

AN EVALUATION OF
ECOSYSTEM RESTORATION AND MANAGEMENT OPTIONS FOR
COKEVILLE MEADOWS NATIONAL WILDLIFE REFUGE

PREPARED FOR:

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JULY 2010



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Publication No. 10-04

Suggested citation:

Heitmeyer, M. E., M. J. Artmann, L. H. Fredrickson 2010. An evaluation of ecosystem restoration and management options for Cokeville Meadows National Wildlife Refuge. Greenbrier Wetland Services Report 10-04. Blue Heron Conservation Design and Printing LLC, Bloomfield, MO.

Photo credits:

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U. S. Fish and Wildlife Service
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EXECUTIVE SUMMARY



Cokeville Meadows National Wildlife Refuge (NWR) is a relatively new refuge authorized to contain 26,657 acres within an approved boundary in Lincoln County, Wyoming. Current NWR lands include 6,466 acres owned in fee title by the U.S. Fish and Wildlife Service (USFWS), 1,672 acres protected with conservation easements, 758 acres in Farmers Home Administration lands, and a 363 acre State of Wyoming land lease. The Bear River and its floodplain are the primary features on Cokeville Meadows NWR; edges of the floodplain grade into upland bluffs and alluvial fans. Water in the Bear River is seasonally impounded in areas upstream and in Cokeville Meadows NWR and is diverted into floodplain meadows and grasslands through a system of ditches, dikes, and water-control structures. Water diversions and infrastructure, roads, rail beds, and altered land uses have changed vegetation communities and topography on the refuge.

In 2009, a Comprehensive Conservation Plan (CCP) was initiated for Cokeville Meadows. This CCP is being facilitated by an evaluation of ecosystem restoration and management options using Hydrogeomorphic Methodology (HGM). This report provides this HGM evaluation with the following objectives:



1. Identify the pre-European settlement ecosystem condition and ecological processes in the Bear River Valley near Cokeville Meadows NWR.
2. Evaluate changes in the Cokeville Meadows 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 successfully restore specific habitats and conditions within the Cokeville Meadows NWR region.

The contemporary geomorphic surfaces at Cokeville Meadows NWR are primarily one to two mile wide Holocene alluvial deposits from the Bear River flanked by younger-age alluvial fans and low terraces. Numerous abandoned Bear River channels occur in the floodplain in the form of oxbows and floodplain wetland depressions. Soils at Cokeville Meadows include alluvial silt loams overlying alluvial sand and gravel, cobble silt and sandy loam soils on alluvial fans and terraces, and mixed parent material soils on the foothills. Elevations on the refuge range from about 6,500 feet on south end bluffs to 6,170 feet on the north end floodplains.

The climate of the Cokeville Meadows region is semi-arid, midcontinental. Average annual precipitation is about 12 inches; about 38% of annual precipitation occurs as rainfall from April to June. The frost-free growing season is only 60-70 days each year. Evapotranspiration rates are high and the occurrence of natural free-standing surface water is scarce from summer through winter.

Historically, the Bear River had a strongly unimodal discharge/river stage pattern with peak discharges above 400 cubic-feet/second (cfs) in June and relatively low sustained discharges near 100 cfs from August through February. Water from the Bear River begins to enter many off-channel oxbows and floodplain depressions at about 300 cfs and much



of the floodplain is inundated at discharges of > 1,000 cfs. Consequently, historic backwater flooding from the Bear River into floodplains typically occurred for relatively short time periods from late May to mid June in most years. In addition to the strong seasonal pattern of river discharge and flooding, long term data suggest alternating patterns of peak and low discharges about every 12 to 15 years. During the ca. 60 year period of record on the Bear River below Pixley Dam, the river exceeded 1,500 cfs in 9 years and annual peaks were below 500 cfs in 15 years.

