SECTION 4

Vascular Plant Species of Greatest Conservation Need

SECTION 4
MONTANA'S VASCULAR PLANTS OF GREATEST CONSERVATION NEED

MONTANA'S FLORA

Montana is the fourth-largest state in the United States (US), and it encompasses great diversity in its native landscapes, species, and habitats. Mountains define the central and western Rocky Mountain region while grasslands characterize the central and eastern Great Plains region of the state. Throughout are streams, lakes, and wetlands of numerous types. The large topographic relief creates a boreal influence at higher elevations, as well as precipitation patterns that differ in the lower elevations. Collectively, the topography, hydrology, geology, soils, and other factors create numerous habitats, home to a great diversity of species.

Montana's diverse vegetation is composed of 2,092 native[1] vascular plant species that historically or currently grow in the state (Lesica et al. 2022). This is comparable to or less than other western states but is at least 40% more than the midwestern states of North and South Dakota (NatureServe 2023). Another 442 exotic[2] vascular plant species reside in the state, having-arrived primarily through anthropogenic vectors (Lesica et al. 2022). Collectively, Montana is home to 2,833 vascular plant taxa (species, varieties, subspecies, and hybrids) (Lesica et al. 2022).

The distribution and population sizes of Montana's native plant species and prevalence of habitats vary greatly across the state. While most native plants are common or have secure populations, many others are considered rare across the globe or in our state. Whether locally abundant, widely scattered, or scarce, rare plants often exhibit small population sizes, narrow geographic ranges, affinities to unique habitats, and/or have low reproductive rates. Rare plants are often at risk of extirpation in the state, or even worldwide extinction, because of a lack of awareness about their precarious status. This fragile status may be due to biological factors, an inability to recover from catastrophic drought, fire, and/or anthropogenic threats. Rare plants contribute uniqueness to Montana's natural heritage, increasing biodiversity, and beautifying our landscapes; yet their vulnerability to environmental changes and increasing levels of human-caused threats requires special management and greater public awareness.

Like many rare species, some of Montana's common, even iconic, plants are also facing declines and becoming vulnerable to extirpation. In this section of the *Montana Native Plant Conservation Strategy*, we address plant species that are at risk of extirpation in the state and prioritize the plants that are in greatest need of conservation. We also provide information on their status, location, and associated habitats. We outline conservation objectives that, if implemented, would aid their persistence, and help strengthen botanical capacity[3] in Montana.

How Many Plants are At Risk in Montana?

The Montana Natural Heritage Program (MTNHP) is the state's source for information on the species, distribution, and status of

[1] Native vascular plants are those that were known to occur in Montana before European settlement, typically dated as prior to or during the Lewis and Clark Expedition from 1803 to 1806.

[2] Exotic plant species are also referred to as non-native or introduced.

[3] Refer to Section 3, page 2 for definition.

our native and exotic flora [Montana Code Annotated (MCA) 90-15-301]. Currently, the MTNHP tracks 432 vascular plant species, varieties, and subspecies as being a Montana Species of Concern (SOC) or Potential Species of Concern (PSOC)[4] (MTNHP 2024a). The SOC and PSOC designations are based on the plant's conservation status rank, which reflects its level of risk to extinction or extirpation based on rarity (distribution, abundance, and occupied habitat), threats, population trends, and level of protection (Box 4-1). Montana SOC and PSOC have state conservation status ranks, hereafter referred to as a Subnational (S) or State (S) Rank, which ranges from "vulnerable" (S3), to "imperiled" (S2), to "critically imperiled" (S1) (Box 4-1). Many of the Montana SOC and PSOC plants also have federal agency designations, but no additional state agency designations. The State-Rank (S-Rank) carries no statutory or regulatory classification.

Photo Credit: Bruce Selyem

*Photo 4-1. Dwarf Purple Monkeyflower (*Mimulus nanus*) grows in vernally moist, sandy soils on open slopes in southwest Montana.*

Photo Credit: Bruce Selyem

*Photo 4-2. Clustered Lady's-Slipper (*Cypripedium fasciculatum*) grows in warm, dry mid-seral forests dominated by Douglas-fir (*Pseudotsuga menziesii*) trees in northwest Montana.*

Box 4-1. Global and state conservation status definitions for ranking plant species and ecosystems by the Montana Natural Heritage Program (2024a and 2024c) and NatureServe (2024).

GLOBAL (G) RANK	STATE (S) RANK	DEFINITION
G1	S1	**Critically Imperiled** - At very high risk of collapse or global extinction or state extirpation due to a very restricted range, very few populations or occurrences, very steep declines, severe threats, or other factors.
G2	S2	**Imperiled** - At high risk of collapse or global extinction or state extirpation due to a restricted range, few populations or occurrences, steep declines, severe threats, or other factors
G3	S3	**Vulnerable** - At moderate risk of collapse or global extinction or state extirpation due to a fairly restricted range, few populations or occurrences, recent and widespread declines, threats, or other factors.
G4	S4	**Apparently Secure** - At a fairly low risk of collapse or global extinction or state extirpation due to an extensive range and/or many populations or occurrences, but with possible cause for some concern as a result of local recent declines, threats, or other factors.
G5	S5	**Secure** - At very low or no risk of collapse or global extinction or state extirpation due to a very extensive range, abundance populations or occurrences, with little to no concern from declines or threats.

[4] Refer also to Section 1, Box 1-3. Species of Concern (SOC) are native taxa that are at-risk due to declining population trends, threats to their habitats, a restricted distribution, and/or other factors. Potential Species of Concern (PSOC) are native taxa for which current, often limited, information suggests a potential for vulnerability to extirpation in the state.

Determining Plant Species of Greatest Conservation Need

A large partnership of botanists, biologists, and ecologists working for or retired from federal and state land management agencies, non-governmental organizations (NGOs), and academia met on April 26, 2019 to discuss the concept of a Montana Rare Plant Conservation Strategy[5]. The discussions surfaced concerns for common tree and shrub species facing potential decline in addition to rare plants and habitats. It was largely agreed upon that a voluntary, non-regulatory approach could aid efforts to conserve certain plant species and habitats. What transpired was the development of a Montana Native Plant Conservation Strategy and the formation of a Criteria-Species-Habitat Subcommittee (Montana Native Plant Conservation Strategy-Criteria, Species, and Habitats Subcommittee 2021).

A subcommittee determined what would constitute a species, unique habitat, and plant community as being of "greatest conservation need". Information was compiled from MTNHP, federal, and state agency databases, literature, and professional expertise. Potential inclusion of a species was predominantly based on a systematic, scientific approach using centralized data, and mostly not on incorporating cultural information. The subcommittee formulated criteria and reviewed information on listed and recommended species to determine Plant Species of Greatest Conservation Need (Box 4-2). The subcommittee also determined that information on mosses and lichens, while available, was not centralized enough for determining a species of greatest conservation need. In addition, most agencies were not ready to address non-vascular species.

