harvesting, clearing, and fires in thick-billed parrot habitat are assessed and implemented. (Factors A, D, E).

Justification: Continued loss of mature and old-growth habitat is the greatest threat to thick-billed parrot recovery. Formulating and enforcing regulations will help the species to recover.

### **Delisting Criteria**

Delisting criteria for the thick-billed parrot are difficult to establish due to the lack of information concerning its population status, biology, and specific habitat requirements. More research is needed to recommend specific recovery tasks and delisting criteria. Considering the loss of suitable habitat, and length of time needed for forest regeneration to attain suitability, low percentage of breeding pairs, and need for habitat protection, downlisting is unlikely to be reached before year 2050. It is unrealistic to predict the environmental conditions and threats to the species that will prevail at that time. Additional information is also needed regarding the conservation biology of small populations, including impacts of stochastic and catastrophic

events on survival. Delisting criteria will require the establishment of a population target with a high level of confidence. Without knowledge of a minimum population size needed to ensure species survival, it would be unreasonable to provide delisting criteria. With additional knowledge regarding the elements of a population model, such as reproductive capacity, natality and mortality rates, migration patterns and survivorship, or genetic information, we would be more prepared to determine whether the species is no longer in danger throughout all or a significant portion of its range (downlisted to threatened) and no longer likely to become endangered in the foreseeable future (delisted, or recovered). New information gathered through recovery actions will be incorporated into additional population viability assessments as the population approaches its downlisting goals. Delisting criteria will be established at that time, and the overall recovery strategy and actions will be revised as appropriate. Future revisions of this recovery plan are anticipated, and a goal for removing the thick-billed parrot from the List of Threatened and Endangered Species will be set prior to downlisting anticipated in 2050. Some preliminary recommendations are outlined below, which include more specific tasks than the general recovery actions in the PACE (CONANP 2009) and additional contributions from Mexican and U.S. biologists. Some of the Actions Needed address more than one recovery action in the PACE (CONANP 2009).

## **2.5. Actions Needed** (organized by Listing Factor)

### *Factor A= habitat modification or loss*

- Home ranges and migration patterns of reproductive and non-reproductive thick-billed parrot groups are identified and habitat use and availability are evaluated.
- Predictive parrot occurrence models are developed and occurrence sites are verified, evaluated, and quantified.
- The habitat requirements of thick-billed parrots are characterized based on all aspects of the species' life history, and a habitat suitability model is developed to understand and manage habitat areas and features for the parrot.
- Studies are conducted on the relationship between food availability and thick-billed parrot movement and nesting.
- A rangewide long-term thick-billed parrot habitat protection plan (with map) is completed and implemented that provide goals for a) the location, size, and distribution of thick-billed parrot habitat; and b) forest composition and structure.
- Core areas (nesting, drinking, roosting, and perching sites) are permanently protected.
- Technical studies are completed in unprotected occupied breeding and wintering habitat to justify their consideration for designation as federal Protected Areas of Flora and Fauna or other appropriate designation.
- Wintering range is verified and mapped, and conservation needs assessed.
- Currently designated protected areas within the winter range (with significant numbers of verified thick-billed parrot occurrence) are effectively protected, restored, and managed.
- An assessment of forest health at occupied sites is conducted by silviculturists and ecologists, and management recommendations are developed and implemented.
- Site-specific Forest Management Plans are developed and implemented that incorporate habitat and foraging needs, including longer rotational cycles and maintenance of mature trees, snags required for nesting, integrated fire management, and forest health.

- Prescribed burns are planned and implemented where needed to manage thick-billed parrot habitat.

*Factor B= overutilization*

- Illegal collection and poaching of thick-billed parrots is reduced by enforcing existing environmental laws, regulations, plans, and policies for parrot protection .

*Factor D=inadequacy of regulations*

- Existing laws, regulations, plans, and policies to protect thick-billed parrot habitat from illegal harvesting, clearing, and fires are enforced.

*Factor E= other natural or manmade factors*

- A population viability assessment is conducted to determine the size and number of populations necessary to meet the minimum population standards, and these data are incorporated into recovery criteria as appropriate.
- A statistically sound and peer reviewed parrot monitoring protocol is developed and implemented to document population trend.

**2.6. Threats Tracking Table**

SUMMARY OF THICK-BILLED PARROT LISTING FACTORS AND THREATS AND RECOVERY ACTIONS TO CONTROL THOSE THREATS				
Listing Factor	Threats	Recovery Criteria		Recovery Actions
		Demographic.....	Threats	
All	All threat factors	1, 2	1, 2, 3, 4, 5, 6, 7	2.1. Keep stakeholders informed on relevant TBPA legislation.
(A, B, C, D, E Collectively)	A= habitat modification or loss	1, 2	1, 2, 3, 4, 6, 7	2.2. Continuously assess the legal framework for TBPA conservation.
	B= overutilization	1, 2	1, 2, 3, 4, 5, 6, 7	2.4. Share species technical information with government entities.
	C= disease, predation	1, 2	2, 4, 6, 7	3.2. Establish local community watch groups.
	D= inadequacy of regulations	1, 2	2, 4, 6, 7	3.3. Encourage the public to report habitat/species violations.
	E= other natural or manmade factors	1, 2	2, 3, 4, 6, 7	4.3. Work with private landowners.
		1, 2	2	5.4. Evaluate ecotourism impacts to species.
		1, 2	2, 3, 4, 6, 7	7.4. Monitor main threats and its effects
		1, 2	1, 2, 3, 4, 5	9.9. Study various aspects of species ecology
		1, 2	1, 2, 3, 4, 5	10.3. Develop relevant GIS layers
		1, 2	1, 2, 3, 4, 5, 6, 7	12.4. Inform the public on conservation successes and actions.
		1, 2	2, 3, 4, 5, 6, 7	12.5. Inform and engage local communities.
		1, 2	2, 3, 4, 5, 6, 7	12.6. Emphasize importance of TBPA conservation to the public.
		1, 2	2, 5	15.3. Encourage U.S. researchers and institutions in conservation of Mexican parrot populations close to U.S.
Factor A	Population and habitat loss	1, 2	2	1.1. Have Madera and Las Pomas (Chihuahua) decreed federally protected.
		1, 2	2, 3, 4, 7	1.2. Protect trees for nesting and feeding.
		2	2, 3, 4, 7	1.3. Protect habitat through conservation

				easements and on-the-ground actions.
		1, 2	2, 3, 4, 7	1.4. Strengthen protection of private reserves.
		1, 2	2, 3, 4	1.7. Promote sound land use planning at key sites.
		2	2, 3, 4	1.8. Establish Integrated Forest Fire Management programs.
		1, 2	2, 6, 7	3.1. Request from PROFEPA law enforcement actions.
		1, 2	2, 3, 6, 7	3.4. Reinforce law enforcement inspections and monitoring activities.
		1, 2	2, 4	4.2. Exclude mature tree stands and snags from forest harvesting.
		2	2, 3, 4	4.4. Promote the use of different legal tools to protect habitat.
		2	2, 3, 4	4.6. Promote environmentally friendly projects.
		1		5.1. Build, install, and monitor at artificial nest boxes.
		1		8.4. Estimate population numbers in priority areas.
		2	2, 3	8.5. Estimate available habitat in priority areas.
		1	2	9.2. Quantify availability of nest sites.
		2	2, 4	9.3. Determine level of pine cone production in nesting areas.
		2	2, 5	9.8. Evaluate habitat composition and quality for potential reintroductions
		1		10.1. Monitor breeding populations.
		1		10.2. Estimate population size.
		2	2,4	10.4. Monitor habitat changes at nesting sites.
		1, 2	2, 3	13.1. Encourage low environmental impact activities.
		2	2, 3, 6, 7	13.2. Develop sustainable community ecotourism projects.
		2	2, 3, 6, 7	13.3. Train local guides on developing ecotourism projects.
		2	2, 3, 6, 7	13.4. Train community members on 'nature appreciation' themed projects.
		2	2, 3, 6, 7	13.5. Include indigenous groups in ecotourism planning and implementation.
		1	2, 3	13.7. Train CONANP personnel on monitoring protocols.
		1, 2	1, 2, 3, 4, 5, 6, 7	14.1. Develop partnerships with Mexican NGOs and agencies.
		2	2, 3, 4	14.3. Support efforts in Mexico to conserve habitat.
Factor A	Habitat Modification (Management)	1, 2	2, 3, 4	1.4. Strengthen protection of private reserves.
		1, 2	2, 3, 6, 7	1.5. Identify and control access points to key nesting and perching areas.
		1, 2	2, 6, 7	1.6. Install educational and regulatory signage in nesting areas.
		1, 2	2, 3, 4	1.7. Promote sound land use planning at key sites.
		2	3, 4	1.8. Establish Integrated Forest Fire Management programs.
		2	3, 4	1.9. Identify and control pests and diseases of trees in parrot habitat.
		2	2, 3, 4	2.3 Address habitat development through legal prevention and mitigation measures.
		2	2, 3, 4	4.5. Encourage sustainable management of watersheds
		1, 2	2, 3, 4	4.7. Promote payments for environmental services to landowners
		2	2, 3, 4	8.6. Promote land use planning processes to benefit priority areas.
		1		9.4. Determine a suitable design for artificial nests.
		1, 2	2, 3, 6, 7	11.1. Design school environmental education curriculum
		1, 2	2, 3, 6, 7	11.2. Prepare outreach materials.
		1, 2	2, 3, 6, 7	11.3. Prepare information handbook for environmental educators.

		1, 2	2, 6, 7	11.4. Organize community training workshops.
		1, 2	2, 3, 6, 7	11.5. Conduct outreach and education activities in local communities.
		1, 2	2, 3, 6, 7	12.1. Design and distribute outreach and educational materials.
		2	2, 3, 6, 7	12.2. Broadcast informational radio spots.
		1, 2	2, 3, 6, 7	12.3. Prepare and distribute informational videos.
		2		15.1. Implement strategies to preserve U.S. historic habitat.
		2		15.2. Collaborate with Mexico to conserve borderlands habitat.
Factor A	Habitat Degradation	2	2, 3, 4	1.7. Promote sound land use planning at key sites.
		2	2, 3, 4	2.3. Address habitat development through legal prevention and mitigation measures.
		2	3, 4	6.1. Identify degraded areas for restoration.
		2	3, 4	6.2. Implement soils and forest restoration and conservation actions
		1, 2	3, 4	7.1. Develop a forest fire danger map
		1, 2	3, 4	7.2. Implement wildfire prevention measures
		2	3, 4	7.3. Implement reforestation programs.
		1, 2	2, 3, 4	8.6. Promote land use planning processes to benefit priority areas.
		1, 2	2, 4	10.4. Monitor habitat changes at nesting sites.
Factor A	Information Needs	2	3, 4	1.9. Identify and control pests and diseases of trees in parrot habitat
		1, 2	1, 2	4.1. Identify new nesting and feeding areas.
		1, 2	1, 2, 3, 5	8.1. Compile historical and current species distribution information
		1, 2	1, 2, 3, 4	8.2. Identify key sites (nesting, feeding, and migration areas).
		2	1, 2, 3	8.3. Field verify site occupancy and suitable habitat.
		1, 2	1, 3	9.1. Determine migration and dispersal patterns.
		1	5	9.5. Research feasibility of reintroductions.
		1		9.6. Assess current diseases in TBPA wild populations.
		1		9.7. Evaluate genetic variability and population dynamics.
		2	3	10.5. Evaluate winter habitat.
		1, 2	1, 2, 3, 4, 5	13.6. Encourage species research by academia.
		1, 2	1, 2, 3, 4, 5	14.2. Support field work in Mexico to improve knowledge of species ecology
		1		14.4. Support work in Mexico to better assess population numbers and trends.
		1	5	15.4. Support research efforts to evaluate translocations.
Factor B	Overutilization	1, 2	2, 3, 6, 7	3.1. Request from PROFEPA law enforcement actions.
		1, 2	2, 3, 6, 7	3.4. Reinforce law enforcement inspections and monitoring activities.
		1		5.2. Develop guidelines for handling of confiscated parrots.
		1		5.3. Develop handbooks for dealing with parrots held in captivity.
Factor C	Disease, Predation			N/A
Factor D	Inadequacy of Regulation	1, 2	6, 7	14.6. Encourage enforcement of parrot regulations in Mexico
Factor E	Other Natural or Manmade Factors	1, 2	1, 2	4.1. Identify new nesting and feeding areas.
		1		5.1. Build, install, and monitor at artificial nest

				boxes.
		1, 2	1, 2, 3	8.2. Identify key sites (nesting, feeding, and migration areas).
		1		8.4. Estimate population numbers in priority areas.
		1	1, 2	9.2. Quantify availability of nest sites.
		1		9.4. Determine a suitable design for artificial nests.
		1	5	9.5. Research feasibility of reintroductions.
		1, 2	5	9.8. Evaluate habitat composition and quality for potential reintroductions
		1		10.1. Monitor breeding populations.
		1		14.5. Support work by biologists in Mexico to actively monitor and manage breeding populations.
		1	5	16.1. Support research efforts to evaluate translocations.
		2	5	16.2. Conduct a review of U.S. historical habitat
		1	5	16.3. Evaluate the need and efficacy of conducting translocations of individuals into U.S.

### **3.0. RECOVERY PROGRAM**

#### **3.1. Outline of Recovery Actions**

The most step-downed recovery actions are discrete, specific actions and are the actions listed in the Implementation Schedule found at the end of this document. Recovery actions 1 through 13 were derived from the PACE (CONANP 2009), unless indicated otherwise. Those PACE actions that address how to implement the PACE are not repeated because, although they are important, they are not included in the body of a U.S. recovery plan. Recovery actions 14 through 16 were developed for U.S. lead actions. Thick-billed parrots are abbreviated as TBPA.

#### **1. Strengthen or implement protection measures in parrot nesting and dispersal areas, and establish new areas for protection**

- 1.1. Undertake all the necessary steps to decree Madera and Las Pomas (Chihuahua) as Federal Sanctuaries.
- 1.2. Identify priority habitat to facilitate forest resource planning through Forest Management Units with the goal of protecting trees for nesting and feeding.
- 1.3. Take actions to protect habitat through signing legal agreements, fencing properties, building fire barriers, and signage.
- 1.4. Strengthen protection of private reserves through the implementation of ecological easements, conservation certifications, and other programs.
- 1.5. Identify and control access points to primary nesting and perching areas.
- 1.6. Install educational and regulatory signage in primary nesting areas.
- 1.7. Promote sound land use planning and its application in known TBPA sites.
- 1.8. Establish Integrated Forest Fire Management programs in collaboration with CONAFOR.
- 1.9. Evaluate forest health to identify and control pests and diseases of trees in parrot habitat.<sup>1</sup>

#### **2. Educate the various government entities and the public on the importance of enforcing existing laws and regulations to protect parrots.**

- 2.1. Keep all stakeholders informed on current national and international legislation relevant to the protection of the TBPA.
- 2.2. Promote evaluation methods to the legal framework related to the protection and management of the parrot and suggest modifications when needed.
- 2.3. Establish legal prevention and mitigation measures to address development or land-use changes within TBPA distribution areas.
- 2.4. Share species technical information to help government officials in decision-making, as requested.

#### **3. Increase surveillance and prevent illegal activities related to poaching and illegal trade of parrots, and illegal modification of parrot habitat.**

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<sup>1</sup> This recovery action is not included in the PACE (2010) but is recommended by Mexico partners

- 3.1. Request from PROFEPA law enforcement inspections and monitoring at critically important TBPA sites.
  - 3.2. Promote the establishment or enhancement of local community watch groups to identify and control habitat destruction and capture of parrots for the illegal pet trade.
  - 3.3. Encourage the general public to report violations dealing with the illegal capture and trade of TPBAs and any unlawful habitat modifications.
  - 3.4. Reinforce law enforcement inspections and monitoring activities in coordination with the state and municipal governments.
- 4. Develop and implement actions to protect the habitat necessary to support viable parrot populations. Maintain mature trees and snags with characteristics that provide nesting and feeding areas.**
- 4.1. Identify areas with suitable habitat currently used or that could potentially be used for nesting and feeding.
  - 4.2. Recommend to SEMARNAT areas to exclude from authorized use of forestry resources within current and potential habitat, including mature tree stands and snags with characteristics that provide necessary nesting and feeding areas.
  - 4.3. Promote protection of the parrot to landowners of private parcels located within TBPA habitat.
  - 4.4. Promote the use of different legal tools such as ejido reserves, ecological easements, and usufructs to protect lands within occupied habitat with the goal of regulating and modifying land use practices.
  - 4.5. Encourage the management of watersheds in such a way that generates financial resources through habitat conservation and payments for environmental services.
  - 4.6. Collaborate with the Ministry of SAGARPA (Rural Development) to promote environmentally friendly projects among the communities located in the parrot's known distribution areas.
  - 4.7. Promote payments for environmental services to landowners involved in management and conservation actions that contribute to maintaining TBPA populations.
- 5. Develop monitoring and management guidelines that promote population increases in parrots.**
- 1.1. Build, install, and monitor at least 40 artificial nest boxes in each thick-billed parrot nesting site.
  - 1.2. Develop guidelines for handling confiscated parrots.
  - 1.3. Develop handbooks for managing, rehabilitating, and reintroducing parrots held in captivity.
  - 1.4. Evaluate the impact to the species from ecotourism on TBPA protected areas.
- 6. Restore suitable habitat that has been degraded or eliminated within the historical distribution of species.**
- 6.1. Identify degraded areas in need of restoration that are considered important to the conservation of the species.
  - 6.2. Implement soils and forest restoration and conservation actions such as gabions construction, retention berms, cover crops, reforestation, fluvial terraces, brush piles,

dead wood removal (to reduce fuel loads), living fences, and resting the land to decrease habitat loss in TBPA priority areas.

