Conservation Assessment and Conservation Strategy for Swift Fox in the United States – 2023 Update

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Cover photo – Trail camera surveys have become the most popular method of monitoring swift fox populations. The swift fox shown here was photographed in South Dakota by one of Emily Mitchell's trail cameras as part of her master's thesis.

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EXECUTIVE SUMMARY

In 1992, the United States (U.S.) Fish and Wildlife Service (USFWS) received a petition to list the swift fox under the federal Endangered Species Act (ESA) in the northern portion of the species' range (Montana, North Dakota, South Dakota, and Nebraska), if not the entire range. In 1994, the USFWS concluded that listing was warranted in the entire range. In response to this finding, the 10 affected state wildlife management agencies and interested cooperators formed the SFCT with a goal of developing a document that could describe the status and assess the threats to swift foxes in the U.S. and guide swift fox conservation efforts such that federal listing would not be necessary. In 1995, with knowledge of the formation of the SFCT, the USFWS published their 12-month finding which designated the swift fox as a federal candidate species with listing warranted but precluded by higher listing priorities. The SFCT completed a *Conservation Assessment and Conservation Strategy for Swift Fox in the United States* (CACS) in 1997. This document represented a coordinated approach to rangewide conservation and management. As a result of new information and improved coordination among partners, the USFWS removed the swift fox from the candidate species list in 2001 (Dowd Stukel 2011).

In 2011, an updated CACS was published identifying eight objectives for securing swift fox conservation (Dowd Stukel 2011). A change to the format of the 2011 document from the previous version consisted of providing accomplishments and a conservation assessment based directly on the five factors the USFWS uses to evaluate species for listing or delisting under the ESA. A major conclusion of that document was the SFCT's assessment that none of the five listing factors had risen to the level of a threat.

This is the third version of CACS. In assessing the objectives identified in the previous CACS, we believe these objectives are currently being met, though some underlying strategies and activities remain incomplete. Like the previous CACS, we provide a conservation assessment organized by listing factor, and again conclude none of these factors currently rise to the level of a threat. Though questions about the status of swift foxes in portions of the range exist, we do note the apparent range expansion documented in this publication. We also note the significant amount of research conducted and knowledge gained about swift foxes since the inception of the SFCT. Notable summary documents include the book entitled The Swift Fox: Ecology and Conservation of Swift Foxes in a Changing World (Sovada and Carbyn 2003) and more recently a book chapter on swift fox (Peek et al. 2024). In addition, Clark, Jr. (2014) identified over 100 publications on swift foxes with many more in nearly a decade since.

With most states having documented long-term stability or even an increase in distribution in the decades since the inception of the SFCT, the swift fox is now being surpassed by species of higher conservation priority in many states. As a result, the participation of some of our federal partners has waned. In addition, swift fox habitat conservation in most states is increasingly being addressed as a landscape level, multi-

species approach. As a result, SFCT representatives have, as directed in the 2011 Conservation Strategy (action 1.1.3), considered the necessity and role of the SFCT into the future.

These discussions were finalized at the 2023 Kansas meeting, where SFCT representatives concluded that, though the long-term status of the swift fox was secure, the SFCT was still serving a useful purpose relative to swift fox conservation, particularly in terms of assessing the range wide status of swift fox based on distribution and other factors and providing a forum for collaboration and information exchange. Other decisions made at the meeting intended to streamline the activities of the group, eliminate unnecessary efforts, and share the responsibilities of the SFCT between the representatives were to continue biennial meetings on a rotational basis based on longest duration since hosting (see Appendix 1), assigning the chair position to the state agency representative hosting the meeting, and defining the duties of the chair as including developing a meeting agenda, chairing the meeting, and completing a report of the meeting minutes to be published on the SFCT website as an alternative to previously published annual or biennial reports.

Regarding the CACS, the goal and strategies were updated based on the SFCT's past and current priorities. The new goal statement reflects the SFCT's interest in keeping the swift fox from listing under the U.S. ESA (which was previously a strategy). The new strategies reflect the SFCT's interest in identifying quantifiable strategies directed more specifically toward the swift fox. A key component of this document remains the Conservation Assessment of the swift fox based on the five ESA listing factors. It is anticipated that the status of the SFCT and this document will be reviewed in 10 years.

LIST OF ACRONYMS

APHIS = Animal and Plant Health Inspection Service
AZA = Association of Zoos and Aquariums
BLM = Bureau of Land Management
CACS = Conservation Assessment and Conservation Strategy
CPW = Colorado Parks and Wildlife
CRP = Conservation Reserve Program
DU = Ducks Unlimited
EPA = Environmental Protection Agency
ESA = Endangered Species Act
GAP = Gap Analysis Program
GIS = Geographic information system
KDWP = Kansas Department of Wildlife and Parks
MFWP = Montana Fish, Wildlife and Parks
NDGF = North Dakota Game and Fish Department
NGO = Non-Government Organization
NGPC = Nebraska Game and Parks Commission
NMDGF = New Mexico Department of Game and Fish
NRCS = Natural Resources Conservation Service
NRI = National Resources Inventory
ODWC = Oklahoma Department of Wildlife Conservation
SDGFP = South Dakota Department of Game, Fish and Parks
SFCT = Swift Fox Conservation Team
SSP = Special Survival Plan
SGCN = Species of Greatest Conservation Need
SWAP = State Wildlife Action Plan
TAG = Taxon Advisory Group
TNC = The Nature Conservancy
TPWD = Texas Parks and Wildlife Department
USDA = U.S. Department of Agriculture
USFS = U.S. Forest Service
USFWS = U.S. Fish and Wildlife Service
USGS = U.S. Geological Survey
WAFWA = Western Association of Fish and Wildlife Agencies
WGFD = Wyoming Game and Fish Department

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ACCOMPLISHMENTS FOR 2011-2022

ACCOMPLISHMENTS SUMMARIZED BY OBJECTIVES FROM THE SWIFT FOX CONSERVATION ASSESSMENT AND CONSERVATION STRATEGY, 2011

Background:

The goal of the 2011 Conservation Strategy was to: "…maintain or restore swift fox populations within each state to provide the spatial, genetic and demographic structure of the United States swift fox population to ensure long-term species viability, to provide species management flexibility, and to encourage population connectivity." (Dowd Stukel 2011). With the intent of achieving this goal, the Conservation Strategy portion of the 2011 CACS identified eight objectives, with corresponding strategies and activities (Table 1).

Accomplishments of the SFCT are provided below by objective, first as a SFCT summary and then individually by state – as provided by state agency representatives on the SFCT. We do note that some accomplishments represent the work of other cooperators, but that any work benefitting swift foxes within the state during the 2011–2022 time frame would be applicable to this section.

This is meant to be an abbreviated summary, and more detailed information on these and other accomplishments can be found in published literature or on the SFCT website, which is hosted by Colorado Parks and Wildlife at: https://cpw.state.co.us/learn/Pages/SwiftFoxConservationTeam.aspx.

Table 1. List of objectives, strategies, and activities from the 2011 CACS (Dowd Stukel, 2011.)

Objective	**Strategies and activities**
1. Maintain a Swift Fox Conservation Team, (SFCT) to include 1 representative of each of the state wildlife agencies within the historical range of the swift fox	1.1 The SFCT is comprised of a single representative from each of the 10 state wildlife resource agencies (state), BLM (regional), USFS (regional), U.S. Geological Service (USGS) (regional), Animal and Plant Health Inspection Service (APHIS) (regional), and USFWS (regional). Interested cooperators are encouraged to participate with the team (other state and federal agencies, state universities, tribal governments, conservation organizations, research institutions, Canadian recovery team). The SFCT is to coordinate and assist in directing management and research activities outlined in the conservation strategy. The SFCT will annually monitor the attainment of objectives and evaluate the completion of specific activities within each state. 1.1.1 Responsibilities of the SFCT are to: 1) determine priorities and set timetables for conservation strategy objectives and activities, 2) establish interteam technical committees that will address specific management or research needs to accomplish stated objectives, 3) draft habitat and species management guidelines when appropriate, 4) provide a forum for technical information exchange, and 5) promote state and federal funding support for specific activities. 1.1.2 The SFCT will generate an annual or biennial report to present state and regional progress toward attainment of conservation strategy objectives. An annual or biennial SFCT meeting is to be scheduled by the appointed chair to synthesize information and prepare the annual or biennial report. 1.1.3 Ten years following publication of this revision, SFCT members and cooperators will evaluate progress in meeting objectives and completing activities. Evaluation of progress will include discussion of whether the SFCT may disband because it has accomplished its original purpose to design and implement a multi-state approach to assure long-term swift fox persistence.
2. Maintain swift fox distribution in at least 50 percent of the suitable, available habitat	2.1 State wildlife agencies will periodically update statewide species distribution maps to monitor long-term changes in distribution and evaluate progress toward conservation strategy objectives. Maps will be updated or modified every 5 years. Sovada et al. (2009) should be updated and submitted for publication with new information 5 years following its publication date.
	2.2 Expand distribution of existing state populations and restore swift foxes to unoccupied suitable habitat. Promote natural dispersal through species protection measures while developing methodology and priority areas for augmentation through wild-captured swift fox translocations. 2.2.1 The SFCT will work with state wildlife agencies, federal land management agencies and cooperators to prioritize potential restoration efforts in areas with a limited distribution and potentially suitable habitat, when needed.
	2.3 Each state wildlife agency will maintain adequate regulatory mechanisms to promote a self-sustaining swift fox population. 2.3.1 The state wildlife agencies of Colorado, Kansas, Montana, New Mexico, and Texas, which currently allow a legal harvest, will evaluate

	the feasibility of implementing a registration/pelt tagging program in addition to conducting mandatory carcass collections.
3. Periodically evaluate the status of swift fox populations	3.1 Monitor swift fox distribution within each state using various detection methods and/or species harvest data. Systematic presence/absence and population surveys or compiling site-specific harvest information should provide each state with adequate information to delineate and monitor statewide species distributions. 3.1.1 State wildlife agencies will continue to collect and compile existing species distribution data internally and from cooperators. State agencies and cooperators may need to collect additional information utilizing various sources such as: 1) species population surveys; 2) state and federal agency occurrence reports; 3) soliciting public participation; 4) scientific field investigations; or 5) trapper and hunter harvest data.
4. Identify and conserve existing native shortgrass and mixed-grass grasslands, focusing on those with habitat characteristics conducive to swift foxes	4.1 Continue to identify, describe, and delineate existing suitable swift fox habitat within each state. This effort will form the basis for evaluating remaining species restoration activities and identify constraints and opportunities within each state for possible swift fox conservation efforts. 4.1.1 Each state wildlife agency will coordinate with state, tribal, and federal land management agencies and private landowners to conduct and continue habitat inventories and to describe land ownership patterns. Landscape analysis of suitable prairie habitat should utilize the best available landscape data, using supplemental map tools (soils, vegetation), Geographic Information Systems (GIS), and Gap Analysis Program (GAP), in addition to aerial or ground surveys. This activity may include cooperation from the BLM, USFS, Natural Heritage Programs, NRCS, state universities, and other entities with GIS/Gap Analysis mapping capabilities.
5. Facilitate partnerships and cooperative efforts to protect, restore, and enhance suitable habitats within potential swift fox range.	5.1 Identify and delineate lands under federal, state, or tribal management control in occupied/suitable swift fox habitat. The ability to maintain or restore state swift fox populations will depend on conserving open space in the existing grassland landscape. This activity will potentially be most effective when focused on major landscape-scale habitat initiatives. 5.1.1 Each state wildlife agency will coordinate with the federal and state land management agencies to evaluate current levels of legal protection of native grasslands located within federal and state ownership. These areas are to be delineated as an additional cover layer with suitable habitat and current swift fox distribution. Protected sites are to be mapped and acreages determined within the 10 states. Spatial relationships, such as defining habitat corridors or habitat blocks, will be examined. Prairie habitat is to be classified as currently protected, in need of protection, or for special management needs based on maintaining or enhancing habitat quality for swift foxes. 5.1.2 State and federal wildlife agencies will investigate habitat conservation agreements with federal and state land management agencies, as habitat needs are identified. Establish memorandums of understanding (MOU) and habitat conservation agreements (HCA) for habitat protection and management with land management agencies to conserve or enhance suitable prairie habitats under public ownership. 5.1.3 Identify habitat corridors and surrounding areas between habitat blocks, based on the spatial location of suitable habitat that is available to be managed for swift foxes. This activity will identify where habitat conservation and management efforts should occur to protect, enhance, or improve suitable habitat. Each state is to identify and delineate these

	areas through mapping to help conservation measures, agreements, or habitat enhancement efforts.
	5.2 Identify and delineate private land ownership patterns under individual or corporate control in occupied and suitable swift fox habitat. The ability to maintain or restore state swift fox populations will depend on conserving existing prairie habitat. 5.2.1 State and federal wildlife agencies are to initiate land conservation or protection measures under current lands programs as limited by priorities and within funding ability, or are to consider creating a lands program with new or redirected funding sources. Agencies will investigate the feasibility of partnerships with the private sector. On identified critical private lands state agencies should utilize conservation easements or agreements, leases, donations, exchanges, or acquisitions. Federal wildlife agencies should consider habitat conservation plans (HCPs) and federal land management agencies should consider land exchanges and acquisitions. State wildlife agencies may use wildlife action plan implementation activities to assist with swift fox and native habitat management.
	5.3 The SFCT should encourage investigation of opportunities to provide population connectivity through coordinated habitat mapping and reintroduction among partner states, tribes, agencies, and private landowners.
	5.4 Integrate swift fox conservation strategy objectives with management and habitat objectives of other prairie ecosystem species such as bison (*Bison bison*), black-footed ferret (*Mustela nigripes*), burrowing owl (*Athene cunicularia*), mountain plover (*Charadrius montanus*), prairie chicken (*Tympanuchus* spp.), and prairie dog (*Cynomys* spp.). 5.4.1 Provide swift fox distribution and suitable habitat information to other prairie ecosystem conservation efforts through activities associated with the Western Association of Fish and Wildlife Agencies, Landscape Conservation Cooperatives, Association of Zoos and Aquariums, Joint Ventures, and other relevant conservation activities that cross state and agency boundaries.
6. Identify and encourage research studies that contribute to swift fox conservation and management	6.1 Provide a scientific basis for swift fox management and an avenue for technical information exchange. 6.1.1 The SFCT will continue to provide recommendations on standard management guidelines, beneficial range management practices for swift foxes, methods for data collection/database management, and current information on swift fox ecology, management, and research to wildlife and land managers; government entities; land planners; and state and federal policy makers. 6.1.2 The SFCT will consider cooperating on a joint publication that promotes the scientific basis for conserving prairie species, including swift fox, for distribution to wildlife and land managers. If it is determined that this document is needed and jointly supported, funding will be solicited from cooperators and partners. 6.1.3 The SFCT is to identify and encourage research studies addressing interspecific interactions, climate change, energy development, and other factors that may affect swift fox conservation. 6.1.3.1 State wildlife agencies and cooperators will address species/habitat needs in site-specific areas identified as having special concerns for population maintenance. An example may be

