

Draft Recovery Plan for the Northern Aplomado Falcon
(*Falco femoralis septentrionalis*), First Revision



U.S. Fish and Wildlife Service
Southwest Region
Albuquerque, New Mexico
August 2026

Approved: _____
Regional Director, Southwest Region,
U.S. Fish and Wildlife Service

PURPOSE AND DISCLAIMER

This document presents the U.S. Fish and Wildlife Service's (USFWS) plan for the conservation of northern aplomado falcon. The recovery plan is the second part of the USFWS's 3-part recovery planning framework and includes the statutorily required elements pursuant to section 4(f) of the Endangered Species Act (ESA). This recovery plan is informed by the first part of the framework, a Species Status Assessment (SSA). The SSA report delivers foundational science for informing decisions related to the ESA and includes an analysis of the best available scientific and commercial information regarding a species' life history, biology, and current and future conditions that characterizes the species' viability (i.e., ability to sustain populations in the wild over time) and extinction risk. We have also prepared a Recovery Implementation Strategy (RIS), the third part of the framework. The RIS is an easily updateable operational plan that is separate and complimentary to the recovery plan that details the on-the-ground recovery activities needed to complete the recovery actions contained in the recovery plan.

Recovery plans describe the envisioned recovered state for a listed species (when it should no longer meet the ESA's definitions of a threatened species or endangered species) and include a recovery strategy, recovery criteria, recovery actions, and the estimates of time and cost needed to achieve it. Plans are published by the USFWS and are often prepared with the assistance of recovery teams, contractors, State agencies, and others. Recovery plans do not necessarily represent the views, official positions, or approval of any individuals or agencies involved in plan formulation, other than the USFWS. They represent the official position of the USFWS only after they have been signed by the Regional Director as approved. Recovery plans are guiding and planning documents only; identification of an action to be implemented by any public or private party does not create a legal obligation beyond existing legal requirements. Nothing in this plan should be construed as a commitment or requirement that any Federal agency obligate or pay funds in any one fiscal year in excess of appropriations made by Congress for that fiscal year in contravention of the Anti-Deficiency Act, 31 U.S.C. 1341, or any other law or regulation. Approved recovery plans are subject to modification as dictated by new findings, changes in species status, and completion of recovery actions.

ACKNOWLEDGEMENTS

This recovery plan has benefitted from the advice and assistance of many individuals, agencies, and organizations. We thank the following individuals for their assistance and apologize to anyone whose name was omitted inadvertently from this list:

Lead Author(s)

Jennifer Davis, New Mexico Ecological Services Field Office, Albuquerque, New Mexico
Jonathan Moczygemba, Texas Restoration Office, Las Fresnos, Texas
Marilyn Wright, New Mexico Ecological Services Field Office, Albuquerque, New Mexico
Stephanie Bilodeau, Santa Ana National Wildlife Refuge, Alamo, Texas

Other Contributors

Alberto Macías-Duarte, Universidad Estatal de Sonora, Hermosillo, Mexico
Janess Vartanian, Southwest Regional Office, Albuquerque, New Mexico

57

58 **RECOMMENDED CITATION AND ELECTRONIC AVAILABILITY**

59 U.S. Fish and Wildlife Service. 2026. Draft recovery plan for northern aplomado falcon (*Falco*
60 *femoralis septentrionalis*), First Revision. U.S. Fish and Wildlife Service, Southwest Region,
61 Albuquerque, Regional Office State, USA. 21 pp.

62 An electronic copy of this Final Recovery Plan will be made available at:

63 <https://ecos.fws.gov/ecp/species/1923>.

64

65

1. INTRODUCTION

This recovery plan describes criteria for determining when the northern aplomado falcon should be considered for delisting, lists site-specific actions that will be necessary to meet those criteria, and estimates the time and cost to achieve recovery. Additionally, a brief summary of information on the species' biology and status are included, along with a brief discussion of factors limiting its populations. A detailed discussion of these and other topics pertinent to the recovery of northern aplomado falcon can be found in the SSA. Detailed on the ground activities implementing recovery actions can be found in the Recovery Implementation Strategy. These supplemental documents are available at <https://www.fws.gov/species/northern-aplomado-falcon-falco-femoralis-septentrionalis>. The Recovery Implementation Strategy (RIS) and SSA are finalized separately from the Recovery Plan and will be updated on a routine basis.

The northern aplomado falcon is a rare, non-migratory, medium-sized neotropical falcon of the open grasslands ranging from the southwestern United States (U.S.) and Mexico to Central America. This subspecies was listed as endangered in 1986 due to its extirpation as a breeding bird in the U.S., and evidence of pesticide contamination and population declines in eastern Mexico (51 FR: 6686). There are three wild populations of northern aplomado falcons: one in coastal Texas, one in the Chihuahuan Desert of the U.S. and Mexico, and one in the tropical lowlands of Mexico (Figure 1). Currently, the Coastal Texas and Chihuahuan Desert Populations are considered to have low resiliency and the Tropical Lowlands Population, moderate resiliency (USFWS 2025, pp. 40-50).

The once extirpated Coastal Texas Population was reestablished through an intensive captive breeding and release program. The population reached a post-reintroduction high of 44 pairs in 2005. However, following population fluctuations from unknown and natural causes (i.e. Hurricane Harvey) the population is now comprised of fewer than 25 pairs (The Peregrine Fund 2012, p. 9; 2017, p. 3; 2019, pp. 3, 8; USFWS 2025, pp. 22-23). Augmentation of the Chihuahuan Desert Populations within the U.S., through the release of captive-bred northern aplomado falcons, was not as successful. Post-release survival and retention of released falcons varied widely and may have been influenced by severe drought conditions (Hunt *et al.* 2013, p. 345, 347; USFWS 2014, pp. 25-28). Currently, there are one to three known breeding pairs in the U.S. portion of the Chihuahuan Desert and approximately 10 pairs in Mexico (A. Macías-Duarte, pers. comm., May 5, 2024). In the tropical lowlands of Mexico, modeling suggests that occupancy of nesting territories remained constant from 2005 to 2015 in central Veracruz (A. Macías-Duarte, pers. comm., May 5, 2024); however, publicly provided eBird data suggests negative abundance trends from 2007-2021 through nearly half of the tropical lowlands (Fink *et al.* 2022, accessed 2023).

