

Chapter 3—Alternatives



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Lesser Yellowlegs

This chapter describes the management alternatives considered for Quivira Refuge. Alternatives take different approaches toward sustaining native populations and the habitats on which they depend. They are designed to achieve the refuge’s purposes, vision, and goals; the mission of the Refuge System; and our overall mission. We developed alternatives to address the issues, concerns, and problems that we identified, with help from the public, during public scoping and throughout the development of this draft CCP.

3.1 Development of Alternatives for the Refuge

We assessed planning issues described in chapter 2, existing biological conditions described in chapter 4, and external relationships that affect the refuge. With this information, we formulated several alternatives, each, of which, broadly describes different

approaches for meeting the long-term goals listed in chapter 2. We then evaluated how well each alternative would achieve these goals.

Alternative A, the no-action alternative, captures our current intent and activities at Quivira Refuge. Because it did not originate in this planning process, alternative A may not meet all the goals of this CCP. It does, however, provide a baseline for comparing the other alternatives. Alternative B looks at managing for focal species and is our proposed-action alternative. There is more detail on our proposed action in chapter 6. No-action and proposed-action alternatives are both required by NEPA. Alternative C would restore the refuge closer to presettlement conditions but would also likely limit future management capability.

Table 4 in section 3.7 summarizes the actions that would be carried out under each alternative, as well as the potential consequence of those actions. Detailed information on consequences may also be found in chapter 5.

To help us in comparing alternatives, we created a map that shows the location of general habitat types on the refuge (figure 6).

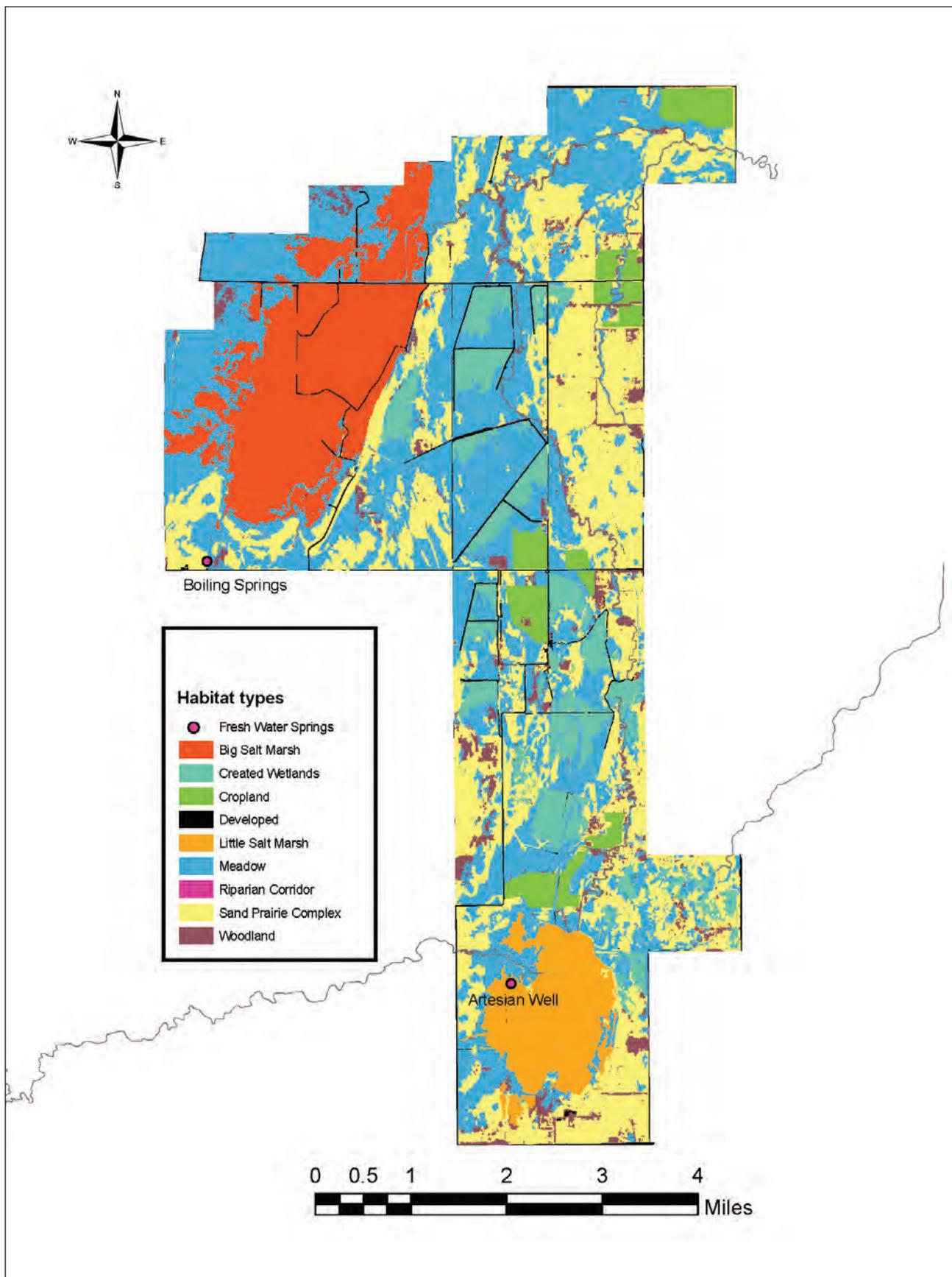


Figure 6. Habitat types, Quivira National Wildlife Refuge, Kansas.

We did not consider, and then drop, any alternatives from detailed study. Some management perspectives, however, such as the spatial extent of suitable shrub and tree coverage, were carefully considered and addressed outside of alternative development elsewhere in this draft CCP and EA.

Our three alternatives have some consistencies. The following key elements will be included in our management of Quivira Refuge regardless of the alternative selected:

- We will make sure that management of the refuge complies with all Federal laws and regulations that provide direction for managing units of the Refuge System.
- All wildfires will be managed in accordance with Federal Wildland Fire and Service policy. The initial action on a human-caused wildfire will be to suppress the fire at the lowest cost with the fewest negative consequences with respect to firefighter and public safety. Under alternative A, all wildfires would be managed with the intent to suppress. Under alternatives B and C, a naturally occurring wildfire may be concurrently managed for one or more refuge objectives. Further, objectives can change as the fire spreads across the landscape. Thus, under alternatives B and C, wildfire would be viewed as playing a more natural role in the environment. Prescribed fire may be used in all habitat types at any time of the year based on refuge objectives, and related to hazardous fuel reduction or habitat management.
- We will attempt to control invasive species through an integrated pest management (IPM) approach that uses biological, chemical, cultural, and mechanical treatment methods.
- We will allow use of various strategies, such as methods that involve rest, water level control, prescribed grazing, burning, mechanical, chemical, and cultural-related activities, to appropriately accomplish refuge goals and alternatives.
- We will protect and manage all cultural resources.
- We will support our own research efforts and those of others to help achieve management objectives.
- As needed, we will observe for, and respond to, signs of wildlife diseases such as cholera, chronic wasting disease, avian influenza, and botulism.
- We will promote strong and diverse partnerships to help meet the objectives and goals of the refuge.
- We will maintain current water rights throughout the refuge.
- Our approach to climate change adaptation in the next 15 years would be similar for all alternatives, however there are resulting differences in management capacity (constraints) and ecosystem resiliency (adaptability) potential as reported throughout the document under various goals and topic headings. Many of our actions address key findings of climate change adaptations listed by Staudinger et al. (2012). At some level, all alternatives would promote sustainability of ecosystems, biodiversity of organisms, and wildlife-dependent ecosystem services. None of the alternatives would manage to stabilize natural conditions, instead, all manage system transitions and promote strategies that closer mimic or support natural processes. All alternatives would reduce or alleviate environmental stressors or vulnerabilities, such as grassland fragmentation and the effects of invasive species, which may be magnified with climate change. All alternatives would carry out an adaptive management process that involves the experimentation and modification of management actions and monitoring to increase success in achieving goals and objectives. For example, timing of management actions may require adjustments for success with changing climate conditions. Regardless of the alternative, there remains

uncertainty in the effects of climate change, such as how system variability and vulnerability will change and affect land use and environmental regulations at landscape scales that collectively influence refuge management planning. For example, we are uncertain of how water use and rights issues within the watershed and western Kansas aquifers will be affected with climate change and what the consequences will be for refuge resources and management (for example, Rosenberg 2010, Schlager and Heikkila 2011). Over the time of this plan, knowledge will be gained of anticipated future changes that inform management strategies and decisionmaking.

3.4 Alternative A (Current Management—No Action)

Alternative A is the no-action alternative, which represents the current management of Quivira Refuge. This alternative provides the baseline against which to compare the other alternatives. It also fulfills a need of NEPA. Under alternative A, our management activity would continue unchanged. We would not develop any new management, restoration, or education programs at the refuge. Current habitat and wildlife practices benefiting migratory species and other wildlife would not be expanded or changed. Habitat management would remain focused primarily on benefiting migratory birds. Our staff would keep monitoring, inventory, and research activities at current levels. Budget and staff levels would remain the same with little change in overall trends. Programs would follow the same direction, emphasis, and intensity as they do now.

Landscape Conservation Actions

This section includes actions for climate change and land protection under alternative A.

Climate Change

We would manage habitats to promote resilience through the conservation of native communities. Baseline checking of habitat conditions that might show the effects of climate change would continue. We would support an existing weather station, and monitoring of plant and wildlife community factors

would occur as part of planning and to support certain larger landscape efforts (for example, midwinter waterfowl survey). Management would reduce current environmental stressors, such as grassland fragmentation and the spread of invasive species. Otherwise, our staff would continue to mostly rely on our partners such as the USGS, GPLCC, and the Service Climate Change Team, for climate change-related information, research, monitoring programs, and modeling.

We would attempt to reduce the carbon footprint of our existing facilities. We completed a major project to reduce the carbon footprint in June 2011 through the American Recovery and Reinvestment Act. During that project, we installed a ground source HVAC and photovoltaic system panels (28 kilowatts) at the headquarters building. Activities in the near future would likely include modest improvements to facilities, including weather proofing and upgrading furnaces, doors, and windows. Our increased use of webinars and other virtual meeting devices would decrease that part of our carbon footprint related to travel.

Land Protection

These actions involve a variety of issues and programs.

Refuge Boundary

We have already acquired all lands within the refuge boundary. No expansion of the current refuge boundary is planned.

Private Lands Programs

Our staff would continue to promote cooperative work between landowners, the Natural Resources Conservation Service of the U.S. Department of Agriculture (NRCS), KDWPT, and our other partners on various types of land protection and management easements or agreements throughout Kansas.

Oil and Gas Activities

We own most mineral rights within the fee-title boundary of Quivira Refuge. Mineral rights would be reclaimed, as allowed, when mineral rights are abandoned.

Emerging Conservation Issues

Our staff would continue to seek information and support communications about current and potential future conservation issues affecting the refuge, while periodically assessing the role of the refuge at different landscape scales. For example, Ecological Services has been given responsibility for leading USFWS activities related to wind and energy development, including those potentially influencing the



Rachel Laubhan/USFWS

Insects flourish in the habitat surrounding the Big Salt Marsh on Quivira Refuge.

whooping crane, but we need to understand USFWS positions and related factors.

Native Ecological Community Conservation Actions

This section includes actions for a variety of habitats and activities under alternative A.

Big Salt Marsh

The hydrology of the BSM would be allowed to fluctuate with natural climate variations, and use of Rattlesnake Creek water would be limited. As a result, 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 and continue drying through the summer.

This management would contribute to restoring characteristics of a natural saltmarsh, including higher salinities over time and habitat dominated by a mosaic of open salt flat and saltgrass that are attractive to many nesting shorebirds. Occasionally, water from Rattlesnake Creek would be diverted into the BSM partly to allow proper management of units 57 and 58 and some canal waters, and for flood control. Also, with a declining water table and other future uncertainties of water availability in the watershed because of circumstances largely outside of our control, it is possible that managing the hydrology of the BSM may become more reliant on Rattlesnake Creek water in the future. Therefore, while the intent of this alternative is to decrease use of Rattlesnake Creek water, the ability to periodically use this water source remains important.

Prescriptive fire and grazing would be used to support and restore native vegetation communities. Herbicides would be used to remove invasive plants and prevent new infestations that often result with dynamic seasonal water level fluctuations. Chemical and mechanical treatments would be used to increase the extent of mudflat habitat primarily for use by foraging waterbirds in spring, summer, and fall. Existing roads, dikes, and water control structures would remain.

Little Salt Marsh

The LSM would continue to be used to serve the dual roles of providing waterbird habitat at strategic times within, and among, years as well as to store water from Rattlesnake Creek to facilitate management of other refuge wetlands. In general, the marsh would be drawn down in spring to provide mudflats and shallow water for spring migrants and to moderate the potential adverse effects of periodic high flows in April through June. The marsh would then be allowed to refill during summer so that water could be transported to other areas of the refuge, typically beginning in late August, to provide habitat for fall bird migration. Use of water from the LSM in the fall also helps achieve desired water levels in the marsh, which creates added habitat for fall waterbird migration.

Riparian Corridor

Rattlesnake Creek, Salt Creek, and Dead Horse Slough provide most of the riparian habitat on the refuge. We manage Rattlesnake Creek primarily for water transport, with recognition that ancillary benefits are provided to many native plants and wildlife

species. Water is diverted out of Rattlesnake Creek in various locations under the current water right (figure 5). Our staff would continue to work with the Rattlesnake Creek Partnership and pursue other avenues to protect the annual water right of the refuge. Invasive saltcedar dominates exposed soils next to watercourses and limited chemical, fire, and mowing are used to control it. We also control other invasive species, and other management strategies are used to maintain habitat within the riparian corridor, such as with use of grazing and mechanical treatments.

Created Wetlands

We manage created wetlands as seasonally flooded, or moist-soil, wetlands with hydrologic regimes that vary in flooding depth, coverage, timing, and duration within, and among, years. These habitats would be at least partially flooded sometime between September and April most years and would be generally allowed to dry during the growing season to promote plant germination and growth. Periodic irrigation may be required to maintain growth and promote the availability of food and cover resources as conditions become dry over the growing season. Our staff would continue to use management

tools such as grazing, prescribed fire, mechanical and chemical treatments and water manipulation to accomplish objectives, with a primary focus on foraging habitat for migratory birds and, to a lesser extent, nesting habitat. Our staff would aggressively control wetland invasive plants, such as Phragmites and saltcedar, to decrease spread.

Freshwater Springs

Freshwater springs are an essential resource on the refuge, and we would manage them to sustain current functions and values, including protecting current population of State-threatened Arkansas darters in an area south of the BSM. This area is traditionally known as Boiling Springs because ground water bubbles up to the surface as though it were hot.

We would continue to use fencing to exclude grazing from the artesian well site and to remain extra careful in spot spraying chemicals to control invasive species in the area. We would allow fire as part of prescriptions applied at larger spatial scales while considering the needs of meadow and sand prairie habitat next to springs.

At the Boiling Springs, an existing pipe and pump from an oil well that was removed before would remain. Our staff would continue to check water



Barry Jones/USFWS

Boiling Springs

quality of the Boiling Springs, but further evaluation of current habitat and fish community relations is needed to help in making future decisions about the management of the springs.

Meadow

Characteristics of ground and surface water are main drivers of meadow community composition and structure that are influenced by climate, watershed land use, and habitat conditions at various scales. We apply limited direct, or intentional, management to influence the structural conditions and functions of many meadows on the Quivira Refuge. However, the Marsh Road Meadow is actively managed through haying and prescribed fire to provide habitat for rails, cranes, and bobolinks.

Our staff would continue to improve the health and productivity of the Marsh Road Meadow by conducting actions to periodically reduce litter buildup to increase nutrient cycling and the temporal and spatial diversity of vegetation structure and composition. Most prescriptions involve fire, mechanical, and grazing treatments to decrease the invasion of woody vegetation, or to prevent the conversion of herbaceous meadow habitat to wooded habitat, and to manage a proper balance of vegetation structure and cover that supports the annual life needs of various species. Chemical may also be used to control invasive species such as Phragmites or saltcedar that cannot be controlled effectively using only other means.

Woodland

When evaluating alternatives, woodland habitat generally refers to shelterbelts and larger tree, or land claim, plantings, but excludes small clumps, or scattered, trees and shrubs in other habitats. Our staff would continue to reduce and control invasive woody vegetation, primarily in areas where trees are encroaching into open prairie and wetland habitat. Tree rows and groves of both native trees, like cottonwood, and nonnative trees that were planted or have invaded prairie and wet meadow communities would continue to be removed, and lands would be restored to the proper native community type. Our staff would continue to evaluate potential management trade-offs related to certain woodlands that provide essential benefits to select species, and may subsequently decide to conserve some limited woodland areas that do not jeopardize the grassland size needs of focal species. Similarly, planted tree rows on, or near, refuge boundaries that have a minimal effect on native prairie or wetlands would be a lower priority for removal.