	an evaluation of potential impacts of new energy development in an area with known swift fox occupation. 6.1.4 Encourage and participate in studies that define minimum viable population size estimates. 6.1.5 Conduct periodic testing and analysis of genetic variation among state populations to validate the basis of the metapopulation concept to ensure species persistence. Utilize state, federal, or institutional wildlife and veterinary laboratories that can support appropriate analysis. Publish results of genetic analysis 15 years following the publication of this Conservation Assessment and Strategy revision.
7. Promote public support for swift fox conservation activities through education and information exchange.	7.1 The SFCT will continue to develop informational and educational materials to encourage support from an informed public. Such support will enhance funding opportunities and ease implementation of conservation strategy activities. Among publics to be targeted are trappers, hunters, wildlife viewers, livestock and farm groups, private landowners, conservation organizations, public schools, and city/county governments. Funding will be solicited, as needed, from participating states and cooperators. 7.1.1 SFCT will continue to make use of SFCT website to post reports, annual newsletters, and other information of interest to partners and the general public. 7.1.2 Implement methods and techniques to gain and maintain cooperation with private landowners that will influence range management practices, primarily through state extension agents, federal grazing leases, and NRCS range specialists. Efforts will be directed primarily at occupied habitat and secondarily at suitable habitat.
	7.2 The SFCT will coordinate with the Association of Zoos and Aquariums (AZA) to provide scientifically-supportable information or input on educational displays or other AZA information to help present the most accurate and current information on swift fox conservation and management.
	7.3 The SFCT will continue to support the AZA in its efforts to maintain a viable captive population.
8. Maintain swift fox population viability such that listing under the U.S. Endangered Species Act is not justified.	8.1 States will continue to participate in cooperative information, monitoring, and research efforts to support swift fox sustainability and to facilitate management at a metapopulation level.
	8.2 This document may warrant periodic revision to incorporate related objectives, strategies, or activities that may be outlined in other prairie species conservation plans.
	8.3 Each state wildlife agency, with assistance of cooperators, will continue to refine management guidelines that include species and habitat conservation measures to assure species persistence. These may involve a review of state legal classification and protection; long-term programs to monitor species distribution, population size, and habitat maintenance; and may include harvest strategies above target population levels.

OBJECTIVES

1. Maintain a Swift Fox Conservation Team (SFCT).

SFCT progress:
The SFCT was formally established in 1994 and consists of representatives from the 10 state wildlife agencies within the historical swift fox range as well as federal, tribal, nongovernmental, and university research partners. The SFCT met annually from 1994–2008 (except for 2004) and then biennially from 2010-2018 (Appendix 1). A planned 2020 meeting was cancelled due to Covid, and the group met virtually (online) in 2022. Team meetings are open to the public and provide a forum for information exchange and discussion as well as coordination for documenting team activities in the form of annual or biennial reports.

CPW hosts a SFCT website where contact information for SFCT representatives can be found as well as various documents describing the Team's accomplishments and activities. This includes the 1997 and 2011 Conservation Assessment and Conservation Strategies and all of the Team's annual and biennial reports. (https://cpw.state.co.us/learn/Pages/SwiftFoxConservationTeam.aspx)

Individual state progress:

- All 10 states have had a representative on the SFCT since its inception in 1994, and all representatives have remained active within the group in terms of meeting attendance, assisting with document and status updates, information dissemination, and general participation.

2. Maintain swift fox distribution in at least 50 percent of the suitable, available habitat

SFCT progress:
Documenting the distribution of swift foxes has been a major challenge for the SFCT since the team's inception. Past efforts included the states compiling survey and observation data from a 5-year period and submitting to researchers from Northern Prairie Wildlife Research Center (NPWRC), who produced updated estimates of rangewide distribution (Sovada and Scheick 1999, Sovada and Assenmacher 2005, Sovada et al. 2009). Sovada et al. (2009) now generally represents the team's accepted methodology for assessing range wide status of swift foxes. At a time frame determined by the SFCT, each state should submit county-level presence-absence data from within the historical range in that state for a 5-year period. Methods used to identify county-level presence-absence are not standardized in recognition of swift fox populations, land access, road densities, and other characteristics that vary between states, but the combined data represent the best available depiction of swift fox distribution.

The 2011 CACS identified a target of updating the range wide status maps every 5 years (objective 2.1). The team has fallen short of that objective, but within this publication, an updated status of the range wide distribution of swift fox is provided for the years 2014–2018. That estimate of occupied distribution was 49% of the historical range, up from the estimate of 44% found in Sovada et al. (2009).

While we are satisfied with this methodology for assessing distribution, we do note there is uncertainty about what constitutes "suitable, available habitat." Some areas within the historical range that were thought to have suitable grassland habitat have resulted in unsuccessful reintroductions or have not been re-occupied by adjacent swift fox populations. This may be the result of changing precipitation levels, altered vegetation types, or a modified wild canid community. Considering the difficulty of defining suitable habitat, assessing success toward this objective is somewhat difficult.

The SFCT continues to support reintroduction efforts from states with secure swift fox populations to areas of potentially suitable but unoccupied habitat in other states. However, large portions of grassland in the eastern parts of the historic swift fox range remain unoccupied. We do note that it is questionable whether these habitats are currently suitable. These areas are primarily mixed grass prairie, and the grass may simply be too tall for swift foxes to survive under existing conditions. In addition to fragmentation of the prairie, we do note changes since historical times in grazing (historical bison and ungulate grazing replaced by modern cattle grazing), fire regimes, and the canid hierarchy (with the removal of wolves and probable increase in coyote and/or red fox abundance and density, probably exacerbated by the presence of agriculture). Changes in grazing and climate (both temperature and precipitation) may have resulted in changes in grassland structure and/or composition, combined with the current interspecific competition pressures, that render these habitats unsuitable.

Regarding regulatory oversight, past CACSs included a recommendation that states that allow harvest consider pelt tagging as a means of documenting harvest (SFCT 1997, Dowd Stukel 2011). Though accurate harvest estimates can also be attained from properly designed surveys, several states still struggle with harvest estimation. Several states have developed methods to assess sustainable harvest levels (see Conservation Assessment, Section B). Harvest in each of these states was well below their established thresholds. Swift fox populations are considered stable or increasing in all states that allow harvest with the possible exception of Texas (Peek et al. 2024).

<u>Individual state progress</u>:

- Colorado – CPW is not engaged in any formal species-specific efforts to expand distribution as occupancy of best suitable habitat is ~ 80%. They do contribute to out-of-state reintroduction efforts. The swift fox is harvested furbearer in Colorado. Harvest estimate is via phone/internet survey of hunters with furbearer license or permit. Pelt tagging is not required.

- Kansas – KDWP has not specifically tried to expand swift fox populations eastward in the state, where over half of the historic range is unoccupied. There is no landscape level barrier between occupied and unoccupied habitat, and it is believed swift foxes would have reoccupied the eastern part of the historic range through natural dispersal if the habitat was suitable. It is believed they have not because rangeland vegetation is too tall for swift foxes to survive under current conditions (i.e. land use and coyote (*Canis latrans*) densities). The swift fox is managed as a furbearer, with pelt tagging required. An average of 122 swift foxes were tagged annually from 2011–2022. Department personnel opportunistically collect swift fox location information year-round. KDWP has verbally agreed to provide swift foxes for the Fort Belknap reintroduction, but they have not yet formally applied for foxes.
- Montana – Swift foxes are classified as a species of concern in Montana but are a harvestable furbearer in a small portion of the state. Harvested animals must be reported within 24 hours, and there is a mandatory check, pelt tagging, and jaw collection. A swift fox reintroduction project is currently underway onto Fort Belknap Tribal lands. Last year (2022), was the 3rd year of translocations, and 103 foxes have been translocated to date.
- Nebraska – The swift fox is protected in Nebraska as a state endangered species. This protected status facilitates natural expansion.
- New Mexico – No specific efforts have been made in New Mexico to expand swift fox populations. Swift foxes are classified as protected furbearers. They are harvestable during the open season. Harvest is monitored through mandatory harvest reporting, for which we typically have 85-90% reporting rate. They do not pelt tag. Given the low numbers of swift fox harvested each year, we are confident in harvest reporting providing robust data on the number of swift foxes harvested.
- North Dakota – NDGF has not made any efforts to expand swift fox range. They are classified as a furbearer with a closed season.
- Oklahoma - ODWC continues to monitor the swift fox population to determine the currently occupied range and an index of population trend. Swift foxes occupy the entire Oklahoma panhandle (an area of 5,700 square miles) except for the northwestern 6 townships (an area of approximately 210 square miles) around Black Mesa, which is a hilly and brushy landscape associated with the Rocky Mountains. In addition to the panhandle, swift foxes are likely to occur in portions of two counties in the main body of the state adjacent to the panhandle. They appear to occur at a lower density in the main body of the state, and the habitat is patchier, therefore, they are more difficult to detect. The area within the state that is currently occupied by swift foxes is at least 70% of the species' historic range and possibly more depending upon the fox's status in the two counties in the main body of the state. The legal status of the swift fox also has remained unchanged during the 11-year period; there remains a year-round closed season on the Swift Fox and it remains classified as a Species of Greatest Conservation Need (SGCN) in the Oklahoma State Wildlife Action Plan.
- South Dakota – SDGFP helped to fund further analysis of data and implications of a study we previously funded on swift fox reintroduction on the Bad River Ranches in

central South Dakota. Those analyses and related publications were completed by Indrani Sasmal at South Dakota State University. Topic areas included habitat selection by female swift foxes during the pup-rearing season, genetic diversity in a reintroduced swift fox population, and release method evaluation for swift fox reintroduction at Bad River Ranches (Sasmal et al. 2011, Sasmal et al. 2013, Sasmal et al. 2015). The swift fox is classified as a state threatened species in South Dakota.

- Texas – TPWD has not made any efforts to expand swift fox range. They are a harvestable furbearer; no pelt tag is required and there is no estimation of harvest. Swift foxes were identified as a SGCN in the 2012 Texas Conservation Action Plan (State Wildlife Action Plan).
- Wyoming –Natural range expansion has occurred in Wyoming in recent years. They have not had any in-state reintroductions or translocations during the reporting period, but they have provided foxes for the Fort Belknap reintroduction. Swift foxes remain classified as a protected species in the State of Wyoming with no legal harvest season.

3. Periodically evaluate the status of swift fox populations.

SFCT progress:
The SFCT has spent an extensive amount of time assessing swift fox survey and monitoring techniques. The 1997 CACS identified the need to establish a standardized monitoring protocol (Strategy 3.1; SFCT 1997). However, the SFCT and others eventually concluded that a commitment to regular monitoring was more important than standardized methods, which were not reasonably attainable given variation in swift fox populations and other factors between states (Dowd Stukel 2011). Another past objective eventually determined infeasible was an effort to determine minimum viable population size estimates. It was eventually concluded these efforts required an excessive amount of data for precise estimates, and that continued population monitoring across the species' range would detect changes in abundance or distribution necessitating specific conservation or management actions (Dowd Stukel 2011).

Consequently, the present focus is on systematic monitoring suitable to each individual state. Though some states have established survey methodology, this remains an issue in others where limited land access and/or low populations complicate these efforts. Though survey designs vary, most states presently use motion activated cameras for monitoring swift fox populations.

Individual state progress:

- Colorado – CPW conducts occupancy surveys of short-grass prairie habitats every 5 years (2011, 2016, 2021). Occupancy is around 80% and no change has been detected in the last 15 years.
- Kansas – KDWP does not currently have an established, repeatable survey methodology to assess swift fox distribution and/or abundance. Track surveys were

conducted in the past (Sargeant et al. 2005) but were logistically difficult to conduct according to protocol and were last conducted in 2004. More recently, an extensive camera trapping effort was conducted to assess distribution and habitat use (Werdel 2022). While the intent is to repeat the habitat mapping portion of this project, the camera trapping portion of the project was probably too extensive to duplicate given the difficulty of obtaining private land access at 360 sites. However, camera trapping is the preferred survey methodology in Kansas, and some reduced version may be a possibility. Kansas bolsters their occasional survey data with county of harvest data from mandatory pelt tagging of harvested swift foxes as well as opportunistic documentation of observations by KDWP employees.

- Montana - MFWP's swift fox occupancy efforts were conducted in the far eastern portion of the state in 2012 and 2015 using systematic trail camera surveys. A census has been conducted 4 times (2000–2001, 2004–2005, 2014–2015, 2018–2019), with the 5th effort occurring in winter 2022–2023. This effort is conducted along the Canada/Montana border, where swift fox harvest is allowed, and uses a mixture of trail camera and live capture transects by township. MFWP will begin a statewide systematic trail camera survey effort, beginning in 2023. This effort will be a 3-year roving effort. In 2021 and 2022 agency personnel conducted pilot efforts to better inform the survey design. At this time the frequency at which to repeat this survey depends on the success of this upcoming effort.
- Nebraska – NGPC collects swift fox observations (roadkill, photos, etc.) from the public, state and federal agency personnel, and other sources, which are documented and mapped. Scent station surveys have been used in previous years. Trail camera surveys were completed during 2014–2016. Trail camera surveys will be conducted every 5-10 years.
- New Mexico – NMDGF monitors distribution annually through harvest reporting. In 2020 they began opportunistically collecting tissue samples from harvested swift and kit foxes (*Vulpes macrotis*) to accumulate a database for future genetic analysis to look at delineation of distribution for each species and potential hybridization. In 2019 and 2020, we conducted a non-invasive genetic study collecting scat in a spatial capture-recapture framework to estimate population density in northeastern New Mexico. Model estimates were 9.0 swift foxes per 100 km2 (6.5-12.5, 95% CI) using models that incorporated sex-effects on detection and movement and a behavioral effect on detection for baited sites.
- North Dakota – NDGF monitors swift foxes infrequently with camera traps. Credible sightings are investigated to try and verify.
- Oklahoma – ODWC uses a track-search method to determine the presence. A survey grid has been placed across the three Oklahoma panhandle counties and every-other township in that grid is surveyed on approximately a three-year rotation, with the exception of three townships in the northwestern corner of the panhandle in an area known as Black Mesa. The Oklahoma panhandle is comprised of three counties and 168 townships. We survey half of those townships (84) except for three that contain no suitable habitat and another one that contains no public roads.