There is no known connectivity between the existing populations. Although juveniles are capable of dispersing long distances, current populations are separated by at least 373 miles, suggesting they do not interact with each other. Further supporting this, Rolek *et al.* (2022, p. 9) found immigration of non-breeders and emigration negligible, suggesting an isolated population in coastal Texas. Although populations are geographically separate, which limits the risk of any single catastrophic event impacting the entire subspecies, retaining population redundancy requires conservation actions that increase the resiliency of the Chihuahuan Desert and Coastal Texas Populations. Representation in the form of genetic or ecological diversity is important to

maintain the capacity of northern aplomado falcons to adapt to future environmental changes. The northern aplomado falcon has likely lost genetic diversity following the local extirpation of the species from coastal Texas and the drastic declines experienced in the Chihuahuan Desert. Of the existing populations, only two (Tropical Lowlands and Chihuahuan Desert Populations) possess unique genetics, as all individuals in coastal Texas are the progeny of captive-born birds sourced from the Tropical Lowlands Population in Mexico.

Threats

Below we summarize the primary threats impacting the northern aplomado falcon. Impacts from these threats may vary by population. For more information on all potential threats, please see the SSA Report (USFWS 2025, pp. 25-38).

Drought

The North American Southwest is currently experiencing a megadrought that has surpassed the regions average duration of 19-20 years (Williams *et al.* 2020, p. 314) and is projected to become more arid with more frequent multi-year droughts (Seager *et al.* 2007, p. 1181). Warming and drying conditions may drive decreasing perennial grass cover and increasing cover of annual species, including the invasive Lehmann lovegrass (*Eragrostis lehmanniana*) and buffelgrass (*Pennisetum ciliare*) (Bodner and Robles 2017, pp. 6-7; Ludwig *et al.* 2017, pp. 55-57; Kleinhesselik *et al.* 2023, pp. 7-8). Changes to grassland structure and vegetative composition has resulted in shifts away from species that benefit native grassland birds (Gulf South Research Corporation and La Tierra Environmental Consulting 2016 as cited in La Tierra 2021, entire). Drought can reduce the availability of food resources for migratory avian species, resulting in a decrease of prey for the northern aplomado falcon (Macías-Duarte *et al.* 2004, p. 1089; Macías-Duarte *et al.* 2018, p. 48). When compounded with heavy grazing pressure, drought could also impact habitat conditions that provide cover for migratory passerine birds, negatively impacting survival of prey species during winter (Macías-Duarte and Panjabi 2013, p. 147). The loss of prey base could make northern aplomado falcons more susceptible to disease or predation (Hunt *et al.* 2013, p. 347), and result in delayed initiation of nesting (Macías-Duarte *et al.* 2004, p. 1089). Because the tropical lowlands and coastal Texas receive more precipitation and offer more prey during droughts than the Chihuahuan Desert, northern aplomado falcon populations in coastal Texas and the tropical lowlands are likely less impacted by drought relative to the Chihuahuan Desert Population.

Sea Level Rise

In the western Gulf coast, sea levels are projected to rise (intermediate-high estimate of 0.51-0.79 meters (m); Sweet *et al.* 2022, p. 19), which can result in the inundation of low-lying habitats such as marshes and grasslands. In coastal Texas, where northern aplomado falcons are primarily distributed near the coast, rising seas are likely to result in the loss of northern aplomado falcon habitat (USFWS 2025 p. 27). The tropical lowlands in Mexico are also likely to lose habitat to rising seas; however, because the Tropical Lowland Population is distributed further inland than the population in coastal Texas, the Tropical Lowland Population is more resilient to rising seas than the Coastal Texas Population.

Tropical Storm/Hurricane

The frequency of major hurricanes is expected to increase 2- to 4.5-fold going forward (Bruyere *et al.* 2017, p. 69). Although northern aplomado falcons are likely capable of moving away from hurricanes that make landfall during the day, they may be more impacted by hurricanes that make landfall during the night when they are roosting. For example, the Coastal Texas Population experienced a sharp decline during Hurricane Harvey and the subsequent slow recovery suggests vulnerability to hurricanes (USFWS 2025, pp. 22-23 & 28). Based on data from the past approximately 120 years, the northern aplomado falcon population viability analysis (PVA) modeled impacts from catastrophic events at frequencies which coincide with predicted increases in severe hurricanes for coastal populations (USFWS 2025, p. 28). As the incidence of Category 4 and 5 hurricanes increases, adult mortality is expected to increase and additional habitat loss is likely to occur (USFWS 2025, p. 28). Coastal populations need to be large and widely distributed to be more resilient to hurricanes. Given the Tropical Lowlands Population's size and distribution, it is likely more resilient to hurricanes than the Coastal Texas Population.

Fire Regime Changes

Altered fire regimes in the Chihuahuan Desert can impact prey availability (Bock and Block 2005, pp. 4-8). Fire is a natural driver of Chihuahuan Desert grassland community structure (Humphrey 1974, pp. 388-393). The synergistic effect of fire on a plant community during a prolonged drought can result in a changed plant community as well as slow the overall recovery of the plant community for years (Ladwig *et al.* 2014, p. 626). This reduction in native grassland vegetation cover and species composition in favor of invasive species from the effects of fire could result in a decrease in prey availability for the northern aplomado falcon as avian and small mammal prey species, that depend upon this vegetation for cover and food, decrease in abundance (Brooks and Pyke 2002, p. 8; Hunt *et al.* 2013, p. 344).

While fire can be a stressor by consuming nests and killing northern aplomado falcon nestlings, fire is also vital to conserving northern aplomado falcon habitat. Reduced fire frequency is one of the greatest underlying causes of habitat loss to woody encroachment in coastal Texas. A decrease in fire frequency could result in increased woody encroachment, negatively affecting habitat in the Chihuahuan Desert and Coastal Texas Populations.

