

Yellowstone Wetland and Rare Plant Program

The wetland and rare plant program at Yellowstone National Park serves to protect wetlands and rare plants by two primary functions: 1) surveying for wetlands and rare plants prior to a construction event and 2) monitoring wetlands and rare plants once they have been restored.

Wetlands

The National Park Service (NPS) mandates through policies that wetlands must be protected. The U.S. Army Corps of Engineers (USACE) also requires that we avoid wetlands and if a wetland is impacted, a permit must be issued by the USACE, a wetland mitigation plan written if wetland impacts are greater than 0.1 acres and the NPS must mitigate for the wetland at a ratio determined by the USACE. NPS policies require that mitigation be only in the form of wetland restoration within the region. This means that wetland enhancement and wetland creation are not allowed for the NPS. Once a permit for construction has been issued, the permit is not released by the USACE until the wetland mitigation sites identified in the wetland mitigation plan meet certain criteria. The criteria for a successful wetland mitigation site are identified in the wetland mitigation plan. Successful wetland criteria require the wetland mitigation sites have high cover of native hydrophytic plant species and wetland hydrology. In order to document that native hydrophytic plant species and wetland hydrology have established, vegetation monitoring transects, photographic points, and shallow groundwater monitoring wells are installed at each mitigation site. The Wetland and Rare Plant Program installs and reads the vegetation transects and groundwater monitoring wells; and submits reports to the USACE. The Wetland and Rare Plant Program also delineates wetlands in the park prior to construction and identifies wetland mitigation opportunities in the project area.

Successful Wetland Mitigation Project

Turbid Lake Road was part of Yellowstone National Park's (YNP) East Entrance Road from 1902 until the road was reconstructed between 1928-1936. The 1928-1936 reconstruction realigned a portion of the road to follow the shore of Yellowstone Lake. The original 5.5 mile long segment, now referred to as the Turbid Lake Road, was open to visitor traffic until the 1950's and was also used for YNP administrative travel until 1986 when it was closed to vehicular traffic.

The Turbid Lake Road traverses prime grizzly bear habitat and several wetlands, some of which are geothermally influenced. Prior to restoration, the road had been totally closed for fifteen years yet there had been little to no reestablishment of natural vegetation. Yellowstone National Park did the following to the Turbid Lake Road: decompacted and ripped the roadbed to encourage revegetation, excavated stream crossings to restore the original drainage and reshaped the road cuts and fills to encourage unrestricted surface flow of water. Salvaged topsoil and "clumps" of herbaceous vegetation from adjacent undisturbed areas were spread on the reclaimed areas. In the summer of 2003, part of the Turbid Lake Road burned in the East Wildfire. The natural disturbance helped camouflage the road scar in the forested wetlands and aided in the vegetation renewal process.

Yellowstone National Park began restoration of the Turbid Lake Road in 1997 and completion of roadbed removal was completed in 2004. The wetlands restored are wet sedge meadows and eventually some will be forested wetlands. All of the wetlands restored were classified as palustrine emergent wetlands (Cowardin, *et al.* 1979). Yellowstone National Park (YNP) has restored thirty one wetlands to mitigate wetland impacts associated with the work on Dunraven and East Entrance Road. Wetland Specialist in the park had estimated that YNP would be able to restore 2.922 acres of wetlands. YNP restored 2.517 acres of wetlands or 86% of the anticipated wetland area was successfully restored. Challenges faced on this project with wetland restoration included existing patches of nonnative species such as timothy

(*Phleum pratense*) quickly invaded disturbed ground and thrive in wetlands. Mildly geothermally influenced sites also presented a challenge as they did not meet the criterion for success suggesting they are more difficult to restore due to their unusual hydrology.

Current Wetland Mitigation Projects

Gibbon River Canyon Road was a 1.8 mile long segment of the Grand Loop Road between Madison and Norris obliterated in the fall of 2010. The road was confined by the river and numerous wetlands and thermal features. The extensive wetland mitigation proposed is compensation for 2.51 acres of lost wetland functions and values resulting from the reconstruction of the Madison to Norris road between Gibbon Meadows picnic area and Madison Junction. In 2012 2.911 acres of area (mitigation sites GCR001-GCR025) expected to return to wetland was mapped along the Gibbon Canyon corridor.