- South Dakota – SDGFP has not yet developed a range wide monitoring technique for this species. They hope to work with a furbearer specialist/researcher to help formulate and implement repeatable and logistically-feasible monitoring during the next several years. In the meantime, they continue to solicit data and observations for entry into the South Dakota Natural Heritage Database.
- Texas – TPWD funded camera trapping/occupancy surveys performed in 2017 and 2018. TPWD staff also supported a West Texas A&M swift fox monitoring project (camera traps) from 2020–2022 on Rita Blanca National Grasslands. Currently there is no set monitoring schedule; however, TPWD is planning future monitoring with camera traps.
- Wyoming – WGFD continues to survey swift fox on a 5-year basis via occupancy surveys that utilize trail cameras and lure. Survey grid cells have been expanded during the reporting period to include new regions and novel habitats within the state where swift foxes appear to be expanding their range and distribution. Surveys in 2017 confirmed the presence of swift foxes in western portions of the state, and repeat surveys are currently being conducted in Fall 2023 to confirm if the species has expanded further within the state. Distribution maps are created based on these surveys and confirmed observations of the species entered into the statewide wildlife observation system database maintained by the Wyoming Natural Diversity Database with input from the WGFD.

4. Identify and conserve existing native shortgrass and mixed-grass grasslands.

SFCT progress:
There are a variety of tools that produce a spatial assessment of grassland habitats in all or portions of the swift fox range. Sovada et al. (2009) identified existing grassland habitat within the historic and occupied swift range using GAP for the U.S. portion. We used 2016 LANDFIRE data (https://www.landfire.gov/) to duplicate these efforts because GAP data for more recent years are not available (see Conservation Assessment, section A). Other recent tools include the Central Grasslands Roadmap which is a collaborative effort to establish and maintain resilient and connected grasslands and human communities (https://www.grasslandsroadmap.org/) and The Midwest Conservation Blueprint which is a basemap of priority lands and waters for conservation in the Midwest (https://mcap-fws.hub.arcgis.com/pages/midwest-conservation-blueprint). Another resource is the Grassland and Sagebrush Conservation Portal, which includes maps, data and other resources for planning and implementing conservation actions (https://gs-portal-fws.hub.arcgis.com/). Davidson et al. (2023) developed a conservation planning tool for the black-tailed prairie dog capable of spatial analyses considering not just the ecological, but also the social, political, and threat landscapes with the intent that such findings could be incorporated into other large-scale, multi-species conservation planning efforts being developed for the Central Grasslands of North America.

Conservation of grasslands is a high priority for many federal and state agencies and non-government organizations. This is reflected in the many programs intended to conserve grasslands. While none of these programs were designed specifically for swift foxes, efforts to protect and restore grasslands of suitable structure and height should ultimately benefit swift foxes. Some of the major national or regional programs with a grassland conservation component are included below. Most of these programs are funded through the federal Farm Bill.

Western Grasslands Initiative – This is a broad-scale, multi-state initiative of WAFWA intended to create partnerships and cooperative efforts to stabilize and expand grasslands while halting and reversing declines in wildlife species dependent on them. This initiative covers most of the historical swift fox range in the U.S.

Working Lands for Wildlife (WLFW) – This NRCS program offers a targeted approach to conserving wildlife species through sustainable farming and ranching. Practices directed at conserving grasslands that would be applicable within the swift fox range are described in an NRCS publication describing a framework for conservation action in the Great Plains grasslands biome (NRCS 2021).

Great Plains Grassland Initiative (GPCI)- This program is part of the NRCS WLFW program and targets intact grassland cores. It is intended to maintain these areas by managing woody invasion and increasing prescribed fire.

Environmental Quality Incentives Program (EQIP) – This NRCS program offers a full suite of rangeland practices.

Conservation Reserve Program (CRP) – This program administered by the Farm Service Agency (FSA) provides a yearly rental payment to farmers who remove environmentally sensitive land from agricultural production and plant species that will improve environmental health and quality.

Grasslands CRP - Grasslands CRP is part of the CRP program. Existing grasslands are eligible whereas only farmed lands are eligible with traditional CRP. This program helps landowners and operators protect grassland, including rangeland, pastureland, and certain other lands, while maintaining the areas as grazing lands.

Agricultural Conservation Easement Program - Agricultural Land Easement (ACEP-ALE) – This program implemented by NRCS protects private agricultural land from conversion to non-agricultural uses by funding conservation easements on farm and ranch land.

Partners for Fish and Wildlife Program - This program administered by USFWS provides technical and financial assistance to landowners interested in restoring and

enhancing wildlife habitat on their land. Examples of habitat treatments involving grasslands include prescribed burning and native grass and forb plantings.

Regenerative Grazing Lands (RGL) – This is The Nature Conservancy's (TNC) strategy for protecting and restoring 240 million acres of intact grazing lands in the U.S. by 2030 through easements and collaborative management.

Preserving our Prairies Initiative – This Ducks Unlimited (DU) program offers conservation easements compensating producers for their efforts to conserve wetlands or grasslands. DU also helps landowners convert idled fields into new grassland through habitat offset programs.

Individual state progress:

- Colorado - Grassland conservation effort is not specific to swift fox but there is a fair bit that is occurring with ancillary benefits to swift fox including work on prairie dog, black-footed ferret, general grassland easement work, primarily for ag purposes, conversion of marginal ag lands to reestablished grasslands (CRP, state CRP-like programs), conversion of CRP to grazing, etc. A fair bit of work is occurring on private rangelands via CPW partner biologist programs attempting to enhance grazing management or providing new infrastructure on existing grasslands. However swift fox seem to do quite well in heavily grazed and often degraded rangelands, which constitute the bulk of the shortgrass prairie in Colorado. There is limited formal monitoring occurring on grasslands outside of requirements for various federal programs. CPW has invested in capacity for this type of monitoring work in the past but it is a minor part of our current grassland efforts. With additional habitat biologist capacity in the future, CPW may invest more effort into monitoring.
- Kansas - A new spatial assessment tool for identifying grasslands and other habitats in Kansas and Nebraska was recently developed (Diamond et al. 2021). KDWP has a private lands program called Habitat First that provides funding for a variety of habitat practices including some specific to grassland conservation including prescribed fire, grazing plans, and tree removal. With many acres of CRP lost in recent years, KDWP has targeted these properties with cost share for fencing and water development to try and maintain them as grazing land rather than having them return to agriculture on vulnerable soils. In Kansas where tallgrass species are planted into CRP, being removed from CRP and grazed would actually improve their habitat quality for swift foxes. KDWP also works closely with a variety of government and non-government entities to promote both state and federal grassland management programs.
- Montana - MFWP initiated a Grassland Initiative program in order to protect intact, native grasslands using 30-year habitat leases. The swift fox was one of the grassland species of concern for which they were working to protect habitat as part of that initiative. In 2022 the agency introduced a new habitat lease program focusing on protecting intact, native grasslands for 30–40 years. They are not specifically monitoring and mapping grassland areas on a regular basis. However,

they do regularly monitor grasslands under easements and leases for habitat conversion. They have also been heavily involved with various entities to get a good working swift fox habitat suitability model for the state of Montana. They currently have four different models made and used for swift fox efforts, however none of them work quite as well as they would like across the statewide range.

- Nebraska – In Nebraska, rangeland management including water development, fencing, and grazing management plans, are being done through U.S. Department of Agriculture (USDA) conservation programs. The University of Nebraska monitors acres of grassland lost to cropland and encroachment by invasive trees (Eastern red-cedar, rocky mountain juniper, etc.).
- New Mexico – NMDGF has partnered with the Playa Lakes Joint Venture and participating landowners/land managers have restored 18 playas in eastern New Mexico. Playa lakes are beneficial to a wide variety of wildlife not only because they provide water in an arid landscape, but also because they provide high quality habitat and forage in the grassland buffer surrounding the playa. The continual cycle of holding water and drying out provides a unique ecosystem benefitting many species adapted to these conditions. The clay bottom of the playas allows for water recharge to the Ogallala Aquifer.
- North Dakota – NDGF has begun an effort to both protect (long term agreement) and restore (plantings) native grasslands in the range of the swift fox in ND.
- Oklahoma - ODWC continues to monitor land use changes in the panhandle and northwestern Oklahoma. Over the eleven-year period, there has been a small increase in the acreage of land used for center-pivot-irrigated crop fields. This is the result of the conversion of non-irrigated cropland to irrigated crop land and the conversion of some land from CRP easements to center-pivot irrigation. There has been very little conversion of prairie to crop fields, and the acreage of land in CRP has declined by less than 10%. Several large wind-energy developments have been constructed in the panhandle during the past eight years. These occur on a nearly equal ratio of non-irrigated crop fields and shortgrass prairie rangeland. Overall, we don’t have any indication that wind energy development degrades swift fox habitat.
- South Dakota – SDGFP and a number of NGO partners have increased presence and staffing in western South Dakota to facilitate new landowner habitat partnerships, with an emphasis on native grasslands.
- Texas - Habitat management via prescribed grazing has been performed by the U.S. Forest Service at Rita Blanca National Grasslands. There are 63,972 acres enrolled in CRP in Dallam County as of 2020.
- Wyoming - WGFD continues to coordinate with the BLM, U.S. Forest Service (USFS), and NRCS to maintain suitable grassland habitats to support a suite of associated SGCN, including swift foxes. Current concerns include the expansion of both wind and solar energy projects and resulting fragmentation of grassland and prairie habitats. WGFD provides comments and recommendations to energy industry developers on public lands with the goal of minimizing impacts to SGCN species. Most habitat work to improve/maintain sagebrush/grasslands habitats is intended to benefit sage grouse. Treatments include juniper removal, cheatgrass

control, mechanical treatment of decadent and/or dense sagebrush stands. Other conservation efforts include mitigation of energy developments (wind, solar) and reclamation of altered sites (oil/gas) with native sagebrush steppe/grassland species.

5. Facilitate partnerships and cooperative efforts to protect, restore, and enhance suitable habitats within potential swift fox range.

SFCT progress:
This objective included assessing the ownership and management of existing lands. Identification of public lands is readily available with current mapping technology and numerous mapping tools now exist that allow for a special analysis of land ownerships and habitat types (see Objective 4). All states now participate in various broad grassland conservation efforts that are part of their larger agency mission intended to ensure the conservation of many species. Partners in this effort to protect and rehabilitate shortgrass and mixed grass prairies include federal agencies such as USFWS, NRCS and FSA, and non-government organizations such as The Nature Conservancy, American Prairie Foundation, World Wildlife Fund, DU, and Pheasants Forever. Again, these partnerships and efforts are rarely directed specifically at swift foxes but are more broadly directed at grassland conservation. One exception was the development of a swift fox habitat management leaflet in 2005 by NRCS and the Wildlife Habitat Council. This publication describes the species habitat requirements and provides guidance to landowners and managers wishing to incorporate the management needs of swift foxes into grassland management plans (NRCS 2006).

Individual state progress:
- Colorado - Information on identified lands is available to partners and is included generally in the state wildlife action plan and is likely to be included in our statewide big game habitat connectivity and conservation plan that is in early stages of development. There are multiple partnerships focused on grassland conservation and CPW has working relationships with Colorado Cattlemen's Association, Colorado Farm Bureau, various other ag commodity groups (wheat growers, corn growers etc.), NRCS, FSA, conservation districts, Pheasants Forever, Bird Conservancy of the Rockies, High Plains Land Conservancy, various county or community open space agencies, USFWS national wildlife refuges, USFS national grasslands etc. The program types are generally categorized as conservation easements generally restricting development or conversion from ag uses, habitat enhancements, farm bill program delivery and implementation, technical assistance and planning, state run habitat enhancement incentive programs-generally grassland establishment on previously cropped lands or grassland habitat enhancements, invasive annual grass control to support grassland health and productivity, control of invasive riparian trees, and some control of pinyon/juniper

expansion from canyonlands into grasslands associated with swift fox range. CPW is in the process of developing a big game habitat connectivity and conservation plan that will overlap with grassland habitat needs for swift fox. Grassland habitat is generally addressed in state wildlife action plan. CPW has participated and supported larger grassland conservation planning efforts such as the Central Grasslands Roadmap and (proposed) North American Grasslands Conservation Act.

- Kansas – Kansas is only about 2% public land so effective management of wildlife is dependent upon effective private lands management in this state. KDWP is highly engaged in promoting Farm Bill conservation programs. KDWP also partners with Pheasants Forever to hire additional staff (habitat specialists) who promote state and federal conservation programs including those focused on grassland conservation. This is an ongoing task that is generally part of the agency's larger mission.
- Montana - State, federal, and private lands are delineated for the entire state. MFWP works with private landowners to conserve grasslands with perpetual easements, 30–40 year leases, and grassland restoration projects. They also coordinate and comment on federal and state land management plans, as well as occasionally partnering with NRCS and other agencies on perpetual easements and grassland restoration efforts. State agency personnel regularly attend and participate in the SFCT, and regularly present data and findings of their most recent efforts to that group. On occasion, agency personnel or students working on agency projects present those findings at conferences. All research and monitoring efforts are used to make the best management decision for the species.
- Nebraska - NGPC is aware of which public lands are within swift fox suitable habitat. They partner with public land agencies while conducting surveys and collecting carcasses. They also partner with private landowners through state and federal land management programs and through cooperation with TNC.
- New Mexico – The National Fish and Wildlife Foundation has awarded a grant to support the work of the Playa Lakes Joint Venture and 5 land trusts, including the New Mexico Land Conservancy. Funding will support funding new conservation easements, outreach to landowners to encourage enrollment in conservation easements, and to restore and manage grasslands for the benefit of wildlife.
- North Dakota - NDGF has begun an effort to both protect (long term agreement) and restore (plantings) native grasslands within the statewide range of swift foxes. Swift foxes are listed in the State Wildlife Action Plan (SWAP) as a species of conservation priority. The SWAP focuses on habitat protection and restoration to maintain species diversity.
- Oklahoma – ODWC has not been working actively on this strategy because of limited staff resources and insufficient financial resources to support conservation easements and land acquisitions within the swift fox's range.
- South Dakota – See response to #4 above. The swift fox is a SGCN in South Dakota's SWAP, making the species eligible for State Wildlife Grant funding. Like other states, SDGFP has made habitat partnerships with private landowners a department priority, with private lands biologists stationed throughout the state.

SDGFP also partners with federal agencies and NGOs to fund shared partner biologists to serve a similar function of enhancing habitat restoration and enhancement and improving access to these habitats for hunting, trapping and angling.