Historic vegetation communities at Cokeville Meadows NWR included: 1) narrow riparian/riverfront forest corridors along the Bear River, 2) semipermanently flooded floodplain wetland depressions, 3) wet meadow sedge and grassland communities, and 4) upland sagebrush/grassland communities. A HGM matrix of relationships of these plant communities to geomorphic surface, soils, hydrology, and elevation was developed to map potential distribution of historic communities on Cokeville Meadows. Generally historic communities were distributed as relatively parallel bands as water-elevation gradients moved from the Bear River upslope to valley terraces and alluvial fans. Persistent emergent wetland communities were imbedded within floodplains in abandoned channels and depressions. The suite of vegetation communities historically provided important resources for diverse populations of animals. Migratory birds, both terrestrial and wetland species, were especially abundant in the floodplain ecosystem; most were seasonal visitors, but in wet years many waterbirds bred in the region.

This study obtained information, where available, on contemporary: 1) physical features, 2) land use and management, 3) hydrology, 4) vegetation communities, and 5) fish and wildlife populations of Cokeville Meadows NWR and the surrounding region. Native people apparently occupied the region at various times over the past 10,000 to 12,000 years, but European settlement did not become widespread until the mid 1800s. Sparse human populations, limited growing seasons, and little transportation and economic infrastructure limited ecosystem changes to the



area until the mid 1900s, except for early diversions of water for human and livestock use, eventual extensive grazing, and rail/road construction. Most water diversion structures were built in the 1930s and 1940s to move water from the Bear River onto meadow and grassland areas in the floodplain to enhance forage and hay production during summer. Typically, the low-level Pixley and B-Q dams on the Bear River near Cokeville Meadows NWR were closed in spring to divert water into contour distribution ditches that branched from the diversion site to meadow fields. Irrigation companies operated and maintained water delivery systems and infrastructure. Water from the Smith's Fork River also was diverted into the Cokeville Meadows region via the Covey Canal. At the end of the irrigation season (about mid July), water is drained from meadows to allow drying and subsequent haying and then summer/fall grazing.

A set of seniority rights govern water use in the Bear River Valley during limited water periods. All water management and uses in the Bear River Basin are governed by the Bear River Compact, which determines water rights and obligations in Wyoming, Utah, and Idaho. Currently, 50 separate water rights are present on Cokeville Meadows NWR lands. Over 100 groundwater wells have been drilled in the Bear River Valley in the Cokeville Meadows region and they supply water for agriculture and urban uses. Ten of these wells are on existing NWR lands.

Current land use in the NWR acquisition boundary is dominated by shallowly flooded wet meadow habitats in the floodplain and sagebrush-grassland habitats on alluvial fans and upland terraces. Nearly 4,000 acres of terrace and alluvial fan areas have been converted to irrigated cropland and alfalfa fields. About 1,200 acres in the NWR boundary are in deeper wetland depressions and abandoned channel areas. The more consistent and prolonged spring/summer flooding on Cokeville Meadows NWR has shifted grass and wetland species to slightly wetter and fresher types. Creeping foxtail has expanded to dominate meadow communities. Cattail and bulrush now dominate deeper floodplain depressions and ditch/canal edges. Several noxious



and invasive plants have become established on the refuge including Canada thistle, whitetop, musk thistle, and Russian knapweed.

Since Cokeville Meadows NWR was authorized in 1989 by an act of the Wyoming Legislature, the refuge has expanded through acquisition, easement, and land transfer. The purposes of the refuge are: 1) conservation of wetlands to meet obligations of migratory bird treaties and conventions, 2) conservation of Western Intermountain ecosystems, and 3) sustaining migratory bird populations. Management and development on the refuge began in the early 1990s and has included partial impoundment of floodplain sites for waterfowl production; enhancement of foraging areas for migratory waterfowl, sandhill cranes, eagles and raptors, songbirds, and shorebirds; providing nesting habitat for waterbirds; protecting roost sites for bald eagles; and protecting and enhancing lek sites for sage grouse. Existing irrigated hay and pastureland has been mostly maintained on the refuge, although some small areas were originally converted to dense nesting cover for waterfowl. About 50% of hayable meadows are hayed by adjacent landowners under permit. Invasive and noxious weeds also are controlled by permittees.

