

# Chapter 6—Implementation of the Proposed Action



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*Wilson's Phalaropes*

This chapter describes how we intend to carry out the proposed action through the formulation of objectives and strategies that are designed to help us achieve our goals for Quivira Refuge.

As stated in the Improvement Act, the primary mission of our Refuge System is wildlife conservation. Multiple policies and guidance documents have been developed to accomplish this mission, including the policy on Biological Integrity, Diversity, and Environmental Health and the 2011 Conserving the Future document developed in collaboration with our

stakeholders and the public. The Biological Integrity, Diversity, and Environmental Health policy provides directives for keeping and restoring the biological integrity, diversity and health of the Refuge System, whereas Conserving the Future articulates the desired roles for refuges and provides recommendations for the next decade and beyond (Refuge System 2011) and states, “At the root of these challenges [that the Refuge System must address] is the increasing consumption of natural resources, which has caused loss, degradation and fragmentation of habitat around the world. Habitat loss is largely responsible for the current extinction event, in which the Earth may lose half of its species in the next 100 years.” Our focus and planning approach for Quivira Refuge is consistent with the visions and principles promoted in the Improvement Act; the policy on Biological Integrity, Diversity, and Environmental Health; and the Conserving the Future document,

including conserving native communities and species of concern and developing “quantifiable conservation objectives” that “integrate the conservation needs of the larger landscape (including the communities they support).”

The vision, proposed alternative, and goals for Quivira Refuge collectively focus objectives and associated management strategies on achieving sustainable, diverse, native communities that will conserve native species of concern at landscape and local scales. Achieving this vision represents the greatest contribution we at the refuge can make in addressing current and future threats to natural resources in the central Great Plains. Threats include increasing habitat fragmentation and decreasing landscape connectivity, adverse effects on water quantity and quality, and cumulative risks associated with changing climate and energy production. To alleviate these and to meet the purposes of the refuge requires us to consider multiple perspectives, including Refuge System policies and guidance, the current understanding of native community ecology, increasing human demands on natural resources, continued landscape change, and our need to collaborate with the public and our partners, on projects that span beyond refuge boundaries.

## 6.2 Landscape Conservation Goal

*Actively protect, preserve, manage, and restore the functionality of the diverse ecosystems of the Rattlesnake Creek watershed.*

Quivira Refuge’s contribution toward conserving natural resources in the central Great Plains must be considered within the context of the greater, surrounding landscape. Substantial loss and degradation of native environments have occurred there, which limits the amount, distribution, and quality of habitat available for native wildlife. Identifying primary needs of wildlife that are of conservation concern is essential for making decisions about the desired future condition of refuge lands, because we may have the potential to fulfill those needs. In addition, incorporating information on ecosystem function at the watershed scale is necessary because past and ongoing modifications near the refuge significantly affect our current, and future, capability to sustain the functions required to provide quality wildlife habitat. The watershed is the most appropriate scale at which to consider these factors because all flow of

energy and materials in its environment are contained within its boundaries. This means that land use practices, such as conservation actions, at one site within a watershed can influence other sites within that same watershed.

In the case of Quivira Refuge, the Rattlesnake Creek watershed (subbasin) forms our most appropriate scale at which to consider landscape conservation planning. Refuge lands are at the lowest elevation of the subbasin, and the end of its primary surface water source, Rattlesnake Creek, is north-east of the BSM where it joins with Salt Creek on the refuge (figure 15). The subbasin mostly overlies the Great Bend Prairie Aquifer, which is a subregion of the High Plains Aquifer (Basin Management Team 2011). Although the area of the subbasin is 1,232 square miles, the area that actually contributes runoff to the refuge is only about 519 square miles and contributes drainage for USGS Zenith gaging station #07142575, which is located within a few miles of the creek’s entrance into the refuge (USGS 2012d). The long-term average annual precipitation since 1948 is 24.33 inches, but it varies from about 15 to more than 27 inches. The average annual free-surface evaporation is about 64 inches (Sophocleous et al. 1997), with rates being highest during the summer months (Latta, 1950).

The dominant land use in this watershed is agriculture, and crop irrigation occurs largely by pumping ground water from the aquifer, which can affect ground water levels on, and near, the refuge. In addition, there is a direct connection between ground water levels and Rattlesnake Creek flows. The quantity of ground water pumped is inversely related to the amount and timing of precipitation, but most pumping occurs from May through October when surface water from Rattlesnake Creek is needed for managing refuge habitats to support annual wildlife needs.

Water rights in Groundwater Management District Number 5, which encompasses the subbasin, are overappropriated, with 1,377 water rights authorizing the use of 266,726 AFY. Ground water use often exceeds recharge (Basin Management Team 2011). The 10-year rolling average of ground water use for the stream–corridor part of the subbasin has been around 30,000 AFY for the years 2009–2011, and basin-wide estimates that include the refuge and the larger mineral intrusion area exceeded 55,000 AFY (Basin Management Team 2012). Since 1974, streamflow at USGS Zenith gaging station #07142575 has averaged 44.36 cubic feet per second (cfs), and average streamflow for the years 2000–2009 was 37.36 cfs (Basin Management Team 2011). These flows are below historical reports. A streamflow of 100 cfs was estimated in the area of the refuge at the time of establishment in the 1950s, and that was during a

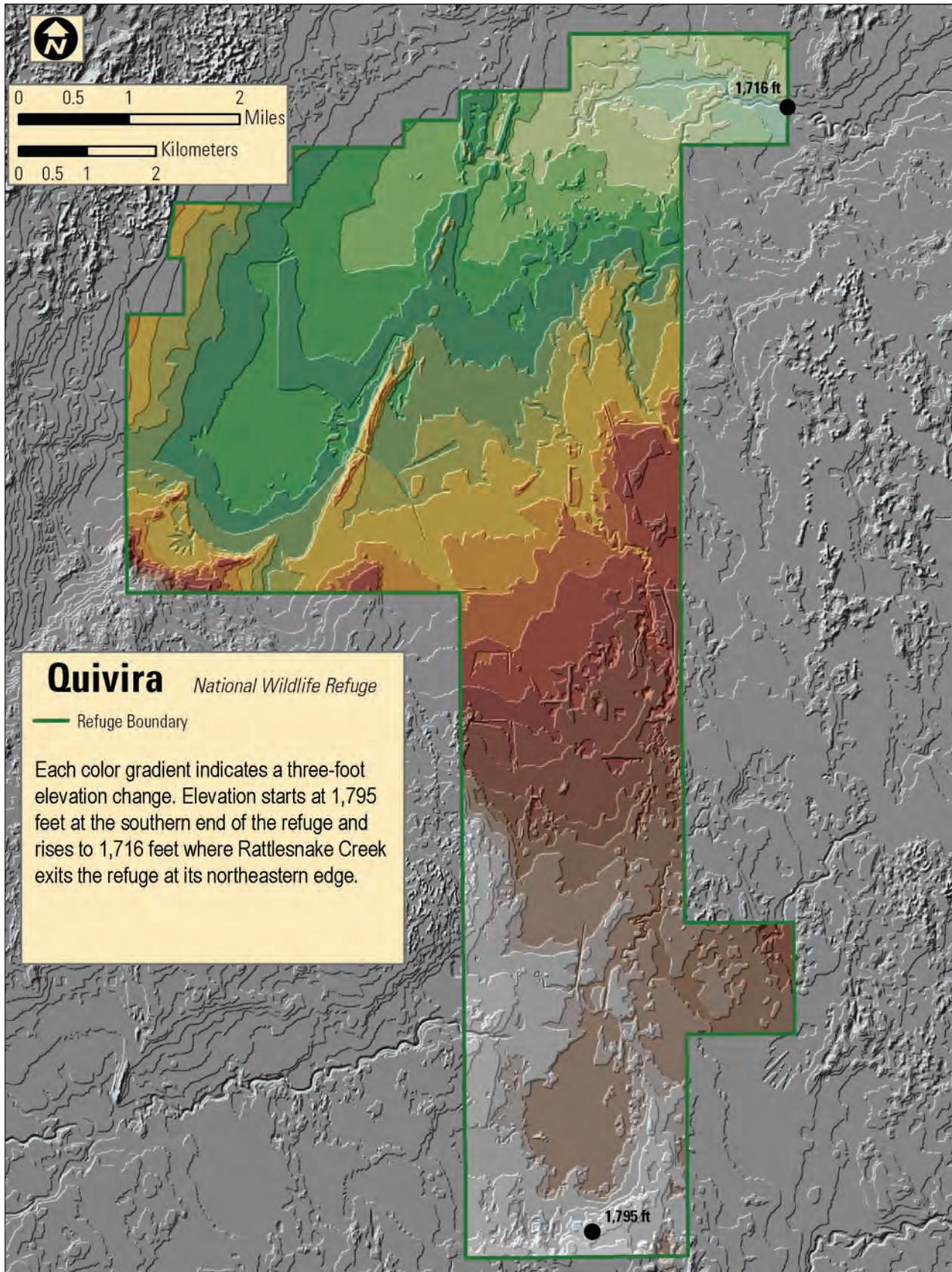


Figure 15. Elevation at Quivira National Wildlife Refuge, Kansas.

dry period (Heitmeyer et al. 2012). Declines in the ground water table lead to reduced streamflows that are often insufficient to meet surface water demands. Water levels have continued to decline throughout most of the subbasin between 2001 and 2012 (Basin Management Team 2012). Total water use for the subbasin reported for years 1989 through 2009 averaged 175,656 AFY, ranging from 119,204 AFY in 1997 to 216,347 AFY in 2002 (Basin Management Team 2011).

The refuge has a senior water right [Permit # 7571] allowing use of Rattlesnake Creek water quantities of 14,632 AFY and flows of 300 cfs. Since 1984, the minimum desirable streamflow criteria for USGS Zenith gaging station #07142575 have been: 15 cfs for the months of December through June, 5 cfs in July, 3 cfs from August through October, and 10 cfs in November. There are periods of record where the minimum desirable streamflow was not met, but water use was not administered because it was difficult to figure out individual diversion effects on streamflow (Basin Management Team 2012).

Information on current environmental conditions at the subbasin scale was evaluated to name factors that could limit the value of the refuge and adjacent lands for wildlife. In addition, land use practices occurring in the watershed were considered that have altered, or could alter, important processes, like hydrology, and that constrain our, and the public's, ability to provide quality habitat in the entire subbasin. We used this evaluation to develop landscape objectives that address priority needs in the subbasin and to make decisions on which habitat types to provide on refuge lands. Relative to the rest of the subbasin, land use activities closer to the refuge have created an area that has more grassland and wetland habitat (figure 7). This offers potential benefits to native communities and species of concern.

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## Landscape Conservation

### Objective 1: Land Ownership and Collaboration

Throughout the life of the plan, collaborate with other programs and with natural resource agencies to promote land protection, restoration, and management in the Rattlesnake Creek watershed, emphasizing lands within 10 miles of the refuge boundary.

#### **Strategies**

- Collaborate with Partners, NRCS, KDWPT, and other agencies to develop private lands programs that promote the sustainability of water resources, the control of invasive species, and the restoration of native plant communities in the Rattlesnake Creek watershed.
- Collaborate with educational institutions, as well as with other agencies and organizations, to find pertinent research and monitoring programs to name best management practices that can be incorporated into private lands programs.
- Collaborate with agencies responsible for regulating water use in the Rattlesnake Creek watershed to help find and improve water use efficiencies.

#### **Rationale**

We considered expanding the refuge boundary and acquiring more fee-title lands to enhance landscape conservation. However, it would be difficult for us to obtain large tracts of land adjoining the refuge in fee title, and any acquired lands would require extensive restoration and maintenance. Agriculture and energy developments within the watershed have significantly altered surface and ground water dynamics, which has not only resulted in the loss and fragmentation of wetland and grassland habitats near the refuge, but has altered hydrologic functions that influence refuge wetlands and grasslands (Heitmeyer et al. 2012). Therefore, we decided that it would be better to collaborate with our partners to develop and conduct programs that address natural resource issues on private lands near the refuge.

Many agencies and organizations have programs that are available to landowners in the subbasin, including Partners, KDWPT, Playa Lakes Joint Venture, NRCS, and the Rattlesnake Creek Partnership, among others. Such programs may provide better conservation in the Rattlesnake Creek watershed because current, and emerging, environmental threats, such as water deficiencies and invasive species, are pervasive and difficult, if not impossible, to address by only acquiring and restoring small tracts of land. Furthermore, new techniques, such as decision support systems and models, are being developed by several entities, like the landscape conservation cooperative, the Western Governors Association, and KDWPT, which help target lands where implementation of program practices would generate the greatest benefits. Private lands programs are also cost effective because they are flexible and can be strategically deployed to address

- Continue to include Partners staff in our regular refuge staff meetings.

specific issues. They not only improve habitat for wildlife on lands around the refuge, but they help us to reduce the sources of invasive species, to protect senior water rights, and to do more on refuge lands.

We mean this objective to complement, rather than override, the objectives of the Rattlesnake Creek Subbasin management plan, which identifies multiple, ranked areas for water conservation throughout the watershed. Many activities that occur more than 10 miles from the refuge influence our water resources. We support water conservation-related activities throughout the subbasin that contribute to the improvement and sustainability of water resources.

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## Landscape Conservation

### Objective 2: Habitat Fragmentation

- Reduce fragmentation of refuge grassland habitats within the next 15 years by strategically removing, at most, 850 acres of trees or tall shrubs, as shown in appendix F, to benefit grassland-dependent wildlife, particularly species that exhibit area sensitivity during essential life cycle events.
- Initiate the restoration of about 866 acres of remaining refuge agricultural lands (figure 6) during the next 15 years to proper, native plant communities, based on ecological site descriptions, to help native grassland species, including those that are area sensitive during certain life cycle events.

### Strategies

- Remove specific tree species as follows (other strategies may be used if they are likely to increase success in achieving objectives):
  - Eastern red cedar—cut, pile, and burn; prescribed fire to prevent invasion; mowing.
  - Black locust, honey locust, elm, Russian olive, cottonwood, or trees that resprout—cut and spray herbicides, or spray herbicides and cut, particularly black locust.

- Cottonwood and eastern red cedar—cut and pile cedar under cottonwood, follow with burning.
- Saltcedar—burn and apply herbicide to regrowth because cutting is difficult.
- Plum and sumac—conduct a combination of three treatments within two growing seasons to include burning or mowing as low as possible.
- Large cottonwood—chainsaw and follow up with herbicide.
- Restore agricultural lands, including areas that are removed from production but not seeded to natives, and treed areas.
  - Prepare a largely weed-free, smooth seedbed. Options include using herbicides or planting Glyphosate-ready crops or other agricultural crops, with the last year being a grain crop. As stated earlier, policy allows for the use of genetically modified crops, and that remains an option. However, the refuge has never permitted this use to date and does not plan to do so in the near future. It is a more commonly used strategy in the northern plains largely because of differences in agricultural trends.
  - Use high-diversity seeding, at least 15–20 species of forbs and grasses, that is proper for the soil type and for other environmental conditions.
  - Collect seed from the refuge or buy local ecotypes.
  - Seed during normal-to-wet periods and avoid seeding during drought periods.
  - Broadcast seed over snow, if possible.
  - Buy a native grass harvester, like a stripper, and harvest local seed.

