Wetlands

Photo courtesy of WGFD

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Information included in this section was adapted from the Wyoming Wetlands Conservation Strategy (WJVSC 2010). Those desiring additional information on Wyoming wetlands and wetland conservation not covered in this section should consult this document.

Habitat Description

Wetlands are habitats where the soil is annually saturated with water or covered by water at some time during the growing season of each year. For the purposes of this document, wetlands include wet meadows, potholes, playas, oxbows, beaver ponds, marshes, bogs, seeps, the vegetated shorelines of lakes and ponds, and other types of open water. Wetlands have been segregated from riparian areas (page III-8-1) which are designated as habitats associated with riverine systems. This differentiation has been made for SWAP planning and implementation purposes. Conservation and ecological issues for wetlands and riparian habitat types have considerable overlap. A list of the NatureServe Ecological Systems included in the wetlands habitat type can be found in Table 19. Much of Wyoming lacks the precipitation needed to support expansive wetland complexes such as those found in wetter regions of the country (Hubert 2004). Wyoming is the fifth driest state in the United States based on a statewide average rainfall of 16.8 inches (Wyoming State Geological Survey undated).

Wyoming wetlands can be divided into several morphological groups depending on their location and origin. The plains and intermountain basins are typified by low densities of shallow, playa-type wetlands that formed either in blowouts or, in some cases, as a result of tectonic activity. Kettle, cirque, and moraine type wetlands and lakes are present in higher elevations once covered by montane glaciers; however, the Pleistocene glacial sheets that left dense wetland complexes throughout the U.S. and Canadian prairie pothole region, did not reach Wyoming. Springs, bogs, and seeps are scattered throughout the state, but are most common in the montane areas.

Prior to settlement, natural wetlands covered about 3.2% of Wyoming (Dahl 1990) and were predominantly associated with riparian corridors and glaciated montane regions. By the mid-1980s, the total area of wetlands had been reduced to approximately 2% (Dahl 1990). Both the number and area of natural wetlands continue to decline, though this is offset to some extent by an increase in ponds and other human-created wetlands and water bodies.

Since the late 1800s, manmade wetlands have been created, both deliberately and coincidentally, as a result of human activities. Created wetlands vary in quality and can be associated with livestock impoundments; spring developments; windmill basins; irrigation seepage or runoff; sediment retention basins; reclaimed and abandoned mine impoundments; produced water from oil and gas operations; highway ditches and borrow pits; reservoir backwaters; mitigation sites; habitat areas on private, state, and federally-managed lands; and other miscellaneous activities (Tessmann 2004).

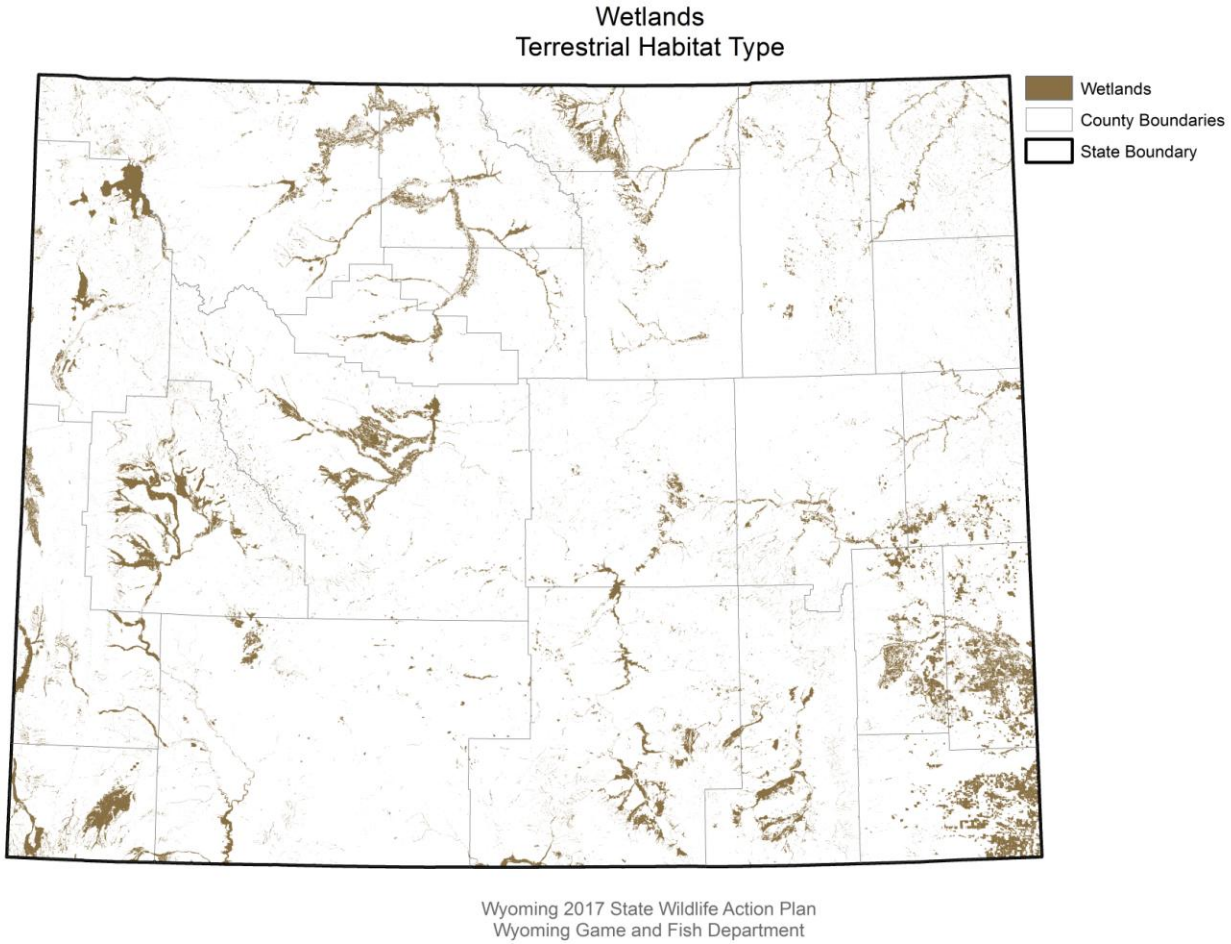


FIGURE 19. Wyoming Wetlands

TABLE 19. Wyoming Wetlands NatureServe Ecological Systems[1]

1. Open Water
2. Pasture/Hay
3. Inter-Mountain Basins Playa
4. Introduced Riparian and Wetland Vegetation
5. Great Plains Prairie Pothole
6. Rocky Mountain Alpine-Montane Wet Meadow
7. Western Great Plains Open Freshwater Depression Wetland
8. North American Arid West Emergent Marsh
9. Columbia Plateau Vernal Pool
10. Rocky Mountain Subalpine-Montane Fen
11. Western Great Plains Closed Depression Wetland
12. Western Great Plains Saline Depression Wetland
13. Inter-Mountain Basins Alkaline Closed Depression
14. Inter-Mountain Basins Interdunal Swale Wetland

[1] Descriptions of NatureServe Ecological Systems which make up this habitat type can be found at: NatureServe Explorer: an online encyclopedia of life [web application]. Version 7.1. NatureServe, Arlington, Virginia. http://www.natureserve.org/explorer.