Although timing of fire is important to reduce risks to nests, in the tropical lowlands, managed fire is generally considered beneficial as it creates and maintains open fields which are used by northern aplomado falcons. Thus, altered fire regimes may be a stressor for northern aplomado falcon populations in the Chihuahuan Desert grasslands and coastal Texas, but may not be a population-level stressor for the Tropical Lowlands Population where it is generally considered beneficial.

Land Conversion

Conversion of desert grassland habitat to urban, commercial, agricultural, or residential use will generally result in a complete loss of functional habitat, while habitat fragmentation may leave areas of desert grassland intact but reduce their value as breeding or foraging habitat for falcons.

From 1986-2020, approximately 2 percent (758,313 acres [ac] of 46,362,655 ac, or over 22,000 ac per year) of all Chihuahuan Desert grassland habitat was lost to human development in the U.S. (USFWS 2024a, pp. 4-5). This has resulted in approximately one third of the Chihuahuan Desert habitat in the U.S. being highly impacted by direct loss or fragmentation, as well as habitat modification, especially from energy development (McClung *et al.* 2019, p. 1954). An additional 5 percent (over 2,100,000 ac) of Chihuahuan Desert grassland habitat may be lost to human development in the U.S. by 2080 (USFWS 2024a, p. 5-7), primarily from industrial and residential land development. Non-renewable energy development (oil and gas) was historically the dominant form of energy development in this habitat and will continue to modify Chihuahuan Desert grassland habitat into the future, particularly in southeastern New Mexico and western Texas (USFWS 2025, p. 31). Renewable energy development (e.g., solar) is also increasing in Chihuahuan Desert habitat with high concentrations likely in southwestern New Mexico (USFWS 2025, p. 31). This could deter future northern aplomado falcon territories in these areas as well as reduce avian prey species richness and relative abundance.

Although residential and commercial development are unlikely to result in large scale habitat loss in the Mexican portion of the Chihuahuan Desert, the conversion of desert grassland habitat to irrigated agriculture (from 1986 to 2021) has resulted in the loss of historical nesting territories and nearby habitat (USFWS 2025, p. 32). Approximately 7 percent of known northern aplomado falcon occupied habitat was lost from agricultural development in the Chihuahuan Desert of Mexico since 1986 (USFWS 2024b, p. 9; A. Macías-Duarte, pers. comm., May 5, 2024).

Livestock grazing has modified habitat impacting the sustainability of prey species required for northern aplomado falcons and may disturb nesting falcons (USFWS 2025, p. 32). Intense grazing has resulted in significant levels of woody vegetation encroachment, which impairs the ability of northern aplomado falcons to effectively hunt. Grazing impacts to vegetation community structure continues to be a risk factor to the recovery of Chihuahuan Desert grassland habitat in southern New Mexico and western Texas (USFWS 1990, pp. 34-35; Zimmer 1995, pp. 50-56; Meyer and Williams 2005, p. 355).

Human development is proceeding rapidly in coastal Texas and is a primary threat to northern aplomado falcon habitat for this population. Between 1986 and 2020, 14 percent of coastal Texas grass and shrub vegetation was lost to development, primarily through agricultural conversion (8%) and urban development (5%), with 1 percent lost to modification from grazing impacts resulting in barren or disturbed ground (USFWS 2024a, pp. 3-5). An additional 20 percent (over 104,000 ac) of coastal Texas grass and shrub habitat may be lost to human development by 2080, primarily from urban, suburban and rural land development (USFWS 2025, p. 33).

In the Chihuahuan Desert, habitat fragmentation (from roads and infrastructure development) can reduce the abundance and diversity of avian prey species, negatively influencing northern aplomado falcon territory and nest establishment, and survival (USFWS 2025, p. 33). In coastal Texas, road and drainage networks suppress processes that maintain northern aplomado falcon habitat and facilitate woody encroachment (USFWS 2025, p. 33).

230 Land conversion is not considered a stressor for falcons in the tropical lowlands. Conversion
231 typically converts forest into grasslands for grazing or into agricultural fields, which could
232 benefit northern aplomado falcons by increasing suitable habitat.

233 *Woody Encroachment*

234 Encroachment of woody vegetation is a threat for all populations of northern aplomado falcons.
235 Increased woody vegetation reduces hunting effectiveness and promotes habitat conditions that
236 support predators.

237 The timing and drivers of woody encroachment differ between populations. In the Chihuahuan
238 Desert, historical livestock grazing practices are the primary driver of woody encroachment in
239 the U.S whereas encroachment of woody vegetation is a more recent occurrence in Chihuahua,
240 Mexico (USFWS 2025, p. 35). In coastal Texas, reduced fire and changes in flooding frequency
241 can degrade coastal grasslands and marshes leading to encroachment of woody vegetation
242 (USFWS 2025, pp. 28 & 33). In the tropical lowlands of Mexico, vegetational succession of
243 abandoned pastures and cropland facilitates thornscrub establishment (USFWS 2025, p. 36).

244 *Predation*

245 The threat posed by northern aplomado falcon predators tends to be greatest in woodlands and in
246 areas lacking yuccas or artificial nest structures where northern aplomado falcons may nest in
247 shrubs or on the ground (Brown and Collopy 2008, entire). Woodlands are usually inhabited by
248 great horned owls (*Bubo virginianus*) and other species which prey on northern aplomado
249 falcons (USFWS 2025, p. 36). Northern aplomado falcon nests located in shrubs and on the
250 ground are much more vulnerable to predators and much less successful than nests in yuccas and
251 artificial structures (Brown and Collopy 2008, entire).