Sand Prairie Complex

When evaluating alternatives, the sand prairie complex includes scattered woody vegetation and relatively small, temporal–seasonal wetlands without water control structures that are parts of a larger grassland area defined in figure 6. We would continue to manage the sand prairie complex to support native plant communities characteristic of the associated soil types, thereby keeping a high level of habitat diversity in terms of both structure and composition that would be closer to presettlement conditions, as described in chapter 4. Thus, with respect to woody vegetation, we would continue to promote small, scattered native shrub stands that are mostly plum at various seral stages. Overall, an open sand prairie community would be conserved through the periodic use of fire, grazing, mechanical, and chemical treatments.

Cropland

We would manage current cropland through cooperative farming agreements with local farmers to produce annual seed cover crops. However, as cooperators voluntarily withdraw from farming (current rate of approximately 40–80 acres annually), our staff would continue to convert these lands to reconstructed native communities comprised of native grasses and forbs proper for the associated soil type. Following initial seeding, we would actively manage reconstructed native communities with mechanical methods, fire, grazing, and herbicides to encourage the establishment and maintenance of native species. We expect that all cropland would be reconstructed to some level within the next 15 years, however, achieving conditions similar to those characteristic of native communities might take decades longer.

Migratory Birds

We would continue to focus on migratory birds and primarily on wetland management to provide migration, resting, and nesting habitat for a diversity of waterbirds, especially waterfowl, cranes, shorebirds, and rails. We would continue to manage upland habitats for the migratory and nesting needs of native wildlife communities characteristic of open sand prairie. However, as shown above, some limited woody habitat would be kept to help various wildlife species, including herons for their rookeries, bald eagles for their nesting and roosting, and some other species of conservation concern for their nesting and migration. Our staff would continue to conduct annual population counts, or landscape-level checking, of migratory birds, including the Christmas and

midwinter waterfowl, shorebird, sandhill crane, whooping crane, bald eagle, and interior least tern bird surveys. We would continue with other measures to support migratory birds, including the implementation of seasonal or area closures to decrease disturbance to nesting bald eagles, interior least terns, and whooping cranes.

Fish

We would conserve native fish communities where possible, paying particular attention to the Arkansas darter, plains killifish, and other native fish of concern in areas of the BSM, riparian corridor, and freshwater springs. Carp are present throughout the Rattlesnake Creek basin, and control is an ongoing challenge. Our staff would continue to control carp and other undesirable fish, primarily through the periodic drying of wetlands. On rare occasions when drying is extremely difficult or impossible, but water levels are low, such as is common with the Kid's Fishing Pond, a limited use of chemical is allowed. Fish stocking of the Kid's Fishing Pond would continue for recreational and educational purposes. Our staff would avoid stocking, and introducing conditions favorable to, nonnative fish.

Threatened and Endangered Species and Species of Concern

We would continue to manage habitats in support of Federal and State threatened and endangered species, Federal candidate species, and State Species in Need of Conservation, especially those species with designated critical habitat on Quivira Refuge lands and those that most commonly depend on refuge resources. For several species, we provide favorable habitat without specifically focusing on those particular species, such as with mudflat–shallow water habitat used by migrating piping plovers that are rarely observed at Quivira Refuge during migration.

Our staff would continue to support applicable threatened and endangered species recovery plans. Nesting interior least tern and western snowy plover use similar areas on the refuge and our management of habitats to support both species would continue. Similarly, we would continue to promote roosting and foraging habitat for whooping cranes. Monitoring programs for these species when they live on the refuge would continue, and activities would be controlled to protect quality conditions for these birds, such as reducing disturbance. As required, our staff would consult with our, and KDWP's, endangered species staff before conducting management actions that may affect listed species. Area closures would

continue to be imposed to protect federally listed species using the refuge.

In general, our practices conducted on Quivira Refuge result in habitat conditions that should be suitable for most of the State Species in Need of Conservation that occur in Stafford County, though several are not known to regularly use the area. In particular, we would continue to manage meadows around the BSM in a way that promotes use by black rail and bobolink, including our periodic use of prescribed fire and haying to manage the composition and structure of vegetation and promote nutrient cycling. Treatments would not occur in meadows during the main nesting period for these species without evaluation and by following existing policy.

Wildlife Native to the Region

We would conserve wildlife native to this region of the Great Plains by supporting native habitat communities, both resident and migratory. We would continue proper uses of fire, grazing, mechanical methods, rest, and invasive species control to provide more favorable habitat for native species, including some like the greater and lesser prairie-chicken and the long-billed curlew, that historically used the refuge or its vicinity more extensively in the past.

Wildlife Health

We would manage habitat for conditions that decrease adverse health conditions for wildlife. Monitoring for contaminant levels would occur periodically to make sure that conditions are within a normal range for the ecosystem, and we would regularly watch for signs of disease outbreaks. Our staff would continue working with those who are conducting formal surveillance monitoring programs for avian influenza and chronic wasting disease. We would cooperate with regional and national monitoring programs to respond to new wildlife disease threats. We would not, however, allow the trapping of nuisance animals.

Inventory, Monitoring, and Research

We would continue wildlife and habitat inventory, monitoring, and research efforts in the short term, but our staff would periodically evaluate and appropriately revise these efforts, while making sure that refuge goals and objectives are being addressed. We would gather, review, and synthesize information relevant to biology and management of refuge lands for use in planning and decisionmaking. This would include ongoing inventory of refuge biological resources, development of a vegetation cover map, and new protocols to improve the checking of water

quantity and quality, nesting interior least terns, and vegetation conditions. Annual and periodic surveillance and survey types conducted in recent years include: shorebird, midwinter waterfowl, marshbird, midwinter eagle, spring and fall whooping crane, spring sandhill crane, interior least tern and snowy plover, refuge breeding bird, Christmas bird, deer, Monarch butterfly (tagging), Emerald ash borer, invasive plant species, and water quality.

Cooperative research with other agencies and educational institutions would continue to expand knowledge of refuge biological resources and to inform refuge management. We would allow research activities that are compatible with refuge goals and objectives; involve good communication with our refuge staff; provide information related to refuge resources and management; and address a current or future conservation or societal issue, such as human and wildlife health.

Visitor Services Actions

Recreational uses help visitors focus on wildlife and other natural resources, and provide opportunities to become aware of resource issues, management plans, and how the refuge contributes to the Refuge System mission.

We encourage national wildlife refuges to provide wildlife-dependent recreation where feasible and compatible with the purposes of refuges. This is defined as a compatible use of a Refuge System unit involving hunting, fishing, wildlife observation and photography, environmental education and interpretation. Other activities may be allowed to facilitate compatible wildlife-dependent recreation.

Hunting

Hunting programs on the refuge would not change. No new areas, expansions of season, and no new species would be open to hunting. Only approved, nontoxic shot would be used or possessed while hunting upland gamebirds and migratory gamebirds on the refuge. We would limit the area open to migratory bird hunting to no more than 40 percent of available habitat (code of law: 16 USC 668dd(d)(1)(A)). These restrictions make sure that some habitat without direct disturbance from hunting is available to migrating waterfowl. No hunting would be allowed when whooping cranes are present on the refuge. We would make an accessible waterfowl hunting blind available by reservation. We would continue to prohibit commercial outfitting.

Fishing

We would generally allow fishing on all waters according to State-established seasons and regulations. Year-round use of the Kid's Fishing Pond would be permitted with a one-fish limit for children age 14 and under and for adults with an eligible child who is also fishing, unless otherwise posted for management or safety reasons.

We would not allow bait collecting or the use of live fish bait, except for night crawlers.

We would not allow frogging and the hunting of turtles or other reptiles and amphibians.

Wildlife Observation and Photography

Observation blinds, elevated viewing platforms, an up-to-date bird species list, and portable viewing and photography blinds all support wildlife observation and photography on the refuge. We would support seasonal closures to protect sensitive wildlife areas and reduce disturbance to fish and wildlife. We would expand by working directly with the "Wetlands and Wildlife Scenic Byway" committee to increase public awareness, and provide increased opportunities. Bicycling, horseback riding—on established roads only—and dog walking (under owner's control) would be allowed.

We would evaluate commercial photography requests, and requests from commercial led birding tours on a case-by-case basis and authorize through special use permits.

Environmental Education and Interpretation

Quivira Refuge and the GPNC would continue to have interactive and static displays about area flora, fauna, ecology, and history. We would keep two areas of marked pedestrian trails at the refuge: Migrants Mile and the LSM and Headquarters area.

We would provide curriculum-based programs for all school grade levels to help in meeting State educational standards. Onsite and offsite programs would continue at the GPNC that focus on "at risk" youth and other underserved audiences. Interpretive programs would be provided at Quivira Refuge and the GPNC on a variety of refuge management and wildlife-oriented subjects, both by request and as scheduled activities.

Our staff would continue to promote use of the GPNC's classrooms and Quivira Refuge's environmental education classroom for appropriate school and other environmental education programs, as well as for public interpretive programs and workshops.

Other Uses

All areas would remain open on the refuge unless otherwise closed for management or safety reasons, such as when terns or bald eagles are nesting.

Allowable Uses

Would include firewood cutting and dog training by individuals outside of the nesting season.

Requested and Proposed Uses

Other requested and proposed uses would be evaluated, with necessary approval, for appropriateness and compatibility with the purposes of the refuge in accordance with our policies, see appendix D.

Prohibited Uses

Uses that are specifically prohibited on the refuge include: amphibian, crayfish and reptile collecting; antler collecting; berry, fruit, roots, and mushroom harvesting; wildflower collecting; geocaching; commercial photography; boating; camping; recreational trapping; dog field trials; unauthorized vehicle use on roads and trails; off-road vehicle use; and commercial guiding for hunting.

Public Outreach Actions

We would provide onsite and offsite outreach programs to local civic and environmental organizations and emphasize refuge management issues, endangered species, and other pertinent subjects. Our staff would recruit, train, and use volunteers locally to help achieve management and public use goals.

Our staff would continue to work with Friends of Quivira Refuge and Friends of the GPNC to promote public awareness and outreach of the Service and the refuge. We would contribute articles to the quarterly Friends newsletters to update readers on refuge and GPNC management and activities.

We would hold special events several times annually to promote Quivira Refuge, the GPNC, and their respective missions, activities, and goals. We would continue to develop and staff our information booth at the Kansas State Fair.

We would keep and update the Quivira Refuge Web site to reflect refuge operations, hunting information, events, and wildlife sightings.

Cultural Resources Actions

No known cultural sites exist on the refuge. Our regional archeologist recently inspected referenced

areas of interest in the Santana Research Natural Area at least twice and found that these areas were not designated archeological or historic sites. We would protect found cultural resources in accordance with Federal and State laws, policies, and guidelines. Our staff consults with the regional archeologist during the planning phase of proposed projects to decide on the need for an archeological site clearance from the Kansas State Historic Preservation Office before substantial dirt or surface alteration.

Visitor and Employee Safety and Resource Protection Actions

This section includes actions for visitor and employee safety and resource protection under alternative A.

Visitor and Employee Safety

Station safety plans would be kept current and provide emergency contacts, safe operating procedures, and up-to-date training for all employees. Annual review of the station safety plan would be conducted and the plan would be available to all employees, contractors, and visitors, on request. All public use facilities at the refuge and GPNC would be made safe and accessible to everyone. The refuge bridges, trails, roads, and parking lots would be kept to provide safe access and travel. The refuge would keep directional, regulatory, and safety signs along routes of travel.

Emergency shelters would be provided at the refuge and GPNC for employees and visitors.

Security cameras would be used to provide more security for the employees and visitors at the Quivira Refuge headquarters.

The refuge would keep up-to-date Memorandum of Understandings for mutual aid and emergency response with Stafford, Reno, and Rice counties to provide added enforcement for emergencies, disasters, and public safety on and off refuge. The Service-owned GPNC would continue to rely on law enforcement and fire protection provided by the City of Wichita Police Department and security provided by Protection One or a similar contracted alarm system company. Refuge and GPNC fire extinguishers and Automated External Defibrillators would continue to be inspected monthly, with annual professional inspections being conducted. Annual fire drills, annual tornado drills, quarterly safety meetings, and frequent safety briefings for the employees would be conducted. The refuge and GPNC would continue to keep all safety plans current.

The refuge would watch for signs of diseases that could potentially influence the health and safety of visitors and employees such as West Nile virus and avian influenza. The refuge would follow the Region 6 mosquito control plan and pandemic influenza plan. Quarterly water testing for coliforms, nitrates, nitrites and annual testing of lead and copper would continue to be conducted for drinking water at the headquarters and visitor center, the environmental education center, the residences, and bunkhouses.

Job hazard analysis would be kept up to date for hazardous operations performed by employees and proper training provided. The refuge would continue to employ a designated collateral duty safety officer that would oversee the safety operations at the refuge and the GPNC. Annual safety inspections by the collateral duty safety officer and tri-annual inspections by the regional safety office would be conducted at the refuge and the GPNC. Public events and associated activities would continue to be conducted with safety as a high priority.

Resource Protection

The entire refuge would be open to foot travel, unless otherwise posted as closed for critical nesting habitat, presence of whooping cranes, or for any other reason. The refuge would keep the employment of two commissioned, dual-function officers that would provide approximately 25–49 percent of their time conducting law enforcement activities. The focus would be on compliance checks for hunters and anglers on and in proximity to the refuge, keeping regulatory signage, and enforcement of the refuge hunting closure on the entire refuge when whooping cranes are present on the refuge.

Law enforcement would enforce the refuge-specific closures. Refuge officers would also check and enforce the compliance of special use permits and activities. Law enforcement and the refuge's visitor services staff would work together to inform the media and the public of regulation changes.

Administration Actions

This section includes actions for staff and budget and facilities and infrastructure under alternative A.

Staff and Budget

Staff and budget actions include those at both Quivira Refuge and the GPNC.

Quivira Refuge

Our budget at the refuge is adequate to support current staff and facilities. A list of permanent and temporary staff, as well as recommended staff increases, can be found in section 4.9 Administration and in table 17. We also hire one-to-five seasonal biological aids and technicians and range technicians each year as our budget allows. We also use the Youth Conservation Corps (YCC) program, generally with three enrollees annually for 8 weeks. Quivira Refuge also provides office space for a regional refuge zone biologist and a Partners lands biologist.

Great Plains Nature Center

We would continue to support the GPNC through its partnership with the City of Wichita Department of Park and Recreation and the KDWP. Our staff level at the GPNC would remain the same.

Present Limitations and Future Potential

Our capacity for active management at the refuge is constrained by limited staff and budgeting. Our current staff levels are insufficient to meet program mandates, which would result in limited management on some units. More staff would be needed to meet the minimum staff needs as identified in the Refuge Operating Needs System (RONS) database and in a separate law enforcement needs list. The top priority in RONS for Quivira Refuge is to add one permanent, full-time maintenance worker. The regional law enforcement staff plan identified adding one permanent full-time refuge officer. We would seek money through grants and initiatives to supplement staff and projects at the refuge.



The Great Plains Nature Center draws an ever-increasing visitation from the city of Wichita and beyond.

Facilities and Infrastructure

We would keep facilities, infrastructure, vehicles, and other equipment in good working condition and use annual and deferred maintenance money to achieve our goals. We would not, however, allow the trapping of nuisance animals.

We have 25 miles of canals, 24 miles of dikes and 103 water control structures on the refuge that are used for water delivery and wetland management. We would continue to support more than 14 miles of roads and 33 parking lots for public use and 27 miles of roads for our management purposes. We would also keep more than 97 miles of barbwire fence and 54 miles of electric fence for the grazing program.

Our buildings on the refuge include an office, a visitor center, a maintenance shop, three storage buildings, one pole barn, an environmental education classroom, two residences, two bunkhouses and two vault toilets.

The GPNC has a large visitor center building with classrooms, offices, and an auditorium; a separate storage garage; and a fenced compound.

The RONS database identifies a deferred maintenance projects list, which is a potential source of more money.



We would focus on restoring native communities and promoting the potential natural range of conditions on Quivira National Wildlife Refuge that help focal resources, or focal species and their respective habitats and on increasing public use opportunities for hunting. We would increase our attention and understanding of the connectedness of habitats and the effectiveness of our management. To achieve this alternative, relatively minor changes in our operations; inventory, monitoring programs, and research; staff; and infrastructure would likely be required.