### Rationale

We looked at refuge lands and the current surrounding landscape to find the desired future vegetation types needed to sustain native habitats and associated focal species. A review of existing spatial data showed that land use beyond the refuge boundary is dominated by crop and livestock production.

Our planning team found that the remaining grassland tracts near the refuge are often isolated from each other and surrounded by croplands and by woody vegetation in areas that are not conducive to farming, like sandhills, and in shelterbelts that are used between fields and in areas that are managed for game, especially white-tailed deer. In addition, managing for livestock often creates areas with short-stature grasses and few forbs that do not provide adequate structure for native wildlife at certain times during the year. For example, fields of hay and other crops may be used by species for breeding or other activities early in the growing season, but harvesting, or plowing between plantings, often occurs before primary nesting activities are complete. Given these considerations, our planning team found that native prairie habitats were underrepresented in the landscape surrounding the refuge to sustain habitat for wildlife on the refuge.

Woody encroachment into habitat that was open before, resulting in the eventual replacement of grassland, has been reported as one of the greatest threats to this ecosystem (Knapp et al. 2008). Woody encroachment into grasslands around the world not only threatens ecosystem integrity but, more specifically, threatens the presence, abundance, nesting success, and local composition of grassland-obligate birds (Bakker 2003, Chapman et al. 2004). Based on our observation, this trend appears to hold true for the remaining tracts of sand prairie in, at least, the northern section of the Rattlesnake Creek watershed and on lands surrounding the refuge. Therefore, reducing woody vegetation would help refuge lands to provide unique and essential grassland habitat conditions.

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## Landscape Conservation

### Objective 3: Environmental Health and Climate Change

- Promote ecological resilience by restoring and maintaining native communities (see native community objectives below) based on the following principles:
  - Continue to collect climate information and to conduct baseline inventories of refuge water use and wetland water chemistry during the next 15 years to document changes in abiotic factors to assess changes in environmental conditions that will help us develop our approach.

- Conduct inventories of refuge habitats, including composition and structure of vegetation, at periodic intervals not to exceed 5 years, to document vegetation conditions that can be used to assess changes because of our actions and because of natural variation.
- Conduct informal surveillance of select wildlife species, such as waterfowl, shorebirds, and deer, during the next 15 years



*A twilight view from Old Township Road on Quivira Refuge*

to detect disease outbreaks and monitor wildlife health.

## Strategies

- Continue collecting climate information from established weather stations on refuge lands.
- Collaborate with our Region 6 Water Resources Division staff and with our partners to design and carry out:
  - monitoring programs on Rattlesnake Creek flow parameters at designated points of diversion on the refuge;
  - inventories of water chemistry on refuge lands.
- Develop educational programs to help the public understand the threat of environmental contaminants.
- Collaborate with our partners to collect relevant abiotic data and to periodically assess changes in environmental conditions that will help us adjust our activities.
- Reclaim mineral rights on refuge lands, as legally allowed, when existing oil wells are not used or abandoned.
- Continue to collaborate with our partners like KDWPT and academic organizations to conduct surveillance that increases the detection, prevention, and knowledge of disease outbreaks, including avian influenza and chronic wasting disease, and adjust refuge hunting programs if necessary.

## Rationale

Land use practices in the Rattlesnake Creek watershed have not only resulted in the loss and fragmentation of native habitats, but they have also modified how remaining native habitats function. Agricultural and energy practices, as well as our past refuge management activities, have resulted in the introduction of nonnative plants and animals; an increased presence of chemicals, like fertilizers and pesticides; and altered disturbance regimes, such as the frequency, timing, and magnitude of fire, herbivory, and hydrology, that influence processes like nutrient cycling and sedimentation. The effects of these would likely be exacerbated by climate change,

which is predicted to include higher temperatures and less frequent, but more intense, precipitation events at the refuge. Collectively, these factors can have significant effects on our ability to restore and support native plant communities and associated wildlife species.

Addressing these challenges would require us to develop flexible strategies that promote native species diversity, which has been reported to increase the resiliency of systems to climate change (Peterson et al. 1998). To accomplish this objective, we must use information about the current status of key abiotic factors that influence plant community composition and, ultimately, wildlife community composition in our management plans. We chose climate, water quality, and water quantity measures as primary abiotic factors to monitor because they influence the vegetation composition and structure of refuge habitats and are among the first to change in response to altered environmental conditions, regardless of what caused the change. For example, refuge lands are located at the lowest elevation in this agriculture-dominated watershed, thus, the amount, timing, and quality of water entering the refuge is not only influenced by climate patterns but also by agricultural practices, like irrigation and pesticide use, and by energy practices, like drilling and the storing of resources onsite.

## 6.3 Native Ecological Community Conservation Goal

*Actively conserve and, as appropriate, improve environmental conditions within refuge boundaries to promote sustainable native ecological communities and support species of concern associated with this region of the Great Plains.*

The primary purpose of the Refuge System is to conserve wildlife, which requires us to provide the plant communities necessary for wildlife to complete their annual life cycle needs, like breeding and migration. Thus, we chose habitat-based objectives that provide the resources necessary to support a native wildlife community over objectives based on individual wildlife species because (1) the long-term, sustainable productivity of habitats is essential for wildlife regardless of the landscape scale we consider; (2) most of the management activities conducted by our refuge staff indirectly influences wildlife composition and population by altering vegetation composition and structure; (3) decisions about

our management activities must be made within the context of current habitat conditions relative to the life requisites of multiple species; and (4) assessing habitat composition and structure to gauge our progress in achieving the vision and goals of Quivira Refuge is more reliable and informative than assessing wildlife populations because their migrations can include great fluctuations in things like turnover rates and lengths of stay that would affect our study of them.

We need to integrate multiple factors, including landscape form and function, regional and local environmental stressors, and the public's various perspectives, to make decisions about habitat types and management strategies. We used information from peer-reviewed outlets and refuge reports as the foundation on which to develop objectives that are supported by the best available science, that contain sufficient specificity to guide future management, and that could be studied to assess our progress and help us make decisions using an adaptive management framework (Adamcik et al. 2004). Before we held planning meetings, our refuge staff compiled and synthesized pertinent data—with the relevant literature referenced and cited throughout this document—to help guide our discussions and to make sure that our decisions were consistent with the facts. We also developed charts and tables to help us interpret data, and many of these are in this CCP.

Sometimes objectives can be misinterpreted when taken out of context. For example, seeing habitat-based objectives as static targets to achieve annually on the same tract of land is inconsistent with the more flexible reality of plant community ecology, and attempts to manage for static targets tend to alter important processes, like hydrology, that eventually lead to lower productivity. To resolve this potential problem, our refuge staff found that the following would be consistently applied to the set of biological objectives created to support this goal:

- We will consider these objectives collectively as representing a continuum of spatial and structural conditions that are characteristic of that habitat type in the central Great Plains.
- We will use these objectives as a reference to provide the full range of conditions necessary to support the wildlife community that is native to the refuge and the surrounding area.
- We will optimize the area and distribution (structure) of various habitat conditions characterized by the objectives to help focal species within the constraints imposed by

using management that ensures sustained productivity (processes, function) of the habitat.

The following describes the initial steps we took to collect and organize information in a manner that would be useful for developing habitat-based objectives, including assumptions and rationales used to make decisions during our planning meetings.

### ***Delineation of Current Habitat Types***

Our staff at Quivira Refuge completed a spatially explicit plant community inventory in 2011. Based on 2008 aerial photography, communities were mapped to the alliance, or dominants, and finer associations, or subdominants, as defined by the NVCS using e-cognition software. The minimum mapping unit was 0.5 acre, but was adjusted to 0.2 acre during ground-truthing of woody vegetation. More than 95 percent of the e-cognition polygons were ground-truthed for accuracy and modified if necessary (figure 10 and table 7). A total of 43 associations, ranging in area from 0.3 to 4,926 acres, were mapped.

In addition, Quivira Refuge took part in a pilot project to map invasive species during 2011 (Edvarchuk and Ransom 2012). Approximately 10,160 acres, or 46 percent, of refuge lands were inventoried for 17 priority invasive species using standardized protocols that provided 90 percent confidence in detecting infestations greater than 100 square feet. A total of 3,573 individual infestations totaling 133 acres were mapped. These detailed maps were used to produce more map products using a GIS, as needed, to inform our planning activities. For example, plant associations provide valuable information for developing our strategies for specific areas, whereas broader community categories are more proper when evaluating area needs of grassland-nesting birds.

### ***Defining a Focal Wildlife Community***

The refuge staff, with input from the core planning team, developed a list of focal species that we will use to help guide our development of habitat-based objectives. By providing the habitat types and conditions necessary to support focal species, we will also provide life requisites for other species and plants on the refuge and surrounding landscape. The concept of using select wildlife species to subdivide community resources along a continuum has been used to guide planning and management of both wetlands (Short 1989) and grasslands (VerCauteren and Gillihan 2004), as well as to describe habitat use patterns (Skinner 1975).

We chose migratory birds and threatened and endangered species known to use the refuge to serve

as a starting point for developing the larger focal wildlife community because these species are a primary responsibility of the Refuge System and are central to the purpose of Quivira Refuge. The current refuge bird list contains more than 340 species and represents sightings recorded since refuge establishment. The list not only has native or endemic species characteristic of the region, but also species whose occurrences are considered rare or accidental and those that were introduced to the area following substantial habitat changes (Johnsgard 1978). The current list of threatened and endangered bird species known to occur on the refuge has species that are listed by both Federal and State governments. While refuge bird lists are not based on standardized surveys, this list is the best available information we have for some species occurrences on the refuge.

We further refined the refuge bird list to find a suite of focal species to help us quantify the range of structural and successional habitat conditions that we would need to provide for them. This approach helps us to prevent underestimating the wildlife values of the site, and it has been advocated by others. For example, breeding bird species documented in the Great Plains is approximately 320 (Johnsgard 2009), but developing suitable grassland restoration objectives for a local area may focus on as few as 32 bird species (Samson and Knopf 1994).

The following criteria were used to find the focal community:

- Include species that conform to the purpose of the refuge, including those listed as endangered, threatened, or of concern by various laws or conservation plans. We consulted various plans, including our species of conservation and management concern for the Mountain–Prairie Region, the U.S. Shorebird Conservation Plan, the North American Waterfowl Management Plan, and the Central Mixed-grass Prairie Bird Conservation Region, which is part of the North American Bird Conservation Initiative.
- Include species that rely on unique or important refuge wetland habitats. Habitat uniqueness and importance on the refuge has been noted through its designation as a wetland of international importance by the Ramsar Convention and as a site of regional importance for shorebirds by the Western Hemisphere Shorebird Reserve Network.
- Include species that have comparatively greater dependence on, or association with, unique characteristics of refuge habitats, such as native sand prairie. The incorpora-

tion of species that use these habitats provides a more representative description of native upland communities and promotes diversity at spatial scales beyond refuge boundaries.

- Include species with core distributions that include refuge lands and have habitat needs that are not typically provided for on private lands in the vicinity. For example, species that require larger blocks of key habitat were given priority consideration relative to species that are considered habitat generalists or that have adapted to human modifications like urban encroachment and agriculture.
- Include species that are indicators of ecosystem health, such as having an abundance of prey species, or changing salinity conditions.

We identified 127 focal bird species that have recently occurred on the refuge and are representative of native habitat types and species of concern (table 3). We chose many focal species, in part, because of the importance of refuge habitats to a diversity of wetland-dependent species during migration. We do not expect to benefit all focal species every year because many factors outside the boundaries and control of the refuge influence species occurrences and densities. For example, climate conditions are a primary driver of waterfowl, shorebird, and whooping crane migration chronology and residence times. Furthermore, we will not be able to conduct monitoring programs for all focal species. Instead, life cycle needs of these species will be used to guide our development of habitat-based objectives, which subsequently will be used to develop annual management planning and implementation activities and monitoring programs.

Species other than birds, such as the Arkansas darter and regal fritillary, are important parts of native communities, and they may be added to the focal species list in the future because resources and landscape conditions will continue to change and more information of species–habitat relationships will become available.

### ***Life Requisites of Focal Species***

For each focal species, the life cycle events occurring on Quivira Refuge, such as breeding or migration, were noted and a literature search was conducted to locate quantitative information that characterized suitable habitat conditions for as many focal species as possible. Sources of information

largely included dissertations, scientific periodicals, published books and refuge files held onsite. The specific information we sought included:

- chronology of use, including dates of spring migration, breeding, fall migration, and wintering activities on the refuge
- spatial needs for breeding, including minimum area, perimeter-to-area ratios, area of 50-percent occupancy, and distance from other required, or hostile, habitat types or conditions, such as nesting within a minimum distance to water or from a woodland edge
- vegetation composition at breeding sites, including the percent of grass, forb, and shrub
- vegetation structure at nest sites of breeding species, including litter depth, visual obstruction, and plant height
- characteristics of waterbird foraging habitats, including preferred foraging depths, diet, and vegetation cover

Information on each of these factors was not available for all species. This is not a problem, however, because information on individual species was grouped into functional guilds, such as species that forage in water less than 2 inches, to find important parameters that influence habitat suitability. We further organized this information into categories that were based on our capability. For example, foraging depths of waterbirds were grouped in minimal increments of greater or equal to 2 inches because our staff experience suggests that the existing water infrastructure, such as structure type and canals, would facilitate management at this level of specificity. We do not denote distinct community types for individual species, but we provide a broader perspective of multiple species benefits provided by a habitat type in different successional conditions (figure 16).

While our approach maximizes the use of existing information, there are limitations. First, most quantitative information on the habitat needs of many species is based on certain points during the breeding season and reflects conditions near nest sites or breeding territories during the growing season. By comparison, there is relatively little quantitative information on the habitat needs during the non-breeding period, except for dietary information and waterbird foraging depths. Therefore, the quantitative information compiled to develop objectives is limited because, as focal species table 3 shows, Qui-

vira Refuge is an important migration stopover for wetland-dependent migratory birds, and it also provides some wintering habitat. In cases where we lacked detailed information, our planning team used less common descriptive measures and anecdotal information provided by experts to categorize the habitat needs of some focal species.

Second, most information on habitat needs of species was obtained from research not conducted on the refuge. As such, the results of this research may not apply directly to the refuge because of differences in landscape context, like the land use practices surrounding the refuge; abiotic qualities, like soils and climate; and other factors. Our planning team reduced this concern by considering only information from sand prairie or sandhill ecosystems. However, information on many species were still absent, thus, information from other ecotypes was also included. In these cases, the habitat measures, like visual obstruction and plant height, were included only if they could be met in refuge habitats. We made this determination by comparing the metrics reported in the literature to the ecological site potential of the proper habitat on the refuge.