TABLE 20. Wyoming Wetlands Species of Greatest Conservation Need

Mammals
Fringed Myotis
Hayden's Shrew
Little Brown Myotis
Long-eared Myotis
Long-legged Myotis
Moose
Northern Long-eared Myotis
Pallid Bat
Preble's Shrew
Pygmy Shrew
Spotted Bat
Townsend's Big-eared Bat
Water Vole

Birds
American Bittern
American White Pelican
Black-crowned Night-Heron
Black Tern
Caspian Tern
Cattle Egret
Clark's Grebe
Common Loon
Forster's Tern
Franklin's Gull
Snowy Egret
Trumpeter Swan
Virginia Rail
Western Grebe
White-faced Ibis

Reptiles
Red-sided Gartersnake
Valley Gartersnake
Plains Gartersnake
Smooth Greensnake
Western Painted Turtle

Amphibians
Columbia Spotted Frog
Great Basin Spadefoot
Great Plains Toad
Northern Leopard Frog
Plains Spadefoot
Western Tiger Salamander
Western Toad
Wood Frog
Wyoming Toad

Wetlands Wildlife

Wetlands are an extremely important wildlife habitat, disproportionately contributing to the diversity of Wyoming wildlife relative to the land base which they occupy. About 90% of wildlife species in Wyoming use wetlands and riparian habitats daily or seasonally during their life cycle, and about 70% of Wyoming bird species are wetland or riparian obligates (Nicholoff 2003). The high wildlife value of wetlands is derived largely from the presence of water which supports a large diversity of plants and animals, including invertebrates, which provide a forage base. Along altitudinal gradients, wetlands at mid and lower elevations tend to support greater diversity and density of wildlife because the growing season is longer, enabling those wetlands to be more productive. High elevation wetlands (over 8,000 ft) can be important for specific life stages of several species, but are not as productive.

Wetlands serve a valuable role in storing water. Marshes, fens, wet meadows, and similar cover types act as sponges that absorb and retain snowmelt and runoff, then slowly release it through the growing season. This increases the amount and reliability of downstream flows, especially in late summer, which in turn increases the quality of downstream riparian habitats. In addition, most wetlands improve the quality of water that is discharged. This is accomplished by removing sediments and some pollutants from water, thus acting as filtration systems for downstream communities, both human and ecological.

Clusters of wetlands in close proximity (wetland complexes), especially wetlands of differing size, chemistry, vegetation cover, and hydrology tend to sustain greater use by wildlife (WJVSC 2010). In addition, species richness and abundance tend to increase with wetland size (Mack and Flake 1980, Belanger and Couture 1988, Brown and Dinsmore 1986, McKinstry and Anderson 2002). Accordingly, diversity of size and water permanence are important attributes of wetland systems. Isolated wetlands in arid environments are also extremely valuable for wildlife. Wetlands in these areas often provide a crucial water source and enhanced cover and forage production, making

them a hub of activity for terrestrial wildlife that inhabit the surrounding area.

Wetlands provide irreplaceable habitat for waterfowl. Notable waterfowl species in Wyoming include the mallard, pintail, American widgeon, gadwall, green-winged teal, blue-winged teal, cinnamon teal, redhead, ring-necked duck, goldeneye, snow goose, and Canada goose.

Migrating shore birds also depend on wetlands. Shorebirds are known to have the longest migrations of any animal species, migrating as far as from the Arctic to the tip of South America, with non-stop flights, exceeding a thousand miles per leg (Brown et al. 2001). Wetlands provide food rich environments for shorebirds to build up fuel reserves needed to complete these long flights. Shorebirds frequently seen in Wyoming wetlands include American avocet, black-necked stilt, Wilson's phalarope, greater and lesser yellowlegs, long-billed dowitcher, killdeer, common snipe, spotted sandpiper, solitary sandpiper, western sandpiper, semipalmated sandpiper, willet, long-billed curlew, and white-faced ibis.

Wetlands are also very important for bats. Physical characteristics that influence how bats use water resources include size of the water body, extent of open water, surrounding and emergent vegetation, turbulence of the water, proximity to roosts, and water quality. In general, water features increase in value to bats if they are large, calm, and uncluttered; are in close proximity to roosts; have a diverse and productive riparian zone; support a diverse insect community; and are free of pesticides and other contaminants. Bats drink while in flight, accordingly they require water sources that are large and uncluttered for them to approach and skim the surface. Although tall vegetation and other features surrounding small bodies of water may reduce accessibility for some bats, the presence of some vegetation around water is nevertheless an important component of bat habitat. The vegetation provides abundant insect prey and protection from predators, and improves foraging conditions by blocking wind.

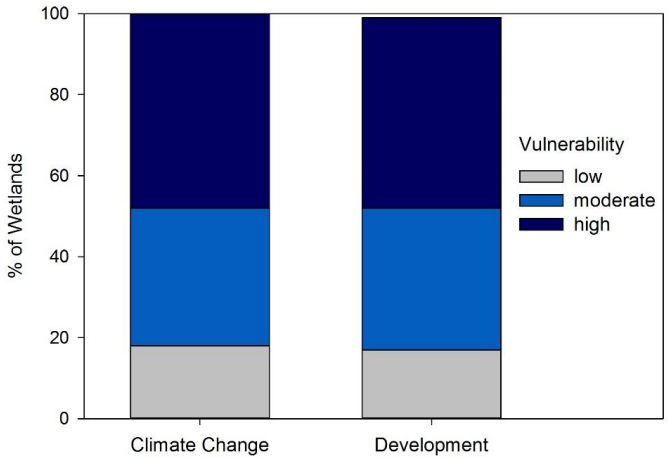
Alpine and sub-alpine wetlands and wet meadows are especially important for shrews and the water vole. These semi-aquatic species, rely heavily on leaves, roots, and stems of forbs, and invertebrates.

Wetlands are an important feature for amphibians. All of Wyoming's amphibian species are reliant on water to complete their life cycle. Eggs are laid aquatically, where they hatch into larvae (some are referred to as tadpoles). The larvae then undergo metamorphosis to become terrestrial adults. However, the western tiger salamander may remain aquatic as an adult while retaining larval characteristics (termed *paedomorphism*). Many wetlands provide ephemeral fishless pools that amphibians prefer for breeding. In addition to utilizing wetlands for breeding and larval development, many frogs, toads, and salamanders are tied to aquatic environments as adults. Many amphibians, primarily frogs and salamanders, require wet environments to prevent desiccation and to provide cover from predators. Western tiger salamanders may live their entire lives in an aquatic environment, exhibiting paedomorphism.

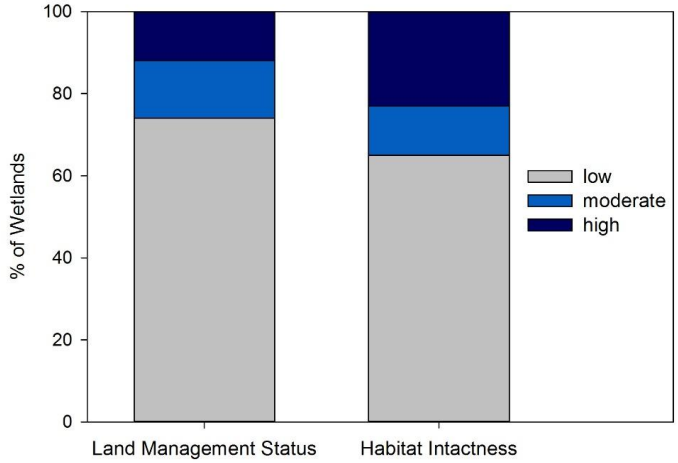
Many reptile species also prefer wetland habitats. Gartersnakes are particularly reliant on this habitat type. Gartersnakes are found in the subfamily Natricinae and closely related to the genus Nerodia (watersnakes). They are typically found in the moist environments found in wetlands and other riparian corridors. Gartersnakes feed on a variety of aquatic species including fish, invertebrates, and amphibians.