**7. Prevent (minimize) destructive anthropogenic activities such as fires, erosion, and deforestation that result in habitat loss and degradation.**

- 7.1. Develop a forest fire danger map encompassing important TBPA nesting areas.
- 7.2. Implement wildfire prevention measures (firebreaks, controlled burns, and community watch) within TBPA habitat.
- 7.3. Implement reforestation programs within TBPA habitat, with a special emphasis in areas that harbor tree species used by the parrot.
- 7.4. Monitor the effect of the main threats to TBPA populations and its habitat and evaluate impacts on population trends.

**8. Compile and verify information on the current distribution of the parrot, including areas used for nesting, feeding, migration, and wintering.**

- 8.1. Compile historical and current distribution information for the TBPA.
- 8.2. Identify key sites (nesting, feeding, and migration areas) through species distribution models and interviews with local residents.
- 8.3. Verify in the field the presence of the species and suitable habitat.
- 8.4. Estimate species population sizes in priority areas.
- 8.5. Estimate available habitat in priority areas.
- 8.6. Promote joint actions in municipal and state land use planning processes focused on preventing land use changes in conservation priority areas.

**9. Promote the development of research on the parrot and its habitat that leads to effective protection, management, and recovery actions.**

- 9.1. Use satellite telemetry to determine migration and dispersal patterns of adult and juvenile parrots.
- 9.2. Implement field studies to quantify availability of nest sites.
- 9.3. Determine level of pine cone production in nesting areas.
- 9.4. Conduct studies to determine a suitable design for artificial nests.
- 9.5. Conduct research to better understand the physical, biological, and adaptability requirements of the species with the end goal of being able to conduct reintroduction efforts.
- 9.6. Conduct an assessment of current diseases in TBPA wild populations.
- 9.7. Implement population genetic studies to evaluate genetic variability and understand the dynamics of the population.
- 9.8. Evaluate habitat composition and quality using tools such as HEP (Habitat Evaluation Procedures) and HQI (Habitat Quality Index) models to identify potential areas for species reintroduction efforts.
- 9.9. Conduct studies to better understand the ecological requirements of the species to implement effective conservation strategies and map forest elements useful to the species such as nesting and shelter sites, water sources, food, perches, and mineral banks.

**10. Monitor parrots and habitat to assess population trends and habitat conditions.**

- 10.1. Implement or continue existing monitoring studies of breeding populations.
- 10.2. Implement monitoring studies to estimate population size.
- 10.3. Develop a Geographical Information System (GIS) to determine land cover of habitat used, vegetation types, ecological features, wildfire impacts, and land use changes and trends.
- 10.4. Monitor habitat regeneration or deterioration as well as forest restoration at nesting sites.
- 10.5. Evaluate winter habitat to better understand other threats to the populations.

**11. Promote a culture of conservation for the parrot and its habitat through outreach efforts and active public participation.**

- 11.1. Design an environmental education curriculum for schools in the local communities (especially those close to nesting sites), as well as urban and rural schools.
- 11.2. Prepare printed materials and audiovisual presentations to conduct outreach on TBPA biology, ecology, protection status, and threats, and conservation actions contributing to recovery.
- 11.3. Prepare a TBPA information handbook for environmental educators.
- 11.4. Organize community training workshops for school teachers, environmental education staff, and people interested in conducting outreach in communities near nesting areas to encourage conservation of the species and its forests.
- 11.5. Conduct outreach and education activities including workshops, field trips, field activities, contests, clean-up activities, and public meetings, in the communities adjacent to TBPA habitat.

**12. Implement outreach campaigns that allow the public to understand the conservation status of the species and actions necessary conserve it.**

- 12.1. Design and distribute posters, fliers, comic strips, games, printed banners, and activity books to educate the public on the importance of the Thick-billed Parrot and its habitat.
- 12.2. Sign agreements with regional radio stations to broadcast informational spots.
- 12.3. Prepare and distribute informational videos on the TBPA and its habitat.
- 12.4. Inform the public (through printed materials) on conservation successes and actions taken to protect the species.
- 12.5. Share information on threats to the TBPA and its habitat with communities adjacent to occupied areas to involve these communities in conservation of the species.
- 12.6. Emphasize the importance of the general public actively participating in the protection, conservation, and recovery of the species and its habitat.

**13. Seek collaborations with communities, associations, institutions, and other stakeholders to facilitate species and habitat conservation through training and capacity building.**

- 13.1. Encourage activities with low environmental impact among the communities located within distribution areas of the parrot.
- 13.2. Develop community ecotourism projects jointly with tourism companies to limit access through fees, and to provide lodging and local guides in areas inhabited by TPBA.
- 13.3. Train local guides to develop ecotourism projects that are harmless to the species and to assist in monitoring their populations.

- 13.4. Train people (lodge owners, guides, etc.) living in communities close to TBPA priority areas to focus on a 'nature appreciation' theme in coordination with the Office of Tourism.
- 13.5. Include indigenous groups living in TBPA inhabited areas in the planning and implementation of ecotourism projects.
- 13.6. Encourage participation by students and graduates on species projects.
- 13.7. Train CONANP personnel on censusing populations and monitoring nesting success in TBPA sites falling within Natural Protected Areas.

**14. Assure the long-term viability of thick-billed parrot conservation by cooperating with partners in Mexico and providing any available technical or financial support for implementing recovery actions.**

- 14.1. Develop partnerships with Mexican NGOs and agencies to support implementation of recovery actions.
- 14.2. Support field work in Mexico to better understand the biology of the species including better defining the wintering ranges of the known breeding populations.
- 14.3. Support effort to assess, protect, and restore sufficient habitat to sustain viable populations in Mexico.
- 14.4. Support work by biologists in Mexico to more accurately assess population numbers and trends.
- 14.5. Support work by biologists in Mexico to actively monitor and manage breeding populations.
- 14.6. Encourage enforcement of psittacid (parrot family) regulations in Mexico to increase protection of TBPAs

**15. Preserve and enhance U.S. historical habitat and augment cross border connectivity of habitat.**

- 15.1. Develop and implement strategies to preserve and enhance historical habitat in the mountains of Southeastern Arizona and Southwestern New Mexico.
- 15.2. Collaborate with Mexico to identify specific strategies to preserve and enhance borderlands habitat (northwest Chihuahua, northeast Sonora) including the northern most breeding site of Mesa de las Guacamayas and potential habitat in Sierra San Luis.
- 15.3. Encourage U.S. based researchers and institutions to continue or enhance conservation efforts of Mexican parrot populations closest to the U.S.

**16. Evaluate feasibility, risks, and appropriateness of conducting translocations of individuals into historical and potential habitats as part of a comprehensive conservation strategy.**

- 16.1. Support research efforts to evaluate techniques for translocating parrots for the potential establishment or reestablishment of new populations.
- 16.2. Conduct a review of U.S. historical habitat, current habitat management, and habitat connectivity with Mexico.
- 16.3. Assess the feasibility, risks, and appropriateness of translocating parrots into historical and potential habitats in the U.S.

### **3.2. Narrative of Recovery Actions**

A narrative for the recovery actions was not included in the PACE and was not developed for this addendum.

## **4.0. IMPLEMENTATION SCHEDULE**

The following implementation schedule outlines priorities, potential or responsible parties, and estimated costs for the specific actions for recovering the thick-billed parrot. It is a guide to meeting the goals, objectives, and criteria from Section 2 RECOVERY 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 thick-billed parrot.

### **4.1. Responsible Parties and Cost Estimates**

The value of this plan depends on the extent to which it is implemented; the USFWS has neither the authority nor the resources to implement many of the proposed recovery actions. The recovery of the thick-billed parrot is dependent upon the voluntary cooperation of many other organizations and individuals who are willing to implement the recovery actions. The implementation schedule identifies agencies and other potential “responsible parties” (private and public) to help implement the recovery of this species. This plan does not commit any “responsible party” to carry out a particular recovery action or to expend the estimated funds. It is only recognition that particular groups may possess the expertise, resources, and opportunity to assist in the implementation of recovery actions. Although collaboration with private landowners and others is called for in the recovery plan, no one is obligated by this plan to any recovery action or expenditure of funds. Likewise, this schedule is not intended to preclude or limit others from participating in this recovery program.

The cost estimates provided are not intended to be a specific budget but are provided solely to assist in planning. The total estimated cost of recovery, by priority, is provided in the Executive Summary. The schedule provides cost estimates for each action on an annual or biannual basis. Estimated funds for agencies included only project-specific contract, staff, or operations costs in excess of base budgets. They do not include ordinary operating costs (such as staff) for existing responsibilities.

### **4.2. Recovery Action Priorities And Abbreviations**

Priorities in column 1 of the following Implementation Schedule are assigned as follows:

**Priority 1** - An action that must be taken to prevent extinction or to prevent the species from declining irreversibly in the foreseeable future.

**Priority 2** - An action that must be taken 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 provide for full recovery of the species.

The assignment of these priorities does not imply that some recovery actions are of low importance, but instead implies that lower priority items may be deferred while higher priority items are being implemented.

**The following abbreviations are used in the Implementation Schedule:**

AGFD = Arizona Game and Fish Department

AZA = Association of Zoos and Aquariums

CBP = U.S. Customs and Border Protection

CESTAC = Consejo Ecoregional Sierra Tarahumara

CITES = Convention on International Trade in Endangered Species of Wild Fauna and Flora

CNA = Comisión Nacional del Agua

CONAFOR = Comisión Nacional Forestal

CONABIO = Comisión Nacional para el Conocimiento y uso de la Biodiversidad

CONANP = Comisión Nacional de Áreas Naturales Protegidas

DOW = Defenders of Wildlife

EJIDOS = Ejidos Ubicados dentro de las zonas de anidacion de la Cotorra Serrana Occidental

GOBIERNOS ESTATALES = Gobiernos Estatales de Chihuahua y Durango, México

INEGI = Instituto Nacional de Estadística y Geografía

ITESM = Instituto Tecnológico y de Estudios Superiores de Monterrey

NAT = Naturalia

NMDGF = New Mexico Department of Game and Fish

NMSU = New Mexico State University PL = Private Landowners

PROFEPA = Procuraduría Federal de Protección al Ambiente PRNA = Pronatura

PRONATURA = Pronatura

RAN = Registro Agrario Nacional

SAGARPA = Secretaria de Agricultura, Ganadería, Desarrollo Rural, Pesca y Alimentación

SCT = Secretaría de Comunicaciones y Transportes

SECTUR = Secretaria de Turismo

SEM = Secretaría de Medio Ambiente y Recursos Naturales (SEMERNAT)

UACH = Universidad Autónoma de Chihuahua

UANL = Universidad Autónoma de Nuevo León

UA = University of Arizona

UAAAN = Universidad Autónoma Agraria Antonio Narro

UMAFOR = Unidad de Manejo Forestal

UNAM = Universidad Nacional Autónoma de México (National Autonomous University of Mexico)

USFWS = U.S. Fish and Wildlife Service

### 4.3. Implementation Schedule

The actions presented in Spanish in this table are taken directly from the PACE (pages 41-52). For consistency, the original Spanish wording for each action has been left intact (actions in Spanish are described in the PACE as encompassing both the thick-billed parrot and the maroon-fronted parrot, as appropriate). However all the information (e.g., priority number, Recovery Criterion Number, etc) presented in this table for each action only addresses the thick-billed parrot. Action 1.9 in this table does not appear in the PACE, but was added in consultation with the Mexican biologists. This table also excludes 4 actions that appear in the PACE under “Evaluation and Follow-up”, because they had an administrative focus. Actions 1.1 through 13.7 are included in the PACE and costs were estimated by Mexican partners. Actions 14.1 through 16.3 were developed for U.S. based recovery tasks and were not translated into Spanish.

Las acciones presentadas en español en esta tabla son tomadas directamente del PACE (paginas 41-52). Para mantener consistencia, se ha tomado el texto original de cada acción según aparece en el PACE (las acciones descritas en el PACE abarcan ambas especies, la cotorra serrana occidental y la cotorra serrana oriental, según sea apropiado). Pero toda la información (nivel de prioridad, numero de criterio de recuperación, etcétera) presentada en esta tabla para cada acción, solo cubre a la cotorra serrana occidental. La acción denominada 1.9 en esta tabla no aparece en el PACE, fue agregada en consulta con biólogos de México. Esta tabla también excluye 4 acciones que aparecen en el PACE bajo “Componente de Evaluación y Seguimiento”, por ser mas de enfoque administrativo. Las acciones denominadas 1.1 a 13.7 están incluidas en el PACE y los costos fueron estimados por los socios en México. Las acciones denominadas 14.1 a 16.3 fueron desarrolladas por las tareas basadas en los EEUU y no fueron traducido al español.

Priority Number <i>Nivel de Prioridad</i>	Action Number <i>Número de la acción</i>	Action Description  <i>Descripción de acciones para la Recuperación (vienen del PACE paginas 41-52)</i>	Recovery Criterion Number(s)  <i>Numero(s) de Criterio de Recuperación</i>		Threats <i>Amenazas</i>	Action Duration (years) <i>Duración de actividad (en años)</i>	Responsible Parties  <i>Socio(s) responsables</i>	Is USFWS Lead? <i>Actividad liderada por USFWS?</i>	Total Cost (\$1,000s) <i>Costo Total (en miles USD)</i>	Cost per Year (by \$1,000s) <i>Presupuesto estimado por año (en miles USD)</i>					Comments  <i>Comentarios</i>
			Demo-Graphic	Threats						2013	2014	2015	2016	2017	
1	1.1	Have Madera and Las Pomas (Chihuahua) decreed federally protected. ----- Realizar las gestiones necesarias para decretar como Santuario Federal las zonas conocidas como Madera, Mesa de las Guacamayas, Tutuaca, Heredias y las Pomas (Chihuahua), y zonas en el rango invernal; Las bufas, California, y San Miguel de las Cruces (Durango).	1,2	2	A	<4	CONANP, PRONATURA	No	40	15	15	10	-	-	Other areas proposed by Mexican biologists for protection, and not included in the PACE (2009) actions include: Mesa de las Guacamayas, Tutuaca, Heredias (Chihuahua), and Las bufas, California, San Miguel de las Cruces (Durango) in the wintering range.  Incluye otras áreas propuestas para

																proteccion por los biólogos Mexicanos y no incluidas en las acciones del PACE (2009): Mesa de las Guacamayas, Tutuaca, Heredias (Chihuahua) y areas en el rango invernal; Las bufas, California, y San Miguel de las Cruces (Durango).
1	1.2	Protect trees for nesting and feeding. ----- Identificar los hábitats críticos o prioritarios de las cotorras serranas para planear el aprovechamiento forestal, a través de las Unidades de Manejo Forestal con el fin de conservar el arbolado propicio para la anidación y alimentación de las cotorras serranas.	1,2	2,3,4,7	A	<5	ITESM, PRONATURA	No	25	15	10	-	-	-		
1	1.3	Protect habitat through conservation easements and on-the-ground actions. ----- Efectuar acciones de protección de tierras, las cuales incluyen la firma de acuerdos legales, cercado de predios, brechas cortafuegos, y señalamientos.	2	2,3,4,7	A	4	PRONATURA, CONANP	No	956	-	239	239	239	239		
2	1.4	Strengthen protection of private reserves. ----- Fortalecer el nivel de protección de las reservas privadas, a través de servidumbres ecológicas y certificados de conservación, entre otros mecanismos.	1,2	2,3,4,7	A	<5	PL, EJIDOS, PRONATURA, ITESM, CONANP	No	40	10	10	10	10	-		

1	1.5	Identify and control access points to key nesting and perching areas. ----- Identificar y controlar los accesos a las principales áreas de anidación y dormideros de cotorras serranas.	1,2	2,3,6,7	A	<3	ITESM, CONANP	No	20	7	7	6	-	-	
2	1.6	Install educational and regulatory signage in nesting areas. ----- Instalar señalización informativa y restrictiva en las principales áreas de anidación de cotorras serranas.	1,2	2,6,7	A	<5	PRONATURA, CONANP	No	216	44	43	43	43	43	
1	1.7	Promote sound land use planning at key sites. ----- Promover la realización y ejecución de Programas de Ordenamiento Ecológico del Territorio en sitios de ocurrencia de ambas especies.	1,2	2,3,4	A	<5	GOBIERNOS ESTATALES CONANP PRONATURA	No	50	-	25	-	25	-	
1	1.8	Establish Integrated Forest Fire Management programs. ----- Efectuar programas de manejo y control integrado del fuego en los bosques en colaboración con la Comisión Nacional Forestal (CONAFOR).	1,2	2,3,4	A	<3	PRONATURA, CONANP, CONAFOR	No	120	40	40	40	-	-	
1	1.9	Evaluate forest health to identify and control pests and diseases of trees in parrot habitat <sup>2</sup>  Identificar, zonificar y controlar plagas y enfermedades de arbolado	2	3,4	A	<10	CONAFOR, UMAFOR, UAAAN	No	1280	128	128	128	128	128	Costs calculated for 10 years. Los costos se calculan para 10 años.