Photo Credit: Matthew Stewart, 406 Stewart Photography

*Photo 4-3. Lesser Rushy Milkvetch (*Astragalus convallarius*) is known from two disjunct localities in southwest Montana - where it grows in grasslands and Ponderosa Pine (*Pinus ponderosa*) woodlands.*

The subcommittee, with agreement by the larger partnership on April 12, 2021, proposed 129 plant species for inclusion in the *Montana Native Plant Conservation Strategy*, hereafter the *Strategy*. Further refinement of the Montana State Threat Score, input from

Box 4-2. Criteria used for determining a Plant Species of Greatest Conservation Need in Montana.

1) A Vascular Plant Species of Concern ranked as:
   - G1, G2, G3, or in combination, OR S1, S2, S3, or in combination, AND
   - Faces a direct or indirect threat as determined by the Montana State Threat Score, OR is associated with a Unique Habitat or Plant Community of GCN that faces a significant or highly probable threat, OR is poorly documented/information needed [PSGIN] AND
   - Lacks taxonomic problems OR large location ambiguity.
2) A vascular non-SOC plant that is nominated by several Strategy partners representing different organizations as being "of management concern" because the species is facing significant threats and potential decline.

[5] This meeting laid the groundwork for planning and development of a *Montana Native Plant Conservation Strategy: Vascular Species and Habitats of Greatest Conservation Need*. Almost 35 organizations were invited; 22 people attended, representing retired and working professionals for federal and state government, NGOs, and academic herbaria organizations (see Table 1, page *iii*).

engaged *Strategy* partners, and a second round of data review honed the list, and the Strategy now identifies 109 vascular plants as Plant Species of Greatest Conservation Need (GCN). A subset of these plants are also categorized as a Plant Species of Greatest Inventory Need (PGSIN) because they are poorly documented and information is needed. It is likely that with more information, insight, and attention from the statewide botanical community the list of Plant Species of GCN will be revised in future versions of the *Strategy*.

MONTANA'S PLANT SPECIES OF GREATEST CONSERVATION NEED

The 109 Plant Species of GCN consist of 105 Montana SOC and 4 "of management concern" vascular plants of which many are also cultural plants (Tables 4-1 and 4-2). The 109 Plant Species of GCN are further divided into categories of priority. Priority 1 is assigned to 23 plant species for which there is more rigorous observation and mapping data, at least some monitoring or research data, and/or biological literature (Table 4-1). Because we know more about the Priority 1 species, it is possible for members of the botanical community to develop species-specific conservation profiles and conservation objectives/actions. Priority 2 is assigned to 86 plant species about which less is known beyond accurate observation data and, for some species, moderately precise mapping (Table 4-2). Priority 2 was also assigned to SOC plants that associate strongly with a Unique Habitat or Plant Community of GCN, in which conservation is focused more heavily on the habitat.

Many of the Plant Species of GCN have additional designations (Tables 4-1 and 4-2). Under the Endangered Species Act (ESA) of 1973, as amended, the US Fish and Wildlife Service (USFWS) shares responsibility in managing five Montana SOC plants: Spalding's Catchfly (*Silene spaldingii*), Ute ladies'-tresses (*Spiranthes diluvialis*), and Whitebark Pine (*Pinus albicaulis*) are federally-listed as Threatened (USFWS 1992, 2001, 2022); Water Howellia (*Howellia aquatilis*) was delisted in 2021 but is being tracked through the post-delisting monitoring plan (USFWS 2020); and Thick-leaf Bladderpod (*Physaria pachyphylla*) was petitioned for listing with the 12-month status review ongoing (USFWS 2021). Region 1 of the US Forest Service (USFS-Region 1) designates 52 Plant Species of GCN as Sensitive or Species of Conservation Concern. The Montana/Dakotas Bureau of Land Management (MT/Dakotas BLM) designates 17 Plant Species of GCN as Sensitive. Tribal Nations in Montana may also have designations for plant species that are culturally significant or locally rare on their Tribal lands; these plant species are protected through their own Tribal laws, regulations, ordinances, and land management policies. Federally recognized tribes that have a land-base, who have Tribal Historic Preservation Offices, may also protect culturally significant native plant species in their project work. There are no additional State of Montana agency designations, beyond SOC and PSOC, for the 109 Plant Species of GCN.

Photo Credit: Henry Hardin

*Photo 4-4. Populations of Short-spine Horsebrush (*Tetradymia spinosa*), a shrub, tend to be small and reproduction may be tied to precipitation patterns.*

Table 4-1. The 23 vascular Plant Species of Greatest Conservation Need in Montana categorized as Priority 1[a]. Information on their distribution, ranks, status, designations, threats, occurrences, and select reasons for inclusion as a GCN reflects data as of April 2024 (MTNHP 2024b).

MTNHP Primary Name *Scientific Name*[b] Common Name[c]	State Distribution Pattern[d]	Global Rank[e]	State Rank[f]	Montana State Status[g]	Federal Designations ESA[h] BLM[i] USFS[j]	Montana State Threat Score[k]	Climate Change Vulnerability Index[l]	Number of SOs[m]	Select Reasons for Being Plant Species of GCN[n]
Astragalus barrii Barr's Milkvetch	regional endemic	G3G4	S3	SOC		Medium - Low	Highly Vulnerable	187	Threat
Boechera fecunda Sapphire Rockcress	state endemic	G2	S2	SOC	**BLM:** Sensitive **USFS:** Sensitive- Known (BD, BRT); Sensitive-Suspected (LOLO)	Medium	Moderately Vulnerable	68	Threat; Metamorphosed Limestone GCN
Cirsium longistylum Long-styled Thistle	state endemic	G2G3	S2S3	SOC		Medium	Less Vulnerable	154	Threat
Cypripedium fasciculatum Clustered Lady's-slipper	scattered, peripheral	G4	S3	SOC	**USFS:** Sensitive- Known (KOOT, LOLO); Species of Conservation Concern (FLAT)	Medium	Moderately Vulnerable	113	Threat
Cypripedium passerinum Sparrow's-egg Lady's-slipper		G5	S2S3	SOC	**USFS:** Sensitive- Known (KOOT); Sensitive-Suspected (LOLO); Species of Conservation Concern (FLAT, HLC)	Low	Moderately Vulnerable	89	Peatland [Fen] GCN
Epipactis gigantea Giant Helleborine	scattered	G4	S5	SOC	**USFS:** Sensitive- Known (BD, BRT, KOOT, LOLO); Species of Conservation Concern (FLAT, HLC)	Low	Moderately Vulnerable	46	Peatland [Fen] GCN
Fraxinus pennsylvanica Green Ash		G4	S5	management concern					Significant Potential Threat; Of Management Concern
Goodyera repens Northern Rattlesnake-plantain		G5	S3	SOC	**USFS**: Species of Conservation Concern (HLC)	High - Low	Moderately Vulnerable	244	Threat

Table 4-1. [continued from page 6] The 23 vascular Plant Species of Greatest Conservation Need in Montana categorized as Priority 1[a]. Information on their distribution, ranks, status, designations, threats, occurrences, and select reasons for inclusion as a GCN reflects data as of April 2024 (MTNHP 2024b).

