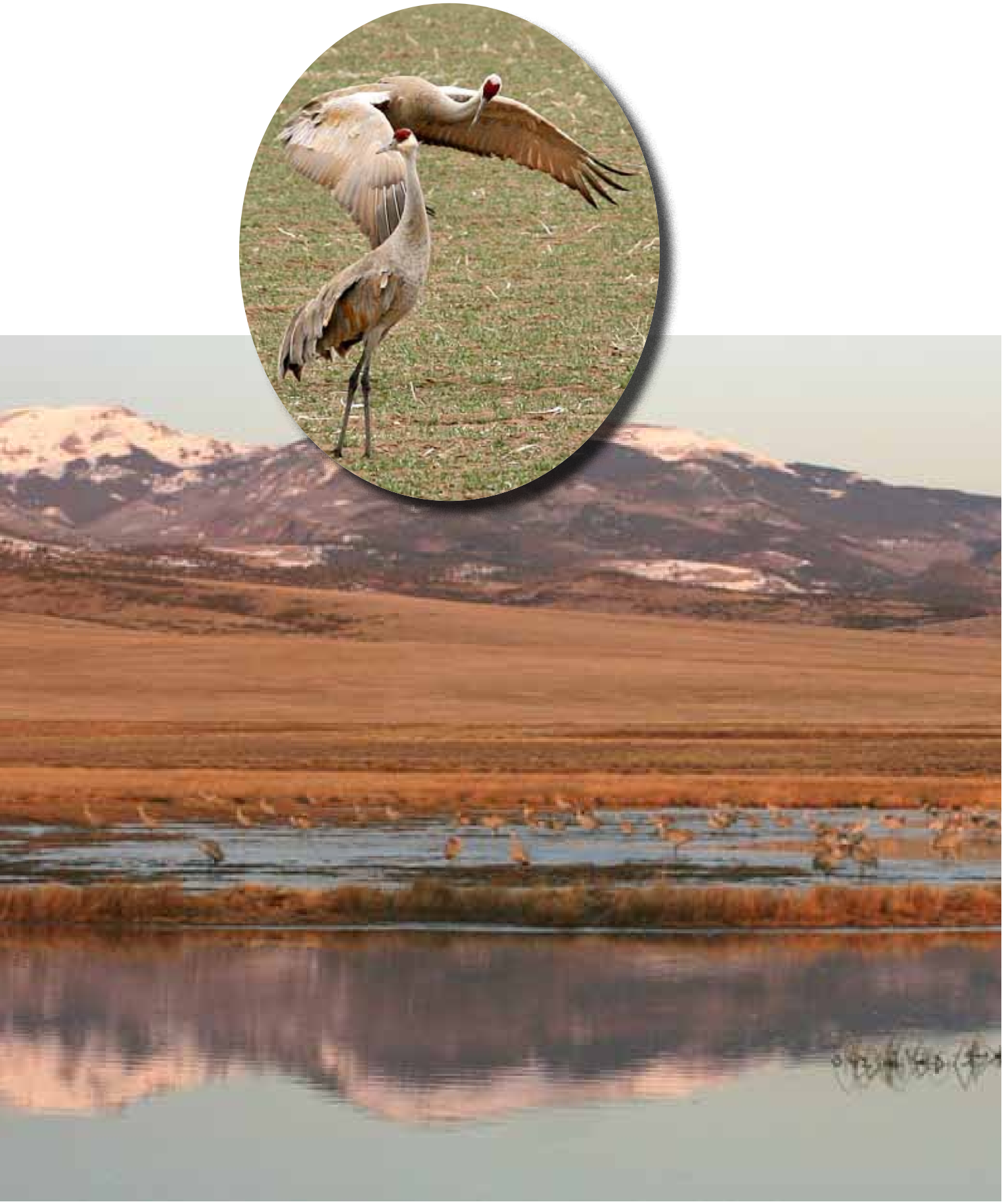

INTRODUCTION

Monte Vista National Wildlife Refuge (NWR) contains 14,800 acres on the west side of the San Luis Valley (SLV) in south-central Colorado (Fig. 1). The refuge was established in 1952 under the authority of the Migratory Bird Treaty Act in response to local interest in protecting wintering duck habitat along Spring Creek and reducing waterfowl depredation on nearby privately owned grain fields (U.S. Fish and Wildlife Service (USFWS) 2003). The authorizing purpose of the refuge was "… for use as inviolate sanctuary or for any other management purpose, for migratory birds." Acquisition of lands for a NWR in the region was considered as early as 1941, when a refuge to be named "Spring Creek NWR" was initially discussed by the USFWS. In August 1949 a potential refuge boundary (with a name change to "Monte Vista NWR") that encompassed about 13,475 acres was officially proposed (Hise 1994). The first funds for acquiring the refuge were made available in 1951-52; thereafter fee-title acquisition of private lands and withdrawal of public lands administered by the U.S. Bureau of Land Management (BLM) eventually created the current refuge size.