<sup>2</sup> This action was not included in the PACE, but was provided by Mexican biologists.

		en el hábitat de distribución de Cotorra Serrana Occidental													
1	2.1	Keep stakeholders informed on relevant TBPA legislation. ----- Difundir entre los diferentes sectores involucrados en la protección y conservación de las cotorras serranas y su hábitat, la legislación nacional e internacional vigente aplicable.	1,2	1,2,3,4,5,6,7,	A,B, C,D, E	< 3	PROFEPA, PRONATURA, CONANP, GOBIERNOS ESTATALES	No	30	10	10	10	-	-	Includes cost for Action 2.2.  Los costos incluyen acción 2.2.
2	2.2	Continuously assess the legal framework for TBPA conservation. ----- Promover y difundir mecanismos de evaluación y en su caso modificación del Marco Jurídico vigente entre los sectores involucrados con la conservación, protección y manejo.(Costo incluido en el criterio anterior)	1,2	1,2,3,4,6,7	A,B, C,D, E	<5	PROFEPA, PRONATURA, CONANP, GOBIERNOS ESTATALES	No	-	-	-	-	-	-	Costs included in Action 2.1.  Costos incluidos en acción 2.1.
1	2.3	Address habitat development through legal prevention and mitigation measures. ----- Diseñar medidas de prevención legal y mitigación de impactos que puedan ocurrir por la implementación de desarrollos o cambios de uso de suelo en áreas de distribución de las cotorras serranas.	2	2,3,4	A	<5	PROFEPA, PRONATURA, CONANP, GOBIERNOS ESTATALES	No	30	6	6	6	6	6	
1	2.4	Share species technical information with government entities. ----- Proporcionar, a solicitud de	1,2	1,2,3,4,5,6,7	A,B, C,D, E	<5	USFWS, AGFD, ITESM, PRONATURA	No	10	-	10	-	-	-	

		las autoridades que así lo requieran, información técnica de la especie que ayude en la correcta toma de decisiones.														
1	3.1	Request from PROFEPA law enforcement actions. ----- Solicitar operativos de inspección y vigilancia por parte de la PROFEPA en las áreas críticas identificadas para las cotorras serranas, entre otros sitios.	1,2	2,6,7	A,B	<5	PROFEPA, CONANP, GOBIERNOS ESTATALES	No	11.52	5.76	5.76	-	-	-		
1	3.2	Establish local community watch groups. ----- Promover la formación de comités de vigilancia participativa y la mejora de los ya existentes con la finalidad de identificar y controlar el aprovechamiento ilegal de cotorras serranas y la destrucción de su hábitat.	1,2	2,4,6,7	A,B, C,D, E	<5	PL, EJIDOS PRONATURA, CONANP	No	30	10	-	10	-	10	Costs include Action 3.4.  Los costos incluyen acción 3.4.	
1	3.3	Encourage the general public to report habitat/species violations. ----- Promover entre la sociedad en general, la detección y denuncia pública de la captura y tráfico ilegal de estas aves así como de la alteración ilegal de su hábitat.	1,2	2,4,6,7	A,B, C,D, E	<5	PRONATURA, CONANP, ITESM, PROFEPA, GOBIERNOS ESTATALES	No	25	5	5	5	5	5	Costs include Action 4.3.  Los costos incluyen acción 4.3.	
1	3.4	Reinforce law enforcement inspections and monitoring activities. ----- Reforzar las actividades de inspección y vigilancia en coordinación con los gobiernos estatales y municipales.	1,2	2,3,6,7	A,B	<5	PRONATURA, CONANP, CONAFOR, PROFEPA, GOBIERNOS ESTATALES	No							Costs included in Action 3.2.  Costos incluidos en acción 3.2.	
1	4.1	Confirm existing and identify new nesting and	1,2	1,2	A,E	<3	ITESM, SEMARNAT	No	12	6	6	-	-	-	Costs include Actions 8.3, 8.5, and 9.2.	

		feeding areas. ----- Identificar las áreas con hábitat adecuado que registren uso actual y potencial (posibilidad de uso futuro) para la anidación y alimentación de cotorras serranas.															Los costos incluyen acción 8.3, 8.5, y 9.2.
1	4.2	Exclude mature tree stands and snags from forest harvesting. ----- Proponer a la SEMARNAT, áreas de exclusión de autorizaciones de aprovechamientos maderables en aquellas áreas consideradas como hábitat actual y potencial para las cotorras serranas, incluyendo los arbolados con características requeridas por las cotorras para su anidación y alimentación.	1,2,	2,4	A	<5	CONANP, PRONATURA	No	64	16	16	16	16				
1	4.3	Work with private landowners. ----- Fomentar entre los titulares de predios ubicados en áreas consideradas como hábitat de cotorras serranas, la protección y conservación de las mismas.	1,2	2,3,4,6,7	A,B, C,D, E	<5	PL, EJIDOS PRONATURA, CONANP	No	-	-	-	-	-	-	-	-	Costs included in Action 3.3.  Costos incluidos en acción 3.3.
1	4.4	Promote the use of different legal tools to protect habitat. ----- Promover la aplicación de diferentes herramientas de protección legal de tierras en donde habitan las cotorras tales como Reservas Ejidales, Servidumbres Ecológicas y Usufructos, con la finalidad de regular el aprovechamiento de estas	2	2,3,4	A	<5	PRONATURA, CONANP, CONAFOR	No	306	62	61	61	61	61	61	61	Costs include Action 4.7.  Los costos incluyen acción 4.7.

		áreas y de replanificar las actividades productivas.													
2	4.5	Encourage sustainable management of watersheds. ----- Fomentar el manejo de cuencas hidrológicas con el fin de generar recursos a través de la conservación del hábitat de las especies y la generación de pago por servicios ambientales.	2	2,3,4	A	<5	PRONATURA, CONANP, CNA, CONAFOR	No	60	12	12	12	12	12	Costs include Action 13.1.  Los costos incluyen acción 13.1.
3	4.6	Promote environmentally friendly projects. ----- Efectuar proyectos productivos amigables al medio ambiente en las comunidades de las regiones donde se distribuyen las cotorras, en colaboración con la Secretaría de Agricultura, Ganadería, Desarrollo Rural, Pesca y Alimentación (SAGARPA).	2	2,3,4	A	<5	PRONATURA, ITESM, CONANP, SAGARPA	No	82	17	17	16	16	16	
2	4.7	Promote payments for environmental services to landowners. ----- Promover el pago de servicios ambientales para aquellos propietarios que realicen acciones de manejo y conservación encaminadas al mantenimiento de poblaciones de cotorras serranas en México	1,2	2,3,4	A	<5	PRONATURA, CONANP, CONAFOR	No	-	-	-	-	-	-	Costs included in Action 4.4.  Costos incluidos en acción 4.4.
2	5.1	Build, install, and monitor artificial nest boxes. ----- Diseñar, instalar y monitorear al menos 40 nidos artificiales para la cotorra serrana occidental en cada sitio de anidación detectado.	1	-	A,E	<5	ITESM, EJIDOS	No	19	4	4	4	4	3	Costs include Actions 9.4.  Los costos incluyen acción 9.4.
1	5.2	Develop guidelines for handling confiscated	1	-	B	<5	USFWS, AGFD, CITES,	No	8	4	4	-	-	-	

		parrots. ----- Desarrollar un protocolo para la canalización de ejemplares de cotorras serranas decomisados.					PROFEPA, SEMARNAT, AZA								
1	5.3	Develop handbooks for dealing with parrots held in captivity, rehabilitation, and for releases. ----- Elaborar manuales para el manejo de ejemplares de cotorras serranas en cautiverio, así como para la rehabilitación y reintroducción de ejemplares.	1	-	B	<5	USFWS, AGFD, CITES, AZA, ITESM	No	10	3	7	-	-	-	
2	5.4	Evaluate ecotourism impacts to species. ----- Evaluar el impacto que generan en las cotorras serranas la instauración de programas de ecoturismo de áreas protegidas con ocurrencia de estas especies.	1,2	2	A,B, C,D, E	<5	SECTUR, CONANP, ITESM	No	40	10	10	10	10	-	
1	6.1	Identify degraded areas for restoration. ----- Identificar áreas perturbadas que requieran acciones de restauración consideradas como prioritarias para la conservación de cotorras serranas.	2	3,4	A	4	ITESM, PRONATURA, UNAFOR, CONAFOR	No	20	10	10	-	-	-	
1	6.2	Implement soils and forest restoration and conservation actions. ----- Establecer acciones de restauración y conservación de suelos y áreas forestales tales como la instalación de presas de gavión, bordos, empalizadas, siembra de cultivos, reforestación, uso de terrazas, líneas con	2	3,4	A	5	PRONATURA, ITESM, CONNP, CONAFOR, UMAFOR	No	170	34	34	34	34	34	Costs include Action 7.3.  Los costos incluyen acción 7.3.

		material vegetal muerto, remoción de madera muerta (material combustible), cercos vivos e inclusive promover el descanso del aprovechamiento, etc. que disminuyan los efectos de pérdida de hábitat en zonas prioritarias para la conservación de cotorras serranas.													
1	7.1	Develop a forest fire danger map. ----- Elaborar un mapa de riesgo de incendios forestales que incluya la zonificación de los sitios de anidación más importantes para ambas especies	1,2	3,4	A	<4	PRONATURA, CONANP, CONAFOR, ITESM, UMAFOR	No	15	5	5	5	-	-	
1	7.2	Implement wildfire prevention measures. ----- Efectuar acciones de prevención de incendios (apertura de brechas cortafuego, quema controlada, vigilancia participativa) dentro de las áreas consideradas como hábitat de cotorras serranas.	1,2	3,4	A	<5	USFS, PRONATURA, CONANP, CONAFOR, ITESM, UMAFOR	No	192	39	39	38	38	38	
1	7.3	Implement reforestation programs. ----- Implementar programas de reforestación en áreas catalogadas como hábitat con especial énfasis en áreas con presencia de especies vegetales utilizadas por estas aves	2	3,4	A	>5	USFS, PRONATURA, ITESM, CONANP, CONAFOR, UMAFOR	-	-	-	-	-	-	-	Costs are included in Action 6.2.  Costos incluidos en acción 6.2.
1	7.4	Monitor main threats and its effects ----- Monitorear el efecto de los principales factores de riesgo identificados para las poblaciones de las cotorras	1,2	2,3,4,6,7	A,B, C,D, E	<5	PRONATURA, ITESM, CONANP, CONAFOR, UMAFOR	No	20	5	5	5	-	5	

		serranas y su hábitat y evaluar su impacto en las tendencias poblacionales de estas aves.													
1	8.1	Compile historical and current species distribution. ----- Compilar información histórica y actual de la distribución de las cotorras serranas.	1,2	1,2,3,5	A	<5	ITESM, UACH, USFWS	No	11	4	4	3	-	-	
1	8.2	Identify key sites (nesting, feeding, and migration areas). ----- Identificar áreas clave (áreas de anidación, alimentación o de migración) para las dos especies mediante algoritmos de predicción y entrevistas con gente local.	1,2	1,2,3	A,E	4	ITESM, SEMARNAT	No	21	6	5	5	5	-	Costs include Action 8.3.  Los costos incluyen acción 8.3.
1	8.3	Field verify site occupancy and suitable habitat. ----- Corroborar en campo la presencia de las especies y la existencia del hábitat apropiado.	2	1,2,3	A	4	ITESM, SEMARNAT	No	-	-	-	-	-	-	Costs included in Action 4.1 and 8.2.  Costos incluidos en acción 4.1 y 8.2.
1	8.4	Estimate population numbers in priority areas. ----- Estimar las poblaciones de cotorras serranas en áreas prioritarias.	1	-	A,E	<5	ITESM, PRONATURA, UACH	No	51	11	10	10	10	10	
1	8.5	Estimate available habitat in priority areas. ----- Estimar la disponibilidad de hábitat de las cotorras serranas en áreas prioritarias.	2	2,3	A,E	<5	PRONATURA, CONANP, ITESM	No	-	-	-	-	-	-	Costs included in Action 4.1  Costos incluidos en acción 4.1.
1	8.6	Promote land use planning processes to benefit priority areas. ----- Promover acciones coordinadas para el ordenamiento territorial	2	2,3,4	A	<5	GOBIERNOS ESTATALES PRONATURA, CONANP, ITESM	No	50	10	10	10	10	10	

		municipal y estatal, enfocadas a evitar cambios de uso de suelo en áreas prioritarias de conservación de las cotorras serranas.													
1	9.1	Determine migration and dispersal patterns. ----- Aplicar técnicas de telemetría con transmisores satelitales para determinar los movimientos de migración y dispersión de ejemplares adultos y juveniles.	1,2	1,3	A	<5	ITESM, PRONATURA,	No	111	38	37	36	-	-	
1	9.2	Quantify availability of nest sites. ----- Implementar estudios en campo para cuantificar la disponibilidad de sitios de anidación.	1	1,2	A,E	<5	ITESM, PRONATURA	No	-	-	-	-	-	-	Costs included in Action 4.1. Costos incluidos en acción 4.1
1	9.3	Determine level of pine cone production in nesting areas. ----- Determinar la producción de conos de pino consumibles por las cotorras en las áreas de reproducción	2	2,4	A	<5	ITESM, PRONATURA, CONANP	No	14	4	4	3	3	-	
1	9.4	Determine a suitable design for artificial nests. ----- Desarrollar estudios para obtener el diseño adecuado de nidos artificiales para la cotorra serrana occidental.	1		A,E	2	ITESM, PRONATURA	No	-	-	-	-	-	-	Costs included in Action 5.1. Costos incluidos en acción 5.1.
3	9.5	Research feasibility of reintroductions. ----- Efectuar estudios que permitan conocer los requerimientos físicos, biológicos y de adaptabilidad de La especie con la finalidad de poder efectuar reintroducciones.	1		A,E	7	ITESM, PRONATURA, AZA USFWS, AGFD	No	20	-	-	-	-	10	Calculated for 7 years. Calculado de 7 años.