Focal Species or Resources

National wildlife refuges are managed for “wildlife first,” however, Quivira Refuge is isolated within a fragmented watershed with disrupted processes. It is too small to successfully meet the life cycle needs of all native wildlife that historically occurred on these refuge lands yearly. Therefore, we manage habitat conditions to optimize productivity and sus-

tainability, which requires dynamic fluctuations in hydrology and periodic disturbance.

Our approach ultimately helps a greater diversity of native wildlife over the long term, as habitat conditions are in a constant state of flux.

To make sure that critical habitat resources are provided to as many species as possible, our planning team developed a list of priority management species termed “focal species or resources” that can be used as indicators of habitat quantity and quality over time (table 3). We developed this list using various regional and national conservation plans and species of concern lists, while applying refuge location and natural resources for context. We considered factors such as: (1) relevance to the refuge purposes and proper policies and mandates; (2) a species status as native or nonnative; (3) species population trends; (4) species range distribution in relation to refuge location; (5) species current and potential occurrence on refuge lands; (6) species tolerance of grassland fragmentation, urbanization, and agricultural activities; and (7) the availability and condition of habitat outside refuge boundaries (figure 7).

We are now working on technical guidance for the implementation of a surrogate species approach for managing species. Surrogate species is a commonly used scientific term for system-based conservation planning that uses a species as an indicator of landscape habitat and system conditions. Surrogate species are used for comprehensive conservation planning that supports multiple species and habitats within a defined landscape or geographic area.

Different criteria are used to create focal species and surrogate species, and the two terms are not interchangeable. Therefore, definitions and criteria

described in the Quivira Refuge CCP and EA for focal species were developed independently of the surrogate species approach. When the Service finishes the surrogate species approach, we will implement it as appropriate.



Interior Least Tern

USFWS



Bald Eagle

USFWS

Table 3. Focal species by life event and habitat at Quivira National Wildlife Refuge, Kansas.

Species Common Name	Recent Seasonal Abundance ¹				Management Priority by Habitat Association and Life Event ²		
	March to May	June to August	September to November	December to February	Migration	Breeding	Wintering
<i>Ducks, Geese, and Swans</i>							
1	Greater White-fronted Goose	c	r	c	c	WWW	WWW
2	Snow Goose	c	r	c	c	WWW	WWW
3	Ross's Goose	u		u	u	WW	WW
4	Cackling Goose	c	r	c	c	WWW	WWW
5	Canada Goose*	c	c	c	c	WWW	WWW GGG
6	Trumpeter Swan	o		o	o	W	W
7	Tundra Swan	o		o	o	W	W
8	Wood Duck*	c	c	c	o	WWW	
9	Gadwall*	c	u	c	o	WWW	WW GG
10	American Wigeon*	c	u	c	o	WWW	
11	Mallard*	c	c	c	c	WWW	WWW GGG
12	Blue-winged Teal*	c	c	c		WWW	WWW GGG
13	Cinnamon Teal	u	r	o	r	W	
14	Northern Shoveler*	c	u	c	u	WWW	WW GG
15	Northern Pintail*	c	u	c	c	WWW	WW GG
16	Green-winged Teal*	c	o	c	u	WWW	
17	Canvasback*	c	o	c	u	WWW	WW
18	Redhead*	c	o	c	u	WWW	WW
19	Ring-necked Duck	c	o	c	u	WWW	WW
20	Greater Scaup	o		o	o	W	W
21	Lesser Scaup*	c	o	c	u	WWW	WW
22	Bufflehead	u		c	c	WWW	WWW
23	Common Goldeneye	c		c	c	WWW	WWW
24	Hooded Merganser*	u	r	u	u	WW	WW
25	Common Merganser	u		r	c	WW	WWW
26	Red-breasted Merganser	r		o	r	W	W
27	Ruddy Duck*	c	u	c	u	WWW	WW
<i>Grouse and Quail</i>							
28	Greater Prairie-Chicken*	r	r	r	r		G
29	Lesser Prairie-Chicken	Refuge was part of historical range, but is not now. May use in future, especially considering climate change adaptation.					
30	Northern Bobwhite*	u	u	u	u		GG SS
<i>Loons and Grebes</i>							
31	Pied-billed Grebe*	c	c	c	o	WWW	WWW
32	Horned Grebe	u		u	o	WW	
33	Eared Grebe*	c	o	c	r	WWW	
<i>Pelicans and Misc.</i>							
34	American White Pelican	c	c	c	o	WWW	

Table 3. Focal species by life event and habitat at Quivira National Wildlife Refuge, Kansas.

Species Common Name	Recent Seasonal Abundance ¹				Management Priority by Habitat Association and Life Event ²		
	March to May	June to August	September to November	December to February	Migration	Breeding	Wintering
<i>Hérons, Egrets, and Ibis</i>							
35	American Bittern*	u	u	u	o	WW	WW
36	Least Bittern*	o	u	o		W	WW
37	Great Blue Heron*	c	c	c	u	WWW	
38	Great Egret*	c	c	c		WWW	WWW (foraging)
39	Snowy Egret*	c	c	c		WWW	WWW (foraging)
40	Little Blue Heron*	u	u	o		WW	
41	Green Heron*	u	u	o		WW	
42	Black-crowned Night-Heron*	c	c	c	r	WWW	WWW
43	Yellow-crowned Night-Heron*	u	u	o		W	
44	White-faced Ibis*	c	c	c	r	WWW	WWW (foraging)
<i>Birds of Prey</i>							
45	Mississippi Kite*	u	u	o		TT	TT
46	Bald Eagle*	u	u	u	c	WW TT	TT WWW TTT
47	Northern Harrier*	c	o	c	c	WWW GGG	W G WWW GGG
48	Swainson's Hawk*	c	c	o		GGG TTT	SSS TTT
49	Ferruginous Hawk			r	o	G	G
50	Rough-legged Hawk	u		r	u	WW GG	WW GGG
51	Prairie Falcon	r	r	o	o		W
<i>Rails and Cranes</i>							
52	Black Rail*	u	u	r		WW	WW
53	King Rail*	u	u	r	r	WW	WW
54	Virginia Rail*	c	c	u	o	WWW	WWW
55	Sora*	c	u	c		WWW	WW
56	Sandhill Crane	c		c	o	WWW	W
57	Whooping Crane	o		o	r	W	
<i>Shorebirds</i>							
58	Black-bellied Plover	u	u	u	r	WW	
59	American Golden-Plover	u	o	u		WW	
60	Western Snowy Plover*	c	c	c		WWW	WWW
61	Semipalmated Plover	c	u	c		WWW	
62	Piping Plover	u	o	o		W	
63	Killdeer*	c	c	c	o	WWW	WWW
64	Black-Necked Stilt*	c	c	u		WWW	WWW
65	American Avocet*	c	c	c		WWW	WWW
66	Spotted Sandpiper*	c	u	c		WWW	

Table 3. Focal species by life event and habitat at Quivira National Wildlife Refuge, Kansas.

Species Common Name	Recent Seasonal Abundance ¹				Management Priority by Habitat Association and Life Event ²		
	March to May	June to August	September to November	December to February	Migration	Breeding	Wintering
67	Solitary Sandpiper	u	u	o		WW	
68	Greater Yellowlegs	c	c	c	o	WWW	
69	Willet	u	u	u		WW	
70	Lesser Yellowlegs	c	c	c	r	WWW	
71	Upland Sandpiper*	c	o	o		WWW	WW GG
72	Whimbrel	o	o	o		W	
73	Long-billed Curlew	o	o	o		W	
74	Hudsonian Godwit	u	r	u		WW	
75	Marbled Godwit	u	u	u		WW	
76	Ruddy Turnstone	o	o	o		W	
77	Sanderling	o	o	o		W	
78	Semipalmated Sandpiper	c	c	c		WWW	
79	Western Sandpiper	c	c	c		WWW	
80	Least Sandpiper	c	c	c		WWW	
81	White-rumped Sandpiper	c	c	u		WWW	
82	Baird's Sandpiper	c	c	c		WWW	
83	Pectoral Sandpiper	u	u	u		WW	
84	Dunlin	u	o	u	r	WW	
85	Stilt Sandpiper	c	c	c		WWW	
86	Buff-breasted Sandpiper	o	r	u		WW	
87	Short-billed Dowitcher	u	u	o		WW	
88	Long-billed Dowitcher	c	c	c		WWW	
89	Wilson's Snipe	u	r	u	o	WW	
90	Wilson's Phalarope*	c	c	c		WWW	WWW GGG
91	Red-necked Phalarope	o	r	o		W	
<i>Gulls and Terns</i>							
92	Franklin's Gull	c	u	c	r	WWW	
93	Interior Least Tern*	u	u	o		WW	
94	Black Tern*	c	c	u		WWW	
95	Forster's Tern*	c	c	o		WWW	
<i>Pigeons and Doves</i>							
96	Yellow-billed Cuckoo*	o	u	r			SS
<i>Owls</i>							
97	Short-eared Owl*	r		r	o		G
<i>Woodpeckers</i>							
98	Red-headed Woodpecker*	c	c	c			TTT
<i>Flycatchers</i>							
99	Western Kingbird*	c	c	u			SSS TTT
100	Eastern Kingbird*	c	c	u			TTT
101	Scissor-tailed Flycatcher*	o	o	o			S

Table 3. Focal species by life event and habitat at Quivira National Wildlife Refuge, Kansas.

Species Common Name	Recent Seasonal Abundance ¹				Management Priority by Habitat Association and Life Event ²		
	March to May	June to August	September to November	December to February	Migration	Breeding	Wintering
<i>Shrikes and Vireos</i>							
102	Loggerhead Shrike*	u	u	u	u	SS TT	
103	Bell's Vireo*	u	u	o		SS	
<i>Larks</i>							
104	Horned Lark*	o	o	o	o	G	G
<i>Thrushes, Pipits, Waxwings, and Misc.</i>							
105	Sprague's Pipit	r		r		G	
<i>Longspurs</i>							
106	Lapland Longspur	r		o	u		GG
107	Chestnut-collared Longspur	r			r	G	
<i>Wood Warblers</i>							
108	Yellow Warbler*	u	u	o		SS (riparian area)	SS TT
109	Common Yellowthroat*	c	c	u	o	GGG	WWW GGG
<i>Sparrows and Towhees</i>							
110	Cassin's Sparrow	r					G S
111	Field Sparrow*	c	u	c	u	GGG	GG GG
112	Vesper Sparrow	c	r	c		GGG	
113	Lark Sparrow*	c	u	o		GGG	GG
114	Savannah Sparrow	c		c	o	GGG	
115	Grasshopper Sparrow*	u	u	u		GG	GG
116	Le Conte's Sparrow	o		o	r	W G	
117	Harris's Sparrow	c	r	c	c	GGG	SSS
<i>Grosbeaks and Buntings</i>							
118	Blue Grosbeak*	u	u	r			SS
119	Dickcissel*	c	c	r			GGG
<i>Blackbirds and Allies</i>							
120	Bobolink*	u	u				GG
121	Red-winged Blackbird*	c	c	c	c	WWW	WWW
122	Eastern Meadowlark*	c	c	c	c		GGG GGG
123	Western Meadowlark*	u	o	u	c		G GGG
124	Yellow-headed Blackbird*	c	c	u	r	WWW	WWW
125	Orchard Oriole*	c	c	o			TTT
126	Baltimore Oriole*	c	c	o			TTT
<i>Finches</i>							
127	American Goldfinch*	c	c	c	c	GGG	GGG GGG

* Reported nesting on the refuge.

1 Abundance is indicated as follows: c = common (certain to be seen in suitable habitat), u = uncommon (present, but not certain to be seen), o = occasional (seen a few times during season), r = rare (seen every 2–5 years).

2 Habitat Association is indicated as follows: G = grass or meadow, W = wetland–riparian area–flooded, S = shrubs, T = isolated trees–small groves. Within a cell, the number of times a letter is repeated is proportional to abundance. For example, WWW = common and W = occasional or rare in wetland habitat during the indicated life event.

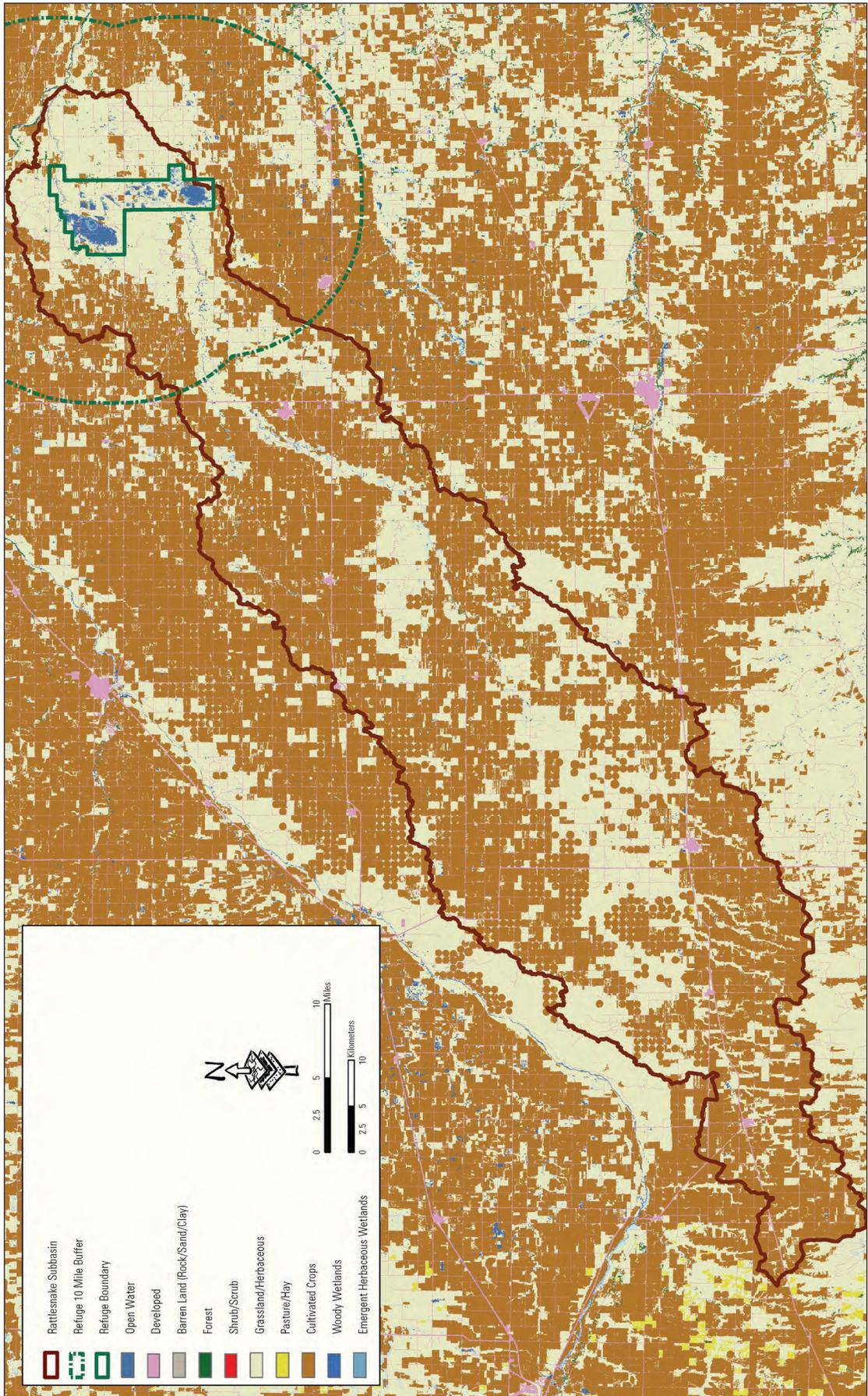


Figure 7. Land use and habitat outside the boundaries of Quivira National Wildlife Refuge, Kansas.

Landscape Conservation Actions

This section includes actions for climate change and land protection under alternative B.

Climate Change

Would be the same as under alternative A.

Land Protection

Our actions would be the same as under alternative A. We would also increase work with adjacent private landowners through the Partners for Fish and Wildlife (Partners) program in a newly established focus area that is comprised of Quivira Refuge and Cheyenne Bottoms Wildlife Area. We would rank areas, when possible, based on providing quality habitat for focal resources with a secondary emphasis on restoring natural processes. However, conducting projects would depend on the level of interest and objectives of private landowners.

Native Ecological Community Conservation Actions

This section includes actions for a variety of habitats and activities under alternative B.

