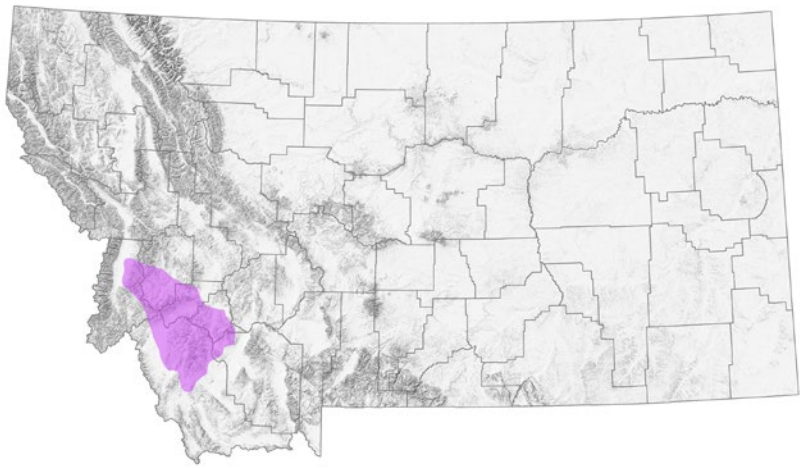
APPENDIX A

Conservation Profiles for Plant Species of GCN

CONSERVATION PROFILE: SAPPHIRE ROCKCRESS (*BOECHERA FECUNDA*)

Photo Credit: Peter Lesica

Photo 1. Sapphire Rockcress is only found in Montana (endemic). The species was first described from specimens collected in Ravalli County (type collection).



Source: Montana Natural Heritage Program (2024a)

Figure 1. The range for Sapphire Rockcress in Montana.

PURPOSE:

This conservation profile provides information about Sapphire Rockcress, a Plant Species of Greatest Conservation Need (GCN) in Montana. It highlights the plant's state-level distribution; factors that put it at risk for loss; and conservation objectives that, if implemented, would aid the persistence of Sapphire Rockcress. This conservation profile aims to be an abbreviated, stand-alone document that can be used by, or shared with, land managers, landowners, educators, decision-makers, regulators, and anyone interested in Sapphire Rockcress. This conservation profile should also be used in conjunction with Section 4 of the Montana Native Plant Conservation Strategy which addresses overarching conservation objectives for Plant Species of GCN.

INFORMATION ON SAPPHIRE ROCKCRESS

Distribution, Status, and Identification

Sapphire Rockcress (*Boechera fecunda)* is endemic to Montana, where, on a worldwide scale, it is only found in particular locations within southwest Montana (Lesica 2022) (Photo 1; Figure 1). Sapphire Rockcress is restricted to a metamorphosed limestone habitat, which is designated as a Unique Habitat of Greatest Conservation Need (GCN)[1].

Globally Sapphire Rockcress is ranked by NatureServe as a G2 indicating it is at high risk of global extinction due to a restricted range, few populations, steep declines, severe threats, or other factors (NatureServe 2024). In Montana, Sapphire Rockcress is a Species of Concern (SOC) plant as determined by the Montana Natural Heritage Program (MTNHP) (2024a). Ranked in the state as an S2, Sapphire Rockcress is at high risk because of a restricted range, very few populations or occurrences, threats, and other factors (MTNHP 2024a). Sapphire Rockcress is also designated as a sensitive species on the Beaverhead National Forest (BHDL NF) and with the Montana/ Dakotas Bureau of Land Management (MT/ Dakotas BLM).

Learn about Sapphire Rockcress identification, biology, and state status in the Montana Field Guide[2].

RATIONALE FOR PLANT SPECIES OF GREATEST CONSERVATION NEED

Photo Credit: Jessie Salix

Photo 2. Botanists monitor Saphhire Rockcress on the Beaverhead-Deerlodge National Forest.

Sapphire Rockcress is a Plant Species of Greatest Conservation Need (GCN) in Montana because of its rarity, affinity to a Unique Habitat of GCN, and threats. Plants are only found on metamorphosed limestone habitat which occurs in rare locations of southwest Montana (MTNHP 2024b). As a result, plant populations are relatively few and widely separated (MTNHP 2024a). Sapphire Rockcress is facing direct threats from invasive, non-native plants and advanced succession, and indirect threats from ecologically incompatible livestock grazing and recreational use (MTNHP 2021). Invasive non-native plant species can detrimentally affect native plants by altering pollinator behavior, competing for water and nutrients, and altering ecosystem attributes, such as microclimates, fire ecology, hydrology, and nutrient cycling. Spotted Knapweed (*Centaurea stoebe*), a noxious weed,

[1] Refer to the *Montana Native Plant Conservation Strategy*, Section 5-Unique Habitats of GCN and Appendix B-Metamorphosed Limestone Unique Habitat of GCN.

[2] Montana Field Guide, Sapphire Rockcress: https://fieldguide.mt.gov/speciesDetail.aspx?elcode=PDBRA06290

occurs at some Sapphire Rockcress occurrences and has been shown to suppress seed germination and establishment (Lesica and Shelly 1991 and 1996). Vegetation succession at the Birch Creek and possibly the Cattle Gulch occurrences is resulting in an establishment of conifers; however, the cause is unknown because metamorphosed limestone habitat is not thought to be maintained by natural fire regimes. Livestock grazing occurs at most sites. When not managed properly, livestock grazing can trample plants, break up biological soil crusts, and become a vector for non-native plant species. A study conducted at Charley's Gulch and Lime Gulch found a positive association between the presence of biological soil crust and the presence of Sapphire Rockcress plants (Lesica and Shelly 1992). Recreational use of metamorphosed limestone for rock climbing has increased at some sites.

CONSERVATION GOALS & OBJECTIVES FOR SAPPHIRE ROCKCRESS

The intent of the *Montana Native Plant Conservation Strategy: Vascular Species and Habitats of GCN* is to promote the collective and coordinated stewardship of Montana's Plant Species of GCN to ensure their viability and persistence using a fusion of approaches. Sections 3-*Strengthening Botanical Capacity* and 4-*Plant Species of GCN* present overarching goals and conservation objectives that can indirectly help sustain Sapphire Rockcress populations. In this profile we present conservation objectives specific to Montana's Sapphire Rockcress populations from four areas that are pillars to plant conservation:

- Information Needs [Inventory, Monitoring, Research]
- Protection and Restoration
- Outreach and Education
- Policy and Regulation

Photo Credit: Lauren Carley

Photo 3. Basal rosettes of Sapphire Rockcress, a long-lived perennial plant.

The conservation objectives were developed by a Sapphire Rockcress Working Group that met in spring 2022, and are based on published research, monitoring, professional expertise, and field observations. The working group consisted of botanists, ecologists, a rangeland specialist, a consulting botanist, and retired professionals from the US Forest Service (Region 1 and BHDL NF), MT/Dakotas BLM, and private sectors (see Table 1 on page *iii* of the *Strategy*). Working within and across jurisdictional boundaries, these voluntary conservation objectives are intended to empower federal, state, and non-government conservation land managers, and landowners who want to contribute to or collaborate on processes that could aid Sapphire Rockcress persistence on the landscape. These voluntary actions can be pursued or implemented by a single entity, or as a collaborative effort by individuals, agencies, and organizations. They are presented in no prioritized order.

Information Needs [Inventory, Monitoring, Research]

Conservation Goal

Improve scientific understanding of Sapphire Rockcress in Montana and the ecological and cultural processes that sustain plants and habitat through statewide coordination, inventory, monitoring, and research.

Conservation Objectives

1) Work collaboratively with federal agencies, NGOs, and other organizations to acquire necessary field data and share the information with MTNHP to conduct the following assessments:

   a. Review and revise Species Occurrence Ranks (SO-Ranks). An SO-Rank represents the overall "quality" of the site based on an assessment of the plant's population size, habitat quality, landscape context, and abiotic and biotic conditions. Updated and accurate SO-Ranks are used by managers in planning projects, prioritizing occurrences for restoration, identifying reference sites, and aiding management decisions. SO-Ranks should be reviewed and revised on a five- to ten-year cycle.

   As of 2023, 88% of extant Sapphire Rockcress occurrences were ranked in 2009, and are in need of a re-assessment, and 12% are in need of a full assessment (Box 1). Acquiring revisit data on SOs and updating SO-Ranks at regular intervals creates a tool for inferring trend (stable, improving, or degrading) for the site.

   Box 1. Status of SO-Ranks for approximately 68 extant Sapphire Rockcress occurrences as of 2023:

   - 8 lack SO-Rank
   - 6 0 ranked in 2009

   b. Evaluate and update State Threat Score and rationale. Sapphire Rockcress has a State Threat Score of medium based on the 2021 Threat Assessment (MTNHP 2021)[1]. The State Threat Score and rationale should be updated by MTNHP at five-year intervals, or as warranted by current data. Reported threats and data analysis should be posted on the Montana Field Guide to create transparency in the ranking process. The State Threat Score represents the degree to which the target plant is degraded by extrinsic factors, which are characterized in terms of threat type timing, severity, and scope (MTNHP 2021).

2) Develop working relationships with private landowners who have Sapphire Rockcress plants on their properties. Facilitate conversations with the landowners about their concerns, observations and knowledge of the plant, permissions to access habitat, ability to conduct revisits or acquire plant counts and habitat condition data, and address other needs. Consider providing survey results (both present and absent observations) to MTNHP for inclusion in the botany database.

3) Collaborate with private landowners to seek input and permissions to conduct surveys on lands identified as high or moderate suitability by the most current Predicted Suitable Habitat Model. Consider providing survey results (both present and absent observations) to MTNHP to help refine the Predicted Suitable Habitat Model for Sapphire Rockcress in Montana.

[1] Sapphire Rockcress profile, Montana Field Guide: https://fieldguide.mt.gov/speciesDetail.aspx?elcode=PDBRA06290

Information Needs [Inventory, Monitoring, Research]

4) For established plots at the Birch Creek/Lime Gulch, Vipond Park, and Canyon Creek populations in the BHDL NF, support the ongoing data (population monitoring and trend assessments) collection, mapping, data analysis, and reporting. Share results with the MT/Dakotas BLM-Dillon Field Office, MTNHP, private landowners, and other pertinent conservation organizations.

Photo Credit: Jessie Salix

Photo 4. Monitoring Saphhire Rockcress in the Canyon Creek occurrence on the Beaverhead-Deerlodge National Forest.

5) Collaborate with all federal and private landowners to acquire revisit data from known Sapphire Rockcress occurrences on a frequency of at least once every ten years. Revisits could be coordinated with a Montana Citizen Botany Program (see also Section 3, Information Needs, Conservation Objective #4). Consider providing survey results (both present and absent observations) to the MTNHP botany database.

6) Determine whether plant specimens should be collected to ensure that the species' distribution, genetics, and morphology is adequately preserved in a state herbarium. If warranted, specimens could be deposited at the University of Montana (MONTU), Montana State University (MONT), and/or Montana State University-Billings (MSUB) herbaria.

7) Develop a monitoring study to measure the establishment of conifers within Birch Creek and Cattle Gulch Areas.

8) Encourage research and awareness through collaboration with the BHDL NF, MT/Dakotas BLM-Dillon Field Office, and the Montana University System.

9) Use existing resources to find literature, research studies, and other information when investigating research questions or needs and designing monitoring studies. Reference material - already compiled can be found at:
   - Cited and Additional References section in the Montana Field Guide Sapphire Rockcress profile[1]

10) Research topics that could further our understanding of this unique plant and/or assist in plant conservation efforts include, but are not limited to:
   - Develop and conduct studies that examine pollination biology.

Protection and Restoration

Conservation Goal

Secure on-the-ground, site-specific habitat and/or management protection or restoration for Sapphire Rockcress on public and private lands.

Conservation Objectives

1) If established monitoring on the Beaverhead-Deerlodge National Forest indicates a potential or real downward trend, then develop an interagency conservation strategy for Sapphire Rockcress.
2) Develop partnerships between federal, state, non-profit, and/or private organizations within the Montana range for Sapphire Rockcress and the following potential facilities to conduct seed banking, germination trials, genetic research, and/or related topics relative to collected plant materials:
   - Rae Selling Berry Seed Bank, Portland State University, Oregon[3]
   - Plant Germplasm Introduction Test and Research Unit, Pullman, Washington
3) Implement the Cattle Gulch Weed Management Plan to control invasive non-native plants, specifically from Spotted Knapweed (*Centaurea stoebe*), Musk Thistle (*Carduus nutans*), and Hound's-Tongue (*Cynoglossum officinale*) that have invaded the bottom of the draw and could potentially move upslope to Sapphire Rockcress populations.

Outreach and Education

Conservation Goal

Facilitate the stewardship of Sapphire Rockcress populations and habitat through education, outreach, and coordination.

Conservation Objectives

1) Revise the Sapphire Rockcress profile on the *Montana Field Guide* to current MTNHP standards to update and expand known information on life history, ecology, fire ecology, population counts and trends, genetics, germination, transplant experiments, pollination biology, identification, biological characteristics, economics, rangeland management, threats, taxonomy, and other interesting facts; create links to the *Strategy* and other online information; and improve readability.
2) Through the Montana Native Plant Society, conduct field trips to known Sapphire Rockcress sites to increase public awareness of the plant, its habitat, and status, and garner public support for it as a Plant Species of GCN.
3) Update information on the developing Montana Native Plant Conservation Strategy webpage hosted on the Montana Natural Heritage Program's website[4].
4) Work with US Forest Service staff and other conservation organizations to assess the interpretive sign at Vipond Park[5] to determine its condition and the need to update

[3] Rae Selling Berry Seed Bank: https://www.pdx.edu/seed-bank/
[4] Montana Natural Heritage Program: https://mtnhp.mt.gov/
[5] Vipond Park: https://www.fs.usda.gov/wildflowers/regions/northern/VipondPark/index.shtml

Outreach and Education

information relative to Sapphire Rockcress and Metamorphosed Limestone Unique Habitats of GCN. Interpretive signs that are maintained and updated can give recreational users a sense of place, enhance their experience, and garner support for rare plants, unique habitats, and other stewardship activities.

Policy and Regulation

Conservation Goal

Improve conservation of Sapphire Rockcress through public participation and implementation of existing policies and regulations in cooperation with federal agencies, private landowners, and other interested stakeholders.

Conservation Objectives

1) Advocate for the Beaverhead-Deerlodge NF and Region 1 of the USFS to finalize the proposed establishment of the Cattle Gulch RNA.
2) Continue efforts that comply with the 2009 Beaverhead-Deerlodge Forest Revised Forest Plan (USDA 2009) for Sensitive plant populations and their habitats: "Assess the status and work towards the goal that large core populations and/or fringe populations of *Boechera fecunda* are conserved in RNAs, botanical special interest areas, or protected as populations in conservation strategies or through project design specifications on the Beaverhead-Deerlodge National Forest."
3) Continue efforts that comply with the BLM Resource Management Plan for Sensitive plant populations and their habitats (USDA 2006 and 2020). These efforts are to:
   - Identify, conserve, and monitor rare, vulnerable, and representative habitats, plant communities, and ecosystems to ensure that there is a self-sustaining persistence of special status plants within the BLM Dillon Field Office.
   - Ensure that proposed land uses initiated or authorized by BLM avoid inadvertent damage to federal and non-federal habitats supporting special status plants and plant communities.
   - Promote public awareness, appreciation and understanding of rare plants and their habitats.
4) Support the preservation and use of Research Natural Areas designated by the US Forest Service-Region 1. Readers are encouraged to consult the general technical report titled, "Research Natural Areas on National Forest System Lands in Idaho, Montana, Nevada, Utah, and Western Wyoming: A Guidebook for Scientists, Managers, and Educators" (Evenden et al. 2001).

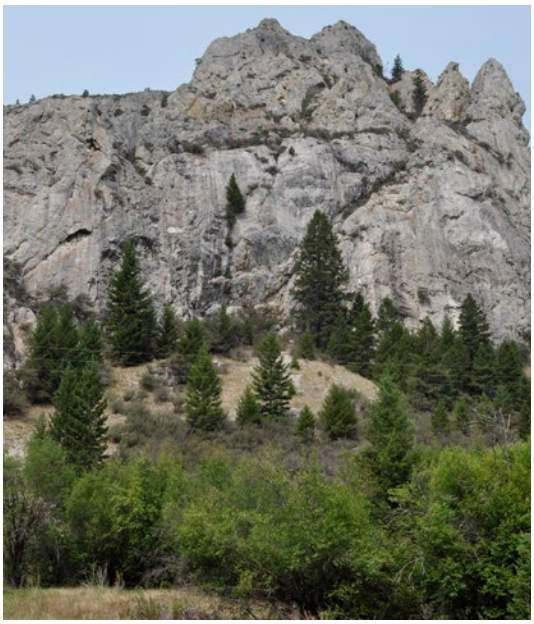


Photo Credit: Andrea Pipp

Photo 5. Metamorphosed Limestone outcrops are visible on the landscape from afar. The calcareous sandy or silty loams provide proper soil conditions for Sapphire Rockcress.

REFERENCES

Lesica, Peter, Matt T. Lavin, and Peter F. Stickney. 2022. *Manual of Montana Vascular Plants*, 2nd Edition. Fort Worth, TX: BRIT Press.

Lesica, Peter. and J. Stephen Shelly. 1991. The effect of the introduced weed *Centaurea maculosa* on *Arabis fecunda*, a threatened Montana endemic. Prepared for Montana Natural Heritage Program, Helena, MT. 15 pp. plus appendix.

Lesica, Peter. and J. Stephen Shelly.1992. "Effects of cryptogamic soil crust on the population dynamics of *Arabis fecunda* (Brassicaceae)." *American Midland Naturalist* 128(1): 53-60.

Lesica, Peter. and J. Stephen Shelly. 1996. "Competitive effects of Centaurea maculosa on the population dynamics of *Arabis fecunda*." *Bulletin of the Torrey Botanical Club* 123(2):111-121.

Montana Natural Heritage Program (MTNHP). 2021. An assessment of threat data reported for *Boechera fecunda*. MTNHP Botany Database. Helena, MT.

Montana Natural Heritage Program (MTNHP). 2024a. Observation and species level data on *Boechera fecunda*. Botany Database. Helena, MT. [Accessed 29 April 2024]

Montana Natural Heritage Program (MTNHP). 2024b. *Boechera fecunda* profile in the *Montana Field Guide*. https://fieldguide.mt.gov/speciesDetail.aspx?elcode=PMORC2B100 [Accessed 28 April 2024]

Evenden, Angela G.; Moeur, Melinda; Shelly, J. Stephen; Kimball, Shannon F.; Wellner, Charles A. 2001. Research Natural Areas on National Forest System Lands in Idaho, Montana, Nevada, Utah, and Western Wyoming: A Guidebook for Scientists, Managers, and Educators. Gen. Tech. Rep. RMRS-GTR-69. Ogden, UT: US. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 84 pp.