In 2010, the old road base (asphalt and fill) were removed, contours restored, and replanted with native vegetation. Earthwork, riverbank stabilization with coir logs, and revegetation with native plants will restore the river corridor to natural conditions. Since it is an old road base, some nonnative species do exist and treatment for these species is expected to continue on into the foreseeable future. In 2011 a high water year resulted in the loss of topsoil and coir logs in newly restored areas. Some of these areas were replanted in the field season of 2011. However many of these areas were washed out down to bedrock and will likely not ever have high vegetation cover.

The permit requires restoration of 2.57 acres of wetlands. During the field season of 2014, wetland mitigation sites (GIBCAN001-GIBCAN025) groundwater monitoring wells were monitored during the field season for at least a month. All wetland mitigation sites met the hydrology requirement except for two (GCR011 (0.021 Acres) and GCR012 (0.019 Acres)). GCR019 and GCR014 wetland mitigation sites did not meet the hydrology requirement in the 2013 season but did meet the requirement in 2014. Most of the wells installed in GCR025 meant the hydrology requirement in 2014 and in 2013. However a few of them (GCR025E and GCR025A) did not meet the requirement in 2013.

Vegetation transects were read in all of the wetland mitigation sites. Eleven (GCR004, GCR006, GCR007, GCR008, GCR009, GCR010, GCR014, GCR015, GCR017, GCR018, GCR025) of the wetland mitigation sites during the 2014 field season had vegetation relative cover over 50% and all of them had more than 50% of the cover being native hydrophytes. Due to a high water year in 2011 much of the topsoil was lost and the coir logs in newly restored areas. Some of these areas were replanted in the field season of 2011. An additional 1,380 one-year old *Deschampsia cespitosa* plugs were put in during the fall of 2014 in wetlands (GCR001, GCR002, GCR003, GCR005, GCR019, GCR020, and GCR021) that had lost significant amounts of soil during the high water year. Due to the disturbance of frequent flooding in the spring and exposure of bedrock with little soil development, these wetlands will likely never have the high vegetation covers of the seeps that are not adjacent to the river. The seeps are also saturated at the surface where the riparian bench wetlands are saturated within six to eight inches of the surface. As observed last year, most wetland mitigation sites have ample water and the wetland vegetation is quickly reestablishing even in the sites that lost topsoil. Wetland mitigation sites that are seeps have reestablished the fastest with native wetland vegetation.

In summary, NPS feels confident that 2.57 acres of wetland will be restored in the Gibbon Canyon. While some of the mitigation sites have low cover and in the span of the permit will always have low cover, the wetland hydrology requirement is being met, and the sites are functioning as a wetland.

East Entrance Road Rock Cut Sites are examples of on-site wetland mitigation. On-site restoration of wetlands along rock cuts and hillslope cuts was expected to occur when the area was excavated and the

contour and vegetation restored. In places the road cuts were excavated into the cliff faces (also called rock bench sites). Most of these rock cuts did not have retaining walls (no fill material added) to the cliff face. Due to the vertical nature of the rock cut sites, the permit states the rock cut sites will be documented with photo documentation and no groundwater monitoring wells or vegetation plots would be feasible. In yet other sites impacts occurred on the downhill side and on yet other sites, ditches were expected to be restored on sites parallel to the original wetland ditch. In 2013 field crews relocated the on-site wetland mitigation sites and photo documented the sites. Routine Wetland Determination Forms were also filled out for rock cut sites with wetland hydrology and vegetation. Many of the rock cut sites lacked the hydrology to be considered successful. In the fall 2014 a final report was submitted to the U.S. Army Corps of Engineers for review.

Norris Picnic Area is the site of a small section of abandoned road (0.12 miles or 620 feet) between the Norris Picnic Area and Gibbon River that was removed in 2009. The wetland credit is compensation for excavating and backfilling 0.03 acre of wetland abutting the Gibbon River. The mitigation site here is part of a larger wetland complex that is adjacent to the Gibbon River and receives surface water from the river in the spring. The remaining wetland credit will be applied to Norris to Golden Gate Phase II. During the field season of 2014, groundwater monitoring well was read starting in May. In May the water was a little above the surface and on June 17 the water was two inches below the surface. The site is easily meeting the wetland hydrology criteria. 52 vegetation plots total were read at the site in September 2014. Forty four plant species were found, seven of which were nonnative, eight were native upland, and 29 were native hydrophyte species. The average relative cover of native hydrophytes is 37.85% (compared to last year 30.22%). Nonnative hydrophyte cover composed 2.84% of the relative cover. All of the nonnative species are present in the area and have been present prior to the restoration of this site. Timothy (Phleum pratense), redtop (Agrostis gigantea) and clover (Trifolium repens) have all been planted in the park at one point in the park's history. They are particularly common along roadsides and since this was an old road bed it is no surprise to find these species at the site. Carex aquatilis (6.58% OBL), Poa palustris (9.99% FACW), and Juncus balticus (4.89% FACW) are the native hydrophytes that dominate the site. Smatterings of upland native species in low covers (8.25% total) were also found. The total vegetation cover in 2014 was 49.64%, an increase from last year's cover of 40.67%.