Big Salt Marsh

We would mimic a more natural hydroperiod that promotes the sustainability of native plant communities that meet the requisites of focal species. Hydrology, or the quantity, timing, and duration of flooding, would be largely determined by climate elements such as precipitation and temperature and by ground water discharge. Our intentional diversions of Rattlesnake Creek water into the BSM would be infrequent and used primarily to overcome the limitations of our existing water management infrastructure on the refuge. For example, we may periodically divert water through water control structures on the east side of the BSM through units 57 and 58 and along the east side of Wildlife Drive to Salt Creek because this is the only way to actively dewater units 57 and 58 and some Rattlesnake Creek canal water and a way management handles flood flows in this area.

Also, because we face a declining water table and other uncertainties about water availability in the watershed, it is possible that our management of the BSM may become more reliant on Rattlesnake Creek water in the future. Therefore, while this alternative



Dickcissel

Aron Flanders/USFWS

would seek to decrease regular use of Rattlesnake Creek water in this area of the refuge, we would keep our ability to periodically use this water source. We would evaluate the need, and the ability, to change ditches and structures to improve natural hydrology as long as focal species and their associated habitats are not compromised. We would be able to use prescribed fire, chemicals, mechanical methods, and prescriptive grazing to restore native plant communities and provide for focal species.

Little Salt Marsh

Would be the same as under alternative A.

Riparian Corridor

Our actions would be the same as under alternative A, but we would place a greater emphasis on restoring the native plant communities and structure needed to support focal resources.

Created Wetlands

Our actions would be the same as under alternative A, except drawdown, flooding, and rehabilitation treatments would more specifically consider the needs of focal species and their associated habitats. Our staff would evaluate opportunities and conduct actions, as our budget allows, to improve water management capabilities and efficiencies that would help us to promote seasonal wetland plant productivity and diversity.

Freshwater Springs

Our actions would be the same as under alternative A, except that we would evaluate the effects of removing or changing the artesian well pipe, human-altered features, and current environmental conditions in the Boiling Springs area. If our evaluation

shows that changes would likely be positive for the native plant community and threatened and endangered (T and E) fish habitat needs, then we would act to improve conditions. Grazing, fire, chemical, and mechanical treatments would be limited to the best methods for controlling invasive species while supporting native communities and the needs of focal resources.

Meadow

Our actions would be the same as under alternative A, except that we would place more emphasis on restoring hydrology and native plant communities that provide structure and foods that support focal resources. For example, we would seek to restore sheet flow and ground water movement in meadows as long as it doesn't negatively affect other communities, such as created wetlands. We would use prescribed grazing and prescribed fire to restore or support the native plant community composition and structure required for focal resources. Initially, we would apply chemical and mechanical treatments more extensively to control woody invasive species, and then we would rely on prescribed fire, grazing, and mechanical treatments, such as haying, to support desirable plant communities.

Woodland

Our actions would be the same as under alternative A, except that we would place more emphasis on developing prescriptions that would increase benefits for focal resources.

Sand Prairie Complex

Our actions would be the same as under alternative A, except that management decisions would be based on creating habitat conditions that meet the life history needs of focal resources at a finer level. We would evaluate and possibly remove infrastructure that improves sheet flow but does not compromise other community types. We would place temporary fences to aid grazing in controlling undesirable vegetation and to create structure for focal species.

Cropland

Our actions would be the same as under alternative A, plus go-back areas, which are areas that were farmed before and that have been allowed to revegetate without human intervention, would be "interseeded" and managed more intensively using prescribed grazing, fire, and mechanical or chemical

treatments to restore native plant community composition and structure.

Migratory Birds

Emphasis on obligate and endemic grassland and meadow species that are focal resources would be increased.

Fish

Our actions would be the same as under alternative A, plus we would evaluate creating and keeping suitable habitat for focal resources that are of conservation concern in proper areas, like sloughs and segments of the Rattlesnake Creek channel. Our staff would work with partners to conduct habitat management and restoration actions and, if appropriate, reintroduce species. We would conduct more intensive monitoring programs on habitats and focal species to quantify population health.

Threatened and Endangered Species and Species of Concern

Our actions would be the same as under alternative A, plus we would carry out strategies in proper habitats that explicitly address the needs of species of concern, as well as State- and federally listed fish, amphibians, and reptiles.

Wildlife Native to the Region

Our actions would be the same as under alternative A, with the recognition that this alternative would add detailed structural habitat needs for focal species.

Wildlife Health

Our actions would be the same as under alternative A, plus we would watch water quality and quantity more closely to detect changes that may adversely affect refuge resources and we would allow trapping—after a trapping plan has been approved—with a special use permit, if necessary, to help us control mammalian predators, such as skunks and raccoons, that negatively affect focal resources or that pose a disease risk. We would: allow the use of body gripping traps, commonly known as Conibear® traps, and live traps; continue to prohibit leg-hold traps; and set areas and seasons for trapping that avoid conflicts with whooping cranes and hunters and use methods that promote the safety of visitors and refuge staff.

Inventory, Monitoring, and Research

Our actions would be the same as under alternative A, plus we would develop more monitoring protocols so that we can better help focal wildlife and habitat resources. We would advocate for research that informs or complements refuge management or landscape-level monitoring programs and studies.

Visitor Services Actions

This section includes actions for a variety of activities under alternative B.

Hunting

We would expand hunting on Quivira Refuge by increasing the area open to hunting and adjusting traditional hunting zone boundaries to protect endangered species. For all hunting seasons, the refuge manager would have the authority to close any area at any time to protect endangered species like the whooping crane. We would evaluate decisions and details related to the hunting program, including but not limited to changes in hunting season frameworks, on how they directly and indirectly affect wildlife populations and behaviors and on how they provide quality public hunting experiences

Migratory and Upland Birds

Hunting for migratory and upland birds would be the same as under alternative A, except that the hunting area would be modified to reduce conflict with traditional whooping crane use areas. We would only close specific units when whooping cranes are present in, or near or next to, those units. The recent movements and behavior of whooping cranes would be among multiple factors that we would consider when closing areas to hunting. The entire area open to waterfowl hunting would consist of no more than 40 percent of the refuge, based on Quivira Refuge's legislative authorities and as required by the Administration Act. Based on our past experience, this change would result in an increase in the number of days that the public could hunt waterfowl on the refuge. Upland bird hunting areas would not necessarily be the same areas as those for waterfowl hunting.

Deer

We would establish a new, limited archery hunting season for white-tailed deer. We would set herd health and population targets in consultation with KDWPT that would be used to define bag limits and areas open for hunting. We may also consider limited muzzleloader and shotgun seasons if we find that

population targets would not be met with archery-only hunting. We would also consider visitor safety in determining which areas would be open to hunting and which types of hunting would be offered.

Upland Game (Turkey, Prairie-chicken, Furbearers)

We would establish a new turkey hunting season and a furbearer hunting season. The area open for hunting would be established by our refuge management in consultation with KDWPT, and we would set bag limits based on refuge populations and wildlife health targets. Under this alternative, prairie-chicken hunting would be allowed only if our refuge staff finds that refuge populations are deemed to be of sufficient health.

Fishing

Our actions would be the same as under alternative A, except that we would only stock fish in the Kid's Fishing Pond or to reestablish native fish. Frogging for bullfrogs, only, would be allowed. All activities at Kid's Fishing Pond would require adult supervision.

Wildlife Observation and Photography

Would be the same as under alternative A.

Environmental Education and Interpretation

Our actions would be the same as under alternative A, except that we would emphasize focal resources and how we manage for them in environmental education and interpretation programs. The environmental education and interpretation programs are continuously being enhanced, modified, or adapted to meet changes in methods and content at both Quivira and the GPNC. We would also allow and encourage virtual geocaching to increase the appreciation of our resources at Quivira Refuge.

At the GPNC, we would continue to evaluate the exhibits and displays found in the Koch Habitat Hall and update them, as needed and as money becomes available. We would continue to evaluate the facility as it fits the needs of the partner agencies and make changes, as needed and as money becomes available.

Other Uses

Our actions would be the same as under alternative A, except that we would allow commercial photography and commercial tours for birding only, both with a special use permit.

Public Outreach Actions

Our actions would be the same as under alternative A, plus we would install a tower camera at the nesting bald eagle and BSM areas to help visitors understand and appreciate our resources on Quivira Refuge. We would set up a moveable camera to aid wildlife viewing on the refuge and the public would have a better idea of the wildlife to be seen when looking toward the BSM area. Camera-related activity would be noted on the Web, through social media and in public programs.

Setting up a tower camera would also encourage more visitation to the refuge and our Web page.

Cultural Resources Actions

Our actions would be the same as under alternative A, except that we would also increase the interpretation of cultural resources by adding exhibits in the visitor center and in the environmental education center and we would install better signage through-

out the refuge. We would also work with tribal partners to provide more correct and diverse interpretation products.

Visitor and Employee Safety and Resource Protection Actions

This section includes actions for visitor and employee safety and resource protection under alternative B.

Visitor and Employee Safety

Would be the same as under alternative A.

Resource Protection

Our actions would be the same as under alternative A, except that our refuge hunting areas would be modified and we would establish new regulations on when and how to close areas when whooping cranes are present.



Barry Jones/USFWS

This observation tower at the Little Salt Marsh is part of the extensive infrastructure maintained on Quivira Refuge.

Administration Actions

This section includes actions for staff and budget and facilities and infrastructure under alternative B.

Staff and Budget

Would be the same as under alternative A.

Facilities and Infrastructure

Our actions would be the same as under alternative A, plus we would ask for another cold storage building and fire cache to fully carry out this alternative. The bunkhouse in the center of the refuge would be replaced with a facility in a new location near our headquarters. Water quality at the bunkhouse is poor, and consolidating all residences would reduce the footprint of our administrative sites and provide a nicer living area. We would also issue special use permits to trap and remove beavers and other burrowing animals that threaten our infrastructure, including water control structures, roads, dikes, and canals (see above wildland health section, alternative B, for details).

We would ask for more space at the GPNC for a larger classroom, a multipurpose room, and more offices. Money would mostly come from sources outside the Government. We would also ask for another storage building and a larger equipment compound.

To the extent possible, we would promote self-sustaining natural processes with less regard to the effects on focal species relative to alternative B, though we understand that complete ecological restoration is impossible. Our key values for restoring natural ecological processes include achieving the long-term sustainability of native communities and lowering maintenance costs. We find that it is widely accepted that native plant communities tend to be more resilient to climate change and other environmental stressors than nonnative and highly managed ecosystems. Native wildlife species, including our trust resources, are also able to adapt to such changes. Our efforts, such as prescribed fire, grazing, and invasive species control, would be focused on supporting native plant community composition and diversity, and we would presume that native wildlife would benefit from these activities. Relative to our other alternatives, habitat conditions would be allowed to fluctuate more with climatically driven

wet and dry cycles, however, we would still need to mitigate the effects of past land uses on the refuge and in the watershed that have permanently altered some ecological processes.

Considerable time would be required up front for us to assess current ecological functions, find key elements that should be restored, and evaluate potential restoration options that could be conducted given biological, economic, social, political, and legal constraints.

Our ability to restore surface and subsurface hydrology is the one factor most likely to influence restoration potential. First, to maintain water rights to conserve natural resources, we would need some water control structures to remain on Quivira Refuge to divert Rattlesnake Creek water. Second, we cannot alter, or fully mitigate for, some infrastructure and actions known to change hydrologic processes, such as county roads that bisect important flow paths on the refuge and water uses by others that deplete ground water in the watershed. While these are major constraints, opportunities would still exist to improve ecological functions. For example, we could alter water amounts and movements to mimic natural, seasonal patterns of flooding, and we could remove or change dikes and trails on the refuge to restore hydrologic connectivity and sheet flow in certain refuge areas.

We would carry out this alternative in stages over many years, and changes in our research and monitoring programs, staff, operations, and infrastructure on the refuge would be required. Our success would be greatly influenced by our ability to develop new and expanded partnerships with stakeholders in the Rattlesnake Creek watershed.

Landscape Conservation Actions

This section includes actions for climate change and land protection under alternative C.

Climate Change

Our actions would be the same as under alternative A, plus we might increase ecosystem resilience by restoring ecological processes on a greater part of the refuge. However, we may have less control over the area's hydrology when we remove or change some infrastructure, which may influence the amount of available wetland habitat within, and among, years.

Land Protection

Our actions would be the same as under alternative B, except that we would rank areas based on

restoring ecosystem processes and place less emphasis on providing resources for focal resources.

Native Ecological Community Conservation Actions

This section includes actions for a variety of habitats and activities under alternative C.

Big Salt Marsh

We would manage water the same as under alternative B, except that we would focus more on the restoration and sustainability of native plant communities than on focal resources. We would use fire and grazing prescriptions to restore native plant communities and then on supporting native plant community composition and nutrient cycling. We would use patch burns, which involve the use of prescribed fire to make certain areas more attractive to grazing by cattle or bison and to create a diversity of habitat in the landscape, and we would evaluate the grazing by native ungulates, like bison, as a possible prescription. We may need to remove interior fences, and we would only use chemical and mechanical treatments during the plant restoration phase.

We would manage infrastructure the same as under alternative B, except that we would evaluate our ability and need to change the infrastructure that we own, such as roads, dikes, ditches, and water control structures, for improving the sustainability of native communities and natural hydrology instead of for focal resources. For example, we would consider the modification or removal of the wildlife drive dike or road to Mandalay.

Little Salt Marsh

Our actions would be the same as under alternative B, except that we would focus more on restoring processes for the long-term sustainability of native plant communities than on supporting annual habitat needs for focal resources.

Riparian Corridor

Our actions would be the same as under alternative B, except that we would evaluate our infrastructure for managing created wetlands, and we would change or remove features that we find to be nonessential or obstructive to natural hydrologic flow paths. We would evaluate adding more diversion points as a strategy to mimic natural hydrologic patterns in sloughs and in Rattlesnake Creek. We would

restore natural hydrology and processes in certain areas to support the sustainability of native communities with the assumption that native wildlife would benefit from our efforts.

Created Wetlands

Our actions would mimic a more naturally functioning system that may require less active water management by refuge staff. Our current infrastructure used to manage created wetlands would be evaluated, and features that are nonessential or that hinder natural hydrologic flow paths would be removed or modified to restore hydrology and to improve native plant communities.

We would consider adding diversion points as a strategy to increase our flexibility in restoring hydrology. Most created wetlands would be restored to native habitat types based on an HGM analysis conducted for Quivira Refuge (Heitmeyer et al. 2012).

Freshwater Springs

Would be the same as under alternative B.

Meadow

Our actions would focus on restoring the natural processes and native vegetation characteristic of meadows in this region. We would base hydrology on ground water discharge, sheet flow, and precipitation. The infrastructure that we own, such as roads, dikes, ditches, and water control structures, would be evaluated, and features that are considered nonessential would be removed to improve natural hydrology. Our restoration success would be affected, in part, by limitations in our ability to mitigate onsite and offsite hydrologic effects that are beyond our control, like the presence of county roads and changes in the water table.

We would use fire and grazing prescriptions to restore native plant communities and then to support the processes, like nutrient cycling, necessary to support native plant community composition. We would consider using patch burns and grazing by native ungulates, like bison, and we may remove interior fences. We would use chemical and mechanical treatments extensively up front to combat invasive species, but we would only use it later when prescribed fire and grazing are not effective.

Woodland

We would remove woodlands, such as larger shelterbelts and planted tree groves (figure 6), and we would restore these areas to their proper habitat

types as described in an HGM analysis for Quivira Refuge (Heitmeyer et al. 2012) and in chapter 4.

Sand Prairie Complex

Our actions would be the same as under alternative B, except that we would focus on restoring natural functions and native plant and wildlife communities.

We would use fire and grazing prescriptions up front to restore native plant communities and then use prescriptions to support environmental conditions and native plant community composition. Because we would manage for natural processes, we would expect sand blowouts and active sand dunes to develop, which we would consider to be parts of this habitat type. Interior fences may be removed and patch burn grazing by native ungulates, like bison, may be used to support native communities. We would use chemical and mechanical treatments extensively during the plant restoration phase, but use these later only when fire and grazing are not effective.

We would remove or alter, as in breach, infrastructure such as refuge roads and ditches when necessary to restore hydrology and to promote native plant communities. As a result, it is possible that prairie or upland vegetation might replace wetland vegetation. Initially we would use existing fencing to accomplish plant restoration, but, when restoration is complete, nonessential interior fencing would be removed.

Cropland

Our actions would be the same as under alternative B, except that we would devote more resources to restoration activities and restore cropland to native communities more quickly.

Migratory Birds

Actions would involve a variety of habitats.

Wetland

Our actions would be the same as under alternative A, except that some created wetland habitat would be removed and surface water would be reduced in the LSM during some years. This would reduce habitat for nesting and migrating waterbirds in most years. The amount of shallowly flooded shorebird habitat would fluctuate annually and, in most years, would be reduced.