NatureServe Explorer. 2024. Global Rank for *Boechera fecunda*. https://explorer.natureserve.org/Taxon/ELEMENT_GLOBAL.2.159353/Boechera_fecunda [Accessed 6 July 2024]

US Department of Agriculture (USDA), Forest Service. 2009. Beaverhead-Deerlodge National Forest Land and Resource Management Plan. Dillon, MT: USDA, Forest Service, Beaverhead-Deerlodge National Forest. 504 p.

US Department of Interior (USDA), Bureau of Land Management. 2006. Record of Decision and Approved Dillon Resource Management Plan. Dillon Field Office, Dillon, MT.

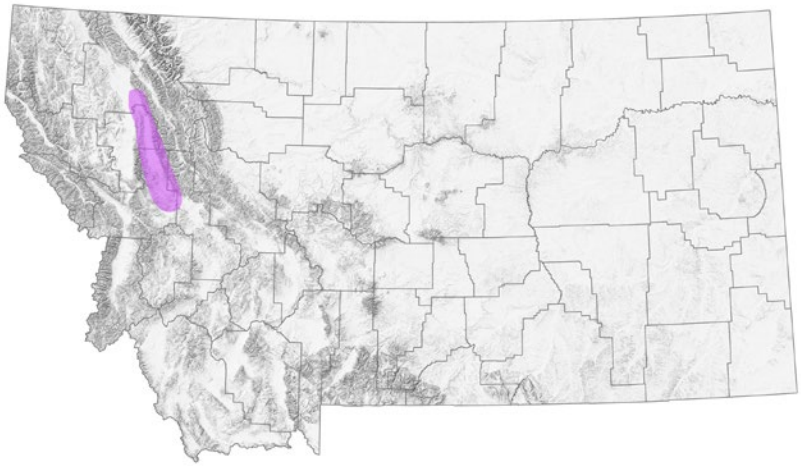
US Department of Interior (USDA), Bureau of Land Management. 2020. Montana/Dakotas Special Status Species List. Instructional Memorandum No. MT-2020-012.

CONSERVATION PROFILE:
WATER HOWELLIA (*HOWELLIA AQUATILIS*)

Photo Credit: Scott Mincemoyer

Photo Credit: Rebecca Durham

Photos 1 and 2. Water Howellia (inset) growing in its vernal pool habitat on the Flathead National Forest.



Source: Montana Natural Heritage Program (2024a)

Figure 1. The range for Water Howellia in Montana.

PURPOSE:

This conservation profile provides information about Water Howellia, a Plant Species of Greatest Conservation Need (GCN) in Montana. It highlights the plant's state-level distribution; factors that put it at risk for loss; and conservation objectives that, if implemented, would aid the persistence of Water Howellia. This conservation profile aims to be an abbreviated, stand-alone document that can be used by, or shared with, land managers, landowners, educators, decision-makers, regulators, and anyone interested in Water Howellia. This conservation profile should also be used in conjunction with Section 4 of the Montana Native Plant Conservation Strategy which addresses overarching conservation objectives for Plant Species of GCN.

INFORMATION ON WATER HOWELLIA

Distribution, Status, and Identification

Water Howellia (*Howellia aquatilis*) is endemic to the US where, on a worldwide scale, it is sparsely found in the Pacific Northwest (Photos 1a/b) (USFWS 2021). In Montana, Water Howellia was first documented in 1978 growing in a vernal pond. Since then plants have been found in numerous vernal ponds and in a few old river oxbows, but all within the Swan Valley (Figures 1 and 2) (Mincemoyer 2005; MTNHP 2024a).

In 1994 Water Howellia was federally listed as a threatened species under the Endangered Species Act (ESA) of 1973, as amended, by the US Fish and Wildlife Service (USFWS) (59 FR 35860; USFWS 1994). A draft recovery plan was prepared for the USFWS, but never finalized (USFWS 1996). Listing facilitated surveys and research, bringing forth a great amount of information on the plant's life history, ecological needs, and ways to manage its persistence. The Flathead National Forest developed a conservation strategy (USFS 1997) and established collaborative long-term monitoring studies with state and private land managers. In 2021 Water Howellia was removed from the list of threatened and endangered species under the ESA because collaborative conservation efforts resulted in additional species occurrence locations, land ownership transfers, and long-range land management plans (USFWS 2021). Delisting triggered implementation of the Water Howellia Post-Delisting Monitoring plan, which is being implemented across its range through the year 2036 (USFWS 2020).

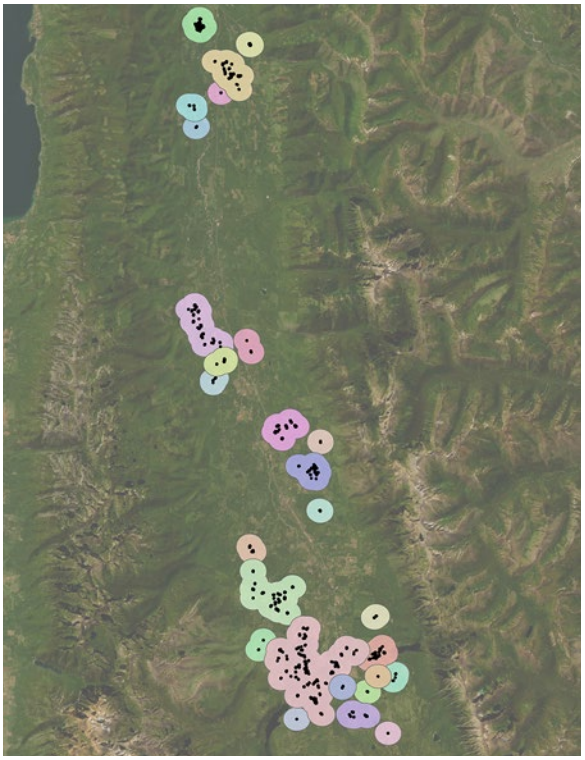


Figure 2. The distribution of Water Howellia occurrences within the Swan Valley of Montana (MTNHP 2024a). Black dots represent Species Occurrences (SOs) as mapped by MTNHP. Colored polygons that encapsulate them represent Element Occurrences (EOs) based on NatureServe methods.

Water Howellia is a Montana Species of Concern (SOC) plant as determined by the Montana Natural Heritage Program (MTNHP) (2024b). Ranked in the state as an S3, Water Howellia is vulnerable to extirapation because of a fairly restricted range, relatively few populations or occurrences, recent and widespread declines, threats or other factors (Montana Natural Heritage Program [MTNHP] 2024a).

Learn about Water Howellia identification, biology, and state status in the Montana Field Guide[1]

Learn about Water Howellia range-wide information and federal status in the USFWS Environmental Conservation Online Systems (ECOS)[2]

[1] *Montana Field Guide*, Water Howellia: https://fieldguide.mt.gov/speciesDetail.aspx?elcode=PDCAM0A010
[2] USFWS ECOS website: https://ecos.fws.gov/ecp/species/7090

RATIONALE FOR PLANT SPECIES OF GREATEST CONSERVATION NEED

Water Howellia is a Plant Species of Greatest Conservation Need (GCN) in Montana because of its rarity, habitat specificity, and potential threats to its persistence. In the state, Water Howellia is only found in the Swan Valley. Plants depend on a hydrologic cycle whereby vernal ponds fill in the spring from snowmelt, precipitation, and groundwater, and partially or completely recede by autumn in most years (Mincemoyer 2005; USFS 1997). Being an aquatic winter annual, plants grow, flower, and set seed when inundated by water. As the ponds dry, seeds germinate only after being exposed to air and fluctuating temperatures (USFS 1997). Obtaining accurate population data can be a challenge because abundance is partially dependent upon environmental conditions and can vary greatly from year to year (Mincemoyer 2005).

Water Howellia populations are vulnerable to actions that negatively impact its restricted habitat, annual lifecycle, or vernal pond hydrology (MTNHP 2021; Mincemoyer 2005). Montana boasts the largest population of the species across its worldwide range, and its persistence has been helped by improved land stewardship and possibly by a mosaic landscape (Mincemoyer 2005; Pipp 2017). Yet, potential threats to the persistence of Water Howellia populations remain ever-present from invasive aquatic plants, land development, and ground-disturbing activities that can alter water quantity, quality, or cycling (MTNHP 2021; Pipp 2017; Mincemoyer 2005; USFS 1997).

Photo Credit: Andrea Pipp

Photo Credit: Steve Shelly

Photos 3 and 4. The vernal pond fills in the spring from snowmelt, precipitation, and groundwater (upper) and dries partially to fully by late summer (lower). Swan Valley, Montana.

CONSERVATION GOALS & OBJECTIVES FOR WATER HOWELLIA

The intent of the *Montana Native Plant Conservation Strategy: Species and Habitats of GCN* is to promote the collective and coordinated stewardship of Montana's Plant Species of GCN to ensure their viability and persistence using a fusion of approaches. Sections 3-*Strengthening Botanical Capacity* and 4-*Plant Species of GCN* present overarching goals and conservation objectives that indirectly can help sustain Water Howellia populations. In this profile we present objectives specific to Montana's Water Howellia populations from four areas that are pillars to plant conservation:

- Information Needs [Inventory, Monitoring, Research]
- Protection and Restoration
- Outreach and Education
- Policy and Regulation

The conservation objectives were developed by a Water Howellia Working Group that met in November 2022, and are based on published research, monitoring, professional expertise, and field observations. The working group consisted of staff from federal and state land management agencies, consulting businesses, the Montana Natural Heritage Program, the Montana Native Plant Society, and retired researchers and land management professionals (see Table 1 on page *iii* of the *Strategy*). Working within and across jurisdictional boundaries, these voluntary conservation objectives are intended to empower federal, state, and non-government conservation land managers, landowners, businesses, and individuals who want to contribute to or collaborate on processes that could aid Water Howellia persistence on the landscape. These voluntary actions can be pursued or implemented by a single entity, or as a collaborative effort by individuals, agencies, and organizations. They are presented in no prioritized order.

Information Needs [Inventory, Monitoring, Research]

Conservation Goal

Improve scientific understanding of Water Howellia in Montana, and the ecological processes that sustain plants and habitat through statewide coordination, inventory, monitoring, and research.

Conservation Objectives

1) Work collaboratively with state agencies, private landowners, NGOs, and other organizations to acquire necessary field data and share the information with MTNHP to conduct the following assessments:
   a. Review and Revise Species Occurrence Ranks (SO-Ranks). An SO-Rank represents the overall "quality" of the site based on an assessment of the plant's population size, habitat quality, landscape context, and abiotic and biotic conditions. Updated and accurate SO-Ranks are used by managers in planning projects, prioritizing occurrences for restoration, identifying reference sites, and aiding management decisions. SO-Ranks should be reviewed and revised on a five-to ten-year cycle.

Information Needs [Inventory, Monitoring, Research]

As of 2023, 78% of extant Water Howellia occurrences were ranked in 2009, and are in need of a re-assessment, and 22% are in need of a full assessment (Box 1). Acquiring revisit data on SOs and updating SO-Ranks at regular -intervals creates a tool for inferring trend (stable, improving, or degrading) for the site.

Box 1. Status of SO-Ranks for 232 extant Water Howellia occurrences as of 2023:

- 51 lack SO-Rank
- 181 ranked in 2009

b. Evaluate and Update State Threat Score and rationale. Water Howellia has a State Threat Score of high-medium based on the 2021 Threat Assessment (MTNHP 2021a). The State Threat Score and rationale should be updated by MTNHP at five-year intervals, or as warranted by current data. Reported threats and data analysis should be posted on the Montana Field Guide to create transparency in the ranking process. The State Threat Score represents the degree to which the target plant is degraded by extrinsic factors, which are characterized in terms of timing, severity, and scope (MTNHP 2021b; Master et al. 2012).

2) Collaborate with landowners to seek input and permissions to conduct consecutive years of surveys on lands identified as having high, moderate, or low suitability by the most current Predicted Suitable Habitat Model. Consider providing survey results (both present and absent observations) to MTNHP to help refine the Predicted Suitable Habitat Model for Water Howellia in Montana. Based on presence/absence data reported from 1978 to 2017, two consecutive years of survey are needed to detect the presence of the plant approximately 86% of the time (MTNHP 2017). Landowners with whom to collaborate include:
   - Private landowners
   - NGO landowners, specifically The Nature Conservancy
   - State land management agencies, specifically MT DNRC
   - Federal land management agencies, specifically Flathead National Forest (NF), Lolo NF, Swan River National Wildlife Refuge

3) Where known Water Howellia populations occur, collaborate with landowners to seek input and permissions to acquire data or conduct consecutive years of surveys at least once in a 10-year period - to obtain current data on population size, threats, and habitat condition and to track trends. Consider providing survey results (both present and absent observations) to MTNHP for inclusion into the botany database. Based on presence/absence data

Photo Credit: Andrea Pipp

Photo 5. A member of the Mission Mountains Youth Crew successfully finds Water Howellia during a plant survey.

reported from 1978 to 2017, two consecutive years of survey are needed to detect the presence of the plant approximately 86% of the time (MTNHP 2017). Landowners with whom to collaborate - include:

- Private landowners
- NGO landowners, specifically The Nature Conservancy (TNC)
- State land management agencies, specifically MT DNRC
- Federal land management agencies, specifically Flathead National Forest (NF), Lolo NF, Swan River National Wildlife Refuge (NWR)

Photo Credit: Kristi DuBois

Photo 6. The tiny, white flowers of Water Howellia peep just above the water surface.

4) For ponds categorized as unoccupied (U-Pond) by the 1998-2012 monitoring studies (MTNHP 2024a), collaborate with landowners to seek input and permissions to acquire data or conduct consecutive years of surveys at least once in a 10-year period in assess Water Howellia occupancy and potential habitat condition. Unoccupied ponds that were surveyed and determined to have potential habitat were categorized as U-Ponds and may serve as future refugia for Water Howellia. Consider providing survey results (both present and absent observations) to MTNHP for inclusion into the botany database. Based on presence/absence data reported from 1978 to 2017, two consecutive years of survey are needed to detect the presence of the plant approximately 86% of the time (MTNHP 2017). Landowners with whom to collaborate - include:
   - Private landowners
   - NGO landowners, specifically TNC
   - State land management agencies, specifically MT DNRC
   - Federal land management agencies, specifically Flathead NF, Lolo NF, Swan River NWR

5) For Water Howellia occurrences that are part of the established Post-Delisting Monitoring Plan, maintain collaboration among the USFWS, USFS, and MTNHP and retain the monitoring schedule and data collection methods. Also, acquire any funds needed to complete the required work in 2028 and 2029 (years 7-8) and in 2035-2036 (years 14-15) and comply with the ESA (USFWS 2020). The 2022-2023 baseline monitoring dataset consists of 30 mandatory and approximately 24 optional ponds to monitor (MTNHP 2024a).

6) For Water Howellia occurrences that are not part of the established Post-Delisting Monitoring Plan implementation, work cooperatively with federal and state agencies, NGO land managers, and private landowners to conduct revisits for the purpose of acquiring current plant population and habitat data. Consider providing survey results (both present and absent observations) to MTNHP for inclusion in the botany database. Based on presence/absence data reported from 1978 to 2017, two consecutive years of survey are needed to detect the presence of the plant approximately 86% of the time (MTNHP 2017).

Information Needs [Inventory, Monitoring, Research]

7) For each Water Howellia occurrence, strive to obtain population presence and absence, habitat, threat, and mapping data at least once every ten years and share data with the MTNHP. Maintaining current and accurate information on each Water Howellia occurrence helps maintain accurate information for use in status assessment, projects, and planning efforts.

8) Use existing resources to find literature, research studies, and other information when investigating research questions or needs and designing monitoring studies. Across Water Howellia range information has accumulated from a variety of sources including academic research, federal and state research and management reports, and observation data, on topics of life history traits, ecology and habitat requirements, germination, growth, and transplanting, pollinators, livestock grazing and management, fire ecology, and others. Reference material - already compiled can be found at the following sources:
   - Cited and Additional References section in the Montana Field Guide Water Howellia profile[1]
   - USFWS ECOS website[2]

9) Research topics that could further our understanding of this unique plant and/or help plant conservation efforts include, but are not limited to:
   a. Conduct research on seed collection, storage techniques, and germination trials for incorporating into a seed bank. Refer also to Section 4, Protection and Restoration Conservation Objective #7.
   b. Develop studies that examine the effects of fire on vernal pond hydrology (groundwater processes). Refer also to "An analysis of disturbance buffers surrounding occupied Water Howellia (*Howellia aquatilis*) ponds and unoccupied ponds in Montana (Pipp 2017).
   c. Develop studies to examine the effects of silvicultural treatments on Water Howellia populations and vernal pond hydrology (groundwater processes).
   d. Conduct studies relative to pollinators for Water Howellia.
   e. Conduct study mechanisms of seed dispersal for Water Howellia. Readers should also consult the Flathead NF Conservation Strategy for Water Howellia (USFS 1997).
   f. Use a research-based monitoring study to examine the effect of drafting water from vernal ponds on Water Howellia population ecology.
   g. Conduct research to determine the cytotype of Reed Canarygrass (*Phalaris arundinacea*) in the Swan Valley. Certain forms of Reed Canarygrass are invasive to native plants and their habitats (Merigliano and Lesica 1998); however, there are currently no techniques for identifying these forms prior to their invasion. Knowing which form of Reed Canarygrass occurs at each Water Howellia occurrence would provide a management tool to assess the actual risk of invasion by Reed Canarygrass and is needed to more accurately assess the State Threat Score. Readers should also consult the Flathead NF Conservation Strategy for Water Howellia (USFS 1997).

Information Needs [Inventory, Monitoring, Research]

h. Study the successional dynamics of the surrounding upland forests in the Swan Valley and determine how Water Howellia is affected by those dynamics. Readers should also consult the Flathead NF Conservation Strategy for Water Howellia (USFS 1997).

i. Determine the relationship between Water Howellia vigor and nutrient availability in pond substrates (USFS 1997). Particular nutrients, such as phosphorus, nitrate, and ammonium, may influence fertility and vigor (Lesica 1990). This type of information could help determine the impact that activities like grazing, roadside fertilizing, and logging may have on Water Howellia populations. Readers should also consult the Flathead NF Conservation Strategy for Water Howellia (USFS 1997).

Protection and Restoration

Conservation Goal

Secure on-the-ground, site-specific habitat and/or management protection or restoration for Water Howellia on public and private lands.