Tower to Dunraven Phase II is the 2.4 mile section of road from Tower Junction to the Tower Falls parking area. This section of road was reconfigured in 2013. During that time 0.24 acres of wetlands were permanently impacted and 0.04 acres of wetlands are expected to be mitigated on-site. The permanent impacts were mitigated through Turbid Lake Road. There are four on-site mitigation areas on this stretch. The permit requires YNP to monitor the on-site wetland mitigation areas and document if the sites are a wetland. During the field season of 2014, groundwater monitoring wells and photo points were established at each site. A Routine Wetland Form was also filled out for each site. Two of the sites (TWL 02-1 and TWL 08-1) have a very high chance of meeting the wetland success criteria. One site (TWL 03-1) has many weeds and needs to have the grade lowered. The other site (TWL 09-1) will likely not meet the criteria as the wetland hydrology is not present.

Tower to Dunraven Phase III is the section of road from the Tower Falls parking area to the Chittendon Road. This section of road will be reconstructed in the near future. The road corridor was surveyed for wetlands in the 90's but the surveys have expired. The U.S. Army Corps of Engineers requires surveys to be within the last five years before they will issue a permit for construction. During the field season of 2014, the road corridor was resurveyed for wetlands and rare plants.

Future Wetland Mitigation Projects

Elk Park Road is a future wetland mitigation project where removal of the old road base will start in the fall of 2014. Elk Park is located just South of the Norris Geyser Basin. Part of the Grand Loop Road, this

segment a wagon trail originally then auto road traversed thru this soggy meadow continuing towards the back of the Norris Geyser Basin. This old segment of road was last used around 1919 and then the road was realigned to his current (?) location. However, while much of the road has been reclaimed or taken back by the geothermal wetland, the road scar remains. Once the road scar is removed, the hydrology will be restored to the wetland complex.

Elk Park is a beautiful example of a geothermal wetland. While this wetland complex is not particularly diverse in plant species, geothermally influenced wetlands are found in few other places in the world besides Yellowstone making them quite rare on the landscape. Many geothermal wetlands are dependent on thermal features to maintain the wetland hydrology. The dominant plant growing in this wetland is beaked spikerush (*Eleocharis rostellata*) and when you see it growing in Yellowstone, you can be almost 100% certain that the wetland is thermally influenced and the thermal feature is in close proximity.

During the summer of 2013, field crews documented the existing conditions on the old road base for a wetland mitigation plan that was submitted to the USACE. Current conditions were documented using GPS equipment, looking at soil material, and filling out Routine Wetland Determination Forms. A Functional Wetland Assessment was also completed. The Functional Wetland Assessment will be used to assess the functionality of the wetland post restoration. Wetland acres that are anticipated to be restored were estimated as well as wetland improvements. Much of the road is now considered wetland; however the subtle change in microtopography of the road also changes the hydrology or flow of water thru the wetland. Portions of the road that are currently wetland will be improved by removal of the road fill material. Elk Park wetland mitigation will be for impacts to wetlands along the first phase of the Norris to Golden Gate road project.

Yellowstone Rare Plants

The NPS has policies that direct us to protect rare plants. YNP is home to three endemic plants (Ross's bentgrass (*Agrostis rossiae* var. *rossiae*), Yellowstone Sand Verbena (*Abronia ammophilia*), and Yellowstone sulphur buckwheat (*Eriogonum umbellatum* var. *cladophorum*). However, while they occur nowhere else in the world, these plants are not a listed species on the Endangered Species Act (ESA). There are no plants that occur in YNP that are listed on the U.S. Endangered Species Act. However each state (Wyoming, Montana, and Idaho) maintains a rare plant list or species of concern list. YNP also maintains its own rare plant list or plants that we believe we need to protect. For example, YNP is on the edge of the Great Basin Flora so some plants occur in the Gardiner Basin or the north part of the park that do not occur anywhere else in the park and in some cases are known to have only one population within the park. However, just across the park boundary in Paradise Valley, the species may be common. Other species are special to the geyser basins or thermal features. Yet other species occur at high elevations on calcareous substrates (calciophiles).