Herbaceous Upland

Would be the same as under alternative B.

Woodland

We would remove woodland on the refuge because it is not a naturally occurring habitat type and would not have been present during the presettlement period.

Fish

Our actions would be the same as under alternative B, except that we would remove the Kid's Fishing Pond by restoring it to its original habitat as much as possible. We would restore riparian habitat, including the hydrology of waterways on the refuge, which could increase native fish populations by improving streamflows in the Rattlesnake and Salt Creeks. In addition, we would consider reintroducing native fish into Dead Horse Slough. By restoring freshwater springs, we would expect to enhance the protection and sustainability of existing native fish populations.

Threatened and Endangered Species and Species of Concern

Our actions would be the same as under alternative B, except that our prescriptions would be based more on restoring the processes necessary to promote native communities than on providing habitat for species. While we are uncertain about how habitat conditions will develop, it is possible that we would reduce habitat for interior least tern and western snowy plover nesting in some years and would reduce spring and fall migration habitat for whooping cranes. We would also consider introducing bison and other extirpated native species to the refuge.

Wildlife Native to the Region

Would be the same as under alternative B, except that we would use larger scale prescriptions to promote plant community characteristics.

Wildlife Health

Our actions would be the same as under alternative A, plus our staff would watch for a broader suite of environmental conditions that are related to diseases in this area of the Great Plains. We would conduct more wildlife health surveillance through proactive health checks, and we would manage refuge habitats to decrease adverse health issues. Our restoration of the cropland and removal of the woodland habitat types may reduce disease potential because these habitat types often harbor high concentrations of wildlife. In our evaluation of bison



Rachel Laubhan/USFWS

Eastern Racer

introduction, we would need to consider increased wildlife health issues, such as disease transmission among bison and other herbivores.

Inventory, Monitoring, and Research

Our actions would be the same as under alternative B, except that we would monitor populations to decide if, when, and how hunting and trapping would be allowed on the refuge. Habitat-monitoring programs would increase as we conduct restoration to decide how we might use grazing, fire, and invasive species control.

Visitor Services Actions

This section includes actions for a variety of activities under alternative C.

Hunting

Hunting opportunities would be same as under alternative B, except that we would base all hunting seasons and bag limits on keeping refuge populations at proper sizes based on habitat conditions and wildlife health and not just in accordance with State-determined seasons. Sandhill crane, deer, turkey, and prairie-chicken hunting would be permitted if refuge populations allow it and if it is necessary to address health concerns, as decided on by our refuge staff. We would employ special regulations to address issues specifically related to the refuge deer herd. We would allow furbearer hunting with shotgun or archery only if refuge populations allow it or for

health purposes. Our staff would continue to close the refuge to migratory bird hunting when whooping cranes are present to reduce the risk of killing them. For deer, furbearer, and upland game hunting, we would only close specific units if whooping cranes are present to prevent disturbing them.

Fishing

Our actions would be the same as under alternative B, but only if populations allow them or for health management purposes. We would also more aggressively control nonnative fish, reptiles, and amphibians. We would reduce fishing opportunities in Darrynane Lake, as we would likely remove the structures that provided deeper water habitat there. We would remove the Kid's Fishing Pond.

Wildlife Observation and Photography

Our actions would be the same as under alternative A, except that we would restrict entry during the nesting season to selected roads to reduce disturbance. We would also close the Wildlife Drive during the nesting season and, during the next 15 years, evaluate the need to remove the Wildlife Drive infrastructure because it may negatively affect the environment. Our tour route would be much more limited, when compared to the other alternatives, because our management units would be larger. If we reintroduce bison, viewing opportunities would become more limited because we would remove the hunter access road and, possibly, the Wildlife Drive and we may need to install taller boundary fences. Visitors would have to go around the outside boundary to observe wildlife. Our only open roads would be State, county, and township roads.

Environmental Education and Interpretation

Would be the same as under alternative B, plus we would decrease, or remove, developments such as trails that facilitate the dispersal of invasive plants or that would otherwise negatively affect biological populations through disturbance or other actions.

Other Uses

Our actions would be the same as under alternative A, except that we would decrease, or remove, developments such as trails that facilitate the dispersal of invasive plants or that would otherwise negatively affect biological populations through disturbance or other actions.

During the nesting season, we would close the Wildlife Drive and entry would be restricted to selected roads to reduce disturbance and improve safety.

Public Outreach Actions

Would be the same as under alternative B.

Cultural Resources Actions

Would be the same as under alternative B.

Visitor and Employee Safety and Resource Protection Actions

This section includes actions for visitor and employee safety and resource protection under alternative C.

Visitor and Employee Safety

Would be the same as under alternative A.

Resource Protection

Our actions would be the same as under alternative A, except that we would only stop waterfowl and sandhill crane hunting when whooping cranes are

present. We would leave all other areas open when whooping cranes are present unless a specific unit or area is closed for protection. We would increase efforts to enforce regulations related to closed areas because more areas would be closed when compared to alternatives A and B.

Administration Actions

This section includes actions for staff and budget and facilities and infrastructure under alternative C.

Staff and Budget

Our actions would be the same as under alternative A, plus we would need two more permanent, full-time biological staff to conduct increased biological inventorying and wildlife population and habitat checking. We would need more permanent staff to more aggressively control invasive species and to restore native plant communities. More positions would be needed to manage bison and horses if they are reintroduced to conduct health checks and other necessary activities.

Facilities and Infrastructure

We would set priorities for infrastructure that impedes natural hydrologic flows, and is not necessary, for removal or modification. We would restore lands affected by these changes to habitat types identified in the HGM analysis for Quivira Refuge as best we can. We would remove many interior fences because grazing regimes would change to allow for a much more natural movement of herbivores. Trapping to remove nuisance animals would be the same as under alternative B.

If we reintroduce native herbivores, taller boundary fences would be required and access on interior roads would be reduced because interior fences would be removed to allow for natural movement. We would require bison handling facilities.

3.7 Summary of Alternatives and Consequences

Table 4 summarizes the management actions and environmental consequences for alternatives A–C.

Table 4. Summary of the actions and consequences of the management alternatives for the Comprehensive Conservation Plan for Quivira National Wildlife Refuge, Kansas.

<i>Alternative A—no action</i>	<i>Alternative B—proposed action</i>	<i>Alternative C</i>
Landscape Conservation Goal. Actively protect, preserve, manage, and restore the functionality of the diverse ecosystems of the Rattlesnake Creek watershed.		
Climate Change—actions		
<p>Conserve native communities.</p> <p>Rely on partners, Great Plains landscape conservation cooperatives, Service Climate Change Team for climate change-related information, research and monitoring programs, and modeling.</p>	Same as alternative A.	Same as alternative A, plus restore native plant communities and processes on a greater part of the refuge.
Climate Change—environmental consequences		
<p>Refuge-specific information would be used to improve management strategies or to evaluate changes.</p> <p>We may detect and consider shifts in some plant and wildlife species distributions and conditions, but likely would not differentiate between various factors influencing community changes.</p>	Same as alternative A.	<p>Shift in management focus may result in more support of ecosystem resilience.</p> <p>We may not be in a position to resist, or prolong, community changes over time.</p>
Land Protection—actions		
<p>Promote NRCS, KDWPT, and Partners work with landowners on various types of land protection and management easements and agreements throughout Kansas.</p> <p>Periodically assess roles of the refuge at different landscape scales.</p> <p>Communicate conservation issues.</p> <p>On abandonment of oil wells, reclaim mineral rights.</p>	<p>Same as alternative A, plus would increase work with Partners programs in newly established focus area.</p> <p>Rank areas based on providing quality habitat for focal species with a secondary emphasis on restoring processes.</p>	Same as alternative B, except would rank areas most beneficial to restoring processes, with a secondary emphasis on providing resources for focal species.
Land Protection—environmental consequences		
<p>A potential negative effect is the risk that we promote landscape programs when, in some cases, land management on private lands conflicts or adversely affects the achievement of our objectives.</p> <p>Knowledge of landscape changes would help us interpret changes observed or measured on the refuge, to keep or improve public interactions, to keep or improve relevancy in educational programs, and to promote management efficiency.</p> <p>Socially, the limitation and gradual elimination of oil wells would be a benefit because visitors do not want to see oil-related activities on the refuge. Reduced economic activity on the refuge may affect the local economy over time.</p>	Same as alternative A, plus collaborating on common concerns would improve effectiveness of management.	Same as alternative B, except restoring ecological processes would improve ecosystem resiliency over other alternatives.

Table 4. Summary of the actions and consequences of the management alternatives for the Comprehensive Conservation Plan for Quivira National Wildlife Refuge, Kansas.

<i>Alternative A—no action</i>	<i>Alternative B—proposed action</i>	<i>Alternative C</i>
Native Ecological Community Conservation Goal. Actively conserve and 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.		
Big Salt Marsh—actions		
Manage the BSM and adjacent salt flats largely depending on natural climate and hydrology and minimal use of Rattlesnake Creek water, allowing dynamic fluctuations in water quantity and quality to occur within, and among, years.	Manage under a more natural hydroperiod, while providing native plant communities that meet requisites of focal species.	Restore the natural hydroperiod and native plant communities to the extent possible within certain constraints.
<i>Water Management</i> —Base hydrology on ground water discharge and minimal use of Rattlesnake Creek water.	<i>Water Management</i> —Base hydrology on ground water discharge and minimal intentional diversion of Rattlesnake Creek water.	<i>Water Management</i> —Same as alternative B, except focus more on restoring natural conditions and focus less on focal species.
<i>Fire</i> —Base prescriptions on the restoration of native plant communities.	<i>Fire</i> —Base prescriptions on the restoration of native plant communities and on providing for the needs of focal species.	<i>Fire</i> —Base prescriptions on restoring native plant communities followed by prescriptions that are related to environmental conditions and keeping native plant community composition. Evaluate patch burn grazing.
<i>Chemical and Mechanical Treatments</i> —Use to decrease undesirable plant species and encourage more favorable conditions for native communities.	<i>Chemical and Mechanical Treatments</i> —Restore native plant communities and provide for the needs of focal species.	<i>Chemical and Mechanical Treatments</i> —Restore native plant communities.
<i>Grazing</i> —Use to restore native vegetation.	<i>Grazing</i> —Increase prescriptive grazing to promote restoration of native plant communities and provide for the needs of focal species.	<i>Grazing</i> —Increase prescriptive grazing to restore native plant communities. After completing restoration, use grazing to keep native plant community composition. Evaluate reintroducing bison.
Infrastructure—no change in current infrastructure.	Infrastructure—Evaluate to improve natural hydrology as long it does not compromise focal species management.	Infrastructure—Same as alternative B, except focus more on restoring natural conditions and focus less on focal species.
Big Salt Marsh—environmental consequences		
Dynamic fluctuations in water conditions would promote nutrient cycling and wetland productivity. Carp would be controlled to improve water quality and sunlight penetration through the water column and reduce competition with migratory birds for invertebrate resources. Natural salinity to the marsh would be restored over time and limit the growth of emergent cattail and Phragmites. Promoting natural marsh cycles would allow us to educate about inland saltmarsh systems.	There would be improved natural hydrology to better help focal species. The periodic drying of the marsh would allow wind to naturally scour basins, which is an important process for increasing wetland productivity.	There would be improved natural hydrology but there would be fewer benefits for focal species in some years. Would likely provide less water for hunting and waterfowl early in the season.

Table 4. Summary of the actions and consequences of the management alternatives for the Comprehensive Conservation Plan for Quivira National Wildlife Refuge, Kansas.

<i>Alternative A—no action</i>	<i>Alternative B—proposed action</i>	<i>Alternative C</i>
Big Salt Marsh—environmental consequences (continued)		
<p>Seasonal declines in water levels would increase shallow water–mud-flat habitat to help shorebirds during late-spring and summer migration, but water would not be available in some years for waterfowl migration in September and October.</p> <p>Burning would prevent woody vegetation encroachment, recycle nutrients, prevent litter buildup, and support an early successional stage.</p> <p>Saltcedar—not affected by increased salinities—may increase as new seedlings establish when water levels decline in the summer.</p>		
Little Salt Marsh—actions		
<p>Manage primarily as a water storage wetland to convey water to all the other wetlands throughout the refuge except the BSM area.</p>	<p>Use as storage, but allow fluctuations for productivity, restoring native plant communities, and habitat for T and E, migratory birds, and herptiles.</p>	<p>Same as alternative B, except focus more on restoring natural conditions and focus less on focal species.</p>
Little Salt Marsh—environmental consequences		
<p>Would hold water to flood created wetlands, though it would lose capacity through sedimentation. Could be the last source of water for wildlife in a drought.</p> <p>Would become fresher as salt is slowly diluted through managing as a flow-through marsh, not an overflow sump.</p> <p>Would be attractive to many migratory birds, primarily for roosting and some foraging if water levels are held low in the spring and fall.</p> <p>Carp infestation would recur because of its connection to the creek.</p> <p>Cattails would continue to dominate the shoreline as water levels are kept relatively stable during most of the year and salinities continue to decline. Phragmites and saltcedar would continue to expand without more herbicide control efforts.</p> <p>Would continue to be the most popular fishing location and has an accessible fishing pier. Fishing would still be of low quality because carp dominate and Phragmites and cattail affect the accessibility of shorelines.</p>	<p>Same as alternative A, except the benefits to focal species may increase slightly.</p>	<p>Same as alternative B, except management would encourage natural conditions to the extent possible. In the short term, this would result in less water available for fall flooding, but it is possible that less would be needed as created wetlands would also be altered. The highest periodic flooding would occur after rainfall events in the spring, followed by drying in the summer and fall, while still providing roosting habitat for whooping cranes in the early spring and fall. Nesting by least terns would not increase, but would be occasional depending on favorable habitat conditions.</p>

Table 4. Summary of the actions and consequences of the management alternatives for the Comprehensive Conservation Plan for Quivira National Wildlife Refuge, Kansas.

<i>Alternative A—no action</i>	<i>Alternative B—proposed action</i>	<i>Alternative C</i>
Riparian Corridor—actions		
<p>Manage for water transport with ancillary benefits to wildlife</p> <p>Control invasive plant species with grazing, fire, mowing, tree cutting, chemicals, and rest.</p> <p>Protect current annual water rights.</p>	<p>Same as alternative A, plus emphasize restoring native plant communities and the structure needed to support focal species.</p> <p>Evaluate changing ditches and structures to improve natural drainage, do not compromise created impoundments.</p>	<p>Same as alternative B, except focus less on focal species.</p> <p>Evaluate more diversions and modifications to current nonessential infrastructure to promote the sustainability of natural systems.</p>
Riparian Corridor—environmental consequences		
<p>Would continue to transport nonnative, invasive species.</p> <p>Would provide ancillary help to wildlife.</p> <p>Would discourage cattle from congregating and causing damage by removing invasive trees.</p>	<p>Same as Alternative A, except would place greater emphasis on restoring native plant communities.</p>	<p>Same as Alternative B, except would remove or change features deemed to be nonessential or obstructive to mimic natural hydrologic patterns and support the long-term sustainability of native communities. Native wildlife, presumably, would benefit.</p>
Created Wetlands—actions		
<p>Manage as seasonally flooded wetlands with hydrologic regimes that vary in flooding depth, coverage, timing, and duration within, and among, years.</p> <p>Aggressively control wetland invasive plants to prevent their establishment and spread.</p> <p>Use grazing, prescribed fire, mechanical and chemical treatments, and water manipulation to accomplish objectives for foraging migratory birds and some nesting.</p>	<p>Same as alternative A, except use drawdown, flooding, and rehabilitation treatments for specific focal species.</p> <p>Find opportunities to improve water management capabilities and efficiencies.</p>	<p>Seek modifications to promote the restoration of natural processes and native communities in certain areas.</p> <p>Alter infrastructure to restore sheet flow and natural hydrology, within constraints.</p>
Created Wetlands—environmental consequences		
<p>Without active management, the extent and quality of seasonally flooded wetland resources would be substantially less in most years.</p> <p>High productivity would be sustained with the periodic drying and flooding.</p> <p>Would continue to successfully conserve biological communities, but its extent would not be understood, which would be of highest concern.</p> <p>Could positively influence the predictability and long-term success of implementation with a planning process that more efficiently informs management.</p>	<p>Controlling hydrology within refuge boundaries may increase the long-term probability of sustaining native communities that occurred in presettlement times.</p> <p>Improved planning activities and more fully develop biological knowledge would likely increase the conservation of resources of highest concern.</p> <p>Would likely require more time to collect, synthesize, and assess information in the continual planning process.</p>	<p>Having less control over hydrology within refuge boundaries would pose the greatest risk by increasing reliance on watershed conditions to achieve refuge purposes, goals, and objectives at a time when water quantity and quality are of greater concern. The availability and reliability of required resources for many species might be more dynamic within, and among, years.</p> <p>More temporally to seasonally flooded habitat could replace more permanently flooded habitat and cause species associated with those habitat types to shift accordingly. This change would likely favor many shorebird species over some diving waterfowl species.</p> <p>Time and costs for controlling invasive species could increase.</p>

Table 4. Summary of the actions and consequences of the management alternatives for the Comprehensive Conservation Plan for Quivira National Wildlife Refuge, Kansas.