Wetland Habitat Threats

Figure 20. Wetlands Vulnerability Analysis



The colored bars show the proportion of the habitat type that was identified as having low, moderate, or high vulnerability to climate change or development, based on classification of scores ranging from 0 to 1 into the following categories: low (<0.34), moderate (0.34-0.66), and high (>0.66). Rankings for climate change or development vulnerability were based on the land area of the habitat type classified as having high vulnerability: low (<10%), moderate (10-33%), or high (>33%). Vulnerability was calculated as exposure minus resilience. Development vulnerability includes existing and projected residential, oil and gas, and wind energy development. Further details are provided in the Leading Challenges section of this report and in Pocewicz et al. (2014).



The colored bars show the proportion of the habitat type that was identified as having low, moderate, or high land management status or habitat intactness. For land management status, high corresponds to the percent of the habitat occurring in GAP status 1 or 2, moderate to the percent occurring in GAP status 2b or 3, and low to the percent occurring in GAP status 4. Rankings for land management status were based on the land area of the habitat type classified as having high status or legal protection: low (<10%), moderate (10-33%), or high (>33%). For habitat intactness, scores ranging from 0 to 1 were assigned to categories as follows: low (<0.34), moderate (0.34-0.66), and high (>0.66). Rankings for intactness were based on the land area of the habitat type classified as having high intactness: low (<25%), moderate (25-75%), or high (>75%).

For a more additional detail and more complete listing of threats facing Wyoming wetlands, please refer to *Wyoming Wetland Conservation Strategy* (WJVSC 2010) and *Wyoming Partners In Flight Bird Conservation Plan - Wetlands Section (*Nicholoff 2003). For consistency, habitat threats ranked *extreme* in the Wyoming Wetland Conservation Strategy were ranked *high* in the SWAP which does not use an *extreme* threat category.

Climate Change and Drought - High
Variable weather patterns and periodic drought cycles are common occurrences in the West and an important driver of wetland ecology. However, the frequency and duration of droughts have increased markedly since the 1980s, producing undesirable changes in wetland hydrology and the long-term loss of functional wetlands in some areas. Wetlands associated with irrigation may be insulated from drought if water continues to be available. Alternatively, wetlands dependent upon irrigation, particularly created wetlands with junior water rights, can remain dry for extended periods. In addition, natural wetlands can be severely impacted by long-term climatic changes leading to desertification and depleted stream flows (see Wyoming Leading Wildlife Challenges - Climate Change).

Rural Subdivisions – High
Houses, outbuildings, and lawns directly eliminate native wildlife habitat. Additional infrastructure such as roads, buildings, power lines, and fences, along with disturbances including traffic, human activity, and increased predator densities, can lessen the suitability of wetland habitats for sensitive wildlife. Loose pets, especially cats, are very problematic for wildlife near subdivisions. Pesticides, herbicides, and nutrients may enter aquatic environments, and their concentrations increase as a result of runoff from nearby lawns and landscaping use. Soil disturbance from construction and the year-round grazing of horses and other hobby livestock can facilitate the establishment of invasive plant species. Wildlife attempting to avoid human-related disturbances expend greater energy and displace to lower quality habitats, resulting in lower survival and reproductive capacity (See Wyoming Leading Conservation Challenges – Rural Subdivision and Development).

Conversion of agricultural operations to rural residential development can also lead to a loss of flood irrigated meadows which are important to many wildlife species. The establishment of water wells for domestic use can deplete groundwater and negatively impact springs and wetlands.

Invasive Plant Species - High
Invasive plants impair habitat functions of wetlands and riparian communities in many regions of the Wyoming. Tamarisk (also known as *saltcedar*) and Russian olive are causing the most significant impact on Wyoming's wetland habitats. Although tamarisk and Russian olive provide cover and forage benefiting some species of wildlife, they often dominate native vegetation, adversely affect wetland hydrology, and attract abnormally high densities of predators (see Wyoming Leading Wildlife Challenges – Invasive Species). Other invasive species also impact wetlands including leafy spurge, Dalmatian toadflax, whitetop, Canada thistles, black henbane, and spotted knapweeds.

Water Development Projects – High
The Wyoming Game and Fish Department's Stream/Lake Database includes 666 manmade reservoirs covering a surface area of slightly over 248,000 acres or 388 mi^2 (these figures do not include most livestock impoundments or waters on the Wind River Indian Reservation). At least 30 Wyoming reservoirs exceed 10,000 acre-ft in capacity, and 15 exceed 100,000 acre-ft. Although dams create large deepwater habitats, significant areas of wetlands and riparian habitats are often inundated. The potential for wetland margins to develop around shores of large reservoirs is limited by wave action and unstable water levels, which generally preclude the establishment of wetland vegetation. In addition, large reservoirs stabilize flows and cause several downstream impacts including loss of braided channels, eventual loss of oxbow wetlands, and channel constriction by riparian vegetation. Flood control also allows residential and commercial development to take place within floodplains. Finally, reservoirs trap silt loads, and the clear water that is discharged from dams causes additional channel downcutting and

erosion (see Wyoming Leading Wyoming Wildlife Challenges – Disruption of Historic Disturbance Regimes *and* Riparian Habitat Type).

Energy Development and Mining Practices - High
Gas, oil, coal, uranium, coal-bed methane, and wind development are taking place on a landscape scale throughout many regions of Wyoming (see Wyoming Leading Conservation Challenges – Energy Development). Bentonite, trona, and gypsum are also mined on a large scale. Impacts from energy development vary depending on the type of development, location, regulatory requirements, and mitigation efforts.

Vegetation clearing, road construction, noise, and increased human and equipment activity associated with energy development and mining are known to adversely impact several species of wildlife (see Transportation Infrastructure). Ponds and wetlands have been created on some gas fields by discharging oil- and gas-produced water onto the surface in specific locations. Such ponds are often beneficial to wildlife. However in inappropriate locations, they may enhance breeding conditions for mosquitoes and increase spread of West Nile virus, which is detrimental to sage-grouse and several other avian species. New water sources on big game winter ranges can also change animal distribution, potentially resulting in less forage available during winter. Wind turbines sited within or too close to lakes and wetlands can potentially cause waterfowl, waterbirds, and shorebirds to displace from or avoid areas of otherwise suitable habitat. Turbines and associated power lines also increase mortality due to collisions if they are located too near migration corridors, refuges, and feeding and resting sites (WJVSC 2010). Sand and gravel mining operations sited on floodplains have likely produced a net gain of wetlands and open water habitats in Wyoming because it was historically common to convert abandoned or reclaimed gravel quarries into ponds and small lakes with wetland margins. The net effect of this practice has been an increase in pond-type habitats and some loss of riverine, shrubland, and other types of habitats.

Incompatible Agricultural Practices - High
Agricultural operations have created wetlands in conjunction with irrigation projects, livestock watering ponds, and federal cost share programs for wetland restoration in several areas of Wyoming. However, in the absence of adequate financial incentives or alternative conservation options, some agricultural practices adversely affect wetlands. Sediment runoff from tilled fields, heavily grazed pastures, or poorly managed watersheds can decrease the lifespan of ponds and wetlands. Some agrichemical runoff, including fertilizers, pesticides, herbicides, and animal waste, also impairs water quality and is harmful to plant life, and wildlife. Livestock grazing within wetland basins can remove vegetation cover, and destroy nests of ground-nesting birds. It is important to manage the timing of grazing so nests are not trampled and paths through wetland vegetation are not created, which allows predators to access vulnerable nests, eggs, and young. Most agricultural impacts are minimized or avoided by following appropriate best management practices (Dressing et al. 2003).