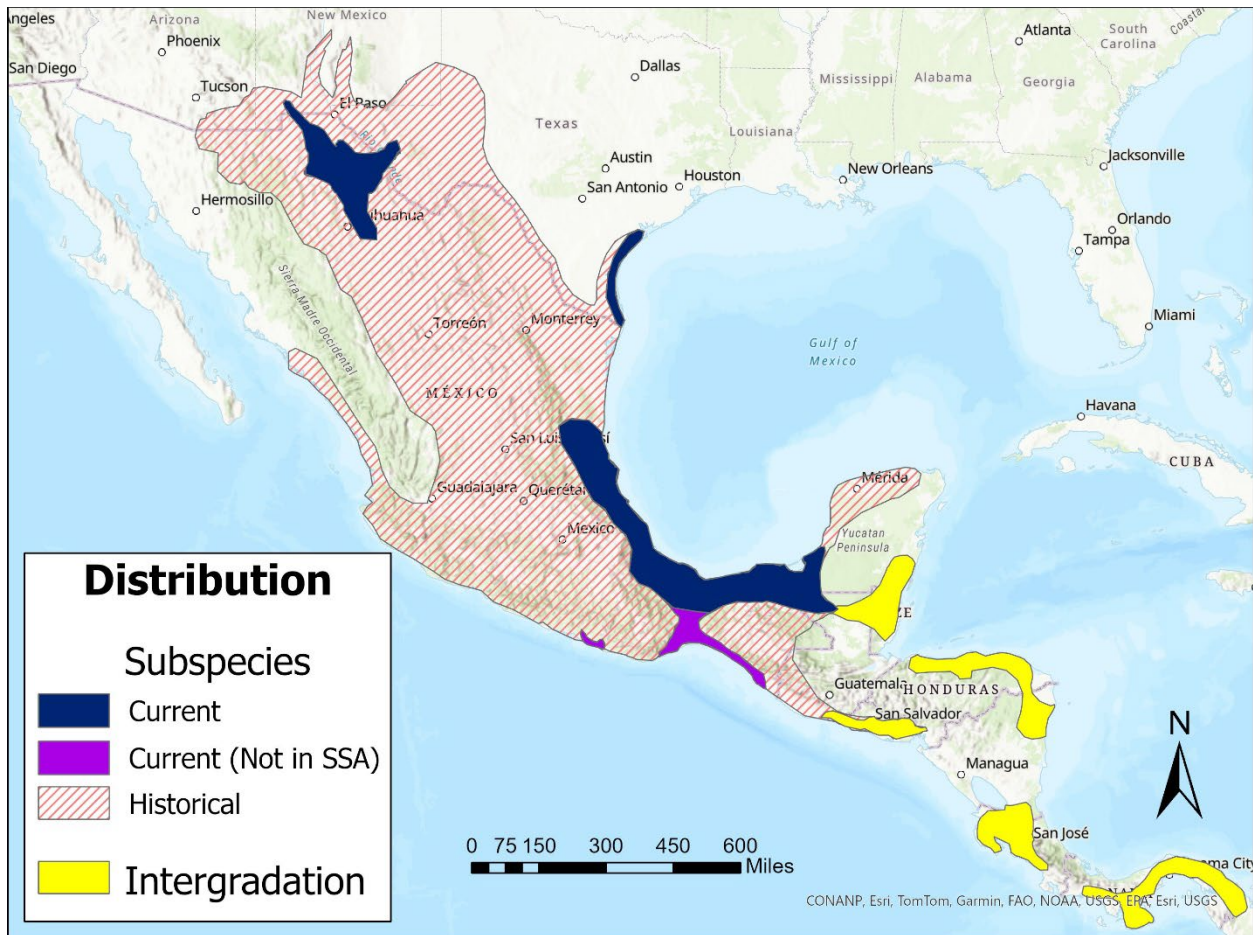


Figure 1. Historical and current distribution of the northern aplomado falcon and suggested zone of intergradation with the nominate subspecies. Note: Current distribution depicted in blue is analyzed in this SSA, current distribution in purple was excluded from analysis. The zone of intergradation depicts areas where the subspecies and nominate species may intergrade as explained in the SSA (USFWS 2025, p. 16, 21)

2. RECOVERY STRATEGY

The recovery strategy provides a concise overview of the envisioned recovered state for northern aplomado falcon, describes the Service's chosen approach to achieve it, and includes the rationale for why the approach was chosen. Specifically, the recovery strategy articulates how the plan's statutory elements (e.g., recovery criteria, recovery actions, and estimates of time and cost) will work together to achieve northern aplomado falcon's recovery.

Northern aplomado falcons will be recovered when three existing populations (Chihuahuan Desert, Coastal Texas, and Tropical Lowlands) are self-sustaining and are maintaining and/or growing. Self-sustaining populations are able to persist into the future, without reliance on human interventions (e.g., release of captive-bred birds), in the face of increasing catastrophic events. This recovery work will be achieved through extensive work with partners and through conservation agreements aimed at protecting, conserving, and restoring habitat. Realized habitat loss may continue to prevent connectivity between the populations into the future. The three populations face distinct threats that must be addressed individually to ensure each remains self-

sustaining. The Chihuahuan Desert Population requires especially urgent conservation due to its very small size, few breeding pairs, and continuing habitat loss.

Key conservation strategies include habitat conservation, restoration, and maintenance through partnerships. These conservation actions will ensure adequate nest site availability, reduce predation risks and promote habitat that supports adequate prey and increased recruitment and survival in each of the subspecies' populations. Additional strategies include captive breeding and releases to increase population size and genetic diversity, and installation of nest boxes in coastal Texas and the Chihuahuan Desert to offset the loss of natural nesting sites. Conservation actions will be implemented through collaborative partnerships with private landowners and managers, binational governments (State and Federal), researchers, and non-governmental organizations.

Current understanding of subspecies' demography and ecology is based largely upon data collected from the Coastal Texas Population; a population re-established solely from captive-bred and released individuals. Increased understanding of naturally occurring populations is needed to provide insight into population-specific management needs and threat mitigation. Research needs outlined below include information needs related to the subspecies' ecology and demography and threats for all three populations and population dynamics of stick nest builders in coastal Texas and the Chihuahuan Desert. Further, key to implementing appropriate captive breeding and release strategies is to understand genetic representation across all populations, wild and captive. We assume that conservation, protection and management of sufficient habitat into the future will provide sufficient prey diversity and densities to support viable populations of northern aplomado falcons into the future. Monitoring of the subspecies and its habitat, to assess response to conservation and management activities, will guide future management actions as needed.