MTNHP Primary Name *Scientific Name*[b] Common Name[c]	State Distribution Pattern[d]	Global Rank[e]	State Rank[f]	Montana State Status[g]	Federal Designations ESA[h] BLM[i] USFS[j]	Montana State Threat Score[k]	Climate Change Vulnerability Index[l]	Number of SOs[m]	Select Reasons for Being Plant Species of GCN[n]
Grindelia howellii Howell's Gumweed	regional endemic	G3	S2S3		**BLM:** Sensitive **USFS:** Sensitive- Known (LOLO); Sensitive-Suspected (KOOT); Species of Conservation Concern (FLAT, HLC)	High - Medium	Less Vulnerable	187	Threat
Howellia aquatilis Water Howellia	disjunct, scattered	*G3*	S3	SOC	**ESA:** DM	High - Medium	Extremely Vulnerable	232	Threat; Wooded Vernal Pools GCN
Penstemon lemhiensis Lemhi Beardtongue	regional endemic	*G3*	S3	SOC	**BLM:** Sensitive **USFS:** Sensitive- Known (BD, BRT)	High - Medium	Moderately Vulnerable	427	Threat
Phlox missoulensis Missoula Phlox	state endemic	*G3*	S3	SOC	**USFS:** Sensitive- Known (BD); Sensitive-Suspected (LOLO); Species of Conservation Concern (HLC)	*to be assessed*	Highly Vulnerable	6	Threat
Physaria didymocarpa* var. *lanata Woolly Twinpod		*G5T2*	S2S3	SOC	**USFS:** Species of Conservation Concern (CG)	No Known Threat		10	Threat
Physaria douglasii Douglas Bladderpod	peripheral	*G5*	S1	SOC	**USFS:** Sensitive-Known (KOOT)	Medium	Extremely Vulnerable	8	Threat
Physaria pachyphylla Thick-leaf Bladderpod	regional endemic	*G2G3*	S2S3	SOC	**ESA:** Petitioned **BLM:** Sensitive	Low	Moderately Vulnerable	16	Threat
Pinus albicaulis Whitebark Pine	widespread	*G3G4*	S3	SOC	**ESA:** LT **BLM/USFS:** Threatened	*to be assessed*	Highly Vulnerable	5799	Threat; Trend?
Pinus monticola Western White Pine	peripheral	*G4G5*	S3S4	management concern		*to be assessed*			Threat; Trend?; Of Management Concern

Table 4-1. [continued from page 7] The 23 vascular Plant Species of Greatest Conservation Need in Montana categorized as Priority 1[a]. Information on their distribution, ranks, status, designations, threats, occurrences, and select reasons for inclusion as a GCN reflects data as of April 2024 (MTNHP 2024b).

MTNHP Primary Name *Scientific Name*[b] Common Name[c]	State Distribution Pattern[d]	Global Rank[e]	State Rank[f]	Montana State Status[g]	Federal Designations ESA[h] BLM[i] USFS[j]	Montana State Threat Score[k]	Climate Change Vulnerability Index[l]	Number of SOs[m]	Select Reasons for Being Plant Species of GCN[n]
Populus tremuloides Quaking Aspen		*G5*	S5	management concern					Threat; Trend?; Of Management Concern; Of Cultural Importance
Primula alcalina Alkali Primrose	scattered	*G2*	S2	SOC	**BLM:** Sensitive **USFS:** Sensitive-Known (BD)	Very High	Extremely Vulnerable	19	Threat
Primula incana Mealy Primrose	scattered	*G5*	S3	SOC		High	Highly Vulnerable	78	Threat
Quercus macrocarpa Bur Oak	peripheral	*G5*	S2	SOC		High	Highly Vulnerable	11	Threat; Bentonite Deposits GCN
Silene spaldingii Spalding's Catchfly	scattered	*G2*	S2	SOC	**ESA:** LT **BLM/USFS:** Threatened	Very High	Extremely Vulnerable	75	Threat
Spiranthes diluvialis Ute Ladies'-tresses	scattered; US endemic	*G2G3*	S1S2	SOC	**ESA:** LT **BLM/USFS:** Threatened	High	Extremely Vulnerable	29	Threat

[a] Strategy Priority: Priority 1 species have more rigorous observation and mapping data, at least some monitoring or research, and/or biological literature. Less is known about Priority 2 plant species - beyond accurate observation data and, for some species, moderately precise mapping.
[b] Scientific Name used as the primary name in the MTNHP botany database (MTNHP 2024b).
[c] Common Name used as the primary name in the MTNHP botany database (MTNHP 2024b).
[d] Distributional pattern of the plant in Montana based on literature (Lesica 2022) and botanical expertise.
[e] Global Rank as determined by NatureServe (2024). Refer to Box 4-1 and NatureServe Explorer: https://explorer.natureserve.org/
[f] State Rank as determined by MTNHP (2024b). Refer to Box 4-1 and MTNHP Montana Field Guide: https://fieldguide.mt.gov/default.aspx
[g] Montana Status: State-level designation (MTNHP 2024b) or other "of concern" notation.
[h] US Fish and Wildlife Service's designation under the Endangered Species Act (MTNHP 2024b).
[i] Montana/Dakotas Bureau of Land Management (BLM) designation (MTNHP 2024b).
[j] Region 1, US Forest Service (USFS) designation by forest (MTNHP 2024b).
[k] Montana State Threat Score (MTNHP Threat Assessment 2021).
[l] Climate Change Vulnerability Index score. See Box 4-5 for definitions (MTNHP 2021).
[m] Number of Species Occurrences (extant, extirpated, and historical) mapped by MTNHP as of March 2024 (MTNHP 2024b). NA means "not applicable".
[n] A selection of abbreviated reasons for being a Plant Species of Greatest Conservation Need (GCN) and Plant Species of Greatest Inventory Need (SPGIN).

Table 4-2. The 86 vascular Plant Species of Greatest Conservation Need in Montana categorized as Priority 2a. Information on their distribution, ranks, status, designations, threats, occurrences, and select reasons for inclusion as a GCN reflects data as of April 2024 (MTNHP 2024b).