There are approximately 98 species on the Wyoming list, 58 species on the Montana list, and 39 species on the Idaho list that occur in the park. Five of the species of concern on the Idaho list are known to occur on the Idaho side of the park (meaning the other 34 occur in WY or MT portion of the park). Of the 58 species listed in Montana, fifteen of them are known to occur within the Montana borders of the park. 85 of the species listed for Wyoming occur in the Wyoming portion of the park. There are 199 plants that are not listed on any state lists but YNP feels warrant additional protection in the park due to the limited knowledge of these species or the limited occurrence of the species in the park. One such example of a plant is clammy weed (*Polanisia trachysperma*). It was just discovered in the field season of 2013 to occur within the park and it is only known to occur at one site. Another such example of a plant is swamp loosestrife (*Lysmachia ciliata*). It was discovered to occur in the park during the field season of 2012. However the local nativity of this plant is questioned. While it is native to Wyoming, it was found right off the road in a small pond that has seen a lot of human disturbance. It is a mystery whether this plant

was transplanted off of equipment or someone's boot. Yet other plants hotspots bentgrass (*Agrostis rossiae* var. *pauzhetica*), small-flowered gaura (*Gaura parviflora*), annual paintbrush (*Castilleja exilis*), and branched centaury (*Centaureum pulchellum*) only grow on thermal ground in the park. Of the 199 species that are considered rare in YNP, eleven of them are historical records and three of them have likely been extirpated. While the vegetation crew did collect plants during 2014 at the Pocket in the Gallatin Mountains, no new rare plant species were found during the field season.

Small-flower *Gymnosteris* (*Gymnosteris parvula*), a Yellowstone species of special concern is known to occur at the Glen Creek Trailhead and in very close vicinity to the newly installed hitching post. During the field season of 2014, the population was located, surveyed with GPS equipment, and monitoring transects were installed. Small-flower *Gymnosteris* is a diminutive annual (<2 inches tall) and very inconspicuous native flower that is known from Oregon and California and east to Wyoming and Colorado. Studies suggest that this species has a small amount of seed in the soil. Only 27% of the seeds are viable for two years. Meltwater from winter/spring snowpack likely provides water for seed to germinate and the plant to grow. It blooms in early June and likes sparsely vegetated areas of sagebrush steppe that receive enough sun to offer warm soil temperatures in the early season.

It is known from only three sites in Yellowstone: White Creek, Swan Lake Flats, and Hayden Valley. The site at Swan Lake Flats especially needs to be protected due to the high volume of traffic from visitors and stock use. With increased visitation at this site, the risk of introduction of nonnative annual plants such as *Alyssum desertorum* and *Chorispora tenella* that are known to invade bare ground increases significantly. While stock are generally not allowed on the trails until later in the season, the increased risk of nonnative annual species brought in by visitors or stock poses a significant risk to species. Nonnative annual species are not considered agricultural weeds (they are ecological weeds like timothy) and therefore species that could be found in "weed-free" stock material. Nonnative annuals also bloom early in the season and would be in direct competition with the rare plant. Unlike the rare plant, nonnative annuals also are generally prolific seeders. Transects were installed to monitor this rare plant population as we are concerned about the increased risk of nonnative species to this population.

YNP Herbarium

The Yellowstone Herbarium (YELLO) contains mainly plants collected in Yellowstone National Park. Our herbarium specimens document the presence of plants in the park over time, and the history of plant collecting in the park, making it an incredibly valuable resource for staff, visitors, and researchers. In 2013, field crews found rush skeletonweed (*Chondrilla juncea*) for the first time in the park. The collection of rush skeletonweed will be kept in the YNP herbarium to document the population. Field crews also found new populations of other species (Scotch thistle, velvet grass, tamarisk) that are on the YNP watch list. No new nonnative species were found to occur during the field season of 2014. These collections will also be housed in the herbarium to document the new populations and for reference material for future crews. The Yellowstone Herbarium is located in the Heritage and Research Center in Gardiner, Montana. Our collection includes: vascular and non-vascular plants, fungi, and lichens. Our oldest specimens date back to 1899 and traveled to the World Fair in 1903. We have over 12,000 specimens including collections of aquatic plants and non-vascular plants, both of which are some of the best collections in the Rocky Mountains. Yellowstone herbarium may now likely have the most comprehensive scientific collection of native aquatic vascular plant specimens in the western United States. We have multiple scopes and reference material that are available to use during the hours the herbarium is open.