3. RECOVERY CRITERIA

Recovery criteria are statutorily required objective, measurable descriptions of a recovered state for northern aplomado falcon, as described in [4\(f\)\(1\)\(b\)\(ii\)](#) of the ESA. Recovery criteria describe the conditions of resiliency, redundancy, representation, and threat abatement that indicate when northern aplomado falcon may no longer meet the ESA's definitions of an endangered species or threatened species. Recovery criteria present our best estimate of a species' recovered condition at the time of recovery plan development. Changes in available information, technologies, and our understanding of the species over time might mean that the recovered state envisioned by the recovery criteria differs from our assessment in a later status determination.

Downlisting Criteria

The following downlisting criteria, when met collectively, would indicate that northern aplomado falcon may be reclassified as a threatened species.

Downlisting Recovery Criterion 1:

1. At least 380 breeding pairs are distributed across three populations over 15 years. The following conditions are also met:

- An average of at least 50 breeding pairs in the Coastal Texas Population over 15 years.
- An average of at least 50 breeding pairs in the Chihuahuan Desert Population over 15 years, with at least 17 of those pairs within the U.S.
- At least 280 breeding pairs over 15 years in the Tropical Lowlands Population.

Rationale for Downlisting Criterion 1

Maintaining multiple sufficiently abundant populations increases the resiliency and redundancy of the northern aplomado falcon. The PVA predicts that populations established with a minimum of 50 breeding pairs have roughly a 70 percent probability of persisting for more than 50 years (The Peregrine Fund 2023, entire). However, under this scenario, the subspecies would remain vulnerable to catastrophic events. At these levels, population expansion to increase resilience remains a primary goal to reduce the likelihood that catastrophic events will cause localized population extirpation or significant range-wide declines.

Maintaining at least 50 breeding pairs in both the Coastal Texas and Chihuahuan Desert Populations would substantially improve the resiliency of these populations, which are currently in low overall condition (Macías-Duarte et al. 2016, entire; USFWS 2025, pp. 41-50). The 15-year timeframe is considered sufficient to assess population fluctuations from variability in environmental conditions and prey resources (Macías-Duarte et al. 2009, entire). Maintaining the Tropical Lowlands Population at or above 280 breeding pairs would also bolster the largest and most geographically widespread population of the subspecies, providing some additional resiliency to hurricanes and sea-level rise.

Maintaining all three populations adequately preserves the subspecies' geographic, ecological, and genetic representation. The Chihuahuan Desert Population possesses unique genetic characteristics, while the Coastal Texas Population was established from captive-bred descendants of birds originating from the Tropical Lowlands Population. Maintaining all three populations preserves genetic variation and thus preserves the capacity to respond to changing environmental conditions.

Downlisting Recovery Criterion 2:

2. Sufficient breeder habitat is protected or conserved to support the populations described in Downlisting Criteria 1, above, and is distributed across the landscape such that a single catastrophic event is not likely to have population level impacts.

Rationale for Criterion 2

Information on the amount of habitat needed to support a breeding pair of northern aplomado falcons varies by population and habitat conditions. Therefore, additional information, specifically from the Chihuahuan Desert and Tropical Lowlands Populations, is needed to better understand how much habitat needs to be protected or conserved to support population sizes in Criteria 1 (USFWS 2025, pp. 53-56). For the Coastal Texas Population, at least 100,000 acres

(40,469 ha) is thought sufficient to support 50 breeding pairs of falcons (USFWS 2025, pp. 42, 57, 59); with additional habitat needed to support floaters.

Habitat for each population must be distributed across the landscape in a manner that limits the effects of catastrophic events on the population. For example, in 2017 Hurricane Harvey resulted in the loss of approximately 25% of breeding adult falcons in the Coastal Texas Population. Population abundance has not rebounded and remains well below previous estimates; 39-44 pairs before the hurricane (2017 and 2005, respectively) and 26 pairs as of 2025. For coastal populations, increasing the populations distribution both inland and along the coastline will improve population resilience by reducing the proportion of the population that can be impacted by a single event such as a hurricane. For the Chihuahuan Desert Population, breeding areas (i.e., groups of breeding birds) should be distributed across the landscape such that they may experience differential climatic or other challenges (e.g., drought, disease, land conversion). Breeding areas should be less than 80 miles, but cannot be more than 230 miles (maximum documented dispersal distance), from one another allowing for natural dispersal to other areas or recolonization (USFWS 2025, pp. 42, 44).

Delisting Criteria

The following delisting criteria, when met collectively, may indicate that northern aplomado falcon no longer meets the ESA's definitions of either a threatened species or endangered species, and may be able to be removed from the Federal Lists of Endangered and Threatened Wildlife and Plants:

Delisting Recovery Criterion 1:

1. At least 430 breeding pairs are distributed across three self-sustaining populations, and each population is considered stable or increasing over 15 years. The following conditions are also met.
 - An average of at least 75 breeding pairs in the Coastal Texas Population.
 - An average of at least 75 breeding pairs in the Chihuahuan Desert Population, with at least 25 of those pairs within the U.S.
 - At least 280 breeding pairs in the Tropical Lowlands Population.

Rationale for Delisting Criterion 1

Population viability analyses (PVA) indicate that an initial population of 50 pairs of northern aplomado falcons has a roughly 70 % probability of persisting 50 years. However, the Coastal Texas population reached a maximum size of 44 (just shy of 50) in 2005 and at a population size of 39 pairs in 2017 the population declined following Hurricane Harvey and has not recovered to previous levels. The population has hovered around 25 pairs and remains vulnerable to extirpation. To have a greater than 70% probability of persisting 50 years, the PVA suggests that at least 75 pairs are needed. Therefore, to provide greater confidence in a population's ability to rebound, 75 pairs was selected for delisting criteria to better ensure long-term viability in the face of increasing risks of catastrophic events expected in the future.