Transportation Infrastructure - High
Road improvements can affect wetlands through vegetation removal, alteration of hydrology, and increased human activity including vehicle traffic. Hydrology is affected by drainage ditches, borrow pits, gravel quarries, culvert installation, and instances of construction of the original roadbed blocking surface drainage. Additional impacts associated with roads include disturbances caused by traffic, which can displace sensitive species from nearby wetlands. Roads also become barriers to less mobile wildlife such as salamanders and turtles, and heavy traffic increases mortality of all wildlife attracted to nearby wetlands.

Management and Maintenance of Existing Wetland Projects - High
It can be a challenge for agencies to obtain ongoing funding needed to maintain wetlands in a productive, properly functioning condition. This is particularly the case at created wetlands where water levels need to be manipulated, dikes maintained, vegetation treated, and the appropriate grazing and erosion control practices administered.

Alternation of Irrigation Delivery Systems - Moderate
Wetlands have become established in many locations by seepage along irrigation canals and lateral ditches, and runoff from irrigated fields. Improvement projects intended to reduce seepage losses, such as installing canal linings or pipes, can potentially eliminate some of these wetlands. On the other hand, more efficient water delivery can increase appropriated water supplies to some wetlands, and may also increase irrigation runoff into others. Ongoing conversions from flood irrigation to center pivot sprinkler systems is adversely impacting wetlands in several regions of Wyoming because this water conservation measure yields substantially less runoff or waste water into watersheds and wetland basins.

Current Wetlands Conservation Initiatives

Wetlands conservation is receiving a great deal of attention in Wyoming. Prominent organizations engaged in these efforts include Ducks Unlimited, US Fish and Wildlife Service's Partners for Fish and Wildlife Program, Intermountain West and Northern Great Plains Joint Ventures, Natural Resource Conservation Service, Conservation Districts, The Nature Conservancy, and regional land trusts.

Ducks Unlimited (DU) is a nonprofit organization focused on wetland and waterfowl conservation. To accomplish its goals, DU frequently works with private landowners to build, restore, and conserve wetlands through conservation easements, fee title acquisitions, management agreements, and technical assistance. Two of DU's efforts that benefit Wyoming are the Platte River Initiative and Rainwater Basin Initiative in DU's Southern Great Plains region and the High Country Wetlands Initiative in DU's Northern and Southern Rockies region.

The mission of the Intermountain West Joint Venture (IWJV) is to facilitate the long-term conservation of key avian habitat including planning, funding, and developing habitat projects that benefit all biological components of Intermountain ecosystems. The IWJV Management Board reviews and ranks various habitat protection, restoration and enhancement projects for funding through NAWCA and other programs. The IWJV Implementation Plan identifies priority bird species and lists statewide conservation goals for priority habitats such as total acreage protected, maintained, enhanced, or restored (Intermountain West Joint Venture 2005). The Northern Great Plains Joint Venture (NGPJV), a similar initiative, has been engaged primarily in planning efforts and is a cooperator in the development of a NE Wyoming regional component of the Wyoming Wetlands Conservation Strategy. The NGPJV administrative boundary includes seven counties in NE Wyoming: Campbell, Converse, Crook, Johnson, Niobrara, Sheridan, and Weston (Pool and Austin 2006).

The U.S. Fish and Wildlife Service's Partners for Fish and Wildlife Program promotes on-the-ground wetland restoration projects on private lands. Focal areas targeted for wetland projects include the Laramie Plains, Goshen Hole, Wind River Indian Reservation, Great Divide Basin, and the New Fork Pothole Region of the Upper Green River Basin.

The Dumbell Ranch Stream, Riparian and Wetland Bank was approved by the U.S. Army Corps of Engineers in 2014, in conjunction with an Interagency Review Team consisting of the U.S. Environmental Protection Agency, U.S. Fish and Wildlife Service, Bureau of Land Management, Natural Resources Conservation Service, Wyoming Department of Environmental Quality, Wyoming Game and Fish Department and Wyoming State Engineer's Office. The Bank can be used to mitigate unavoidable wetland and stream impacts within a defined geographical service area. Credits may be approved for use outside of the service area with at the discretion of the U.S. Army Corps of Engineers. The stated goal of the Bank is to restore, enhance and maintain palustrine emergent wetlands, riparian areas and aquatic resources within the 740.59 acre bank boundary.

The Natural Resources Conservation Service (NRCS) offers three Programs, authorized through the 2014 Farm Bill that can be used to address wetland conservation needs on the land. The Environmental Quality Incentives Program (EQIP)

provides financial and technical assistance to agricultural producers in order to address natural resource concerns and deliver environmental benefits. The Conservation Stewardship Program (CSP), helps agricultural producers maintain and improve their existing conservation systems and adopt additional conservation activities to address priority resources concerns. The Agricultural Conservation Easement Program (ACEP) provides financial and technical assistance to help conserve agricultural lands and wetlands and their related benefits. The Agricultural Land Easements (ALE) component protects working agricultural lands. Under the Wetlands Reserve Easements (WRE) component, NRCS helps to restore, protect and enhance enrolled wetlands.

The Wyoming Game and Fish Department (WGFD) has worked on a number of small projects to provide nesting and summer habitat for a population of trumpeter swans established in the Upper Green River basin through a captive breeding program.

Local Conservation Districts in Wyoming have been involved in numerous projects to improve wetlands habitat through land management and restoration techniques on private lands. Conservation easements held by Wyoming land trusts, including the Jackson Hole Land Trust, Sheridan Community Land Trust, and Wyoming Stock Growers Agricultural Land Trust, also help to protect wetlands from potentially detrimental land uses and development.

The Wyoming Wetlands Conservation Strategy (WWCS) was developed through a collaboration between several agencies and organizations represented on the Wyoming Joint Ventures Steering Committee (WJVSC) in 2010 (WJVSC 2010). The WWCS presents a thorough review and analysis of important wetland and riparian habitats, major threats, conservation goals and strategies, regulatory framework, partnership opportunities, and links to resources that can assist efforts to conserve and enhance wetlands and riparian habitats in Wyoming.

Conservation focus areas identified in the WWCS were based upon results of two studies. The first was a semi-qualitative assessment completed by the WGFD and U.S. Fish and Wildlife Service (USFWS) for inclusion in the 1995 Statewide Comprehensive Outdoor Recreation Plan (WGFD 1995). The 1995 study identified 49 wetland complexes including 8 priority complexes throughout Wyoming. A more recent geospatial analysis by The Nature Conservancy (TNC) has identified 222 wetland complexes (Copeland et al. 2010). The Copeland et al. study also produced several sets of condition indices that can be applied in a variety of ways to prioritize wetlands.

For purposes of the WWCS, 28 priority complexes were identified based on highest species diversity scores (Copeland et al. 2010), and the WJVSC selected three additional complexes based on unique ecological considerations (Appendix A, Table 21). From the 31 priority wetland complexes, the WJVSC identified 9 primary focus areas (wetland complexes) in which partners will be encouraged to plan and implement projects over the next 10-year horizon (shown as green-shaded rows in Appendix A, Table 21, and as dark blue shaded complexes in Figure 11). The criteria for selecting 6 focus areas included a normalized Shannon diversity score of at least 93 (on a scale of 100), combined with a *high* project opportunity rating. The 3 complexes with unique ecological values were added to these. All 8 priority complexes identified in the 1995 study are included in the 9 focus areas identified by the WJVSC.

A thorough review of the regulatory and statutory framework influencing wetland conservation, mitigation, and restoration in Wyoming is provided in the WWCS (WJVSC 2010).