- Texas - TPWD works with private landowners and with the U.S. Forest Service at Rita Blanca National Grasslands to conserve grasslands. They also developed a state conservation plan in 2022 for swift fox to support issues identified in the 2012 Texas Conservation Action Plan (Texas SWAP).
- Wyoming - WGFD coordinates regularly with federal land management agencies in the state to provide comments and recommendations on public land projects that may impact swift fox suitable habitat. They developed standardized language to provide consistent commenting regarding swift fox presence and use of habitats that overlap proposed development projects, and work with developers to mitigate potential impacts to swift foxes within proposed project areas. They also collaborate regularly with Thunder Basin Grasslands Prairie Ecosystem Association. State habitat and wildlife biologists have partnered with this group of federal, state, local, industry, and private interests to focus funding and research towards projects within the TBNG ecosystem region. As an SGCN, swift fox presence and habitat use is considered and evaluated relative to any developments or activities submitted by industry for recommendations.

6. Identify and encourage research studies that contribute to swift fox conservation and management

SFCT progress:
A substantial amount of research on swift foxes has been conducted since the formation of the SFCT (see Clark, Jr. 2014). A broad and comprehensive book on swift fox ecology and management was published in 2003 (Sovada and Carbyn 2003). More recently, a comprehensive compilation of information on swift fox was published in the form of a book chapter (Peek et al. 2024). While some information gaps remain, much is known about swift fox ecology, habitat requirements and conservation needs. Several strategies identified in this section and not accomplished (joint publication on prairie conservation, minimum viable population size determination) have not impeded swift fox conservation in a detectable way.

Individual state progress:

- Colorado – No new formal research projects have been conducted since 2010, although significant work was done in Colorado over the previous 20+ years.
- Kansas – KDWP has funded one major swift fox research project in recent years intended to better inform swift fox distribution and habitat in the state (Werdel 2022). This project will be used to assess changes in habitat and probable swift fox distribution in the future.
- Montana - In 2012 and 2015, MFWP partnered with NGOs and University personnel to conduct systematic trail camera survey efforts for swift fox in the far eastern part

of the state. From 2016–2018 the agency had a graduate student researching swift fox habitat use, population dynamics, and connectivity in the core area of the swift fox population. Two publications came from this research in 2020 (Butler et al. 2020*a*, Butler et al. 2020*b*). From 2017–2022, biologists have collected data on disease exposure, radio collared and tracked swift foxes when funds and time allowed, assisted with development of new radio collar technology, provided data to inform new habitat suitability models, and conducted efforts to improve success of camera surveys. As part of the translocation effort on tribal lands, the Smithsonian Institute is monitoring and researching the released foxes. MFWP has regularly partnered with Canada to conduct the Montana/Canada population census, and has incorporated different data collection types to more easily monitor the population and improve results.

- Nebraska – A dissertation was completed (Corral 2018) which resulted in several additional publications (Corral et al. 2022a, Corral et al. 2022b).
- New Mexico - In 2020, NMDGF began opportunistically collecting tissue samples from harvested swift and kit fox to accumulate a database for future genetic analysis investigating the distribution of each species and potential hybridization. In 2020 and 2021, NMDGF conducted a non-invasive genetic study collecting scat in a spatial capture-recapture framework to estimate population density in northeastern New Mexico. Four-hundred and 63 samples were collected of which 454 had usable DNA. Of those, 447 were from swift fox (7 from coyote). Six or more microsatellite loci were amplified for 87% of the samples, which were matched by genotype profiles to generate individual capture histories. Model estimates were 9.0 swift foxes per 100 km2 (6.5-12.5, 95% CI) using models that incorporated sex-effects on detection and movement and a behavioral effect on detection for baited sites.
- North Dakota - Sighting information is used to inform a species suitability model for western ND/Eastern MT.
- Oklahoma – ODWC provides financial support toward addressing our most pressing research needs during the period between 1996 and 2007. Since 2007, we have focused our research resources on higher priority species and have not funded any research into swift fox ecology.
- South Dakota - SDGFP funded the following project: Assessing swift fox presence with the distribution of other carnivores in western South Dakota, conducted by M.S. student Emily Mitchell, Jon Jenks (South Dakota State) and Doni Schwalm (Oregon State). Important findings: 1) Coyotes occupied 63–69% of the swift fox study area, and red fox occupied 46–53% and 2) Average litter sizes were 3.25 pups. Compared to other studies, the researchers found swift fox in this study to have large home ranges, large dispersal distances, high survival, and dens located farther from roads. 3. Swift fox had high prevalence of canine parvovirus and the causative agent for tularemia but low prevalence of canine distemper and the causative agent for sylvatic plague.
- Texas - TPWD funded a project using camera traps and scat collection from 2017–2019, "Assessing distribution, genetic diversity, occupancy, and habitat suitability for swift fox in Texas" (Texas Parks and Wildlife Department Contract #490790).

Additionally, TPWD staff assisted with a swift fox project through West Texas A&M University which focused on swift fox occupancy monitoring with camera traps on Rita Blanca National Grasslands from 2020–2022.

- Wyoming: WGFD has facilitated multiple research projects to better understand swift fox populations, range expansion, habitat use, and genetic diversity within the state. Wyoming has also contributed swift foxes for translocation to tribal lands and other states to reestablish populations within their historic range. All of these studies and contributions should help further our knowledge base of the status and continued expansion of the species within the state, and provide additional data to make more informed management decisions.

7. Promote public support for swift fox conservation activities through education and information exchange.

SFCT progress:
CPW continues to host a website where reports, newsletters, select peer reviewed articles, and other pertinent documents of the SFCT are maintained and made publicly available. Most efforts to gain support for and promote programs for grassland conservation with land managers fall broadly within the mission of the SFCT member agencies and are also a priority for many of the participating cooperators. These efforts are typically intended to benefit a host of grassland species including swift fox.

The SFCT has maintained a strong partnership with representatives of AZA. The AZA has been an important partner in sharing information about swift foxes to zoo visitors around the country and in maintaining captive swift foxes in AZA-member facilities. The swift fox falls under the AZA's Canid and Hyaenid Taxon Advisory Group (TAG). The Canid TAG created a Species Survival Plan (SSP) for the swift fox. Both the studbook keeper and the swift fox SSP coordinator are active partners and participants in SFCT activities, engaging with the group on AZA needs for captive swift foxes and discussing educational opportunities associated with swift foxes and grassland ecosystems. The AZA occasionally needs new swift foxes in their captive population to maintain genetic diversity, and SFCT remains committed to supporting these and other AZA needs to maintain a viable captive population.

Individual state progress:

- Colorado – CPW hosts the SFCT webpage, which is periodically updated with new articles and information. They also recently developed a Furbearer webpage with specific swift fox information including occupancy monitoring reports and professional video of recent reintroduction efforts to Ft Belknap.
- Kansas – KDWP has not recently engaged in specific efforts to promote swift fox conservation but does generally do so as part of the furbearer program (website, published materials, direct contact with furharvesters during pelt tagging, furbearer pelt display at youth event, etc.). Many landowners and managers view swift foxes

favorably in Kansas, but it is also unlikely concern for swift foxes is the driving factor in any management decisions made by these individuals.

- Montana - Local biologists have created information sheets and often hand them out and talk about swift foxes at predator hunt rules meetings and with the public. Nongame biologists across the swift fox range have talked with school kids about swift foxes and MFWP research and monitoring efforts. Swift fox information and our research and monitoring efforts have been posted about multiple times on different social media plat forms. In 2018, Montana Outdoors magazine published an article about the research and conservation efforts toward swift fox in eastern Montana. In 2019, MFWP attempted unsuccessfully to get funding to develop a virtual learning and citizen science course about swift for science teachers to utilize.
- Nebraska - Using a unique approach which incorporates landowners in the conservation process, undergraduate students were sent back to their family ranches to survey for swift fox. Many students in conservation majors at Chadron State College and University of Nebraska-Lincoln are from working ranches in Western Nebraska, which allows them to assist NGPC, Nebraska Department of Roads/Nebraska Department of Transportation, and USFS in facilitating the conservation of swift foxes. This project greatly increased awareness of swift foxes, particularly in areas with suitable habitat. NGPC has developed a swift fox information page on their agency website (outdoornebraska.gov/swiftfox/).
- New Mexico - In an effort to educate furbearer trappers and hunters on the occurrence of swift and kit foxes and recruit them to provide tissue samples from their harvested foxes, NMDGF included a page in their “Furbearer Rules and Info” publication requesting samples and giving basic information on identification, distribution, and biology for the two species.
- North Dakota - An informational poster was produced and distributed within the range to help generate sighting information.
- Oklahoma – ODWC has not focused resources on this strategy during the past eleven years.
- South Dakota - As a state threatened species, swift fox is addressed during South Dakota's biennial T&E species status review. This document is updated by SDGFP staff, presented to the SDGFP Commission, and shared with the public. The document reflects significant updates during the previous two years. SDGFP has not formulated delisting goals for this species pending further data but hope additional data resulting from standardized monitoring (see response to #3) will provide information needed to develop this goal.
- Texas – None.
- Wyoming - WGFD nongame biologists regularly contribute reports, media releases, and articles within the agency’s wildlife magazine, and presentations to conservation organizations and schools regarding the general biology, population status, and research activities focusing on swift foxes within the state.

8. Maintain swift fox population viability such that listing under the U.S. Endangered Species Act is not justified.

SFCT progress:
The SFCT has remained active and represents a major avenue of information sharing and collaboration on swift fox conservation. All states except Texas consider swift fox populations to be stable or increasing (see Peek et al. 2024). Sovada et al. (2009) represents an acceptable framework for monitoring the range wide distribution of swift foxes, and our effort to duplicate their methods in this publication indicates the distribution of swift foxes has increased. With a solid framework for swift fox conservation established and the range wide status of the species considered secure, this objective is being met.

Individual state progress:
- Colorado – Robust occupancy surveys of shortgrass prairie habitats don't support evidence of decline. In fact, swift foxes have been commonly documented in other habitat types that aren't surveyed.
- Kansas – The distribution of swift foxes in Kansas has been stable in recent decades. Though a more systematic approach to monitoring would be more sensitive to changes in distribution and abundance, we do not believe population viability has decreased during the past 10 years.
- Montana - MFWP has continued to monitor the swift fox population in the northeast region where harvest is allowed. The population census survey was recently completed in 2022–2023. Preliminary results indicate an increased population from the 2014–2015 census survey. Continued population monitoring is planned in collaboration with Canada, since the northeast population is split between Montana and Canada. In addition, a statewide occupancy survey is currently underway and will continue until 2026.
- Nebraska - Swift foxes are protected as an endangered species in Nebraska, and their distribution has been stable over the last few decades. There is no recent evidence of a decrease in population viability.
- New Mexico - Given low harvest and relative stability of land use practices across swift fox range, swift fox populations are considered stable. NMDGF will continue to monitor the status of swift fox via harvest reporting and monitoring efforts, particularly where the most robust populations (and the most habitat) occur in the northeastern part of the state. Further investigation of the hybrid zone between swift and kit foxes in southeastern New Mexico, where shrub encroachment into grasslands could result in loss of pure swift fox populations, is warranted. Grassland conservation efforts in eastern New Mexico that would benefit swift fox would be planned and undertaken with a multi-species focus.
- North Dakota - Swift fox occurrences are documented in the NDGFD furbearer database.
- Oklahoma - ODWC continues to monitor the Oklahoma swift fox population and land use changes within its occupied range. We also provided state updates for the

SFCT’s biennial reports and continue to maintain a protective closed harvest season in cooperation with our furbearer program.

- South Dakota - No documented change in population viability.
- Texas - There has been observed swift fox range contraction between 2011 and 2022 within Northern Texas and furthermore, within Dallam County. Swift foxes are native to 79 counties in Northern Texas. However, as of earlier surveys in 2005–2007, they were only found in 2 counties, Dallam and Sherman (Schwalm 2007). During occupancy surveys across 14 counties in 2017 and 2018, swift foxes were only found in Dallam County and a single detection in Hartley County. Currently the species is only known to occur in Rita Blanca National Grasslands and surrounding private lands. Due to this decline, there is concern about the species' viability in Texas.
- Wyoming: Wyoming has been fortunate regarding swift fox population status and expansion of the species into novel habitats within the reporting period. Monitoring and research in recent years have focused on understanding the mechanisms of this expansion, and whether the use of novel habitats will continue to expand or contract in future years. WGFD continues to collaborate with adjacent states and the SFCT to share research and monitoring results to be incorporated across the multi-state range of swift foxes. While range expansion appears to continue, WGFD has no plans to alter the protected status of the species in the state. To date there has been no consistent interest from the public to trap or otherwise harvest swift foxes. Long-term monitoring of swift fox populations via occupancy surveys continues to occur at 5-year intervals and has expanded to statewide to better understand trends in species status throughout the state.

CONSERVATION ASSESSMENT, 2023

The purpose of this conservation assessment is to describe the current known status of the swift fox in the U.S. and to identify and assess risks to the species (SFCT 1997).

Conservation Status

The swift fox was removed from the federal candidate list in 2001. Repeated survey efforts have indicated the range wide distribution of swift fox is increasing. Sovada et al. (2009) reported a 5% increase in swift fox occupancy of their historic range between 1995–1999 and 2001–2006 survey periods. We report an additional 5% increase from the latter survey period to our 2014–2018 survey period (see "Updated distribution and habitat assessment" below). Recently, state agency representatives from all states except Texas indicated the swift fox was stable or increasing within their jurisdiction (see Peek et al. 2024).

Given the stability or improvement in swift fox population status in most states in the decades since the SFCT was formed, the swift fox has been surpassed as a management concern in most states by more at-risk species (Peek et al. 2024). In addition, agencies are generally shifting resources from single species to a landscape-level management focus impacting numerous species (i.e. grassland conservation) such that swift fox conservation needs are being indirectly addressed through broad actions of agencies and their partners.

We also note a captive population is being maintained and managed under an SSP, directed by the AZA. The captive breeding program is being maintained through careful management and occasional incorporation of new swift foxes into this population, which numbers approximately 40 foxes housed at over 20 institutions.

Updated Distribution and Habitat Assessment

Sovada et al. (2009) estimated the historical distribution of the swift fox based largely on the pre-settlement extent of shortgrass and mixed grass prairies. They estimated a total historical range of 1,448,057 km^2 including 1,085,621 km^2 in the U.S. They also assessed swift fox distribution based on county-level presence-absence. They discussed the advantages and disadvantages of assessing distribution at that scale. We concur with them that this is a suitable scale for assessing distribution range wide over time, while recognizing that monitoring at a finer scale may be desirable within most states. Sovada et al. (2009) estimated that swift foxes occupied 44% of their historical distribution in the U.S. and 3% in Canada based on data collected from 2001–2006. They also assessed habitat availability by identifying existing grassland and cropland habitats within the historic and occupied swift fox range using GAP for the U.S. portion. They estimated 39% of the historical distribution in the U.S. was high-quality grassland habitat and an additional 13% was medium-quality. They also estimated 14% of the

historical distribution was medium-quality (dryland) cropland habitat and an additional 22% was low-quality (irrigated) cropland.