1	9.6	Assess current diseases in TBPA wild populations. ----- Realizar un análisis de las enfermedades existentes en las poblaciones silvestres de cotorras serranas.	1		A	4	ITESM, PRONATURA, AZA, NMSU, SDZSP	No	25	6.25	6.25	6.25	6.25	-	
1	9.7	Evaluate genetic variability population dynamics. ----- Implementar estudios de genética poblacional para evaluar la variabilidad genética y conocer el funcionamiento poblacional de ambas especies.	1		A	<5	NMSU, AZA, ITESM, UANL	No	50	10	10	10	10	10	
1	9.8	Evaluate habitat composition and quality for potential reintroductions. ----- Evaluar las características y la calidad del hábitat de las cotorras serranas con la finalidad de identificar áreas potenciales para su reintroducción, utilizando herramientas como los modelos HEP (Procedimientos de Evaluación del Hábitat, por sus siglas en inglés) e HSI (Índice de Calidad del Hábitat, por sus siglas en inglés).	2	2,5	A,E	<5	ITESM, PRONATURA, INEGI, CNA, CONABIO, USFWS, AGFD	No	10	-	10	-	-	-	
1	9.9	Study various aspects of species ecology. ----- Efectuar estudios que permitan conocer los requerimientos ecológicos de las cotorras para permitir la implementación de estrategias efectivas para su conservación y generar mapas con los atributos del bosque de utilidad para estas especies como sitios de anidación, refugio, fuentes de agua, alimento,	1,2	1,2,3,4,5	A,B, C,D, E	<4	ITESM, PRONATURA, INEGI, CNA, CONABIO	No	10	-	10	-	-	-	

		dormideros, bancos de minerales y perchas													
1	10.1	Monitor breeding populations. ----- Implementar o dar continuidad a los estudios de monitoreo de las poblaciones reproductivas de cotorras serranas.	1	-	A,E	>5	ITESM, PRONATURA	No	13	3	-	3	-	3	Calculated for 5 years, every other year. Calculado de 5 años, cada año  Costs include Action 10.2. Los costos incluyen acción 10.2.
1	10.2	Estimate population size. ----- Implementar monitoreos para realizar estimaciones del tamaño poblacional de las dos especies de cotorra serrana.	1	-	A	>5	ITESM, PRONATURA, INEGI, CNA, CONABIO	No	-	-	-	-	-	-	Costs included in Action 10.1 and 11.5. Costos incluidos en acción 10.1 y 11.5.
1	10.3	Develop relevant Geographical Information System (GIS) layers. ----- Integrar un Sistema de Información Geográfica (SIG) con la finalidad de determinar la cobertura de hábitat utilizado y los tipos de vegetación disponible para las dos especies, las características ecológicas del mismo, el impacto de incendios y el cambio de uso de suelo, así como las tendencias de éste último, entre otros aspectos.	1,2	1,2,3,4,5	A,B, C,D, E	<5	CONAFOR, CONABIO, PRONATURA, ITESM, USFWS, AGFD, INEGI	No	33	23	10	-	-	-	
1	10.4	Monitor habitat changes at nesting sites. ----- Monitorear los procesos de regeneración o de deterioro del hábitat de estas especies así como la restauración forestal en los sitios de anidación.	2	2,4	A	>5	CONAFOR, UMAFOR, PRONATURA, ITESM, CONANP, USFWS	No	15	-	3	-	3	-	Calculated for 5 years, every other year.  Calculado de 5 años, cada año.
1	10.5	Evaluate winter habitat. ----- Evaluar el hábitat invernal	1,2	2,4	A	>5	ITESM, PRONATURA	No	15	3	3	-	3	-	

		de las cotorras para conocer otros factores de riesgo de las poblaciones.													
1	11.1	Design school environmental education curriculum. ----- Diseñar un programa de educación ambiental que pueda ser incorporado en el programa escolar de las comunidades locales (principalmente en los sitios de anidación de las cotorras), tanto de escuelas urbanas como de escuelas rurales.	1,2	2,3,6,7	A	<5	PRONATURA, ITESM, DOW	No	88	22	22	22	22	-	Costs include Actions 11.2 and 11.4.  Los costos incluyen acción 11.2 y 11.4.
1	11.2	Prepare outreach materials. ----- Desarrollar materiales impresos y audiovisuales que informen sobre las características biológicas de las dos especies, ecología, estado de riesgo, principales problemas que enfrenta y las acciones de conservación implementadas para su recuperación así como la importancia de estas últimas.	1,2	2,3,6,7	A	>5	PRONATURA, ITESM, CONANP, DOW	No	-	-	-	-	-	-	Costs included in Action 11.1.  Costos incluidos en acción 11.1
1	11.3	Prepare information handbook for environmental educators. ----- Desarrollar un manual con información de las dos especies dirigido a educadores ambientales.	1,2	2,3,6,7	A	4	PRONATURA, ITESM, CONANP, DOW	No	30	10	10	10	-	-	Costs include Action 12.2.  Los costos incluyen acción 12.2.
2	11.4	Organize community training workshops. ----- Implementar talleres de capacitación comunitaria dirigidos a profesores de escuela, educadores ambientales y personas interesadas en difundir	1,2,	2,6,7	A	<5	PRONATURA, ITESM, CONANP	No	-	-	-	-	-	-	Costs included in Action 11.1.  Costos incluidos en acción 11.1.

		información sobre estas especies para fomentar su conservación y la de los bosques en las comunidades aledañas a las áreas de anidación.														
1	11.5	Conduct outreach and education activities in local communities. ----- Efectuar actividades de educación y concientización social directamente con habitantes de las comunidades donde se localizan estas especies a través de talleres, excursiones, prácticas de campo, concursos, actividades de saneamiento, talleres de planeación participativa, etc.	1,2	2,3,6,7	A	<5	PRONATURA, ITESM, DOW	No	54	10	14	15	15	-		
2	12.1	Design and distribute outreach and educational materials. ----- Diseñar y distribuir carteles, trípticos, tiras cómicas, juegos, lonas, libros de actividades y otros materiales, con información sobre la importancia de ambas especies y su hábitat.	1,2	2,3,6,7	A	<5	PRONATURA, ITESM, CONANP, DOW	No	6	3	3	-	-	-		
3	12.2	Broadcast informational spots. ----- Establecer convenios con las estaciones de radio regionales para efectuar la transmisión de cápsulas informativas.	1,2	2,3,6,7	A	<5	PRONATURA, ITESM, CONANP	No	-	-	-	-	-	-	Costs included in Action 11.3.  Costos incluidos en acción 11.3.	
3	12.3	Prepare and distribute informational videos. ----- Elaborar y difundir videos con información sobre las cotorras serranas y su hábitat.	1,2	2,3,6,7	A	<5	PRONATURA, ITESM, CONANP	No	25	-	-	-	-	-		

1	12.4	<p>Inform the public on conservation successes and actions.</p> <p>-----</p> <p>Publicar material de divulgación en el que se den a conocer las acciones de protección desarrolladas en favor de la conservación de las cotorras serranas, así como los logros alcanzados</p>	1,2	1,2,3,4,5,6,7	A,B,C,D,E	<5	PRONATURA, ITESM, CONANP	No	26	-	-	12	14	-	
1	12.5	<p>Inform and engage local communities.</p> <p>-----</p> <p>Difundir en las comunidades cercanas a las áreas de distribución de cotorras serranas, la problemática de la especie y su hábitat en México, con la finalidad de que se colabore en la implementación de acciones de conservación de la especie en su comunidad.</p>	1,2	2,3,4,5,6,7	A,B,C,D,E	4	PRONATURA, ITESM, CONANP	No	-	-	-	-	-	-	Costs included in Action 11.5.  Costos incluidos en acción 11.5
3	12.6	<p>Emphasize the importance of TBPA to the public.</p> <p>-----</p> <p>Difundir la importancia de la sociedad en general, en las tareas de protección, conservación y recuperación de las cotorras serranas y su hábitat.</p>	1,2	2,3,4,5,6,7	A,B,C,D,E	4	PRONATURA, ITESM, CONANP	No	20	7	6.5	6.5	-	-	
	13.1	<p>Encourage low environmental impact activities.</p> <p>-----</p> <p>Fomentar actividades productivas de bajo impacto ambiental entre las comunidades inmersas en las áreas de distribución de cotorras serranas.</p>	1,2	2,3	A	>5	PRONATURA, ITESM, CONANP, SAGARPA	No	-	-	-	-	-	-	Costs included in Action 4.6.  Costos incluidos en acción 4.6.
3	13.2	<p>Develop sustainable community ecotourism projects.</p> <p>-----</p> <p>Diseñar proyectos</p>	2	2,3,6,7	A	7	PRONATURA, GOBIERNOS ESTATALES SECTUR, CONANP,	No	77	11	11	11	11	11	Cost calculated for 7 years.  Los costos se calculan para 7 años.

		ecoturísticos comunitarios en convenio con empresas (control en el acceso a partir de cuotas, hospedaje, contratación de guías locales) en sitios con ocurrencia de cotorras.					CONAFOR								
2	13.3	Train local guides on developing ecotourism projects. ----- Capacitar a los guías locales en el desarrollo de proyectos ecoturísticos inocuos a las cotorras y para que contribuyan con el monitoreo de las poblaciones.	2	2,3,6,7	A	<5	PRONATURA, GOBIERNOS ESTATALES SECTUR, CONANP, CONAFOR	No	15	5	5	5	-	-	
	13.4	Train community members on 'nature appreciation' themed projects. ----- Capacitar a la gente de las comunidades cercanas a las áreas prioritarias (dueños de cabañas, guías, etc.) en el enfoque de "Apreciación de la Naturaleza" en coordinación con la Secretaría de Turismo.	2	2,3,6,7	A	<5	CONAFOR, CONANPSECRETUR	No	80	16	16	16	16	16	
3	13.5	Include indigenous groups in ecotourism planning and implementation of ecotourism. ----- Incluir a grupos étnicos establecidos en las áreas de distribución de cotorras serranas en el desarrollo e implementación de proyectos ecoturísticos.	2	2,3,6,7	A	>5	CONAFOR, GOBIERNOS ESTATALES PRONATURA, CESTAC, RAN	No	15	-	-	-	15	-	
3	13.6	Encourage participation by academia. ----- Promover la participación de estudiantes y tesis en proyectos con estas especies.	1,2	1,2,3,4,5	A	>5	ITESM, PRONATURA, UACH, NMSU, UA	No	80	8	8	8	8	8	Costs calculated for 10 years. Los costos se calculan para 10 años.

3	13.7	Train CONANP personnel on monitoring protocols. ----- Capacitar a personal de la CONANP para llevar a cabo censos de monitoreo de las cotorras serranas, además del seguimiento de su éxito de anidación, en las Áreas Naturales Protegidas donde ocurran las especies.	1	2,3	A	>5	PRONATURA, CONANP	No	18	6	6	6	-	-	
1	14.1	Develop partnerships with Mexican NGOs and agencies.	1,2	1,2,3,4,5,6,7	A	4	USFWS, AGFD, NMDGF, NAT, PRNA, SEM, SDZSP	Yes	5	2	1	1	1	-	
1	14.2	Support efforts in Mexico to improve knowledge of species ecology.	1,2	1,2,3,4,5	A	4	USFWS,AGFD	Yes	50	10	10	10	10	-	
1	14.3	Support effort in Mexico to conserve habitat.	2	2,3,4	A	>5	USFWS,AGFD	Yes	50	10	10	10	10	10	
1	14.4	Support work in Mexico to better assess population numbers and trends.	1	-	A	>5	USFWS,AGFD	Yes	50	10	10	10	10	10	
1	14.5	Support work by biologists in Mexico to actively monitor and manage breeding populations.	1	-	E	>5	USFWS,AGFD	Yes	50	10	10	10	10	10	
1	14.6	Encourage enforcement of parrot regulations in Mexico.	1,2	6,7	D	4	USFWS, CITES, CBP	Yes	5	1	1	1	1	1	
3	15.1	Implement strategies to preserve U.S. historic habitat.	2	-	A	>5	USFS	Yes	-	-	-	-	-	-	In progress with Firescape Program. En marcha programa de Firescape.
2	15.2	Collaborate with Mexico to preserve borderlands habitat.	2	-	A	4	USFS, USFWS, AGFD, NMDFG	Yes	10	-	5	5	-	-	
2	15.3	Encourage U.S. based researchers and institutions to enhance conservation efforts of Mexican parrot populations closest to the U.S	1,2	2,5	A,B, C,D, E	>5	USFWS, UA, USFS, NMSU, SDZSP	Yes	50	10	10	10	10	10	

3	16.1	Support research efforts to evaluate translocations.	1	5	E	>5	USFWS, AGFD, NMDGF, NAT, PRNA, SEM, AZA, SDZSP	Yes	10	-	-	5	5	-		
3	16.2	Conduct a review of U.S. historical habitat.	2	5	E	2	USFWS, AGFD	Yes	5	5	-	-	-	-		
3	16.3	Evaluate the need and efficacy of conducting translocations of individuals into U.S.	1	5	E	5	USFWS, AGFD	Yes	10	-	10	-	-	-		
		Total Cost of Recovery								5,180*						*Annual costs do not add up to Total costs because some tasks continue beyond 2016. These additional costs are included in the Total.

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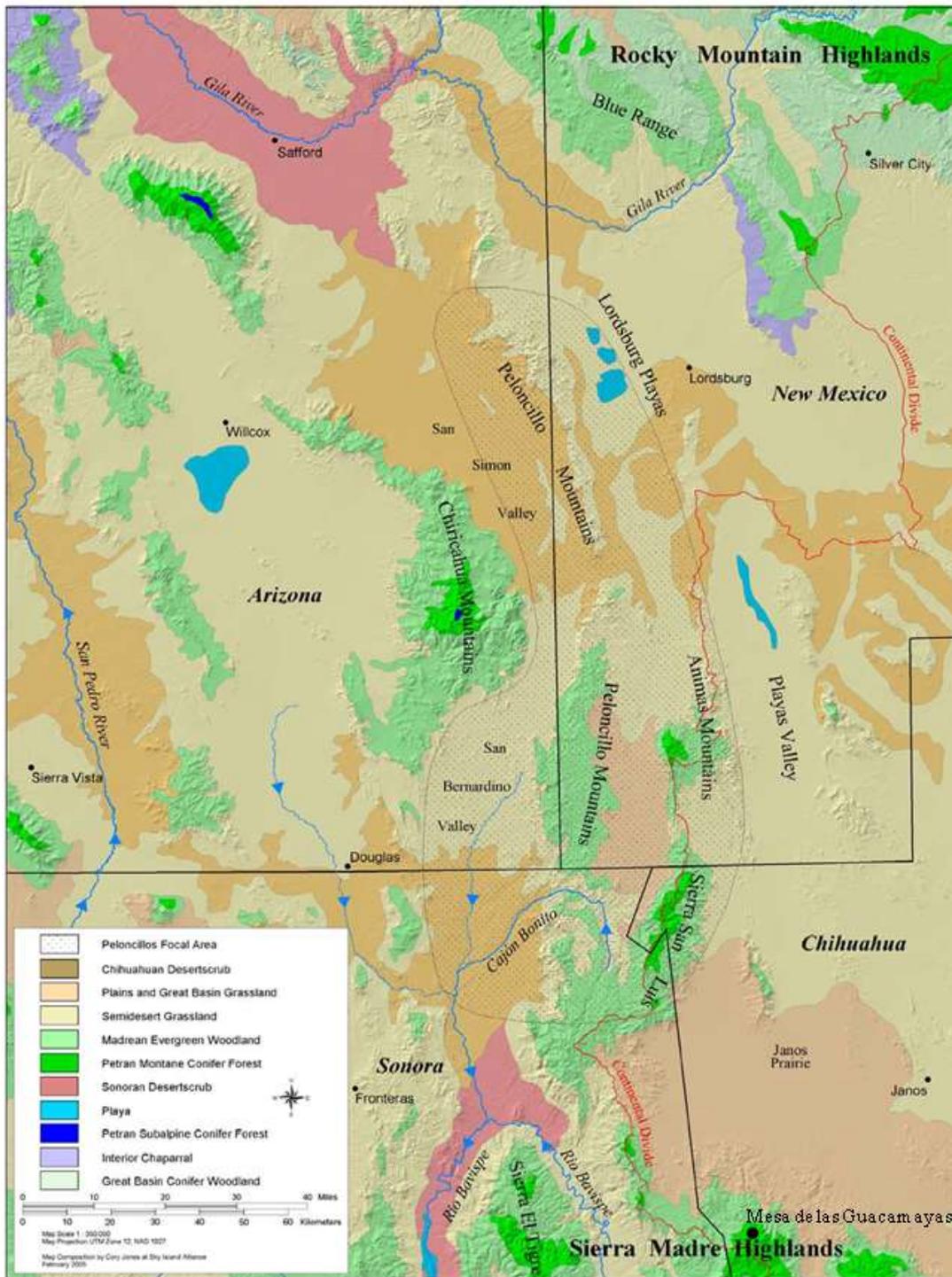
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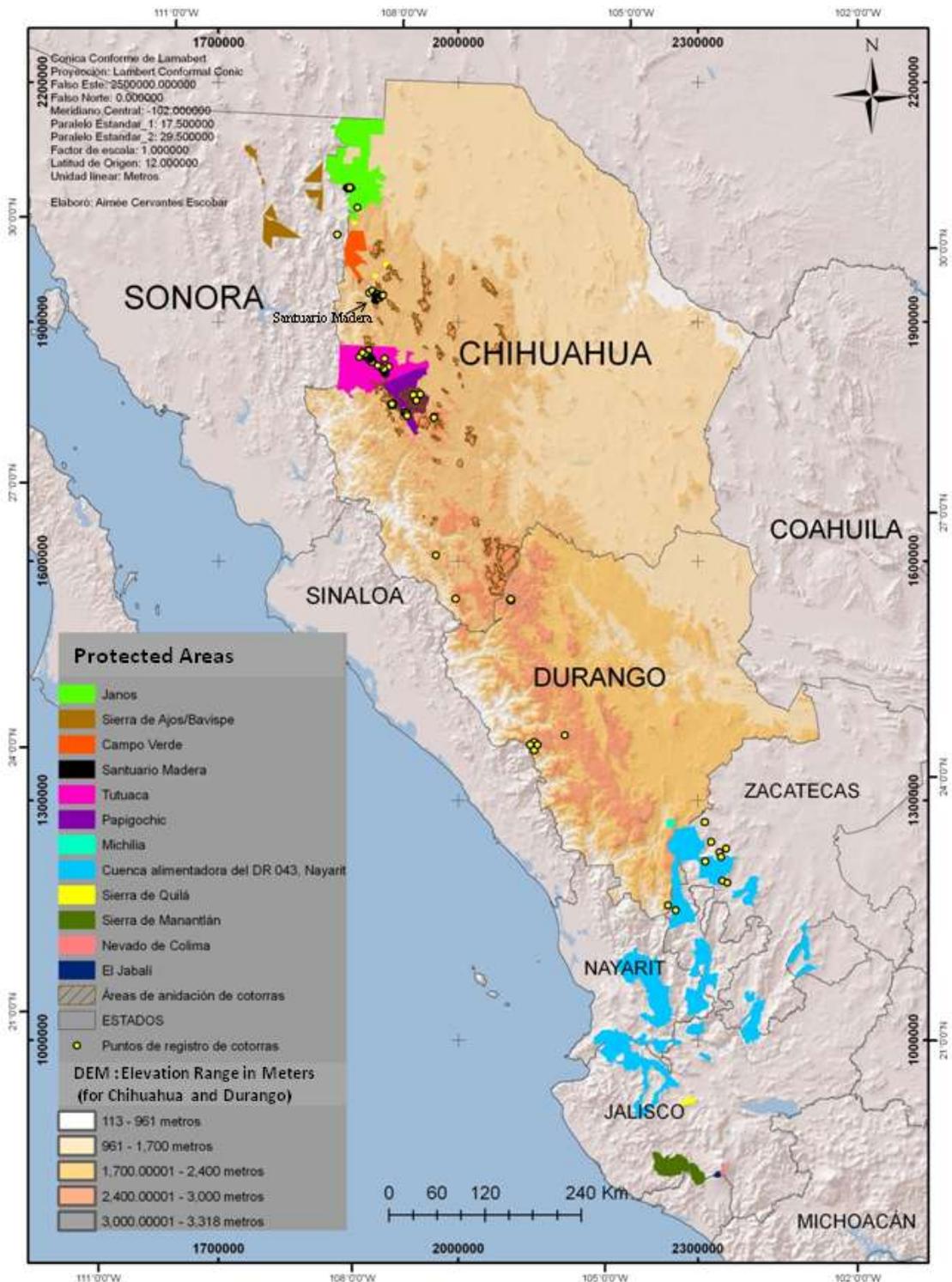
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APPENDIX A. Figures Cited in Text



Map 1. Ecological context of portions of the Sky Islands area. Mesa de Las Guacamayas (part of the Janos Biosphere Reserve), the northernmost breeding area of the thick-billed parrot, is shown for reference. Biotic community characterizations are based on Brown and Lowe (1980). Map adopted from Bodner et al. (2005).