Given these limitations, we find using habitat-based objectives for a given native plant community to represent a continuum of conditions along a successional gradient for long-term sustainability to be a proper interpretation of the data. From our perspective, this more aptly represents the dynamic nature of systems and ends any attempt to keep static habitat conditions within, and among, years or to manage exclusively for a few, select species or species groups. At the same time, it provides sufficient guidance to make sure that different seral stages required by wildlife are provided on refuge lands, with the understanding that refuge-specific information is limited and that the applicability of data collected on other sites may not apply directly to the refuge. It also embraces the value of using quantitative information, which:

- decreases the confusion associated with qualitative terms such as “tall” and “dense” and provides a unifying perspective of what management is attempting to achieve;
- enables our staff to establish thresholds that name when a decision must be made about treatment and the type of treatment to apply;
- provides a baseline on which to develop a monitoring plan that would provide refuge-specific information useful for understanding treatment effects and species-habitat

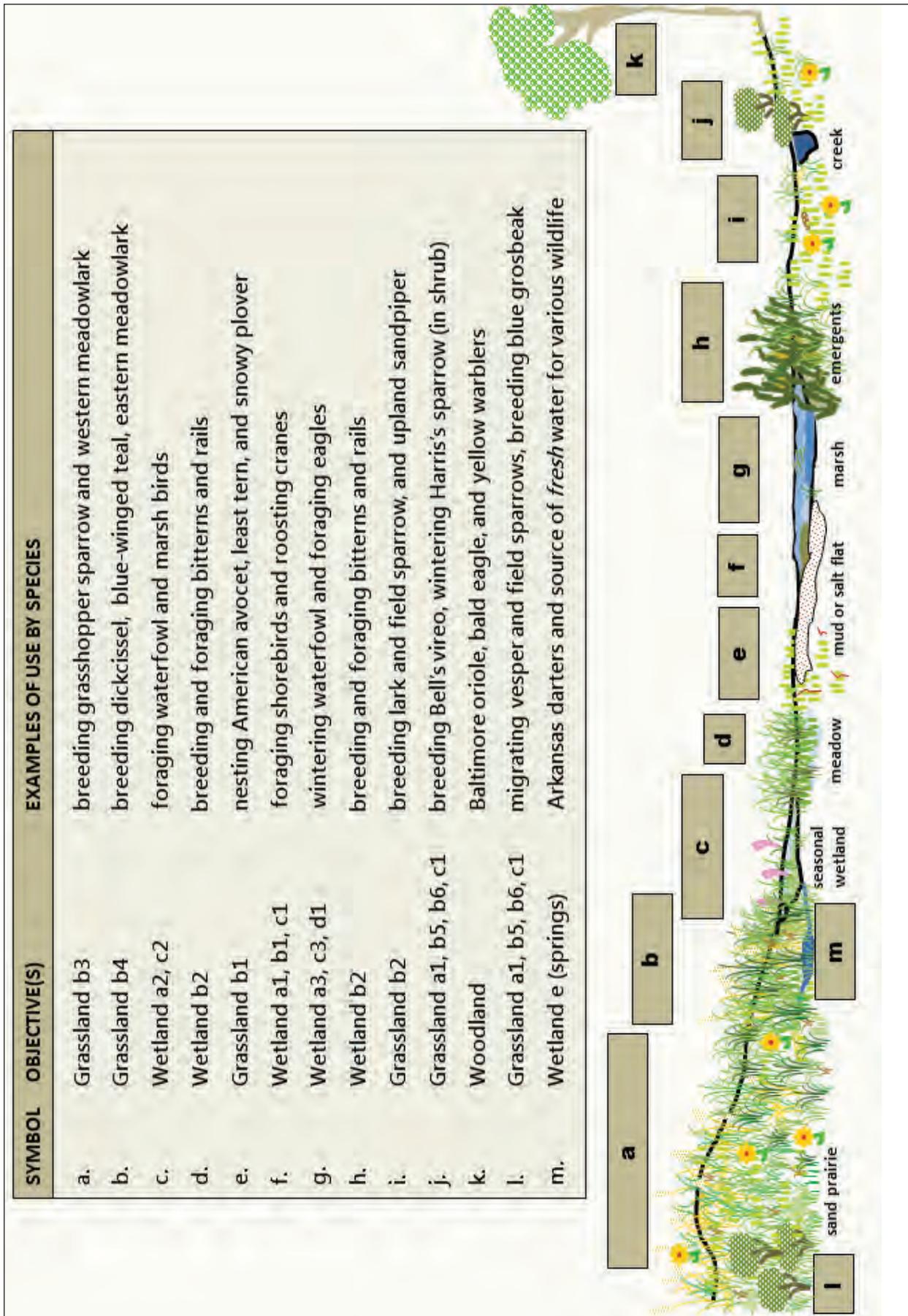


Figure 16. Native Ecological Community Conservation Objectives for Quivira National Wildlife Refuge, Kansas, Illustrated in a Community Profile Schematic.

relationships, which ultimately can be used to refine management treatments.

## Native Ecological Community Conservation Objective 1: Wetlands

Maintaining the integrity and persistence of all wetland types is important. Of principal importance is restoring and maintaining proper hydrological cycles characteristic of each wetland type to the extent possible, as described in the objective below, because hydrology is the single greatest driver of wetland functions, including nutrient cycling and sediment dynamics, as well as plant community dynamics (Mitsch and Gosselink 2003, Euliss et al. 2004, Laubhan et al. 2012).

### Criteria

A. Apply from mid-February through May—spring migration:

1. Reliably provide, at minimum, 70 percent of the 2,931 estimated potential acres of early successional habitat—defined as bare mudflat or salt flat with less than 25 percent cover vegetation—flooded to depths less than 6 inches to provide foraging habitat for shorebirds and waterfowl, as well as roosting habitat for cranes (table 29); tolerance level of exotic or invasive plant species is equal to, or less than, 5 percent.

2. Reliably provide, at minimum, 70 percent of the 1,581 estimated potential acres of early mid-successional habitat—defined as greater than 75 percent cover of annuals—moist soil—or wet meadow—sedges and rushes—flooded to depths less than 15 inches for foraging waterfowl (table 29); tolerance level of exotic or invasive plant species is equal to or less than 1 percent and perennial robust emergent vegetation, such as cattail, is equal to, or less than, 25 percent.

3. Reliably provide, at minimum, 70 percent of the 2,160 estimated potential acres of mid-to late-successional habitat, defined as less than 25 percent cover of emergent vegetation and greater than 20 percent aquatic vegetation, flooded to depths of 6–30 inches to provide foraging and roosting habitat for American white pelican and waterfowl (table 29); tolerance level of exotic or invasive plant species is equal to, or less than, 5 percent.

B. Apply from May through July—breeding season:

1. Reliably provide a minimum of 70 percent of the 1,740 estimated potential acres of early successional habitat, defined as bare mudflat and salt flats with less than 25 percent cover of all vegetation, next to moist or shallowly—equal to, or less than, 1 inch—flooded areas to provide breeding habitat for western snowy plovers, interior least terns, and resident focal species (table 29);



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*An example of a wetland with interspersed tall, dense cover on Quivira Refuge.*

tolerance level of exotic or invasive plant species is equal to, or less than, 5 percent.

2. about 400–500 acres, with a minimum block size of 50 acres, of mid- to late-successional habitat, defined as 30–60 percent interspersed, flooded emergent cover with a visual obstruction of 4–20 inches and a height greater than 20 inches to provide breeding and foraging habitat for pied-billed grebe, sora, Wilson’s phalarope, black-crowned night-heron, and American bittern in most years (table 29); tolerance level of exotic or invasive species is equal to, or less than, 5 percent.

C. Apply from late July to November—fall migration:

1. Reliably provide, at minimum, 70 percent of the 576 estimated potential acres of early successional habitat, defined as bare mudflat or salt flat with less than 25 percent cover vegetation, flooded to depths less than 6 inches to provide foraging habitat for shorebirds and waterfowl, as well as roosting habitat for cranes (table 29); tolerance level of exotic or invasive species is equal to, or less than, 1 percent.
2. Reliably provide, at minimum, 70 percent of the 1,073 estimated potential acres of early mid-successional habitat, defined as greater than 75 percent cover of annuals—moist soil—or wet meadow—sedges or rushes—flooded to depths less than 15 inches for foraging waterfowl (table 29); tolerance level of exotic or invasive plant species is equal to, or less than, 1 percent and perennial robust emergent vegetation, such as cattail, is equal to, or less than, 25 percent;
3. Reliably provide, at minimum, 70 percent of the 903 estimated potential acres of mid- to late-successional habitat, defined as less than 25 percent cover of emergent vegetation and greater than 20 percent aquatic vegetation, flooded to depths of 6–30 inches to provide foraging and roosting habitat for American white pelican and waterfowl (table 29); tolerance level of exotic or invasive plant species is equal to, or less than, 5 percent.

D. From November through February—winter—reliably provide, at minimum, 70 percent of the 5,086 estimated potential acres, with a minimum block size



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*Damselflies on a wetland with submerged aquatic vegetation.*

of 50 acres, of mid- to late-successional habitat, defined as less than 25 percent vegetation cover and greater than 20 percent aquatic vegetation, flooded to depths of 6–30 inches to provide foraging and roosting habitat for geese, diving ducks, swans, American white pelican, whooping and sandhill cranes, and bald eagles—foraging only (table 29); tolerance level of exotic or invasive plant species is equal to, or less than, 5 percent.

E. Support the current integrity of freshwater springs on the refuge, including quantity, to the extent possible, and direction of waterflow; native vegetation composition; and Arkansas darter population protection.

Areas that can be managed to provide designated habitat are provided in table 29. For each part of this objective, the greatest potential area is based on current water control structure elevations; available information, like spatial analysis using a GIS, aerial imagery, lidar and vegetation data, and our staff experience and knowledge of management potential; and on management philosophy described under the proposed alternative. Even if environmental and management conditions are ideal, the greatest potential is not intended to be met in any given year because of the need to vary prescriptions to mimic natural wetland processes to sustain long-term wetland structure and function. This means that, for a given created wetland, we would not keep static hydroperiods within, and among, years.

**Table 29. Estimated greatest potential distribution of wetland habitat conditions (acres by unit and objective) for the proposed alternative for Quivira National Wildlife Refuge, Kansas.**

Wetland	Acres	<i>Mid-February through May spring migration</i>			<i>May through July summer breeding</i>		<i>August–November fall migration</i>			<i>November– February winter</i>
		A1	A2	A3	B1	B2	C1	C2	C3	D
		Acres bare flats <25% vegetation, flood <6 inches	Acres >75% annual or meadow, flood <15 inches	Acres <25% emerging >20% sub- merged aquatic veg- etation, flood 6–30 inches	Acres of bare flats <25% cover	Acres of 30– 60% tall emerging, flood <10 inches	Acres of bare flats <25% vegetation, flood <6 inches,	Acres >75% annual or meadow, flood <15 inches	Acres <25% emerging >20% submerged aquatic vegetation, flood 6–30 inches,	Acres <25% emerging, flood 6–30 inches
Little Salt Marsh	931	181.2	0	662.9	3.8	87.3	181.1	0	662.9	931
Unit 7 (created)	62	15.8	40.5	5.6	15.8	0	15.8	40.5	5.6	62
Unit 10a (created)	19	12.9	12.9	6.3	0	6.3	0	12.9	0	19
Unit 10b (created)	14	0	0	10.3	0	0	3.9	0	10.3	14
Unit 10c (created)	7	6	6.1	0.8	6.1	0	0	6.1	0.8	7
Unit 11 (created)	30	11.9	12	16.3	0	0	0	12	6.3	30
Unit 12b (created)	12	8.8	8.8	2.9	0	11.5	0	8.8	2.9	12
Unit 14a (created)	100	15.5	73.9	0	27.3	0	15.6	73.9	0	100
Unit 14b (created)	45	43.1	43.1	1.7	0	1.7	0	43.1	1.7	45
Unit 16 (created)	14	0	5.8	8.5	0	14.2	0	5.8	8.5	14
Unit 20a (created)	69	60.3	60.4	8.5	0	8.5	0	60.4	8.5	69
Unit 20b (created)	66	0	62.2	3.7	0	3.7	0	62.2	3.7	0
Unit 21 (created)	11	3.9	0	5.9	3.8	1.5	3.8	0	5.9	11
Unit 22 (created)	12	0	0	12.1	0	12.1	0	0	12.1	12
Unit 23 (created)	14	0	0	14.1	0	14.1	0	0	14.1	14
Unit 24 (created)	54	0	0	54.1	0	54.1	0	0	54.1	54
Unit 25 (created)	54	0.6	53.4	0	0	0	0	53.4	0	54
Unit 26 (created)	69	69.1	69.1	0	0	0	0	69.1	0	69
Unit 28 (created)	61	60.8	60.9	0	0	0	0	60.9	0	61

**Table 29. Estimated greatest potential distribution of wetland habitat conditions (acres by unit and objective) for the proposed alternative for Quivira National Wildlife Refuge, Kansas.**

Wetland	Acres	<i>Mid-February through May spring migration</i>			<i>May through July summer breeding</i>		<i>August–November fall migration</i>			<i>November– February winter</i>
		A1	A2	A3	B1	B2	C1	C2	C3	D
Unit 29 (created)	27	23.7	23.7	3.6	0	0	0	23.7	3.6	27
Unit 30 (created)	42	41.6	41.6	0	0	0	0	41.6	0	42
Unit 37 (created)	50	0	0	49.8	0	49.8	0	0	49.8	50
Unit 40 (created)	36	36.7	36.4	0	0	0	0	36.4	0	36
Unit 48 (created)	55	54.4	54.4	0.8	0	0	0	54.4	0.8	55
Unit 49 (created)	85	83.9	83.9	1.3	83.9	0	83.9	83.9	1.3	85
Unit 50 (created)	91	90.5	90.6	0	0	0	0	90.6	0	91
Unit 57 (created)	89	0	43.4	34.0	11.5	43.4	11.5	0	34	89
Unit 58 (created)	116	67.5	0	48.9	0	48.9	0	0	0	116
Unit 61 (created)	121	121.2	104.2	0	121.2	0	17.2	104.2	0	121
Unit 62 (created)	38	35.7	35.8	1.7	0	0	1.7	35.8	1.7	38
Unit 63 (created)	103	93	93	0	10	0	10.0	93	0	103
Unit 80 N. Lake	393	393.2	0	72.1	393.2	0	0	0	0	393
Marsh Road Meadow	494	267.6	226.2	226.2	267.6	0	0	0	0	0
Wildlife Drive (BSM)	801	723.2	0	107.3	697.1	0	25.1	0	0	801
Big Salt Marsh	1209	408.8	0	800.6	98.3	0	206.4	0	0	1209
Salt Springs	252	0	238.3	0	0	14.7	0	0	14.6	252
<b>Total</b>	<b>5646</b>	<b>2930.9</b>	<b>1580.6</b>	<b>2160</b>	<b>1739.6</b>	<b>371.8</b>	<b>576</b>	<b>1072.7</b>	<b>903.2</b>	<b>5086</b>

NOTE: Table does not include wetlands managed as part of the grassland habitat type.



