

INTRODUCTION

Alamosa National Wildlife Refuge contains 12,026 acres in the central portion of the San Luis Valley in south-central Colorado (Fig. 1). The refuge was established in 1962 under authority of the Migratory Bird Treaty Act with the authorizing purpose "... for use as inviolate sanctuary or for any other management purpose, for migratory birds." Acquisition of lands for Alamosa NWR incorporated an area once referred to as the "Island Ranch" including seven river miles of the Rio Grande (U. S. Fish and Wildlife Service (USFWS) 2003). The first funds for acquiring the refuge were available in 1962-64 with fee-title acquisition of private lands. Other lands included in the refuge were obtained by withdrawal of public lands administered by the U.S. Bureau of Land Management (BLM) and lease of Colorado state lands.

Most of Alamosa NWR is located within the historic Rio Grande floodplain where Rock and La Jara Creeks and the Alamosa River entered the Rio Grande from the west (Fig. 2). Hansen's Bluff forms the eastern boundary of the Rio Grande floodplain on the refuge. Historically, the Rio Grande had two split active channels in the lower half of the refuge and movement of the river across its floodplain over time created an extensive system of abandoned channel sloughs, oxbow lakes, and wet meadow depressions, some of which are still present today. Riparian narrowleaf cottonwood (*Populus angustifolia*) and willow (*Salix* spp.) woodland historically was present along the main stem and western branch of the active Rio Grande channel. Salt desert shrub occupied higher elevations on floodplain terraces and uplands.

Many land and water use changes have occurred throughout the SLV, including at Alamosa NWR, since European settlement. Following major expansion of

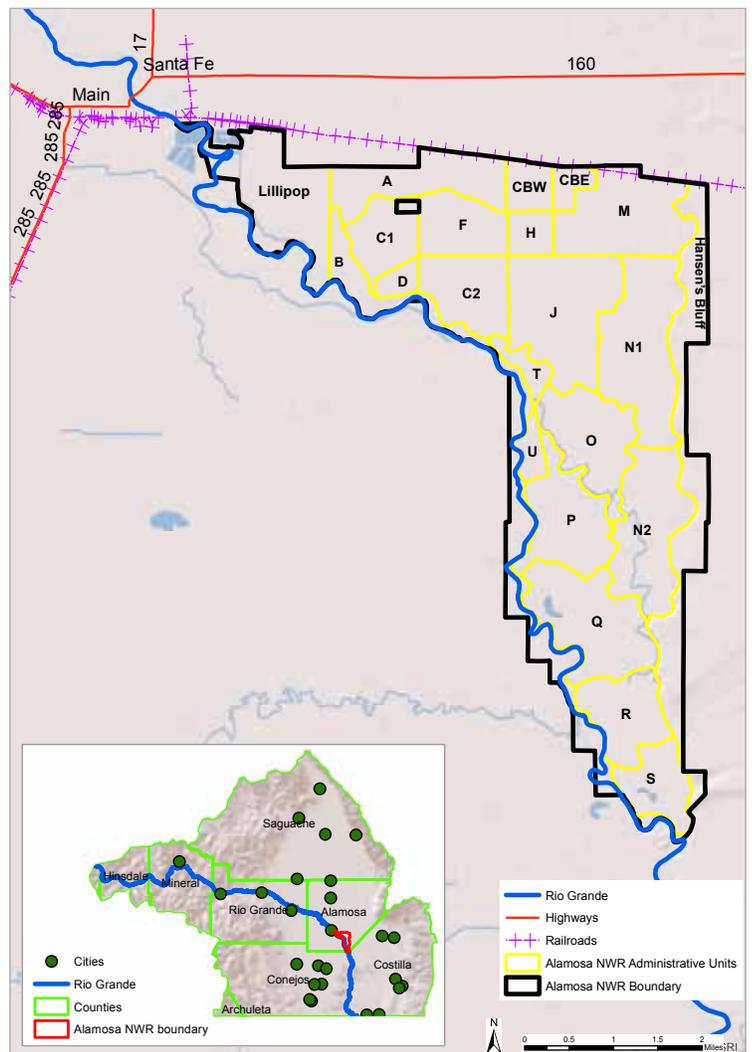


Figure 1. General location of Alamosa National Wildlife Refuge in southern Colorado.