Little quantitative information is available to assess changes in presence, abundance, and distribution of animal species over time in the Cokeville Meadows NWR region. Use and production by some waterbird species may have increased as more annually consistent and prolonged water regimes have occurred because of annual water diversions. However, reduction in long-term dynamics of flooding may be decreasing wetland productivity and diversity of both plant and animal species. The effects of changes in wet meadow vegetation, including a now dominated creeping foxtail community, on animal populations are unknown. Total number of sage grouse lek sites on the refuge has not changed, but some individual lek sites have been abandoned. Populations of some mammal species have changed from historic periods and few native fish remain in the Bear River or its tributaries.



The major ecosystem changes and issues that affect future management and restoration of habitats on Cokeville Meadows NWR include: 1) maintaining and complying with adjudicated water rights and irrigation/drainage constraints with neighbor land holdings that control water flow and delivery pathways onto, and across refuge lands, 2) disjunctive land ownership, 3) presence and expansion of invasive and introduced plant species, 4) altered water flow and seasonal flooding regimes, 5) altered vegetation communities, and 6) public expectations for continued agricultural uses and expansion of lands and public access. Based on the HGM context of this study, future management of Cokeville Meadows should seek to:

1. Maintain the physical and hydrological character of the Bear River and its floodplain in the refuge boundary.
2. Restore natural topography, water regimes, and physical integrity of surface water flow patterns in and across the Bear River floodplain and adjacent terraces and alluvial fans.
3. Restore and maintain the diversity, composition, distribution, and regenerating mechanisms of native vegetation communities in relation to topographic and geomorphic landscape position.

Specific recommendations for each of these primary ecosystem goals include:

Goal #1. Bear River floodplain physical and hydrological character

- Protect and restore, where possible, the physical and hydrological integrity of the Bear River and major tributary channels and their water flows, especially the large spring pulse of water in these rivers and streams that originates from snowmelt and spring precipitation.
- Protect the natural heterogeneous topography of the floodplain including the unique geologic/soil



characteristics of abandoned channels and river meander scars, floodplain drainages, alluvial fans, and older geologic-age higher elevation terraces.

- Maintain a low human presence in, and disturbance of, floodplain/terrace plant and animal communities.
- Protect alluvial aquifers and the delicate soil-mineral balances throughout the floodplain and its adjoining alluvial fans and terraces.

Goal #2. Topography, Water Regimes, Water Flow Patterns

- Restore natural topography and reconnect natural water flow patterns and pathways where possible.
- Manage wetland impoundments (that are retained) and natural floodplain depressions for more natural seasonal and long-term water regimes.

Goal #3. Natural Vegetation Communities

- Restore distribution of plant communities to appropriate sites based on HGM-predicted geomorphology, soil, topography, and hydrology features.
- Improve conditions to increase the distribution and historic composition of native Wet Meadow habitats.
- Reduce the area of more permanently flooded wetlands and persistent emergent vegetation.
- Actively control invasive and noxious plant species

Future management of Cokeville Meadows NWR should include regular monitoring and directed studies to delineate refuge features and communities and to determine how ecosystem structure and function are changing, regardless of whether restoration and management options identified in this report are implemented. Ultimately, the success in restoring and sustaining communities and ecosystem



functions/values at Cokeville Meadows NWR will depend on how well the physical and hydrologic integrity of the Bear River is protected and how key ecological processes and events, especially the short pulsed duration spring flooding, can be restored or emulated by management actions. Critical information and monitoring needs include: 1) obtaining key baseline soil, topography, plant and animal data; 2) annual monitoring of water use and flow patterns; 3) long-term changes in vegetation and animal communities.