To update the distribution of the swift fox in the U.S. and reassess available habitat, we repeated the methods of Sovada et al. (2009). We collected range wide county-level presence-absence data for the years 2014–2018 from the 10 states within the historical swift fox distribution. GAP data were not available range wide for the years in question, so we used 2016 LANDFIRE data (https://www.landfire.gov/) for the habitat assessment. We attempted to duplicate the habitat quality classifications of Sovada et al. (2009), with biologists from each state classifying short structured grasslands without a shrub component as high-quality, grasslands with a short, sparse shrub component as medium quality, dryland croplands as medium-quality, and irrigated croplands as low-quality. We believe LANDFIRE will provide a consistent data layer that will allow for comparison in future analyses.

LANDFIRE classified agricultural habitats but did not differentiate irrigated and dryland agriculture. Consequently, a dataset called LandID (Xie et al. 2021; https://zenodo.org/records/5548555) was used to identify irrigated lands for 2016 within the range. Then this total was subtracted from the total agricultural area identified by LANDFIRE to estimate the total dryland acres. Consistent with Sovada et al. (2009), we classified all agricultural lands in North Dakota and South Dakota as low-quality given the lack of association with agriculture by swift foxes in those states.

A summary of the state-level county occupancy data collected during this assessment is provided in Table 2. The occupied area within the historical distribution of the swift fox in the U.S. increased by 57,015 km^2 from the 2001–2006 to the 2014–2018 survey periods. This represents a 5% increase in occupied area from 44–49% of the historical range. We do note that our estimates of statewide and total historical distribution are slightly different (0.016%) than those of Sovada et al. (2009) despite our use of their historical range shapefile, and believe this can be attributed to updated geospatial data and technologies. In addition to our occupancy estimates, swift foxes were documented during this survey period in three counties covering over 56,000 km^2 outside the historical range in Wyoming, which are not included in this analysis, but are shown in the updated depiction of swift fox distribution in the U.S provided in Figure 1. County-level changes in occupancy status between the two survey periods are depicted in Figure 2.

Our estimates of suitable swift fox habitat within the historical distribution, as well as the amount of suitable habitat occupied, by state, can be found in Table 3. We estimated that high-quality habitat constituted 31% of the historical distribution in the U.S., an additional 15% was medium quality grassland habitat, and 17% and 20% were medium and low quality cropland habitats, respectively. We report similar data here to that found in Sovada et al. (2009) but note that because different data layers were used in these two analyses, suitable habitat estimates found in each are not directly comparable.

The habitat types classified as suitable within each state are found in Appendix 2. We do note however, the uncertainty that exists regarding what constitutes suitable habitat under current landscape conditions. For example, changes in grazing, fire frequency and timing, precipitation, intraspecific predator presence and densities, and other factors may render portions of apparently suitable habitat within the historic range as unsuitable. For example, portions of the mixed grass prairie in the eastern part of their historic distribution which may have previously supported swift foxes may now be too tall, too fragmented, or have too high of coyote or red fox densities for swift foxes to persist.

We also note that Sovada et al. (2009) classified CRP fields in Kansas as medium quality habitat because CRP is usually planted to tallgrass species in Kansas and seldom used by swift foxes (Sovada et al. 2003). However, we were unable to identify or delineate CRP fields in Landfire as Sovada et al. (2009) did with GAP. Presumably undisturbed CRP in Kansas was classified as Tallgrass prairie by Landfire which was considered unsuitable, but disturbed CRP (hayed or grazed) was likely classified into some other habitat category by Landfire.

We conclude by acknowledging additional research is needed to assess the suitability of some of the habitat types identified in Landfire. With many states having already conducted camera surveys to assess swift fox occupancy, the data needed to compare occupancy with Landfire habitat types may already exist for many areas.

Table 2. Estimated area of swift fox historical distribution and occupied area within that distribution based on county level data collected from 2014–2018, and the change in county and area occupancy from the 2001–2006 surveys (Sovada et al. 2009) to the 2014–2018 surveys.

	Total	Total Area	Occupied	Occupied Area		Counties	Counties	Area Change	
State	Counties	(km^2)	Counties	(km^2)	(%)	Gained	Lost	(km^2)	(%)
Colorado	29	108,262	22	102566	95%	5	0	15,597	14%
Kansas	59	119,930	25	57638	48%	1	2	-979	-1%
Montana	37	199,529	25	159519	80%	13	5	56,515	28%
Nebraska	53	88,382	12	31504	36%	6	0	13,587	15%
New Mexico	12	47,002	8	29690	63%	0	3	-13,665	-29%
North Dakota	53	167,016	3	8500	5%	3	0	8,500	5%
Oklahoma	13	31,334	3	13962	45%	0	3	-9,090	-29%
South Dakota	56	164,203	10	54255	33%	2	7	-23,862	-15%
Texas	52	86,971	2	7671	9%	1	1	1,381	2%
Wyoming[1]	13	72,813	12	67032	92%	4	1	9,031	12%
Total	377	1,085,442	122	532,337	49%	35	22	57,015	5%

[1] Three additional occupied counties outside the historical range in Wyoming representing an additional 56,183 km^2 are excluded from this table.

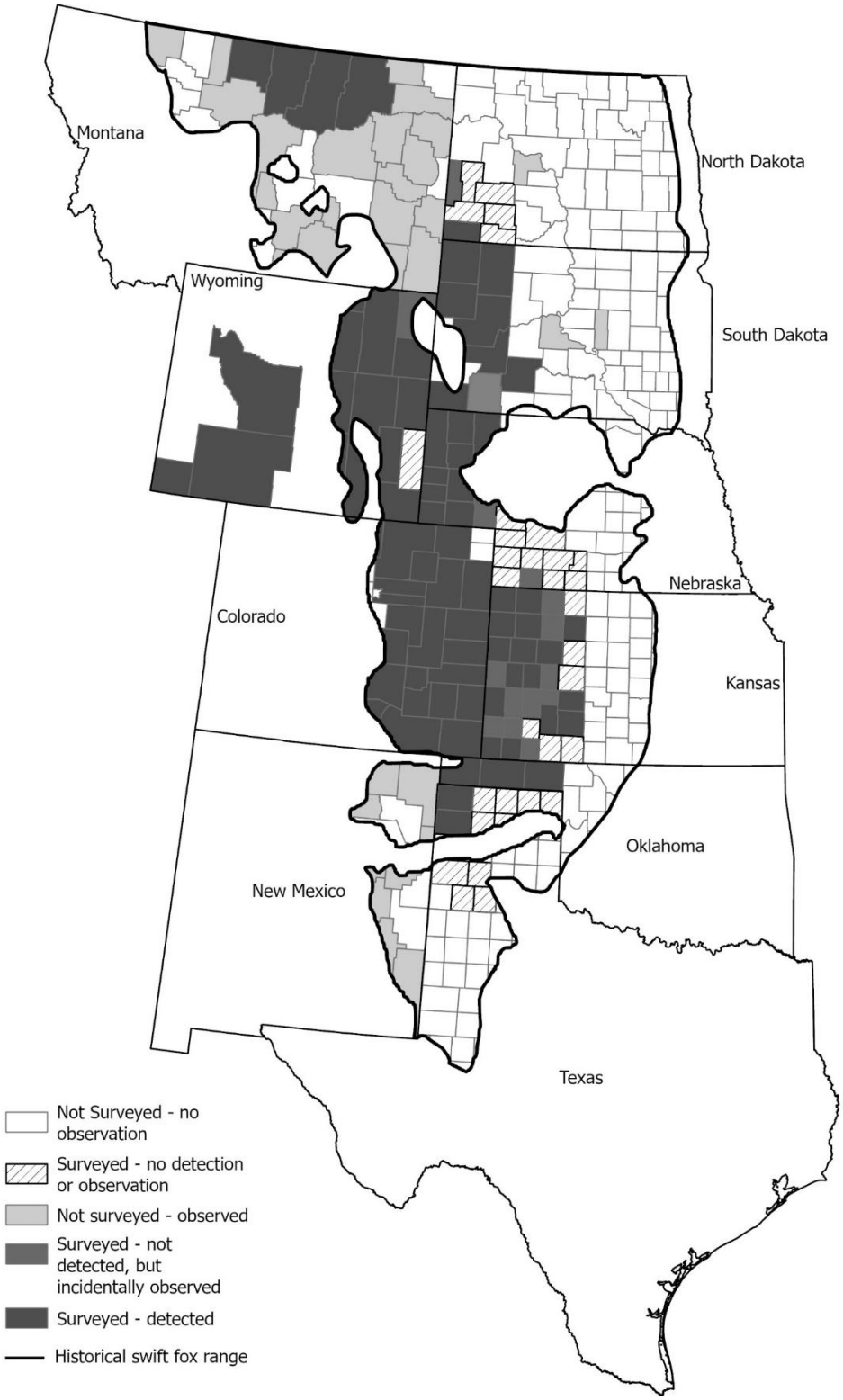

Figure 1. Swift fox distribution in the U.S. by county based on occupancy data collected from 2014–2018.

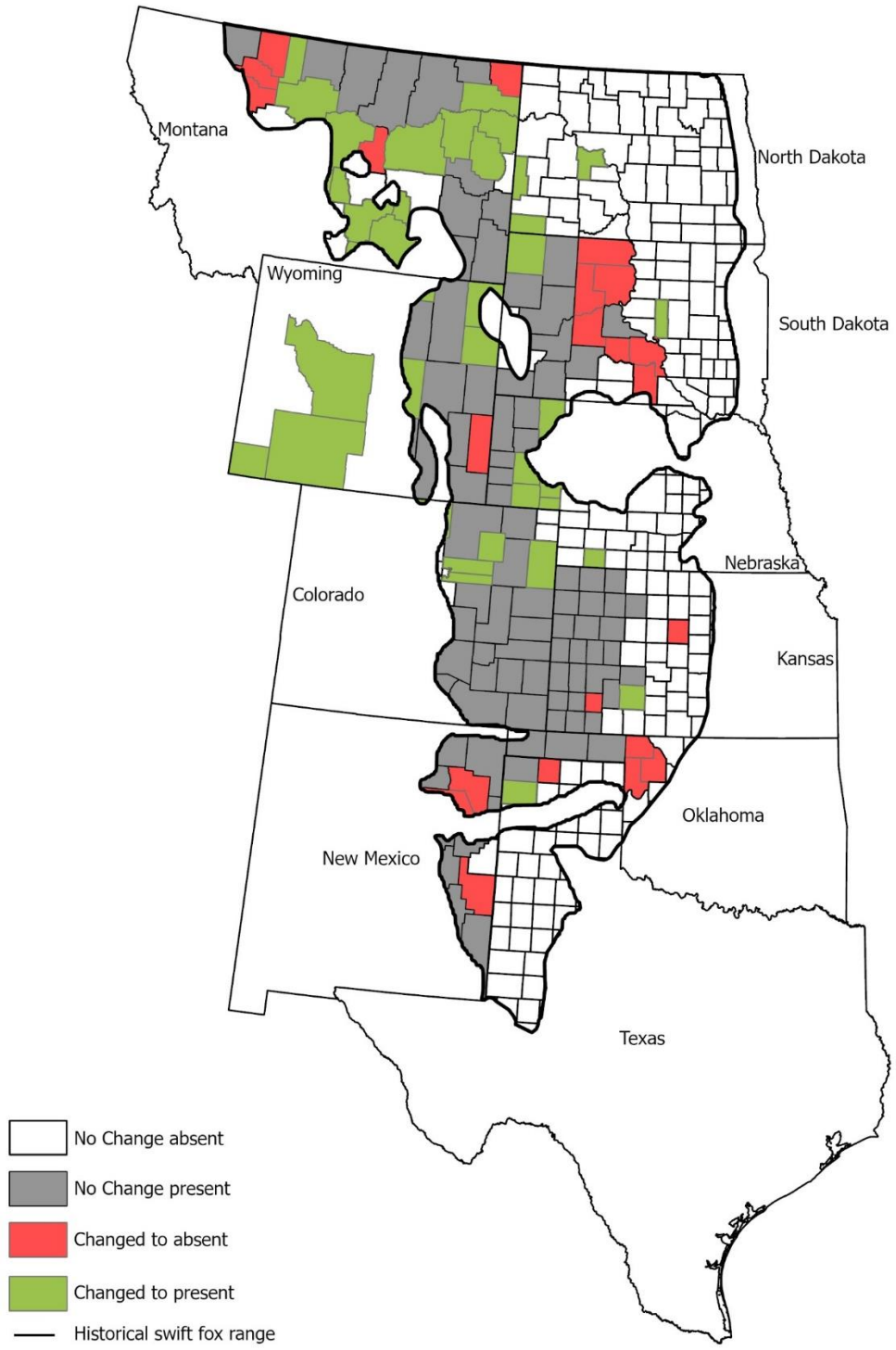

Figure 2. Change in swift fox occupancy in the U.S. by county from the 2001–2006 surveys (Sovada et al. 2009) to the 2014–2018 surveys.

Table 3. Estimated area of swift fox historical distribution in the U.S., the area of suitable habitat within that distribution, and the area of suitable habitat occupied by swift foxes from 2014–2018.