settlements in the SLV in the mid-1800s, agricultural production increased greatly, but was limited by the availability of surface and groundwater. To support a growing agricultural economy, agricultural irrigation “systems” were extensively developed in the SLV and included diversion of water from the Rio Grande and other rivers/creeks, conveyance of diverted river water through an elaborate system of ditches and canals, exploitation of groundwater using pumped wells from shallow unconfined aquifers and pumped and free-flowing deeper artesian water,

and various use and diversion of prior-used water drained from agricultural fields after irrigation (locally called “drainwater”, see Buchanan 1970, Athearn 1975, Hanna and Harmon 1989, Emery 1996 and others). Use and allocation of both surface and groundwater in the SLV have been regulated through many complex water right agreements beginning with the Embargo of 1896 and Mexican Treaty of 1906 (Natural Resource Committee 1938). The interstate Rio Grande Compact (Compact) was ratified in 1939 and stipulated water use and diversion among states, local irrigation districts, and individual water source/diversion legalities.

Water available for wetland management on Alamosa NWR has become more limited over time because of reduced natural river and stream flows, decreases in groundwater-levels and discharges, and many local and SLV-wide water and land use issues (Emery et al. 1973, Cooper and Severn 1992, Ellis et al. 1993, Emery 1996, refuge annual narratives). For example, water in Rock and La Jara Creeks and the Alamosa River no longer reach the refuge except sometimes through drains or return flow from upstream ditches. Future efforts to regulate over-appropriated and limited groundwater in the SLV (and the entire Rio Grande system) is being directed by the Colorado State Engineer, pursuant to Colorado General Assembly SB 04-222, subsection 4, rules Governing the Withdrawal of Groundwater in Water Division No. 3. SB 04-222 requires full replacement of all new or increased withdrawals from the confined aquifer system and maintenance of artesian pressures and SB 04-222 requires an “Augmentation Plan”, or replacement plan for new groundwater withdrawals. Alamosa NWR will need to develop an augmentation plan for groundwater used from the Mumm Well based on response