Map 2. Protected Areas (PAs) in Mexico with thick-billed parrot occurrence (current, historical, or anecdotal). PAs in southern Durango and further south fall within the winter range. Specific sites with verified (within the last 15 years) thick-billed parrot occurrence are shown with yellow points (although no points are shown falling within the Campo Verde PA proper, nearby points are considered part of its area of influence). Potential breeding areas (identified by hashed polygons) based on MaxEnt modeling work by Cruz-Maldonado (2011). List of PAs derived from CONANP (2009) table 1, with Cerro de Mohinora excluded (polygon not well defined). Map courtesy of Pronatura Noroeste and Instituto Tecnológico y de Estudios Superiores de Monterrey (ITESM).

**APPENDIX B. Thick-billed Parrot Program of Action for the Conservation of the Species:  
(*Rynchopsitta* spp.). English translation.**

## **ENDANGERED SPECIES RECOVERY PLAN**

**Maroon-fronted and Thick-billed Parrot  
(*Rynchopsitta terrisi* and *R. pachyrhyncha*)**

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## I. INTRODUCTION

On February 24, 2007 at El Llano de las Papas in the of State of México, Felipe Calderón-Hinojosa, President of México, presented the strategic plan “Commitment to Conservation” to the Mexican people. This series of programs to control the deterioration of the Mexican ecosystems and biodiversity will be implemented through the Mexican National Commission of Protected Natural Areas (Comisión Nacional de Áreas Protegidas, CONANP). As part of this commitment, the Division of Species of Conservation Priority under CONANP implemented the Endangered Species Conservation Program (PROCER, in 2007). The program’s general objective is to design the framework, and coordinate, promote, and link Federal Government efforts with the various sectors of society to the recovery and conservation of 30 Mexican priority and endangered species.

More than 60 people from various public sectors participated in a comprehensive analysis to select the species to be included in the Federal Endangered Species Conservation Program. Both species of *Rhynchopsitta* were selected as warranting protection as part of the Endangered Species Recovery Plan [Programas de Acción para la Conservación de las Especies PACE].

Since the Maroon-fronted Parrot (*Rhynchopsitta terrisi*) and the Thick-billed Parrot (*R. pachyrhyncha*) share many physical and biological characteristics as well as similar threats and conservation needs, the Technical Consultative Subcommittee for the Protection, Conservation, and Recovery of Psittacids in

Mexico<sup>3</sup> decided to include both species in a single Recovery Plan.

The Subcommittee was very involved in the preparation of The Endangered Species Recovery Plan for both *Rhynchopsitta* species along with other organizations, institutions, and people interested in the conservation of the species, and federal and state government organizations. Based on previous work by this group, it addressed the critical needs for both parrot species conservation. Concrete actions are scheduled to address these needs using six conservation strategies: 1) Protection, 2) Management, 3) Restoration, 4) Research, 5) Outreach and Education, and 6) Human and Financial Resources and Partnerships. This established a document to guide the management practices for both parrot species and their habitats. The Plan will incorporate the conservation efforts, create institutional and social synergies, optimize financial, material, and personnel resources to maintain these species in the wilds of Mexico far into the future.

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<sup>3</sup> The present document refers to the Technical Consultative Subcommittee for the Protection, Conservation, and Recovery of Psittacids in Mexico as the Psittacids specialist group after the Technical Consulting Committee for the Recovery of Endangered Species in Mexico (which gave legality to the Endangered Species Subcommittees) was repealed in the Diario Oficial de la Federación on March 17, 2009, until a new legal concept is created

Since the Endangered Species Conservation Program is a government program linked to the current Mexican presidential term, the Maroon-fronted and Thick-billed Parrot Endangered Species Recovery Plan presents goals for 2012, and requires that scheduled activities be synchronized with the biological factors necessary for the conservation and recovery of the species and their habitats. Likewise the general goals and objectives go beyond the mentioned time periods giving continuity to previous conservation efforts and scheduled actions in the short-, medium-, and long-term. For these purposes, we define short-term as one to two years, medium-term as three to four years, and long-term as more than five years.

The proposed actions by the experts group are necessary and feasible for the conservation of both species. But the challenges to both parrot species and

their habitats are not static and could require the modification of the strategies presented here. The Recovery Plan was planned as a dynamic document using an evaluation process to improve the course and strategies as needed to accomplish the established goals and objectives.

Finally it is worth mentioning that the Maroon-fronted and Thick-billed Parrot Recovery Plan includes actions to involve the local communities in research, protection, management, and conservation. The Plan also promotes the implementation of social programs to help the local residents gain access to financial resources from conservation projects. The intention of this is not only to improve both parrot species conditions but also the quality of life of people living in the area.

## II. BACKGROUND

In the temperate forests of northern Mexico, there are two parrot species in the genus *Rhynchopsitta*, the Maroon-fronted Parrot (*R. terrisi*), and the Thick-billed Parrot (*R. pachyrhyncha*), known by the Spanish names guacamaya enana or guaca (Enkerlin et al., 1999). Today, both parrot species are legally protected in Mexico and worldwide.

Both species are listed as Endangered Species in the *Norma Oficial Mexicana NOM-059-SEMARNAT-2001a* (D.O.F., 2002, 2008a). Similarly they are included in the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) Appendix I. In the International Union for Conservation of Nature (IUCN) Red List of Threatened Species, the Maroon-fronted Parrot is listed as a Vulnerable Species, while the Thick-billed Parrot is listed as an Endangered Species (IUCN, 2007). It is worth mentioning that recent evaluations of the former species recommended increasing the protection status to Endangered Species, which is in process and waiting for resolution. In addition, the Maroon-fronted Parrot is one of the priority species to be monitored by the Conservation Assessment and Monitoring, Information System (SIMEC) of the Comisión Nacional de Áreas Naturales Protegidas (CONANP-UANL, 2008).

Extensive forests areas used by both species are included in the National Protected Areas System (SINAP) as part of their conservation efforts. Such is the

case of the Áreas de Protección de Flora y Fauna de Tutuaca y Papigochic in Chihuahua, which contains one of the largest breeding populations of the Thick-billed Parrot. Likewise a decree to create a Sanctuary for this species near Madera, Chihuahua, another important breeding area, is currently in process. Other sites have been located in the Región Prioritaria para la Conservación Sierra Tarahumara such as the Cerro Romurachi, close to the Cusarare waterfall in the Municipio de Bocoyna, and the Cerro Mohinora in the Municipio de Guadalupe y Calvo. The latter is the southernmost area in Chihuahua with Thick-billed Parrot (Enrique Correón, pers. comm.). Other protected areas for the species are mentioned later.

Similarly the Cumbres de Monterrey National Park in the Sierra Madre Oriental protects more than 150,000 forest hectares (370,658 acres), including almost half of the breeding colonies known for the Maroon-fronted Parrot. It is worth mentioning that this is an important protected area providing various environmental services to about five million people living in the city of Monterrey and its metropolitan area (CONANP-UANL, 2008). In addition there are other federal protected areas like El Potosí National Park in San Luis Potosí, and El Cielo Biosphere Reserve in Tamaulipas, which partially cover the remaining known breeding colonies and part of the wintering sites.

Finally there are the private protected areas, such as the El Taray Sanctuary in Coahuila. This Sanctuary was created in 1996, specifically to protect the Maroon-fronted Parrot. This is an area with about 350 hectares (864 acres) of conifer forest critical to the species because it includes the largest known breeding colony, and close to 40% of the known breeding pairs (Enkerlin et al. 1998). El Taray is a private reserve managed by the Mexican Bird Museum in Saltillo, Coahuila. The Mexican National Commission for Knowledge and Use of Biodiversity (CONABIO) and donations by domestic and foreign organizations such as the Zoological Society of San Diego and the U.S. Fish and Wildlife Service funded the reserve (Enkerlin et al., 1998). But severe wildfires in February and March of 2006 destroyed 1,685 hectares (4,163 acres) of forest in the region (CONAFOR 2006a, b), including more than 90% of this protected area. It is worth mentioning that today the Sanctuary has a management program (CONANP-Pronatura Noreste, 2008).

In the case of the Thick-billed Parrot different legal protection tools have been used in private properties. They are ejido reserves, ecological easements (voluntary legal agreements to limit the use of private land to protect a specific habitat in exchange for monetary compensation from the organization that obtains the legal rights to the land), and usufructs (the legal right to use and benefit from it without full ownership, as long as the property is not damaged) were created to control logging and other forest uses such as cattle and agricultural activities, hunting, and fishing (CONANP-Pronatura Sur, 2008) to develop activities compatible with the protection of the species. Today, 3,500

hectares (8,648 acres) in the Tutuaca and Conoachi ejidos in Chihuahua are protected as ejido reserves (op. cit.). Although these areas are small, they play important roles in maintaining high levels of local biodiversity (Sánchez-Mateo et al, 2007), making them very valuable ecoregion reserves. In addition, the protected breeding areas for both parrot species are also important ecosystems for other species such as the Eared Quetzal (*Euptilotis neoxenus*, Monterrubio-Rico and Enkerlin, 2004b).

Related to the information available on these parrot species, the first distribution, breeding, and population studies were done in the late 1970's and early 1980's (Lanning and Shiflett 1981, 1983; Lawson and Lanning 1981; Ridgely, 1981). Starting in 1995, the Instituto Tecnológico y de Estudios Superiores de Monterrey (ITESM) began various studies of population stability, monitoring, and assessment for both species. These studies have helped to establish a point of reference for the conservation of both parrot species (Enkerlin-Hoeflich et al., 1997, 1998, 1999; Macías-Caballero 1998; Ortiz-Maciel, 2000). In 1999 Enkerlin and collaborators continued their study on the status, distribution, ecology, and conservation of both parrot species. In addition researchers from the Universidad Autónoma de Nuevo León (UANL) worked in 2008 on a project in the Cumbres de Monterrey National Park to characterize the breeding habitat and associated landscape for the Maroon-fronted Parrot (CONANP-UANL, 2008). These studies allowed ITESM and Pronatura to determine population size, trends, and threats with high precision, and began to define conservation strategies for big areas (CONANP-Pronatura Sur, 2008).

Education and outreach have also been included in the conservation of both parrot species and their habitats. In late 2008, Pronatura Noreste, with support of CONANP and within the Endangered Species Conservation Program (PROCER), developed casual and formal environmental education activities on the Maroon-fronted Parrot in seven localities in the Cumbres de Monterrey National Park (PNCM). These localities were Canoas, El Terrero, La Jacinta, La Peñita, San Antonio de la Osamenta, San José de las Boquillas, and Santa Cruz (CONANP-Pronatura Noreste, 2008). It is worth mentioning that in these workshops, Pronatura designed teaching aids such as workbooks, posters, printed banners, and board games.

In addition it was found that land values in the Sierra Madre Oriental are very high. Pronatura Noreste did a survey in the Maroon-fronted Parrot distribution area communities and found that the cost varies from 50,000 to 2 million pesos per hectare. Land values have increased because of the construction of luxurious country houses with potential for tourism activities (CONANP-Pronatura Noreste, 2008).

Within the Mexican legal framework, a recent development is the modification of the General Wildlife Law to prohibit the exploitation of any Mexican native psittacids for food or profit (DOF 2008b). Also, today the Federal Government is protecting at various levels more than 700,000 hectares (1,729,737 acres) of forest in the Sierra Madre Occidental through the Protected Areas System (CONANP-Pronatura Sur, 2008).

Given the conservation status of both parrot species in Mexico, the Technical Consultative Subcommittee for the Protection, Conservation, and Recovery of Psittacids in Mexico developed a project in 2000 on the Conservation, Management and Sustainable Use of Psittacids in Mexico (PREP) where both species of *Rhynchopsitta* were considered priority species for conservation (SEMARNAP-INE 2000). The Psittacids Subcommittee had a Workshop on Selection of Priority Species of Psittacids to be included in the Endangered Species Recovery Plan (PACE) on June 30, 2008, which resulted in the present document.

### III. BIOLOGY, ECOLOGY, AND THREATS

**Class:** Aves  
**Order:** Psittaciformes  
**Family:** Psittacidae  
**Species:** *Rhynchopsitta terrisi*  
**Spanish common names:**  
Cotorra serrana Oriental,  
guaca, guacamaya enana

**Class:** Aves  
**Order:** Psittaciformes  
**Family:** Psittacidae  
**Species:** *Rhynchopsitta pachyrhyncha*  
**Spanish common names:**  
Cotorra serrana occidental,  
guaca, guacamaya enana

#### Species Description

They are attractively colored like most psittacids. The body is mainly dark green with red or maroon markings on the forehead and the thighs, a superciliary stripe, and a shoulder patch. Their eyes are amber, with yellow eye-rings, and the beak is black (Howell and Webb, 1995). There are a few differences between the species. The Maroon-fronted Parrot (*Rhynchopsitta terrisi*) with maroon-brown forehead markings is between 40 cm (16 in) and 45 cm (18 in) in length (Forshaw 1989). While the Thick-billed Parrot (*Rhynchopsitta pachyrhyncha*) with red forehead is about 38 cm (15 in) in length with yellow feathers underneath the wings (Forshaw 1989). Neither of the species shows sexual dimorphism.

#### Distribution

##### Thick-billed Parrot

The Thick-billed Parrot was historically found from the northernmost regions of the Sierra Madre Occidental in Mexico into the United States in the Chiricahua Mountains in southeastern Arizona and the Animas Mountains in southwestern New Mexico until the 20<sup>th</sup> century (Forshaw 1989). The last official report for the species in the United States was in 1938. Later it was declared extirpated from the country caused by such human pressures such as hunting and habitat destruction (Snyder et al., 1994). Their distribution in Mexico was from northern Chihuahua and Sonora through Michoacán and Jalisco (Forshaw 1989; Howell and Webb, 1995) with the southernmost distribution in Veracruz and the State of Mexico (CONANP-Pronatura Sur, 2008).

