



INTRODUCTION

Quivira National Wildlife Refuge (NWR) contains 22,135 acres in Stafford, Rice, and Reno counties in south-central Kansas (Fig. 1). In May 1955, the Migratory Bird Conservation Commission approved establishment, and processing of purchase agreements, of the “Great Salt Marsh NWR” in recognition of two unique historical salt marshes on the area – the Little and Big Salt Marshes (Fig. 2). In 1958, the name of the refuge was changed to Quivira NWR after the Spanish word “Quivira” for the native American name “Kirikuru, which local people called themselves when the Spanish explorer Don Francisco Vasquez de Coronado visited the region in 1541 in search of the fabled Seven Cities of Cibola. The authorizing purpose of the refuge was “...for use as an inviolate sanctuary, or for any other management purpose, for migratory birds (16 USC 715d Migratory Bird Conservation Act)” ... for the development, advancement, management, conservation, and protection of fish and wildlife resources (16 USC 742f(a)4” ... for the benefit of the U.S. Fish and Wildlife Service (USFWS), in performing its activities and services: subject to the terms of any restrictive or affirmative covenant, or condition of servitude ...” (16 USC 742f(b)1 Fish and Wildlife Act of 1956).

Quivira NWR is located in the Great Bend Sand Prairie Ecoregion (Chapman 2001) and contains a mixed-grass sand prairie ecosystem imbedded with the original namesake salt marshes and bisected by Rattlesnake Creek, a tributary of the Arkansas River. Habitats

currently on the refuge include diverse grassland and wetland communities (Faber-Langedoen 2001) with a range of salinities along with stream corridors, salt flats, sand dunes and hills, and agricultural

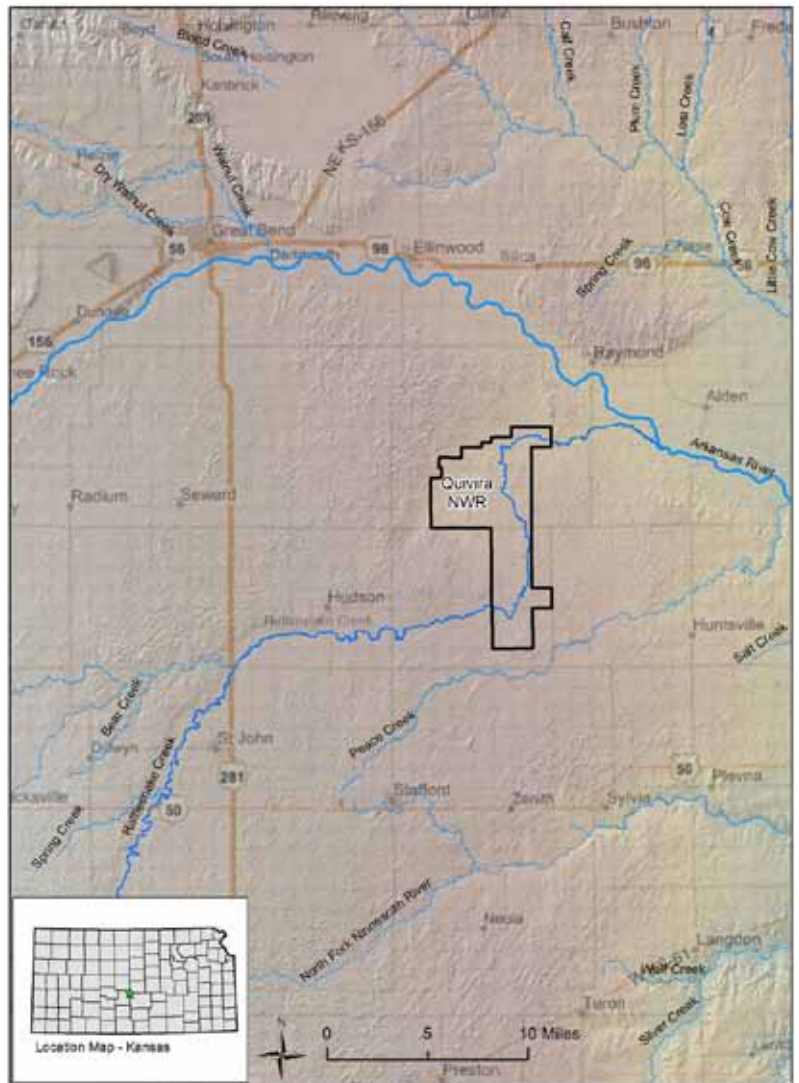


Figure 1. General location of Quivira NWR.