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Northern shoveler in a wetland with midheight, sparse vegetation.

### Wetlands Strategies

- Store Rattlesnake Creek water in the LSM, in accordance with existing water rights, to:
  - provide a source of water that can be used to manage vegetation and to provide flooded habitat in created wetlands;
  - inundate mudflats and annual vegetation that would provide foraging habitat for waterbirds.
- Transport water from the LSM to:
  - create mudflats and shallow water habitats, <16 inches, for foraging and roosting waterbirds;
  - expose bare mudflat and salt flat habitat for nesting shorebirds;
  - promote the germination and growth of vegetation in created wetlands.
- Keep infrastructure and replace water control structures as necessary. Develop structures for A2 and A3.
- Use a combination of treatments, such as prescribed fire, chemical, grazing, and mechanical, to reduce and control invasive species and hazardous fuel.
- Refine the measures used in objectives as new information becomes available, such as through monitoring programs or research.

- When appropriate, use wildfires to help achieve land and resource management objectives.
- Refine strategies as new or better information become available to improve success in accomplishing objectives.
- Disk wetland soil surface when necessary and appropriate to benefit or encourage germination and growth of desirable vegetation.

### Wetlands Rationale

Located within the migration corridor of the central flyway, Quivira Refuge is an important stopover for a diversity of waterbirds. Thus, we consider providing migratory habitat to be most important; and a primary role of refuge wetlands is to provide plant foods rich in carbohydrates, like seeds, tubers, and browse, and animal foods high in protein, like invertebrates. During spring, these foods provide the energy necessary for birds to reach their breeding grounds and, for some species, accumulate reserves necessary for egg production. In the fall, these foods provide energy for birds traveling to wintering grounds and protein for feather molt. Diets vary among species, with shorebirds consuming predominantly invertebrates, waterfowl consuming a combination of plant foods and invertebrates, cranes consuming predominantly plant foods, and American white pelican consuming fish.

While providing migration habitat is our primary concern, refuge wetlands also support limited breeding habitat for several bird species and, in some years, provide early winter habitat, primarily for large-bodied waterbirds that forage in wetlands. Therefore, we want to provide suitable habitat for completing these life cycle events even though the area of habitat needed is much less than for migration habitat. Primary nesting species include the federally listed interior least tern, the State-threatened western snowy plover, pied-billed grebe, sora, Wilson's phalarope, American bittern, and black-crowned night-heron.

Early winter habitat offers abundant, energy-rich foods and, for some waterfowl species, thermal cover in stands of tall emergent vegetation such as cattail and bulrush. As with the breeding season, the foods and cover required by these species are typically produced when we manage refuge wetlands for migration habitat. Therefore, the primary consideration for winter habitat is to make suitable sites available by flooding at proper times and depths. In addition, wildlife values of a given wetland change within, and among, years, and attempts to manage for static con-

ditions often leads to lower primary productivity that reduces wildlife benefits. Given these considerations, objectives were developed by considering refuge wetlands collectively rather than by developing objectives for each wetland unit.

The refuge also has a unique habitat in the fresh-water springs, which supports a population of the State-threatened Arkansas darter. We want to keep the integrity of these springs for them. Because little is known of the historical condition of this area, necessitating further study, the life history needs of the Arkansas darter will be used to guide our management efforts while we conduct more research.

### Little Salt Marsh

Historically, hydrology of the marsh was determined by a combination of ground water levels and overbank flooding of Rattlesnake Creek. Water levels in the marsh fluctuated greatly and in some years no surface water was present. Similarly, water chemistry ranged from brackish to fresh depending on the amount of surface water inputs. However, before refuge establishment, Rattlesnake Creek was diverted directly into the marsh. Consequently, complete drying of marsh substrates is rare as some water enters the marsh annually and water chemistry likely has changed.

The ability to restore the hydrology of the LSM and reactivate the historic Rattlesnake Creek channel is not considered feasible because refuge water rights may be forfeited. In addition, extensive ground water depletion in the watershed, coupled with reduced flows in Rattlesnake Creek, has severely reduced the quantity and timing of water reaching the refuge that affects management capability. For example, in years of below average precipitation and extensive agricultural demands, insufficient water quantities are delivered to the refuge to exercise all habitat management options (Heitmeyer et al. 2012). Consequently, continuing to use the LSM as a storage reservoir is the best way for providing quality wildlife habitat on the refuge.

Although the hydrology of the LSM has been altered, management can still manipulate water levels within the marsh to promote important processes (for example, nutrient cycling) and simultaneously optimize habitat for a diversity of waterbirds. Partial drawdowns can be conducted to oxidize soils and facilitate plant decomposition on the marsh perimeter, which provide nutrients for invertebrates and create suitable conditions for plant germination and growth on islands and along the marsh perimeter (Fredrickson and Taylor 1982, Laubhan et al. 2012). In addition, partial drawdowns also create bare flats suitable for nesting shorebirds and concentrate prey for shorebirds (invertebrates), as well as bald eagles and American white pelicans (fish). Conversely, addi-

tion of water during storage phases of the cycle results in flooding of newly established vegetation and creates a range of water depths suitable for roosting and foraging by many waterbirds throughout the year, including shorebirds and cranes.

### Big Salt Marsh

The historical hydrology of the BSM has been altered by activities both on, and off, the refuge. Development of the water transport infrastructure on the refuge has included canals that facilitate the movement of water from Rattlesnake Creek to the BSM, whereas ground water depletion in the watershed has likely reduced the quantity and timing of ground water discharge to the BSM. In combination, we presume that increased use of Rattlesnake Creek water and smaller amounts of ground water discharge has resulted in lower salinities, which is supported by the increased occurrence of cattail and other species that germinate under low saline conditions. In addition, the increased input of Rattlesnake Creek water has altered the timing of flooding and reduced the frequency and extent of drying. Collectively, these changes have stimulated a change in vegetation community composition, including an increase in cattail and an accompanying decline in salt-tolerant emergent species such as alkali bulrush and alkali sacaton. We also presume that these changes have altered the composition of the invertebrate community.

Although vegetation communities with different salinity tolerances provide food and cover to focal wildlife species, emergent vegetation better adapted to less saline conditions can be managed in other areas of the refuge to provide food resources and robust structural cover, as in created wetlands and wet meadows. By contrast, the ability to provide an interspersed of barren salt flats with large expanses of saltgrass and scattered areas of salt-tolerant emergent plant species is unique to the BSM area because saline conditions limit the amount of vegetation cover on mud and alkali flats, which provides open areas near water that are suitable for nesting interior least terns and snowy plover, foraging and roosting habitat for cranes, and foraging habitat for migratory shorebirds. In addition, the deeper parts of the marsh provide flooded open water that provides foraging and roosting habitat for American white pelicans and diving ducks throughout the year.

Given these considerations, mimicking historical conditions to the extent possible and relying on ground water discharge as the primary hydrologic input represents our best way for managing the BSM. Dynamic fluctuations in water quantity and quality would occur within, and among, years. In most years, surface water would be allowed to evaporate in late summer and ground water discharge

would slowly begin to provide surface water in late October, with the marsh becoming full by January. Areas that are typically shallow when the marsh is fully flooded would have water during the spring, and then slowly begin drying in late spring through the summer. Use of Rattlesnake Creek water would be diverted to keep water chemistry, as in salinity, within the range of conditions necessary to sustain native plant communities or to avoid infrastructure damage during substantial flooding events.

### ***Big Salt Marsh Strategies***

- Support or improve proper salinity gradients through water management, including limiting fresh water from Rattlesnake Creek.
- Support or improve water control structures and associated infrastructure.
- Use a combination of treatments, such as prescribed fire, chemical, grazing, and mechanical, to promote native plant communities and reduce invasive species and hazardous fuel.
- Evaluate, then change or install water control structures to improve surface waterflows.
- Evaluate, then change or remove roads, such as ditches and roads on the west side, Y road, Road to Mandalay, and Tern Pad Road, that significantly alter surface waterflows.
- Evaluate the south end and, when oil wells become inactive, remove oil well roads and restore those areas.
- Replace the Unit 80 structure with a larger structure to better export water from the BSM to Salt Creek and to improve water management capability to better prevent flooding of least tern and snowy plover nests.
- When appropriate, use wildfires to help achieve land and resource management objectives.



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*Big Salt Marsh*

## Created Wetlands

The primary purpose of managing created wetland units is to produce plant and animal foods for migratory birds during spring and fall migration that supplement foods provided in other wetland types, see objectives A2 and C2 above. Plant food production in these units usually exceeds the production in other wetland types on the refuge because the time and rate of drawdowns can be manipulated to stimulate the germination and growth of desirable annual vegetation, like barnyard grass and sprangletop, that produces abundant seed and structure for invertebrate production after reflooding in the fall and winter. Similarly, making these foods available to a greater diversity of birds is possible because we can control the time and depth of flooding (Fredrickson and Taylor 1982, Laubhan and Fredrickson 1997, Laubhan et al. 2012, Laubhan and Roelle 2001). Created wetland units that we manage to mimic seasonally flooded wetlands to produce foods also provide many other benefits. For example, drawdowns to stimulate plant germination often can be timed to create mudflats, oxidize soils, and increase invertebrate availability during spring shorebird and crane migration. Following plant germination, units can be shallowly flooded to improve plant growth and seed production, and provide summer foraging habitat for breeding species.

Some created wetland units on Quivira Refuge can also be managed as temporary or semipermanent wetlands to provide supplemental migration or breeding habitat and thermal cover for certain species.

## Created Wetlands Strategies

- Manage hydroperiods for desired conditions. Gather and apply information on the germination and growth needs of plants and on the utilization criteria, such as chronology, foraging depths, and nesting needs, of the species that use these wetlands.
- Keep water transfer infrastructure and associated water control structures 95-percent free of emergent vegetation.
- Evaluate water control structure conditions and replace or change them as necessary. One such structure is on Dead Horse Slough.
- Use a combination of treatments, such as prescribed fire, chemical, grazing, and



Created Wetland

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mechanical, to reduce and control invasive species and hazardous fuel.

- Inventory these units to refine the measures used in objectives. Correlate water level gauge readings with unit elevation gradients to help predict habitat potentials.
- When appropriate, use wildfires to help achieve land and resource management objectives.

## Freshwater Springs

The freshwater springs are a source of permanent water that is unique to the refuge. The site has been modified by the installation of a pipe and the creation of more small pools to trap spring flows and by the installation of a pipe that created an artesian well. These pools support aquatic vegetation, and surrounding lands support a mixture of native and non-native vegetation and scattered trees. Monitoring programs of wildlife use here have not been conducted, but the value of this habitat for waterbirds is likely limited because of the small size and depth of these pools and the presence of trees. However, the area does support an isolated population of Arkansas darter.

## Freshwater Springs Strategies

- Collaborate with experts on evaluating habitat improvements to make sure that the Arkansas darter population persists, including the removal of existing infrastructure north of the springs.
- Develop a 15-year management plan.



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*Seasonal Prairie Wetland*

### Temporary and Seasonal Prairie Wetlands

There are many temporary and seasonal wetland basins interspersed throughout the upland community on the refuge. The exact locations of all basins are not known, but most are less than 0.5 acre. Local precipitation and ground water fluctuations determine their hydrology, and no water management capabilities exist for them. Consequently, plant communities there are dynamic and range from perennial sedges and rushes and annual emergent vegetation to obligate upland species. When flooded, we presume that these basins provide temporary foraging habitat for waterbirds, like waterfowl and ibis, and supplement foods in other wetland types. Other uses for these wetlands may also occur.

We manage these basins as part of their surrounding upland communities and typically use prescribed fire and grazing to alter vegetation community composition and structure. However, we will not intentionally drain or ditch these wetlands, and we will control their nonnative vegetation.

### Temporary and Seasonal Prairie Wetlands Strategies

- Find and map the location of these basins.
- Protect the integrity of basin morphology, such as their shape, structure and pattern.
- Avoid mechanical disturbances that would drain these basins.

- Time prescribed fires and grazing to avoid their peak periods of use by wildlife.
- Control nonnative vegetation and hazardous fuel.
- When appropriate, use wildfires to help achieve land and resource management objectives.

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## Native Ecological Community Conservation Objective 2: Grasslands

The grasslands objective was written based on the considerations of different species–habitat relationships of focal species, known characteristics of the soil–plant associations on the refuge, the need for periodic management treatments, and limitations of management. Individually, objectives capture perceived differences in bird habitat types within the grassland community that also seem realistic for management implementation. It represents the potential range of natural environmental conditions of the grassland community needed to promote the long-term sustainability of the system. Quantifiable measures of vegetation composition, height, density, litter depth, and other factors are commonly reported attributes of breeding grassland bird habitat descriptions and were used to develop the objective (appendix E).

Available quantitative information of grassland bird cover and structural needs during the nonbreeding season is comparably less than that during breeding. Knowledge of birds outside of the breeding season traditionally relates to diet, energetics, foraging behavior, and, more recently, large-scale movements between breeding and wintering grounds. Descriptions that quantify structure and composition of habitat preferred by nonbreeding grassland passerines are lacking. Yet, management of grassland determines the extent, distribution, and within stand attributes of different habitat conditions within the community. Limited information of nonbreeding bird habitat was used to determine shrub attributes in grassland and is discussed in more detail below. Otherwise, until more information becomes available, management presumes that accomplishment of the grasslands objective relevant to the breeding season will concurrently satisfy habitat needs during the nonbreeding season. For example, by managing for a range of successional stages during the breeding and growing season as defined in the objective below, then a similar range of conditions would be provided during the nonbreeding season. As well, the distribution of the different successional stages would be expected to shift, dependent on methods of dispersal and growth in relation to current plant composition (Ratajezak et al. 2011), the ecological site potential, environmental conditions under relatively wet and dry conditions, and disturbance history.

Some woody vegetation is acceptable within native grasslands, thus the planning team had to evaluate relevant available information to identify optimal habitat conditions and proper management actions such as mowing or burning. Again, species-habitat relationship information, such as percent shrub cover and proximity to other habitat types, facilitated this process.

## **Criteria**

A. From January through March—nonbreeding—provide a range from 5–30 percent of tall, about 3–10 feet, native shrub interspersed within larger grassland blocks to support both focal grassland and shrub-grassland specialists.

B. Apply from April through August—breeding:

1. Provide a minimum of 500 acres of estimated habitat predominantly native—short, bare-sparse—to help associated focal species, such as breeding killdeer, American avocet, interior least tern, western snowy plover, upland sandpiper, and ground-foraging passerines; defined as composition of

less than 5 percent grass or fine-stemmed emergent, less than 5 percent forb, and 0 percent shrub; mean greatest height less than 6 inches; visual obstruction, or height density, of less than 4 inches; litter depth 0 centimeters; the estimated acres do not overlap with similar habitat made available under wetland objective B1 above.