<i>Alternative A—no action</i>	<i>Alternative B—proposed action</i>	<i>Alternative C</i>
Freshwater Springs—actions		
<p>Sustain in part to protect the current population of Arkansas darters.</p> <p>Evaluate habitat conditions in relation to fish community conservation.</p> <p>Check water quality for adverse effects from increased public contact and evaluate for closure.</p>	<p>Same as alternative A, except would restore hydrology and native plant communities and manage to sustain focal species.</p>	<p>Same as alternative A, except would restore hydrology and native plant communities and manage to sustain T and E species habitat.</p>
<p><i>Water Management</i>—Keep existing pipe and pump from removed oil well or pad.</p>	<p><i>Water Management</i>—Evaluate the potential effects of removing well relative to native plant community and T and E habitat needs. Remove well if effects would be positive.</p>	<p><i>Water Management</i>—Same as alternative B.</p>
<p><i>Grazing</i>—Generally do not allow, however, it may occur periodically when managing adjacent community types.</p>	<p><i>Grazing</i>—Limit to situations when treatment is most effective in controlling invasive species, stimulating plant growth, and creating structure necessary for focal species.</p>	<p><i>Grazing</i>—Use only if needed to keep native plant community or to alter vegetation structure to meet the life requisites of T and E species.</p>
<p><i>Fire</i>—Use only indirectly, as when prescriptions are based on the criteria for adjacent plant communities in the unit.</p>	<p><i>Fire</i>—Use when it is the best method for controlling invasive species, keeping native plant community structure, and creating structure for focal species.</p>	<p><i>Fire</i>—Use only if needed to keep native plant communities or to alter vegetation structure to meet the life requisites of T and E species.</p>
<p><i>Chemical and Mechanical Treatments</i>—Use minimally.</p>	<p><i>Chemical and Mechanical Treatments</i>—Limit to when grazing and prescribed fire are not effective or are unsuccessful in controlling invasive species and creating structure required by focal species.</p>	<p><i>Chemical and Mechanical Treatments</i>—Use only if fire and grazing are unsuccessful in meeting the life requisites of T and E species.</p>
<p><i>Infrastructure</i>—No change.</p>	<p><i>Infrastructure</i>—Depending on evaluation, may remove well to improve natural hydrology. Evaluate changing enhanced ponds near springs.</p>	<p><i>Infrastructure</i>—Same as alternative B, except have ecological restoration in mind instead of the needs of focal species.</p>
Freshwater Springs—environmental consequences		
<p>Fresh water would benefit some wildlife and fresh-to-saline conditions may encourage diversity.</p> <p>Exotic, invasive woody vegetation would increase and green sunfish and possibly other species would be supported in larger ponds that are adverse to the Arkansas darter.</p> <p>Would reduce exotic, invasive trees, which may improve the availability or quantity of water.</p> <p>Existing pipe would remain with unknown effects, full habitat potential may not be realized.</p> <p>Habitat evaluation for fish community conservation would inform future management, but actions would be limited.</p>	<p>Arkansas darter habitat conditions would be protected and enhanced.</p>	<p>Same as alternative B, except emphasis would be on restoring natural ecological conditions that may or may not help species other than the Arkansas darter.</p>

Table 4. Summary of the actions and consequences of the management alternatives for the Comprehensive Conservation Plan for Quivira National Wildlife Refuge, Kansas.

<i>Alternative A—no action</i>	<i>Alternative B—proposed action</i>	<i>Alternative C</i>
Freshwater Springs—environmental consequences (continued)		
<p>Increased visitor use would increase threats to conservation.</p> <p>There would be no anticipated economic or social issues.</p>		
Meadow—actions		
<p>Restore and improve health and productivity.</p> <p>Decrease woody vegetation invasion to prevent conversion and manage for a proper balance of vegetation structure and cover that helps various species.</p> <p>Periodically reduce litter buildup, improve nutrient cycling, and increase the diversity of vegetation structure and composition by using fire, mechanical, and grazing treatments.</p> <p>Influence hydrology by climate, ground water fluctuations like aboveground and belowground flooding, and wetland flooding and drying. Target certain meadow sites.</p>	<p>Same as alternative A, except emphasize restoring hydrology and native plant communities and focus on focal species.</p>	<p>Restore natural hydrology and plant communities, though changes in hydrology within the watershed may limit options.</p>
<p><i>Water Management</i>—Conduct, but with limited ability to control sheet flow. Manage water in created wetlands and ground water discharge as indirect influences.</p>	<p><i>Water Management</i>—Same as alternative A, but emphasize restoring sheet flow and ground water movement in balance with other communities.</p>	<p><i>Water Management</i>—Restore hydrology to the extent possible, including removing or altering infrastructure that inhibit sheet flow and interrupt ground water flow paths.</p>
<p><i>Grazing</i>—Conduct in select areas. Prescription targets vary, but include the removal of litter, breakup of soil duff, stimulation of growth, and promotion of nutrient cycling.</p>	<p><i>Grazing</i>—Base prescription on a combination of restoring or keeping native plant community composition and on structure required for focal species.</p>	<p><i>Grazing</i>—Target prescriptions to restore native plant communities followed by supporting plant communities by more closely emulating natural patterns. Evaluate the introduction of bison.</p>
<p><i>Fire</i>—Base prescription on restoring and keeping native plant communities by removing litter, promoting nutrient cycling, and controlling invasive species.</p>	<p><i>Fire</i>—Base prescription on a combination of restoring or keeping native plant community composition and on structure required for focal species.</p>	<p><i>Fire</i>—Target prescriptions to restore native plant communities followed by supporting plant communities by more closely emulating natural patterns. Evaluate patch burn grazing.</p>
<p><i>Chemical and Mechanical Treatments</i>—Use to control invasive woody species and excessive litter accumulation.</p>	<p><i>Chemical and Mechanical Treatments</i>—First use more extensively to control invasive species and then add other treatments to keep native plant community composition and structure required by focal species.</p>	<p><i>Chemical and Mechanical Treatments</i>—First use intensively to combat invasive species and to restore native communities then limit to cases where fire and herbivory are not effective.</p>
<p><i>Infrastructure</i>—No change.</p>	<p><i>Infrastructure</i>—Find and carry out changes that would improve sheet flow and ground water discharge while not compromising other community types.</p>	<p><i>Infrastructure</i>—Remove or alter infrastructure necessary to restore hydrology and promote native plant communities. Remove interior fences.</p>

Table 4. Summary of the actions and consequences of the management alternatives for the Comprehensive Conservation Plan for Quivira National Wildlife Refuge, Kansas.

<i>Alternative A—no action</i>	<i>Alternative B—proposed action</i>	<i>Alternative C</i>
Meadow—environmental consequences		
<p>Existing infrastructure management may cause changes and conversion to other community types.</p> <p>Reduced levels in the ground water table and changes in surface runoff may cause conversion to other community types. Sheet flow restoration or the removal of past alterations would be minimal.</p> <p>Infrastructure would limit the full biological potential of meadows to support native communities.</p>	<p>Same as alternative A, except expect an improvement in the support of focal species.</p> <p>May see improved awareness of the connectedness of different habitats and species relationships because this is a highly transitional habitat type.</p>	<p>Restoration of natural processes and native vegetation would improve sheet flow and other characteristics necessary for increasing productivity.</p> <p>Effects on ground water levels might highly influence community changes.</p>
Woodland—actions		
<p>Reduce invasive woody vegetation, especially in encroachment areas.</p> <p>Evaluate trade-offs with other areas to sustain native sand prairie communities and meet other conservation concerns, and rank activities accordingly.</p>	<p>Same as alternative A, except emphasize prescriptions that would help focal species.</p>	<p>Remove and restore area to habitat types identified in the HGM report.</p>
Woodland—environmental consequences		
<p>Water table changes would likely have some effect on plant restoration following tree removal. Changes and consequences would be unknown and likely be influenced by watershed management.</p> <p><i>Biological</i>—Would reduce the abundance and, possibly, the richness of wildlife here, which would increase those levels in open prairie habitat.</p> <p>Reducing Russian olive and saltcedar would improve soil and water conservation.</p> <p><i>Social</i>—Would expect mixed reactions from different interest groups. Would be no foreseeable effect on waterfowl hunters.</p> <p>Remaining woodland would not help those species that draw visitors or promote their observation.</p> <p>Would increase the awareness of “wildlife first” and refuge roles and responsibilities.</p>	<p>Same as alternative A, except would improve benefits to focal species.</p> <p>May affect hunters by affecting proposed deer and turkey hunting.</p>	<p>Same as alternative A, except would be made similar to presettlement conditions consisting of few, isolated trees and no tree groves. Would favor native species associated with relatively small groves of native trees and shrubs, and the abundance. Richness of species that now use nonnative shelterbelts would likely be reduced.</p> <p>May affect hunters by affecting proposed deer and turkey hunting.</p>

Table 4. Summary of the actions and consequences of the management alternatives for the Comprehensive Conservation Plan for Quivira National Wildlife Refuge, Kansas.

<i>Alternative A—no action</i>	<i>Alternative B—proposed action</i>	<i>Alternative C</i>
Woodland—environmental consequences (continued)		
<p>Economical—Costs would increase in the short term with reduction followed by habitat restoration. Subsequent costs would decrease in part because of a reduction in invasive species and woody encroachment control. Costs related to water use and availability would decrease with the substantial reductions in tree cover, especially saltcedar along the riparian corridor.</p> <p>Cultural and historic—Would bring communities closer to what occurred in presettlement times.</p>		
Sand Prairie Complex—actions		
<p>Control woody vegetation and conserve the unfarmed areas by using fire, grazing, and mechanical and chemical treatments.</p> <p>Reduce occurrence and control encroachment of invasive woody species to what is believed to have occurred historically.</p> <p>Manage upland sand prairie to support native communities, while keeping a high level of habitat diversity.</p> <p>Evaluate trade-offs and set priorities for woody vegetation to sustain native communities, but also consider supporting other conservation concerns.</p>	<p>Same as alternative A, except: reduce woody vegetation, to help focal species.</p>	<p>Same as alternative A, except restore natural functions and native plant and wildlife communities.</p>
<i>Water Management</i> —None.	<i>Water Management</i> —Same as alternative A.	<i>Water Management</i> —Same as alternative A.
<i>Grazing</i> —Prescriptions would vary by target such as cattail control, vegetation composition and structural diversity, and soil disturbance.	<i>Grazing</i> —Same as alternative A, except focus on helping focal species.	<i>Grazing</i> —Base prescriptions on restoring and supporting native plant communities, including the creation of sand blowouts and active sand dunes. Evaluate the use of bison.
<i>Fire</i> —Target prescriptions to control invasive species, stimulate growth, and remove litter.	<i>Fire</i> —Same as alternative A, except focus on helping focal species.	<i>Fire</i> —Base prescriptions to support native plant communities. Consider patch burn grazing.
<i>Chemical and Mechanical Treatments</i> —Use as needed to control invasive species.	<i>Chemical and Mechanical Treatments</i> —Same as alternative A, except focus on helping focal species.	<i>Chemical and Mechanical Treatments</i> —Use only when fire and herbivory are ineffective.
<i>Infrastructure</i> —No change.	<i>Infrastructure</i> —Remove to improve sheet flow. Use temporary fences to control vegetation and create structure for focal species.	<i>Infrastructure</i> —Remove or alter to restore hydrology and promote native plants. Fence for restoration, then remove what is not essential.

Table 4. Summary of the actions and consequences of the management alternatives for the Comprehensive Conservation Plan for Quivira National Wildlife Refuge, Kansas.

<i>Alternative A—no action</i>	<i>Alternative B—proposed action</i>	<i>Alternative C</i>
Sand Prairie Complex—environmental consequences		
<p>Woodlands would threaten ecosystems and the presence, abundance, nesting success, and local composition of grassland birds through avoidance, lower species density or nest success, and increased predation and parasitism.</p> <p>Shrubs would affect grasslands like trees do. Native grasses may out-compete cheatgrass with the effects of cattle and trees removed and tall shrubs mowed.</p> <p>Might see wider range of habitat and wildlife use and more wildlife diversity and abundance, but focal species may not be adequately managed. Species of little concern would likely benefit more.</p> <p><i>Economical</i>—Reducing trees and shrubs would decrease costs.</p> <p><i>Cultural and Historic</i>—Would approach presettlement conditions.</p>	<p>Same as alternative A, except species that are of conservation concern would benefit more.</p> <p>Treatments costs would be unknown but would differ from alternative A. They would be less than under alternative C.</p> <p>More specific monitoring measures and subsequent feedback would measure progress and help develop recommendations.</p>	<p>Would restore communities and functions better than alternative B.</p> <p><i>Social</i>—Would expect mixed reactions from different interest groups if bison were introduced and areas were to be closed to the public for safety reasons.</p> <p><i>Economical</i>—Costs would likely increase initially to change infrastructure and reduce invasive species. Monitoring programs would increase to evaluate the effects of infrastructure changes.</p> <p>For bison, would consider adding boundary fences, removing most fencing within the refuge, coordinating the burning program, screening for health and culling the herd, constructing and maintaining a handling facility and water tanks, and moving bison safely and logistically. While there may be added costs, tourism may increase.</p>
Cropland—actions		
<p>Manage current acreage with cooperative farming agreements using annual seed cover crops. Convert farmed lands to native communities as cooperators voluntarily withdraw.</p> <p>Gradually reseed to restore native community. Actively manage planted areas. Aggressively control invasive plants.</p>	<p>Same as alternative A, except reseed and restore areas that were farmed before and that have been allowed to revegetate without human intervention to native communities.</p>	<p>Same as alternative B, except restoring cropland to native communities would occur quicker because more resources would be devoted and our cooperators would be informed.</p>
Cropland—environmental consequences		
<p>Would harvest restored areas for seed. Would not affect food for regional and national waterfowl population goals. Presume that removal would improve conditions.</p> <p>High deer densities would be tied to winter wheat crops and waste grains. Visitors may be drawn to these areas, as many are near roads and would have lots of deer and waterfowl that would, however, also use the rest of the refuge.</p> <p>Farming would encourage annual invasive species establishment and spread because of equipment and disturbances to bare ground.</p>	<p>Same as alternative A except more areas would be reseeded instead of being left to naturally go back to a native community. This would speed the recovery of cropped acreage, but would cost more in time and money than alternative A.</p> <p>There would be few negative or positive effects related to public use because these areas do not have the same types of wildlife use and public viewing opportunities as cropland.</p>	<p>Would accelerate restoration and consume more time and money than alternatives A or B, resulting in faster restoration of native communities. Effects would be the same as under alternative B, except benefits to wildlife would occur sooner.</p>

Table 4. Summary of the actions and consequences of the management alternatives for the Comprehensive Conservation Plan for Quivira National Wildlife Refuge, Kansas.