Conservation Objectives

1) Provide incentive-based programs to conserve, enhance, and restore habitats that support Water Howellia. Tools could include long-term conservation leases, conservation easements, grazing system development, seeding projects, invasive species control, and funding mechanisms. Programs that could help include, but are not limited to:

- USFWS Section 6 Grant Program
- Montana Fish, Wildlife & Parks (MFWP) Habitat Montana Program[3]
- Montana Association of Land Trusts[4]
- Natural Resources Conservation Service (NRCS), Agricultural Conservation Easement Programs (ACEP)[5] for Montana

  -Agricultural Land Easements (ALE)[6]

  -Wetland Reserve Easements (WRE)[7]

[3] MFWP Habitat Montana: https://fwp.mt.gov/conservation/landowner-programs/habitat-montana Refer also to Section 3, Protection and Restoration, Conservation Objective #1.

[4] Montana Association of Land Trusts: https://montanalandtrusts.org/

[5] NRCS ACEP: https://www.nrcs.usda.gov/programs-initiatives/acep-agricultural-conservation-easement-program/montana/agricultural

[6] NRCS ACEP - ALE: https://www.nrcs.usda.gov/programs-initiatives/acep-agricultural-conservation-easement-program/montana/agricultural

[7] NRCS ACEP – WRE: https://www.nrcs.usda.gov/programs-initiatives/acep-agricultural-conservation-easement-program/montana/agricultural

2) Develop partnerships between federal, state, non-profit, and/or private organizations within the Montana range for Water Howellia and the following potential facilities to conduct seed banking, germination trials, genetic research, and/or related topics relative to collected Water Howellia plant materials:
   - Rae Selling Berry Seed Bank, Portland State University, Oregon[8]. Study trials in the 1990s showed that Howellia aquatilis seeds are short-lived and live seeds could not successfully be stored with conventional methods (Lesica 1990; USFWS 1998).
   - Plant Germplasm Introduction Test and Research Unit, Pullman, Washington

3) Promote resiliency for the Swan Valley meta-population. Where land is managed, strive to retain or promote a complex mosaic of vernal pond types, hydrologic conditions, and vegetation types and successional stages. It is thought that a landscape that contains different types of vernal ponds with varying hydrological characteristics will help -retain potential habitat for Water Howellia to colonize as the climate changes.

4) Work with local, county, and state transportation agencies to reduce or eliminate roadside applications of herbicide, sanding, or salting along Water Howellia ponds that are within road right-of-ways. Reducing the amount of chemicals and sediment that enter Water Howellia ponds will maintain good water quality.

Photo Credit: Will Schlegel

Photo 7. A USFS Botanist collects baseline data as part of the Post-Delisting Monitoring Plan for Water Howellia. Flathead National Forest, Montana.

5) Coordinate with county weed extensions, local watershed groups, and other natural resource service providers in Water Howellia habitat areas to provide information on Water Howellia pond locations and increase awareness.

6) Prevent the introduction or spread of invasive species into vernal pond habitat, regardless of whether the pond is occupied by Water Howellia, by:
   - Not dumping aquarium plants or animals into ponds, rivers, and other aquatic habitats.
   - Monitoring for aquatic invasive plants.

7) Minimize ground disturbance in the upland habitat that surrounds vernal ponds to minimize possible negative impacts to water quality, especially those occupied by Water Howellia.

[8] Rae Selling Berry Seed Bank: https://www.pdx.edu/seed-bank/

Outreach and Education

Conservation Goal

Facilitate the stewardship of Water Howellia populations and habitat through education, outreach, and coordination.

Conservation Objectives

1) Through educational and conservation NGOs, teach, lead outdoor experiences, and/or develop educational materials to further awareness and conservation efforts relative to Water Howellia or vernal pond habitat. Organizations to partner with include, but are not limited to:
   - Montana Native Plant Society (MNPS)[9]
   - Swan Valley Connections (SVC)[10]
   - Montana Conservation Corps MCC)[11]
   - Mission Mountains Youth Crew, (MMYC)[12] sponsored by Swan Valley Connections, National Forest Foundation, Flathead National Forest, and Salish Kootenai College.

Photo Credit: Erica Rudolph

Photo 8. A USFS Botanist surveys for Water Howellia as part of the Post-Delisting Monitoring Plan. Flathead National Forest, Montana.

2) Work with educators and plant- and habitat-focused non-profits to incorporate Water Howellia into an education unit on Montana's rare plants or vernal pond ecology for students in primary and secondary schools.

3) Assess the Water Howellia interpretive sign and bench along the Holland Lake nature trail to determine their condition and need for an update. In addition, develop recommendations on how to repair and/or maintain this resource for the short and long term. This interpretive sign and the bench can further Water Howellia conservation by creating a sense of placeand interesting information on a truly unique plant to enhance the recreational user's experience.

4) Tell the story of Water Howellia, its unique life history and habitat, and the conservation practices that have led to de-listing it from the ESA by writing articles, conducting field trips, presenting talks, and developing stories for news, social, and web media. Pair people who are knowledgeable about Water Howellia with writers, conservation-oriented organizations, local media producers, local and regional governing bodies, and/or educators - to showcase Swan Valley's iconic plant, tell a success story for ESA, bring awareness, and - foster stewardship.

[9] MNPS: https://mtnativeplants.org/

[10] SVC: Swan Valley Connections: https://www.swanvalleyconnections.org/

[11] MCC: https://www.mtcorps.org/

[12] MMYC Program: https://www.nationalforests.org/regional-programs/northern-rockies/mission-mountains-youth-crew-program

Policy and Regulation

Conservation Goal

Improve conservation of Water Howellia through public participation and implementation of existing policies and regulations in cooperation with federal, state, and Tribal land managers, private landowners, and other interested stakeholders.

Conservation Objectives

1) Re-establish an interagency technical working group, to include the USFS, USFWS, and the MTNHP (USFS 1997). This technical working group should periodically review the status of the species and assess the effectiveness of the 1997 Conservation Strategy for *Howellia aquatilis*, particularly during the post-delisting monitoring period from 2022 to 2036 (USFWS 2020).

2) Through collaboration between the USFS and USFWS and/or with an interagency technical working, ensure that the Post-Delisting Monitoring Plan (USFWS 2020) is implemented as scheduled and that results are analyzed - to determine a final post-delisting monitoring outcome.

3) Support the Flathead National Forest in its decision to incorporate the 1997 Conservation Strategy for *Howellia aquatilis* into the Flathead National Forest Revised Forest Plan[9] (FNF 2018).

4) Continue compliance with Water Howellia conservation measures through the Flathead National Forest Revised Forest Plan (FNF 2018).

REFERENCES

Lesica, P. 1990. Habitat requirements, germination behavior and seed bank dynamics of *Howellia aquatilis* in the Swan Valley, Montana. Unpublished report to the Flathead National Forest. Conservation Biology Research, Helena, MT. 44 pp. plus appendix.

Master, L., D. Faber-Langendoen, R. Bittman, G. Hammerson, B. Heidel, L. Ramsay, K. Snow, A. Teucher, and A. Tomaino. 2012. NatureServe Conservation Status Assessments: *Factors for Evaluating Species and Ecosystem Risk*. NatureServe, Arlington, VA.

Merigliano, Micheal F., and Peter Lesica. 1998. "The native status of reed canarygrass (*Phalaris arundinacea* L.) in the inland Northwest, U.S.A." *Natural Areas Journal*, 18(3): 223-30.

Mincemoyer, Scott. 2005. Range-wide status assessment of *Howellia aquatilis* (water howellia). Prepared for the USFWS. Helena, MT: Montana Natural Heritage Program . 21 pp. + appendices.

[9] Flathead National Forest Revised Forest Plan: https://www.fs.usda.gov/detailfull/flathead/home/?cid=stelprdb5422786&width=full

Montana Natural Heritage Program (MTNHP). 2016. Botany database compilation and analysis for Water Howellia in Montana. Information from 2015 to 2016 provided in datasheet, tabular, graphical, and summarized formats. Andrea Pipp, Program Botanist, MTNHP, Helena, MT.

Montana Natural Heritage Program (MTNHP). 2024a. *Howellia aquatilis* profile in the *Montana Field Guide*. https://fieldguide.mt.gov/speciesDetail.aspx?elcode=PDCAM0A010 [Accessed 8 February 2024]

Montana Natural Heritage Program (MTNHP). 2024b. *Howellia aquatilis* observation data from the botany database. [Accessed 8 February 2024]

Montana Natural Heritage Program (MTNHP). 2022c. Implementing the Post-Delisting Monitoring Plan in Montana. Annual progress report. Submitted - to the USFWS, Denver CO, .by Program Botanist, MTNHP, Helena, MT.

Pipp, Andrea. 2017. An analysis of disturbance in buffers surrounding occupied Water Howellia (*Howellia aquatilis*) ponds and unoccupied ponds in Montana. Prepared for the USFWS, Montana Ecological Services Field Office, Helena, MT. Helena, MT: Montana Natural Heritage Program.19pp + appendix.

US Fish and Wildlife Service (USFWS). 1994. Endangered and Threatened wildlife and plants; the plant, Water howellia (*Howellia aquatilis*), determined to be a Threatened species. 50 CFR Part 17. Federal Register 59(134):35860-35864.

US Fish and Wildlife Service (USFWS). 1996. Technical Draft *Howellia aquatilis* Recovery Plan. Prepared by Steve Shelly, US Forest Service and Montana Natural Heritage Program, Missoula, MT and John Gamon, Washington Natural Heritage Program, Olympia, WA. Prepared for USFWS, Helena, Montana.

US Fish and Wildlife Service (USFWS). 1998. Proceedings from the Forum on Research and Management of *Howellia aquatilis*. March 24-25. Turnbull National Wildlife Refuge, Cheney, WA.

US Fish and Wildlife Service (USFWS). 2013. *Five-Year Review: Summary and Evaluation of Water Howellia*. Montana Ecological Services Field Office, Helena, MT.

US Fish and Wildlife Service (USFWS). 2020. Post-Delisting Monitoring Plan for Water Howellia (*Howellia aquatilis*). Prepared by USFWS, Montana Ecological Services Field Office, Helena, MT.

US Fish and Wildlife Service (USFWS). 2021. Endangered and threatened wildlife and plants; removing the water howellia from the list of endangered and threatened plants. Federal Register 86(114):31955-31972.

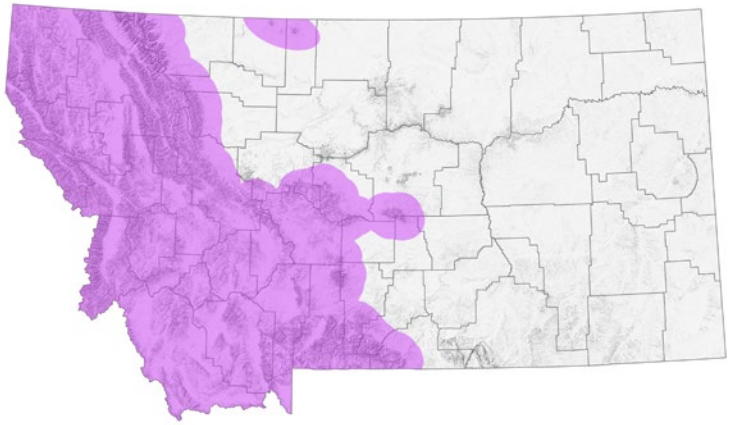
US Forest Service (USFS). 1997. Conservation Strategy - *Howellia aquatilis*. Second Edition, April. United States Department of Agriculture, Forest Service Northern Region, Kalispell, MT. 24 pp.

US Forest Service (USFS). 2018. Flathead National Forest Land Management Plan. Flathead, Lake, Lewis and Clark, Lincoln, Missoula, and Powell Counties, MT. Flathead National Forest, Kalispell, MT. https://www.fs.usda.gov/detailfull/flathead/home/?cid=stelprdb5422786&width=full

CONSERVATION PROFILE: WHITEBARK PINE (*PINUS ALBICAULIS*)

Photo Credit: Bryce Maxell

Photo 1. A mature, healthy Whitebark Pine tree growing in the upper subalpine zone in Montana.



Source: Montana Natural Heritage Program (2024a)

Figure 1. The range for Whitebark Pine in Montana.

PURPOSE:

*This conservation profile provides information about Whitebark Pine (*Pinus albicaulis*), a Plant Species of Greatest Conservation Need (GCN) in Montana, and the US Fish and Wildlife Services' recovery planning effort. It highlights the plant's state-level distribution, factors that put it at risk for loss, and conservation objectives that, if implemented, would aid its persistence. This conservation profile aims to be an abbreviated, stand-alone document that can be used by, or shared with, land managers, landowners, educators, decision-makers, regulators, and anyone interested in Whitebark Pine. This conservation profile should also be used in conjunction with Section 4 of the Montana Native Plant Conservation Strategy, which addresses overarching conservation objectives for Plant Species of GCN and in conjunction with the soon-to-be-released Whitebark Pine Recovery Plan.*

INFORMATION ON WHITEBARK PINE

Distribution, Status, and Identification

Whitebark Pine (*Pinus albicaulis*) is a prominent tree in the high-elevation forests of the western United States (US) and Canada (Photo 1) (Kral in Flora of North America 1993). Worldwide, the distribution of Whitebark Pine occurs from about 36 degrees North latitude in the southern Sierra Nevada Range to about 55 degrees North latitude in the northern coastal ranges of Canada (Tomback and Sprague 2022; McCaughey and Schmidt 2001). This area encompasses the US states of California, Idaho, Montana, Nevada, Oregon, Washington, and Wyoming, and the Canadian provinces of Alberta and British Columbia. In the Rocky Mountains, trees grow from about 42 degrees North latitude in the southern Greater Yellowstone area to about 54 degrees North latitude in Canada (Tomback and Sprague 2022; McCaughey and Schmidt 2001).

In Montana, Whitebark Pine trees are found in the major mountain ranges (Figure 1) (MTNHP 2024). They are a dominant or co-dominant tree in the upper subalpine zone where they often define the tree line, but also can be found growing at lower elevations (Figure 2). In the upper elevation communities, Whitebark Pine is considered a "climax" tree and will persist and maintain dominance due to optimal site conditions where it maintains a competitive foothold. Since it is averse to shade, trees grow most successfully on sites with full exposure to solar radiation and where tree canopies are open. However, Whitebark Pine can also be a "seral" species in lower subalpine and mid- to upper montane forests, particularly where there are sufficient gaps in the forest canopy (Figure 2).

Whitebark Pine has also established successfully in shrubland and lower montane vegetation types in Montana. In the southwest portion of the state, a Whitebark Pine population has established in the Mountain Big Sagebrush (*Artemisia tridentata*) community type (Guiberson 2020). In the southern Bitterroot Mountains (Arno 1993) and east of the Continental Divide (Pfister et al. 1977), trees have been known to occur in lower montane sites in Montana.

Across its distribution, both globally and in Montana, Whitebark Pine is predominantly found on federal lands (MTNHP 2024a; Tomback et al. 2022). The US Forest Service (USFS) is the largest landowner nationally and in Montana, with about 74% and 85% of Whitebark Pine's land area, respectively (MTNHP 2024a; Tomback et al. 2022). The National Park Service (NPS) is the second largest landowner nationally and in Montana, with about 10% and 7% of the land area, respectively (MTNHP 2024a; Tomback et al. 2022). The Bureau of Land Management (BLM) is the third largest landowner nationally with about 4% of the land base (Tomback et

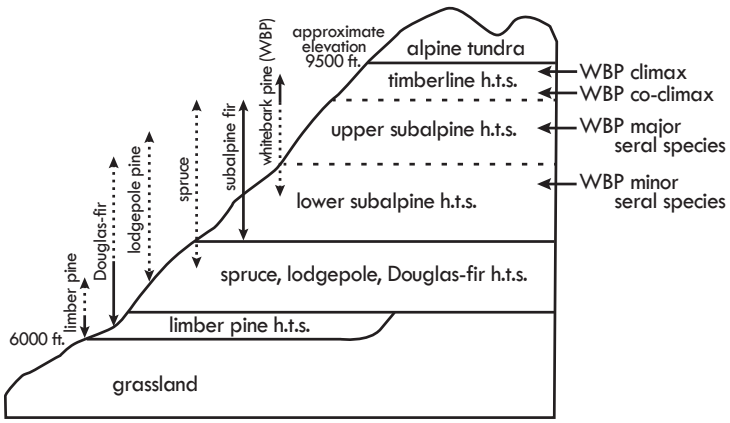


Figure 2. The general elevational distribution for forest trees and habitat type series (h.t.s.), including Whitebark Pine, on non-calcareous geological substrates in south-central Montana. Solid portion of arrow indicates where a species is the potential climax and the dotted portion shows where it is seral (Tomback, Arno, and Keane 2001).

al. 2022). In Montana, the Montana/Dakotas BLM (MT/Dakotas BLM) and the state are tied, each managing about 1% of the land area for Whitebark Pine (MTNHP 2024a). The remaining roughly 5% of land area for Whitebark Pine in Montana is under Tribal and private ownerships (MTNHP 2024a). Ski areas make up a large percentage of the privately owned land.

Learn about Whitebark Pine identification, biology, and state status in the Montana Field Guide[2]

Learn about Whitebark Pine range-wide information, federal status, and management in the USFWS Environmental Conservation Online Systems (ECOS)[3]

Learn about Whitebark Pine ecology, conservation, restoration, and educational efforts at the Whitebark Pine Ecosystem Foundation (WPEF)[4]

Whitebark Pine is a Montana Species of Concern (SOC) plant as determined by the Montana Natural Heritage Program (MTNHP) (2024b) (Photo 2). Ranked in the state as an S3, Whitebark Pine is vulnerable due to recent and widespread declines and threats (MTNHP 2024b). On January 17, 2023, Whitebark Pine was federally-listed as a threatened species under the Endangered Species Act (ESA) of 1973, as amend (87 FR 76882) (USFWS 2022a). A Recovery Outline[1] was issued in December 2022 (USFWS 2022b). A recovery plan is expected in 2024.

Roles as a Keystone and Foundation Species

Whitebark Pine is ecologically and culturally an important tree species throughout its range (Tomback et al. 2022). As a keystone species, the tree promotes biodiversity because its large, nutritious seeds provide wildlife food while mature stands create high-elevation nesting and foraging habitat for numerous birds and mammals (Tomback 1978; Hutchins and Lanner 1982; Arno 1986; Tomback and Kendall 2001; Cross and Crabtree 2021). The tree depends on the Clark's Nutcracker (*Nucifraga columbiana*), a bird that has shaped many features of the pine (Tomback 1982; WPEF 2024a). Cones mostly grow horizontally at the tips of vertical branches where they are easily accessible to birds. If not foraged upon by the Clark's Nutcracker, the cones remain on the branches to disintegrate at maturity – a unique feature for North American pines (Arno and Hammerly 1977). Their large seeds are wingless and cannot be carried by the wind. However, the Clark's Nutcracker hammers a hole into the thick cone scale with its long, pointed, and sturdy bill to extract the seed (Arno and Hammerly 1977) (Photo 2). They deposit the

Photo Credit: Nathan DeBoer

*Photo 2. A Clark's Nutcracker (*Nucifraga columbiana*) has a long, pointed, and sturdy bill for hammering into pine cones.*

[1] Recovery Outline for Whitebark Pine: https://ecos.fws.gov/docs/recovery_plan/20221215_WBP_Final_Recovery_Outline_v11_DRDsigned.pdf NOTE: This reference will no longer be accessible once the recovery plan is issued.