2. Provide a minimum of 70 percent of the estimated 4,163 acres of predominantly native—short-mid, sparse-medium—grassland habitat, including at least 1 area on, or near, a prairie dog town on, or next to, refuge lands to support associated focal species, such as breeding burrowing owl, field sparrow, lark sparrow, grasshopper sparrow, upland sandpiper, and western meadowlark; defined as composition of 40–50 percent grass or fine-stemmed emergent, 10–20 percent forb, and 10–20 percent shrub; mean greatest height 6–20 inches; visual obstruction, or height density, of less than 4 inches; litter depth 0.2–1.2 inches.
3. Provide a minimum of 70 percent of the estimated 2,053 acres of predominantly native—mid-tall, medium—grassland habitat to support associated focal species, such as breeding western meadowlark, grasshopper sparrow, bobolink, dickcissel, northern harrier, and blue-winged teal; defined as composition of 40–50 percent grass or fine-stemmed emergent, 10–20 percent forb, and less than 15 percent shrub; mean greatest height greater than 6 inches; visual obstruction, or height density, of 4–12 inches; litter depth greater than 0.8 inch.
4. Provide a minimum of 70 percent of the estimated 2,756 acres of predominantly native—tall, medium-dense—grassland habitat to support associated focal species, such as breeding western meadowlark, grasshopper sparrow, bobolink, dickcissel, northern harrier, and blue-winged teal; defined as composition of 40–50 percent grass or fine-stemmed emergent, 10–20 percent forb, and less than 15 percent shrub; mean greatest height greater than 20 inches; visual obstruction, or height density, of 4–12 inches and greater than 12 inches; litter depth greater than 0.2 inch; acres estimated for this objective do not include acres with at least 50 percent plum or shrub coverage—1,278.58 acres, which mostly occur

in subirrigated soil types where tallgrasses characteristically dominate.

5. Provide greater than 10 sparse stands of shrub—mostly plum—interspersed within larger grassland blocks and riparian corridor to support associated focal species, such as lark and field sparrows; defined as: shrub height about 3–10 feet; stand size about 0.40–0.90 acre each; and within-stand shrub coverage of 7–11 percent.

6. Provide greater than 10 dense stands of shrub—mostly plum—habitat interspersed within larger grassland blocks and riparian corridor to support shrub-dependent focal species, such as Bell’s vireo; defined as shrub height about 3–10 feet, stand size about 0.75–1.5 acre each, and within-stand shrub coverage of 25–35 percent.

C. From September through December—nonbreeding—provide the same as criterion A.

There are about 9,512 acres of native, grass-dominated vegetation associations outside of what is defined as wetland, based on GIS calculations of recent coverage (table 30). The acreage estimates used in the grassland criteria B.1–4 do not include other association types in the larger grassland landscape: about 82 acres of nonnative, invasive cheatgrass; 1,279 acres of plum or shrub-dominated (equal to, or greater than, 50 percent) habitat; about 870 acres of recently or currently farmed lands; 1,008 acres of trees; and 3,483 acres of herbaceous or emergent wetland association types, such as prairie cordgrass–three square (2,054), cattail–rush (1,096), water (176), spikerush (135), and Phragmites (23). Still, these other association types interspersed throughout the larger grassland blocks are managed as part of grassland. While the restoration of farmed lands, nonnative habitats, and many woody-dominated habitats to native grassland association types will be started over the next 15 years, the duration of this restoration phase is unknown and may take many years, depending on various factors such as climate. Because of this uncertainty, these other association types are not included in the acreages used in the grassland criteria B.1–4.

**Table 30. Dominant nonwetland habitat types at Quivira National Wildlife Refuge, Kansas.**

<i>Habitat type</i>	<i>Dominant vegetation</i>	<i>Estimated acres</i>
Native tallgrass	Switchgrass	1,720
	Big bluestem	974
	Sand bluestem	62
	Total	2,756
Native midgrass	Little bluestem	2,053
Native shortgrass	Saltgrass	4,362
	Prairie dog town	19
	Buffalograss	1
	Total:	4,381
Natural bare–sparse	Sand flats	322
Shrub	Plum, sumac, dogwood	1,279
Nonnative upland grass	Cheatgrass	82
Agricultural (farmed)	Agricultural (farmed)	885
	Cottonwood	355
	Locust	253
	Saltcedar	125
	Other	105
	Red cedar	85
	Willow	57
	Russian olive	28
	Total:	1,008
Wetland	Prairie cordgrass–three square	2,054
	Cattail–rush	1,096
	Water	176
	Spikerush	135
	Phragmites	23
	Total:	3,483
Other	Roads	316
	Bare ground (like oil pads)	12
	Buildings, structures	6
	Total:	327
Grand total outside wetland		16,581

## Strategies

- Use a wide range of disturbance types, lev-

els, and frequencies to support or improve habitat, including prescribed grazing or fire, flooding and drying, and chemical and mechanical methods.

- Use a combination of treatments such as prescribed fire, chemicals, grazing, and mechanical methods to reduce and control invasive species and hazardous fuel.
- Promote the restoration and conservation of native understories and the reduction or elimination of cheatgrass-dominated understories when applying treatments for shrub-related objectives.
- Evaluate the feasibility of managing sites when planning annual prescriptions. For example, some semipermanent shrub sites have long-term coverage of some shrub habitat where management can be difficult to impossible and other sites occur between drainages that can impede equipment access.
- Conduct a monitoring program early on to meet our objectives for shrubs because we have limited knowledge and information on plum habitat.
- When appropriate, use wildfires to help achieve land and resource management objectives.

## Rationale

Quivira Refuge is recognized for wetland and waterbird resources, but the refuge is also comprised of thousands of acres of upland, native sand prairie habitat that commonly support grassland obligates and species of concern, such as grasshopper sparrow and dickcissel. The decline of grassland bird populations are of serious conservation concern (Sauer et al. 2008). In general, these declines are attributed to habitat loss and degradation caused by many factors, including land use changes, the spread of invasive species, habitat fragmentation, urbanization, and the management of water quantity and quality. The relative importance of each of these factors depends on the resources and scales considered. Quivira Refuge lands have the potential to contribute to grassland bird conservation, especially when considering that public lands compose less than 3 percent of Kansas and Quivira Refuge comprises a smaller percentage of those lands that are specifically managed for natural resource conservation.



*Kildeer in short, sparse grassland.*

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*Little bluestem in intermediate grassland.*

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*Switchgrass in tall, dense grassland.*

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Some woody vegetation is acceptable within native grasslands. Nonbreeding (fall, winter, spring) specialists of grassland and shrub-grassland in Texas, many of which also occur on Quivira Refuge, had their highest combined densities reported in shrub-grassland habitat with less than 30 percent interspersed woody vegetation generally less than



Barry Jones/USFWS

Sandhills

3.28 yards tall by 24.71 acres (3 meters tall by 10 hectares) compared to habitat with less than 10 percent woody interspersed or less than 50 percent woody interspersed (Igl and Ballard 1999). When evaluated separately, grassland specialists had their highest densities in the same habitat as when combined, but shrub–grassland specialists had their highest densities in woodland dominated by trees more than 3.28 yards tall and secondarily in brushland dominated by woody plants less than 3.28 yards tall and comprising more than 30 percent woody canopy coverage. If Quivira trends are similar to what was reported, then management will be supporting less optimal habitat for grassland–shrub specialists to support both grassland and shrub–grassland specialists during the nonbreeding season. The same intent influenced the decision to provide at least 10 dense and sparse stands each—or between 5–30 percent interspersed total shrub coverage—during the breeding season. Also considered was the knowledge that much additional shrub coverage occurs in the landscape that is not defined as shrub habitat for refuge mapping and planning purposes because stands are less than 0.2 acre in size or have more than 50 percent shrub coverage (not a dominant plant type within stand).

There are about 9,512 acres of native grass-dominated vegetation associations outside of what is defined as “wetland” based on GIS calculations of recent coverage. Grassland communities are dynamic and cannot be held in static conditions, as illustrated in State transition diagrams of soil–vegetation associations and ecological site descriptions (Natural Resource Conservation Service 2010). For example, factors contributing to grassland dynamics include variation in climate effects, such as from changes in precipitation, temperature, and wind; landscape features, such as differences in soil, aspect, and slope

position; plant–wildlife interactions, such as plant adaptations to herbivory and soil disturbance; and the timing of environmental changes or disturbances in relation to plant and wildlife life stages (Anderson 2006, Helzer 2010). Thus, it is unrealistic to set an objective that attempts to maintain static conditions over time. Development of this objective considered these factors, the recent spatial location of various vegetation associations, and the understanding that areas of the refuge will be “rested” (no planned burning or grazing) each year. This explains the desirability to attain a minimum of 70 percent of the estimated potential acres of the associated grassland conditions described in the grassland criteria B. 1–4. While this proportion is somewhat arbitrary, it promotes the sustainability of ecosystem processes and the need for periodic disturbance as well as management’s ability to mimic natural stressors, such as when using fire and herbivory.

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## Native Ecological Community Conservation Objective 3: Woodland

At least 125 acres of woodlands largely located on the refuge perimeter and within 55 yards of the refuge’s main roads will remain during the next 15 years, see appendix E.

### Strategies

- Based on current conditions, maintain woodlands in areas identified in appendix E.

- Keep select trees or small groves that are located in areas along roads or next to other undesirable habitat on and off the refuge where removal would not provide substantial benefits to native wildlife, such as obligate grassland birds, and where their presence may benefit species of concern, such as Loggerhead shrike or bald eagle. Ultimately, this would be the refuge manager's decision based on available information.
- Conduct no substantial active management, such as regular stand thinning and fire suppression in most cases, specifically to benefit species largely associated with nonnative woodlands. Prioritize time and money resources for other species–habitat communities over woodland, especially shelterbelts and nonnative types.
- Manage woodland areas to reduce seed or propagation sources or to maintain fence lines and other infrastructure, such as with the removal of red cedar growth under canopy trees or Russian olive in the Artesian Grove.
- Do not allow encroachment of woodland into surrounding habitat.
- Allow limited native trees to remain onsite where they might have occurred naturally, such as up to a few willow or cottonwood trees near a spring.

## Rationale

Historically, nonwetland habitats comprising the refuge were dominated by native prairie inter-

persed with inclusions of shrubs (Heitmeyer et al. 2012). However, changes in land use practices in the watershed, coupled with our past management direction, led to the encroachment of shrubs and native and nonnative trees. By 2008, thousands of acres of woody vegetation existed on refuge lands (figure 17). Years ago, our refuge staff decided that restoring native prairie communities represented the best use of refuge lands, given the extensive loss and fragmentation of this habitat in the watershed and the accompanying population declines of some species, particularly of grassland obligates that rely on it.

However, removing all trees during the next 15 years may not be warranted given the location of woodlands surrounding the refuge and other hostile habitat on and off refuge lands. And it may not be feasible given our limited staff and budgets.

Migratory birds that require woodlands to complete essential life history events, like nesting, historically were not common on the refuge. Thus, they generally were not selected as focal species during the planning process. However, isolated trees and small groves would benefit focal species, such as loggerhead shrike and Swainson's hawk. Because woodland areas are attractive to wildlife enthusiasts, primarily bird watchers and photographers, a list of birds recorded using the woodlands not now planned for removal in the next 15 years was compiled from refuge files and recent observations to assess potential loss in birdwatching opportunities on the refuge (table 11). This list—which is presumed to be incomplete given that formal surveys have not been conducted—includes 49 species, indicating that birdwatchers would still have opportunities to view woodland-associated birds on refuge lands in easily accessible areas. It seems that bird species richness would be maintained.



USFWS

Shrubland



USFWS

Woodland

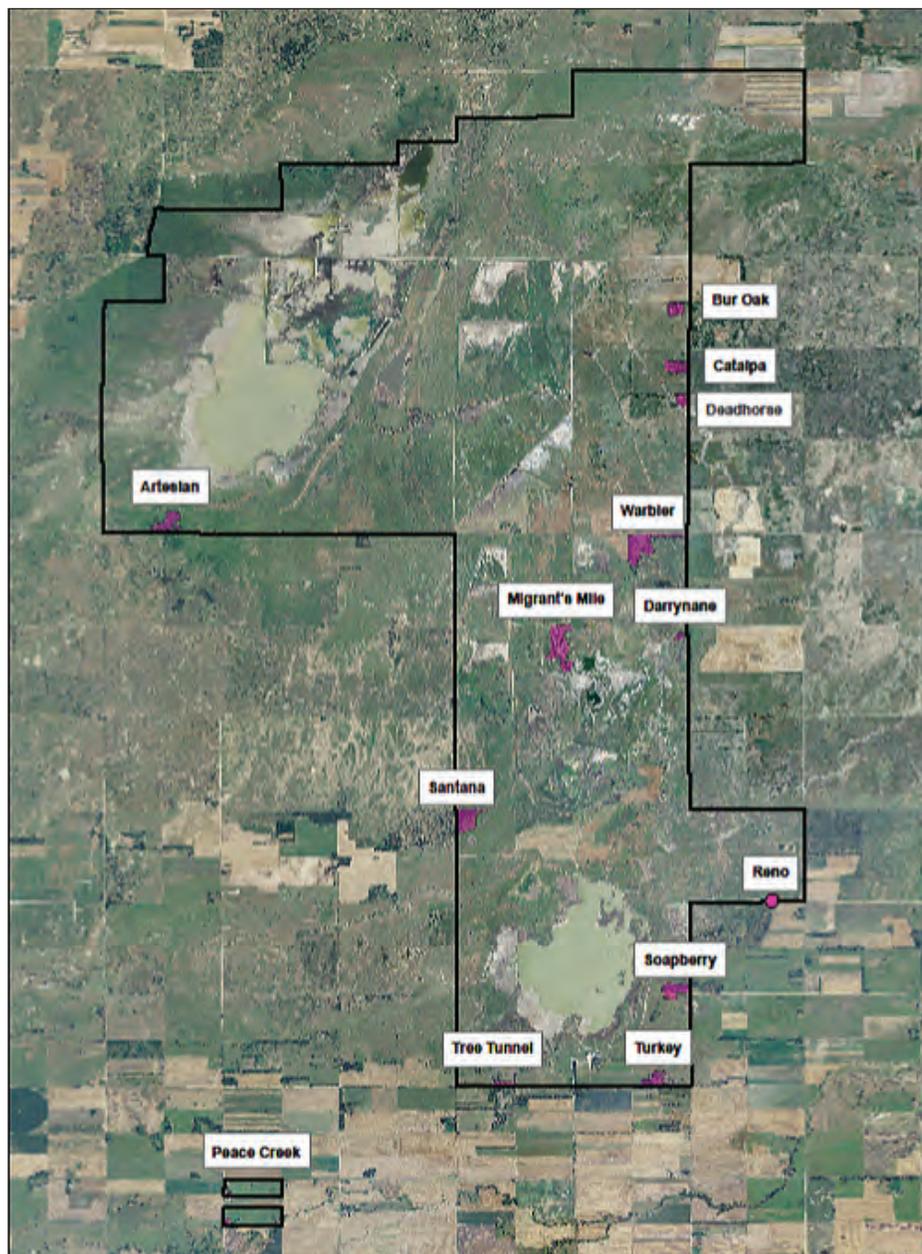


Figure 17. Location of woodland groves at Quivira National Wildlife Refuge, Kansas, in 2012.