<i>Alternative A—no action</i>	<i>Alternative B—proposed action</i>	<i>Alternative C</i>
Migratory Birds—actions		
<i>Wetlands</i> —Manage to provide migratory habitat and emphasize waterfowl, cranes, shorebirds, and rails, as well as nesting interior least tern and snowy plover and migratory whooping cranes.	<i>Wetlands</i> —Same as alternative A.	<i>Wetlands</i> —Same as alternative A.
<i>Herbaceous Uplands</i> —Manage to provide migratory and nesting habitat and emphasize grassland and meadow wildlife communities.	<i>Herbaceous Uplands</i> —Emphasis obligate grassland and meadow birds and focal species.	<i>Herbaceous Uplands</i> —Same as alternative B.
<i>Woodlands</i> —Keep some to provide habitat for rookeries and for indirect benefits to neotropical migrants.	<i>Woodlands</i> —Keep less than under alternative A.	<i>Woodlands</i> —Remove.
Migratory Birds—environmental consequences		
<p>Would promote a wide diversity and abundance of migratory birds.</p> <p>Would reduce habitat for heron rookeries, raptor perching, some neotropical migrant resting and foraging, and other tree- and shrub-associated species use. Would increase the migration and nesting activities of endemic grassland birds. May decrease predation of eggs, young, and adult birds.</p> <p>Benefits would decrease for certain generalist species that have benefited from human modifications to the landscape, but they may be supported by habitat conditions occurring beyond refuge boundaries.</p> <p>Would support species recovery plans and various regional and national bird conservation plans.</p>	<p>Same as alternative A, except for an increase of potential benefits to endemic and obligate grassland species and waterbirds adapted to environments with fewer trees and shrubs. Would be reduced benefits for tree- and shrub-dependent species.</p>	<p>Would likely decrease the overall abundance of migratory birds because of potential changes in hydrology, refuge infrastructure, and management.</p> <p>Wading bird rookeries would likely exist off of the refuge, and other tree-nesting species would decline on the refuge. Conditions removed here would continue to be commonly found, and increase, on both the regional and State levels.</p> <p>Provided water would be managed at the watershed level. Would support long-term ecosystem sustainability and productivity and would continue to provide long-term benefits to migratory birds.</p>
Fish—actions		
<p>Control undesirable fish like carp primarily with periodic drying. Use chemicals rarely when drying is difficult or impossible.</p> <p>Conserve native fish communities while supporting native habitats.</p> <p>Reduce invasive plants.</p> <p>Avoid stocking and introduction that favor nonnative fish over native fish, except for at the Kid's Fishing Pond where stocking is for public use and education.</p>	<p>Same as alternative A, except would evaluate creating and keeping suitable habitat in targeted areas to support native species.</p> <p>Would work with partners to carry out habitat management actions and to reintroduce species.</p>	<p>Same as alternative B, except that the Kids' Fishing Pond would be restored to its original habitat as much as possible.</p>

Table 4. Summary of the actions and consequences of the management alternatives for the Comprehensive Conservation Plan for Quivira National Wildlife Refuge, Kansas.

<i>Alternative A—no action</i>	<i>Alternative B—proposed action</i>	<i>Alternative C</i>
Fish—environmental consequences		
<p>Would improve water quality with the control of carp and other undesirable fish. Species would continue to enter via Rattlesnake Creek inflows and through upstream migration via Salt Creek and Rattlesnake Creek.</p> <p>Would encourage a more natural range of high salinity and other water quality conditions in the BSM area to support native fish that tolerate high salinity.</p> <p>Would conserve the Boiling Springs freshwater habitat to support a source population of State-threatened Arkansas darters.</p> <p>Would avoid the stocking of nonnative fish to reduce the likelihood of introducing foreign or unwanted diseases and pathogens to resident aquatic species.</p> <p>Crayfish populations would continue to predate on, and compete for, food and shelter with some wildlife species and provide food and shelter for others.</p>	<p>Same as alternative A, except would improve the conservation of native fish populations by reintroducing native fish and by evaluating, creating, and keeping more suitable habitat in targeted areas both on and off the refuge through partnerships.</p> <p>Would further reduce the likelihood of introducing diseases and pathogens to existing refuge populations of aquatic species by not allowing the use of live fish bait.</p> <p>Would allow frogging—bullfrogs only—which may introduce changes in fish populations and other associated links in the ecosystem, though the level of take is not expected to have major effects.</p>	<p>Same as alternative B, except that improvements in water quality and restored hydrology would be expected to help fish populations native to prairie streams.</p> <p>Sport and nonnative fish populations would likely decline with the removal of Kid's Fishing Pond because regular stocking would no longer occur.</p> <p>Conditions would vary in wet and dry years. The extent and duration of deep, permanent water on the refuge connected to Rattlesnake Creek would likely be reduced, thus adversely affecting nonnative or sport fish occurrence and survival. However, some of the natural sloughs and ponds and riffle pools that have areas that are periodically isolated from the creek may function better to conserve native prairie fish populations. Also, there may be improved habitat for certain life cycle events of native fish in certain year or overall.</p> <p>Because of reduced water control, there may be occasional issues related to carp or other undesirable fish.</p>
Threatened and Endangered Species and Species of Concern—actions		
<p>Keep existing designated critical habitat for T and E species.</p> <p>Maintain federally designated critical habitat for whooping cranes.</p> <p>Maintain State-designated critical habitat for snowy plover, Arkansas Darter, and interior least tern, which is also federally listed.</p> <p>Support T and E species recovery implementation plan actions.</p>	<p>Same as alternative A, except would develop prescriptions that explicitly address the habitat needs of species of concern as well as State- and federally listed fish and herptiles.</p>	<p>Same as alternative B, except prescriptions would be based more on keeping native communities and processes than on providing for the habitat needs of species. May provide reduced habitat for interior least tern, snowy plover, and whooping crane.</p> <p>Would evaluate the introduction of bison and other extirpated species.</p>

Table 4. Summary of the actions and consequences of the management alternatives for the Comprehensive Conservation Plan for Quivira National Wildlife Refuge, Kansas.

<i>Alternative A—no action</i>	<i>Alternative B—proposed action</i>	<i>Alternative C</i>
Threatened and Endangered Species and Species of Concern—environmental consequences		
<p>Reduce woody vegetation would improve habitat conditions for all listed species except, possibly, the eastern spotted skunk.</p> <p>Predation of eggs, young, and adults may decrease.</p>	<p>Same as alternative A, except a shift in management focus and more quantitative checking of management effects may increase potential benefits for species.</p>	<p>Same as alternative A, except limited control may make habitat availability less dependable within, and among, years. Reintroduced species may benefit.</p> <p>Provided water would be managed at a watershed level and may support long-term ecosystem sustainability and productivity and species benefits.</p> <p>Would manage the BSM to more closely mimic presettlement times, benefiting some species over others.</p> <p>Traditional least tern nesting areas would likely flood less because water would not be kept artificially high in the spring, the basin would have more room to store rainfall, and artificial dikes and roads that impede water-flow would be removed.</p>
Wildlife Native to the Region—actions		
<p>Support native habitat communities. Manage habitat in ways that indirectly help species.</p>	<p>Same as alternative A, except add a greater level of management for focal species.</p>	<p>Same as alternative B, except increase scale. Base prescriptions more on processes and plant community characteristics.</p>
Wildlife Native to the Region—environmental consequences		
<p>Species diversity would be supported at regional, landscape, and national levels.</p> <p>Species associated with woody habitat would decrease within refuge boundaries, while native endemic species associated with open grassland would increase.</p>	<p>Same as alternative A, except that benefits to endemic and obligate grassland species and wetland species adapted to environments with less coverage of trees and shrubs would increase.</p>	<p>Same as alternative B, except the overall abundance would likely be mixed depending on species and conditions. Wildlife populations would likely experience more dynamic fluctuations within, and among, years.</p> <p>Long-term ecosystem sustainability and productivity would be maximized and provide long-term benefits to wildlife.</p> <p>If patch burning occurs, it may benefit species diversity.</p>
Wildlife Health—actions		
<p>Promote habitat conditions that decrease adverse health conditions.</p> <p>Watch for wildlife disease outbreaks regularly using formal or informal protocols and encourage testing for diseases or contaminants of potential concern. Support actions to address observed signals and symptoms and regional health trends.</p>	<p>Same as alternative A, except emphasize water quality and quantity to detect changes that may adversely affect refuge resources.</p> <p>Allow trapping of nuisance animals with a special use permit.</p>	<p>Same as alternative A, except watch a broader suite of environmental conditions related to diseases.</p> <p>Increase wildlife health surveillance including proactive health checks.</p> <p>Trapping of nuisance animals would be the same as alternative B.</p>

Table 4. Summary of the actions and consequences of the management alternatives for the Comprehensive Conservation Plan for Quivira National Wildlife Refuge, Kansas.

<i>Alternative A—no action</i>	<i>Alternative B—proposed action</i>	<i>Alternative C</i>
Wildlife Health—environmental consequences		
<p>Would keep contaminant levels within a normal range for the ecosystem.</p> <p>Changes in deer distribution may occur and contact rates should decline. The potential effects of chronic wasting disease may decrease.</p>	<p>Same as alternative A, except emphasize water sampling to improve the early detection of potentially adverse conditions, and possibly prevent substantial wildlife die-offs. Would regularly sample water and, possibly, soil in and near streams and tributaries, ditches, and oil wells on the refuge to track trends in contaminant levels.</p> <p>Changes in hunting regulations may improve wildlife health conditions, specifically for the current high-density deer population.</p> <p>Trapping could help control disease and nuisance animals, which would directly help wildlife. There would be a small economic benefit to trappers, who would most likely be locals.</p>	<p>Same as alternative A, except a broader suite of environmental conditions would be watched, further improving wildlife health.</p> <p>A possible reduction in the control of water may result in a decrease in managing disease and health concerns.</p> <p>Management for ecosystem sustainability may increase resiliency, barring human-caused disasters such as an oil spill.</p> <p>If bison are introduced, wildlife health issues, such as disease transmission among bison and other herbivores, may increase.</p> <p>Trapping effects would be the same as alternative B.</p>
Inventory, Monitoring, and Research—actions		
<p>Continue to evaluate current activities and end or revise.</p> <p>Organize, review, and synthesize information relevant to biology and the management of the refuge and develop a vegetation cover map.</p> <p>Develop new protocols to improve monitoring programs for water quality, nesting least terns, and vegetation conditions in a manner that is practical and useful.</p> <p>Encourage informative research. Allow activities compatible with goals and objectives, involve good communication with refuge staff, provide information related to refuge resources and management, and may address a current and potential future conservation or societal issue.</p>	<p>Same as alternative A, except emphasize developing monitoring protocols that would provide the information necessary to improve decisions. Base research on need or on cooperation in landscape-level monitoring programs and studies.</p>	<p>Same as alternative B, except use better monitoring programs for habitat and populations before allowing uses like hunting.</p>
Inventory, Monitoring, and Research—environmental consequences		
<p>Would inform about factors within refuge boundaries, and provide indications of how management may influence conditions.</p> <p>Monitoring programs would involve relatively broad-scale measures and, perhaps, less intensive sampling.</p> <p>Would support management and resources of concern and support the interests of conservation programs and groups, educational institutions, and local economies.</p>	<p>Same as alternative A, except that monitoring measures related to species-habitat needs would be more specific. Bell's vireo or upland sandpiper would likely benefit as a result of this finer level of checking.</p> <p>More specific monitoring measures and subsequent feedback would be involved to measure progress and to help with recommendations.</p>	<p>Same as alternative B, except those activities related to biological factors would be more extensive.</p> <p>Activities would be needed to evaluate the accomplishments of restoration activities before and after program implementation.</p> <p>Monitoring programs would be more costly.</p>

Table 4. Summary of the actions and consequences of the management alternatives for the Comprehensive Conservation Plan for Quivira National Wildlife Refuge, Kansas.

Alternative A—no action	Alternative B—proposed action	Alternative C
Visitor Services Goal. See that visitors enjoy quality, wildlife-dependent recreational opportunities.		
Hunting—actions		
<p>Migratory Birds—Permit for mourning dove, snipe, rail, and waterfowl in accordance with State seasons. Allow on no more area than what is approved now. Do not permit when whooping cranes are present. Make waterfowl hunting blind accessible by reservation</p> <p>Upland Game—Permit for pheasant, quail, rabbits, and squirrel in accordance with State seasons.</p> <p>Deer, Turkey, Sandhill Crane, Prairie-chicken, Furbearers—Do not permit.</p>	<p>Migratory Birds—Same as alternative A, except change hunt area to reduce conflict with whooping crane use areas. Close specific units when whooping cranes are present, similar to Cheyenne Bottoms.</p> <p>Upland Game—Change the hunt area to reduce conflict with whooping crane use. Do not tie upland game areas specifically to waterfowl hunting areas. Close specific units if whooping cranes are present.</p> <p>Deer—Select an area open for hunting and set limits based on herd health and population targets. Establish with help from the State. Close specific units if whooping cranes are present.</p> <p>Turkey—Select an area open for hunting. This would be established with help from the State. Close specific units when whooping cranes are present.</p> <p>Sandhill Crane—Do not allow.</p> <p>Prairie-chicken—Allow if refuge population can support it or for health purposes, as decided by staff. Close specific units when whooping cranes are present.</p> <p>Furbearers—Allow only with shotgun or archery if refuge population can support it or for health purposes.</p>	<p>Migratory Birds—Same as alternative A, except permit if refuge populations allow or for health purposes. Close when whooping cranes are present.</p> <p>Upland Game—Allow if refuge populations can support it or for health purposes. Close specific units when whooping cranes are present.</p> <p>Deer—Allow if refuge population can support it or for health purposes, as decided by staff. Employ special regulations. Close specific units when whooping cranes are present.</p> <p>Turkey—Allow if refuge population can support it or for health purposes, as decided by staff. Close specific units when whooping cranes are present.</p> <p>Sandhill Crane—Allow if refuge population can support it or for health purposes. Close when whooping cranes are present.</p> <p>Prairie-chicken—Allow if refuge population can support it or for health purposes, as decided by the State. Close specific units when whooping cranes are present.</p> <p>Furbearers—Allow only with shotgun or archery, if refuge population can support it or for health purposes.</p>
Hunting—environmental consequences		
<p>Deer—White-tailed deer should continue to increase until artificial controls, such as hunting, or natural controls, such as disease, change this trend.</p> <p>May exceed habitat carrying capacity threshold and deer health and habitat may decline. High deer populations may negatively affect native forbs and shrubs.</p> <p>Chronic wasting disease in deer may come closer to the refuge.</p> <p>Would offer spectacular deer viewing.</p> <p>High deer populations could become a traffic safety concern.</p> <p>Increased poaching could affect law enforcement.</p> <p>Would not allow the retrieval of deer that were originally shot off the refuge.</p>	<p>Migratory Birds—Changes in water management in response to hunting would provide higher-quality, moist-soil habitat that would attract more waterfowl.</p> <p>Deer—Would develop hunt plan to involve archery-only or youth-archery-and-muzzleloader-only seasons, with limited entry by draws for all hunt seasons. Would explore all possibilities for hunting deer and consider visitor safety.</p> <p>Would want to know if selected harvest strategies could result in reduced deer count, though such information may be hard to get.</p> <p>Would create more opportunities for hunting on public lands.</p> <p>Deer would become more wary and difficult to closely observe and photograph.</p>	<p>Priority would be on the protection of resources. There would continue to be no migratory bird hunting when whooping cranes are present.</p> <p>All other hunting, including upland game hunting, would continue but would be closed in specific units when whooping cranes are present. There would be more upland bird hunting with little-to-no risk to whooping cranes.</p> <p>Migratory Birds—Waterfowl and other migratory bird hunting should decline with less consistent water conditions in the fall.</p> <p>Deer, Turkey, Prairie-chicken, Furbearers—Would be the same as under alternative B.</p> <p>Added costs would be the same as under alternative B.</p>

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<i>Alternative A—no action</i>	<i>Alternative B—proposed action</i>	<i>Alternative C</i>
Hunting—environmental consequences (continued)		
<p><i>Whooping crane protection</i>—Increased whooping crane use may limit hunting, leading to continued hunter frustration.</p>	<p>Hunters and nonhunters may interact more because of an increase in hunting.</p> <p>Youth and muzzleloader hunting could increase the range of firearms used on the refuge and increase safety issues for hunters and nonhunters, while also allow for more opportunities for various hunters, more harvest, meeting the goal for increased youth hunting, and decreasing deer densities.</p> <p>The retrieval of deer that were originally shot off the refuge could be allowed. Requests for hunters to enter the refuge to retrieve deer may result in many calls during nonworking hours, leading to hunter frustration. Costs may increase when employees return to work to retrieve a deer.</p> <p><i>Turkey, Prairie-chicken, and Furbearers</i>—Would promote the mission of the Refuge System and provide more opportunities without jeopardizing wildlife populations.</p> <p><i>Whooping crane protection</i>—More law enforcement, signage and communications would be required. The popular salt flats and North Lake areas would be closed to hunting but a similarly sized area less prone to closure would be opened to negate effects.</p> <p>There would be more parking areas and roads for access and more costs related to changing hunt areas, signage, parking lots, brochures and adding law enforcement.</p>	<p><i>Whooping crane protection</i>—Whooping crane use may shift with the unpredictability of conditions from year to year, which would also affect hunting. Would increase public awareness of cranes using kiosks, signage, and public programs.</p> <p><i>Bison protection</i>—If restored to Quivira, hunting opportunities may have to be altered to prevent bison-hunter interactions in the field. Refuge policy prevents the hunting of captive herds of ungulates on refuges, so a hunting season on bison would not be allowed.</p>
Fishing—actions		
<p>Allow fishing on all waters according to State-established seasons and regulations.</p> <p>Allow yearlong use of the Kids' Fishing Pond with a one-fish limit only to children age 14 and under and for adults with an eligible child fishing with them, unless otherwise posted for management or safety reasons.</p> <p>Do not allow frogging and the hunting of turtle or other herptiles.</p> <p>Do not allow bait collecting and the use of live fish bait. Permit night crawlers.</p> <p>Do not allow crayfish fishing.</p>	<p>Same as alternative A, except there would be no stocking outside of Kids' Fishing Pond.</p> <p>Only allow the frogging of bullfrogs.</p>	<p>Allow fish and herptiles if their populations support it or for health purposes.</p> <p>More aggressively control nonnative fish and herptiles.</p>