MTNHP Primary Name *Scientific Name*[b] Common Name[c]	State Distribution Pattern[d]	Global Rank[e]	State Rank[f]	Montana State Status[g]	Federal Designations ESA[h] BLM[i] USFS[j]	Montana State Threat Score[k]	Climate Change Vulnerability Index[l]	Number of SOs[m]	Select Reasons for Being Plant Species of GCN[n]
***Agastache cusickii* Cusick's Horsemint**	scattered or peripheral	*G3G4*	S2S3	SOC	**BLM:** Sensitive **USFS:** Sensitive-Known (BD)	High - Medium	Moderately Vulnerable	9	Threat
Allium columbianum Columbia Onion	scattered	*G3*	S1	SOC	**USFS:** Sensitive-Known (BD)	Medium	Highly Vulnerable	12	Bedrock Glades GCN
Allium parvum Small Onion	scattered	*G5*	S2S3	SOC	**USFS:** Sensitive-Known (BRT); Sensitive-Suspected (BD)	Very High - High	Less Vulnerable	174	Threat; Trend
Alnus rubra Red Alder	disjunct	*G5*	S2S3	SOC		No Known Threat		9	Information Needs (PSGIN)
Ammannia robusta Scarlet Ammannia	scattered, disjunct	*G5*	S2	SOC		Medium	Moderately Vulnerable	7	Threat; Poorly Documented (PSGIN)
Anthoxanthum hirtum Northern Sweet Grass		*G5*	S3S4	management concern					Threat; Trend; Of Cultural Importance
Astragalus ceramicus* var. *apus Painted Milkvetch		*G4T3*	S1S2		**BLM:** Sensitive	Medium - Low	Extremely Vulnerable	2	Centennial Valley Sand Dunes GCN; Threat
Astragalus convallarius Lesser Rushy Milkvetch	disjunct	*G5*	S3	SOC	**USFS:** Species of Conservation Concern (HLC)	Medium - Low	Moderately Vulnerable	76	Western (Montane) Grasslands GCN
Astragalus oreganus Wind River Milkvetch		*G4?*	S2	SOC		Medium	Moderately Vulnerable	8	Threat
Athysanus pusillus Sandweed	peripheral	*G5*	S1S2	SOC	**USFS:** Sensitive-Known (BRT, KOOT); Sensitive-Suspected (LOLO)	High	Highly Vulnerable	24	Threat
Braya humilis Low Braya		*G5*	S2	SOC	**USFS:** Sensitive-Known (BD); Species of Conservation Concern (HLC)	Unknown?	Highly Vulnerable	7	Threat (CCVI); Trend?; Information Needs (PSGIN)

Table 4-2. [continued from page 9] The 86 vascular Plant Species of Greatest Conservation Need in Montana categorized as Priority 2a. Information on their distribution, ranks, status, designations, threats, occurrences, and select reasons for inclusion as a GCN reflects data as of April 2024 (MTNHP 2024b).

MTNHP Primary Name *Scientific Name*[b] Common Name[c]	State Distribution Pattern[d]	Global Rank[e]	State Rank[f]	Montana State Status[g]	Federal Designations ESA[h] BLM[i] USFS[j]	Montana State Threat Score[k]	Climate Change Vulnerability Index[l]	Number of SOs[m]	Select Reasons for Being Plant Species of GCN[n]
Calochortus bruneaunis Bruneau Mariposa Lily	peripheral	*G5*	S2	SOC		Low	Highly Vulnerable	6	Threat; Sagebrush Communites GCN
Carex gravida Heavy Sedge	scattered	*G5*	S3	SOC	**USFS:** Species of Conservation Concern (CG)	High - Medium	Moderately Vulnerable	39	Threat
Carex idahoa Idaho Sedge	scattered and peripheral	*G3*	S3	SOC	**BLM:** Sensitive **USFS:** Sensitive-Known (BD)	High	Highly Vulnerable	59	Threat
Carex sychnocephala Many-headed Sedge	extant?	*G5*	S1S2	SOC		High - Medium		9	Threat
Castilleja covilleana Coville Indian Paintbrush		G3G4	S3		**USFS:** Sensitive-Known (BD, BRT); Sensitive-Suspected (KOOT)	Low	Moderately Vulnerable	115	Trend? (PSGIN)
Clarkia rhomboidea Diamond Clarkia	peripheral	*G5*	S3	SOC	**USFS:** Sensitive-Known (LOLO)	Low	Less Vulnerable	55	Threat? (PSGIN)
Cleome lutea Yellow Beeplant		*G5*	S1S2	SOC		No Known Threat?		14	Poorly Documented (PSGIN); Threat (lack of disturbance)?
Cryptantha fendleri Fendler Cat's-ey	scattered	*G5*	S2	SOC	**BLM:** Sensitive	Medium	Extremely Vulnerable	40	Centennial Valley Sand Dunes GCN; Threat
Cyperus schweinitzii Schweinitz's Flatsedge	scattered and peripheral	*G5*	S2	SOC		Low		19	Other Sandy Habitats GCN
Dichanthelium acuminatum Panic Grass	scattered	G5	S2S3	SOC		Unknown		14	Hot Springs (Sensitive Area, not GCN)

Table 4-2. [continued from page 10] The 86 vascular Plant Species of Greatest Conservation Need in Montana categorized as Priority 2a. Information on their distribution, ranks, status, designations, threats, occurrences, and select reasons for inclusion as a GCN reflects data as of April 2024 (MTNHP 2024b).