Maintaining at least 75 breeding pairs in both the Coastal Texas and Chihuahuan Desert Populations would substantially improve the resiliency of these populations, which are currently in low overall condition (Macías-Duarte et al. 2016, entire; USFWS 2025, pp. 41-50). The 15-year timeframe is considered sufficient to assess population fluctuations from variability in environmental conditions and prey resources (Macías-Duarte et al. 2009, entire). Maintaining the Tropical Lowlands Population at or above 280 breeding pairs would also bolster the largest and most geographically widespread population of the subspecies, providing some additional resiliency to hurricanes and sea-level rise.

Maintaining all three populations adequately preserves the subspecies' geographic, ecological, and genetic representation. The Chihuahuan Desert Population possesses unique genetic characteristics, while the Coastal Texas Population was established from captive-bred descendants of birds originating from the Tropical Lowlands Population. Maintaining all three populations preserves genetic variation and thus preserves the capacity to respond to changing environmental conditions.

Delisting Recovery Criterion 2:

2. Sufficient breeder habitat is protected or conserved to support the populations described in Delisting Criteria 1, above, and is distributed across the landscape such that a single catastrophic event is not likely to have population level impacts.

Rationale for Delisting Criterion 2

Information on the amount of habitat needed to support a breeding pair of northern aplomado falcons varies by population and habitat conditions. Therefore, additional information, specifically from the Chihuahuan Desert and Tropical Lowlands Populations, is needed to better understand how much habitat needs to be protected or conserved to support population sizes in Criteria 1 (USFWS 2025, pp. 53-56). For the Coastal Texas Population, at least 150,000 acres (60,703 ha) is thought sufficient to support 75 breeding pairs of falcons (USFWS 2025, pp. 42, 52); with additional habitat needed to support floaters.

Habitat for each population must be distributed across the landscape in a manner that limits the effects of catastrophic events on the population. For example, in 2017 Hurricane Harvey resulted in the loss of approximately 25% of breeding adult falcons in the Coastal Texas Population. Population abundance has not rebounded and remains well below previous estimates; 39-44 pairs before the hurricane (2017 and 2005, respectively) and 26 pairs as of 2025. For coastal populations, increasing the populations distribution both inland and up and down the coastline will improve population resilience by reducing the proportion of the population that can be impacted by a single event such as a hurricane. For the Chihuahuan Desert Population, breeding areas (i.e., groups of breeding birds) should be distributed across the landscape such that they may experience differential climatic or other challenges (e.g., drought, disease, land conversion). Breeding areas should be less than 80 miles, but cannot be more than 230 miles (maximum documented dispersal distance), from one another allowing for natural dispersal to other areas or recolonization (USFWS 2025, pp. 42, 44).

4. RECOVERY ACTIONS

Recovery actions are the statutorily required, site-specific management actions needed to achieve recovery criteria, as described in section [4\(f\)\(1\)\(B\)\(i\)](#) of the ESA. The USFWS assigns recovery action priority numbers (1-3) to rank recovery actions. The assignment of 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. Recovery action priority numbers are based on the following:

Priority 1: An action that must be taken to prevent extinction or to prevent the species from declining irreversibly.

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.

Table 1. Recovery action summary table

Related Recovery Criterion	Recovery Priority Number	Action and Activity numbers	Recovery Action	Additional Information	Site
2	2	1	Restore and improve native prairie/grassland vegetation communities and habitat conditions across the subspecies' range.	High quality and abundant native grassland habitats are necessary to support northern aplomado falcon territory establishment and range expansion.	Coastal Texas, Chihuahuan Desert, and Tropical Lowland Populations.
1 and 2	1	2	Restore and improve nest site availability throughout the subspecies' range.	Not Applicable	Coastal Texas, Chihuahuan Desert, and Tropical Lowland Populations.
1	2	3	Protect and maintain sufficient migratory grassland bird breeding habitat in the high plains and northern prairies in the U. S. and Canada to provide an adequate winter prey base for northern aplomado falcons.	Not Applicable	High plains and northern prairies in the U. S. and Canada.
2	1	4	Conserve and protect northern aplomado falcon habitat across the subspecies' range.	Not Applicable	Coastal Texas Population and Chihuahuan Desert Populations.
1 and 2	3	5	Conduct population monitoring across the subspecies' range	Not Applicable	Coastal Texas, Chihuahuan Desert, and Tropical Lowland Populations.
1	2	6	Reduce mortality in all life-stages of northern aplomado falcons in coastal Texas and the Chihuahuan Desert.	Not Applicable	Coastal Texas Population and Chihuahuan Desert Populations.

1	1	7	Augment current populations with captive releases to improve self-sustaining populations in Coastal Texas and Chihuahuan Desert (U.S. and Mexico)	Not Applicable	Coastal Texas, Chihuahuan Desert, and Tropical Lowland Populations.
1	2	8	Conduct efforts to biobank/cryopreserve samples (e.g., blood feather, tissue) from live or deceased falcons in the wild or captivity.	Biobanking of tissues or other appropriate samples (e.g., blood feathers) can assure the retention of unique genetic characteristics that future genetic research could use in the recovery or restoration of populations that are greatly decimated or extirpated.	Throughout the subspecies' range; priority emphasis for Chihuahuan Desert Population.
1 and 2	3	9	Enhance public support for northern aplomado falcon recovery through outreach and educational programs across the subspecies' range.	Not Applicable	Coastal Texas, Chihuahuan Desert, and Tropical Lowland Populations.
1 and 2	3	10	Conduct research to understand subspecies' demography and ecology.	Not Applicable	Coastal Texas, Chihuahuan Desert, and Tropical Lowland Populations.
1 and 2	2	11	Conduct, as necessary, research to identify or understand impacts to the subspecies from novel or changing threats.	Not Applicable	Coastal Texas, Chihuahuan Desert, and Tropical Lowland Populations.
1 and 2	2	12	Increase understanding of stick nest builder population dynamics.	Northern aplomado falcons do not build nests; therefore, they rely upon stick nest building species for adequate nesting structures.	Chihuahuan Desert Population and Coastal Texas Population.