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<i>Alternative A—no action</i>	<i>Alternative B—proposed action</i>	<i>Alternative C</i>
Fishing—environmental consequences		
<p>Would be low quality because of carp infestations.</p> <p>Would draw mostly local people who would return often. Those from outside the local area may come during the annual Kid's Fishing Day.</p> <p>Many of the other waters on the refuge undergo periodic drying to manage wetlands for migratory birds, which reduces, or stops, the possibility of establishing other fishing areas that could be kept except for possibly at Darrynane Lake.</p> <p>No live fish bait, except for night crawlers, would be permitted to avoid introducing exotic or invasive fish into the refuge. Enforcing no bait collecting would be difficult if crayfish fishing were allowed.</p>	<p>Fishing activities would likely increase with the periodic removal of carp.</p> <p>More bait fish would be available because there would be no bait fish collecting.</p> <p>The harvesting of bullfrogs could be sustained.</p> <p>Economic and social activities would be the same as under alternative A.</p>	<p>Quality would improve with the control of carp and the restocking of native fish.</p> <p>Would require more monitoring programs for fish, reptile and amphibian populations for sustainability.</p> <p>More aggressive control on nonnative fish, reptiles, and amphibians would increase costs.</p> <p>Depending on the activity, permits may have to be issued for some fishing, such as for turtling, or for frogging.</p> <p>Costs related to stocking the Kid's Fishing Pond would decrease.</p>
Wildlife Observation and Photography—actions		
<p>Encourage wildlife observation and photography except in seasonally closed areas.</p> <p>Keep the auto tour route, the observation towers, scopes, and two photography blinds.</p> <p>Provide from sunrise to sunset daily at the GPNC.</p> <p><i>Horseback Riding</i>—Allow only on public and county roads, not on hiking trails.</p> <p><i>Bicycling</i>—Allow on existing roads.</p> <p><i>Dogs</i>—Allow when under owners' control.</p>	<p>Same as alternative A.</p>	<p>Same as alternative A, except restrict public entry to select roads during nesting season.</p> <p>Close Wildlife Drive during nesting season and evaluate the potential environmental effects of Wildlife Drive and human use of the area during the next 15 years.</p>
Wildlife Observation and Photography—environmental consequences		
<p>Would be affected when closing areas seasonally to prevent disturbance to bald eagles and tern nesting sites and for other, changing conditions like the presence of whooping crane roosting areas.</p> <p>Horseback riding may continue to spread invasive species on access roads. But use would be low and the effects negligible.</p>	<p>Same as alternative A.</p>	<p>Same as alternative A, except more closures would be carried out during the nesting season.</p> <p>If results of an evaluation support bison management, then there would be mixed effects. For instance, areas would be closed to the public for safety reasons, but the presence of bison might provide a new attraction.</p>
Environmental education and interpretation—actions		
<p>Allow environmental education programs at both Quivira Refuge and the GPNC that provide curriculum-based programs for all school grade levels to help in meeting State educational standards.</p>	<p>Same as alternative A, except emphasize focal species.</p> <p>Enhance environmental education through improvements to facilities at both Quivira Refuge and the GPNC.</p>	<p>Same as alternative B, except may alter or remove some roads to support ecological restoration.</p>

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<i>Alternative A—no action</i>	<i>Alternative B—proposed action</i>	<i>Alternative C</i>
Environmental Education and Interpretation—actions (continued)		
<p>Allow onsite and offsite programs at the GPNC for underserved audiences like at-risk youth.</p> <p>Promote the use of both Quivira Refuge and GPNC facilities as outdoor classrooms.</p> <p>Keep current or improved staff levels and partnerships at the GPNC.</p> <p>Provide interpretive programs on request and as scheduled activities at Quivira Refuge and the GPNC.</p>	<p>Move the environmental education classroom to a site near headquarters.</p> <p>Encourage virtual geocaching.</p>	<p>Emphasize the benefits of ecological restoration through environmental education and interpretation programs.</p>
Environmental Education and Interpretation—environmental consequences		
<p>Environmental education and interpretive programs would help meeting State educational standards and teach environmental ethics and awareness.</p> <p>Programs would help foster an interest in, and a sense of stewardship of, public lands such as national wildlife refuges.</p>	<p>A growing environmental education program would require more space at the GPNC, such as a larger classroom, multipurpose room and office space.</p> <p>Moving the environmental education classroom would consolidate facilities, improve the environmental education capabilities, and further the development of a comprehensive program.</p> <p>Virtual geocaching would increase the public's appreciation of refuge resources.</p>	<p>Same as alternative B, except: environmental education and interpretive programs may be affected if facilities are modified or removed. Would attempt to replace facilities and programs in new locations. There would be an opportunity to learn more about the benefits of healthy ecosystems, natural processes, and managing for sustainable systems.</p>
Other Uses—actions		
<p>Allow all areas to remain open unless otherwise closed for management or safety reasons. Do not allow public to drive on closed roads and trails.</p> <p><i>Field trials and dog training</i>—Allow for individuals, but not for commercial operators. Do not allow during nesting season.</p> <p><i>Firewood cutting</i>—Allow in designated areas and with an approved special use permit.</p> <p><i>Commercial tours (birding)</i>—Allow with a special use permit.</p> <p><i>Amphibian, crayfish and reptile collecting; antler collecting; berry, fruit, roots, and mushroom harvesting; wildflower collecting; geocaching; commercial photography; boating; camping; recreational trapping; dog field trial; off-road vehicle use; and commercial guiding for hunting.</i>—Do not allow.</p>	<p>Same as alternative A, except allow commercial photography with a special use permit.</p>	<p>Same as alternative B.</p>

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<i>Alternative A—no action</i>	<i>Alternative B—proposed action</i>	<i>Alternative C</i>
Other Uses—environmental consequences		
<p>Restricted public vehicle access would decrease wildlife disturbance and limit road costs.</p> <p>Trained dogs that retrieve game, horseback riding, and bicycling would allow greater access and should pose little negative effect on wildlife or other public uses. Would be reevaluated if wildlife disturbances occur.</p> <p>Regulations and restrictions would continue to prevent wildlife disturbance, the removal of wildlife food and parts of plants, and commercial activities. Would have little economic effect, as few would conduct or request these activities.</p>	<p>Same as alternative A, except commercial photography would expand opportunities for photographers and enhance the public's appreciation of wildlife.</p>	<p>Same as alternative B.</p>
<p>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.</p>		
Public Outreach—actions		
<p>Reach out to local civic and environmental organizations emphasizing management issues and philosophy, endangered species, and other subjects, both on and offsite.</p> <p>Work with Friends of Quivira and Friends of the GPNC to increase awareness and outreach. Contribute articles to the Friends newsletter. Hold events several times a year at the refuge and GPNC to promote mission, activities, and goals.</p> <p>Keep and update the refuge Web site and social media to on operations, hunting, events, and wildlife sightings.</p> <p>Develop, support, and staff information booth at the Kansas State Fair.</p> <p>Recruit, train, and use local volunteers to further goals at the refuge and GPNC.</p>	<p>Same as alternative A, plus install tower camera at the bald eagle and BSM areas to provide more observation opportunities of remote wildlife. Encourage refuge visitation and increased positive personal experiences with natural resources.</p>	<p>Same as alternative B.</p>
Public Outreach—environmental consequences		
<p>Would foster appreciation of wildlife and the outdoors and instill a sense of stewardship of lands like Quivira Refuge.</p> <p>Would encourage youth to study wildlife through the Junior Federal Duck Stamp program and to become engaged by displaying their artwork at many locations throughout the State during the year.</p>	<p>Same as alternative A, except would also provide more observation of remote wildlife, encourage refuge visitation, and increase positive personal experiences with natural resources. Tower camera viewers would not need to leave their homes to see the refuge, which might negatively affect initiatives like Get Outside and Connect with Nature. These viewers may also become more interested in seeing the action in person.</p>	<p>Same as alternative B, but would emphasize awareness of the benefits of ecological restoration and healthy natural systems.</p>

Table 4. Summary of the actions and consequences of the management alternatives for the Comprehensive Conservation Plan for Quivira National Wildlife Refuge, Kansas.

<i>Alternative A—no action</i>	<i>Alternative B—proposed action</i>	<i>Alternative C</i>
Public Outreach—environmental consequences (continued)		
Updated Web sites and social media would provide the most current information for visitors to the refuge.	The tower camera should not negatively affect wildlife or habitat, though there would be short-term effects during installation. There would be more costs for installation and operation of the remote tower camera. Donations may be requested and used to offset costs. Outreach efforts would place more emphasis on teaching about focal species.	
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.		
Cultural Resources—actions		
Obtain permits and clearances before substantial dirt or surface alteration. Protect cultural resources in accordance with Federal and State laws, policies and guidelines. Consult regional archeologist during the planning phase of proposed projects to decide on the need for an archeological site clearance from the Kansas State Historic Preservation Office.	Same as alternative A, except increase the interpretation of cultural resources and, specifically, of Native American historic use of the refuge through exhibits and signage.	Same as alternative B.
Cultural Resources—environmental consequences		
Would protect resources according to existing rules and regulations. Would document and protect new cultural resources as discovered.	Same as alternative A, except public knowledge of historic Native American use for gathering, hunting, and salt collecting would increase.	Same as alternative B.
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.		
Visitor and Employee Safety—actions		
Keep current Station Safety plans providing emergency contacts, procedures, and training for all employees. Keep public safety in mind when providing emergency shelters, accessibility, and when supporting trails and roads. Keep and update directional and safety signage along public roads. Follow infectious disease plan and policy.	Same as alternative A.	Same as alternative A.
Visitor and Employee Safety—environmental consequences		
Would support visitor and employee safety.	Same as alternative A.	Same as alternative A, except visitor and employee dangers would be heightened if bison are introduced to the refuge. Would require employee training to work with, and around, bison and would incur more costs for employee training and safety needs.

Table 4. Summary of the actions and consequences of the management alternatives for the Comprehensive Conservation Plan for Quivira National Wildlife Refuge, Kansas.

<i>Alternative A—no action</i>	<i>Alternative B—proposed action</i>	<i>Alternative C</i>
Resource Protection—actions		
<p>Protect critical nesting habitat and enforce hunting, fishing, and all other regulations in CFR and State laws.</p> <p>Do not allow hunting when whooping cranes are present.</p> <p>Close areas that are actively being used by nesting T and E species.</p>	<p>Same as alternative A, except alter hunting areas and establish new regulations for closed areas when whooping cranes are present.</p>	<p>Same as alternative A, except restrict waterfowl and sandhill crane hunting when whooping cranes are present.</p> <p>Increase efforts to enforce regulations related to closed areas.</p>
Resource Protection—environmental consequences		
<p>Law enforcement would adequately protect refuge resources.</p>	<p>Same as alternative A, except more species would be permitted to be taken by, hunting, fishing and trapping.</p> <p>Increased visitor use would require more law enforcement to enforce compliance with regulations. The increased workload would require one full time refuge officer and two dual-function officers to adequately enforce the increased use.</p>	<p>Same as alternative B, plus sandhill crane hunting would be permitted, which would require increased law enforcement. Because of the sandhill crane's similarity in appearance to the whooping crane, increased staff time would be needed to more closely watch whooping crane locations to prevent an accidental shooting. Increased whooping crane education would be result from more signage, kiosk displays, and handouts.</p>
<p>Administration Goal. Provide and support facilities, strategically acquire and allocate staff, increase volunteer opportunities and partnerships, and effectively raise and use money to keep the long-term integrity of infrastructure, habitats, and wildlife resources at the refuge and Great Plains Nature Center.</p>		
Staff and Budget—actions		
<p>Support 11 permanent full-time employees, 1 permanent part-time employee, 3 temporary employees, and 2 regional employees that are not paid through the refuge.</p> <p>Find needed positions and projects in RONS database and in a separate law enforcement needs list. Top priority in RONS is one full-time maintenance worker. Law Enforcement has identified one full-time refuge officer.</p> <p>Use YCC program.</p> <p>Seek money through grants and initiatives for staff and projects.</p> <p>Continue to provide office space for a zone biologist and a Partners biologist.</p>	<p>Same as alternative A.</p>	<p>Same as alternative A, except increase biological staff with two permanent, full-time positions to expand inventory and monitoring efforts.</p> <p>Increase permanent, full-time staff by one to control invasive species because work would increase with the full restoration of native communities.</p>
Staff and Budget—environmental consequences		
<p>Budget would be adequate to keep staff and facilities.</p>	<p>Same as alternative A.</p>	<p>More staff would make implementation more successful.</p>
Facilities and Infrastructure—actions		
<p>Keep more than 21 miles of canals, 24 miles of dikes and more than 100 water control structures. Keep 14 miles of roads and 33 parking lots for public use and 27 miles of roads for management. Keep more than 97 miles of barbwire and 54 miles of electric fencing for grazing.</p>	<p>Same as alternative A, except request another cold storage building and a fire cache.</p> <p>Request more space at the GPNC for a larger classroom, a multipurpose room, and for office space. Need another storage building and a larger equipment compound.</p>	<p>Same as alternative B, except reduce trails, parking lots, roads, dikes, canals, water control structures, and fences.</p> <p>Decrease or remove developments like trails that facilitate the spread of invasive species or otherwise negatively affect biological populations.</p>

Table 4. Summary of the actions and consequences of the management alternatives for the Comprehensive Conservation Plan for Quivira National Wildlife Refuge, Kansas.

<i>Alternative A—no action</i>	<i>Alternative B—proposed action</i>	<i>Alternative C</i>
Facilities and Infrastructure—actions (continued)		
<p>Keep refuge office, visitor center, maintenance shop, three storage buildings, one pole barn, environmental education classroom, two residences and two bunkhouses. Keep GPNC visitor center, classrooms, offices, auditorium and storage garage.</p> <p>Provide both interactive and static displays at both visitor centers.</p> <p>Keep two areas of pedestrian trails at the refuge. Keep trails and structures, like bridges, signs, and boardwalks.</p> <p>Use the GPNC’s classrooms and Quivira Refuge’s environmental education classroom for education and interpretive programs and for workshops open to the public.</p>	<p>Move environmental education classroom at Quivira Refuge to a location near headquarters, but keep a restroom in the current environmental education area.</p> <p>Allow trapping only for wildlife and infrastructure purposes and with a special use permit.</p>	<p>Remove unnecessary roads and use canals only to spread waterflow over the refuge in sheet flow to mimic natural flooding and drying.</p> <p>Construct more spillways to spread sheet flow out of Rattlesnake Creek and across meadows and wetlands.</p> <p>If bison are reintroduced, fence large blocks of land to allow bison to move on their own and graze as much as possible in a natural setting.</p> <p>Trapping would be the same as alternative B.</p>
Facilities and Infrastructure—environmental consequences		
<p>Extensive water management facilities would require annual maintenance money and recurring structure replacement.</p> <p>Rehabilitation and replacement of structures would be more intensive dues to saltwater. Stainless steel would be used whenever possible as a result but at a higher cost. ABS plastic culverts would be used when possible, to combat deterioration.</p> <p>The shop bay would be too short to allow some heavy equipment to be moved inside for maintenance and repair.</p> <p>Vehicle and equipment storage would be inadequate because there is not enough room for all vehicles to be kept inside and protected from packrats. Biological controls, like barn owl nest boxes, would be kept, but a few expensive vehicle and equipment repairs would be expected.</p> <p>Non-Quivira Refuge employees would sometimes be stationed at the refuge and need storage space for vehicles and equipment.</p> <p>Would support the GPNC building and storage garage with annual maintenance money and with deferred maintenance money for large projects. Settling cracks would require maintenance.</p>	<p>Same as alternative A, except more money would be needed to buy more facilities and for their long-term maintenance.</p> <p>Trapping could help control nuisance animals, which would directly help refuge operations in preserving infrastructure. There would be a small economic benefit to trappers, who would most likely be locals.</p>	<p>Same as alternative B for buildings at Quivira Refuge and at the GPNC, but much of the other infrastructure would be reduced or removed to complete the ecological restoration.</p> <p>The initial cost may be higher, but it would result in long-term cost savings by reducing the maintenance of structures.</p> <p>Trapping effects would be the same as alternative B.</p>