[2] Montana Field Guide, Whitebark Pine: https://fieldguide.mt.gov/speciesDetail.aspx?elcode=PGPIN04010

[3] USFWS ECOS website: https://www.fws.gov/species/whitebark-pine-pinus-albicaulis

[4] Whitebark Pine Ecosystem Foundation: https://whitebarkfound.org/our-work/national-whitebark-pine-restoration-plan/

seeds into their throat pouch – a structure unique to nutcrackers – and later bury them in the ground (seed cache). Seed caches become the primary food source for the adult birds, and their nestlings and fledglings. What doesn't get eaten germinates (Photo 3). Hence,

Photo Credit: Dee Blank

Photo 3. A cache of Whitebark Pine seeds – germinating.

Clark's Nutcrackers are an important long-distance disperser for Whitebark Pine seeds. The Red Squirrel (*Tamiasciurus hudsonicus*) is also quite adept at harvesting the cones, ripping the scales to expose the seeds, and storing cones in rotten logs and in the ground (Arno and Hammerly 1977). Seeds are also sought out by Grizzly and Black Bears (Ursus arctos and U. americanus, respectively) in Montana and Wyoming (WPEF 2024). For many Native American tribes, Whitebark Pine seeds are a traditional food (Lanner 1996; Moermon 1998).

Whitebark Pine is also a foundation species because it modifies the environment in a way that benefits animals living in these high-elevation landscapes. Whitebark Pine trees form plant communities that help stabilize the harsh high-elevation environments by initiating tree islands and influencing the retention and re-distribution of snow (Farnes 1990; Tomback et al. 2016). They create stable shelter for the establishment and growth of numerous other plants, and regenerate soon after fire and other ground-level disturbing events (Tomback et al. 2016). Mature and reproducing stands form discreet communities, often dominated by herbaceous and dwarf shrub understories dependent on snow catchment, prolonged summer moisture, and cooler soil temperatures. Many associated dwarf shrubs in these mature communities provide important culturally significant and wildlife (Grizzly bear and other high elevation fauna) food sources.

For people, the communities created by Whitebark Pine contribute to enjoyment and opportunities for recreation (Tomback and Sprague 2022). These pines may seldom be seen from a car, but hikers and mountain climbers who frequent the high country may refer to them as a sort of "old friend" (Arno and Hammerly 1977). Large, multi-stemmed old-growth trees and gnarled, wind-sculpted forms contribute beauty to these high-elevation landscapes sought by recreationists (Tomback and Sprague 2022) (Photo 4). They create an ecosystem in which people ski, hike, backpack, and picnic, which in turn helps to bolster local economies and the outdoor recreation industry Tomback and Sprague 2022).

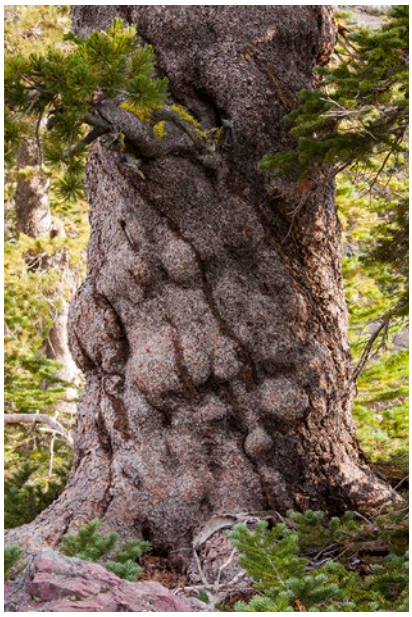


Photo Credit: Dee Blank

Photo 4. Whitebark Pine trees become sculptured by time and the environment.

RATIONALE FOR PLANT SPECIES OF GREATEST CONSERVATION NEED

Whitebark Pine is a Plant Species of Greatest Conservation Need (GCN) in Montana because of its ecological and cultural importance coupled with multiple, interrelated threats. Consequently, the loss of Whitebark Pine would lead to cascading ecosystem changes (Tomback and Kendall 2001).

Across its range, Whitebark Pine populations have drastically declined from a multitude of causes (Photos 5 and 6). High proportions of mature stands have been killed by *Cronartium ribicola*, an introduced pathogen that infects trees and causes White Pine Blister Rust (WPBR) disease, and by large-scale infestations of the native Mountain Pine Beetle, *Dendroctonus ponderosae* (USFWS 2018 and 2020; Tomback et al. 2022; Tomback and Sprague 2022). Data from the USFS's Forest Inventory Analysis (FIA) program estimates that, as of 2016, 51% of all standing Whitebark Pine trees in the US were dead (USFWS 2022a; Goeking et al. 2018). Further, the FIA data revealed that the number of dead trees with a diameter of five inches or greater increased dramatically between the 1990s and 2016 (Goeking and Islar 2018). Additionally, altered fire regimes and climate change are factors that likely drive population dynamics across its range (USFWS 2022a). Fire is an important landscape-level disturbance in these systems, but it might also be a stressor for Whitebark Pine. It's ability to withstand varying intensities of wildfire is not well understood. Changes in climate may contribute to an exacerbation of the primary threat factors, including susceptibility to infestation by forest pests, and changes in fire frequency and intensity (USFWS 2022). Research in Idaho suggests that a warm climate may increase growth of Whitebark Pine in certain locations (Kichas et al. 2020). However, much is still to be learned about how Whitebark Pine will respond to climate change.

Photo Credit: Melissa Jenkins

*Photo 5. A dead and dying Whitebark Pine stand succeeding to Subalpine Fir (*Abies lasiocarpa*) near Link Lake Trail on the Flathead National Forest.*

Photo Credit: Andrea Pipp

Photo 6. A young Whitebark Pine shows signs of an infection - green needles turning red. Beal Hill in Montana.

CONSERVATION GOALS & OBJECTIVES FOR WHITEBARK PINE

The intent of the *Montana Native Plant Conservation Strategy*: *Species and Habitats of GCN* is to promote the collective and coordinated stewardship of Montana's Plant Species of GCN to ensure their viability and persistence using a fusion of approaches. Sections 3-*Strengthening Botanical Capacity* and 4-*Plant Species of GCN* present overarching goals and conservation objectives that can indirectly help sustain Whitebark Pine populations. In this conservation profile we present conservation objectives specific to Montana's Whitebark Pine populations from four areas that are pillars of plant conservation:

- Information Needs [Inventory, Monitoring, Research]
- Protection and Restoration
- Outreach and Education
- Policy and Regulation

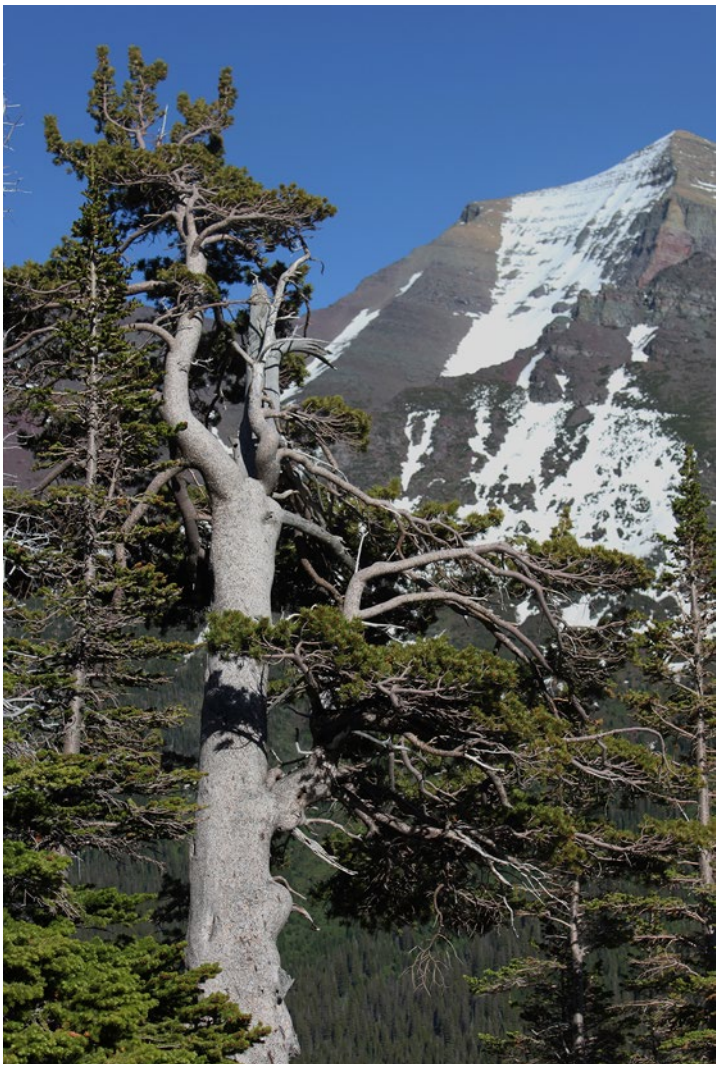


Photo Credit: Tara Luna

Photo 7. A Whitebark Pine tree in Glacier National Park.

The conservation objectives were developed by a Whitebark Pine Working Group that met in December 2022 and January 2024, and are based on published research, monitoring, professional expertise, draft agency guidance, and field observations. **Due to Whitebark Pine's change in status to federally listed as threatened, these suggested conservation objectives for populations in Montana will continue to evolve – especially in anticipation of the recovery plan**. The working group consisted of biologists, ecologists, botanists, and foresters working for federal and state land management agencies (see Table 1 on page *iii* of the *Strategy*). Working within and across jurisdictional boundaries, these voluntary conservation objectives are intended to empower federal, state, Tribal, and non-government conservation land managers, landowners, businesses, and individuals who want to contribute to or collaborate on processes that could aid the persistence of Whitebark Pine. These voluntary actions can be pursued or implemented by a single entity, or as a collaborative effort by individuals, agencies, and organizations, including businesses. They are presented in no prioritized order.

This conservation profile in no way supersedes the operations or strategic directions for Whitebark Pine management and recovery on public, Tribal, and private lands. Federal and state land managers, along with other users of this conservation profile should first consult with the Recovery Plan, when released, for Whitebark Pine.

The USFS and Canadian genetic resource managers have developed a specialized set of terms that is used at tree nursery facilities that screen seed sources for blister rust (Tomback et al. 2022). The terms come from long-standing tree improvement and breeding programs that are now incorporating new genomic, forest management, and climate modelling approaches. Other practitioners in USFS-Region 1 have also developed terms and definitions (Hendrix 2024). A selection of terms and a brief definition is provided in this profile for convenience (Table 1). Users of this *Strategy* may want to consult the full suite of terms, definitions, and source references found in Tomback et al. 2022.

Table 1. Terms used by the United States Forest Service in Region 1 (Hendrix 2024; Tomback et al. 2022).

Term	Brief Definition
Genetic Resistance	The quantitative genetic resistance to Whitebark Pine Blister Rust. Resistance is based on polygenic inheritance of genes with allele frequencies that differ among individuals and populations meaning resistance spans a continuum.
Plus Tree	Relatively healthy, cone-bearing, phenotypically resistant trees that are included in a selective breeding program (geo-referenced and tagged tree) where performance is based on results of artificial inoculation screen trials and ranking for growth or from a stand with high infection level and mortality from White Pine Blister Rust (WBPR). The tree is a promising candidate for resistance screening, but resistance is not yet confirmed.
Elite Tree (resistant seed source)	A seed or plus tree confirmed through resistance screening to have heritable (genetic) resistance (i.e., reduced susceptibility) to WPBR. A plus tree with high ranking in blister rust resistance from the artificial inoculation screening trials and high ranking in growth trials.
Operational Collection Tree	A tree with characteristics that make it desirable as a source of cones to use in the production of seedlings for out-planting.
Phenotypically Resistant Tree	A tree that is relatively free of WPBR when compared to the infection level of the stand as a whole. Trees may or may not be part of the artificial inoculation screen trial.
Resistant Seedlings	Seedlings grown from elite tree seeds, or seeds from a mix of elite trees and unscreened plus trees. Since wind-pollinated seeds of elite parent trees will be used, there will be a wide continuum of susceptibility within seed lots, and seedling survival in high WPBR areas may be 50% or lower because of cross-pollination or recombination. Not all seedlings will carry resistance traits, but seedling survival is expected to be greater than for seedlings grown from untested plus trees alone. Bulked seed lots can be screened to provide a better estimate of the frequency of resistance for determining appropriate planting densities.

Information Needs [Inventory, Monitoring, Research]

Conservation Goal

Improve scientific understanding of Whitebark Pine in Montana and the ecological and cultural processes that sustain plants and populations through statewide coordination, inventory, monitoring, and research.

Conservation Objectives for Inventory

1) Work collaboratively with federal, state, Tribal, and private landowner partners to acquire necessary field data and biological information so the MTNHP can evaluate information to:

   a. Maintain an accurate and timely Subnational Rank (hereafter the State Rank or S-Rank) for Whitebark Pine in Montana.

   b. Determine the State Threat Score and rationale for Whitebark Pine in Montana. The State Threat Score represents the degree to which the target plant is degraded by extrinsic factors, which are characterized in terms of timing, severity, and scope (MTNHP 2021b; Master et al. 2012). As of 2024, Whitebark Pine in Montana lacks a State Threat Score. Once assigned, it is recommended that the State Threat Score and rationale be updated by MTNHP at five-year intervals, or as warranted by current data. It is also recommended that threat reports and data analysis be more transparent and posted on the Montana Field Guide species profile.

2) Promote genetic resistance to WPBR in Montana by identifying seed zones for Whitebark Pine or by improving designated seed zone boundaries as more genetic information and results from common garden and genomic studies become available (Tomback et al. 2022). Seeds collected from any tree within the designated seed zone will generally be adapted across that environment; therefore, identifying seed zones can reduce the loss of planted seedlings or trees from maladaptation. Analysis units identified in the Species Status Assessment (SSA) generally serve as seed zones (USFWS 2021).

Photo Credit: Tara Luna

Photo 8. Whitebark Pine pollen (male) cones are typically reddish.

Photo Credit: Mike Chapman

Photo 9. Whitebark Pine seed cones (female) grow horizontally at the tips of branches.

Information Needs [Inventory, Monitoring, Research]

3) Support the process for obtaining genetic resistance to WPBR using defined methods to inventory and select seed and plus trees, conduct resistance screening, and obtain a target number of elite trees for restoration plantings in each seed zone. The number of trees to identify and select - to obtain the target number for restoration plantings will vary greatly depending upon the regional or local incidence of blister rust infections. The concept is that about 100 elite trees with usable resistance to blister rust are needed within a particular seed zone over time to maintain genetic resistance (Tomback 2022).

4) Within a geographic area, collect cones from plus and elite trees, especially in good years of production. This would involve using certified tree climbers to climb trees in early summer and install hardware cloth or screen envelopes around unripe cones. These envelopes protect the maturing cones from seed removal by squirrels and Clark's Nutcrackers. Certified tree climbers would return in late summer to fall to climb and harvest ripe cones.

5) Continue efforts that update and share spatial data layers of high-value Whitebark Pine tree and stand locations. These ongoing efforts help inform decisions related to wildland fire management, specifically to assist in decisions of implementing full suppression, partial suppression, or allowing to burn (Tomback et al. 2022).

Conservation Objectives for Monitoring

1) When conducting silvicultural or fire treatments intended to restore ecosystem processes or promote Whitebark Pine retention and growth, consider incorporating a long-term monitoring program designed to include (Tomback et al. 2022):
   - A narrowly focused and well-articulated management question(s) and/or objective(s),
   - A random sampling design that stratifies by elevation, aspect, access or safety considerations, or other criteria,
   - Input from a statistician to pre-determine the type of statistical analyses that should be done.

2) Support and participate in the monitoring network that was initiated and funded in 2023. Joining a monitoring network helps gather statewide data on the health status of Whitebark Pine stands to help with conservation, restoration, and other management actions and decisions. This network could incorporate - both one-time surveys and repeated monitoring plots where trees are geolocated and tagged to collect precise re-measurements.

Photo Provided by: Melissa Jenkins, USFS.

Photo 10. Volunteers from the Bob Marshall Wilderness Foundation conduct a 20-year remeasurement of Bob Keane's 1994 study plots. Refer to Retzlaff et al. 2016.

Information Needs [Inventory, Monitoring, Research]

3) Support and continue existing monitoring efforts and other long-term data collection efforts that involve Whitebark Pine. Existing monitoring efforts and networks can help track tree health conditions, forest composition and structure, and many other elements. Valuable existing long-term data collection efforts include, but are not limited to:

   - USFS-FIA[5]. The FIA program collects broadscale vegetation data across the US, using a grid-based, coarse level inventory that is re-measured on a ten-year interval. The FIA program can support localized needs for information by installing off-grid plots at a higher density.
   - USFS stand exam data collected by each National Forest.
   - Interagency Whitebark Pine Monitoring Program in the Greater Yellowstone Ecosystem[6].

4) Continue collaboration among USFS-Region 1, MT/Dakotas BLM, and NPS geneticists in promoting genetic resistance and supporting the establishment and use of seed orchards. Whitebark Pine seed orchards that contain 30 to 60 unrelated elite trees from the same seed zone could improve access to a seed source that is more likely to have resistance to White Pine Blister Rust (Tomback et al. 2022). Seed orchards also allow controlled pollination, which can improve progeny resistance.

Photo Credit: Scott Palmer

Photo 11. Cones growing on a graft in the Lolo NF seed orchard. Cone bearing scion material from the top third of the tree continues to produce cones when grafted onto rootstock.

5) Promote genetic resistance by extending existing federal collaboration to other partners, as warranted. Potential partnering organizations include, but are not limited to:

   - Montana Department of Natural Resources and Conservation (MTDNRC), including Montana Native Seed Network (MTNSN) (See also Section 3, Information Needs, Conservation Objective #6).
   - Other State of Montana land management agencies, such as Montana Department of Environmental Quality (MTDEQ), Montana Department of Transportation (MDT), and Montana Fish, Wildlife & Parks (MFWP).
   - Tribal Nations, such as the Confederated Salish & Kootenai Tribes (CSKT) of the Flathead Reservation and Blackfeet Nation of the Blackfeet Reservation.
   - Montana State University (MSU) - Department of Plant Sciences and Plant Pathology or a Professor of Mycology.
   - University of Montana (UM) - Department of Ecosystem and Conservation Sciences or School of Forestry.
   - USFS, Rocky Mountain Research Station, Fort Collins, Colorado[7].