Monte Vista NWR is located at the base of the San Juan Mountain foothills immediately south of where the Rio Grande enters the SLV. The entry of the Rio Grande into the SLV historically created a large elevated alluvial fan, on which Monte Vista NWR sets (Fig. 2, Bachman and Mehnart 1978). Monte Vista NWR is bisected by three creek drainages (Spring, Rock, and Cat Creeks) that originate in the San Juan Mountains. Historically, the alluvial fan at Monte Vista NWR was dominated by an extensive salt desert shrub community, with wetlands located in the relatively narrow creek drainage corridors (Ramaley 1942). The foothills of the San Juan Mountains on the far west side of the refuge contained "undershrub" grasslands. The combination of grassland, shrub, and

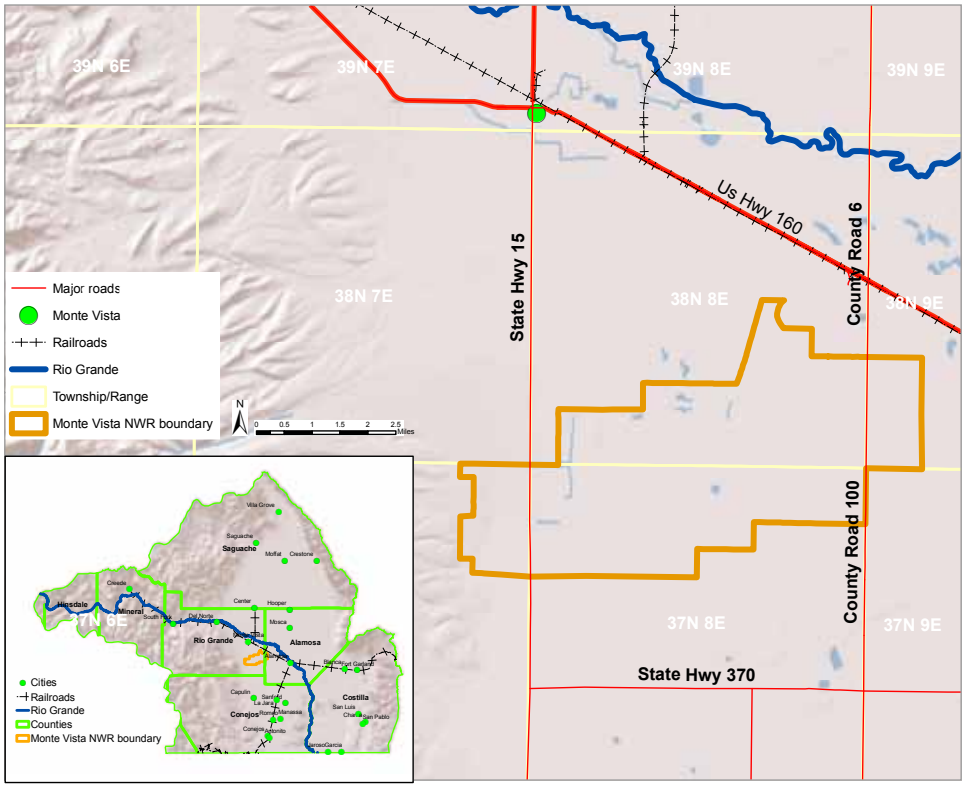

Figure 1. General location of Monte Vista National Wildlife Refuge.