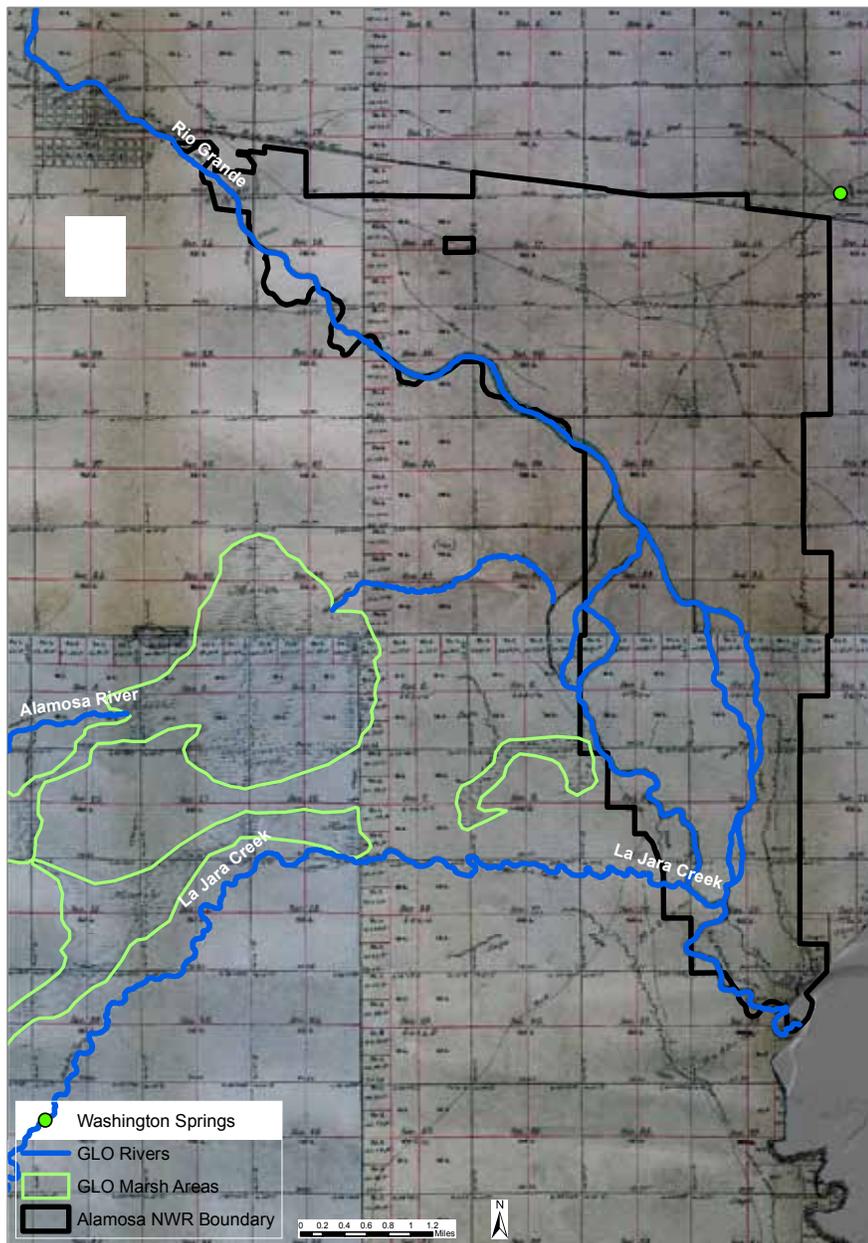


Figure 2. Historic floodplain of the Rio Grande showing marsh areas, rivers, and creeks in relation to the Alamosa National Wildlife Refuge (adapted from late-1800s GLO survey maps).

functions from the Rio Grande Decision Support System (Striffler 2013).

In addition to the extensive alterations in land and water uses in the larger SLV region, the USFWS also modified landform and water distribution on Alamosa NWR after it was established. These modifications included the construction of extensive water management infrastructure (levees, ditches, and water-control structures) and the conversion of former native wet meadow and salt desert shrub communities to artificially irrigated and inundated meadows and wetlands (USFWS 2003). The ecological consequences of long-term diversion of water and seasonal inundation of areas formerly in salt desert shrub and extended annual flooding of wet meadow habitats have included increased soil salinity in many areas, alterations to the presence and distribution of native vegetation species, altered natural resource availability to native animal species, and invasion and establishment of non-native plant species, especially tall whitetop (*Lepidium latifolium*).

In 2003 a Comprehensive Conservation Plan (CCP) was prepared for Alamosa NWR and Monte Vista NWR, to identify habitat and public use goals (USFWS 2003). Since that time, management has sought to implement CCP goals, but also has recognized constraints of water availability and the need for more holistic system-based approaches to design and implement future restoration and management efforts. In 2011 the USFWS initiated a new CCP planning process for SLV NWRs including Alamosa NWR. This new CCP is being facilitated by Hydrogeomorphic Methodology (HGM) evaluation. Recently, HGM has been used to evaluate ecosystem restoration and management options on many NWR's in Region 6 of the USFWS (e.g., Heitmeyer and Fredrickson 2005; Heitmeyer et al. 2009; Heitmeyer et al. 2010a,b; Heitmeyer et al.

2012; Heitmeyer and Aloia 2013). The HGM process obtains and collates historical and current information about: 1) geology and geomorphology, 2) soils, 3) topography and elevation, 4) hydrology, 5) aerial photographs and maps, 6) land cover and plant/animal communities, and 7) physical anthropogenic features of ecosystems (Heitmeyer 2007, Klimas et al. 2009, Theiling et al. 2012, Heitmeyer et al. 2013). HGM information provides a context to understand the physical and biological formation, features, and ecological processes of lands within a 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 evaluation of Alamosa NWR with the following objectives:

1. Describe the pre-European settlement (hereafter Presettlement) ecosystem condition and ecological processes in the Alamosa NWR region.
2. Document changes in the Alamosa 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.
3. Identify restoration and management options and ecological attributes needed to restore specific habitats and conditions within the Alamosa NWR region.



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