## 6.4 Visitor Services Goal

*Visitors enjoy quality wildlife-dependent recreation opportunities.*

Following are objectives for a variety of visitor activities.

### Hunting Objective 1

Within 5 years realign waterfowl and upland game hunt areas to continue to protect whooping cranes and provide approximately 1000 acres of additional, consistent safe zones for whooping cranes in the flats area north of the BSM.

#### Strategies

- Allow hunting on no more acres than what is allowable and approved now, which is about 8,000 acres of the refuge's 22,135 acres.
- Close hunting areas favored by whooping cranes.
- Update boundary signs to reflect new hunt areas.
- Do not allow sandhill crane hunting.
- Keep, improve, and increase access to hunting information through kiosks, interpretive displays, handout literature, and other means, such as social media and the refuge Web site.
- Increase law enforcement.
- Develop new parking areas.
- Alter waterfowl and upland game hunting area boundaries.
- Update hunting maps.

#### Rationale

The refuge must manage the hunt program in a manner that protects whooping cranes from harm and disturbance. Managing hunting areas for when

whooping cranes are present may require the closure, and active management, of a specific unit.

The primary reason for separate hunting unit boundaries for waterfowl and upland game is because only up to 40 percent of the area can be opened for waterfowl hunting on refuges created under the Migratory Bird Hunting and Conservation Stamp Act of 1934 (Federal Duck Stamp Act). There is no limit to areas of the refuge that can be legally opened for upland, small game, furbearer and big game hunting, but hunting areas are decided by the refuge manager based on safety concerns; the need to separate consumptive and nonconsumptive users, when necessary; and disturbance to wildlife, which may necessitate the closure of some areas.

Waterfowl hunting would be altered to remove hunting from the Marsh Road Meadow, Park Smith Meadow and South Deadhorse units, all, of which, have marginal waterfowl use and few wetlands; and more created wetland units would be opened up to hunting. These units (figure 18) would include Unit 2, which includes the managed marsh units 24, 25, and 26, and Unit 4, which includes the managed marsh units 40, 48, 49, 50, 61, 62, 63 and 37 (Dead Horse Slough). The waterfowl area would total 7,606 acres, or 34 percent of the refuge. The current hunt area, by comparison, totals 8,062 acres, or 36 percent of the refuge.

Waterfowl hunting regulations would follow State and Federal regulations. Snow goose hunting during the spring Conservation Hunt season is not allowed on Quivira Refuge.

Upland and small game hunting would be similar to the waterfowl hunting area boundaries (figure 19) but would also include the South Deadhorse Unit, Park Smith Meadow, and Unit 27, which are all primarily upland habitats with no managed wetland units except for a small part of Unit 37 (Dead Horse Slough). The total area open for upland and small game hunting would be 9,289 acres.

### Hunting Objective 2

Within 5 years realign hunt areas to reduce the average annual number of days the refuge is closed to hunting because of the presence of whooping cranes from 30 to 15 days per year.

#### Strategies

- Open new areas that were closed before but not regularly used by whooping cranes.

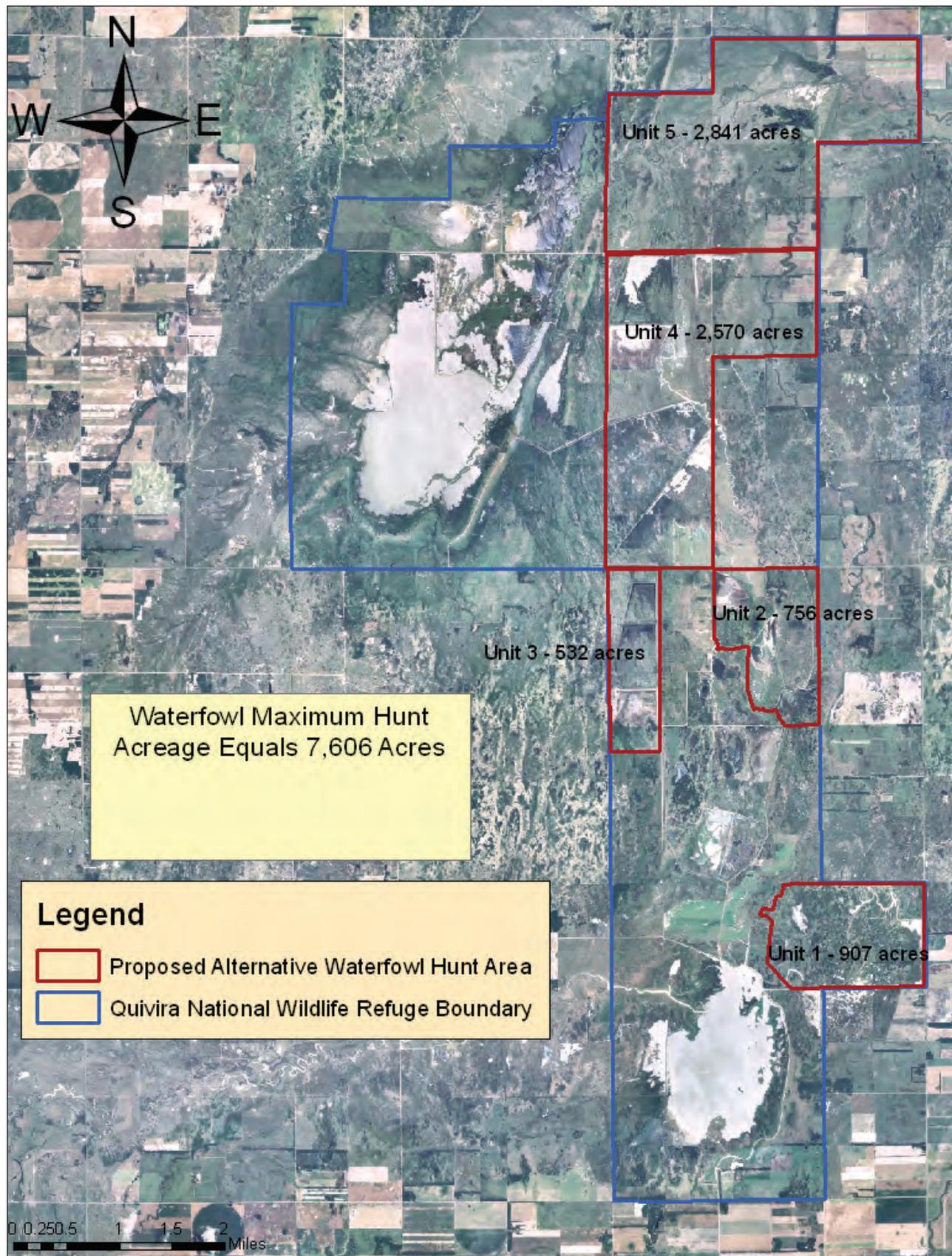


Figure 18. Proposed waterfowl hunt area, Quivira National Wildlife Refuge, Kansas.

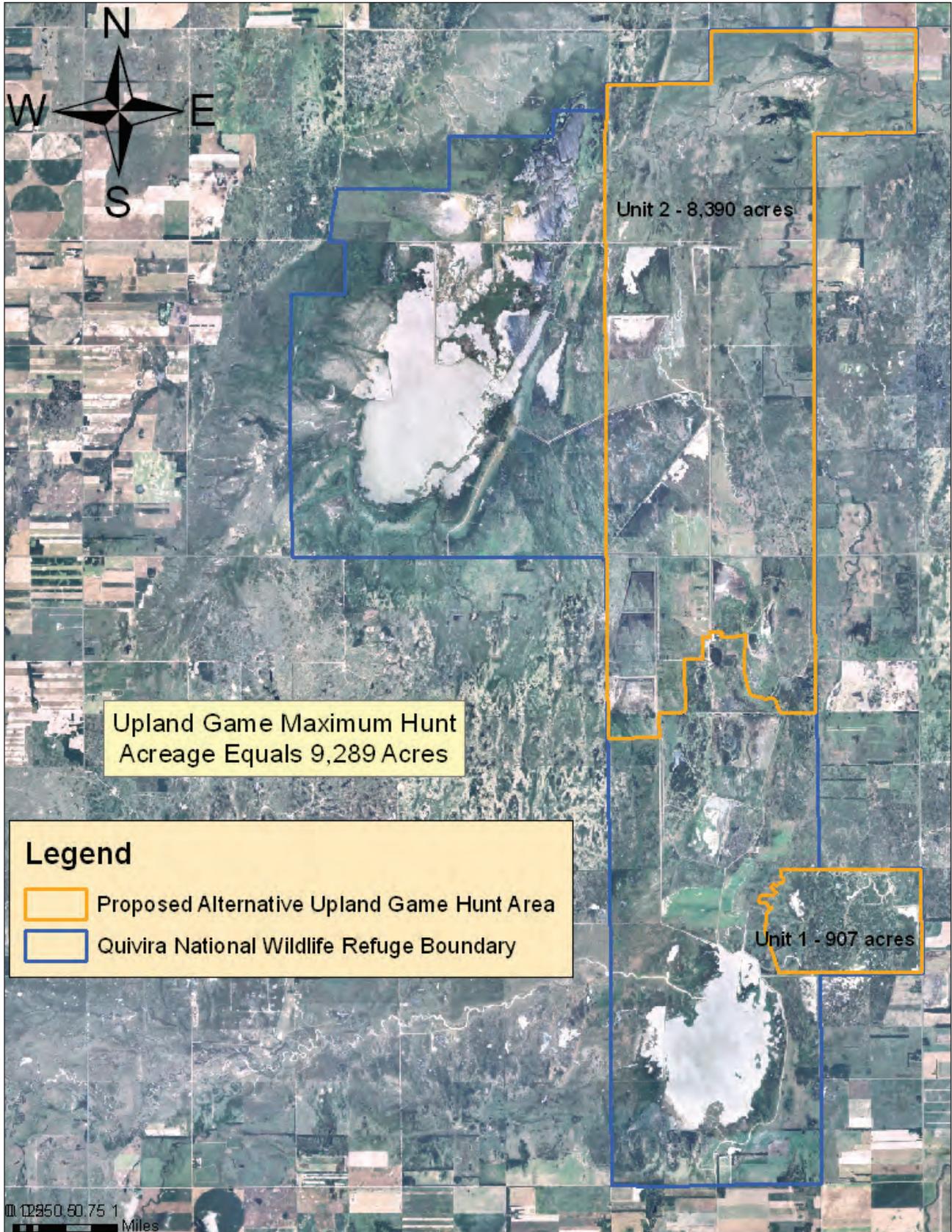


Figure 19. Proposed upland game hunt area, Quivira National Wildlife Refuge, Kansas.

- Update boundary signs to reflect new hunt areas.
- Provide an accessible waterfowl hunting blind, by reservation, in quality wetland habitat.
- Keep, improve, and increase access to hunting information through kiosks, interpretive displays, handout literature, and other means, such as social media and the refuge Web site.
- Increase law enforcement.
- Develop new parking areas.
- Alter waterfowl and upland game hunting area boundaries.
- Update hunting maps.

### **Rationale**

This approach would better accommodate hunter needs while protecting whooping crane use areas. This approach would also reduce staff time spent closing hunt areas when whooping cranes are present. Now the refuge is closed about 30 days per year because of whooping crane presence, which is a frustration to hunters, especially those that travel from out of state to hunt at Quivira.

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## **Hunting Objective 3**

Within 10 years develop a hunt plan to broaden and increase hunting opportunities on the refuge including deer, turkey, and furbearers.

### **Strategies**

- Update the CFR to be consistent with the approved hunt plan.
- Work with State of Kansas to determine areas open for hunting and limits based on deer herd health and population targets.
- Deer hunting would be allowed by special refuge permit only, with hunting potentially occurring during youth, muzzleloader, firearms, special hunts, and archery seasons.

- Turkey hunting would be allowed by State permit and according to State regulations. Close specific units when whooping cranes are present.
- Furbearer hunting would be allowed if refuge populations allow or for health purposes. Open areas would be the same as for big game hunting, in accordance with State regulations.
- Keep, improve, and increase access to hunting information through kiosks, interpretive displays, handout literature, and other means, such as social media and the refuge Web site.

### **Rationale**

Deer, turkey, and furbearer hunting would be allowed on most areas of the refuge, totaling 15,239 acres (figure 20) except (1) the south end of the LSM around the headquarters and the public use facilities at the Kids' Fishing Pond, the tower, and the trail; (2) the area around the Migrants Mile hiking trail and refuge storage facilities, the environmental education classroom, and the bunkhouse; and (3) the BSM area, which contains the Wildlife Drive, the most popular nonconsumptive public use area, and a major roosting area for migratory birds. Deer hunting quotas would be figured out, and managed in consultation with the KDWPT for holders of special refuge permits. Turkey hunting would be allowed without special refuge permits.

Creating separate hunting areas for different species would increase the need to provide more hunting information, signage, and law enforcement because the program would be more complex, but it would increase opportunity for the hunting of other species with little-to-no disturbance to migratory birds

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## **Fishing Objective 1**

Throughout the life of the plan, allow fishing and frogging in refuge waters with minimal disturbance to other wildlife and the natural aquatic ecosystem.

### **Strategies**

- Allow fishing, in accordance with State regulations, year round on all waters on the refuge.