State	Area of historical range	Grassland and sparse shrubland								Cropland							
		High Quality				Medium Quality				Medium Quality				Low Quality			
		Historical range		Occupied counties		Historical range		Occupied counties		Historical range		Occupied counties		Historical range		Occupied counties	
	km^2	km^2	%	km^2	%	km^2	%	km^2	%	km^2	%	km^2	%	km^2	%	km^2	%
Colorado	108,262	52,372	48	51,862	99	2,868	3	2,433	85	25,808	24	23881	93	6,184	6	5,616	91
Kansas	119,930	37,025	31	15,383	42	-	-	-	-	56,317	47	30430	54	11,133	9	6,694	60
Montana	199,529	72,774	36	62,240	86	41,797	21	31,841	76	49,419	25	37756	76	3,207	2	1,992	62
Nebraska	88,382	32,946	37	15,185	46	4,097	5	1,416	35	17,100	19	7134	42	17,289	20	2,847	16
New Mexico	47,002	29,194	62	19,796	68	6,219	13	3,979	64	3,096	7	969	31	1,191	3	492	41
North Dakota	167,016	36,038	22	3,853	11	1,023	1	108	11	-		0	-	95,046	57	2,924	3
Oklahoma	31,334	18,891	60	7,954	42	1,456	5	463	32	6,276	20	3084	49	1,669	5	1,521	91
South Dakota	164,203	4,527	3	1,288	28	72,946	44	35,806	49	-		0	-	63,022	38	7,792	12
Texas	86,971	20,320	23	3,911	19	6,138	7	342	6	22,778	26	820	4	14,463	17	1,892	13
Wyoming	72,813	34,704	48	30,499	88	26,001	36	25,151	97	1,910	3	1486	78	1,646	2	1,187	72
Total	1,085,442	338,789	31	211,971	63	162,546	15	101,538	62	182,704	17	105,561	58	214,850	20	32,956	15

Risk Assessment

In reviewing species' status for listing, USFWS is obligated by the ESA to analyze the effects (i.e. threats) of five factors on the species. Detailed accomplishments pertaining to each of these ESA listing factors were provided in the 2011 CACS, and the risk assessment was organized in direct response to these factors (Dowd Stukel 2011). We combined those two approaches into the risk assessment below. The five ESA listing factors are as follows:

A. Present or threatened destruction, modification, or curtailment of the species' habitat or range;
B. Overutilization for commercial, recreational, scientific, or educational purposes;
C. Disease or predation;
D. Inadequacy of existing regulatory mechanisms; and
E. Other natural or manmade factors affecting its continued existence.

A. Present or threatened destruction, modification, or curtailment of the species' habitat or range.

We provided an updated swift fox "distribution and habitat assessment" in this document (p. 28). Per that analysis, we estimated that swift foxes occupy approximately 49% of their historical distribution, which increased 5% from the previous analysis (Sovada et al. 2009). In terms of available habitat, high-quality habitat constituted 31% of the historical distribution in the U.S. (based on 2016 Landfire data), an additional 15% was medium-quality grassland habitat, and 17% and 20% were medium- and low-quality cropland habitats, respectively. In sum, over half of the habitat within the historical distribution apparently remains suitable and almost half the historical distribution is occupied.

The National Resources Inventory (NRI) provides information on status and trends of land, soil, water, and related resources on nonfederal lands in the U.S. These lands may be privately owned, tribal and trust lands, and lands managed by state and local governments. NRI data have been collected during 1982, 1987, 1992, 1997, and annually since 2000. The most recent NRI summary report described data collected during 2017, and provided comparisons at periodic intervals including 1982–2017 and 2012–2017 (USDA 2020). Three broad habitat categories with some relevance to swift foxes in the U.S. are pastureland, rangeland, and CRP. During those 3 years (1982, 2012, and 2017, respectively), land cover in pastureland was 131,249,800 ac., 122,953,400 ac, and 121,610,200 ac. Land cover in rangeland was 418,617,300 ac, 405,105,200 ac, and 403,897,700 ac. CRP did not exist in 1982, but declined from 32,694,800 ac in 1987 to 23,747,700 ac in 2012 and 15,941,100 ac in 2017 (USDA 2020). In sum, during that 35-year span (1982–2017), pastureland area declined by 7.3% and rangeland area declined by 3.5%. During the 30-year span provided for CRP data (1987-2017), CRP area declined by 51.2%.

Considering CRP in just the states within the swift fox range, total area of general sign-up CRP in each state and the change in CRP area between 2011 and 2020 (the most recent year data were available) is found in Table 4. In sum, 52% of general sign-up CRP was lost during that time period. However, the 2014 Farm Bill provided authority to enroll up to 2 million acres of grasslands into CRP. This program, known as grassland CRP, represented a new category of eligible land which did not have a crop history requirement, and resulted in the protection of 781,972 acres grasslands in 2020 (Table 5).

The lack of protection and loss of native grasslands is a concern. In addition to direct loss including the conversion of native prairie to agriculture and other uses, questions remain about the potential impacts of energy development on rangeland and swift fox habitat use, particularly related to "green" energy including wind and especially solar. As indicated in Accomplishment section 4 in this document, many groups are working towards voluntary conservation of grasslands and grasslands are widely recognized as

a high conservation priority. As a result, total loss of grassland has been somewhat limited in recent decades (7.3% of pastureland and 3.5% of rangeland; USDA 2020). In addition, swift foxes have persisted and even expanded in distribution under the current management pressures on the landscape. As such, it is the view of the SFCT that this factor has not risen to the level of a threat

Potential topics for further research:

1. Monitor changes in swift fox distribution relative to landscape level changes in habitat such as restoration of native rangeland, shifts to or from irrigated to dryland cropping systems, and changes in CRP enrollment.
2. Evaluate the effects of native prairie patch size, vegetation height, and juxtaposition of agricultural lands and prairies on swift foxes to better define and understand what constitutes “suitable habitat.”
3. Examine why swift fox use of croplands is variable.
4. Validate swift fox habitat suitability classifications of LANDFIRE habitat types to better estimate the area of suitable habitat range wide.
5. Potential impact of energy development from both infrastructure and habitat loss on swift foxes.
6. Potential impact of biofuels on swift foxes (i.e., habitat loss from conversion of native habitat to monoculture).

Table 4. Area of general sign-up CRP enrollment by state within the swift fox distribution and the difference in enrollment between 2011 and 2020.

State	2011[a] Acres	2020[b] Acres	Change
Colorado	2,191,498	1,615,009	-26%
Kansas	2,604,108	155,918	-94%
Oklahoma	848,587	587,285	-31%
Nebraska	899,343	435,787	-52%
New Mexico	448,930	270,950	-40%
North Dakota	2,342,105	606,151	-74%
South Dakota	800,847	246,810	-69%
Texas	3,360,842	2,454,880	-27%
Wyoming	217,058	170,317	-22%
Total	13,713,318	6,543,107	-52%

[a]Source: USDA FSA 2011

[b]Source: USDA FSA 2020

Table 5. Area of grassland CRP enrollment by state within the historic swift fox distribution in 2020.

State	Acres
Colorado	82,286
Kansas	25,124
Oklahoma	33,572
Nebraska	333,424
New Mexico	94,400
North Dakota	25,437
South Dakota	135,550
Texas	30,152
Wyoming	22,027
Total	781,972

Source: USDA FSA 2020

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

Five of the 10 U.S. states and none of the Canadian provinces occupied by swift foxes have open harvest seasons (Table 6). Four of these states allow unlimited harvest by licensed participants within the open season. Montana has a season quota of 10 swift foxes and a per harvester bag limit of three. Wyoming does not have an open season, but swift foxes may be kept if the game warden deems the take was unintentional.

In the past, there was some concern about the impact of harvest on swift fox populations. Scott-Brown et al. (1987) indicated liberal hunting and trapping seasons existed, trapping pressure was regulated by economics, and that current management strategies could lead to declines if trapping pressure was high. The U.S. Fish and Wildlife Service also cited commercial trapping as a potential threat in their 1994 listing decision (Federal Register 1994).

However, the number of swift fox pelts available is too low for the development of any significant international commercial fur market demand (see Peek et al. 2024). In fact, the annual U.S. harvest is probably less than 1000 (Peek et al. 2024). In addition, though swift fox is an important furbearer to some trappers at times, there are usually other species more profitable to pursue because they're more valuable per pelt, similarly valued but more abundant, or both. There is also not a strong motive to harvest swift foxes for damage or management as there is with other species. The result is the swift fox is not heavily pursued. Fewer than 1% of trappers in the U.S. and just 3% of trappers in the western U.S. listed "kit or swift fox" as one of their top four primary species trapped (Responsive Management 2015).

Several states have developed methods to assess sustainable harvest levels. A Population Viability Analysis (PVA) used to assess the Montana population indicated harvest resulted in zero risk of extinction until harvest rates exceeded 17%, and risk of extinction remained below 10% even with harvest rates at or near 30% (Montana Fish, Wildlife and Parks 2019). New Mexico established a harvest management matrix for swift foxes and other furbearers per Thompson et al. (1996). They estimated the sustainable harvest limit for swift fox to be 20% of the population (New Mexico Department of Game and Fish 2013). Colorado established a harvest density threshold not to exceed 15% of their estimated population (Apker 2015). Harvest in each of these states was well below their established thresholds (New Mexico Department of Game and Fish 2013, AFWA 2018). In Colorado, the estimated harvest density (1.2 foxes/100-km^2) was just 1/3 of the conservatively established threshold (3.6 foxes/100-km^2; M. Vieira, personal communication, 2022). Swift fox populations can tolerate high levels of mortality probably due to their relatively prolific life history traits; they first reproduce at an early age and have the potential to produce large litters (Montana Fish, Wildlife and Parks 2019).

It is worth noting the states with the highest swift fox populations have allowed harvest for decades with no detected reduction in distribution or density. This included the late 1970's and 1980's when swift fox harvests were far greater than today (AFWA 2018). The likelihood of approaching historic harvest pressures in the foreseeable future seems unlikely given the fur market status in recent decades. Most of the states currently allowing harvest consider their populations stable or increasing. In addition, changes in swift fox populations have not been detected as various states have opened or closed swift fox harvest seasons (Peek et al. 2024).

Swift foxes are rarely responsible for damage to human interests and as such are rarely the target of damage removal efforts. During a recent 5-year period (2017–2021), USDA APHIS Wildlife Services reported a total number of swift foxes killed of 28 intentional and 13 unintentional (https://www.aphis.usda.gov). Private predator control activities probably also result in a few swift fox mortalities both intentionally and unintentionally. However, predator control activities targeting coyotes may benefit some local swift fox populations (Dowd Stukel 2011).

In sum, studies conducted throughout the swift fox range have shown killing by coyotes and vehicle strikes as the most significant mortality factors (see Peek et al. 2024). Many wildlife biologists have long believed annual mortality resulting from harvest, damage control, and various forms of intentional or unintentional take were a minor portion of total swift fox mortality (Swift Fox Conservation Team 1997). Despite their previous concerns, the U.S. Fish and Wildlife Service concluded in their decision to remove the species from the candidate list that harvest had not limited swift fox populations (Federal Register 2001), and the SFCT concluded in the 2011 CACS that overutilization through harvest and other factors has not risen to the level of a threat (Dowd Stukel 2011). Since that time, additional anecdotal and scientific evidence has been collected that further supports that position, and it continues to be the SFCT's view that this factor has not risen to the level of a threat.

Potential topics for further research:

1. None.

Table 6. State legal status and harvest seasons for swift fox, 2022.

State	Legal Status	Harvest Season	Season Dates/Limits/Additional Comments
Colorado	Furbearer	Open	Season reopened in 2009 (November 1 – end of February); unlimited bag and possession limits. Pelt tagging not required. Recent average annual harvest of 310 foxes under new furbearer harvest permit.
Kansas	Furbearer	Open	May be taken during furharvesting season by furharvester license holders and landowners. Open season mid-November – end February. No limit on take. Pelt tagging required. Average harvest 2011–2022 was 122 foxes.
Montana	Furbearer	Open	Portion of Trapping District 6 open from November 1 – January 15. Quota of 10 animals. No hunting or free shooting allowed. Season will close in 48 hours upon reaching trapping district quota or on the season closure date, whichever occurs first. Trappers may take and possess 3 swift foxes per season. Trappers must report their harvest within 24 hours. Pelt tagging and lower jaw submission is required within 10 days of the season closure date.
Nebraska	Endangered	Closed	N/A; incidentally taken swift foxes must be turned over to the Nebraska Game and Parks Commission
New Mexico	Furbearer	Open	Statewide during open season (November 1 through March 15). Pelt tagging is not required.
North Dakota	Furbearer	Closed	Incidental capture or trapping must be reported and carcass turned over immediately to ND Game and Fish Department.
Oklahoma	Furbearer	Closed	N/A
South Dakota	Furbearer, threatened	Closed	Incidentally-taken carcass must be turned over to SDGFP immediately.
Texas	Furbearer	Open	Commercial take (for fur sales) during November 1 – March 31 season. Recreational harvest from September 1 – August 31. May also be taken for nuisance at any time, in any number, and by any means on a person's land without a hunting or trapping license. Pelts from nuisance take may not be retained. For any form of take, there are no bag limits and pelt tagging is not required.
Wyoming	Nongame	Closed	Incidental take allowed under certain circumstances.

C. Disease and predation.

Swift foxes are susceptible to a variety of infectious diseases and parasites. Diseases such as sylvatic plague (*Yersinia pestis*), tularemia (*Francisella tularensis*), canine parvovirus (CPV), canine distemper virus (CDV), and canine adenovirus-1 (CAV-1) have been found to infect swift foxes throughout the Great Plains. It is believed that swift foxes share these communities of parasites and diseases with sympatric canids and have not developed a specialized suite of species-specific agents.

CDV affects all canine species (Montali et al. 1987). Few swift foxes and kit foxes sampled throughout the western U.S. have been exposed to this potentially deadly disease (Miller et al. 2000, Olson and Lindzey 2002a, Gese et al. 2004, Mitchell 2018). From a sample of 29 swift foxes, Mitchell (2018) found 3 (10.34%) that tested positive for distemper antibodies which is similar to results in other studies (Miller et al. 2000, Olson and Lindzey 2002a). Olson and Lindzey (2002a) documented 2 instances in which swift foxes succumbed to distemper.

CPV has been responsible for high rates of mortality of other canid species, especially in juveniles (Gese et al. 1997, Murray et al. 1999, Deem et al. 2000, Mech et al. 2008, Almberg et al. 2009). However, the effect of parvo on swift fox survival and population trends is unknown. All studies investigating its prevalence in swift fox populations have reported positive CPV tests (Miller et al. 2000, Harrison et al. 2003, Gese et al. 2004, Mitchell 2018). More recent studies in the Dakotas and Montana found an alarmingly high prevalence of CPV titers (71.43% and 68.18%, respectively; Mitchell 2018, Montana Fish, Wildlife & Parks unpublished data). This high prevalence indicates a high rate of exposure to the disease but does not prove a negative impact. Additional research is needed to assess the effects of CPV on swift foxes and their populations.

CAV-1 is a viral infection that can cause liver failure and vasculitis in domestic canines. It has been found to infect wild canids, such as coyotes and red foxes (*Vulpes vulpes*). However the virus' effect on canid populations is unknown (Gese et al. 2004, Tryland et al. 2018). San Juaquin kit foxes (*Vulpes macrotis mutica*) have been reported to have antibodies for CAV-1 (McCue and O'Farrell 1988). Gese et al. (2004) reported that all captured swift foxes tested negative for titers. In 2020, 6 of 8 live-captured swift foxes in Montana tested positive for CAV-1 titers. It is currently unknown if CAV-1 has an effect on swift fox populations. Further research is necessary to better understand the disease and how it relates to swift foxes.