MTNHP Primary Name *Scientific Name*[b] Common Name[c]	State Distribution Pattern[d]	Global Rank[e]	State Rank[f]	Montana State Status[g]	Federal Designations ESA[h] BLM[i] USFS[j]	Montana State Threat Score[k]	Climate Change Vulnerability Index[l]	Number of SOs[m]	Select Reasons for Being Plant Species of GCN[n]
Dichanthelium oligosanthes* var. *scribnerianum Scribner's Panic Grass	scattered	G5T5	S1S2	SOC		Low		10	Poorly Documented (PSGIN)
Draba densifolia Dense-leaf Draba	scattered	G5	S3	SOC	**USFS:** Sensitive-Known (BD, BRT); Species of Conservation Concern (CG, HLC)	Low	Moderately Vulnerable	35	Threat
Drosera anglica English Sundew		G5	S3	SOC	**USFS:** Sensitive-Known (BD, BRT, KOOT, LOLO); Species of Conservation Concern (CG, HLC)	Low	Highly Vulnerable	55	Threat; Peatland [Fen] GCN
Drosera linearis Slenderleaf Sundew		G4G5	S2	SOC	**USFS:** Species of Conservation Concern (FLAT, HLC)	Unknown	Extremely Vulnerable	7	Peatland [Fen] GCN
Eleocharis bella Delicate Spikerush		G5	S1	SOC				7	Poorly Documented (PSGIN)
Eleocharis rostellata Beaked Spikerush	scattered	G5	S3	SOC	**USFS:** Species of Conservation Concern (CG, FLAT, HLC)	Unknown	Less Vulnerable	28	Hot Springs (Sensitive Area, not GCN)
Elymus flavescens Sand Wildrye	peripheral	G3	S1S2	SOC	**BLM:** Sensitive	Low	Extremely Vulnerable	4	Centennial Valley Sand Dunes GCN; Threat
Erigeron leiomerus Smooth Fleabane		G4	S2	SOC		Low	Extremely Vulnerable	5	Threat; Information Needs (PSGIN)
Erigeron linearis Linear-leaf Fleabane	peripheral	G5	S2	SOC		Low	Less Vulnerable	75	Threat
Eriogonum salsuginosum Smooth Buckwheat	peripheral	G4?	S1S2	SOC		Unknown	Moderately Vulnerable	4	Information Needs (PSGIN)

Table 4-2. [continued from page 11] The 86 vascular Plant Species of Greatest Conservation Need in Montana categorized as Priority 2a. Information on their distribution, ranks, status, designations, threats, occurrences, and select reasons for inclusion as a GCN reflects data as of April 2024 (MTNHP 2024b).

MTNHP Primary Name *Scientific Name*[b] Common Name[c]	State Distribution Pattern[d]	Global Rank[e]	State Rank[f]	Montana State Status[g]	Federal Designations ESA[h] BLM[i] USFS[j]	Montana State Threat Score[k]	Climate Change Vulnerability Index[l]	Number of SOs[m]	Select Reasons for Being Plant Species of GCN[n]
Eriogonum soliceps Railroad Canyon Wild Buckwheat		G3	S3	SOC	**BLM:** Sensitive	No Known Threat	Less Vulnerable	25	Information Needs (PSGIN)
Githopsis specularioides Common Blue-cup	disjunct?	G5	S1S2	SOC	**USFS:** Sensitive-Known (KOOT)	No Known Threat?		1	Vernally Moist Cliffs GCN; Information Needs (PSGIN)
Glossopetalon spinescens Spiny Greasebush		G5	S1	SOC	**USFS:** Sensitive-Known (BRT)	Unknown?		1	Threat?; Information Needs (PSGIN)
Grayia spinosa Spiny Hopsage	peripheral	G5	S2	SOC	**USFS:** Species of Conservation Concern (CG)	Unknown	Less Vulnerable	28	Threat?; Information Needs (PSGIN)
Heterocodon rariflorum Western Pearl-flower		G5	S2	SOC	**USFS:** Sensitive-Known (BRT, KOOT, LOLO)	Medium - Low	Moderately Vulnerable	59	Threat; Vernally Moist Cliffs GCN
Idahoa scapigera Scalepod	peripheral	G5	S1S2	SOC	**USFS:** Sensitive-Known (BRT); Sensitive-Suspected (LOLO); Species of Conservation Concern(FLAT)	High - Medium	Moderately Vulnerable	18	Threat; Bedrock Glades GCN
Ipomopsis congesta* ssp. *crebrifolia Ballhead Ipomopsis		G5T3 T4	S2S3	S2S3		No Known Threat		19	Sagebrush Communities GCN
Kochia americana Red Sage	peripheral	G5	S2	SOC		Unknown?	Moderately Vulnerable	5	Information Needs (PSGIN)
Lagophylla ramosissima Slender Hareleaf	disjunct	G5	S1	SOC		LOw		12	Poorly Documented (PSGIN); Threat
Lemna valdiviana Pale Duckweed	peripheral	G5	S1	SOC		Unknown		4	Warm Springs (Sensitive Area, not GCN)

Table 4-2. [continued from page 12] The 86 vascular Plant Species of Greatest Conservation Need in Montana categorized as Priority 2a. Information on their distribution, ranks, status, designations, threats, occurrences, and select reasons for inclusion as a GCN reflects data as of April 2024 (MTNHP 2024b).

MTNHP Primary Name *Scientific Name*[b] Common Name[c]	State Distribution Pattern[d]	Global Rank[e]	State Rank[f]	Montana State Status[g]	Federal Designations ESA[h] BLM[i] USFS[j]	Montana State Threat Score[k]	Climate Change Vulnerability Index[l]	Number of SOs[m]	Select Reasons for Being Plant Species of GCN[n]
Leptodactylon caespitosum Matted Prickly-phlox		G4	S2S3	SOC		Low	Moderately Vulnerable	29	Threat
Lewisia columbiana Columbia Lewisia	peripheral	G4G5	S1S2	SOC	**USFS:** Sensitive-Known (BD)	Medium - Low		5	Threat
Lilium columbianum Columbia Lily		G5	S2	SOC		No Known Threat	Moderately Vulnerable	11	Threat?; Bedrock Glades GCN
Liparis loeselii Loesel's Twayblade		G5	S2	SOC	**USFS:** Species of Conservation Concern (FLAT)	Unknown	Extremely Vulnerable	11	Peatland [Fen] GCN
Lobelia kalmii Kalm's Lobelia		G5	S3	SOC		No Known Threat		30	Peatland [Fen] GCN
Lomatium nuttallii Nuttall Desert-parsley	disjunct	G3	S2	SOC	**BLM:** Sensitive USFS: Species of Conservation Concern (CG)	High - Medium	Moderately Vulnerable	3	Threat; Shale Barrens GCN?
Malacothrix torreyi Desert Dandelion	peripheral	G4	S1S2	SOC		No Known Threat		12	Sagebrush Communities GCN
Mentzelia pumila Dwarf mentzelia	regional endemic	G4	S2S3	SOC		Unknown	Moderately Vulnerable	22	Information Needs (PSGIN)
Mimulus breviflorus Short-flowered Monkeyflower		G4	S1S2	SOC	**USFS:** Sensitive-Known (KOOT); Species of Conservation Concern (FLAT)	Unknown?	Moderately Vulnerable	13	Theats?; Information Needs (PSGIN)
Mimulus nanus Dwarf Purple Monkeyflower		G5	S2S3	SOC	**USFS:** Sensitive-Known (BRT); Species of Conservation Concern (CG)	High - Low	Extremely Vulnerable	21	Threat
Mimulus primuloides Primrose Monkeyflower		G4	S3	SOC	**USFS:** Sensitive-Known (BD, BRT)	Low	Extremely Vulnerable	42	Peatland [Fen] GCN

Table 4-2. [continued from page 13] The 86 vascular Plant Species of Greatest Conservation Need in Montana categorized as Priority 2a. Information on their distribution, ranks, status, designations, threats, occurrences, and select reasons for inclusion as a GCN reflects data as of April 2024 (MTNHP 2024b).