In 1995, the species distribution was from northern Chihuahua and Sonora to Michoacán and Jalisco (Howell and Webb, 1995). Today, the breeding range of the Thick-billed Parrot in the Sierra Madre Occidental is from La Mesa de las Guacamayas in Chihuahua south through Camellones in central Durango (CONANP-Pronatura Sur, 2008). In Chihuahua the following breeding areas stand out: Madera, Cebadillas de Yahuirachi, Vallecillo, and San Juanito (Monterrubio-Rico and Enkerlin 2004). Similarly, Monterrubio-Rico and Enkerlin, (2004) reported the current breeding range of the Thick-billed Parrot to be between 30°39'N in Chihuahua and 25°57'N in Durango, and estimated that the nesting areas for this species are concentrated in about 2,112 hectares (5,219 acres). The diurnal movements between the perching and feeding sites of this species can be as much as 40 km (24.9 miles; SEMARNAP-INE, 2000). The Thick-billed Parrot has a larger population than the Maroon-fronted Parrot, but individuals are more

widely dispersed (Enkerlin et al., 1997).

In winter, this species' distribution area is from Sinaloa and the southern part of Durango through Nayarit and Jalisco. In the pine forests of the Colima Volcano in southern Jalisco flocks of more than 100 individual Thick-billed Parrot were observed in January (Schnell et al., 1974). The distribution area of this species drastically declined in the last few decades (Snyder et al. 1999), with an estimate of less than 1% of the original distribution remaining in 1995 (Lammertink et al., 1997). It is worth mentioning that the localities of Mohinora, Vacas, Camellones, and Nevado that were identified as breeding sites in Durango in the 1980's are today highly disturbed without signs of breeding activity. In turn, sites such as Cebadillas de Bisaloachi and Madera with smaller trees than the ones that existed in the previous four localities, but with well-preserved habitats are currently the most important breeding sites for the species (Monterrubio-Rico and Enkerlin, 2004).

Table 1. Protected Natural Areas with Thick-billed Parrot.

<b>Name</b>	<b>Type</b>	<b>Area</b>	<b>Location</b>
Área de Protección de Flora y Fauna Sierra de Ajos Bavispe	Federal	180,048	Sonora
Reserva de la Biosfera de Janos <sup>2</sup> (Mesa de Guacamayas)	Federal	19,000	Chihuahua
Área de Protección de Flora y Fauna Campo Verde	Federal	108,067	Chihuahua y Sonora
Santuario Madera <sup>2</sup>	Federal	2,800	Chihuahua
Área de Protección de Flora y Fauna Tutuaca	Federal	363,440	Chihuahua y Sonora
Área de Protección de Flora y Fauna Papigochic	Federal	243,639	Chihuahua
Área de Protección de Flora y Fauna Cerro de Mohinora <sup>2</sup>	State	9,126	Chihuahua
Reserva de la Biosfera La Michilía <sup>1</sup>	Federal	9,421	Durango
Cuenca Alimentadora del Distrito de Riego 043 Estado de Nayarit <sup>1</sup>	Federal	1,553,438	Aguascalientes, Jalisco, Durango, Nayarit y Zacatecas
Área de Protección de Flora y Fauna Sierra de Quila <sup>1</sup>	Federal	14,168	Jalisco
Reserva de la Biosfera Sierra de Manantlán <sup>1</sup>	Federal	139,577	Jalisco y Colima
Parque Nacional Nevado de Colima <sup>1</sup>	Federal	6,525	Jalisco y Colima
Área de Protección de Flora y Fauna El Jabalí <sup>1</sup>	Federal	5,065	Colima
Parque Nacional Pico de Tancítaro <sup>1</sup>	Federal	23,448	Michoacán
Parque Nacional Barranca del Cupatitzio <sup>1</sup>	Federal	427	Michoacán

<sup>1</sup> Winter distribution

<sup>2</sup> In process to become officially declared protected area

## Maroon-fronted Parrot

The Maroon-fronted Parrot is a Mexican endemic species (Forshaw 1989), with one of the most restricted distribution range for a bird (Enkerlin et al., 1997). The distribution area for this species was estimated in 18,000 km<sup>2</sup> (6,950 mi<sup>2</sup>) in the 1970's, although habitat used within the area was thought to be only between 3,500 and 7,000 km<sup>2</sup> (1,351 and 2,703 mi<sup>2</sup>; Collar et al., 1992).

Today, the breeding range for the Maroon-fronted Parrot from April to November is limited to a small region in the Sierra Madre Oriental from the Sierra de Zapalinamé, Coahuila (CONACYT, 2006) to the El Cielo Biosphere Reserve in Tamaulipas (Enkerlin et al., 1998; ITESM-Pronatura, 2002) passing through the Cumbres de Monterrey National Park and part of the Municipio de Rayones in Nuevo León. This band is ca. 300 km long and ca. 60 km wide (186 mi long, 37 mi wide, Juniper and Parr 1998).

Recently isolated colonies were reported on the Tamaulipas-San Luis Potosí border, and in the Sierra Gorda Biosphere Reserve in Querétaro. This area is ca. 150 km south of the previous known distribution range cited in the literature (CONANP-Pronatura Noreste, 2008). The Maroon-fronted Parrot movement range is 23.7 km (14 mi) per day within an area of 18,252 hectares (45,101 acres; Ortiz-Maciel, 2000).

Between 40% and 45% of the breeding pairs are concentrated in El Taray, Coahuila (Enkerlin et al., 1998). The El Taray pairs together with other pairs from the Condominios, Santa Cruz, and San Antonio de la Osamenta colonies in the Cumbres de Monterrey National Park represent 80-84% of the breeding pairs for this species. Enkerlin et al (1999) reported 21 breeding colonies of Maroon-fronted Parrot including eight new records after 1994. One to a hundred pairs have been observed in these breeding sites.

In addition, the Universidad Autónoma de Nuevo León (UANL) researchers in the Cumbres de Monterrey National Park (PNCM) found that the biggest concentrations of birds are on the highest peaks (CONANP-UANL, 2008). The Condominios cliff within the PNCM is the best-protected Maroon-fronted Parrot site (Enkerlin et al., 1999).

The winter (December to March) range of this species is mainly in southeastern Nuevo León and southwestern Tamaulipas with

occasional sightings, including 100 individuals in the Sierra Gorda, Querétaro (Pedraza, 1998 *in* Enkerlin et al., 1999). Breeding sites have been reported from El Tarillal, La Tosca, and Aguajito in the Municipio de Arteaga, Coahuila, and La Huasteca in the Municipio de Santa Catarina, and Puerto La Manteca in the Municipio de Santiago, Nuevo León (González-Iglesias et al., no year).

Table 2. Protected Natural Areas with Maroon-fronted Parrot.

Name	Type	Area	Location
Monumento Natural Cerro de la Silla	Federal	6,039	Nuevo León
Parque Nacional Cumbres de Monterrey	Federal	177,396	Nuevo León
Reserva de la Biosfera El Cielo	Estatal	144,530	Tamaulipas
Santuario El Taray	Privada	350	Coahuila
Área de Protección de Flora y Fauna Sierra de Álvarez	Federal	16,900	San Luis Potosí
Parque Nacional El Potosí	Federal	2,000	San Luis Potosí
Reserva de la Biosfera Sierra Gorda de Guanajuato	Federal	236,882	Guanajuato
Reserva de la Biosfera Sierra Gorda	Federal	383,567	Querétaro
Sierra de Arteaga*	Federal		Coahuila

## Migration

The season when the parrots form large migratory flocks starts in late October and early November. The Thick-billed Parrot has been reported from the mountains of Jalisco and Colima from January and February, but no records between May and October, indicating that this species has latitudinal migratory movements (Forshaw, 1989). Although the exact number of wintering sites in the Sierra Madre Occidental today is unknown, it is thought that during this season they do not stay in a single site but move constantly looking for forest areas with good food resources (op. cit.). In contrast, it is considered that the Maroon-fronted Parrot has altitudinal migratory movements (Forshaw 1989), but precise information is not available.

## Reproduction

Both species of *Rhynchopsitta* have a tendency to nest in the same places each year (Lanning and Shiflett 1983, Macías-Caballero 1999), Monterrubio-Rico et al., 2006). In the case of Maroon-fronted Parrot, the pairs nest in crevices in high limestone cliffs (Lawson and Lanning 1981, Macías-Caballero 1999). In contrast, the Thick-billed Parrot mainly nests in tree cavities in dead standing trees (Lanning and Shiflett 1983, Monterrubio-Rico and Enkerlin-Hoeflich 2004a, Monterrubio-Rico et al. 2006) in *Pseudotsuga*, and in the Madera Sanctuary especially in *Populus*. Both species nest in colonies once a year from July to November (Macías-Caballero, 1999). Their fall breeding period coincides with the peaks in pine seed production, their main food.

Both parrot species breed in nesting colonies and have an average of two chicks per nest (Macías-Caballero 1999, Monterrubio-Rico et al., 2002), although in bad years their reproduction can decrease drastically. A pair of Thick-billed Parrot on average laid 2.7 eggs per nest, producing an average of 1.6 young parrots per nest (Monterrubio-Rico and Enkerlin, 2004). The chicks are raised when the pine seeds are mature from late summer through fall (Juniper and Parr, 1998). Maroon-fronted Parrot in the Cumbres de Monterrey National Park averaged 1.09, 1.31, 1.9, 1.8, and 1.3 chicks per nest in 2003, 2004, 2005, 2006, and 2007 respectively (CONANP 2006, Ortiz-Maciel and Valdez-Peña 2007). Similarly, Valdez-Juárez (2006) recorded that 86% of the nests in a colony in the same park produced at least one chick. Crevices in poor or wet conditions have reduced productivity because chicks died of cold (CONANP-Pronatura Sur, 2008) or drowned.

Parrot breeding pairs rest in nesting cavities during their breeding season. In well-protected areas, nest concentration is higher than disturbed areas (Monterrubio-Rico

and Enkerlin, 2004). In Maroon-fronted Parrot, Enkerlin et al., (1998) documented San Antonio de la Osamenta, El Taray, Condominios, and Santa Cruz as the most important breeding sites for the species. Both parrot species are gregarious and are usually found in flocks, sometimes of more than 100 pairs.

## Food

*Rynchopsitta* are considered “specialist” species with restricted diets. They eat mainly seeds from various pines such as *Pinus arizonica*, *P. greggii*, *P. teocote*, *P. montezumae*, and *P. cembroides* (Lawson and Lanning 1981, Forshaw 1989) *P. durangensis*, *P. engelmannii* (Perry 1991, Cruz-Nieto 1998, Snyder et al., 1999), and *P. strobiformis* (pers. comm.). Occasionally they also eat fir (*Abies* spp.) seeds, acorns (*Quercus* spp.), conifers shoots, and occasionally agave flower nectar (Forshaw, 1989). Pine and oak seed production varies by region and the parrots disperse to high production areas, resulting in a considerable variability in their geographic distribution (Lawson and Lanning 1981).

Enkerlin et al. (1998) observed that Maroon-fronted Parrots eat earth (geophagia) from clay banks such as the ones in El Taray. These authors found two clay banks where the birds arrived every day to eat earth, one just at the base of Santa Cruz Canyon and the other in the southern limit of their breeding range near the town of Santa Rosa.

## Habitat

Both parrot species live in forests with *Pinus*, *Abies*, *Pseudotsuga* and *Quercus* with various geomorphic settings at elevations between 2000 and 3000 meters (6561 and 9842 ft). There are also exceptional records between 1300 and 3700 meters (4265 and 12,139 ft; Forshaw 1989). They also have been reported in habitats with trees such as *Arbutus*, *Fraxinus*, *Juniperus*, *Populus*, *Prunus*, and *Pseudotsuga* (Monterrubio-Rico and Enkerlin, 2004). The Maroon-fronted Parrot appears to be very habitat selective, restricted to the conifer forests; it has never been recorded in scrub, grassland, agricultural areas, orchards, or bare areas (Ortiz-Maciel, 2000). Optimal habitat conditions for Thick-billed Parrot with cavities for breeding are found in old-growth forests,<sup>4</sup> where the presence of damaged or dead trees is higher than in younger forests (Enkerlin et al., 1998).

In the Cumbres de Monterrey National Park, Maroon-fronted Parrots nest in the tallest (ca. 20 m or 65 ft) pine and oak forests (CONANP-UANL, 2008)

which are most likely to yield good seed crops. In this area, parrots are associated with plants of the genus *Abies*, *Ageratina*, *Baccharis*, *Dalea*, *Decatropis*, *Dodonaea*, *Fraxinus*, *Galactia*, *Garrya*, *Hechtia*, *Helietta*, *Mortonia*, *Pinus*, *Prunus*, *Quercus*, *Taxus*, *Tecoma*, etc. (op. cit.).

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<sup>4</sup> The established average age for trees in mature forests is 326 years (CONANP-Pronatura Sur, 2008).

It is worth mentioning, especially for the Cumbres de Monterrey National Park, that Oyamel Fir (*Abies religiosa*) forests, pine forests, and oak woodlands dominate the sites with the best habitat. The same is true in the Municipio de Arteaga, Coahuila, and La Huasteca in Santa Catarina, and Puerto La Manteca in Santiago, Nuevo León (CONANP-UANL, 2008). Thick-billed Parrots share the habitat with species such as the Black Bear (*Ursus americanus*), Jaguar (*Panthera onca*), Mountain Lion (*Felis concolor*), Golden Eagle (*Aquila chrysaetos*), Solitary Eagle (*Harpyhaliaetus solitarius*), Wild Turkey (*Meleagris gallopavo*; CONANP-Pronatura Sur, 2008), White-Tailed Deer (*Odocoileus virginianus*), Coati (*Nasua narica*), Red-Tailed Hawk (*Buteo jamaicensis*; Sánchez-Mateo et al., 2007) among others, whose populations have decreased by different causes related to habitat

destruction. The Maroon-fronted Parrot shares habitat with species facing similar challenges such as the Northern Goshawk (*Accipiter gentiles*), Red-Tailed Hawk (*Buteo jamaicensis*), Peregrine Falcon (*Falco peregrinus*), Coati (*Nasua narica*; Enkerlin et al., 1997), the Black Bear (*Ursus americanus*), Collared Peccary (*Pecari tajacu*), Ocelot (*Leopardus pardalis*), Jaguar (*Panthera onca*), Raccoon (*Procyon lotor*), Virginia opossum (*Didelphis virginiana*), and many more.

Temperatures were recorded by UANL researchers (CONANP-UANL, 2008) in the Maroon-fronted Parrot nesting sites or “walls” in the Cumbres de Monterrey National Park. Mean annual temperatures were 18 to 20 °C (64 to 68 °F) at Banco de Abajo, Canoas, and El Pajonal, and 16 to 18 °C (61 to 64 °F) at Condominios, El Hondable, and San Antonio de la Osamenta.

These authors suggested that the species nest within 23.7 km (14.7 mi) of water sources (rivers), equal to or less than the average daily traveling distance reported by Ortiz-Maciel (2000).

## Population Dynamics

The population of Thick-billed Parrot was estimated to be no more than 5,000 individuals in 1992 (Enkerlin, 2000 in BirdLife International, 2007). In contrast, Lammertink et al., (1995, in BirdLife International, 2007) estimated between 1000 to 4,000 birds. In three breeding sites (Madera, Mesa de las Guacamayas, and Tutuaca) Pronatura Sur personnel counted close to 3,500 individuals in 2008 (CONANP – Pronatura Sur, 2008). The species experts reach the conclusion that the numbers of individuals in the populations have decreased drastically the last century, mainly due to timber harvest (Collar et al., 1992).

For the Maroon-fronted Parrot, Lawson and Lanning (1981) estimated a population size between 2,000 to 3,000 individuals. Enkerlin et al., in 1997 showed that in El Taray were close to 100 pairs of these birds, representing nearly a quarter of the total known pairs

at that time, and the breeding center for the species. The second biggest colony was found in Los Condominios, ca. 16 km (9 mi) from El Taray, hosting close to 60 pairs (Enkerlin et al., 1997). Two years later the bird counts in nesting sites estimated a minimum population of 2,500 birds, possibly as high as 3,000 individuals (Enkerlin et al., 1998, 1999). In addition Valdés-Peña and collaborators in 1998 estimated a population size of about 3,500 individuals after watching large flocks in their wintering range.

## Main Threats

### Habitat Destruction

Habitat modification or destruction is the main issue affecting the decrease of Thick-billed Parrot (CONANP – Pronatura Sur, 2008) and Maroon-fronted Parrot (Enkerlin et al., 1998). In the case of the Thick-billed Parrot in the Sierra Madre Occidental it is estimated that only 1% of the old-growth forests with the old trees critical for nesting and feeding are left today.

The Maroon-fronted Parrot nesting activities are not affected by this problem since they use crevices on the cliffs, although wildfires (CONANP – Pronatura Sur, 2008) and land use changes in the forest, usually for agriculture and cattle raising (Ridgely, 1981 cited by Enkerlin et al., 1998 and 1999) and logging for timber production and the cellulose industry, have affected their feeding areas. Most of the areas cleared in the Sierra Madre Oriental were to plant orchards, mainly apples, even though the potential to expand them is limited (Enkerlin et al., 1997).