1	3	13	Increase understanding of impacts of illegal take on population dynamics of northern aplomado falcons in coastal Texas and Mexico.	Not Applicable	Coastal Texas Population and Tropical Lowlands Population.
---	---	----	--	----------------	--

Table 2. Primary threats summary table

Threats Description	4(a)(1) Factor(s)	Recovery Criterion/a ID Number(s)	Recovery Action ID Number(s)
Drought	1	1 and 2	1, 2, 3, 4, 5, 6, 7, 8, 10, 11, 12
Sea-level rise	1	2	2, 5, 7, 8, 10, 11, 12
Tropical storm/hurricane	1	1 and 2	1, 2, 4, 5, 6, 7, 8, 10, 11, 12
Fire regime changes	1 and 5	1 and 2	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12
Land conversion	1	2	1, 2, 4, 5, 7, 8, 9, 10, 11, 12
Woody encroachment	1	2	1, 2, 4, 5, 7, 8, 9, 10, 11, 12
Predation	3	1	2, 5, 6, 7, 8, 9, 10, 11, 12

5. ESTIMATED TIME AND COSTS TO ACHIEVE RECOVERY

Estimates of time and cost, as defined in section [4\(f\)\(1\)\(B\)\(iii\)](#) of the ESA, must reflect, to the maximum extent practicable, the total amount of time and costs it will take to achieve the recovery (delisting) of northern aplomado falcon. The cost estimates provided include base salaries for staff time, do not account for possible future inflation, and may benefit other listed species that use coastal and desert grassland ecosystems.

We estimate that the full implementation of the recovery actions would improve the status of northern aplomado falcon so that it could be delisted within 55 years following the adoption of this recovery plan and cost \$208,441,000 dollars. The recovery process is projected to span approximately 55 years, as most necessary actions will need to be implemented repeatedly over several decades, often asynchronously, to ensure that three separate regional populations become robust, stable, and genetically resilient. We note that the recovery program may change over time, or the timeframe estimated to implement the recovery actions to achieve recovery of the species may take longer than expected. The recovery of northern aplomado falcon will depend largely on the commitment and the ability of the USFWS and partners to implement the recovery actions necessary to achieve the recovery criteria.

6. LITERATURE CITED

- Bock, C.E. and J.H. Block. 2005. Fire and birds in the southwestern United States. *Studies in Avian Biology* 30:1. pp. 4-8.
- Bodner, G.S. and M.D. Robles. 2017. Enduring a decade of drought: Patterns and drivers of vegetation change in a semi-arid grassland. *Journal of Arid Environments*. 136:1-14.
- Brooks, M.L. and D.A. Pyke. 2002. Invasive plants and fire in the deserts of North America. Pages 1-14 in: K.E.M. Galley and T.P. Wilson (eds.). *Proceedings of the Invasive Species Workshop: the role of fire in the control and spread of invasive species*. Fire Conference

- 2000: the First National Congress on Fire Ecology, Prevention, and Management. Miscellaneous Publication No. 11, Tall Timbers Research Station, Tallahassee, FL. 14 pp.
- Brown, J.L. and M.W. Collopy. 2008. Nest-site characteristics affect daily nest-survival rates of northern aplomado falcons (*Falco femoralis septentrionalis*). *The Auk*. 125(1): 105-112.
- Bruyere, C.L., R. Rasmussen, E. Gutmann, J. Done, M. Tye, A. Jaye, A. Prein, P. Mooney, M. Ge, S. Fredrick, P. Friis-Hansen, L. Garre, V. Veldore, and J. Niesel. 2017. Impact of climate change on Gulf of Mexico hurricanes. NCAR Technical Notes. NCAR/TN535+STR. Boulder, Co. 158 pp.
- Fink, D., T. Auer, A. Johnston, M. Strimas-Mackey, S. Ligocki, O. Robinson, W. Hochachka, L. Jaromczyk, A. Rodewald, C. Wood, I. Davies, and A. Spencer. 2022. eBird Status and Trends, Data Version: 2021; Released: 2022. Cornell Lab of Ornithology, Ithaca, New York. <https://doi.org/10.2173/ebirdst.2021>. <https://science.ebird.org/en/status-and-trends/species/aplfal/trends-map> and <https://science.ebird.org/en/status-and-trends/species/chirav/trends-map>, accessed July, 2023
- Humphrey, R.R. 1974. Fire in the deserts and desert grassland of North America. US Forest Service Publication, Chapter 11: 365-400.
- Hunt, W.G., J. Brown, T. Cade, J. Coffman, M. Kurti, E. Gott, W. Heinrich, J.P. Jenny, P. Juergens, A. Macías-Duarte, A.B. Montoya, B. Mutch, and C. Sandfort. 2013. Restoring aplomado falcons to the United States. *Journal of Raptor Research*. 47(4): 335-351.
- Kleinhesselink, A.R., E.J. Kachergis, S.E. McCord, J. Shirley, N.R. Hupp, J. Walker, J.C. Carlson, S.L. Morford, M.O. Jones, J.T. Smith, B.W. Allred, D.E. Naugle. 2023. Long-term trends in vegetation of Bureau of Land Management rangelands in the western United States. *Rangeland Ecology and Management*. 87:1-12.
- La Tierra Environmental Consulting (La Tierra/R. Meyers). 2021. Aplomado falcon surveying and monitoring on Fort Bliss, Texas and New Mexico, 2020-2021. Report to Directorate of Public Works, Environmental Division Fort Bliss Training Complex, Fort Bliss, Texas and U.S. Army Corps of Engineers, Tulsa District, Tulsa, Oklahoma. 8 pp.
- Ladwig, L.M., S.L. Collins, P. L. Ford, and L. B. White. 2014. Chihuahuan Desert grassland responds similarly to fall, spring, and summer fires during prolonged drought. *Rangeland Ecology and Management*. 67:621–628.
- Ludwig, J.A., S.M. Wondsell, E.H. Muldavin, K. Rosalind Blanche, and Y. Chauvin. 2017. Native desert grassland plant species declines and accelerated erosion in the paint gap hills of southwest Texas. *Southwestern Association of Naturalists*. 62(1):53-61.
- Macías-Duarte, A., A.B. Montoya, W.G. Hunt, A. Lafon-Terrazas, and R. Tafari. 2004. Reproduction, prey, and habitat of the aplomado falcon (*Falco femoralis*) in desert grasslands of Chihuahua, Mexico. *The Auk*. 121.:1081-1093.