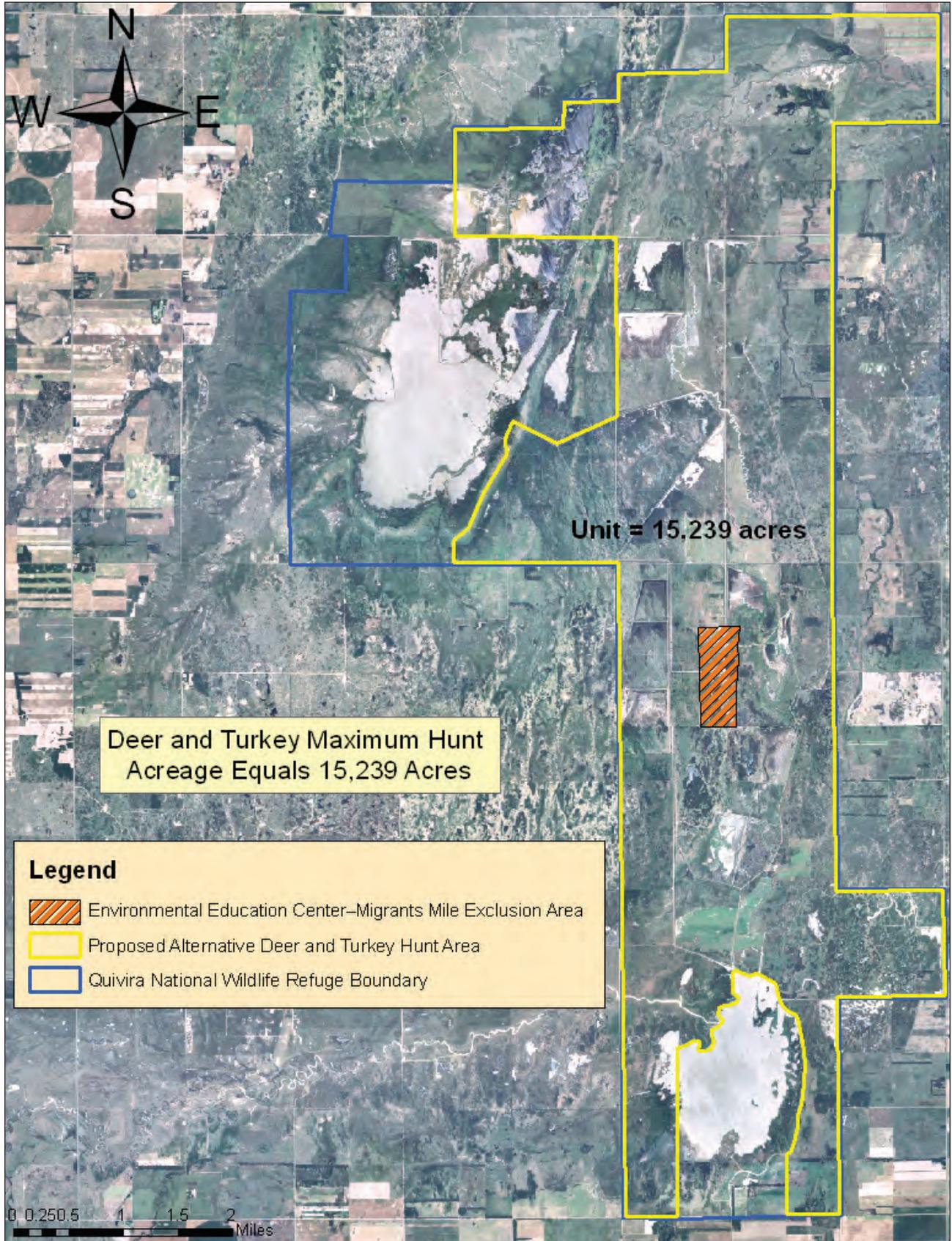


Figure 20. Proposed deer and turkey hunt area, Quivira National Wildlife Refuge, Kansas.

- Provide and maintain accessible fishing docks for visitors with disabilities.
- Do not allow boats on any waters.
- Do not stock Refuge waters (except Kids' Fishing Pond, see objective 2), but instead manage wetlands and lakes for migratory birds, allow these to fluctuate through natural hydrologic cycles.
- Do not allow bait collecting and live fish bait, except night crawlers, on any waters.
- Provide educational materials and interpretive exhibits about native fish, the threat of introducing or spreading nonnative plants or wildlife and other things that could hurt the environment, like diseases harmful to humans or wildlife populations.
- Plan and conduct special fishing events for kids to encourage and support a new generation of anglers.

### **Rationale**

Fishing is a tool to help the public connect with nature and to promote existing and future programs. Fishing and its promotion provides a type of compatible public use that is encouraged by initiatives such as the Department of the Interior's "Youth and the Great Outdoors" and the U.S. Fish and Wildlife Service's "Let's Go Outside." Boats and bait collecting are not allowed because they increase the risk of exotic and invasive species introduction and spread.

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## **Fishing Objective 2**

Enhance fishing and fishing education opportunities for youth by maintaining the Kids' Fishing Pond and annually stocking it with sport fish species.

### **Strategies**

- Allow fishing, in accordance with State regulations, for kids 14 and under (and adults accompanying such children). Adults would not be permitted to fish without children.
- Maintain the existing accessible fishing dock.

- Produce and install an interpretive panel about aquatic ecology with children-supplied artwork and text.
- Produce and keep an interpretive media that is coproduced, written, and continually revised by, and for, children to enhance their knowledge of fishing and fish resources.

### **Rationale**

Similar to Objective 1, but in addition, maintaining a population of sport fish at the Kids' Fishing Pond by stocking provides a location where fish populations are continually stable. It also provides a type of compatible public use that follows initiatives described in objective 1.

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## **Wildlife Observation and Photography Objective 1**

Throughout the life of the plan, increase awareness and access to wildlife observation and photography opportunities on the refuge and the Great Plains Nature Center.

### **Strategies**

- Maintain and improve the 14-mile wildlife auto tour route, trails, other public roads, observation towers, spotting scopes, and photography blinds.
- Keep and improve diverse and dynamic interpretive displays, social media, and handout literature that continually enhance and increase visitors' awareness of and interest in exploring the refuge.
- Loan equipment, like binoculars, scopes, and backpacks, through the Birding Initiative and through Connecting People With Nature.
- Continue to provide opportunities at the GPNC for wildlife observation and photography during operating hours and from sunrise to sunset every day via City of Wichita Chisholm Creek Park.
- Keep refuge open daily during daylight hours.

- Allow and encourage use throughout the entire refuge except in seasonally closed areas.
- Promote awareness of opportunities through the Wetlands and Wildlife National Scenic Byway.
- Collaborate with Friends groups and others to install a tower camera at the bald eagle and BSM areas to provide more observation opportunities of remote wildlife.
- Allow horseback riding and bicycling on established roads, not on hiking trails.
- Allow dogs under their owners' control, but leashed during the nesting season of April 1 to August 15.

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## Wildlife Observation and Photography Objective 2

Over the next 10 years, promote and expand the opportunity of use at 12 existing woodland groves by birdwatchers, and photographers.

### Strategies

- Develop information in brochures, panels and social media that promote wildlife observation and photography in designated woodland areas around the refuge.
- Enhance parking and access at each of the sites
- Promote awareness of opportunity through the Wetlands and Wildlife National Scenic Byway.
- Encourage minimal use of the Artesian Grove through interpretive panels explaining the special nature of the site.

### Rationale for Wildlife Observation and Photography Objectives 1 and 2

Use information provided to promote connections that nurture the appreciation and stewardship of natural resources. Promoting conservation partnerships with support groups (such as Friends groups

and scenic byway) would increase awareness of observation and photography opportunities, and general respect for wildlife resources. Better access to refuge areas would make it easier for people to observe and photograph wildlife.

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## Environmental Education and Interpretation Objective 1

Within 10 years, refuge staff will design and conduct 5–10 programs to enhance the advocacy and improve awareness of our mission and management; fish and wildlife resources; our refuge management activities; and the refuge's natural, cultural, and historic resources.

### Strategies

- Develop an environmental education and interpretation plan.
- Refuge staff will continue to coordinate with Friends of Quivira to create special events and educational programs.
- Provide environmental education programs at the refuge that teach curriculum-based programs for all school grade levels to help meet State educational standards.
- Encourage the use of the refuge by educational organizations as an “outdoor classroom.”
- Continue to promote national initiatives, such as Connecting People with Nature, America's Great Outdoors, and Let's Go Outside!
- Continue to engage visitors to the refuge through loan programs for binoculars and other educational products.
- Continue to provide interpretive programs at the refuge on a variety of refuge management and wildlife-oriented subjects, both by request and as scheduled activities, and increase programs as staff and time allow.
- Interpret the cultural history of the refuge area, including tribal uses and early settlement.

- Continue relevant and effective annual school events, such as those about the conservation of whooping cranes.
- Continue networking and communicating with area educators as to availability of environmental education programs and opportunities both on and off the refuge.
- Allow virtual geocaching.

## Environmental Education and Interpretation Objective 2

Within 5 years, refuge staff will increase interpretive media by 25 percent, thus reaching more public both onsite and offsite.

### Strategies

- Educate and inform individuals, schools, and other organizations through accessible programs, exhibits, signs, pamphlets, the Internet, and social media.
- Continually evaluate interpretive media like brochures, signs, and displays for relevancy, effectiveness, and the timeliness of communications and educational resources.
- Use social media to increase contact and exposure to the refuge.

## Environmental Education and Interpretation Objective 3

At the Great Plains Nature Center, interagency staff will annually conduct an average of 1,700 annual onsite and offsite programs that focus on “at risk” youth and other underserved audiences.

### Strategies

- Evaluate staff needs and increase Service staff, as applicable, to support programming efforts.
- Increase communication and networking efforts with USD 259 (Wichita) and area

school administrators to advertise and market GPNC program opportunities (such as school field trips and in-classroom presentations)

- Coordinate educational programs with area educators to make sure that State Core standards are being met through programming efforts.
- Increase the distribution of educational kits and discovery boxes to educators.
- Continue to promote national initiatives, such as Connecting People with Nature, America’s Great Outdoors, and Let’s Go Outside!
- Educate and inform individuals, schools, and other organizations through accessible programs, exhibits, signs, pamphlets, the Internet, and social media.
- Continue to support the GPNC through its partnership with the City of Wichita Department of Park and Recreation and the KDWPT.
- Use funding opportunities from the Urban Presence Initiative to support educational programming at the GPNC.



Visitors participate in the Monarch Mania event held at Quivira Refuge.

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## Environmental Education and Interpretation Objective 4

Within 5 years Refuge and GPNC staff will create a definition of environmental education and increase the level of professionalism of environmental education programs presented.

### Strategies

Partner agency staff will attend capacity building training and environmental education workshops.

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## Environmental Education and Interpretation Objective 5

Increase outreach and marketing efforts to increase participation by teachers and students in the Junior Federal Duck Stamp program by 10 percent within 5 years.

### Strategies:

- Hire consultant to evaluate program, and suggest improvements to increase participation.
- Display artwork throughout the year at various locations, at least 10 venues per year, including the Kansas State Fair, to further promote interest in wildlife and art.
- Create educational and marketing products (such as calendars, guides) that will engage potential participants including parents, teachers and students.
- Educate and inform individuals, schools, and other organizations through accessible programs, exhibits, signs, pamphlets, the Internet, and social media.

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## Environmental Education and Interpretation Objective 6

Throughout the life of the plan maintain 2 miles of foot trails and increase interpretative signage on trails by 50 percent within 10 years.

## Strategies

- Evaluate Birdhouse Boulevard trail and interpretive components for potential improvements and updates.
- Evaluate the Headquarters and Little Salt Marsh trails for interpretive signage needs and install signage as outlined.
- Evaluate signage needs on the Migrants Mile Trail and replace and install as outlined.
- Evaluate trail surfaces, boardwalks, directional signage and bridges and improve as needed.
- Develop and provide printed media such as trail maps and guides.
- Consider incorporating a fitness program on refuge and GPNC trails through [HealthyKansas.org](http://HealthyKansas.org)

## Rationale for Environmental Education and Interpretation Objectives 1–6

It is important for all ages of the public to have an understanding of the refuge and GPNC missions, goals, and responsibilities. Both facilities are in the “backyard” of several local communities, providing a sense of pride can be nurtured and perpetuated by increased understanding through education and interpretation. In addition, all the local communities benefit economically from their proximity to the facilities and their popularity as destinations. As community members come to know more about the refuge and the GPNC, they will be better able to educate both other residents and visitors.

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## Other Uses Objective

Throughout the life of the plan, provide appropriate and compatible opportunities for wildlife-dependent and non-wildlife-dependent recreation that support the six priority public uses or contribute to the appreciation of the refuge. These opportunities would not be allowed to disturb wildlife and would not be allowed when areas are closed for safety reasons.

## Strategies

- Allow dog training by individuals, not commercial vendors, outside of the nesting season of April 1st to August 15th and without live training aids.
- Allow commercial photography with a special use permit.
- Allow commercial tours for birding only with a special use permit.
- Allow firewood cutting in limited designated areas with a special use permit.
- Do not allow the collection of berries, fruit, roots, and mushrooms.
- Do not allow the collection of shed antlers and wildflowers.
- Do not allow commercial guiding for hunting.
- Do not allow boating or camping.
- Do not allow unauthorized vehicle use on roads and trails.
- Do not allow off-road vehicle use.
- Do not allow the collection of reptiles and amphibians or crayfish.
- Review requests for other non-wildlife-dependent for compatibility and appropriateness on a case-by-case basis.

## Rationale

The Improvement Act states that other uses can occur within the Refuge System, but they must support, or not conflict with, a priority public use. Furthermore, a use may not keep a national wildlife refuge from accomplishing its purposes or the mission of the Refuge System.

The refuge supports various forms of nature-based outdoor recreation that, while not strictly wildlife dependent, may support or facilitate wildlife-dependent recreation. These include activities such as equestrian use, bicycling, or hiking, which are compatible with the purposes of the refuge and contribute to the appreciation and enjoyment of it. These opportunities have been found to be appropriate at certain times of the year, and compatible

with the goals and objectives set by the refuge. The opportunities would not be allowed to disturb wildlife during certain times of the year, and would not be allowed when areas are closed for safety reasons.

## 6.5 Public Outreach Goal

*Visitors of all abilities understand, appreciate, and support the Service mission, as well as the refuge's unique habitats and importance to migratory birds and other wildlife and plant species.*

Following are objectives for a variety of public outreach activities.

### Public Outreach Objective 1

Within 5 years, refuge and GPNC staff will design and conduct outreach programs to present to 10–20 civic and environmental organizations annually in local communities within a 50-mile radius of each respective site.

## Strategies

- Develop speaker-led multimedia programs that emphasize refuge or GPNC features, facilities, management goals, and natural, cultural, and historic resources. Actively seek new civic organizations, clubs, educational groups, and other entities to which we can present programs.
- Work with Friends of Quivira and Friends of the Great Plains Nature Center to promote public awareness of the refuge and its mission and provide opportunities for the public to learn more about the resources of the Great Plains.
- Emphasize the importance of Quivira and GPNC to area communities because of the strong draw the sites have to visitors from outside the area. Present information about what makes each site special, such as unique features to the sites, great birdwatching opportunities and rare species occurrences and the draw these have on bringing visitors to the area.



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*The blue goose, representing the Refuge System, rides in the Octoberfest Parade held in Stafford, Kansas.*

- Work with the Friends of the Great Plains Nature Center to develop information about how Quivira Refuge and the GPNC function as “green” operations in the environment. Provide educational material about geothermal, solar, and other features at these sites through media such as displays, literature, and the Web.
- Install a tower camera at the bald eagle and BSM areas to provide more observation opportunities of remote wildlife to heighten understanding and awareness of refuge resources, encourage refuge visitation, and increase positive personal experiences with natural resources.