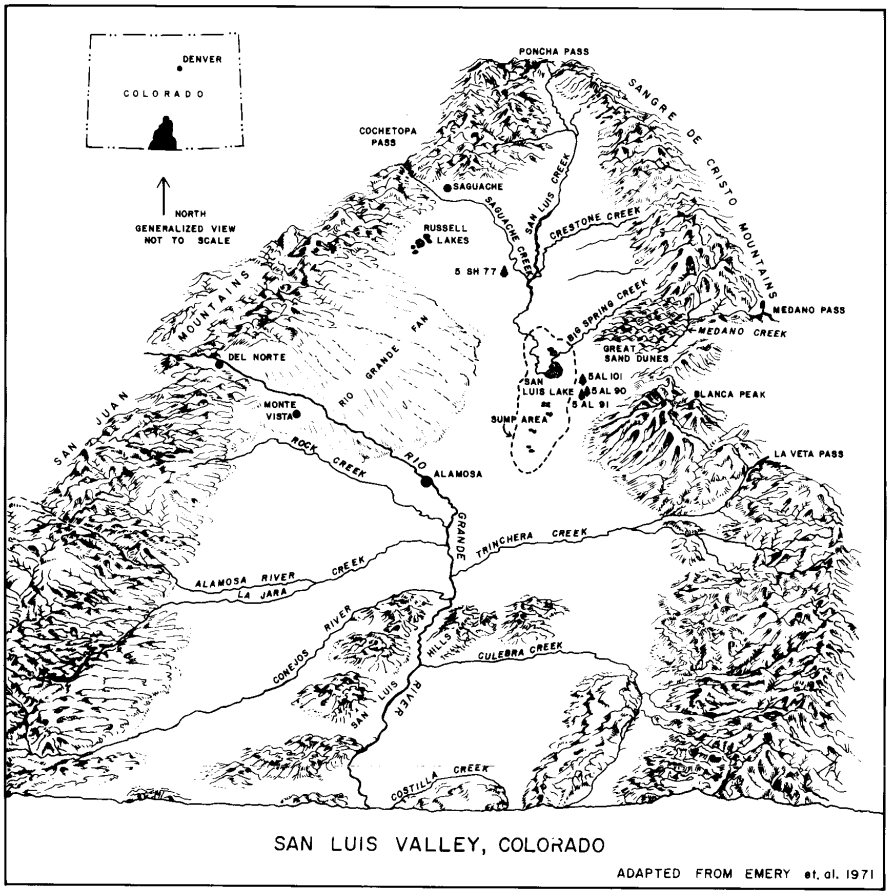

Figure 2. Physiography of the San Luis Valley showing the location of the Rio Grande and Rock Creek alluvial fans (modified from Jodry and Stanford 1996).

wetland communities provided important resources for many diverse animal species (USFWS 2003).

Many land and water use changes have occurred in the SLV and at Monte Vista NWR since European settlement. Following major expansion of settlements in the SLV during the mid-1800s, agricultural production became the predominant way of life for local residents, but was limited by the availability of surface and groundwater. To support a growing agricultural economy, irrigation "systems" were extensively developed in the SLV and included diversion of water from the Rio Grande and other rivers/creeks, conveyance of diverted water through an elaborate system of ditches and canals, exploitation of groundwater using pumped wells from shallow unconfined aquifers and from free-flowing and pumped deeper artesian water, and various use and diversion of prior-used "drainwater" (see Buchanan 1970, Athearn 1975, Hanna and Harmon 1989, Emery 1996 and others). Use and allocation of both surface and groundwaters now is regulated through many complex water rights, the Rio Grande Convention Treaty of 1906 and later interstate "Compact" agreements, state and local irrigation districts, and individual water source/diversion legalities. Over time, water availability for wetland management on Monte Vista NWR has become limited because of reduced natural river and stream flows, decreases in groundwater levels and discharges, climatic conditions, and many other 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, by the late-1970s, groundwater in the region had declined to such an extent that groundwater discharge flows in Spring Creek, which formerly flowed through Monte Vista NWR, ceased (USFWS refuge annual narratives). Future efforts to regulate over-appropriated and limited groundwater in the SLV (and the entire Rio Grande system) is being driven by the Colorado State Engineer through promulgation of Groundwater Rules and Regulations, which will incorporate among other stipulations, the development of an "Augmentation Plan" that undoubtedly will place even greater limitations on water use for the refuge.

In addition to the extensive alterations in land and water uses in the larger SLV region, the USFWS also extensively modified landform and water distribution on Monte Vista NWR after it was established. These modifications included the construction of extensive water management infrastructure consisting of levees, ditches, and water-control structures and the conversion of former salt desert shrub communities to seasonally irrigated and inundated meadows and artificial wetlands (USFWS 1962, 2003). After the first 10+ years of water diversion management on Monte Vista NWR, which had emphasized annual diversion of surface water to shallowly flood wet meadow and former shrubland areas, large numbers of breeding ducks were attracted to the refuge and management priorities changed from maintaining wintering habitat and preventing depredation to active efforts to increase duck and waterbird production (Gilbert et al. 1996, USFWS 2003). The

ecological consequences of long-term diversion of water and seasonal inundation of extensive areas formerly in salt desert shrub habitats have included increased soil salinity in many former shrub areas, shifts in the distribution of native vegetation species, altered resource availability to native animal species, and invasion and establishment of non-native plant species, especially tall whitetop (*Lepidium latifolium*). Monte Vista NWR also has been subject to management constraints from legal actions. For example, Monte Vista NWR was included in a lawsuit filed by the National Audubon Society in 1992 that alleged incompatible uses because of the refuge use of livestock grazing in habitat management. In 1993 the USFWS settled the lawsuit with the plaintiffs out-of-court through an agreement that specified actions for future management of the refuge.

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

1. Describe the pre-European settlement (hereafter Presettlement) ecosystem condition and ecological processes in the Monte Vista NWR region.
2. Document changes in the Monte Vista 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 Monte Vista NWR region.