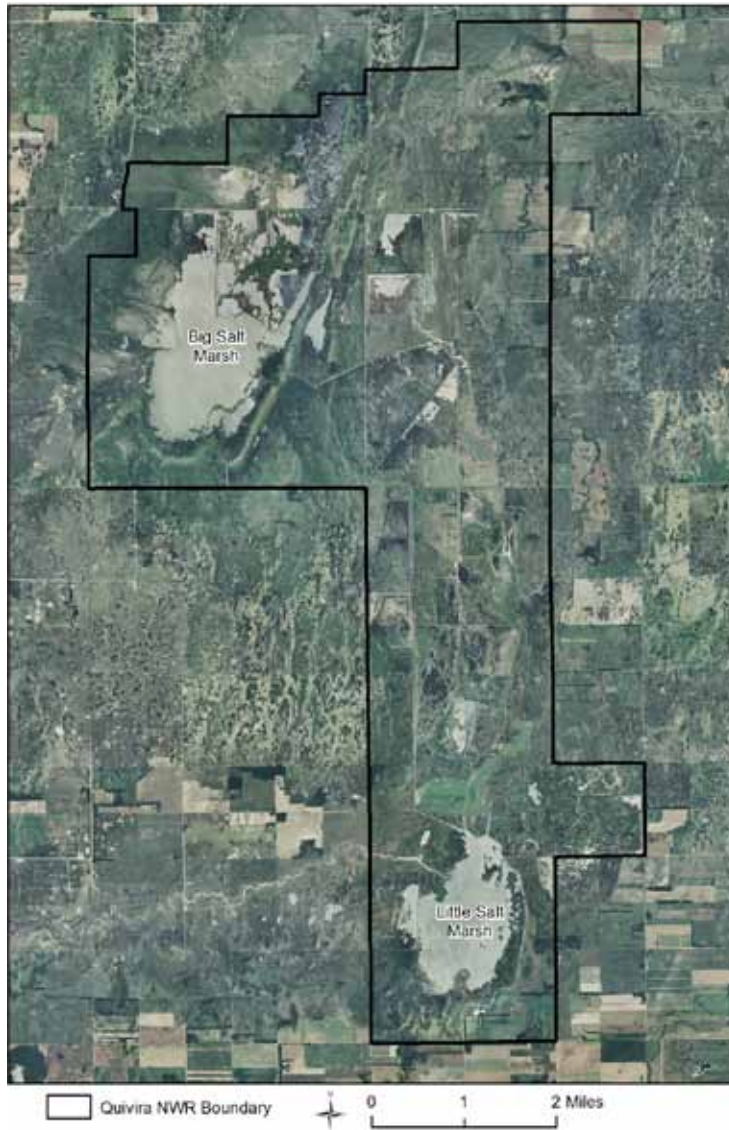


Figure 2. 2010 NAIP aerial photograph showing locations of the Big and Little Salt marshes.

lands. Rattlesnake Creek flows through Quivira NWR enroute to its confluence with the Arkansas River about 15 miles northeast of the refuge. The creek drains the 1,047 square mile Rattlesnake Creek Basin, and the creek section at Quivira NWR generally is a gaining stream that receives most of its surface water from groundwater discharge (Sophocleous 1992). This groundwater discharge originates from the Great Bend Prairie Aquifer, which contacts Permian bedrock formations that contain evaporates such as halite and anhydrite and causes the aquifer, and its discharge, to be saline (Buchanan 1984). Historically, surface water flows in Rattlesnake Creek seasonally recharged many wetlands in the Quivira NWR region, including the Little Salt Marsh. The Big Salt Marsh on Quivira NWR was not histori-

cally connected to Rattlesnake Creek and was recharged primarily from groundwater seepage that originated from the underlying aquifer along the west side of the refuge.

Intentional and unintentional use and modification of groundwater and Rattlesnake Creek streamflow have been occurring in the Rattlesnake Creek Basin and in the Quivira NWR region since the early 1900s (e.g., Latta 1950). Many regions of western and central Kansas have experienced significant declines in these waters, especially in the last three decades, primarily from extensive groundwater appropriations in the Great Bend Prairie Aquifer. While the refuge had an original senior right to divert about 22,200 acre-feet of water from Rattlesnake Creek to refuge wetlands annually, actual diversion has typically been < 14,000 acre-feet partly because of low flows in the creek during the growing season (Estep 2000). In 1996, the Kansas Division of Water Resources certified a water right permit for 14,632 acre-feet for the refuge based on recorded usage. Water from Rattlesnake Creek has been diverted to the Little Salt Marsh since the late 1920s or early 1930s, and since 1959, Quivira NWR has diverted Rattlesnake Creek water through a complex series of ditches, dikes, water-control structures, and three main points of creek water diversion into 34 constructed wetland impoundments and into the Big Salt Marsh. The reduced and altered surface and groundwater availability and controlled distribution of surface water on the refuge are serious challenges for future management of the refuge and

for attempts to restore and sustain historical habitats and resources to endemic plants and animals.

In 2010, the USFWS initiated a Comprehensive Conservation Plan (CCP) for Quivira NWR. The CCP process seeks to articulate the management direction for the refuge for the next 15 years and develops goals, objectives, and strategies to define the role of the refuge and its contribution to the regional landscape and the overall mission of the NWR system. At Quivira NWR, the CCP is being facilitated by an evaluation of ecosystem restoration and management options using Hydrogeomorphic Methodology (HGM). The HGM process obtains and collates historic and current information about: 1) geology and geomorphology, 2) soils, 3) topography and elevation, 4) hydrologic condition and flood frequency, 5) aerial

photographs and cartography maps, 6) land cover and vegetation communities, 7) key plant and animal species, and 8) physical anthropogenic features of the Quivira ecosystem. Recently, hydrogeomorphic information has been used to evaluate ecosystem restoration and management options on many NWR's (e.g., Heitmeyer and Fredrickson 2005, Heitmeyer and Westphall 2007, Heitmeyer et al. 2009, Heitmeyer et al. 2010, Heitmeyer et al. 2012) and provides a context to understand the physical and biological formation, features, and ecological processes of lands within the NWR and surrounding region. This historical assessment provides a foundation, or baseline condition, to determine what changes have occurred in the abiotic and biotic attributes of the ecosystem and how these changes have affected ecosystem structure and function. Ultimately, this information helps define the capability of the area to provide key ecosystem functions and values and identifies options that can help to restore and sustain fundamental ecological processes and resources.

This report provides HGM analyses for Quivira NWR with the following objectives:

- Describe the pre-European settlement (hereafter Presettlement) ecosystem condition and ecological processes in the Quivira NWR region.
- Document changes in the Quivira NWR ecosystem from the Presettlement period with specific reference to alterations in hydrology, vegetation community structure and distribution, and resource availability to key fish and wildlife species.
- Identify restoration and management options and ecological attributes needed to restore specific habitats and conditions within the Quivira NWR region.



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