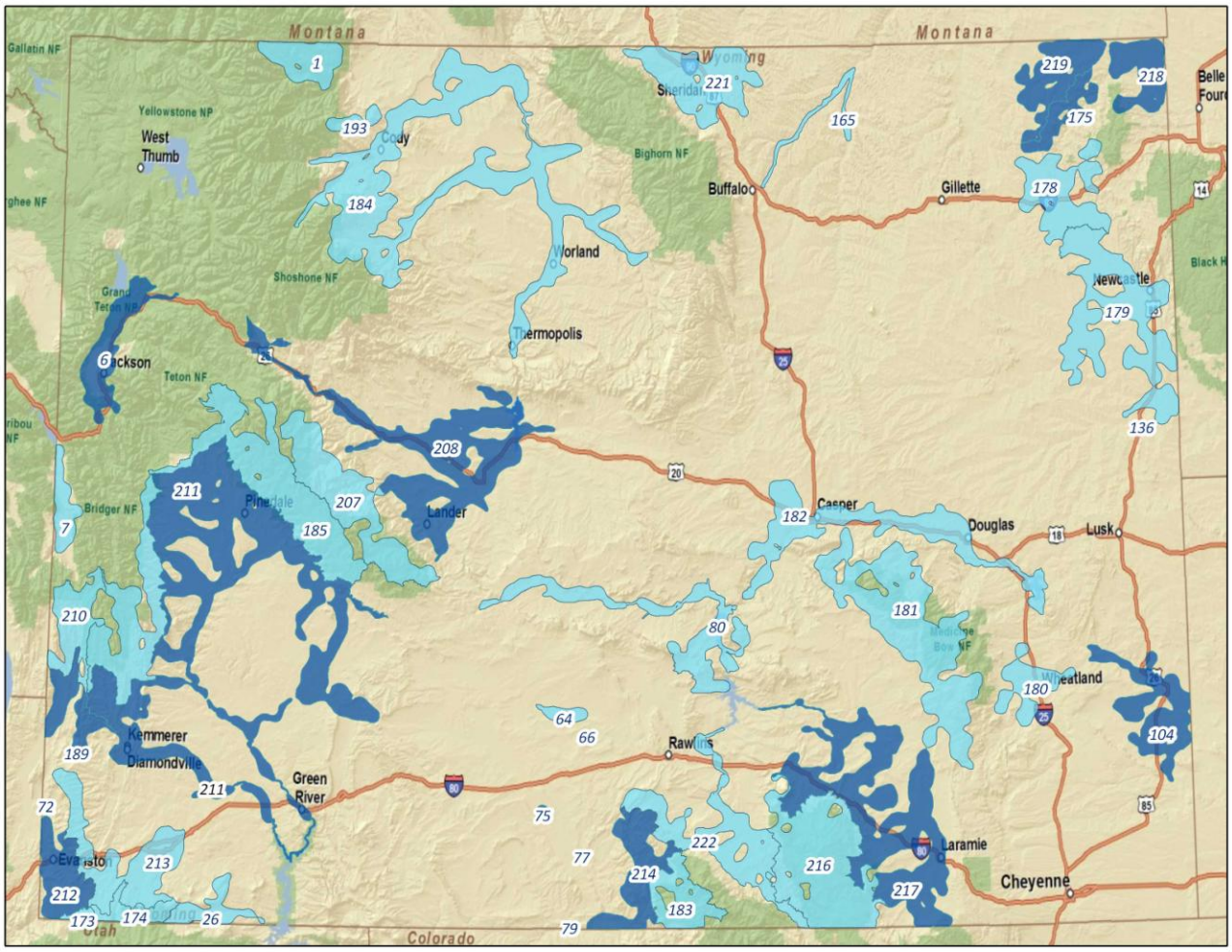


Figure 21. Thirty-one priority wetland complexes including nine primary focus areas (dark blue) identified by the Wyoming Joint Ventures Steering Committee. The nine primary focus areas are: Bear River, Goshen Hole, Laramie Plains, Little Snake R./Muddy Cr., NE Wyoming (Little Missouri R./Belle Fourche R./Beaver Cr.), Red Desert/Great Divide Basin, Snake River Valley (Jackson), Upper Green River, and Wind River Basin. Based on data provided by Copeland et al. (2010).

Recommended Wetlands Conservation Actions

A more comprehensive description of wetland conservation recommendations can be found in the WWCS (WJVSC 2010).

Secure additional human resources to plan and implement wetland conservation projects.
The WJVSC has identified the limited availability of agency specialists and other human resources as the leading constraint to making full use of available wetlands conservation programs and funding sources in Wyoming. Wetlands conservation projects can be complex and time consuming and frequently call for persistent attention to ensure all requirements are met. Specific knowledge is needed to identify and develop project proposals, assemble grant applications, complete certified engineering designs, conduct land surveys, secure permits and clearances including water rights, and administer projects. Currently, a lack of dedicated personnel with specific expertise in these areas is a significant limitation to the level of wetlands conservation work in Wyoming, despite available funding.

The WWCS (WJVSC 2010) has recommended creation of statewide or regional wetlands coordinator positions to connect conservation organizations with partners and available funding sources and to help develop project proposals in order to increase the amount of wetland conservation work done in Wyoming. Funding to support such positions could be assembled from several sources, and the positions could be designed to advance the work of multiple wetland conservation groups operating within the state. The current state hiring freeze may limit the ability to house these positions within the WGFD.

Enhance use of existing wetland conservation and funding programs.
Wetland conservation programs and funding sources available in Wyoming are not being used to their full potential.

Because future state allocations are partially based on previous years' program use, this could negatively impact the amount of funding made available to Wyoming for this program in the future. Capitalizing on existing wetland conservation programs may become increasingly important in an era of budget reductions where the establishment of new funding sources may be limited.

Methods to enhance the use of existing funding sources include increasing coordination and partnerships to leverage dollars in order to meet matching fund requirements for WWNRT, Joint Ventures, and other grant programs. The establishment of watershed/basin scale projects can also improve the ability to access large funding sources such as NAWCA. Organizing projects on a larger watershed or wetlands complex scale can help create lists of eligible shovel-ready projects which are often necessary to take full advantage of funding sources that operate on annual granting cycles. Additionally, increasing dialogue with the Wyoming State Engineers Office, Board of Control, and the NRCS could help identify opportunities to streamline permitting processes and better align permitting with grant funding cycles.

The capability to fully utilize existing wetlands programs is often dependent on availability of personnel to deliver projects. Efforts to fully fund the Wyoming Wildlife and Natural Resource Trust Fund at $200 million should continue in order to meet the state match requirement for most federal conservation programs.

In addition to pursuing voluntary conservation agreements, wetlands protection efforts should include monitoring compliance with state and federal wetlands protection laws; notifying appropriate regulatory authorities of potential violations; and working collaboratively with landowners, industry, and agencies to recommend avoidance or effective mitigation for projects that may potentially impact wetlands.

Rely on the WWCS statewide prioritized list of high wildlife value wetlands to focus conservation efforts.
The 31 priority wetland complexes and 9 focus areas that have been identified in the WWCS (WJVSC 2010) should be used to guide wetlands enhancement and conservation actions in Wyoming (Appendix A, Table 21). However, projects for which there is high interest, partnership potential, and funding availability should not be excluded even if they are not located within one of the priority or focus areas. The WJVSC recently

produced a report highlighting the nine focus areas and strategies for conservation in each area. This report could help catalyze wetlands projects in the nine focus areas, and help make the case for grant funding.

Distribute a statewide list of potential wetlands projects and restoration sites to agencies, industry, and nongovernmental organizations involved with wetlands conservation and mitigation.