## Public Outreach Objective 2

By working in partnership with respective Friends groups, foster appreciation and increase knowledge of the refuge and GPNC by holding at

least 10 special events annually and through the Friends’ newsletters and Web sites.

- Present theme-oriented special events throughout the year that emphasize either subjects, such as butterflies or birds, or activities, such as fishing.
- Make sure that all special events are used to emphasize the purpose, mission, and wild-life of the refuge and the GPNC.
- Contribute regular articles to Friends newsletters and Web sites about refuge and GPNC news, management actions, and other pertinent subjects.
- Recruit, train, and use volunteers from local communities to help us meet our management and public use goals at Quivira Refuge and the GPNC. Strive to help GPNC volunteers contribute at least 2,800 hours of service to the nature center. The Friends of the GPNC volunteer coordinator will work to increase and enhance the GPNC volunteer corps.

## Public Outreach Objective 3

Within five years, contribute to knowledge and appreciation of the refuge, GPNC, and the Service through a minimum of 65,000 public visits to the respective sites; 8,000 visits offsite stations such as the Kansas State Fair, and 40,000 visits to online media.

- Increase and continually freshen Quivira Refuge Web content by offering fresh, informative, and pertinent content about refuge operations, bird and wildlife sightings, hunting, events, and more. The GPNC staff and webmaster continue to update existing pages and add more pages as needed for new events, projects, and programs.
- Oversee the development, maintenance, and staff of our information booth at the annual Kansas State Fair for both Quivira Refuge and the GPNC and continue to update and change its theme. Make sure that information about our various operations, missions, and activities is regularly available, but also offer fun and educational, hands-on exhibits for the entire family.

- Develop static, portable displays about refuge and GPNC wildlife, facilities, and management that can be used at fairs, conventions, and other one- or multiday events.
- Install traffic counters at strategic locations to count visitor use.
- Work with partners to survey visitor use.

## **Rationale for Public Outreach Objectives**

### **1–3**

Following the 2011 “Conserving the Future” visioning workshop, implementation teams were created to address a variety of issues, such as urban wildlife refuges, community partnerships, communication, interpretive and environmental education, volunteers, hunting, fishing, and outdoor recreation. These implementation teams were tasked with developing plans that outline goals, objectives, and strategies to meet issues identified at the visioning workshop. Once these plans are complete, Quivira Refuge staff will review and incorporate their recommendations to enhance public outreach as they apply to refuge and GPNC operations and visitor services opportunities. The plans will also form the basis for various stepdown plans, such as for Visitor Services, that will be created following the completion of this document.

Public outreach furthers the mission of the refuge and the Refuge System for the protection of public trust resources by garnering support for wildlife and their wild places. Using the principle that appreciation begins and is nurtured through understanding, outreach builds and enhances a sense of stewardship in the public, which in turn allows the public to feel better connected to the natural world through the refuge and the GPNC.

## **6.6 Cultural Resources Goal**

*The cultural resources and cultural history of the refuge are identified, valued, and preserved and connect staff, visitors, and the community to the area’s past.*

Following is the objective for cultural resources on Quivira Refuge.

## **Cultural Resources Objective**

Protect and preserve cultural resources on the refuge through coordination with the Region 6 cultural resources branch, which helps our refuge staff in meeting the requirements of Section 106 of the National Historic Preservation Act and other cultural resources-related legislation.

### **Strategies**

- Inform the Region 6 cultural resources staff of refuge projects early in project planning by using the Cultural Resources Review Form.
- Develop exhibits and signage to enhance educational opportunities.
- Encourage collaboration with interested tribes in developing relevant materials and correct interpretation.

### **Rationale**

The refuge was once an important Native American gathering site for hunting and salt gathering. Different cultural values are acknowledged, respected, and celebrated by the Refuge System (Refuge System 2011). Cultural services are one of many ecosystem services, or benefits, that one can get from nature (Refuge System 2011).

## **6.7 Visitor and Employee Safety and Resource Protection Goal**

*Provide for the safety, security and protection of visitors, employees, natural and cultural resources and facilities of the refuge and Great Plains Nature Center.*

Following are objectives for a variety of visitor and employee safety and resource protection activities.

## Visitor and Employee Safety Objective

Make sure that visitor safety and the safety of our employees at Quivira Refuge and the GPNC. Strive to keep the refuge as 100-percent visitor accident free and keep employee accidents and injuries, as reportable to the Office of Workers Compensation Program, below the regional average of 6.2 hours of lost time a year over the life of the plan.

### Strategies

- Educate and inform visitors of their responsibilities when visiting national wildlife refuges and the ways they might mitigate potential dangers and hazards.
- Use directional and informative signage, visitor information kiosks, updated Web pages, and posted warnings to help reduce preventable accidents and mishaps.
- Close roads deemed unsafe for travel because of weather conditions or poor visibility, and post closings on our Web page promptly to alert visitors about our conditions before travelling, if possible.
- Keep up-to-date station safety plans that provide emergency contacts, procedures, and training for all employees.
- Conduct an annual safety inspection of all facilities.
- Provide emergency shelters, accessible facilities, and proper trails and roads.
- Review and follow infectious disease plans and policies and update as necessary every year.
- Law enforcement officers help with protecting visitors and report serious incidents to the proper authorities, per our guidance found in regulation 054 FW 1.
- Keep a collateral duty safety officer at Quivira Refuge.
- Provide employees with proper personal protective equipment.

- Make sure that all required safety and operator training is completed before engaging in risky tasks or work situations. Make sure that other training, such as cardiopulmonary resuscitation, or CPR, and first aid, is available to employees as needed or requested.
- Make sure that employees review job hazard analyses before engaging in at-risk tasks.
- Practice sound risk management, “the state in which risks are acceptable.”

### Rationale

Visiting a national wildlife refuge can be inherently dangerous. Snake bites, stinging and biting insects and their associated diseases, extreme hot and cold temperatures, wind, lightning, tornados, standing or turbulent water, uneven terrain, and steep edges can potentially turn a pleasant day out into a life-altering experience. Our role is to help name these dangers, inform about them, and mitigate these dangers to the greatest extent possible.

Reducing the potential for accidents and injuries is cost efficient, provides better job satisfaction for employees, and is the right way to conduct business. We require written job hazard analyses before undertaking all at-risk tasks, such as operating an all-terrain vehicle or pounding fence posts. A library of job hazard analyses is available on the Region 6 safety office Web site and at refuge headquarters.

## Resource Protection Objective

Protect wildlife and other natural and cultural resources from damage, theft, or illegal taking to preserve resources for visitors to the refuge and to prevent their unnatural decline.

### Strategies

- Enforce hunting, fishing, and all other regulations in accordance with the CFR, State laws, and refuge regulations to protect designated critical habitat and wildlife.
- Close areas to protect wildlife from human disturbance when necessary.
- Change hunting areas and establish new regulations to protect whooping cranes.

- Use law enforcement and education to protect cultural resources in accordance with Federal, State, and tribal laws, policies and guidelines.
- Keep a minimum of two dual-function law enforcement officers or one dual-function and one full-time permanent law enforcement officer.
- Provide ample and easy access to refuge regulations through various media such as printed leaflets, Web site and social media, and six information kiosks located throughout the refuge.

### **Rationale**

To adequately staff refuges with sufficient officers to protect wildlife and habitat and to make refuges safe places for staff and visitors is a top priority for the Refuge System. Conserving the Future (Refuge System 2011), Recommendation 16, charges us to: Conduct a new, independent analysis of refuge law enforcement to measure progress and to name needed improvements.

*Provide and support facilities, strategically acquire and allocate staff, increase volunteer opportunities and partnerships, and effectively develop and use money to support the long-term integrity of infrastructure, habitats, and wildlife resources at the refuge and the Great Plains Nature Center.*

Following are objectives for a variety of administration activities.

## **Staff and Budget Objective 1**

Strive to keep funding level for 11 permanent full-time and 1 permanent part-time staff positions; provide regional or zone office space as needed; and continue to seek money for vacant, seasonal, temporary, and youth positions.

### **Strategies**

- Continue to correctly document budget and staff needs through memos and reports.
- Continue to hire one to five seasonal biological aids and technicians and continue to hire range technicians, as money allows, each year.
- Provide office space at Quivira Refuge for a regional refuge zone biologist, a Partners private lands biologist, and for other program staff as needed.
- Use the YCC program to help accomplish refuge goals and objectives.
- Raise money through grants and initiatives, such as AmeriCorps and Youth in the Great Outdoors, to supplement our staff and projects.
- Keep permanent fire staff to include a fire management office, and refill a supervisory range technician.



*The Great Plains Nature Center*

## Staff and Budget Objective 2

Plan to recruit and fill new positions that are identified in this CCP as being needed for accomplishing the goals and objectives to protect habitat, infrastructure, and wildlife resources at Quivira Refuge and the GPNC throughout the life of the plan.

### Strategies

- Find needed positions and projects in the RONS database and update as requested. The top refuge priority identified in RONS is one full-time maintenance worker.
- Coordinate with our regional law enforcement coordinator.
- Continue to correctly document budget and staff needs through memos and reports.
- Evaluate and add a new position at the GPNC to meet needs
- Refine and increase participation in our refuge volunteer program.

### Rationale

Conserving the Future (Refuge System 2011) states, “We must engage and prepare a diverse group of qualified and enthusiastic professionals that want to make the Service and the Refuge System their life’s work. We must be adaptive and flexible to recruit a workforce that reflects society...to ensure a workforce of the best and brightest minds...we must look for ways to transfer knowledge from senior staff. As part of this succession, we will value diversity of people and skills to create a culture of inclusivity.”

Conserving the Future (Refuge System 2011), Recommendation 22, charges us to: within the next 10 years, make our workforce match the diversity in the civilian labor workforce and recruit and keep a workforce that reflects the ethnic, age, socioeconomic and cultural backgrounds, and language diversity of contemporary America.

## Facilities and Infrastructure Objective 1

At the refuge and GPNC, within 5 years review and update our refuge deferred maintenance projects

list and document deficiencies, and submit a ranked project list for potential money every year.

### Strategies

- Keep and enhance the water delivery infrastructure necessary to achieve our wetland goals and objectives for the refuge.
- Keep the roads and parking lots required to support public use opportunities consistent with our goals and objectives for the refuge.
- Keep the fencing, wells, and other infrastructure necessary to run a grazing program that helps us achieve our goals and objectives for the refuge.
- Keep existing buildings, including an office, visitor center, maintenance shop, three storage buildings, one pole barn, two residences, and two comfort stations.
- Review displays, interactive, portable, and static, about area flora, fauna, ecology, and history at our visitor centers and update as resources allow.
- Keep and enhance the existing 2 miles of trails and accompanying structures, like bridges, boardwalks, interpretive signs, and kiosks, to provide quality visitor use experiences.
- Explore creating more trails on the refuge to provide more opportunities for compatible wildlife-dependent recreation.
- Maintain the infrastructure at the GPNC, including the Koch Habitat Hall, Coleman Auditorium, offices, classrooms, and a storage garage, to support our multi-agency cooperative partnership with the City of Wichita Department of Park and Recreation and KDWPT.

### Rationale

Visitor services infrastructure for both the refuge and GPNC need routine annual and long-term maintenance to keep these resources in good-to-excellent condition. Because of our salty environment at the refuge, our water control facilities and equipment deteriorate faster than those at refuges that protect freshwater marshes. Much of the refuge is also comprised of the sandy, Sand Prairie ecotype soils, which

necessitates more constant maintenance to keep water control structures from washing out. Some water control structures need to be replaced because of advanced age. Boundary fences and signs are in constant need of replacement because of severe weather events, environmental degradation and occasional vandalism.

The maintenance shop requires an addition and updating. The bunkhouse and environmental education classroom were created out of the old, original 1957 block office building, but this building was abandoned because of poor domestic water quality. So, there is a need to again abandon this building and move operations to the current headquarters site to consolidate facilities and operations at one location with good quality water. An improved environmental education program could ensue near the headquarters with access to accessible trails, the observation tower, the visitor center, the Kid's Fishing Pond and to quality wetlands and grasslands for interpretation.

Energy conservation modifications have recently been made at several facilities, but more improvements are needed.

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## Facilities and Infrastructure Objective 2

At the GPNC, within 5 years, identify changes and additions to the facility that will improve our cooperative partnership and agency's performances while enhancing the visitors' experience.

### Strategies

- Work with partner staffs and develop a plan to expand the building, thus adding office space, classrooms, and a large public meeting space that has the possibility to accommodate traveling exhibits.
- Encourage Friends of the GPNC to investigate strategies to pay for building a new addition to the facility and for improved and enhanced programming efforts.
- Continue to work with corporate sponsors to provide up-to-date and state-of-the-art exhibits in the Koch Habitat Hall.

### Rationale

Current exhibits are reaching the end of their expected lifespan and should be replaced and updated. The building will be insufficient for anticipated future needs.

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## Facilities and Infrastructure Objective 3

Within 15 years, design and develop a new environmental education site near the headquarters area.

### Strategies

- Include a capital improvement project in the Service asset and maintenance management system.
- Develop a conceptual site plan and engineering design.
- Demolish and rehabilitate old environmental education site.
- Construct new environmental education site.

### Rationale

Same as objective 2 and rationale for environmental education and interpretation objective 1. Centralized buildings improve visitor service, reduce staff travel, and improve water quality.

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## Facilities and Infrastructure Objective 4

Within 15 years design and construct another cold storage building and fire cache on the refuge.

### Strategies

- Include a capital improvement project in the Service asset and maintenance management system.
- Develop a conceptual site plan and engineering design.



USFWS

*Migrants Mile Trail*

- Potentially demolish and rehabilitate old site.
- Construct new cold storage building and fire cache.

### **Rationale**

Additional storage space is needed to better protect vehicles and to support other refuge objectives.

## **6.9 Stepdown Management Plans**

This CCP is a broad umbrella plan that provides general concepts and specific wildlife, habitat, visitor services, and partnership objectives over the next 15 years. The purpose of stepdown management plans is to provide detail for our managers and employees so they may more effectively carry out the specific actions and strategies authorized by this CCP. Table 31 lists the stepdown plans needed, their status, and their next revision dates.

**Table 31. Stepdown management plans for Quivira National Wildlife Refuge, Kansas.**

<i>Plan</i>	<i>Completed plan, year approved</i>	<i>New or revised plan, completion year</i>
Habitat management plan (annual)	2012	2013 revise annually
Habitat management plan	—	2014
Inventory and monitoring plan	—	2014
Integrated pest management plan	2012	2017
Fire management plan	2009	2014 validate annually
Visitor services plan	1986	2014
Law enforcement plan	2012	2017
Station safety plan	2012	2017
Water management plan (annual)	2012	2013 revise annually
Hunting plan	—	2013
Trapping plan	—	2014
GPNC operations plan	2012	2013 revise annually
Santana Research Natural Area plan	1984	revise as appropriate