Swift foxes have been found to carry *Y. pestis* antibodies but do not exhibit clinical symptoms of the disease (Pybus and Williams 2003, Gese et al. 2004, Gage and Kosoy 2005, McGee et al. 2006, Mitchell 2018). It is generally thought that swift foxes act as a reservoir for the disease, but it has not been documented to negatively affect the foxes themselves or the population.

F. tularensis is a known infectious agent in species swift foxes commonly prey on (e.g., lagomorphs and rodents; Brown et al. 2015, Mani et al. 2016). However, the impact tularemia has on canid species is unknown (Gese et al. 1997). It is likely that canids contract the disease but are relatively unsusceptible and healthy individuals are able to recover (Gier and Ameel 1959, Zarnke and Ballard 1987). Kuehn et al. (2013), proposed that red foxes (*Vulpes vulpes*) could be an indicator of the spread of tularemia due to the species ability to develop antibodies. Tularemia has only been evaluated in swift foxes in one study (Mitchell 2018). It was commonly found in swift foxes in the Dakotas (up to 68% of individuals). Regular testing for tularemia in swift foxes may be used to monitor the regional prevalence of this disease.

Over the past few decades, sarcoptic mange has been a significant mortality factor for red foxes and coyotes in parts of the Dakotas and Montana. If mange spreads to areas with established swift fox populations, mange could become a significant source of mortality in localized areas. Infectious disease prevalence in wild swift fox populations is believed to be on the rise due to rural development and domestic dog (*Canis familiaris*) populations (Arjo et al. 2003). Monitoring for disease prevalence in swift fox populations is an integral part of successful conservation and reintroduction efforts throughout their range.

Predation is typically the most common cause of swift fox mortality, with coyotes as the primary predator of swift foxes in the U.S. and Canada (Covell 1992, Thompson and Gese 2007, Assal et al. 2015, Mitchell 2018, Butler 2019). Other predators of swift foxes include large raptors such as golden eagles (*Aquila chrysaetos*), American badgers (*Taxidea taxus*), and bobcats (*Lynx rufus*; Carbyn et al. 1994, Andersen et al. 2003, Ausband and Foresman 2007). Control of coyotes may enhance the distribution and abundance of swift foxes. However, managers should carefully weigh the likelihood of significantly improved survival and dispersal to the costs of effectively controlling coyotes. Cypher and Scrivner (1992) attempted to reduce coyote numbers to increase kit fox survival but despite reduction in the coyote populations, they were unsuccessful in reducing coyote numbers sufficiently to affect kit fox populations. In contrast, swift foxes were successfully reintroduced to Badlands National Park, South Dakota and the surrounding grasslands despite that area having a relatively dense coyote population and no coyote control efforts (Schroeder 2007).

Red foxes may also pose a threat to swift fox populations due to direct interference and exploitative competition (Ralls and White 1995, Clark et al. 2005). Based on known interspecific relationships between other canids, the red fox may be a substantial barrier to swift fox range expansion and may be more detrimental to swift foxes than coyotes due to a more direct niche overlap (Clark et al. 2005). Although red foxes may occasionally kill swift foxes, the presence of coyotes may benefit swift foxes by excluding red foxes. Unraveling canid relationships is challenging but it is clear that swift foxes are impacted by interference competition from both red foxes and coyotes.

Predation and disease have always been mortality factors impacting swift foxes. However, the range-wide population should not be negatively affected by reasonable rates of mortality. To safeguard against severe decline in the population, continued monitoring by individual states should detect widespread, unusual losses so management actions can be applied. At this time, it is the SFCT's belief that predation and disease are not threatening population viability in many populations. However, further research of diseases such as CPV and CAV-1 are warranted.

Potential topics for further research:

1. Evaluate disease prevalence in native populations of swift fox.
2. Evaluate the effect of diseases such as parvo and adenovirus on swift fox survival.
3. Evaluate the influence of competitive exclusion by other canids on swift fox dispersal and population status.

D. Inadequacy of existing regulatory mechanisms.

Swift foxes are managed under state laws in all 10 states that encompass the species' historical range. All these states except for New Mexico classified the swift fox as a SGCN in their state wildlife action plan or similar document guiding statewide species and habitat conservation priorities. The swift fox is a state endangered species in Nebraska and state threatened in South Dakota (Table 6). Swift foxes are legally harvested in five of the 10 states (Table 6), but there is no indication legal harvest is detrimental to swift fox populations (see Section B). There is also no evidence that unintentional take is an issue, particularly relative to predator control activities. It is the SFCT's view this factor has not risen to the level of a threat.

Potential topics for further research:

1. None

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

Grazing:

Grazing by wildlife or domestic livestock is essential for maintaining the health of native and restored grasslands and is necessary on a landscape scale to maintain a healthy grassland ecosystem. The evolutionary history of the shortgrass and mixed grass prairie resulted in grassland-dependent species adapted to a mosaic of lightly to heavily grazed areas (Bragg and Steuter 1996, Knopf and Samson 1997). The impacts of grazing on swift foxes can vary widely, depending on the dominant vegetation types, climatic conditions, the state or health of range vegetation, and the type of grazing regime utilized. During dryer times and in dryer areas, overgrazing may reduce prey densities and be detrimental to swift foxes. Conversely, both drought and intensive and/or persistent grazing may create swift fox habitat in areas with taller (i.e. mixed grass prairie) or exotic grass species. Prairie dogs and their intensive grazing habits may have also facilitated swift fox distribution into the eastern parts of their historical distribution, with their reduction having altered the landscape mosaic that previously existed. The NRCS has produced a pamphlet to provide an introduction to the habitat requirements of swift foxes and to assist landowners and land managers in developing management strategies that will benefit swift foxes as part of an overall grassland management plan (NRCS 2005). Their primary recommendation relative to grazing is to create a mosaic of grazing intensities over large areas (minimum 125 acre), primarily through rotational grazing. In sum, grazing is necessary to maintain healthy grasslands, and most existing grassland is grazed by livestock.

Potential topics for further research:

1. Influences of drought and over-grazing on availability of food resources in rangeland-dominated landscapes.
2. An assessment of grazing patterns compared to swift fox presence near the edge of the current swift fox distribution.

Climate and Weather:

Global climate change will affect grasslands, and thus swift fox habitat through a variety of mechanisms. Increasing temperatures may result in a northward shift of the climatic conditions most suitable to the species, possibly resulting in the southernmost parts of the current range becoming unsuitable due to drier conditions. Such range shifts are already occurring in many species (Root et al. 2003). Fortunately, extensive habitats that are probably suitable for the species already exist to the north of the current swift fox range, particularly in the Dakotas, Montana, and Canada. Habitat fragmentation, however, could impede or prevent swift foxes from gradually shifting into these more northern habitats as temperatures increase. In addition, climate change may increase

the potential for swift foxes to encounter new pathogens, and new invasive species could affect their habitats (Inkley et al. 2004).

All state wildlife agencies have approved Wildlife Action Plans, which are required to maintain eligibility for a federal funding match source called State Wildlife Grants. Many states are in the process of revising their wildlife action plans, in part due to the potential availability of new federal funding sources. The swift fox is listed as a SGCN by nine of the 10 states within the species' range, making management and recovery efforts eligible for certain federal grants. Conservation projects that address wildlife declines and the impacts of climate change are eligible for funding through the America the Beautiful Initiative, a 10-year federally funded project implemented in 2022. The Recovering America's Wildlife Act that nearly passed in 2022–2023 would have provided additional funding to states to support the management and recovery of SGCNs, including swift fox. Another promising funding opportunity is the North American Grasslands Conservation Act. This proposed legislation would establish a grant program for farmers, ranchers, and Tribes to voluntarily conserve and restore grasslands in North America.

Potential topics for further research:

1. Model shifts in swift fox distribution and/or habitat use relative to climate change

Poisoning:

The widespread use of strychnine-laced carcasses for controlling wolves and coyotes caused the decline of swift fox populations in the 1800s and early 1900s (Scott-Brown et al. 1987). Documented cases of swift fox poisoning in modern times have been very rare (see Peek et al. 2024). Currently, there is concern about how the use of two anticoagulants approved for control of prairie dogs, Chlorophacinone (Rozol) and diphacinone (Kaput-D), may impact swift foxes. Rozol was approved in 2009 via Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) ,Section 3. Rozol use has been approved for prairie dog control by the state agriculture departments in Colorado, Kansas, Montana, Nebraska, New Mexico, North Dakota, Oklahoma, South Dakota, Texas, and Wyoming for their jurisdictions. Kaput-D use was approved in 2012 for prairie dog control in Colorado, Kansas, Montana, Nebraska, New Mexico, North Dakota, Oklahoma, South Dakota, Texas, and Wyoming. Use restrictions apply in geographic areas where federally threatened or endangered species occur (i.e. black-footed ferret, grizzly bear, Preble's meadow jumping mouse; EPA 2022a). Kaput-D use is also prohibited on some tribal lands in Montana, and within certain counties in New Mexico and Texas.

The risk of secondary poisoning to non-target species, such as swift fox, from exposure to Rozol and Kaput-D may be higher than from the commonly used rodenticide zinc phosphide. Anticoagulant use results in a more prolonged period of mortality for prairie

dogs and also has a longer persistence in their body tissues. While the Environmental Protection Agency (EPA) provides anticoagulant pesticide users with guidelines to mitigate take of non-target species from the landscape, levels of compliance by users is untracked and unknown. Consequently, contaminated prey may be available to non-target species for a period of weeks for anticoagulants versus hours for zinc phosphide. The SFCT, through the WAFWA, requested the EPA to fully consult with the USFWS on the use of these 2 pesticides in controlling prairie dogs and the inadequacy of the label restrictions in preventing take of non-target wildlife species. Still, federal use restrictions do not directly address impacts on swift foxes, as they are not a federally listed threatened or endangered species.

Sodium cyanide in the form of M-44 bait devices have been used by livestock operators since 1947 to control coyotes and other wild predators. Currently, the use of sodium cyanide products is permitted for USDA and certified applicator use in South Dakota, Montana, New Mexico, Texas, and Wyoming. In 2019, the EPA issued a revised interim decision on the use of M-44 devices that included updated requirements to ensure continued safe use of the devices with the intent of addressing public health risks and minimizing non-target mortalities of domestic pets. (EPA 2019). In 2022, the EPA also released a risk assessment and associated recommendations regarding the effects of sodium cyanide devices on federally listed species (EPA 2022b). Updated language on labels prohibits the use of sodium cyanide in areas overlapping certain threatened and endangered species, but devices are still permitted in areas potentially occupied by swift foxes. USDA APHIS Wildlife Services reported an annual average of 19 nontarget swift foxes killed between FY11 and FY15 with M-44s equipped with sodium cyanide (Lemay and Hall 2017). Based on more recent data describing total incidental take, this number has apparently declined (https://www.aphis.usda.gov), possibly due to decreased M-44 use by the agency. In early 2024, the use of M-44 devices that deliver sodium cyanide was prohibited from BLM-managed public lands (Branham 2024).

Remnant lead fragments from harvested big game, small game, and upland game birds could be a threat to swift foxes, which may scavenge animal remains left on the landscape. While some states require the use of non-toxic ammunition for hunting particular species (e.g. upland game birds), the majority of game species may still be hunted using lead ammunition. Prairie dog hunting is permitted to some extent in every state within swift fox range, with no restrictions on lead ammunition. Hunters are often encouraged to leave shot prairie dogs on the landscape, as they frequently host parasites that may carry plague and other zoonotic diseases. Such practices create scavenging opportunities where swift foxes may ingest sub-lethal or lethal amounts of lead. Although ample literature exists examining the effects of lead poisoning in raptors and other scavenging birds, there has been little research regarding the effects of lead ingestion in scavenging mammals – including swift fox (Pain et al. 2019). Where feasible, state and federal wildlife agencies may find it beneficial to initiate outreach and education campaigns to encourage the voluntary use of non-toxic ammunition in regions with known swift fox populations (Schultz et al. 2019).

Potential topics for further research:

1. Quantifying levels of applicator compliance to required mitigation and removal techniques following the application of anticoagulant rodenticides for prairie dog control
2. Direct and indirect impacts of anticoagulant rodenticide use on swift fox individuals and populations
3. Direct and indirect impacts of lead ingestion from scavenged carcasses on swift fox individuals and populations

Roadways:

Swift foxes are frequently observed along roadways. Several studies have indicated swift foxes frequently use roadways as travel lanes and for foraging activities, and they may build dens nearby (Hines and Case 1991, Pruss 1999). These roadway associations can be a major source of vehicle-related mortality for juvenile foxes (Sovada et al. 1998), but generally represent a small percentage of total mortalities (see Peek et al. 2024) and do not appear to be a significant problem from a range-wide perspective.

Potential topics for further research:

1. In areas where vehicle collisions constitute a major source of swift fox mortality, assess the impact of this mortality factor on population viability.

Section Summary:

A variety of natural and manmade factors variably impact swift foxes throughout their range. However, none of the factors listed above have been implicated in modern times in the decline of swift foxes at any large scale. It is the SFCT's view that none of these factors have risen to the level of a threat.

CONSERVATION STRATEGY, 2023-2032

Introduction:

This conservation strategy is intended to provide a framework of actions to be taken by the SFCT and its partners to maintain or improve the conservation status of the swift fox in the U.S. over the next 10 years. It is an update of the two previous versions reflecting the progress that has been made towards swift fox conservation as well as changes in the priorities of the SFCT. Notably, the representatives of the SFCT consider the range wide status of the swift fox as secure and have identified systematic monitoring of swift fox distribution and their habitats as high priority actions of the SFCT. Additionally, SFCT representatives recognize that grassland conservation and other major landscape-scale habitat initiatives generally fall broadly within the mission of most agencies and remain a conservation priority of most partners, but that the conservation strategy should primarily be focused on swift-fox specific actions, particularly those with objective and quantifiable outcomes, though the group will continue to support and engage in broader conservation efforts. Finally, the group continues to see value in going through the process of reviewing the status of the swift fox based on the five listing factors of the ESA, a process that began with the 2011 CACS. This exercise creates a structured process to identify and evaluate potential threats as well as existing research needs and is helpful to the group in broadly assessing the range wide conservation status.

In continuing with the philosophy reflected in past CACS documents, this strategy was constructed by the SFCT and its partners with recognition of the significance of cooperation and participation by a broad group of government agencies, tribes, NGOs and private individuals. We also acknowledge the importance of compatible rural livelihoods and activities such as ranching, farming, and outdoor recreation including hunting, trapping, and wildlife watching, to the existence of the swift fox and in the establishment of stakeholders in wildlife conservation. Thus, the focus of this framework is on voluntary collaborative conservation based on shared values and incentives rather than regulatory requirements.