- Macías-Duarte, A. and A. B. Montoya, C. Méndez-González, J. R. Rodríguez-Salazar, W. G. Hunt, and P. Krannitz. 2009. Factors influencing habitat use by migratory grassland birds in the State of Chihuahua, Mexico. *The Auk* 126(4):896-905.
- Macías-Duarte, A. and Panjabi, A.O., 2013. Association of habitat characteristics with winter survival of a declining grassland bird in Chihuahuan Desert grasslands of Mexico. *The Auk*. 130(1), pp.141-149.
- Macías-Duarte, A., A.B. Montoya, J.R. Rodriguez-Salazar, A.O. Panjabi, P.A. Calderon-Domiguez, W.G. Hunt. 2016. The imminent disappearance of the aplomado falcon from the Chihuahuan Desert. *J. Raptor Res.* 50(2):211-216.
- Macías-Duarte, A., A. O. Panjabi, D. B. Pool, I. Ruvalcaba-Ortega, and G. J. Levandoski. 2018. Fall vegetative cover and summer precipitation predict abundance of wintering grassland birds across the Chihuahuan Desert. *Journal of Arid Environments*. 156:41-49.
- McClung, M.R., Nathan T. Taylor, Benjamin K. Zamzow, E. Taylor Stone, Helena Abad, and Matthew D. Moran. 2019. The threat of energy diversification to a bioregion: a landscape-level analysis of current and future impacts on the US Chihuahuan Desert. *Regional Environmental Change*. 19:1949–1962.
- Meyer R.A. and S.O. Williams III. 2005. Recent nesting and current status of aplomado falcon (*Falco femoralis*) in New Mexico. *American Birds*. 59(2): 352-356.
- Rolek, B.W., L. Dunn, B. Pauli, A. Macias-Duarte, B. Mutch, P. Juergens, T. Anderson, C.N. Parish, J.A. Johnson, B. Millsap, and C.J.W. McClure. 2022. Long-term demography of a reintroduced population of endangered falcons. *Global Ecology and Conservation*. 38:1-16.
- Seager, R., T. Mingfang, I. Held, Y. Kushnir, J. Lu, G. Vecchi, H-P. Huang, N. Harnik, A. Leetmaa, N-C. Lau, C. Li, J. Velez, and N. Naik. 2007. Model projections of an imminent transition to a more arid climate in southwestern North America. *Science*. 316:1181-1184.
- Sweet, W.V., B.D. Hamlington, R.E. Kopp, C.P. Weaver, P.L. Barnard, D. Bekaert, W. Brooks, M. Craghan, G. Dusek, T. Frederikse, G. Garner, A.S. Genz, J.P. Krasting, E. Larour, D. Marcy, J.J. Marra, J. Obeysekera, M. Osler, M. Pendleton, D. Roman, L. Schmied, W. Veatch, K.D. White, and C. Zuzak, 2022. Global and regional sea level rise scenarios for the United States: Up-dated mean projections and extreme water level probabilities along U.S. coastlines. NOAA Technical Report NOS 01. National Oceanic and Atmospheric Administration, National Ocean Service, Silver Spring, MD. 111 pp. <https://oceanservice.noaa.gov/hazards/sealevelrise/noaa-nos- techrpt01-global-regional-SLR-scenarios-US.pdf>.
- The Peregrine Fund. 2012. Northern aplomado falcon restoration. Final Report. U.S. Fish and Wildlife Service grant number F12AP00235. 11 pp.
- The Peregrine Fund. 2017. Northern aplomado falcon recovery effort habitat restoration. Final Performance Report. U.S. Fish and Wildlife Service grant number F15AC01043. 6 pp.

- The Peregrine Fund. 2019. Northern aplomado falcon cooperative agreement. Final Report. U.S. Fish and Wildlife Service grant number F17AC01040. 10 pp.
- The Peregrine Fund. 2023. A population viability analysis for the northern aplomado falcon (*Falco femoralis septentrionalis*). The Peregrine Fund. Boise, Idaho. 4 pp.
- U.S. Fish and Wildlife Service (USFWS). 1990. Northern aplomado falcon recovery plan. U.S. Fish and Wildlife Service, Albuquerque, New Mexico. 56 pp.
- U.S. Fish and Wildlife Service (USFWS). 2014. Northern aplomado falcon (*Falco femoralis septentrionalis*) 5-Year Review: summary and evaluation. New Mexico Ecological Services Field Office, August 26, 2014. Unpublished Report. 46 pp.
- U.S. Fish and Wildlife Service (USFWS). 2024a. Supplemental spatial analysis: Examining historical and projected land cover change for the U.S. analysis areas for northern aplomado falcon. U.S. Fish and Wildlife Service, Albuquerque, New Mexico. 7 pp.
- U.S. Fish and Wildlife Service (USFWS). 2024b. Supplemental spatial analysis: Examining Agricultural Growth in the Apacherian-Chihuahuan Semi-Desert Grassland and Steppe of Northern Chihuahua, Mexico. U.S. Fish and Wildlife Service, Albuquerque, New Mexico. 10pp.
- U.S. Fish and Wildlife Service. 2025. Species status assessment report for northern aplomado falcon (*Falco femoralis septentrionalis*), Version 1.0 July 2025, Corpus Christi, Texas. 77 pp.
- Williams, A.P., Cook, E.R., Smerdon, J.E., Cook, B.I., Abatzoglou, J.T., Bolles, K., Baek, S.H., Badger, A.M. and Livneh, B., 2020. Large contribution from anthropogenic warming to an emerging North American megadrought. *Science*. 368(6488): 314-318.
- Zimmer, C. 1995. How to make a desert. *Discover Magazine*. February, p. 51-56.