Wildfires are part of the natural dynamics and succession in forests. However, catastrophic wildfires result in the loss of nesting sites and feeding resources for both parrot species. Wildfires in 2006 destroyed nearly 2,000 hectares (4,942 acres) of pine forest in the Sierra Madre Oriental, which supply feeding resources for the Maroon-fronted Parrot, directly impacting on the nesting success of the species. Unlike pine forests in other regions, the forests in the Maroon-fronted Parrot area have very poor regeneration after wildfire. This is probably caused by very thin rocky soils and relatively scant rains in the region (Enkerlin et al., 1997). Similarly, wildfires in the Sierra Madre Occidental have devastated forest habitats crucial to the Thick-billed Parrot, destroying 3,947 hectares (9,753 acres) from 2004 to 2008 (CONANP-Pronatura Sur, 2008).

In addition forestry practices with logging of pines over 40 cm DBH (Diameter Breast Height) including clear cutting and the removal of standing dead trees, reduce nesting site availability for the Thick-billed Parrot. Large areas of old-growth forest are not found today in the Sierra Madre Occidental (Monterrubio-Rico and Enkerlin-Hoeflich, 2004a, Monterrubio-Rico et al., 2006). In addition when the average ages of trees and conifer forests decrease, seed production reduces by natural stochastic effects and the frequency of sterile cones increases, with considerable effects on the birds that feed on them (Benkman, 1993; Enkerlin et al., 2004; Monterrubio-Rico and Enkerlin-Hoeflich 2004b). In the Sierra Madre Occidental, some areas have been converted by timber harvest to homogeneous young forests with ages of 120 years or less. For successful nesting the Thick-billed Parrot needs forests with average ages of 326 years for *Pinus strobiformis* (= *P. ayacahuite*) and *Pinus durangensis* (CONANP – Pronatura Sur, 2008). A ban implemented by the Environment, Natural Resources, and Fisheries Ministry (SEMARNAP-Secretaría de Medio Ambiente, Recursos Naturales y Pesca) on harvesting trees such as *Pinus strobiformis*, *Abies concolor*, *Pseudotsuga menziesii*, and *Populus tremuloides* has helped to maintain these species in their historical ranges and in disturbed breeding sites.

## Illegal Trade

The demand for both parrot species as pets has caused additional population stresses. It is estimated that from 1984 to 1994 more than a thousand Thick-billed Parrots were captured as adults or chicks poached from nests and illegally smuggled into the United States for the pet market (Snyder et al., 1994; SEMARNAP-INE, 2000). This species is frequently found in the pet market in Mexico, even though their exploitation is prohibited (CONANP –Pronatura Sur, 2008). Especially disturbing are reports of cutting down trees in mature forests to access the nests; e.g., in San Juanito in the Sierra Madre Occidental (CONANP – Pronatura Sur, 2008)

## Breeding Population

Data on breeding success by Enkerlin and collaborators (1998) showed that in the genus *Rhynchopsitta*, the percentages of birds trying to nest and producing eggs is low. The cause of failure in the breeding process varies from low food availability to immaturity of the breeding pairs. For the Maroon-fronted Parrot, it is estimated that less than 25% of the active pairs in the population try to breed. A similar situation occurs with the Thick-billed Parrot where a small fraction of the birds in the flocks in the breeding areas try to nest.

It is worth mentioning that both parrot species, like the macaws on the genus *Ara* (Munn 1991) to which *Rhynchopsitta* is closely related, show a low percentage of breeding pairs (Enkerlin et al., 1998).

Other problems for this species are the low rate of recruitment and small population sizes (SEMARNAP-INE, 2000). Dying or poached birds are not easily replaced, further increasing the difficulty of replenishing small populations. Small populations are vulnerable to catastrophic events such as wildfires that could suddenly kill the entire group.

## Feeding specialization

Wildfires and pine forest logging limit food supplies, resulting in serious impacts on both parrot species because of their strong food specialization. Therefore, their distributions restricted to food areas, especially for the Thick-billed Parrot, are also risks factor to add to the challenges faced by these birds. It is worth mentioning that both parrots can be considered indicator species of the quality of their ecosystems because both species are dependent on mature trees for food, and the Thick-billed Parrot for nesting sites (Enkerlin et al., 1997).

## IV. OBJECTIVES

### General:

Recovery and protection of the wild populations of the two parrot species (*Rhynchopsitta terrisi* and *R. pachyrhyncha*) and their habitat.

### Specific:

Control, stop, and revert the process of habitat loss of both parrot species.

Reach viable population sizes to ensure their long-term survival in the wild.

Promote the protection of wild populations of *Rhynchopsitta* spp. and their habitats through the vigilance of community groups close to breeding and wintering sites.

Generate information on the biology and ecology of both parrot species that results in the protection, management, recovery, and conservation of the species and their habitats.

Encourage the active participation of the various sectors of Mexican society in protection, management, recovery, and conservation of *Rhynchopsitta* spp. and their habitats through education and activities such as workshops, field work, cultural events, etc.

## V. GENERAL GOALS

Generate technical and scientific information about the current state of both parrot species populations and plan and apply actions for their protection and recovery.

Restore, protect, and conserve areas considered both parrot species habitat.

Have long-term viable populations of both the Thick-billed and Maroon-fronted Parrot.

Establish effective and lasting protection actions for both parrot species and their habitat.

Increase the involvement of the various sectors of society in the implementation of the actions in the Recovery Plan.

Establish a continuous operating budget to develop the different activities needed to accomplish the actions of the Recovery Plan.

## VI. GOALS (2012)

To get new Natural Protected Areas dedicated as Sanctuaries for the protection of both parrot species.

In collaboration with the Mexican Environmental Protection Agency (PROFEPA) establish vigilance committees in communities located in both parrot species sighting areas.

With PROFEPA reduce poaching and illegal trade of *Rhynchopsitta* spp. –alive, dead, and related products.

Establish conservation actions jointly with organizations of the three levels of government, academic institutions, and other sectors of society.

Conduct a national diagnostic study of potential habitats to be restored to reintroduce both parrot species, including priorities and management guidelines.

Sign agreements with institutions responsible to carry out urgent actions in both parrot species critical conservation areas.

Produce educational and outreach materials on the species, including a Web Page with current information on the Recovery Plan projects.

## VII. CONSERVATION STRATEGIES (SUBPROGRAMS)

### 1. Protection

#### 1.1 Habitat Protection Elements

##### OBJECTIVES

General:

Strengthen or implement efficient new mechanisms to protect both parrot species habitats.

Specific:

Strengthen or implement protection measures in both parrot species nesting and dispersal sites.

Establish new areas with potential to be used for protection of both parrot species and their habitats.

##### ACTIVITIES

Do all the steps necessary to get the areas of El Taray (Coahuila), Los Condominios (Nuevo León), Madera and Las Pomas (Chihuahua) decreed as Federal Sanctuaries

Do a Technical Justification Study for El Taray's decree as a Federal Sanctuary.

Designation of critical habitat for both parrot species to enable forest planning use through Forest Management Units to protect trees for nesting and feeding.

Protection of land, including signing legal agreements, fencing properties, fire barriers, and signs.

Strengthen protection in private reserves through the implementation of ecological easements, conservation certifications, and other programs.

Locate and control access to both parrot species primary nesting and perching areas.

Put up signs with information and restrictions in both parrot species primary nesting areas.

Promote sound land use planning and its application in areas where both parrot species are present.

Establish Integrated Forest Fire Management in collaboration with the Mexican National Forestry Commission (CONAFOR).

## 1.2 Legal Framework Elements

### OBJECTIVE

Promote the application of laws to protect both parrot species among the different government entities and the people.

### ACTIVITIES

Disperse current national and international legislation on the protection of both parrot species to all interested parties.

Promote evaluation methods to the legal framework related to the protection and management of both parrot species, and suggest modifications when needed.

Establish legal prevention and mitigation measures to control development or land-use changes in both parrot species distribution areas.

Share species technical information to help government officials in decision-making.

### 1.3 Vigilance and Inspection Elements

#### OBJECTIVE

To prevent and detect illegal activities such as poaching, trade, and other uses of both parrot species and illegal modification of their habitat.

#### ACTIVITIES

Ask PROFEPA to have inspection and vigilance personnel in critical habitat areas for both parrot species.

Promote local vigilance committees to improve control of habitat destruction and illegal trade in both parrot species.

Ask the general public to denounce capture and illegal trade of these birds and disturbance of their habitats.

Reinforce inspection and vigilance activities jointly with the state and municipal governments.

## 2. Management

### 2.1. Habitat Management Elements

#### OBJECTIVES

##### General:

Develop and implement actions and activities to protect the habitat necessary to maintain viable populations of both parrot species in their distribution areas.

##### Specific:

Secure the permanence of mature trees important in the forest structure and with nesting and feeding characteristics for both parrot species.

#### ACTIVITIES

Locate good habitat currently used or potentially used for nesting and feeding of both parrot species.

Ask SEMARNAT to exclude current and potential habitat for both parrot species from forestry resources, including forest trees used by the birds for nesting and feeding.

Promote protection of both parrot species among private landowners in their habitat areas.

Promote different ways to protect land in both parrot species habitat to regulate land use, e.g. ejido reserves, ecological easements, and usufructs.

Encourage watershed management to get financial resources through habitat conservation and payments for environmental services.

With the Ministry of SAGARPA (Rural Development) promote environmental friendly projects among the communities located in both parrot species distribution area.

Promote payment for environmental services to landowners involved in management and conservation of both parrot species populations.

## 2.2 Species Management Elements

### OBJECTIVE

Develop monitoring and management guidelines that promote population increases of the species.

### ACTIVITIES

Build, install, and monitor at least 40 artificial nests in each Thick-billed Parrot nesting site.

Develop guidelines to deal with confiscated parrot species.

Prepare handbooks for management, rehabilitation, and reintroduction of captive parrot species.

Evaluate the impact of ecotourism on both parrot species in protected areas.

## 3. Restoration

### 3.1 Habitat and Ecosystem Restoration Elements

#### OBJECTIVE

Restore suitable habitats in the historical distribution of both parrot species that have been disturbed or eliminated.

#### ACTIVITIES

Locate disturbed areas in need of urgent restoration for the protection of both parrot species.

Establish programs to restore and protect soils and forest such as building gabions, retention berms, growing crops, reforestation, fluvial terraces, brush piles, removal of dead wood (fuel material), living fences, and resting the land to decrease the loss of habitat in critical habitat for both parrot species.

### 3.2 Mitigation and Prevention of Impacts

#### OBJECTIVE

Prevent damage and habitat loss caused by anthropogenic activities such as fires, erosion, and deforestation in both parrot species areas.

#### ACTIVITIES

Mapping potential wildfires in important nesting areas of both parrot species.

Prevent wildfires in both parrot species habitat areas through firebreaks, controlled burns, and community vigilance.

Implement reforestation programs in both parrot species habitats, especially forested areas presently used by these birds.

Monitor the effect of the main threats to both parrot species populations and habitats and evaluate their impacts on population trends.

### 4. Research

#### 4.1 Critical Areas Elements

#### OBJECTIVE

Generate information on the current distribution of both parrot species and areas critical to their biological cycle.

#### ACTIVITIES

Compile historical and current distribution information for both parrot species.

Through point-occurrence data, inferential algorithms, and interviews with local residents determine critical areas (nesting, feeding, migration) for both species.

Verify in the field the presence of the species and suitable habitat.

Estimate both parrot species populations in critical areas.

Estimate habitat available for both parrot species in critical areas.

Promote joint actions in municipal and state land use planning processes to prevent land use changes in both parrot species protected areas.

## 4.2 Scientific Research Elements

### OBJECTIVE

Promote research to increase the knowledge of both parrot species and their habitats to generate effective protection, management, and recovery actions to achieve the objectives of the Recovery Plan.

### ACTIVITIES

Use telemetry with satellite transmitters to follow the migrations of adult and juvenile birds.

Implement field studies to count nesting sites available.

Determine pine cone production available to both parrot species in their reproductive areas.

Develop a study for a suitable design for artificial nests for the Thick-billed Parrot.

For both species develop physical, biological, and adaptation studies to understand their requirements with the goal of reintroduction.

Study current health problems in the wild populations of both parrot species.

Implement population genetic studies to evaluate genetic variability and learn about population trends for both species.

Evaluate both parrot species habitat composition and quality using tools like the HEP (Habitat Evaluation Procedures) and HQI (Habitat Quality Index) models to locate potential areas for the species reintroduction.

Study parrots ecological requirements to implement effective conservation strategies and map forest elements useful to the species such as nesting and shelter sites, water sources, food, perches, and mineral banks.

## 4.3 Biological Monitoring Elements

### OBJECTIVE

Learn about parrot population trends and fluctuations through habitat monitoring for both species.

### ACTIVITIES

Implement or continue existing monitoring studies of both parrot species reproductive populations.

Implement monitoring studies to estimate population size of both parrot species.

Develop a Geographical Information System (GIS) to determine coverage of habitat used, vegetation types, ecological features, wildfire impacts, land use changes, and trends for both parrot species.

Monitor habitat changes such as regeneration or deterioration, and habitat restoration in nesting sites for both species.

Evaluate winter habitat for both species to learn about other threats to the populations.

## 5. Outreach and Education

### 5.1 Environmental Education Elements

#### OBJECTIVES

##### General:

Promote a culture of conservation of both parrot species and their habitat through the spread of information to the general public.

##### Specific:

Include the participation of all sectors of society in both parrot species conservation activities

#### ACTIVITIES

Prepare environmental education curricula for the school programs in the local communities especially close to the species nesting sites.

Prepare printed materials and audiovisual presentations to educate about biology, ecology, protection status, threats, and conservation actions for the recovery of both parrot species.

Prepare an information handbook on both parrot species for environmental education teachers.

Organize community-training workshops for school teachers, environmental education staff, and people interested in educating citizens in the communities near nesting areas to encourage conservation of these species and their forests.

Promote outreach and awareness activities like workshops, field trips, field activities, contests, habitat improvement, and public meetings in the communities close to the species habitat.

## 5.2 Public Communication Elements

### OBJECTIVE

Implement advertising campaigns that allow the public to understand the situations of both parrot species and other psittacids, as well the conservation actions necessary to protect them.

### ACTIVITIES

Design and distribute posters, fliers, comic strips, games, printed banners, and activity books to educate the public on the importance of both species and their habitats.

Sign agreements with the regional radio stations to broadcast informational segments.

Prepare and give out information videos on both parrot species and their habitats.

Through printed materials inform the public on the actions taken to protect both parrot species and conservation achievements.

Disperse information on habitats and threats to the species in the communities close to their distribution areas to get them involved in their conservation.

Emphasize the participation of the general public in the activities of protection, conservation, and recovery of both parrot species and their habitats.

## 5.3 Community Involvement Elements

### OBJECTIVE

Through personnel training and education manage the collaboration of communities, associations, institutions, and other stakeholders in the protection of both parrot species populations and their habitats.

### ACTIVITIES

Encourage activities with low environmental impact among the communities in the distribution areas of both parrot species.

In both parrot species sites, plan community ecotourism projects jointly with tourism companies to limit access through fees, and to provide lodging and local guides.

Train local guides to develop ecotourism projects harmless to both parrot species and to assist in monitoring populations.

Train cabin owners, guides, etc. living in communities close to critical areas to work on 'nature appreciation' jointly with the Office of Tourism.

Include indigenous groups in both parrot species areas in the planning and implementation of ecotourism projects.

Encourage student participation through thesis and other projects with these species.

Train CONANP personnel to survey both parrot species, count individuals and assess nest success in Natural Protected Areas.

## 6. Human and Financial Resources; Partnerships

### 6.1 Stakeholders Elements

#### OBJECTIVES

##### General:

Establish the best organizational, administrative, law enforcement, and financial structure to achieve the Recovery Plan objectives.

##### Specific:

Identify the various groups working on research, management, protection, conservation, and recovery of both parrot species.

Management of the financial, material, and logistic resources necessary to implement the Recovery Plan.

#### ACTIVITIES

Determine Recovery Plan operation funding needs.

Acquisition of funds for the Recovery Plan from the government, private sector, and general public through agreements, contracts, and technical support, money, and in-kind donations.

Create a directory of people and organizations involved in the protection of both parrot species to know what is being done and where.

Coordinate activities in the Recovery Plan with the Technical Consultative Subcommittee for the Protection, Conservation, and Recovery of Psittacids in Mexico.

Increase municipal and state government participation in the development of the Recovery Plan.

### 6.2 Schedule Elements

#### OBJECTIVE

Establish a time chart for the activities and projects to accomplish in the Recovery Plan.

#### ACTIVITIES

Determine and prioritize activities in the Recovery Plan.

Develop schedules for short-, medium-, and long-term activities for the Recovery Plan.

Establish the steps necessary to achieve the goals and objectives in the Recovery Plan and prioritize the activities in each step.

Look for opportunities to have simultaneous activities to use resources more efficiently and generate synergy among the different conservation efforts.

Name people and organizations responsible to develop each activity related to the Recovery Plan.