Goal:

The goal of this conservation strategy is to maintain or restore swift fox populations within each state to ensure the spatial, genetic, and demographic structure of the swift fox population in the United States, thereby ensuring long-term population viability such that the species status remains secure and listing under the U.S. Endangered Species Act is not justified.

Objectives, strategies, and activities:

1. Maintain a Swift Fox Conservation Team (SFCT) including one representative of each of the state wildlife agencies within the historical range of the swift fox.

1.1 The SFCT is comprised of a single representative from each of the 10 state wildlife resource agencies (state), Bureau of Land Management (BLM; regional), U.S. Forest Service (USFS; regional), U.S. Geological Survey (USGS; regional), Animal and Plant Health Inspection Service (APHIS; regional), and U.S. Fish and Wildlife Service (USFWS; regional). Interested cooperators including other state and federal agencies, universities, tribal governments, conservation organizations, research institutions, and the Canadian recovery team are encouraged to participate with the team.

1.1.1. Responsibilities of the SFCT are to: 1) provide a forum for collaboration and technical information exchange, 2) identify measurable variables to assess and monitor the range wide status of swift fox, 3) promote swift fox conservation through various avenues of technical support, collaboration, and public outreach and education, 4) support research ensuring sound science is the basis for swift fox conservation, and 5) identify risk factors potentially impacting the status of swift fox.

1.1.2. The SFCT will meet biennially on a rotational basis with the meeting host serving as the chair and the next host serving as co-chair. Meeting minutes will be published on the SFCT website and serve as an update of SFCT activities.

1.1.3. Approximately 10 years following publication of this revision, SFCT members and cooperators will evaluate progress in meeting objectives and strategies and reassess risks to swift fox conservation. This evaluation will include consideration of whether the SFCT may disband because it has accomplished its original purpose of assuring long-term swift fox persistence.

2. Assess the range wide distribution of swift fox in the U.S.

2.1 State wildlife agencies will periodically monitor swift fox distribution within each state using various detection methods such as species presence/absence or population surveys, trapper and hunter harvest location data, and occurrence reports.

2.2 Range wide species distribution maps will be created per the general methodology of Sovada et al. (2009). These figures will be used to monitor

range wide status and changes in distribution, and to identify areas of specific conservation interest such as areas of increasing or decreasing distribution, unoccupied grassland habitat, and habitat corridors facilitating genetic interchange between populations.

2.3 Maintain swift fox distribution in at least 50% of the historical range.

3. Identify existing native shortgrass and mixed grass prairie and other potentially suitable habitats.

3.1 Identify, describe, and delineate existing potentially suitable swift fox habitat range wide using landscape scale geo-spatial data available on a repeated basis (i.e. LANDFIRE) for consistent and comparable assessment. This effort will represent a major component of swift fox status assessment and form the basis for evaluating restoration activities and identifying constraints and opportunities within each state for possible swift fox conservation efforts.

4. Promote swift fox conservation through various forms of collaboration and outreach.

4.1 The SFCT will maintain a website for dissemination of current information on swift fox ecology, management, and conservation including peer-reviewed journal publications, state and federal agency reports, and popular articles and videos. SFCT membership, information, activities, and documents will also be publicized on this website.

4.2 The SFCT will support the Association of Zoos and Aquariums (AZA) in its efforts to maintain a viable captive population.

4.3 States will integrate swift fox conservation needs into both state and multi-state prairie ecosystem conservation programs, initiatives, and efforts intended to address the needs of many grassland-dependent species.

4.4 The SFCT will support various forms of public awareness of and education on swift foxes, species' habitat and management needs, and challenges to species conservation.

4.4.1 The SFCT will collaborate with the AZA to develop educational displays and other outreach materials presenting the most accurate and current information on swift fox conservation and management.

5. Identify and encourage research studies that contribute to swift fox conservation and management.

5.1 Sound scientific research is a critical component of addressing management questions and factors potentially affecting swift fox status and conservation. Potential research needs will be identified as part of the risk assessment described in Objective 4 above.

6. Identify and report on threats to the species based on the five listing factors analyzed by USFWS in reviewing species' status for listing under the U.S. Endangered Species Act (ESA).

6.1 This risk assessment will serve as a framework for identifying threats to swift fox conservation as well as management and research needs. It will also represent a broad description of swift fox conservation status in the U.S.

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Appendix 1. SFCT meeting location, date and publisher of annual or biennial report 1994–2023.

Meeting Location	Meeting Date	Report Publisher
Fort Collins, CO	December 1–2, 1994	
Denver, CO	September 20–21, 1995	ND, OK & SD
Omaha, NE	December 11, 1996	WY & WY CFWRU
Snowmass, CO	September 22, 1997	MT
Amarillo, TX	December 8, 1998	KS
Pheonix, AZ	November 29, 1999	NM
Albuquerque, NM	January 23–24, 2000	NM & WY
Rapid City, SD	October 17–18, 2001	KS
Bismarck, ND	September 23, 2002	WY
Fort Collins, CO	September 16, 2003	TX & WY
Kansas City, KS	March 22–23, 2005	NE & NM
Great Falls, MT	April 4, 2006	ND & SD
Rapid City, SD	April 17–19, 2007	WY
Fort Collins, CO	April 18–20, 2008	ND
Laramie, WY	March 30–April 1, 2010	WWF
Pueblo, CO	April 3–4, 2012	CO
Albuquerque, NM	April 8–9, 2014	CO
Fort Collins, CO	April 20–21, 2016	SD
Bozeman, MT	April 18–19, 2018	MT
Zoom	May 11–13, 2021	unpublished
Colby, KS	October 31–November 1, 2023	Meeting minutes compiled by meeting host

Appendix 2. Area (km^2) of swift fox historical distribution and available habitats potentially suitable for swift fox occupation within the historical distribution in the U.S. by state and total. Habitat categories are those classified in LANDFIRE for individual states (https://www.landfire.gov/). Habitats considered suitable within a state but comprising <1km^2 were excluded from this table.

		Grassland land cover		Agricultural land cover	
Habitat categories	Historical Distribution	High Quality	Medium Quality	Medium Quality (dryland)	Low Quality (irrigated)
Colorado					
Agricultural lands				25,808	6,184
Central Mixedgrass Prairie Grassland		1,556			
Central Mixedgrass Prairie Shrubland			161		
Western Great Plains Foothill and Piedmont Grassland			1,982		
Western Great Plains Sand Prairie			691		
Western Great Plains Shortgrass Prairie		50,816			
Western Great Plains Tallgrass Prairie			35		
Total Area (km^2)	**108,262**	**52,372**	**2,868**	**25,808**	**6,184**
% suitable	81%	48%	3%	24%	6%
Kansas					
Agricultural lands				56,317	11,133
Central Tallgrass Prairie			22		
Central Mixedgrass Prairie Grassland		23,808			
Southeastern Great Plains Tallgrass Prairie			263		
Western Great Plains Sand Prairie		2,544			
Western Great Plains Shortgrass Prairie		10,674			
Western Great Plains Tallgrass Prairie			322		
Total Area (km^2)	**119,930**	**37,025**	**606**	**56,317**	**11,133**
% suitable	88%	31%	1%	47%	9%
Montana					
Agricultural lands				49,419	3,207
Inter-Mountain Basins Big Sagebrush Shrubland			206		
Inter-Mountain Basins Big Sagebrush Steppe			37,391		
Inter-Mountain Basins Mat Saltbush Shrubland			1,568		
Inter-Mountain Basins Montane Sagebrush Steppe			279		
Inter-Mountain Basins Semi-Desert Grassland		9			
Northern Rocky Mountain Lower Montane-Foothill-Valley Grassland		3,614			
Northwestern Great Plains Mixedgrass Prairie		68,811			
Northwestern Great Plains Shrubland			2,285		
Recently Burned-Herb and Grass Cover		110			
Recently Burned-Shrub Cover			61		
Western Great Plains Sand Prairie		229			
Wyoming Basins Dwarf Sagebrush Shrubland and Steppe			4		
Total Area (km^2)	**199,529**	**72,774**	**41,795**	**49,419**	**3,207**
% suitable	84%	36%	21%	25%	2%

Appendix 2 (*continued*).

		Grassland land cover		Agricultural land cover	
Habitat categories	Historical Distribution	High Quality	Medium Quality	Medium Quality (dryland)	Low Quality (irrigated)
Nebraska					
Agricultural lands				17,100	17,289
Central Mixedgrass Prairie Grassland		25,627			
Northern & Central Plains Ruderal & Planted Grassland			4,018		
Northwestern Great Plains Mixedgrass Prairie		3,673			
Recently Burned-Herb and Grass Cover			79		
Western Great Plains Sandhill Steppe		1,685			
Western Great Plains Shortgrass Prairie		1,960			
Western Great Plains Tallgrass Prairie			98		
Total Area (km^2)	**88,382**	**32,946**	**4,195**	**17,100**	**17,289**
% suitable	81%	37%	5%	19%	20%
New Mexico					
Agricultural lands				3,098	1,191
Apacherian-Chihuahuan Semi-Desert Grassland		83			
Apacherian-Chihuahuan Semi-Desert Shrub-Steppe			845		
Central Mixedgrass Prairie Grassland			9		
Central Mixedgrass Prairie Shrubland			241		
Great Plains Comanchian Ruderal Grassland			160		
Recently Burned-Herb and Grass Cover			11		
Western Great Plains Foothill and Piedmont Grassland		528			
Western Great Plains Sand Prairie		227			
Western Great Plains Sandhill Steppe			4,954		
Western Great Plains Shortgrass Prairie		28,356			
Total Area (km^2)	**47,002**	**29,194**	**6,219**	**3,098**	**1,191**
% suitable	84%	62%	13%	7%	3%
North Dakota					
Agricultural lands					95,046
Inter-Mountain Basins Big Sagebrush Steppe			175		
North-Central Interior Sand and Gravel Tallgrass Prairie		4			
Northern Tallgrass Prairie		2,023			
Northwestern Great Plains Mixedgrass Prairie		33,974			
Northwestern Great Plains Shrubland			848		
Recently Burned-Herb and Grass Cover		7			
Western Great Plains Sand Prairie		8			
Western Great Plains Tallgrass Prairie		22			
Total Area (km^2)	**167,016**	**36,038**	**1,023**	**-**	**95,046**
% suitable	79%	22%	1%	0%	57%

*All agricultural lands in North Dakota are classified as low quality given the lack of association with them by swift foxes in that state.

Appendix 2 (*continued*).

		Grassland land cover		Agricultural land cover	
Habitat categories	Historical Distribution	High Quality	Medium Quality	Medium Quality (dryland)	Low Quality (irrigated)
Oklahoma					
Agricultural lands				6,276	1,669
Central Mixedgrass Prairie Grassland		7,802			
Central Mixedgrass Prairie Shrubland		275			
Great Plains Comanchian Ruderal Grassland			1,098		
Western Great Plains Sand Prairie		3,099			
Western Great Plains Sandhill Steppe			359		
Western Great Plains Shortgrass Prairie		7,715			
Total Area (km^2)	**31,334**	**18,891**	**1,456**	**6,276**	**1,669**
% suitable	90%	60%	5%	20%	5%
South Dakota					
Agricultural lands					63,022
Central Mixedgrass Prairie Grassland		4,046			
Central Mixedgrass Prairie Shrubland			14		
Interior Western North American Temperate Ruderal Grassland			28		
Northern & Central Plains Ruderal & Planted Grassland			9,280		
Northwestern Great Plains Mixedgrass Prairie			63,579		
Recently Burned-Herb and Grass Cover			42		
Recently Logged-Herb and Grass Cover			2		
Western Great Plains Shortgrass Prairie		481			
Total Area (km^2)	**164,203**	**4,527**	**72,946**	**-**	**63,022**
% suitable	86%	3%	44%	0%	38%
Texas					
Agricultural lands				22,786	14,463
Apacherian-Chihuahuan Semi-Desert Grassland			76		
Apacherian-Chihuahuan Semi-Desert Shrub-Steppe			578		
Central Mixedgrass Prairie Grassland			3037		
Recently Burned-Herb and Grass Cover			19		
Western Great Plains Sandhill Steppe			2428		
Western Great Plains Shortgrass Prairie		20320			
Total Area (km^2)	**86,971**	**20,320**	**6,138**	**22,786**	**14,463**
% suitable	39%	12%	4%	14%	9%

*All agricultural lands in South Dakota are classified as low quality given the lack of association with them by swift foxes in that state.

Appendix 2 (*continued*).

		Grassland land cover		Agricultural land cover	
Habitat categories	Historical Distribution	High Quality	Medium Quality	Medium Quality (dryland)	Low Quality (irrigated)
Wyoming					
Agricultural lands				1,910	1,646
Central Mixedgrass Prairie Grassland		4,070			
Central Mixedgrass Prairie Shrubland		112			
Great Basin & Intermountain Introduced Annual and Biennial Forbland			35		
Great Basin & Intermountain Introduced Annual Grassland			98		
Great Basin & Intermountain Introduced Perennial Grassland and Forbland			61		
Interior Western North American Temperate Ruderal Grassland			136		
Inter-Mountain Basins Big Sagebrush Shrubland			786		
Inter-Mountain Basins Big Sagebrush Steppe			17,714		
Inter-Mountain Basins Greasewood Flat			305		
Inter-Mountain Basins Mat Saltbush Shrubland			778		
Inter-Mountain Basins Mixed Salt Desert Scrub			70		
Inter-Mountain Basins Montane Sagebrush Steppe			3,704		
Inter-Mountain Basins Semi-Desert Grassland			273		
Inter-Mountain Basins Semi-Desert Shrub-Steppe			73		
Northern & Central Plains Ruderal & Planted Grassland			877		
Northwestern Great Plains Mixedgrass Prairie		23,847			
Northwestern Great Plains Shrubland			189		
Recently Burned-Herb and Grass Cover			77		
Rocky Mountain Lower Montane-Foothill Shrubland			702		
Western Great Plains Sand Prairie		1,534			
Western Great Plains Sandhill Steppe			124		
Western Great Plains Shortgrass Prairie		4,726			
Western Great Plains Tallgrass Prairie		2			
Wyoming Basins Dwarf Sagebrush Shrubland and Steppe		412			
Total Area (km^2)	**72,813**	**34,704**	**26,001**	**1,910**	**1,646**
% suitable	88%	48%	36%	3%	2%
Rangewide U.S. Totals (km^2)	**1,085,442**	**338,789**	**163,248**	**182,715**	**214,849**
% suitable	83%	31%	15%	17%	20%