[5] Forest Inventory Analysis: https://research.fs.usda.gov/programs/fia
[6] 2017 Annual Monitoring Report: https://irma.nps.gov/DataStore/DownloadFile/604180
[7] Rocky Mountain Research Station: https://www.fs.usda.gov/rmrs/

Information Needs [Inventory, Monitoring, Research]

6) Promote studies that examine the role of genetics in susceptibility and resistance of Whitebark Pine to Mountain Pine Beetle attack. Monitoring data that re-assesses areas of past treatments could be incredibly helpful in informing release rates, attack densities, and tree loss from biotic agents. There is a need for surveys that inform our understanding of severity and extent of mountain pine beetle outbreaks, as well as information on post-outbreak survival and regeneration.

7) Support ongoing efforts to promote genetic resistance to White Pine Blister Rust using various screening protocols that involve garden-, greenhouse-, and/or field-based studies:

   - *Garden / Greenhouse Studies:* Current management practices for restoration of Whitebark Pine suggest finding trees with usable resistance to White Pine Blister Rust for each seed zone. Screening involves seedlings grown from seed or plus trees, exposed to high spore densities of *Cronartium ribicola*, and evaluated through time for symptoms of infection, signs of resistance, and, if applicable, specific resistance phenotypes (Tomback et al. 2022).
   - *Field Trial Studies*: Continue field trials in which seedlings from seed or plus trees are out-planted in forested areas with a known White Pine Blister Rust hazard and continue monitoring them for resistance and susceptibility under natural infection conditions. Field trials evaluate the effectiveness of the seedling screening trials, which take place under artificial conditions, in addition to testing the durability and stability of the resistance (Tomback et al. 2022).

8) For an established component population, conduct genetic monitoring to detect declines in genetic diversity as newly planted trees mature (Jenkins et al. 2022).

9) For existing mature populations, conduct genetic monitoring to determine the level of gene flow between populations.

Conservation Objectives for Research

1) Design and conduct studies that examine the relationship between resistance to Mountain Pine Beetle and to White Pine Blister Rust for Whitebark Pine trees and seedlings (Tomback et al. 2022). Research questions identified by Tomback et al. 2022 include:

   - Are certain Whitebark Pine phenotypes more resistant to Mountain Pine Beetle infestations?
   - How does selecting for resistance to White Pine Blister Rust affect the tree's resistance to Mountain Pine Beetle?
   - How does selection for certain resistant phenotypes affect the tree's ability to adapt to changing environments and other pests and pathogens?

2) Design studies to gain information on how much gene flow occurs between populations of Whitebark Pine (Jenkins et al. 2022). The distance of 7.5 miles was determined to be a critical distance that would ensure gene flow between Whitebark Pine populations and was calculated based on flight distances of Clark's Nutcrackers and the potential for long-distance pollen travel (Jenkins et al. 2022). Refer to Jenkins et al. 2022 for suggested research needs.

3) When considering research needs for Whitebark Pine, consult with foresters, botanists, and biologists working for Montana-based land management agencies, especially MT/Dakotas BLM, USFS-Region 1, GNP, YNP, and MTDNRC.

4) Conduct research to improve genetic testing and methods to distinguish Whitebark Pine and Limber Pine trees.

5) Investigate ways to increase overall genetic diversity of Whitebark Pine to promote resistance to Mountain Pine Beetle and other damaging agents.

Protection and Restoration

Conservation Goal

Secure on-the-ground, site-specific habitat and/or management protection or restoration for Whitebark Pine on public and private lands

Conservation Objectives for Protection

1) Land management agencies and private landowners should strive to or continue their efforts to protect seed sources of plus trees, elite trees, and seed orchards from Mountain Pine Beetle, such as with the anti-aggregation pheromone verbenone or by thoroughly spraying trees with carbaryl or pyrethroids (e.g., bifenthrin or permethrin) insecticides. This level of coordination is already in place for some land management agencies in Montana.

2) The locations of plus trees, elite trees, and seed orchards should be incorporated into the land management agency's fire management plan and timber management plan. This level of coordination is already in place for some land management agencies in Montana.

3) Retain all healthy Whitebark Pines trees. If unavoidable, select for shorter trees and those growing in groups with other trees - to prevent losing trees to high winds (Murray et al. 2022).

4) Implement proactive intervention approaches in forest communities where *Cronartium rupicola* is at low levels or absent. This approach uses silvicultural treatments to prepare the landscape to boost Whitebark Pine resiliency to anticipated future or increased levels of infection. NOTE: Readers should refer to Table 4 on page 12 in the paper by Tomback et al. 2022.

Photo Credit: Andrea Pipp

Photo 12. A stand of dead mature Whitebark Pine trees – likely from Mountain Pine Beetle - on Beal Hill in Montana.

Conservation Objectives for Restoration

1) When published, support the recovery actions and activities included in the recovery plan for Whitebark Pine. Support federal and state land management agencies in implementing relevant restoration actions identified in the forthcoming recovery plan.

2) For land management agencies with jurisdiction within the range of Whitebark Pine, consider developing a plan to identify and prioritize restoration activities. One method to consider is the six-step methodology developed for the Crown of the Continent Ecosystem (Jenkins et al. 2022)[8]. This GIS-based method was applied to a subset of the Crown of the Continent Ecosystem, namely Glacier National Park, Flathead National Forest, and Flathead Indian Reservation. The method creates a restoration plan with site-specific actions designed to protect and restore genetically diverse and potentially stable populations that may exhibit on-going evolutionary adaptation across the area of interest. The method can be adapted for use anywhere within Whitebark Pine's range, as well as to populations of other high elevation five-needle pines, such as Limber Pine (*Pinus flexilis*).

3) Future climate scenarios must be considered in conjunction with all restoration objectives and projects (adaptive management). Examples include determining the location and timing to apply tree thinning or prescribed fire treatments, thinning competing species to increase the vigor of surviving trees, and using appropriate genotypes to sow seed or plant Whitebark Pine seedlings.

4) Continue to conserve genetic diversity through seed collection[9], accession storage, and testing. Continue to employ seed collecting protocols that aim to preserve genetic diversity across different seed zones, geographical areas, and elevational bands. Collectors and researchers need to continue to search for seed producing stands that exhibit disease and pest resistance. During the immediate future, and as younger trees reach reproductive status, collectors should target those populations that have shown resilience to recent frequent and intensifying periods of drought, coupled with warming temperatures at higher elevations. These stands may exhibit important recent genetic adaptive traits to contemporary climate change during the past 30 years.

Photo Credit: Aram Eramian

Photo 13. Burlap bags full of cones are placed on drying racks until ready to put into the seed extractor at the Coeur d'Alene Nursery in Idaho.

[8] Crown of the Continent Ecosystem (CCE) strategy: https://www.fs.usda.gov/research/treesearch/62150

[9] Seed collections from different geographical areas can be used to determine genetic diversity within and among populations, for assigning seed zones, - for determining adaptive traits such as cold hardiness and drought tolerance, and for assessing regional differences in genetic resistance to White Pine Blister Rust.

Protection and Restoration

5) Prescribed fires can serve as a restoration tool for Whitebark Pine, but one that is very dependent on specific stand conditions and size classes. Any prescribed fire should be carefully planned and implemented to reduce the risk of killing mature Whitebark Pine trees.

6) When conducting restoration activities, apply best management practices to avoid removing or damaging healthy, unsuppressed Whitebark Pine trees.

Photo Credit: Robert Keane

Photo 14. A fire specialist working for the US Forest Service ignites a controlled burn to restore Whitebark Pine habitat in Idaho.

Outreach and Education

Conservation Goal

Facilitate the stewardship of Whitebark Pine and communities through education, outreach, and coordination.

Conservation Objectives

1) Support the scientific and educational efforts of the Whitebark Pine Ecosystem Foundation[10]. Consider getting involved and/or becoming a member.

2) Revise the Whitebark Pine profile in the Montana Field Guide to current MTNHP standards to update and expand known information on life history, ecology, fire ecology, population counts and trends, genetics, germination, transplant experiments, pollination biology, identification, biological characteristics, economics, rangeland management, threats, taxonomy, and other interesting facts; create links to the Strategy and other online information; and improve its readability.

3) Through collaboration with federal and state agencies, develop a centralized web page or website where information on Whitebark Pine relative to Montana can be publicly shared and updated by pertinent agency staff. A central platform that provides published literature, shares agency resources, and gives other information would facilitate management across administrative boundaries, improve coordination on surveys and monitoring efforts, and promote educational outreach.

[10] Whitebark Pine Ecosystem Foundation: https://whitebarkfound.org

Outreach and Education

4) Garner public support for Whitebark Pine communities by developing educational materials geared to backcountry users, such as skiers, climbers, hikers, and campers. Educational materials that address Whitebark Pine ecology, cultural and ecological values, threats, and the need for protecting and/or restoring these trees creates an informed culture, builds a network of partners and collaborators, and can help conservation efforts (US Forest Service 2022; Tomback et al. 2022).

   a. Encourage any ski area in Montana that has Whitebark Pine to consider becoming a Certified Whitebark Pine Friendly Ski Area[11] (WPEF 2024b). The WPEF's certification process includes three categories of actions: Education, Conservation, and Management/ Restoration/Research.

   b. For ski areas in Montana that are Certified Whitebark Pine Friendly Ski Areas, send them a note of appreciation and encourage them to re-certify when the certification period ends (WPEF 2024b). Find the list of certified Whitebark Pine Friendly Ski Areas on the Ski Area Certification webpage[11].

   c. Distribute the USFS-Region 1 informational brochure or series of brochures on Whitebark Pine.

5) Collaborate with the WPEF and/or other organizations to promote the education campaign of "Needles of five, keep it alive" by posting into local newspapers before Thanksgiving and Christmas. This campaign educates people on the value of five-needle pines, the threats they face, and the rationale for not using them as Christmas trees and boughs.

6) Work with educational organizations or programs to help citizen science data collection efforts, - develop educational materials, and/or provide educational outreach relative to Whitebark Pine. Potential organizations to collaborate with include, but are not limited to:

   - Adventure Scientists[12]
   - iNaturalist[13]
   - Montana WILD[14]
   - Montana Discovery Foundation[15]
   - Montana Native Plant Society[16]
   - Tribal nations

Photo Credit: Sue Crispin

Photo 15. Whitebark Pine in Montana.

[11] WPEF Ski Area Certification: https://whitebarkfound.org/our-work/ski-area-certification/
[12] Adventure Scientists: https://www.adventurescientists.org/
[13] iNaturalist: https://www.inaturalist.org/
[14] Montana WILD: https://fwp.mt.gov/education/montana-wild
[15] Montana Discovery Foundation: http://www.montanadiscoveryfoundation.org/
[16] Montana Native Plant Society: https://mtnativeplants.org/

Outreach and Education

7) Educate the public, landowners, land managers, and land-use planners about the "keystone" and "foundational" roles that Whitebark Pine trees and community's exhibit. This helps garner public support and involvement in actions that improve the health and persistence pf these communities.

8) Extend invitations to members of Tribal Nations within the Montana range of Whitebark Pine to engage in conversations, listen to their knowledge, and hear their concerns and needs regarding Whitebark Pine.

9) Acknowledge Whitebark Pine as a cultural resource in Montana and respectfully consult Tribal leaders or Tribal Liaisons about how to incorporate traditional or Indigenous uses and management of Whitebark Pine - including their action to not convey.

Policy and Regulation

Conservation Goal

Improve conservation of Whitebark Pine through public participation and implementation of existing policies and regulations in cooperation with federal, state, and Tribal land managers, private landowners, and other interested stakeholders.

Conservation Objectives

1) Support the development of a recovery plan authored by the USFWS. Implement recovery objectives of the USFWS plan across all agencies and in conjunction with current and future research, restoration and conservation projects.

2) Support Whitebark Pine management as outlined by the Montana Forest Action Plan (2020) for Forest Health: "Develop a statewide inventory of forest conditions, pests and root diseases, and responses to natural and human disturbances that improves the ability to track and model forest healthy conditions over time. Target at-risk species specifically, such as limber and whitebark pines, that have potential for threatened and endangered listing."[17]

Photo Credit: Melissa Jenkins

Photo 16. A two-year-old containerized seedling is ready for planting.

[17] Montana Forest Action Plan (2020), p. 37, Goal #1, Bullet 7

Policy and Regulation

3) Support Whitebark Pine management as outlined by the Montana Forest Action Plan (2020) for Forest Health: "Improve baseline data and risk information on old growth and species at risk, such as Whitebark Pine and Western White Pine, due to ecological importance of these species and the risk of loss due to climate change and uncharacteristic disturbance."[18]

4) Support Whitebark Pine management on private and publicly owned forests as outlined by the Montana Forest Action Plan (2020) for Working Forests and Economies:

   - "Support conservation projects that provide multiple social, economic, and ecological benefits, including an ongoing supply of forest products, public access to recreation opportunities, watershed health, and wildlife habitat...Engage private landowners adjacent to federal and state lands to participate in cross-boundary projects as they are developed."[19]
   - "Invest in innovative targeted marketing strategies and expand partnerships to increase stewardship activities on non-industrial private forest lands."[20]
   - "Increase data sharing across jurisdictions, specifically pertaining to road inventories, right of way, and forest stand data to emphasize collaborative transportation planning, where appropriate."[21]

5) Support Whitebark Pine management as outlined by the Montana Forest Action Plan (2020) for Biodiversity and Habitat Conservation through Goal #1: "Improve and maintain Montana's wildlife and biodiversity, including maintaining and restoring connected habitats, through collaborative approaches."[22]

6) Support Whitebark Pine management as outlined by the Montana Forest Action Plan (2020) for Biodiversity and Habitat Conservation through Goal #3: "Mitigate the impacts of climate change to wildlife and biodiversity."[23]

7) Support Whitebark Pine management as outlined by the Montana Forest Action Plan (2020) for Human and Community Health through Goal #4: "Mitigate the impacts of climate change to the people of Montana."[24]

[18] Montana Forest Action Plan (2020), p. 38, Goal #4, Bullet 1
[19] Montana Forest Action Plan (2020), p. 52, Goal #1, Bullet 4, sub-bullet 2
[20] Montana Forest Action Plan (2020), p. 52, Goal #1, Bullet 6
[21] Montana Forest Action Plan (2020), p. 52, Goal #1, Bullet 9
[22] Montana Forest Action Plan (2020), p. 62, Goal #1, Bullets 1, 3, 6, 8, 11, 12, and 13
[23] Montana Forest Action Plan (2020), p. 63, Goal #3, Bullets 1, 2, and 3
[24] Montana Forest Action Plan (2020), p. 79, Goal #4, Bullets 1 and 3

REFERENCES

Arno, Stephen F., and Ramona P. Hammerly. 1977. *Northwest Trees*. Seattle, WA: The Mountaineers.

Arno, Stephen F. 1986. "Whitebark pine cone crops – a diminishing source of wildlife food?" *Western Journal of Applied Forestry* 1 (3): 92-4. https://doi.org/10.1093/wjaf/1.3.92

Arno, S. 1993. Personal Communication. From Steve Arno, USFS Forest and Fire Ecologist, Missoula, MT to Mary Manning, USFS Ecologist, Missoula, MT.

Cross, Patrick R., and Robert Crabtree. 2021. "Recent findings suggest adding red fox (*Vulpes vulpes*) to climate-threatened whitebark pine (*Pinus albicaulis*) trophic system." *Canadian Journal of Zoology* 99(7): 618-23.

Farnes, P. 1990.00 SNOTEL and snow course data: describing the hydrology of whitebark pine ecosystems. In: Schmidt, W., and K. McDonald (compilers), *Proceedings-Symposium on Whitebark Pine Ecosystems: Ecology and Management of a High-mountain Resource*. General Technical Report INT-270, USFS, Intermountain Research Station, Ogden, UT, pp. 302-304.

Federal Register. 2020. "Endangered and Threatened Wildlife and Plants; Threatened Species Status for *Pinus albicaulis* (Whitebark Pine) with Section 4(d) Rule." 85:232 (December 2, 2020). United States Fish and Wildlife Service (USFWS), Washington DC. 77408.

Federal Register. 2022. "Endangered and Threatened Wildlife and Plants; Threatened Species Status with Section 4(d) Rule for Whitebark Pine (Pinus albicaulis)." 87:240 (December 15, 2022). United States Fish and Wildlife Service (USFWS), Washington DC. 76882.

Goeking, Sara, Deborah Izlar and Thomas Edwards. 2018. "A landscape-level assessment of whitebark pine regeneration in the Rocky Mountains, USA." *Forest Science* 65(1): 87-99.

Guiberson, E. 2020. Personal Communication. From Emily Guiberson, MT/Dakotas BLM Field Office Silverculturalist, Dillon, MT to Mary Manning, USFS Ecologist, Missoula, MT.

Hendrix, Amanda. 2024. Personal Communication on USFS terminology. May 6th. From Amanda Hendrix, USFS Region 1 Botanist, Missoula, MT to Andrea Pipp, MTNHP Botanist, Helena, MT.

Hutchins, H.E., and R.M. Lanner. 1982. "The central role of Clark's Nutcracker in the dispersal and establishment of whitebark pine." *Oecologia* 55 (2): 192-201.

Jenkins, Melissa; Incashola Jr., Tony; LaFleur, Dawn; Hoang, Linh; Renwick, Katie; Schoettle, Anna; Mellman-Brown, Sabine; Lozeau, James; O'Bennick, Kelly Rose; Meyer, Elliott; Anderson, Karl; Sissons, Rob; Keane, Bob; Jones, Brad. 2020. Crown of the Continent Ecosystem Whitebark Pine Restoration Strategy: 2019 Pilot - Project Summary. Crown Managers Partnership (CMP), High Five Working Group (Hi5WG). 8 p. https://www.fs.usda.gov/research/treesearch/62150 [Accessed 4 June 2024]

Jenkins, Melissa, Anna Schoettle, Jessica Wright, Karl Anderson, Joseph Fortier, Linh Hoang, Tony Incashola Jr., Robert Keane, Jodie Krakowski, Dawn LaFleur, Sabine Mellmann-Brown, Elliott Meyer, ShiNaasha Pete, Katherine Renwick, and Robert Sissons. 2022. "Restoring a forest keystone species: A plan for the restoration of Whitebark Pine (*Pinus albicaulis* Engelm.) in the Crown of the Continent Ecosystem." *Forest Ecology and Management*. 522: 120282.

Keane, Robert. 2001. "Successional dynamics: modeling an anthropogenic threat." In: Whitebark Pine Communities: Ecology and Restoration. Diana F. Tomback, Stephen F. Arno, Robert E. Keane, (eds). Washington, DC: Island Press.

Keane, Robert, and Russell Parsons. 2010. *Management guide to ecosystem restoration treatments: Whitebark pine forests of the northern Rocky Mountains*, U.S.A. Gen. Tech. Rep. RMRS-GTR-232. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 133 p.