MTNHP Primary Name *Scientific Name*[b] Common Name[c]	State Distribution Pattern[d]	Global Rank[e]	State Rank[f]	Montana State Status[g]	Federal Designations ESA[h] BLM[i] USFS[j]	Montana State Threat Score[k]	Climate Change Vulnerability Index[l]	Number of SOs[m]	Select Reasons for Being Plant Species of GCN[n]
Muhlenbergia andina Foxtail Muhly	scattered	G4	S2S3	SOC		Unknown		14	Hot Springs (Sensitive Area, not GCN)
Nama densum Nama	peripheral?	G5	S1S2	SOC		Unknown		1	Sagebrush Communities GCN
Nuttallanthus texanus Blue Toadflax		G4G5	S1S2	SOC		High - Medium		4	Threat
Oenothera pallida* ssp. *pallida Pale Evening-primrose	peripheral or disjunct	G5T4	S1	SOC		Unknown	Extremely Vulnerable	8	Centennial Valley Sand Dunes GCN
Ophioglossum pusillum Adder's Tongue		G4	S3	SOC			Moderately Vulnerable	47	Peatland [Fen] GCN
Oxytropis campestris* var. *columbiana Columbia Locoweed	regional endemic	G5T2	S1	SOC		Very High	Extremely Vulnerable	15	Threat
Pedicularis crenulata Scallop-leaf Lousewort		G4	S1	SOC	**BLM:** Sensitive	High	Extremely Vulnerable	4	Threat; Information Needs (PSGIN)
Penstemon angustifolius Narrowleaf Penstemon		***G5***	S2S3	SOC		No Known Threat	Highly Vulnerable	19	Other Sandy Habitats GCN?
Penstemon payettensis Payette Beardtongue	regional endemic	G4	S1	SOC	**USFS:** Sensitive-Known (BD, BRT)	Very High		11	Sagebrush Communities GCN
Petasites frigidus* var. *frigidus Arctic Sweet Coltsfoot	peripheral	G5T5	S2	SOC	**USFS:** Species of Conservation Concern (FLAT)	Medium	Moderately Vulnerable	11	Sagebrush Communities GCN
Phegopteris connectilis Northern Beechfern		G5	S2S3	SOC	**USFS:** Sensitive-Known (KOOT)	Medium - Low	Moderately Vulnerable	27	Threat
Physaria carinata Keeled Bladderpod	regional endemic	G3G4 TNR	S1S2	SOC	**BLM:** Sensitive **USFS:** Sensitive-Known (BD)	Medium	Moderately Vulnerable	46	Metamorphosed Limestone GCN?; Threat

Table 4-2. [continued from page 14] The 86 vascular Plant Species of Greatest Conservation Need in Montana categorized as Priority 2a. Information on their distribution, ranks, status, designations, threats, occurrences, and select reasons for inclusion as a GCN reflects data as of April 2024 (MTNHP 2024b).

MTNHP Primary Name *Scientific Name*[b] Common Name[c]	State Distribution Pattern[d]	Global Rank[e]	State Rank[f]	Montana State Status[g]	Federal Designations ESA[h] BLM[i] USFS[j]	Montana State Threat Score[k]	Climate Change Vulnerability Index[l]	Number of SOs[m]	Select Reasons for Being Plant Species of GCN[n]
Physaria humilis Bitterroot Bladderpod	state endemic	G2	S2	SOC	**USFS:** Sensitive-Known (BRT)	High - Medium	Highly Vulnerable	9	Threat
Physaria klausii Divide Bladderpod	state endemic	G3	S3	SOC		Low	Moderately Vulnerable	59	Threat; Shale Barrens GCN?
Physaria lesicii Lesica's Bladderpod	state endemic	G2	S2	SOC	**BLM:** Sensitive	High - Medium	Highly Vulnerable	19	Threat
Pleiacanthus spinosus Spiny Skeletonweed	peripheral	G4	S2S3	SOC	**BLM:** Sensitive	Unknown	Moderately Vulnerable	27	Information Needs (PSGIN)
Prunus pumila Sand Cherry	peripheral	G5	S1S3	SOC		Unknown		2	Poorly Documented (PSGIN)
Ranunculus orthorhynchus Straightbeak Buttercup	peripheral	G5	S1S2	SOC		Low		15	Threat; Poorly Documented (PSGIN)
Rotala ramosior Toothcup		G5	S1S2	SOC		No Known Threat	Highly Vulnerable	7	Information Needs (PSGIN)
Sandbergia perplexa Puzzling Rockcress	regional endemic	G4	S2	SOC	**USFS:** Sensitive-Known (BRT)	High - Low	Highly Vulnerable	18	Threat; Sagebrush Communites GCN
Scheuchzeria palustris Pod Grass		G5	S3	SOC	**USFS:** Sensitive-Known (LOLO)	Medium - Low	Moderately Vulnerable	60	Threat; Peatland [Fen] GCN
Sidalcea oregana Oregon Checker-mallow		G5	S2S3	SOC	**USFS:** Species of Conservation Concern (CG)	High - Medium		10	Threat
Tetradymia spinosa Short-spine Horsebrush	peripheral	G5	S2S3	SOC		Unknown?	Less Vulnerable	12	Threat?; Information Needs (PSGIN); Sagebrush Communities GCN

Table 4-2. [continued from page 15] The 86 vascular Plant Species of Greatest Conservation Need in Montana categorized as Priority 2a. Information on their distribution, ranks, status, designations, threats, occurrences, and select reasons for inclusion as a GCN reflects data as of April 2024 (MTNHP 2024b).