Appendix B of the WWCS (WJVSC 2010) contains a statewide list of potential wetlands and riparian conservation and restoration projects and project concepts. The list will be made available to government agencies, industry, and conservation organizations administering wetlands programs. As well, efforts will be made to increase awareness and training for entities required to mitigate wetlands as part of the construction permitting process. The WWCS contains links to several credible sources in the wetlands design arts and other resources that can assist with planning and implementing wetlands projects throughout the state. Advancing wetland creation and enhancement through the Wyoming Wetlands Act [W.S. §§ 35-11-308 through 35-11-311] mitigation banks will also be investigated (WJVSC 2010).

Increase availability and dependability of water supplies.

Water supplies can be a limiting factor for creating and maintaining wetlands in several areas of Wyoming. Excellent water quality at all nesting and foraging sites is critical. Water level management is also vital to ensure that emergent vegetation used for nesting and cover has adequate water for growth, and that nests are neither flooded nor left high and dry, both of which contribute to nest failure. Recurring drought and increasing agricultural, industrial, and residential demands for water will likely be a part of Wyoming's future. New options should be explored to provide adequate water for wetlands creation and enhancement projects. Possibilities include investigating new and existing funding sources to enhance water delivery, developing groundwater wells to augment surface water supplies into constructed wetlands, and leasing or acquiring property on which water rights can be managed to enhance wildlife habitats. Other options to obtain water should be explored with the Wyoming State Engineers Office. Additionally, numerous opportunities exist throughout Wyoming to establish small palustrine wetlands by reintroducing beaver into suitable vacant habitat.

Continue to support wetland-based recreational opportunities.

Access to wetlands outdoor recreation and educational opportunities is important to maintain public support for wetlands conservation. Federal Duck Stamps, required for migratory waterfowl hunting, have generated more than $800 million which has been used to help purchase or lease over 5.7 million acres of waterfowl habitat in the U.S. (USFWS website). Nonprofit organizations founded by outdoor recreationists have contributed even more to wetlands conservation. For example, Ducks Unlimited has directly conserved 13 million acres of wetlands in North America (DU website). In addition to hunting, wetlands sustain other outdoor activities such as fishing, wildlife viewing, and nature photography. In 2006, close to 35 million people visited national wildlife refuges in the lower 48 states, generating almost $1.7 billion of sales in regional economies (Carver and Caudill 2007). About 82 % of these expenditures were generated by activities other than hunting and fishing. While encouraging this interest and support, special attention should be given to minimizing human disturbance, especially during the breeding season, because many species are extremely sensitive and, if disturbed, will abandon nests, eggs, or young.

Create Wyoming wetlands conservation website.

The WJVSC recommends developing and hosting a statewide website to increase awareness about wetlands in order to foster wetland conservation throughout Wyoming. The website would identify wetland habitat protection, mitigation, and enhancement opportunities in priority regions of the state. The overriding purpose is to facilitate cooperation and collaboration among wetlands conservation groups operating in Wyoming and to connect project proponents with available funding and other resources to accomplish additional projects. Projects lists will also present opportunities for companies, individuals, and agencies to fulfill mitigation obligations, as required under various federal laws and programs. Finally, the website would contain

basic information about the ecological values of wetlands, laws and programs pertaining to wetland conservation in Wyoming, as well as mitigation guidelines and management practices. The website could also host a downloadable version of the aforementioned focus areas report.

Wetlands Monitoring Activities

Continue monitoring wetlands SGCN in order to detect population trends or changes in distribution that may reflect habitat problems. This information should be used to guide future monitoring and research, as well as habitat conservation needs.

Continue to monitor the distribution and condition of wetlands through remote sensing and ground surveys.
Remote sensing is a useful tool for tracking the size and distribution of wetlands and changes in their hydrologic condition. Such information would be useful in determining the cumulative impacts through time of activities and events such as drought, energy development, rural subdivision, agricultural conversions, and wetlands creation projects. Special attention should be given to monitoring these parameters within the 31 priority wetland complexes and 9 primary focus areas identified by WJVSC (2010) (Figure 11). This technique will require the further development of monitoring protocols. In addition, periodic ground surveys will be needed to monitor the physical, chemical, and biological condition of wetlands throughout Wyoming, and to identify those that exist in an impaired condition.

Track wetlands conservation, mitigation, and restoration projects on the 31 priority wetland complexes and 9 primary focus areas identified by WJVSC (2010) to assess their success and guide future actions.
Monitoring records should include acreages under various conservation strategies, conservation mechanism (easement, fee title acquisition, management agreement, wetland creation or enhancement project, etc.,), issues addressed (development restrictions, grazing plan, water or watershed management, habitat creation, etc.,) and partners involved. The use of state, federal, and private funds and in-kind match should also be tracked.

In cooperation with research entities and the Wyoming State Climatologist, monitor the effects of climate change including extended drought or wet cycles.

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Appendix A

The Nature Conservancy Wetlands Assessment Study

The Wyoming Wetlands Conservation Strategy (WJVSC 2010) identifies focus areas for wetlands conservation based upon two wetland complex prioritization efforts. The first assessment was completed by the WGFD and U.S. Fish and Wildlife Service (USFWS) for inclusion in the 1995 Statewide Comprehensive Outdoor Recreation Plan (SCORP). The SCORP prioritization relied upon qualitative ranking criteria adapted from National Wetlands Priority Conservation Plan (NWPCP). Priority rankings were based on the following NWPCP criteria and weights: wetland functions and values (33%), historic trends of wetland losses (33%), and relative threat of future loss or degradation (33%).

The Nature Conservancy (Copeland et al. 2010) led a study to define 222 wetland complexes through Wyoming and examine the landscape scale characteristics and conditions of each. Descriptors included wetland density (average number of wetlands per hectare within each complex perimeter), wetland condition or integrity (based on proximity of land uses or activities known to impair wetland functions, Figure 12), wildlife species richness (number of SGCN present), species diversity (Shannon index based on SGCN, Figure 13), number of rare species (based on state and internationally-recognized species), and future vulnerability (based on models projecting future residential and oil and gas development and climatic conditions, Figure 14). Identification of priority complexes was based on SGCN diversity. Primary focus areas included those priority complexes with a normalized diversity score of at least 93 and high project potential. Three additional complexes identified by the WJVSC were included in the list of nine focus areas based on unique ecological considerations and/or high project interest.

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Table 21. Wyoming Wetlands Conservation Strategy (WJVSC 2010) 31 priority wetland complexes and 9 focus areas. *

									Normalized Scores = [(raw score) ÷ (max score)] X 100				
	TNC ID No.	WGFD ID No.	Shannon Diversity Rank	WGFD Rank	Complex Name	Complex Area (mi²)	Wetland Density (No/mi²)	Wetland Area (acres)	No. SGCN	Shannon Diversity	Rare Species Presence	Integrity	Vulnerability	Project Opportunity
	1	49	11		Beartooth Plateau	255.9	10.7	3,433	27	86	83	81	22	Unk.
	6	41	3	6,7	Snake R.Valley – Jackson	239.6	8.0	8,554	32	96	67	70	44	High
	7	39	7	2	Salt River	155.2	10.8	10,064	27	91	67	70	36	Medium
	26	36	11		Henrys Fork	168.4	6.7	10,377	28	86	67	75	31	Low
**	64,66	28,29			Red Desert/Great Divide Basin **	59.9	8.0	2,997	8	59	0	85	34	Medium
	72,189 212	38	4	3	Bear River (3 segments)	587.6	8.0	40,060	32	94	67	71	24	High
**	75,77, 79, 214	27			Little Snake R./ Muddy Creek **	429.5	6.0	11,654	14	69	17	75	62	High
	80	11	9		Pathfinder – Sweetwater River	573.9	6.0	12,527	33	89	67	79	19	Medium
	104	1,2,3,6	4	4	Goshen Hole	491.0	5.7	7,149	32	94	50	56	29	High
	136	17	10		Old Woman Creek	2.0	2.5	5	21	88	33	72	0	Low
	165	21	7		Clear Creek – Powder River	92.2	0.8	109	30	91	33	66	56	Medium
	173	37	12		Sulphur Creek	26.3	16.7	1,012	25	85	67	63	13	Medium
	174	36	9		Wasatch Front	135.6	14.7	2,473	29	89	83	77	10	Unk.
**	175, 218-19	25			NE WY (L Missouri/ Belle F/Beaver Cr)**	877.9	5.0	5,371	23	83	33	76	42	High
	178	25	9		Inyan Kara	477.3	4.6	3,497	27	89	33	71	21	Medium
	179	25	10		Beaver Cr. – Upton	933.5	4.5	4,878	27	88	33	68	16	High