### 6.3 Evaluation and Follow up Elements

#### OBJECTIVE

Accomplish the goals and objectives of the Recovery Plan on the scheduled times through the set up and analysis of success indicators.

#### ACTIVITIES

Schedule meetings to evaluate short-, medium-, and long-term achievements in the Recovery Plan.

Evaluate achieved results, goals, and objectives through the indicators of success identified in the Recovery Plan. Suggest adjustments and modifications to the Recovery Plan according to the evaluations to improve results.

Share the results of the Recovery Plan with everyone involved and the general public.

## VIII. INDICATORS OF SUCCESS

Conservation Strategy	No.	Indicators of Success	Short-Term	Medium-Term	Long-Term
	1	Decreased illegal logging in Thick-billed Parrot nesting areas.		✓	✓
Protection	2	Increased number of people and concerned groups involved in vigilance and conservation programs for both species and their habitats.	✓	✓	✓
	3	Increased area of protected key habitats for the conservation of both parrot species.	✓	✓	✓
Management	4	Increased number of both parrot species nesting sites in Mexico.		✓	✓
	5	Increased number of individuals in both parrot species wild populations in Mexico.		✓	✓
	6	Increased number of projects with alternative uses for natural resources in both parrot species habitat.	✓	✓	✓
	7	Increased number of hectares, either restored or in the restoration process, considered to be crucial habitats for the protection of both parrot species.	✓	✓	✓
Restoration	8	Number of prevention and mitigation projects in critical habitat to the recovery of both parrot species.	✓	✓	✓

Conservation Strategy	No.	Indicators of Success	Short-Term	Medium-Term	Long-Term
Research	9	Number of scientific projects developed according to the Recovery Plan guidelines.	✓	✓	✓
Outreach and Education	10	Increased awareness of both parrot species information through printed and electronic media.	✓	✓	✓
	11	Increased number of training, outreach and environmental education workshops.	✓	✓	✓
Human and Financial Resources; Partnerships	12	Increased financial and human resources for both parrot species protection programs and actions.	✓	✓	✓
	13	Number of actions taken to protect both parrot species jointly with individuals, associations, institutions, and other stakeholders.	✓	✓	✓
	14	Increased number of visitors assisted.		✓	✓
	15	Number of policy and framework proposals to protect both parrot species habitat.		✓	✓
	16	Number of goals reached through the implementation of the actions described in the Recovery Plan.		✓	✓
	17	Number of objectives achieved in the Recovery Plan.			✓

## IX. TABLE OF PLANNED ACTIVITIES

On this table we define Short-Term as one to two years, Medium-Term three to four years, and Long-Term as more than five years.

Activity	Indicators of Success	Short-Term	Medium-Term	Long-Term
1.1 Habitat Protection Elements				
Do all the steps necessary to get the areas of El Taray (Coahuila), Los Condominios (Nuevo León), Madera y Las Pomas (Chihuahua) decreed as Federal Sanctuaries	3,7,13,15		✓	✓
Do a Technical Justification Study for El Taray's decree as a Federal Sanctuary	3, 13, 15		✓	✓
Designation of critical habitat for both parrot species to enable forest planning use through Forest Management Units to protect trees for nesting and feeding.	1,9,6,15	✓	✓	
Protection of land, including signing legal agreements, fencing properties, fire barriers, and signs.	3,8,13		✓	✓
Strengthen protection in private reserves through the implementation of ecological easements, conservation certifications, and other programs.	13, 12	✓	✓	✓
Locate and control access to both parrot species primary nesting and perching areas.	8, 13		✓	✓
Put up signs with information and restrictions in both parrot species primary nesting areas.	10		✓	✓

Activity	Indicators of Success	Short-Term	Medium-Term	Long-Term
Promote sound land use planning and its application in areas where both parrot species are present.	13,15,16		✓	✓
Establish Integrated Forest Fire Management in collaboration with CONAFOR.	8,13	✓	✓	✓
1.2 Legal Elements				
Disperse current national and international legislation on the protection of both parrot species to all stakeholders.	10, 11	✓	✓	✓
Promote evaluation methods to the legal framework related to the protection and management of both parrot species, and suggest modifications when needed.	13, 15		✓	✓
Establish legal prevention and mitigation measures to control development or land-use changes in the both parrot species distribution areas.	7, 15		✓	✓
Share species technical information to help government officials in decision-making.	13, 15	✓	✓	✓

Activity	Indicators of Success	Short-Term	Medium-Term	Long-Term
<b>1.3 Vigilance and Inspection Elements</b>				
Ask PROFEPA to have inspection and vigilance personnel in critical habitat areas for both parrot species.	2, 12		✓	✓
Promote local vigilance committees to improve control of habitat destruction and illegal trade in both parrot species.	2, 12, 13		✓	✓
Ask the general public to denounce capture and illegal trade of these birds and disturbance of their habitats.	10, 12	✓	✓	✓
Reinforce inspection and vigilance activities jointly with the state and municipal governments.	2, 12, 13	✓	✓	✓

### 1.1 Habitat Management Elements

Locate good habitat currently used or potentially used for nesting and feeding of both parrot species.	9, 4, 5	✓	✓	
Ask SEMARNAT to exclude current and potential habitat for both parrot species from forestry resources, including forest trees used by the birds for nesting and feeding.	7, 15		✓	✓
Promote protection of both parrot species among private landowners in their habitat areas.	2, 12	✓	✓	✓

Activity	Indicators of Success	Short-Term	Medium-Term	Long-Term
Promote different ways to protect land in both parrot species habitat to regulate land use, e.g. ejido reserves, ecological easements, and usufructs.	3, 15		✓	✓
Encourage watershed management to get financial resources through habitat conservation and payments for environmental services.	3, 6, 13, 15	✓	✓	✓
With the Ministry of SAGARPA (Rural Development) promote environmental friendly projects among the communities located in both parrot species distribution area.	6, 12, 13		✓	✓
Promote payment for environmental services to landowners involved in management and conservation of both parrot species populations.	3, 6		✓	✓

## 2.2. Species Management Elements

Build, install, and monitor at least 40 artificial nests in each Thick-billed Parrot nesting site.	4, 5, 9	✓	✓	✓
Develop guidelines to deal with confiscated parrot species.	5, 9, 13		✓	✓
Prepare handbooks for management, rehabilitation, and reintroduction of captive parrot species.	5, 10		✓	✓

Activity	Indicators of Success	Short-Term	Medium-Term	Long-Term
Evaluate the impact of ecotourism on both parrot species in protected areas.	9		✓	✓

### 3.1 Habitat and Ecosystem Restoration Elements

Locate disturbed areas in need of urgent restoration for the protection of both parrot species.	7, 9	✓	✓	
Establish programs to restore and protect soils and forest such as building gabions, retention berms, growing crops, reforestation, fluvial terraces, brush piles, removal of dead wood, living fences, and resting the land to decrease the loss of habitat in critical habitat for both parrot species.	7, 8	✓	✓	✓

### 3.2 Mitigation and Prevention of Impacts

Mapping potential wildfires in important nesting areas for both species.	8, 9, 13	✓	✓	
Prevent wildfires in both parrot species habitat areas through firebreaks, controlled burns, and community vigilance.	8	✓	✓	✓
Implement reforestation programs in both parrot species habitats, especially forested areas presently used by these birds.	7, 8	✓	✓	✓

Activity	Indicators of Success	Short-Term	Medium-Term	Long-Term
Monitor the effect of the main threats to both parrot species populations and their habitats and evaluate impacts on population trends.	9	✓	✓	✓

#### 4.1 Critical Areas Elements

Compile historical and current distribution information for both parrot species.	9	✓	✓	✓
Through point-occurrence data, inferential algorithms, and interviews with local residents determine critical areas (nesting, feeding, migration) for both species.	9	✓	✓	
Verify in the field the presence of the species and suitable habitat.	9	✓	✓	
Estimate both parrot species populations in critical areas.	2, 9	✓	✓	✓
Estimate habitat available for both parrot species in critical areas.	9	✓	✓	✓
Promote joint actions in municipal and state land use planning processes to prevent land use changes in both parrot species protected areas.	2, 13, 15		✓	✓

#### 4.2 Scientific Research Elements

Use telemetry with satellite transmitters to follow the migrations of adult and juvenile birds.	9	✓	✓	✓
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Activity	Indicators of Success	Short-Term	Medium-Term	Long-Term
Implement field studies to count nesting sites available.	4, 9	✓	✓	✓
Determine pine cone production available to both parrot species in their reproductive areas.	9	✓	✓	✓
Develop a study for a suitable design for artificial nests for the Thick-Billed Parrot.	4, 9	✓		
For both species develop physical, biological, and adaptation studies to understand their requirements with the goal of reintroduction.	4, 5, 9	✓	✓	
Study current health problems in the wild populations of both parrot species.	9	✓	✓	
Implement population genetic studies to evaluate genetic variability and learn about population trends for both species.	9	✓	✓	✓
Evaluate both parrot species habitat composition and quality using tools like the HEP (Habitat Evaluation Procedures) and HQI (Habitat Quality Index) models to locate potential areas for the species reintroduction.	9, 15	✓	✓	✓
Study both parrot species ecological requirements to implement effective conservation strategies and map forest elements useful to the species such as nesting and shelter sites, water sources, food, perches, and mineral banks.	9	✓	✓	

Activity	Indicators of Success	Short-Term	Medium-Term	Long-Term
<b>4.3 Biological Monitoring Elements</b>				
Implement or continue existing monitoring studies of both parrot species reproductive populations.	9	✓	✓	✓
Implement monitoring studies to estimate population size of both species of parrots.	9	✓	✓	✓
Develop a Geographical Information System (GIS) to determine coverage of habitat used, vegetation types, ecological features, wildfire impacts, land use changes, and trends for both parrots species.	9		✓	✓
Monitor habitat changes such as regeneration or deterioration, and habitat restoration in nesting sites for both species.	7, 9		✓	✓
Evaluate winter habitat for both species to learn about other threats to the populations.	9	✓	✓	✓
<b>5.1 Environmental Education Elements</b>				
Prepare an environmental education curricula for the school programs in the local communities, especially close to the species nesting sites.	10, 11, 12	✓	✓	✓
Prepare printed materials and audiovisual presentations to educate about biology, ecology, protection status, threats, and conservation actions for the recovery of both parrot species.	10, 12	✓	✓	✓

Activity	Indicators of Success	Short-Term	Medium-Term	Long-Term
Prepare an information handbook on both parrot species for environmental education teachers.	10, 12	✓	✓	
Organize community training workshops for school teachers, environmental education staff, and people interested in educating citizens in the communities near nesting areas to encourage conservation of these species and their forests	10, 11, 12	✓	✓	✓
Promote outreach and awareness activities like workshops, field trips, field activities, contests, habitat improvement, and public meetings, in the communities close to the species habitat.	10, 11, 12	✓	✓	✓

#### 5.1 Public Communication Elements

Design and distribute posters, fliers, comic strips, games, printed banners, and activity books to educate the public on the importance of both species and their habitats.	10, 11, 12	✓	✓	✓
Sign agreements with the regional radio stations to broadcast informational segments.	10, 11, 12, 13	✓	✓	✓
Prepare and give out informational videos on both parrot species and their habitats.	10, 11, 12	✓	✓	✓
Through printed materials inform the public on the actions taken to protect both parrot species and conservation achievements.	10, 11, 12	✓	✓	✓

Activity	Indicators of Success	Short-Term	Medium-Term	Long-Term
Disperse information on habitats and threats to the species in the communities close to their distribution areas to get them involved in their conservation.	2, 10, 11, 12	✓	✓	
Emphasize the participation of the general public in the activities of protection, conservation, and recovery of both parrot species and their habitats.	10, 11, 13	✓	✓	

## 5.2 Community Involvement Elements

Encourage activities with low environmental impact among the communities in the distribution area of both parrot species.	3, 6	✓	✓	✓
In both parrot species sites, plan community ecotourism projects jointly with tourism companies to limit access through fees, and to provide lodging and local guides.	6, 13, 14		✓	✓
Train local guides to develop ecotourism projects harmless to both parrot species and to assist in monitoring populations.	2, 6, 14		✓	✓
Train cabin owners, guides, etc. living in communities close to critical areas to work on ‘nature appreciation’ jointly with the Office of Tourism.	6, 13, 14		✓	✓
Include indigenous groups in both parrot species areas in the planning and implementation of ecotourism projects.	6, 13, 14		✓	✓
Encourage student participation through thesis and other projects with these species.	2, 12	✓	✓	✓

Activity	Indicators of Success	Short-Term	Medium-Term	Long-Term
Train CONANP personnel to survey both parrot species, count individuals and asses nest success in Natural Protected Areas.	2, 12, 13	✓	✓	✓
6.1 Stakeholders Elements				
Determine Recovery Plan operation funding needs.	12, 16, 17	✓	✓	
Acquisition of funds for the Recovery Plan from the government, private sector, and general public through agreements, contracts, and technical support, money, and in-kind donations.	12, 13, 16, 17		✓	✓
Create a directory of people and organizations involved in the protection of both parrot species to know what is being done and where.	12, 13	✓		
Coordinate activities in the Recovery Plan with the Technical Consultative Subcommittee for the Protection, Conservation, and Recovery of Psittacids in Mexico.	12, 13	✓	✓	✓
Increase municipal and state government participation in the development of the Recovery Plan.	2, 12, 13	✓	✓	✓

Activity	Indicators of Success	Short-Term	Medium-Term	Long-Term
<b>6.2 Schedule Elements</b>				
Determine and prioritize activities in the Recovery Plan.	16, 17	✓		
Develop schedules for short-, medium-, and long-term activities for the Recovery Plan.	16, 17	✓	✓	
Establish the steps necessary to achieve the goals and objectives in the Recovery Plan and prioritize the activities in each step.	16, 17	✓	✓	
Look for opportunities to have simultaneous activities to use resources more efficiently and generate synergy among the different conservation efforts.	12, 13, 16, 17	✓	✓	
Name people and organizations responsible to develop each activity related to the Recovery Plan.	12, 13	✓		
<b>6.3 Evaluation and Follow up Elements</b>				
Schedule meetings to evaluate short-, medium-, and long-term achievements in the Recovery Plan.	16, 17	✓	✓	✓
Evaluate achieved results, goals, and objectives through the indicators of success identified in the Recovery Plan.	16, 17	✓	✓	✓
Suggest adjustments and modifications to the Recovery Plan according to the evaluations to improve results.	16, 17		✓	✓
Share the results of the Recovery Plan with everyone involved and the general public.	10, 11, 13, 16, 17		✓	✓

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## APPENDIX 1

### ACRONYMS

- CITES: Convention on International Trade in Endangered Species of Wild Fauna and Flora
- CONABIO: The Mexican National Commission for Knowledge and Use of Biodiversity (Comisión Nacional para el Conocimiento y Uso de la Biodiversidad)
- CONAFOR: Mexican National Forestry Commission (Comisión Nacional Forestal )
- CONANP: The Mexican National Commission of Protected Natural Areas (Comisión Nacional de Áreas Naturales Protegidas)
- DAP: Diameter Breast Height – DBH (Forestry measurement)
- HEP: Habitat Evaluation Procedures
- HQI: Habitat Quality Index
- INE: Mexican National Institute of Ecology (Instituto Nacional de Ecología)
- ITESM: The Monterrey Institute of Technology and Higher Education (Instituto Tecnológico y de Estudios Superiores de Monterrey)
- IUCN: International Union for Conservation of Nature
- PACE: Endangered Species Recovery Plan (Programa de Acción para la Conservación de Especies)
- PNCM: Cumbres de Monterrey National Park
- PREP: Listed Species Recovery and Conservation Programs (Proyectos de Conservación y Recuperación de Especies Prioritarias)
- PROCER: Endangered Species Conservation Program (Programa de Conservación de Especies en Riesgo)
- PROFEPA: Mexican Environmental Protection Agency (Procuraduría Federal de Protección al Ambiente)
- SAGARPA: Agriculture, Cattle, Rural Development, Fisheries, and Food Ministry (Secretaría de Agricultura, Ganadería, Desarrollo Rural, Pesca y Alimentación)
- SEMARNAP: Environment, Natural Resources, and Fisheries Ministry (Secretaría de Medio Ambiente, Recursos Naturales y Pesca)
- SEMARNAT: Environment and Natural Resources Ministry (Secretaría del Medio Ambiente y Recursos Naturales)
- SIG: Geographic Information System
- SIMEC: Conservation Assessment and Monitoring, Information System
- SINAP: National Protected Natural Areas System (Sistema Nacional de Áreas Naturales Protegidas)
- UANL: Universidad Autónoma de Nuevo León

## **APPENDIX 2**

### **Acknowledgements**

Juan Elvira Quesada  
Secretario de Medio Ambiente y Recursos Naturales

Ernesto Enkerlin Hoeflich  
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**SECRETARÍA DE MEDIO AMBIENTE  
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