MTNHP Primary Name *Scientific Name*[b] Common Name[c]	State Distribution Pattern[d]	Global Rank[e]	State Rank[f]	Montana State Status[g]	Federal Designations ESA[h] BLM[i] USFS[j]	Montana State Threat Score[k]	Climate Change Vulnerability Index[l]	Number of SOs[m]	Select Reasons for Being Plant Species of GCN[n]
Trichophorum cespitosum Tufted Club-rush		G5	S2	SOC	**USFS:** Species of Conservation Concern (FLAT)	No Known Threat	Moderately Vulnerable	27	Peatland [Fen] GCN
Trifolium eriocephalum Woolly-head Clover	peripheral	G5	S2	SOC	**USFS:** Sensitive-Known (BD, BRT); Sensitive-Suspected (LOLO)	Medium - Low		31	Theat; Riparian Forest GCN
Trifolium gymnocarpon Hollyleaf Clover	peripheral and disjunct	G5	S2	SOC	**USFS:** Sensitive-Known (BD, BRT, LOLO)	Medium - Low		63	Theat; Sagebrush Communities GCN
Trifolium microcephalum Woolly Clover	peripheral or scattered	G5	S3	SOC		High - Medium		10	Theat; Riparian Forest GCN
Utricularia intermedia Flatleaf Bladderwort		G5	S2		**USFS:** Sensitive-Known (KOOT)	No Known Threat		11	Peatland [Fen] GCN
Vaccinium myrtilloides Velvetleaf Huckleberry	peripheral	G5	S2	SOC		Medium - Low	Less Vulnerable	14	Threat
Viburnum lentago Nannyberry	scattered	G5	S2S3	SOC		Unknown		4	Poorly Documented (PSGIN)

[a] Strategy Priority: Priority 1 species have more rigorous observation and mapping data, at least some monitoring data or research, and/or biological literature. Less is known about Priority 2 plant species - beyond accurate observation data and, for some species, moderately precise mapping.
[b] Scientific Name used as the primary name in the MTNHP botany database (MTNHP 2024b).
[c] Common Name used as the primary name in the MTNHP botany database (MTNHP 2024b).
[d] Distributional pattern of the plant in Montana based on literature (Lesica 2022) and botanical expertise.
[e] Global Rank as determined by NatureServe (2024). Refer to Box 4-1 and NatureServe Explorer: https://explorer.natureserve.org/
[f] State Rank as determined by MTNHP (2024b). Refer to Box 4-1 and MTNHP Montana Field Guide: https://fieldguide.mt.gov/default.aspx
[g] Montana Status: State-level designation (MTNHP 2024b) or other "of concern" notation.
[h] US Fish and Wildlife Service's designation under the Endangered Species Act (MTNHP 2024b).
[i] Montana/Dakotas Bureau of Land Management (BLM) designation (MTNHP 2024b).
[j] Region 1, US Forest Service (USFS) designation by forest (MTNHP 2024b).
[k] Montana State Threat Score (MTNHP Threat Assessment 2021).
[l] Climate Change Vulnerability Index score. See Box 4-5 for definitions (MTNHP 2021).
[m] Number of Species Occurrences (extant, extirpated, and historical) mapped by MTNHP as of March 2024 (MTNHP 2024b). NA means "not applicable".
[n] A selection of abbreviated reasons for being a Plant Species of Greatest Conservation Need (GCN) and Plant Species of Greatest Inventory Need (SPGIN).

Locations for Plant Species of Greatest Conservation Need

Populations of the 109 Plant Species of GCN are found across Montana, occurring in numerous types of habitats and on a variety of land ownerships (Figure 4-1). A greater percentage of the species and their occurrences are found in the western third of the state. This skewed distribution is likely a result of the great topographic relief combined with climate patterns and other factors in western Montana that create a greater array of habitats for species to occupy. The skewed distribution also reflects the level of botanical exploration since large portions of central and eastern Montana remain under-surveyed.

Habitats and Plant Species of GCN

Ecologists working for the Montana Natural Heritage Program use the Ecological Systems classification (Comer et al. 2003) to understand the general composition, distribution, and condition of biological communities in Montana. An Ecological System represents a biological community or a major grouping that re-occurs across the landscape in similar physical environments and is influenced by similar (yet dynamic) ecological processes, such as fire or flooding (MTNHP 2024c). The classification also includes a human land use class in Montana. There are eight Level-1 Ecological System (ES) communities or major groupings that have been mapped across the state (Figure 4-2) (MTNHP 2024c). The largest Level-1 ES are Grasslands, which cover just under 30% of the state's land. Following

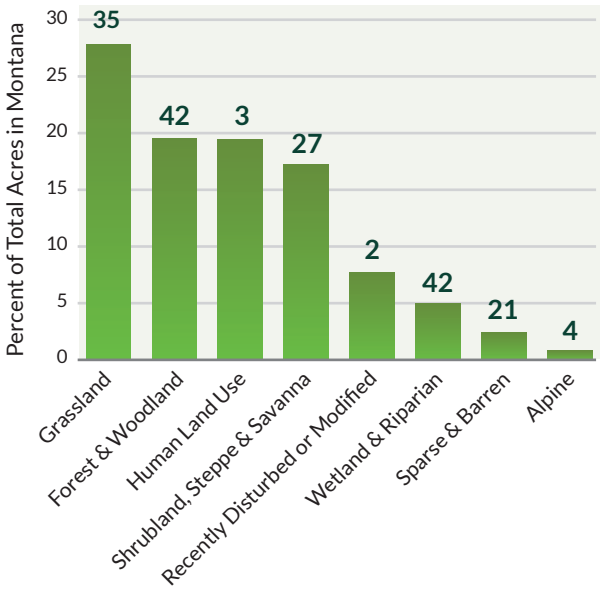

Figure 4-2. The percentage of total acres in Montana for each Level-1 Ecological System. The number of Plant Species of GCN found in each Level-1 Ecological System is listed above the bar. Note: Most species are found in more than one Level-1 Ecological System. *Data Source: MTNHP 2024c.*

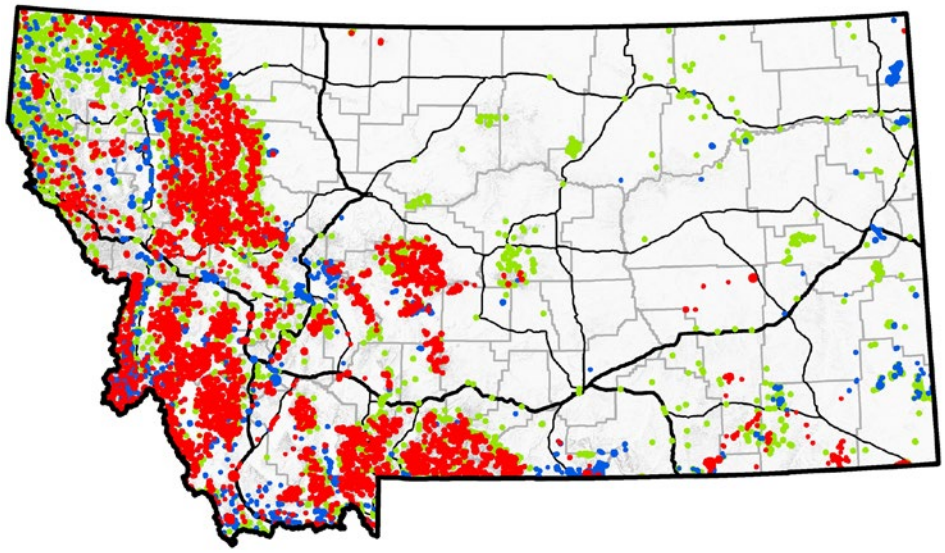

Figure 4-1. The distribution of Plant Species of GCN in Montana. Priority 1 SOC plants are in red. Priority 2 SOC plants are in blue. Priority 1 and 2 plants of management concern are in green.