Table 21. (continued)

									Normalized Scores = [(raw score) ÷ (max score)] X 100				
TNC ID No.	WGFD ID No.	Shannon Diversity Rank	WGFD Rank	Complex Name	Complex Area (mi²)	Wetland Density (No/mi²)	Wetland Area (acres)	No. SGCN	Shannon Diversity	Rare Species Presence	Integrity	Vulnerability	Project Opportunity
180	4 & 5	6		Wheatland	236.6	5.6	4,819	30	92	50	52	8	Medium
181	N/A	9		Laramie Range	1,214.4	5.4	8,295	32	89	50	78	4	Low
182	8	3	8	Middle N. Platte R.	753.3	5.1	9,802	34	96	67	57	75	Low
184	44	1		Bighorn River/ Greybull River	1,859.4	5.7	29,825	41	100	100	53	90	Medium
185	N/A	10		West Wind R. Range	1,603.9	11.3	29,782	36	88	83	86	24	Low
193	Out	10		Skull Creek/Pat O'Hara Creek	80.2	5.4	147	30	88	67	64	37	Unk
207	Out	12		East Wind R. Range	709.7	8.1	9,783	35	85	67	93	6	Low
208	43	3		Wind River Basin	1,246.8	7.1	37,706	40	96	100	65	97	High
210	38	10		Smiths Fork/ Lower Bear River	317.7	5.7	4,860	32	88	67	82	10	High
211	34	2		Green River Basin	2,594.6	8.2	174,193	36	97	100	69	81	High
213	35	4		Blacks Fork/Little Muddy Creek	590.2	8.3	38,006	32	94	83	70	7	Unk.
216	Out	13		Snowy Range	1,021.1	10.1	22,461	30	81	67	73	13	Low
217	15	5	5	Laramie Plains	1,401.9	6.4	83,094	32	93	67	70	34	High
221	22	8		Tongue R. – Sheridan	564.6	4.8	3,625	29	90	33	54	81	High
222	26	6		Upper N. Platte R.	655.6	7.0	27,969	32	92	50	70	8	High

* Data from Copeland et al. (2010) and WGFD (1995, 2008). Areas highlighted in green are priority wetland complexes identified by the Wyoming Joint Ventures Steering Committee (WJVSC). Except as noted below, these areas have TNC diversity ranks in the top 5 *and* high project potential.

** Additional wetland complexes were included at the discretion of the WJVSC because they have unique ecological values that are not reflected by their TNC diversity scores *and* exceptionally high potential for conservation projects.

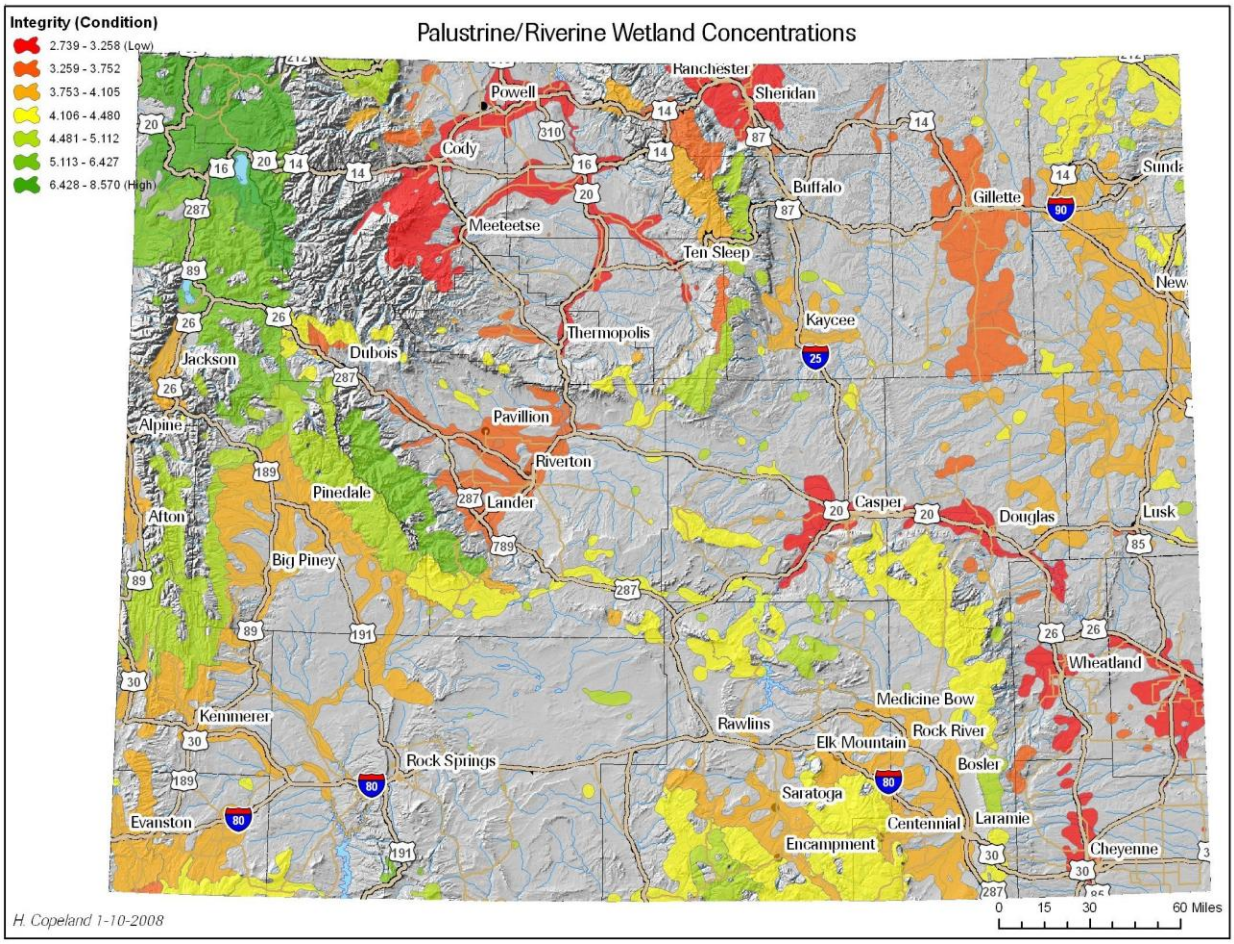

Figure 22. Integrity scores of Wyoming wetland complexes (Copeland et al. 2010).