Keane, Robert, and Diana Tomback; Carol Aubry, Andrew Bower, Elizabeth Campbell, Cathy Cripps, Melissa Jenkins, Mary Mahalovich, Mary Manning, Shawn McKinney, Michael Murray, Dana Perkins, Dan Reinhart, Chris Ryan, Anna Schoettle, and Cyndi Smith. 2012. *A range-wide restoration strategy for whitebark pine* (Pinus albicaulis). Gen. Tech. Rep. RMRS-GTR-279. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 108 p.

Kichas, Nickolas E., Sharon M. Hood, Gregory T. Pederson, Richard G. Everett and David B. McWethy. 2020. "Whitebark pine (*Pinus albicaulis*) growth and defense in response to mountain pine beetle outbreaks." *Forest Ecology and Management* 457:1-13.

Kral, Robert. 1993. *Flora of North America North of Mexico, Pteridophytes and Gymnosperms. Volume 2*. New York: Oxford University- Press. 475 pp.

Lanner, R. 1996. *Made for Each Other: A Symbiosis of Birds and Pines*. New York: Oxford University Press.

Lorenz, T., C. Aubry, C. and R. Shoal. 2008. A review of the literature on seed fate in whitebark pine and the life history traits of Clark's nutcracker and pine squirrels. General Technical Report PNW-GTR-742, USDA Forest Service, Pacific Northwest Research Station, Portland, OR-.

Master, L., D. Faber-Langendoen, R. Bittman, G. Hammerson, B. Heidel, L. Ramsay, K. Snow, A. Teucher, and A. Tomaino. 2012. *NatureServe Conservation Status Assessments: Factors for Evaluating Species and Ecosystem Risk*. NatureServe, Arlington, VA.

McCaughey, W., and W. Schmidt. 2001. "Taxonomy, distribution, and history." In: *Whitebark Pine Communities: Ecology and Restoration*. Diana F. Tomback, Stephen F. Arno, and Robert Keane, (eds.). Washington, DC: Island Press. pp 29-40.

McKinney, S., C. Fiedler, and D. Tomback. 2010. Altered species interactions and implications for natural regeneration in Whitebark Pine communities. Pages 56-63. In: Keane, Robert E.; Tomback, Diana F.; Murray, Michael P.; Smith, Cyndi M., (eds). 2011. The future of high-elevation, five-needle white pines in Western North America: Proceedings of the High Five Symposium; 28-30 June 2010; Missoula, MT. Proceedings RMRS-P-63, USDA Forest Service, Rocky Mountain Research Station, Fort Collins, CO-.

Moerman, D., 1998. *Native American Ethnobotany*. Portland, OR: Timber Press.

Montana Forest Action Advisory Council. 2020. Montana Forest Action Plan. December. Convened by the Montana Department of Natural Resources and Conservation, Helena, MT. https://www.montanaforestactionplan.org/pages/forest-action-plan

Montana Natural Heritage Program (MTNHP). 2024a. An assessment of modelled land area for *Pinus albicaulis*. MTNHP database. June. Helena, MT.

Montana Natural Heritage Program (MTNHP). 2024b. A query of *Pinus albicaulis* data. MTNHP botany database. January to June. Helena, MT.

Murray, M.P., Moody, R., in press. Blister rust infection trends and distribution in southern British Columbia's endangered whitebark pine. In: Strong, W. (Ed.) Joint conference: Genetics of Five-needle Pines and Rusts of Forest Trees, IUFRO. British Columbia Ministry of Lands and Natural Resource Operations, BC, Canada.

Negron, Jose F., and Laurie Huckaby. 2020. "Reconstructing historical outbreaks of mountain pine beetle in lodgepole pine forests in the Colorado Front Range." *Forest Ecology and Management* 473: 118270

Pfister, R., and B. Kovalchik, S. Arno, and R. Presby. 1977. Forest habitat types of Montana. General Technical Report INT-34, USDA Forest Service, Intermountain Forest and Range Experiment Station, Ogden, UT.

Retzlaff, Molly L., Leirfallom, Signe B., and Keane, Robert E. 2016. A 20-year reassessment of the health and status of Whitebark Pine forests in the Bob Marshall Wilderness Complex, Montana. Res. Note RMRS-RN-73. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 10 p.

Schwandt, J.W. 2006. Whitebark pine in peril: A case for restoration. USDA Forest Service, Forest Health Protection, R1-06-28. 20pp.

Tomback, Diana. 1978. "Foraging strategies of Clark's Nutcracker." *Living Bird* 16: 123-61.

Tomback, Diana. 1982. "Dispersal of whitebark pine seeds by Clark's Nutcracker: a mutualism hypothesis." *Journal of Animal Ecology* 51(2): 451-67.

Tomback, Diana. 2022. Personal Communication. October to December. Department of Integrative Biology, University of Colorado, Denver, CO.

Tomback, Diana, Stephen Arno, and Robert Keane (eds.). 2001. *Whitebark Pine communities: ecology and restoration*. Washington, DC: Island Press DC.

Tomback, Diana. and Kate Kendall. 2001. "Biodiversity losses: the downward spiral." In: Tomback, Diane, Stephen Arno, and Robert Keane (eds.), *Whitebark Pine communities: ecology and restoration*. Washington, DC: Island Press, pp 243-262.

Tomback, Diana, Lynn Resler, Robert Keane, Elizabeth Pansing, Andrew Andrade, and Aaron Wagner. 2016. "Community structure, biodiversity, and ecosystem services in treeline Whitebark Pine communities: potential impacts from a non-native pathogen." *Forests* 7(1): 21. https://doi.org/10.3390/f7010021

Tomback, Diana and Eric Sprague. 2022. The National Whitebark Pine Restoration Plan: Restoration model for the high elevation five-needle white pines. *Forest Ecology and Management* 521: 120204.

Tomback, Diana, Robert Keane, Anna Schoettle, Richard Sniezko, Melissa Jenkins, Cara Nelson, Andrew Bower, Clay Demastus, Emily Guiberson, Jodie Krakowski, Michael Murray, Elizabeth Pansing, and Julee Shamhart. 2022. Tamm Review: Current and recommended management practices for the restoration of whitebark pine (*Pinus albicaulis* Englm.), an imperiled high-elevation Western North American forest tree. *Forest Ecology and Management* 522: 119929.

Whitebark Pine Ecosystem Foundation (WPEF). 2022. https://whitebarkfound.org [Accessed November 2023]

Whitebark Pine Ecosystem Foundation (WPEF). 2024a. Wildlife and Whitebark Pine. https://whitebarkfound.org/wildlife/ [Accessed June 2024]

Whitebark Pine Ecosystem Foundation (WPEF). 2024b. Ski Area Certification. https://whitebarkfound.org/our-work/ski-area-certification/ [Accessed January 2024]

United States Fish and Wildlife Service (USFWS). 2021. Species Status Assessment Report for Whitebark Pine, *Pinus albicaulis* v. 1.3. Wyoming Ecological Service Field Office.

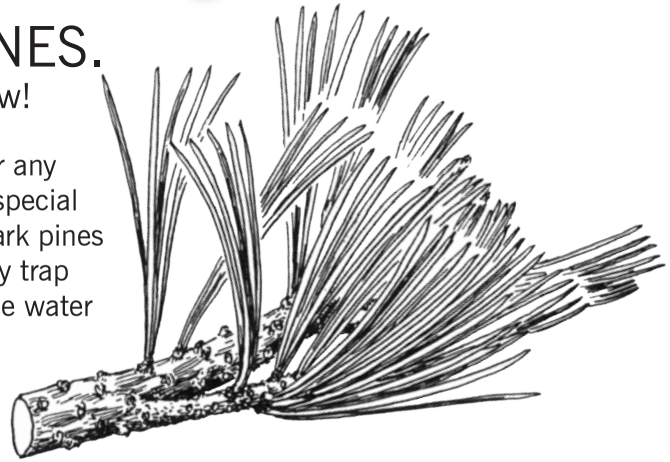
United States Fish and Wildlife Service (USFWS). 2022b. Recovery Outline for Whitebark Pine. December 15th. https://ecos.fws.gov/docs/recovery_plan/20221215_WBP_Final_Recovery_Outline_v11_DRDsigned.pdf [Accessed 19 June 2024] NOTE: This reference will no longer be accessible once the recovery plan is issued.

United States Forest Service (USFS)-Region 1. 2022. Draft Categories of Design Elements/ Conservation Measures Based on Activities. September 6. Developed in conjunction with the USFWS. Provided by the USFS, Region 1, Missoula, MT.

Needles of five, keep it alive!

Please do not cut WHITEBARK PINES.

If a tree's needles grow in clusters of five, leave it to grow!



Whitebark pines live in the mountains, often in areas too harsh for any other tree. More than 100 kinds of living things depend on these special pines, including bears and many bird species. People love whitebark pines for their beauty and strength, and we also need them because they trap snow in the high country, slowing spring runoff and helping provide water to the valleys in summer.

But whitebark pines are in trouble. Many whitebark forests now contain more dead pines than living ones.

- Blister rust, a non-native fungus, weakens the trees, reduces cone production, and eventually causes death.
- Whitebarks are also killed by bark beetles, and beetle epidemics may increase with global climate change.
- Wildfires may kill whitebark pines, although burned areas are good habitat for seedlings. Careful management of fire is essential.

So remember: *If it has five, let's keep it alive!*

For more information and to learn how you can help,
visit the Whitebark Pine Ecosystem Foundation at www.whitebarkfound.org.

CONSERVATION PROFILE: SPALDING'S CATCHFLY (*SILENE SPALDINGII*)

Photo Credit: Beverly Skinner, USFWS

Photo 1. Spalding's Catchfly grows in open, mesic (montane) grasslands within valleys and foothills.

Source: Montana Natural Heritage Program (2024a)

Figure 1. The range for Spalding's Catchfly in Montana.

PURPOSE:

This conservation profile provides information about Spalding's Catchfly, a Plant Species of Greatest Conservation Need (GCN) in Montana. It highlights the plant's state-level distribution, factors that put it at risk for loss, and conservation objectives that, if implemented, would aid the persistence of Spalding's Catchfly. This conservation profile aims to be an abbreviated, stand-alone document that can be used by, or shared with, land managers, landowners, educators, decision-makers, regulators, and anyone interested in Spalding's Catchfly. This conservation profile should also be used in conjunction with Section 4 of the Montana Native Plant Conservation Strategy, which addresses overarching conservation objectives for Plant Species of GCN.

INFORMATION ON SPALDING'S CATCHFLY

Distribution, Status, and Identification

Spalding's Catchfly (*Silene spaldingii*) is endemic to western North America where, on a worldwide scale, plants are found sparsely distributed in eastern Washington, northeastern Oregon, northern Idaho, and northwestern Montana in the US, and in southeastern British Columbia, Canada (Morton in *Flora of North America* 2005). In Montana, plants were first documented in 1894. Today the species is found in discrete areas of northwest Montana where it grows within grasslands in intermontane valleys (Montana Natural Heritage Program (MTNHP) 2024a) (Photo 1; Figure 1).

In 2001, Spalding's Catchfly was federally listed as threatened under the Endangered Species Act (ESA) of 1973, as amended, by the US Fish and Wildlife Service (USFWS) (2007). In 2007 the USFWS issued a recovery plan[1] to protect and maintain reproducing, self-sustaining populations of Spalding's Catchfly in each of the five distinct physiographic regions where it resides. The most recent five-year review[2] of its status was completed by the USFWS in 2020 (USFWS 2020).

Spalding's Catchfly is a Montana Species of Concern (SOC) plant as determined by the MTNHP (MTNHP 2024b). Ranked in the state as S2, Spalding's Catchfly is at risk to extirpation in the state because of very limited and/or potentially declining population numbers, range, and/or habitat (MTNHP 2024b).

Learn about Spalding's Catchfly's identification, biology, and state status in the Montana Field Guide[3]

Learn about Spalding's Catchfly's range-wide information and federal status in the USFWS Environmental Conservation Online Systems (ECOS)[4]

Photo Credit: Andrea Pipp

Photo 2. A Confederated Salish and Kootenai Tribal botanist, assisted by a Salish Kootenai College student monitors Spalding's Catchfly in support of the recovery plan.

[1] Recovery Plan for *Silene spaldingii* (Spalding's Catchfly): https://ecos.fws.gov/docs/recovery_plan/071012.pdf
[2] Five-Year Review for *Silene spaldingii*: https://www.fws.gov/species/spaldings-catchfly-silene-spaldingii
[3] Montana Field Guide, Spalding's Catchfly: https://fieldguide.mt.gov/speciesDetail.aspx?elcode=PDCAR0U1S0
[4] USFWS ECOS website: https://ecos.fws.gov/ecp/species/3681

RATIONALE FOR PLANT SPECIES OF GREATEST CONSERVATION NEED

Spalding's Catchfly is a Plant Species of Greatest Conservation Need (GCN) in Montana because of its rarity and threats that put populations at risk of state extirpation. Plants typically grow in clustered occurrences that are widely scattered within four distinct geographical areas of Montana. Occurrences are often composed of fewer than 150 plants, but depending upon the site can range in size from a single individual to a thousand plants (MTNHP 2024a). Obtaining information on population size, habitat condition, distribution, and other factors is complicated by the fact that plants go through a dormancy period and are often difficult to find when not flowering or fruiting.

Major threats to the persistence of Spalding's Catchfly are from vectors that harm its habitat, predominantly invasive non-native plant species, fire suppression, and ecologically incompatible livestock grazing (MTNHP 2021; USFWS 2007). Invasive non-native plant species detrimentally affect Spalding's Catchfly plants by altering pollinator behavior, competing for water and nutrients, and altering ecosystem attributes, such as microclimates, fire ecology, hydrology, and nutrient cycling (USFWS 2007). In teracting with non-native plant invasions are altered historic fire regimes and grazing systems. In the absence of fire or grazing, plant litter (thatch) can build up in grasslands, potentially reducing plant vigor, smothering germination, or reducing recruitment for Spalding's Catchfly (Lesica 1999; Lesica 2005; USFWS 2007). Ecologically incompatible livestock grazing can trample and remove reproductive plants, compact soil, and degrade habitat. Conversely, proper timing, frequency, and duration of livestock grazing can benefit Spalding's Catchfly populations and maintain habitat (Pipp 2020). Likewise, fire can also hinder or help Spalding's Catchfly depending upon the timing, severity, and frequency (USFWS 2007; USFWS 2020).

Photos: Andrea Pipp

*Photo 3. Within native, intact Rough Fescue (*Festuca campestris*) habitat, the noxious Sulphur Cinquefoil (*Potentilla recta*) weed finds a foothold in a narrow, ephemeral drainage. Flathead Indian Reservation, Montana.*

CONSERVATION GOALS & OBJECTIVES FOR SPALDING'S CATCHFLY

The intent of the *Montana Native Plant Conservation Strategy: Species and Habitats of GCN* is to promote the collective and coordinated stewardship of Montana's Plant Species of GCN to ensure their viability and persistence using a fusion of approaches. Sections 3-*Strengthening Botanical Capacity* and 4-*Plant Species of GCN* present overarching goals and conservation objectives that can indirectly - help sustain Spalding's Catchfly populations. In this conservation profile we present conservation objectives specific to Montana's Spalding's Catchfly populations from four areas that are pillars to plant conservation:

- Information Needs [Inventory, Monitoring, Research]
- Protection and Restoration
- Outreach and Education
- Policy and Regulation

The conservation objectives were developed by a Spalding's Catchfly Working Group that met in December 2022, and are based on published research, monitoring, professional expertise, and field observations. The working group consisted of biologists, ecologists, botanists, and researchers working for federal and state land management agencies, Tribal Nation, non-governmental organizations, consulting business, and others (see Table 1 on page *iii* of the Strategy). Working within and across jurisdictional boundaries, these conservation objectives are voluntary and intended to empower federal, state, Tribal, and non-government conservation land managers, landowners, businesses, and individuals who want to contribute to or collaborate on processes that could aid Spalding's Catchfly persistence on the landscape. They can be pursued or implemented by a single entity, or as a collaborative effort by individuals, agencies, and organizations. They are presented in no prioritized order.

Photo Credit: Andrea Pipp

Photo 4. Monitoring Spalding's Catchfly on the Flathead Indian Reservation - through healthy, intact native Rough Fescue grassland.

Information Needs [Inventory, Monitoring, Research]

Conservation Goal

Improve scientific understandings of Spalding's Catchfly in Montana and the ecological and cultural processes that sustain plants and habitat through statewide coordination, inventory, monitoring, and research.

Conservation Objectives

1) Work collaboratively with federal, state, Tribal, and private landowner partners to acquire necessary field data and share the information with MTNHP to conduct the following assessments:

   a. Review and Revise Species Occurrence Ranks (SO-Ranks). An SO-Rank represents the overall "quality" of the site based on an assessment of the plant's population size, habitat quality, landscape context, and abiotic and biotic conditions. Updated and accurate SO-Ranks are used by managers in planning projects, prioritizing occurrences for restoration, identifying reference sites, and aiding management decisions. SO-Ranks should be reviewed and revised on a five- to ten-year cycle.

   As of 2023, 50% of Spalding's Catchfly occurrences have been ranked, creating useful information that is also a priority for updating (Box 1). Acquiring revisit data on SOs and updating SO-Ranks at regular -intervals creates a tool for inferring trend (stable, improving, or degrading) for the site.

   Box 1. Status of SO-Ranks for 74 extant Spalding's Catchfly occurrences as of 2023:
   - 38 lack SO-Rank
   - 25 ranked in 2009
   - 1 ranked in 2012
   - 6 ranked in 2018
   - 1 ranked in 2019
   - 4 ranked in 2020

   b. Evaluate and Update State Threat Score and rationale. Spalding's Catchfly has a Very High threat score based on the 2021 Threat Assessment by MTNHP (MTNHP 2021a). The State Threat Score and rationale should be updated by MTNHP at five-year intervals, or as warranted by current data. Reported threats and data analysis should be posted on the Montana Field Guide to create transparency in the ranking process. The State Threat Score represents the degree to which the target plant is degraded by extrinsic factors, which are characterized in terms of timing, severity, and scope (MTNHP 2021b; Master et al. 2012).