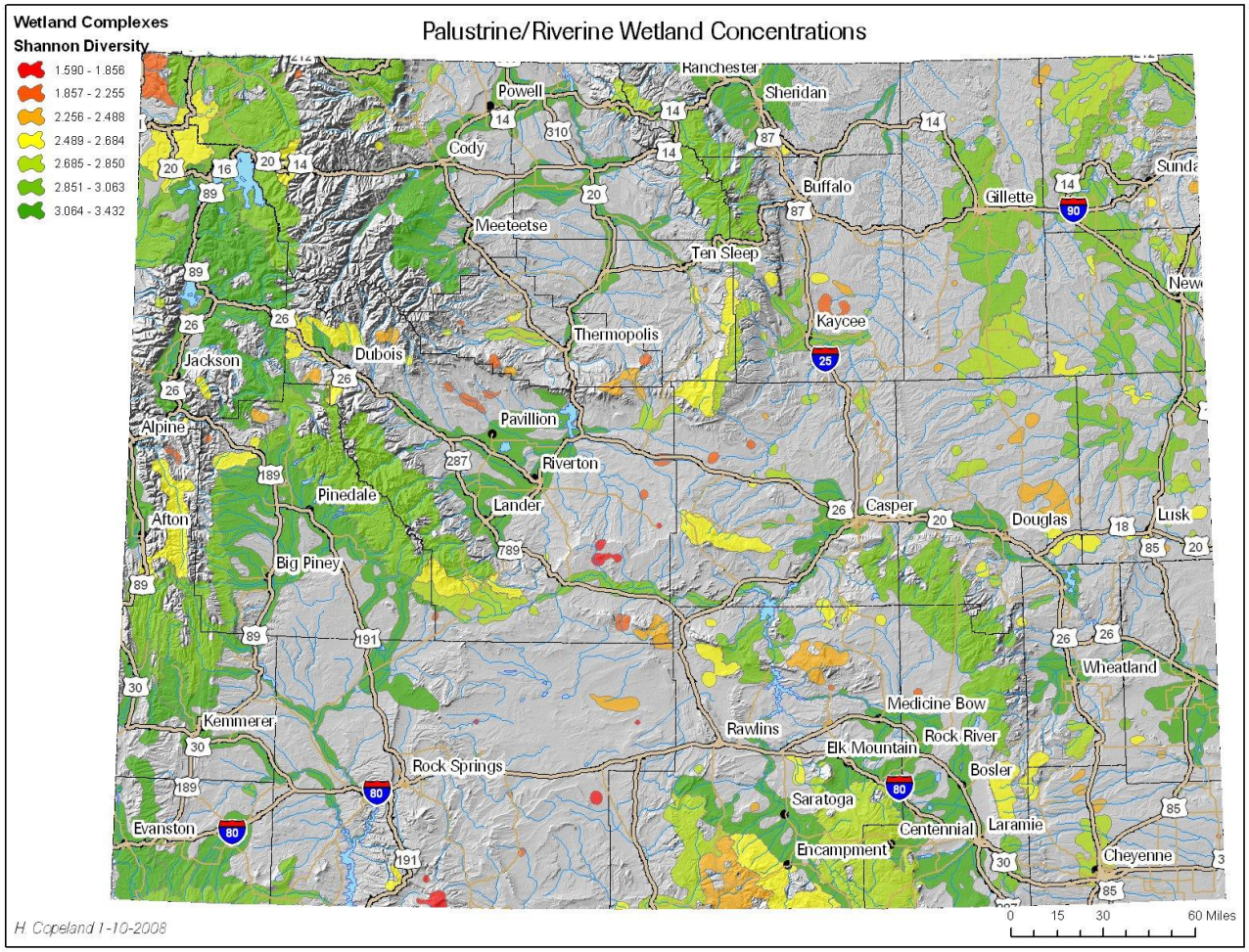

Figure 23. Species diversity (Shannon Diversity Index) of Wyoming wetland complexes based on wetland-associated SGCN (Copeland et al. 2010).

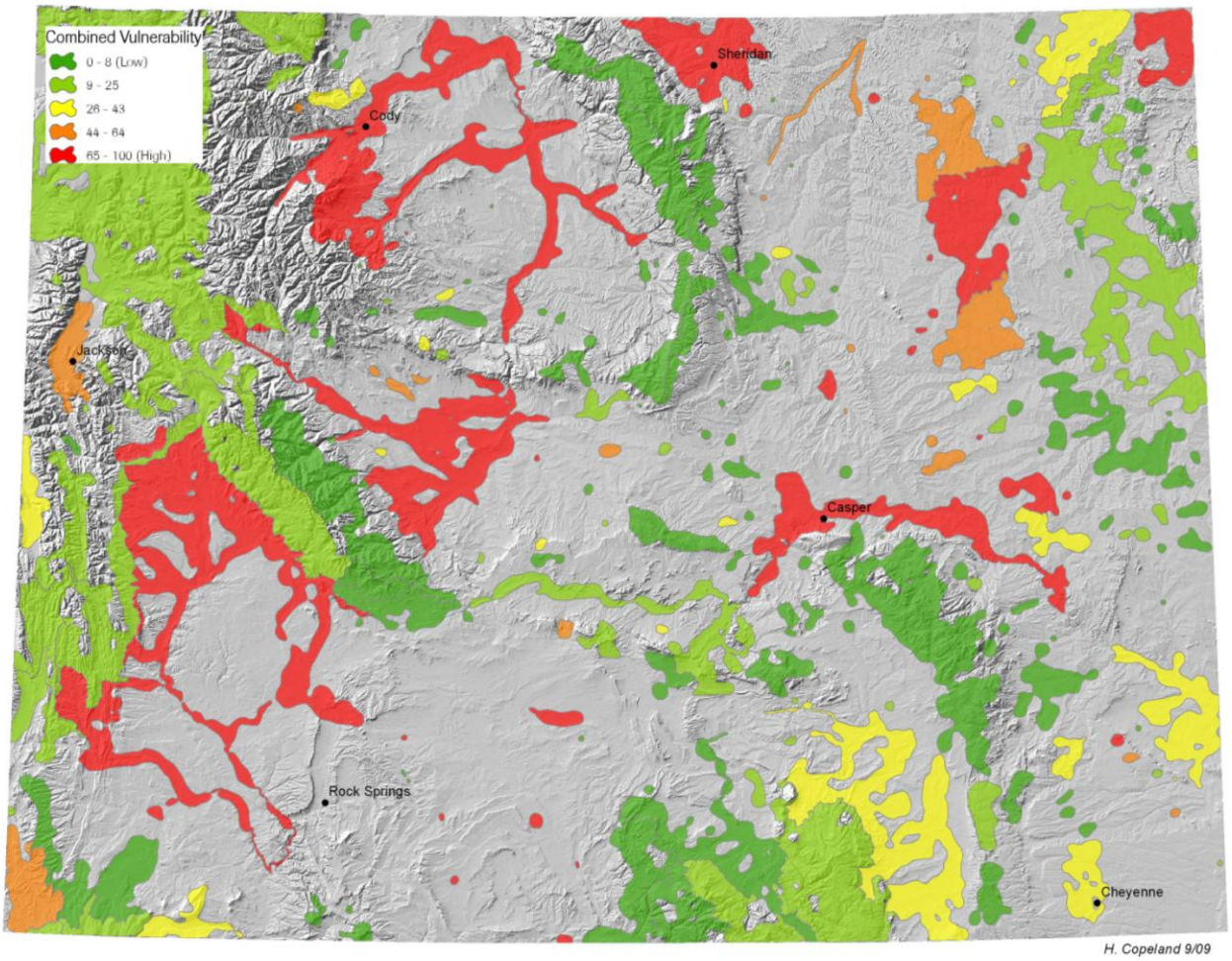

Figure 24. Vulnerability of Wyoming wetland complexes to ongoing and future development (Copeland et al. 2010).