2) Collaborate with landowners to seek input and permissions to conduct consecutive years of surveys on lands identified as having high-to-moderate suitability by the most current Predicted Suitable Habitat Model. Consider providing survey results (both present and absent observations) to MTNHP to help refine the Predicted Suitable Habitat Model for Spalding's Catchfly in Montana. Three consecutive years of monitoring is recommended to significantly improve detection for presence (USFWS 2012). Landowners with whom to collaborate include:
   - Private landowners
   - NGO landowners, specifically The Nature Conservancy (TNC)
   - State land management agencies, specifically MT DNRC
   - ` Federal land management agencies
   - Tribal nations, specifically the Confederated Salish and Kootenai Tribes (CSKT)

Information Needs [Inventory, Monitoring, Research]

3) Where known populations of Spalding's Catchfly plants occur, collaborate with landowners to seek input and permissions to conduct consecutive years of surveys at least once in a 10-year period -to obtain current data on population size, threats, and habitat condition and to track trends. Consider providing survey results (both present and absent observations) to MTNHP for inclusion in the botany database. Three consecutive years of monitoring is recommended to significantly improve detection for presence (USFWS 2012). Landowners with whom to collaborate include:
   - Private landowners
   - NGO landowners, specifically TNC
   - State land management agencies, specifically MT DNRC
   - ` Federal land management agencies
   - Tribal nations, specifically the Confederated Salish and Kootenai Tribes (CSKT)

4) Work to retain the monitoring schedule and data collection methods to ensure that the 20-year monitoring window is completed and in compliance with the *Silene spaldingii* recovery plan (USFWS 2007) for the established transects on the Flathead Indian Reservation (Sullivan Gulch and Crosson Valley/Sullivan Hill areas), USFWS-Lost Trail National Wildlife Refuge (NWR), and The Nature Conservancy-Dancing Prairie Preserve.
   a. Work to retain and/or improve partnerships and secure funding among MTNHP, Confederated Salish and Kootenai Tribes, Lost Trail NWR, and USFWS (Regions 1 and 6 and Montana Ecological Services) to conduct and fund established monitoring work on the Flathead Indian Reservation.
   b. Retain and build collaboration among MTNHP, the Confederated Salish and Kootenai Tribes, Montana Fish, Wildlife & Parks, Lost Trail NWR, USFWS (Region 6 and Montana Ecological Services), The Nature Conservancy, private landowners, and botanical consultants to fund and collect data from established monitoring transects.

Photo Credit: Beverly Skinner

Photo 5. Monitoring Spalding's Catchfly plants on the Lost Trail National Wildlife Refuge through healthy native Rough Fescue grassland

Information Needs [Inventory, Monitoring, Research]

c. Work cooperatively with federal, state, and NGO land managers to conduct revisits to SOs that are not part of an established monitoring effort, at a frequency of at least once every ten years. Strive to obtain current population (negative and positive), habitat, threat, and mapping data that is shared with MTNHP and to conduct SO ranking every five to ten years.

d. Bolster partnerships with private landowners to support other monitoring efforts.

5) Use existing resources to find literature, research studies, and other information when investigating research questions or needs and designing monitoring studies. Across Spalding's Catchfly's range information has accumulated from a variety of sources including academic research, federal and state research and management reports, and observation data, on topics of life history traits, ecology and habitat requirements, germination, growth, and transplanting, pollinators, livestock grazing and management, fire ecology, and others. Reference material already compiled can be found at the following sources:

- Cited and Additional References section in the Montana Field Guide Spalding's Catchfly profile[1]
- USFWS ECOS website[2]
- Spalding's Catchfly Technical Team Lead Office[5]

6) Research topics that could further our understanding of this unique plant and/or assist in plant conservation efforts include, but are not limited to:

a. Conduct research on seed viability and germination trials for Spalding's Catchfly plants representing the range of variability in elevation, geography, population size, and habitat in Montana for the purpose of storing seeds, both for the short and long term.

b. Work towards developing compatible land management practices for Spalding's Catchfly in Montana using long-term research experiments and monitoring to evaluate the response of Spalding's Catchfly plants under various types of livestock grazing and agricultural practices. Previous published research has studied the effects of agricultural practices and livestock management on Spalding's Catchfly plants and populations in other states.

Photo Credit: Andrea Pipp

Photo 6. Insects get trapped in the glandular hairs that cover a Spalding's Catchfly plant.

[5] USFWS, Idaho Fish and Wildlife Office:
-General contact information: https://www.fws.gov/office/idaho-fish-and-wildlife/contact-us
-Spalding's Catchfly information: https://www.fws.gov/species/spaldings-catchfly-silene-spaldingii

Information Needs [Inventory, Monitoring, Research]

c. Work towards developing compatible land management practices for Spalding's Catchfly in Montana using long-term research experiments and monitoring that evaluates the responses of Spalding's Catchfly plants, nonnative vegetation, and habitat condition to various attributes (timing, duration, intensity, severity, and others) of prescribed fire. Based on a small number of plots, a study on the Dancing Prairie Preserve indicated that prescribed fire in the spring can increase recruitment of Spalding's Catchfly (Lesica 1999; Lesica 2005). In addition, monitoring after a prescribed fire could help determine if plants are in a true decline or in an extended period of dormancy (Lesica 1999).

d. Collaborate with the Spalding's Catchfly Technical Team and literature library to continue research on techniques for growing, planting, and establishing plants in Montana.

e. Develop studies that incorporate monitoring to evaluate the responses of plants to livestock grazing practices (i.e., timing and intensity), specifically in Montana.

f. Develop short-term and long-term studies that examine plant community responses to herbicide treatments and prescribed fire in areas with Spalding's Catchfly populations.

Protection and Restoration

Conservation Goal

Secure on-the-ground, site-specific habitat and/or management protection or restoration for Spalding's Catchfly on public, Tribal, and private lands.

Conservation Objectives

1) Support and encourage the development of Habitat Management Plans for proposed Key Conservation Areas by land management agencies, Tribes, and NGOs, as recommended by the Recovery Plan for *Silene spaldingii* (USFWS 2007).

2) Develop partnerships between federal, state, non-profit, and/or private organizations within the Montana range for Spalding's Catchfly and the following potential facilities to conduct seed banking, germination trials, genetic research, and/or other topics related to collected Spalding's Catchfly plant materials:

   - Rae Selling Berry Seed Bank, Portland State University, Oregon[6]
   - Plant Germplasm Introduction Test and Research Unit, Pullman, Washington

3) Work collaboratively with federal, state, and tribal agencies and NGOs to obtain permits and collect seed for short- and long-term storage from Spalding's Catchfly populations and co-occurring, common or dominant native plant species for use in restoration and other projects. Seed collection of the dominant species that make up the community would facilitate restoring the native habitat. Seed collection should represent species' range of elevation, geography, landownership, and habitat.

[6] Rae Selling Berry Seed Bank: https://www.pdx.edu/seed-bank/

Protection and Restoration

4) Provide incentive-based programs to conserve, enhance, and restore habitats that support Spalding's Catchfly. Tools could include long-term conservation leases, conservation easements, grazing system development, seeding projects, and invasive species control. Programs that could help include, but are not limited to:
   - MFWP Habitat Montana Program[7]
   - Montana Association of Land Trusts[8]
   - Montana NRCS Agricultural Conservation Easement Programs (ACEP) for Agricultural Land Easements (ALE)[9]
5) Examine opportunities to restore or maintain habitat on public lands through prescribed fire.
6) Develop guidelines for applying herbicides in areas with Spalding's Catchfly. When controlling invasive plants with an herbicide, spot treatments using the appropriate chemical, timing, and concentration can be compatible with retaining Spalding Catchfly populations.

Outreach and Education

Conservation Goal

Facilitate the stewardship of Spalding's Catchfly plants and habitat through education, outreach, and coordination.

Conservation Objectives

1) Ensure participation from Montana on the Spalding's Catchfly Technical Team - led by the Idaho USFWS (Photo 7). Participants should include working professionals who engage with Spalding's Catchfly biology and/or management in Montana: MTNHP Botanist botanical consultants; federal and state botanists and managers; TNC land managers; CSKT botanists and biologists; and private landowners.

Photo Credit: Andrea Pipp

Photo 7. Silene spaldingii *Technical Team members inspect Spalding's Catchfly seedlings that were grown from seed and planted into a palouse prairie remnant at Steptoe Butte in Washington.*

[7] Habitat Montana: https://fwp.mt.gov/conservation/landowner-programs/habitat-montana
[8] Montana Association of Land Trusts: https://montanalandtrusts.org/
[9] Agricultural Land Easements for Montana: https://www.nrcs.usda.gov/programs-initiatives/acep-agricultural-conservation-easement-program/montana/agricultural

Outreach and Education

2) Ensure that your organization supports and maintains access to the Microsoft Teams site hosted by the Spalding's Catchfly Technical Team and Idaho USFWS. Ensuring access by all organizations into a central repository facilitates information sharing, effective communication, and time management. Information shared includes, but is not limited to: research publications, habitat management plans, planting techniques, monitoring protocols, photographs, meeting notes, mapping, and much more.
3) Revise the Spalding's Catchfly profile on the Montana Field Guide to current MTNHP standards to update and expand known information on life history, ecology, fire ecology, population counts and trends, genetics, germination, transplant experiments, pollination biology, identification, biological characteristics, economics, rangeland management, threats, taxonomy, and other interesting facts; create links to the Strategy and other online information; and improve its readability.
4) Foster partnerships with the CSKT, Salish Kootenai College, and other Tribal organizations in the vicinity of the Flathead Indian Reservation to help increase awareness and educational outreach on Spalding's Catchfly.
5) Foster partnerships between Montana Native Plant Society (MNPS), MTNHP, and environmental educational organizations to develop teaching curricula on Plant Species of GCN, including Spalding's Catchfly.
6) Through the MNPS, conduct field trips to known Spalding's Catchfly sites to expand public awareness about the plant, its habitat, status, and other interesting information.

Policy and Regulation

Conservation Goal

Improve conservation of Spalding's Catchfly through public participation and implementation of existing policies and regulations in cooperation with federal, state, and Tribal land managers, private landowners, and other interested stakeholders.

Conservation Objectives

1) Continue support for the implementation of the 2007 Recovery Plan for *Silene spaldingii* (USFWS 2007).
2) Support Key Conservation Area recognition for Spalding's Catchfly at the Sullivan Gulch and Crosson Valley/Sullivan Hill areas on the Flathead Indian Reservation, USFWS-Lost Trail National Wildlife Refuge, and The Nature Conservancy-Dancing Prairie Preserve (USFWS 2007).
3) Acknowledge and adhere to Tribal laws, ordinances, regulations, and policies, and protect Traditional Knowledge of plants, including Plant Species of GCN, as the intellectual property of Tribal Nations and individual Tribal members, including seeds, propagules and other plant parts occurring on Tribal jurisdictional lands. Refer also to Section 3, Policy and Regulation Conservation Objective, #4.

REFERENCES

Lesica, P. 1999. Effects of fire on the demography of the endangered, geophytic herb *Silene spaldingii* (Caryophyllaceae). American Journal of Botany 86 (7):996-1002.

Lesica, P. 2005. Monitoring Population Trend of *Silene spaldingii* on Dancing Prairie Preserve. Progress Report. - Prepared for The Nature Conservancy, Montana Field Office, Helena, MT.

Master, L., D. Faber-Langendoen, R. Bittman, G. Hammerson, B. Heidel, L. Ramsay, K. Snow, A. Teucher, and A. Tomaino. 2012. *NatureServe Conservation Status Assessments: Factors for Evaluating Species and Ecosystem Risk*. NatureServe, Arlington, VA.

Montana Natural Heritage Program (MTNHP). 2021a. An assessment of threat data reported for *Silene spaldingii*. MTNHP Botany Database. Helena, MT.

Montana Natural Heritage Program. 2021b. Conservation Status Assessment Definitions, Process, Rank Factors, and Calculation of State Ranks for Montana Species. 18 p.

Montana Natural Heritage Program (MTNHP). 2024a. *Silene spaldingii* observation data in the Botany database. Helena, MT. [Accessed 24 April 2024]

Montana Natural Heritage Program (MTNHP). 2024b. *Silene spaldingii* profile on the Montana Field Guide, Helena, MT. https://fieldguide.mt.gov/speciesDetail.aspx?elcode=PDCAM0A010 [Accessed 24 April 2024]

Morton, John. 2005. *Flora of North America North of Mexico, Volume 5, Part 2: Magnoliophyta: Caryophyllidae*. New York: Oxford Press.

Pipp, Andrea. 2020. Three-year baseline monitoring study for *Silene spaldingii* on the Flathead Indian Reservation: Year 2019 and 2017-2019 summary. May15th. Report to the Confederated Salish and Kootenai Tribes of the Flathead Reservation, Pablo, MT and USFWS Montana Ecological Servies Field Office, Helena, MT. Prepared by the Montana Natural Heritage Program, Helena, MT. 84 pp.

US Fish and Wildlife Service (USFWS). 2007. Recovery Plan for *Silene spaldingii* (Spalding's Catchfly). USFWS, Portland, OR. xiii + 187 pp.

US Fish and Wildlife Service (USFWS). 2012. Guidelines for Monitoring Trend of *Silene spaldingii* Populations in Key Conservation Areas. Idaho USFWS Office, Boise, ID. 10 pp.

US Fish and Wildlife Service (USFWS). 2020. Five-Year Review for *Silene spaldingii* (Spalding's Catchfly). September. USFWS, Idaho Fish and Wildlife Office, Boise, ID. 48 pp.

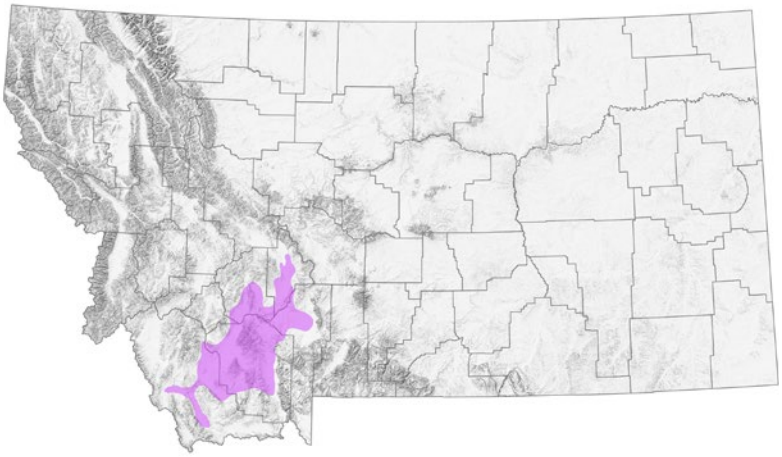
Photo Credit: Peter Lesica

*Photo-9. Native Rough Fescue (*Festuca campestris*) grassland with Spalding's Catchfly and American Harebell (*Campanula rotundifolia*) on the Dancing Prairie Preserve managed by The Nature Conservancy. Montana.*

CONSERVATION PROFILE:
UTE LADIES'-TRESSES (*SPIRANTHES DILUVIALIS*)

Photo Credit: Andrea Pipp

Photo 1. Ute Ladies'-tresses are members of the Orchid Family and endemic to the US.



Source: Montana Natural Heritage Program (2024a)

Figure 2. The range for Ute Ladies'-tresses in Montana.

PURPOSE:

This conservation profile provides information about Ute Ladies'-tresses, a Plant Species of Greatest Conservation Need (GCN) in Montana. It highlights the plant's state-level distribution, factors that put it at risk for loss, and conservation objectives that, if implemented would aid the persistence of Ute Ladies'-tresses. This conservation profile aims to be an abbreviated, stand-alone document that can be used by, or shared with, land managers, landowners, educators, decision-makers, regulators, and anyone interested in Ute Ladies'-tresses. This conservation profile should also be used in conjunction with Section 4 of the Montana Native Plant Conservation Strategy, which addresses overarching conservation objectives for Plant Species of GCN.

INFORMATION ON UTE LADIES'-TRESSES

Distribution, Status, and Identification

Ute Ladies'-tresses (*Spiranthes diluvialis*) is an orchid, endemic to the US (Sheviak and Brown in Flora of North America [FNA] 2002) (Photo 1). Worldwide, plants are sparsely found in eight states (CO, ID, MT, NE, NV, UT, WA, and WY) in the interior western US and in southern British Columbia, Canada (USFWS 2023a).

In 1992, Ute Ladies'-tresses was federally listed as threatened under the Endangered Species Act (ESA) of 1973, as amended, by the US Fish and Wildlife Service (USFWS 1992). A draft recovery plan was developed in 1995 but never finalized (USFWS 1995). In 2023, a Species Status Assessment (SSA) was completed, found predominantly extant populations, and based on extensive analysis, concluded that the species is not in danger of extinction throughout all of its range (USFWS 2023a). The subsequent Five Year Review recommended de-listing the plant from the ESA (USFWS 2023b). However, until there is further action by the USFWS, Ute Ladies'-tresses remains federally threatened.

Although Ute Ladies'-tresses was federally listed in 1992, it was not until 1994 that the species was documented in Montana (Montana Natural Heritage Program (MTNHP) 2022a). Since then, plants have been documented in the valleys of the Beaverhead, Lower Gallatin, Lower Jefferson, Upper Jefferson, Upper Missouri, and Ruby River drainages (Figure 1; MTNHP 2022a). Populations occur predominantly on privately-owned lands with some occurrences on state-owned lands (MTNHP 2022b). Ute Ladies'-tresses is a Montana Species of Concern (SOC) as determined by the Montana Natural Heritage Program (MTNHP) (2024b). Ranked in the state as S1S2, Ute Ladies'-tresses is at risk to highly at risk of extirpation in the state because of very limited to extremely limited and/or potentially declining to rapidly declining population numbers, range, and/or habitat (MTNHP 2024b).

Learn about Ute Ladies'-tresses' identification, biology, and state status in the Montana Field Guide[1]

Learn about Ute Ladies'-tresses' range-wide information and federal status in the USFWS Environmental Conservation Online Systems (ECOS)[2]

RATIONALE FOR PLANT SPECIES OF GREATEST CONSERVATION NEED

Ute Ladies'-tresses is a Plant Species of Greatest Conservation Need (GCN) in Montana because of its rarity, threats, and a lack of information. In Montana, Ute Ladies'-tresses typically have low population counts and are found in a small number of locations within moist, low-elevation valleys where habitat is limited and fragmented by human development (MTNHP 2024a). They grow in calcareous wetlands, wet meadows, swales, and old meander channels that are outside of active stream channels (Heidel 2001; Lesica et al. 2012). Populations are maintained by seasonal flooding, grazing, and other disturbances that help -retain a sparser density of vegetation or an early-seral habitat (Heidel 2001; Fertig 2005).

[1] Montana Field Guide, Ute Ladies'-tresses: https://fieldguide.mt.gov/speciesDetail.aspx?elcode=PMORC2B100

[2] USFWS ECOS website: https://ecos.fws.gov/ecp/species/2159

Montana's populations continue to face a variety of threats, including hydrological changes, weed invasion, broad-based herbicide application, development, and also, a lack of disturbance (MTNHP 2021; Fertig et al. 2005). Certain agricultural and ranching practices can help maintain the plant and its habitat if managed and timed appropriately with its flowering and fruiting life stages (Arft 1995, Fertig 2000, Murphy 2001). Populations predominantly occur on privately-owned lands where current data on plant counts, habitat condition, and precise mapping is needed to accurately assess the plant's status (MTNHP 2022b). Yet acquiring this information often requires three consecutive years of surveying because plants can go through a prolonged dormancy period and must be in flower or fruit (July-August) to be easily spotted.

Photo Credit: Andrea Pipp

Photo 2. Ute Ladies'-tresses occupy small wet meadows and swales within valleys that are also used for roads, railroads, and other infrastructure.

CONSERVATION GOALS & OBJECTIVES FOR UTE LADIES'-TRESSES

The intent of the *Montana Native Plant Conservation Strategy: Species and Habitats of GCN* is to promote the collective and coordinated stewardship of Montana's Plant Species of GCN to ensure their viability and persistence using a fusion of approaches. Sections 3-*Strengthening Botanical Capacity* and 4-*Plant Species of GCN* present overarching goals and conservation objectives that indirectly can help sustain Ute Ladies'-tresses populations. In this conservation profile we present conservation objectives specific to Montana's Ute Ladies'-tresses from four areas that are pillars to plant conservation:

- Information Needs [Inventory, Monitoring, Research]
- Protection and Restoration
- Outreach and Education
- Policy and Regulation

The working group consisted of biologists, ecologists, botanists, rangeland management specialists, and researchers working for federal and state land management agencies, non-governmental organizations (NGOs), consulting businesses, and other organizations (see Table 1 on page *iii* of the *Strategy*). Working within and across jurisdictional boundaries, these conservation objectives are voluntary and intended to empower federal, state, Tribal, and non-government conservation land managers, landowners, businesses, and individuals who want to contribute to or collaborate on processes that could aid Ute Ladies'-tresses persistence on the landscape. These objectives can be pursued or implemented by a single entity, or as a collaborative effort by individuals, agencies, and organizations. They are presented in no prioritized order.

Information Needs [Inventory, Monitoring, Research]

Conservation Goal

Improve scientific understandings of Ute Ladies'-tresses in Montana and the ecological and cultural processes that sustain plants and habitat through statewide coordination, inventory, monitoring, and research.

Conservation Objectives

1) Work collaboratively with state agencies, private landowners, NGOs, and other organizations to acquire necessary field data and share the information with MTNHP to conduct the following assessments:

   a. Review and Revise Species Occurrence Ranks (SO-Ranks). An SO-Rank represents the overall "quality" of the site based on an assessment of the plant's population size, habitat quality, landscape context, and abiotic and biotic conditions. Updated and accurate SO-Ranks are used by managers in planning projects, prioritizing occurrences for restoration, identifying reference sites, and aiding management decisions. SO-Ranks should be reviewed and revised on a five- to ten-year cycle.

   As of 2023, 71% of the 28 extant Ute Ladies'-tresses occurrences were ranked in 2009, and are in need of a re-assessment, and 29% are in need of a full assessment (Box 1). Acquiring revisit data on SOs and updating SO-Ranks at regular intervals creates a tool for inferring trend (stable, improving, or degrading) for the site.

   Box 1. Status of SO-Ranks for 29 Ute Ladies'-tresses occurrences as of 2023:
   - 8 lack SO-Rank
   - 20 ranked in 2009
   - 1 ranked in 2012 as extirpated

   b. Evaluate and Update State Threat Score and rationale. Ute Ladies'-tresses has a State Threat Score of high based on the 2021 Threat Assessment (MTNHP 2021a). The State Threat Score and rationale should be updated by MTNHP at five-year intervals, or as warranted by current data. Reported threats and data analysis should be posted on the Montana Field Guide to create transparency in the ranking process. The State Threat Score represents the degree to which the target plant is degraded by extrinsic factors, which are characterized in terms of timing, severity, and scope (MTNHP 2021b; Master et al. 2012).

Information Needs [Inventory, Monitoring, Research]

2) Work with private landowners or with members from the Missouri Headwaters Partnership, Montana Watershed Coordination Council, Gallatin Valley Land Trust, and/or other local organizations to develop relationships with private landowners who have Ute Ladies'-tresses plants on their properties. Facilitate conversations with - landowners about their concerns, observations and knowledge of the plant, permissions to access habitat, ability to conduct revisits or acquire plant counts and habitat condition data, and address other needs. Conducting consecutive years of surveys at least once in a 10-year period helps to maintain accurate status and trend assessments. Consider providing survey results (both present and absent observations) to MTNHP for inclusion in the botany database. Three consecutive years of monitoring is recommended to significantly improve detection for presence.

3) Collaborate with private landowners to seek input and permissions to conduct consecutive years of surveys on lands identified as high or moderate suitability by the most current Predicted Suitable Habitat Model. Consider providing survey results (both present and absent observations) to MTNHP to help refine the Predicted Suitable Habitat Model for Ute Ladies'-tresses in Montana. Three consecutive years of monitoring is recommended to significantly improve detection for presence.

Photo Credit: Andrea Pipp

Photo 3. A population of Ute Ladies'-tresses that is sustained, in part, by ecologically compatible livestock grazing management in Montana.

Information Needs [Inventory, Monitoring, Research]

4) Collaborate with state land management agencies to seek input and permissions to conduct consecutive years of surveys on lands identified as high or moderate suitability by the most current Predicted Suitable Habitat Model. Share survey results (both present and absent observations) to MTNHP to help refine the Predicted Suitable Habitat Model for Ute Ladies'-tresses in Montana. Three consecutive years of monitoring is recommended to significantly improve detection for presence.

5) Collaborate with state land management and Gallatin County government agencies who have Ute Ladies'-tresses on their parcels to seek input, work to acquire funding and/or field assistance, and obtain permissions to conduct consecutive years of surveys. Conducting consecutive years of surveys at least once in a 10-year period helps to maintain accurate status and trend assessments. Consider providing survey results (both present and absent observations) to MTNHP for inclusion into the botany database. Three consecutive years of monitoring is recommended to significantly improve detection for presence.

6) Collaborate with federal and county agencies and other landowners to seek input and permissions to conduct consecutive years of surveys on lands identified as high or moderate suitability by the most current Predicted Suitable Habitat Model. Consider providing survey results (both present and absent observations) to MTNHP to help refine the Predicted Suitable Habitat Model for Ute Ladies'-tresses in Montana. Three consecutive years of monitoring is recommended to significantly improve detection for presence. Share survey results (both present and absent observations) to MTNHP for inclusion in the botany database.

7) Support the ongoing data (population monitoring and trend assessments) collection and mapping conducted by Montana Department of Transportation (MDT) biologists on their right-of-way, leased, and owned parcels. This dataset continues to accumulate long-term population counts for flowering individuals, habitat conditions, and other information used to accurately inform status assessments, project planning, and management actions.

8) Collaborate with all landowners to acquire revisit data from known Ute Ladies'-tresses occurrences on a frequency of at least once every ten years. Revisits could be coordinated with a Montana Citizen Botany Program (see Section 3, Information Need Conservation Objectives, #4). Recognize that at least two consecutive years of monitoring are recommended to accurately determine presence; additional consecutive years of monitoring are best for collecting population data.

9) Re-establish the 2001 demography study conducted by the MTNHP at Piedmont Swamp in Jefferson County (Heidel 2001). This is Montana's only demographic study for Ute Ladies'-tresses that collected life-stage and reproductive data on individual plants from 1996 to 2000. Re-establishing this study using the same methodology could provide insights into long-term population and habitat trends for the species.

Information Needs [Inventory, Monitoring, Research]

10) Use existing resources to find literature, research studies, and other information when investigating research questions or needs and designing monitoring studies. Across Ute Ladies'-tresses range, information has accumulated from a variety of sources including academic research, federal and state research and management reports, and observation data, on topics of life history traits, ecology and habitat requirements, germination, growth, and transplanting, pollinators, livestock grazing and management, fire ecology, and others. Reference material already compiled can be found at the following sources:
    - Cited and Additional References section in the Montana Field Guide Ute Ladies'-tresses profile[1]
    - USFWS ECOS website[2]

11) Research topics that could further our understanding of this unique plant and/or assist in plant conservation efforts include, but are not limited to:
    a. Work towards developing compatible land management practices for Ute Ladies'-tresses in Montana using long-term research experiments and monitoring. Livestock management and agricultural practices have the ability to aid or hinder the persistence of Ute Ladies'-tresses populations. Published literature has not studied the effects of agricultural practices and livestock management on Ute Ladies'-tresses plants and populations in Montana.
    b. Conduct research to develop techniques that can assess the soils for particular types of mycorrhizal fungi that are necessary for Ute Ladies'-tress plants.
    c. Conduct ecological research that aims to document associated vascular species that may be indicators of Ute Ladies'-tresses habitat and its below-ground microbial community.
    d. Conduct research to identify pollinators and study pollination for Ute Ladies'-tresses.
    e. Conduct research on seed viability and germination trials for Ute Ladies'-tress plants representing the range of variability in elevation, geography, population size, and habitat in Montana for the purpose of storing seeds, both for the short and long terms.

Photo Credit: Clare A. Beelman

Photo 4. A hoverfly examines the flowers of a Ute Ladies'-tresses plant. In Montana, studies examining pollination and pollinators relative to this species are needed.

Protection and Restoration

Conservation Goal

Secure on-the-ground, site-specific habitat and/or management protection or restoration for Ute Ladies'-tresses on public and private lands.

Conservation Objectives

1) Provide incentive-based programs to conserve, enhance, and restore habitats that support Ute Ladies'-tresses. Tools could include long-term conservation leases, conservation easements, grazing system development, seeding projects, invasive species control, and funding mechanisms. Programs that could help include, but are not limited to:
   - USFWS Section 6 Grant Program
   - Montana Fish, Wildlife & Parks (MFWP) Habitat Montana Program[3]
   - Montana Association of Land Trusts[4]
   - Montana Natural Resources Conservation Service (NRCS), Agricultural Conservation Easement Programs (ACEP)[5] for Montana:
     -Agricultural Land Easements (ALE)
     -Wetland Reserve Easements (WRE)
2) Work with the Montana Native Plant Society (MNPS), state and county agencies, private landowners, and other conservation organizations in using publicly available data from MTNHP to investigate the possibility of developing an Important Plant Area (IPA) or a State Natural Area for Ute Ladies'-tresses. An IPA is a recognition by MNPS of locations that have outstanding rare and unique plant occurrences. Refer also to Section 4, Outreach and Education, Conservation Objective #5.
3) Use stakeholders (landowners, land management agencies, conservation organizations, botanists, and others) to identify known occurrences where protection or restoration is warranted. Consider using conservation easements to protect known populations. Where restoration is identified as a need, use an interdisciplinary team to develop a restoration plan, avoid negative impacts to existing Ute Ladies'-tresses plants, and use local/state native plant materials. Refer to: Section 3, Protection and Restoration, Conservation Objectives #1 & #5; Section 4, Protection and Restoration, Conservation Objectives #5, #6, #7, & #9.
4) Promote sharing of management guidelines developed by other federal and state agencies for review and potential use by landowners, as appropriate, for populations in Montana.
5) Develop partnerships between federal, state, non-profit, and/or private organizations within the Montana range for Ute Ladies'-tresses and the following potential facilities to conduct seed banking, germination trials, genetic research, and/or related topics relative to collected Ute Ladies'-tresses plant materials:
   - Rae Selling Berry Seed Bank, Portland State University, Oregon[6]
   - Plant Germplasm Introduction Test and Research Unit, Pullman, Washington

[3] Habitat Montana: https://fwp.mt.gov/conservation/landowner-programs/habitat-montana
[4] Montana Association of Land Trusts: https://montanalandtrusts.org/
[5] NRCS ACEP: https://www.nrcs.usda.gov/programs-initiatives/acep-agricultural-conservation-easement-program/montana/agricultural
[6] Rae Selling Berry Seed Bank: https://www.pdx.edu/seed-bank/

Outreach and Education

Conservation Goal

Facilitate the stewardship of Ute Ladies'-tresses plants and habitat through education, outreach, and coordination.

Conservation Objectives

1) Tell the story of Ute Ladies'-tresses, its unique life history and habitat, and the management practices that can help sustain the plant. Write articles, conduct field trips, present talks, and develop stories for news, social, and web media. Pair people who are knowledgeable on Ute Ladies-tresses with writers, conservation-oriented organizations, local media producers, local and regional governing bodies, and/or educators to provide opportunities to showcase south-central Montana's iconic plant, to bring awareness, promote education, and help foster stewardship for its persistence.

2) Ask the Missouri Headwaters Partnership, Montana Association of Conservation Districts, individual conservation districts, or other Montana-based conservation organizations how to engage private landowners and do public outreach on this plant.

3) Partner with a conservation organization, such as the Missouri Headwaters Partnership, a conservation district, MTNHP, or Montana Native Plant Society, to table/host a booth for educational outreach on Ute Ladies'-tresses and other Montana Species of Concern. Potential events to table or host a booth are:
   - County Fairs in Beaverhead, Broadwater, Gallatin, Jefferson, Madison counties
   - Montana Range Days (when the event occurs within the range of Ute Ladies'-tresses)

4) Foster partnerships with Montana University System faculty, particularly at Montana State University (MSU; Animal and Range Department) and The University of Montana Western (Environmental Sciences) to bring awareness and educational outreach about Ute Ladies'-tresses.

Photo Credit: Ryan Quire

Photo 5. Ute Ladies'-tresses grow in low-elevation valleys where vegetation is less dense and stays green long into the summer because of a shallow groundwater table.

Outreach and Education

5) Foster partnerships with agricultural- and rangeland-focused community and academic organizations - to bring awareness and educational outreach on Ute Ladies'-tresses. Potential organizations to engage with include:
    - Society of Range Management: MSU Range Club
    - Future Farmers of America Chapters: Beaverhead FFA, Twin Bridges FFA, Ruby Valley FFA, and Lima FFA
    - Local 4-H chapters
6) Foster partnerships between Montana Native Plant Society, MTNHP, and environmental education organizations to develop a teaching trunk or curriculum on Montana's Species of Concern plants, including Ute Ladies'-tresses.
7) Conduct field trip to known Ute Ladies'-tresses to foster public awareness of the plant, its habitat, status, and interesting information.
8) Disseminate the 2020 Ute Ladies'-tresses brochure produced by MTNHP[7] to local offices within the known state range to promote awareness and find local landowners interested in conservation:
    - USFS Forest and Ranger District Offices
    - BLM Field Office
    - NRCS Field Offices
    - Missouri Headwaters Partnership
    - Conservation district offices

Policy and Regulation

Conservation Goal

Improve conservation of Ute Ladies'-tresses through public participation and implementation of existing policies and regulations in cooperation with federal and state land managers, private landowners, and other interested stakeholders.

Conservation Objectives

1) Implement actions recommended in the 1995 Draft Recovery Plan for *Spiranthes diluvialis*[8], as appropriate.
2) Through federal and state agency collaboration, continue to provide information and data to the USFWS to help in their assessments, including the five-year review, Species Status Assessment, post-delisting monitoring plant, and others.
3) Support private landowners in their efforts to share plant data with MTNHP and federal agencies.

[7] Contact the Program Botanist at MTNHP for electronic versions of the brochure. https://mtnhp.mt.gov/
[8] Available on the Ute Ladies'-tresses Montana Field Guide profile: https://fieldguide.mt.gov/speciesDetail.aspx?elcode=PMORC2B100

REFERENCES

Arft, Anna Maria. 1995. "The genetics, demography, and conservation management of the rare orchid *Spiranthes diluvialis*." (PhD thesis, University of Colorado, Boulder, CO 170 pp.

Fertig, W. 2000. Status review of the Ute Ladies'-tresses (*Spiranthes diluvialis*) in Wyoming. Report prepared for the Wyoming Cooperative Fish and Wildlife Research Unit, US Fish and Wildlife Service (USFWS), and Wyoming Game and Fish Department by the Wyoming Natural Diversity Database, Laramie, WY.

Fertig, W., R. Black, and P. Wolken. 2005. Rangewide Status Review of Ute Ladies'-Tresses (*Spiranthes diluvialis*). September 30th. Prepared for the USFWS and Central Utah Water Conservancy District.

Heidel, B. 2001. Monitoring Ute ladies'-tresses (*Spiranthes diluvialis*), in Jefferson County, Montana: final report, 1996-2000. Report to Bureau of Land Management. Montana Natural Heritage Program, Helena, MT. 11 pp. plus appendices.

Lesica, P., M. Lavin, and P. Stickney. 2012. *Manual of Montana Vascular Plants*. Fort Worth, TX: BRIT Press. viii + 771 p.

Master, L., D. Faber-Langendoen, R. Bittman, G. Hammerson, B. Heidel, L. Ramsay, K. Snow, A.Teucher, and A. Tomaino. 2012. *NatureServe Conservation Status Assessments: Factors for Evaluating Species and Ecosystem Risk*. NatureServe, Arlington, VA.

Montana Natural Heritage Program (MTNHP). 2021a. An assessment of threat data reported for Spiranthes diluvilias. MTNHP Botany Database. Helena, MT. [Accessed 31 Deecember 2023]

Montana Natural Heritage Program. 2021b. Conservation Status Assessment Definitions, Process, Rank Factors, and Calculation of State Ranks for Montana Species. 18 p.

Montana Natural Heritage Program (MTNHP). 2024a. *Spiranthes diluvialis* profile on the Montana Field Guide. Helena, MT https://fieldguide.mt.gov/speciesDetail.aspx?elcode=PMORC2B100 [Accessed 15 February 2024].

Montana Natural Heritage Program (MTNHP). 2024b. Data on *Spiranthes diluvialis* observation from the botany database. Helena, MT.

Murphy, C. 2001. Monitoring the Habitat of Ute Ladies' Tresses (*Spiranthes diluvialis*) On the South Fork Snake River, Idaho - Methods and First Year Results. Idaho Department of Fish and Game, Natural Resources Policy Bureau. 32 pp.

Sheviak, C. and P. Brown. 2002. *Flora of North America North of Mexico, Magnoliophyta: Liliidae, Liliales, and Orchidales*. Volume 26. New York:Oxford Press. 723 pp.

US Fish and Wildlife Service (USFWS). 1992. Endangered and threatened wildlife and plants; final rule to list the plant *Spiranthes diluvialis* (Ute ladies' tresses) as a threatened species. Federal Register 57(12):2048-2054.

US Fish and Wildlife Service (USFWS). 1995. Ute ladies' tresses (*Spiranthes diluvialis*) draft recovery plan. USFWS, Denver, CO. 46 pp.

US Fish and Wildlife Service (USFWS). 2023a. Species Status Assessment Report for Ute Ladies'-tresses (*Spiranthes diluvialis*). June-Version 1. Prepared for the Utah Ecological Service Field Office, Salt Lake City, UT.

US Fish and Wildlife Service (USFWS). 2023b. Ute Ladies'-tresses (*Spiranthes diluvialis)*, 5-Year Status Review: Summary and Evaluation. August 1. Prepared for Mountain-Region, Denver, CO.