Photo Credit: Henry Hardin

*Photo 4-5. Short-spined Horsebrush (*Tetradymnia spinosa*) shrubs grow in very sandy, and often alkaline, soils. This population occurs in Yellowstone National Park, Montana.*

Photo Credit: Clint Whittle-Frazier

*Photo 4-6. A Citizen Botanist conducts a survey for Small Onion (*Allium parvum*) by meandering through sagebrush steppe habitat in southwest Montana.*

in acreage are the Forest and Woodland, Human Land Use, and Shrubland, Steppe, and Savanna Level-1 ES with each occupying just under 20% in Montana. The Recently Disturbed or Modified Level-1 ES accounts for 8% of Montana; these are places in ecological transition resulting from timber harvests, wildland fires, insect-killed trees, reforestation, or colonized by introduced vegetation. The Wetland and Riparian Level-1 ES accounts for about 5% of Montana. Sparse and Barren Level-1 ES, such as sand dunes, badlands, and cliffs, occupy about 3% of Montana. The Alpine Level-1 ES, which occupies the highest elevational habitat, accounts for the least acreage, at 1% of Montana.

Plant Species of GCN are found in all eight of the Level-1 Ecological System groupings in Montana (Figure 4-2) (MTNHP 2024b). The Forest and Woodland and Wetland and Riparian Level-1 ESs have the greatest number of GCN plants at 42 species each. Following in numbers of GCN plant species is the Grassland, Shrubland, Steppe, and Savanna, and Sparse and Barren Level-1 ESs. Although the Sparse and Barren Level-1 ES accounts for less than 5% of the land base, it is habitat for 20% of GCN plant species. The low number of GCN plant species supported by the Alpine Level-1 ES is most likely a reflection of intact native habitat experiencing few documented threats[6]. The Human Land Use Level-1 ES,

[6] The MTNHP Threat Assessment (2021) and Climate Change Vulnerability Index (2021) acknowledges that climate change is projected as a major threat for many alpine SOC vascular plants; however, actual data has been sparse or lacking for assessed plant species.

which consists of mines, roads, and cultivated areas, and the Recently Disturbed or Modified Level-1 ES, contain only a few GCN plant species.

Land Ownership and Plant Species of GCN

Montana has a diverse land ownership (Figure 4-3) (MTNHP 2024d). More than 50% of the state is privately owned. Nearly 28% of the land base is under federal management, including 18% USFS, approximately 9% Montana/Dakotas BLM, and just over 1% National Park Service. Tribal nations own about 9% of the land base. The State of Montana itself owns relatively little land, at about 6%. Conservation easements under private, federal, state, or other ownerships account for just under 5% of the land base. The remaining 4% is owned by local governments and others.

Plant Species of GCN are found in all categories of land ownership in Montana (Figure 4-3). Nearly 70% of GCN plant species have at least one population on privately owned lands. Consequently, private landowners play an important role in conserving our state's rare species and native flora. Almost all GCN plant species have at least one population on federal lands: USFS-Region 1, MT/Dakotas BLM, and National Park Service (NPS). While the NPS occupies less than 2% of Montana's land base, it supports populations for almost a third of the GCN plant species. State of Montana lands support populations of at least 40% of the GCN plant species. Nearly a third of GCN plant species have at least one population on lands under conservation easements. Tribal lands support populations of about 20% of the GCN plant species. Even local government lands support many Plant Species of GCN.

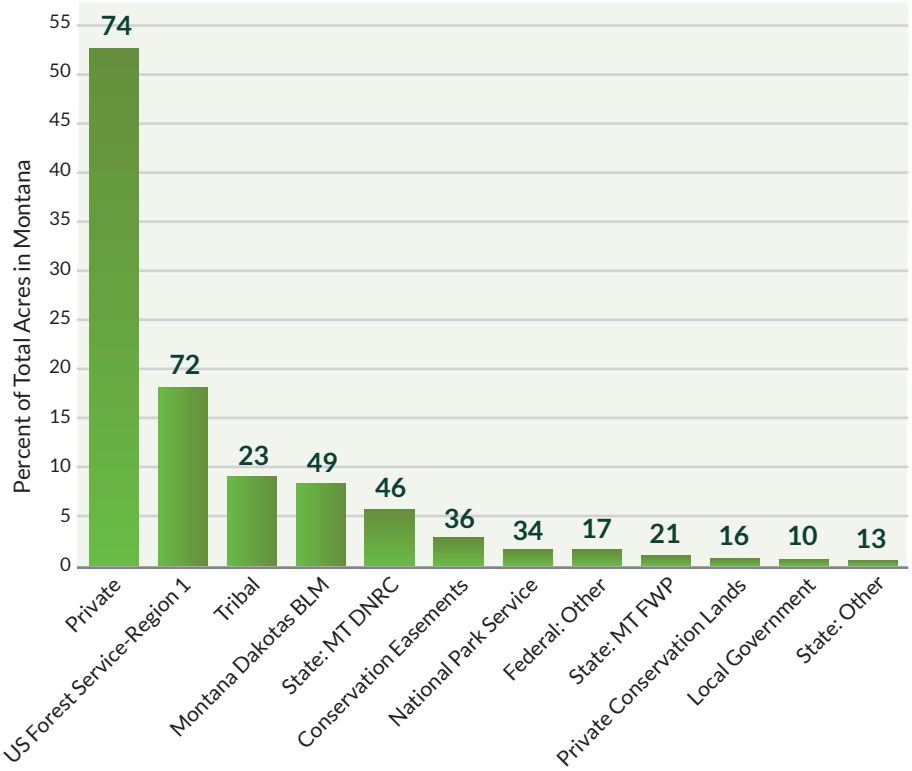

Figure 4-3. The percentage of total acres in Montana by land ownership category. The number of Plant Species of GCN found in each land ownership type is listed above the bar. *Note: Most species have populations in more than one land ownership category. Data Source: MTNHP 2024d.*

Challenges Faced by Plant Species of Greatest Conservation Need

For Plant Species of GCN and other rare plants, challenges to their persistence can come from both natural and anthropogenic sources. Many of these plant species are naturally rare because they are restricted to very specific habitats or rely on specific climatic conditions. Others are rare or in decline from actions directly or indirectly related to humans. Montana's human population has now exceeded one million people, which is a significant statistic for a rural state (US Census Bureau 2024). As Montana's population grows and shifts, conservation planning becomes increasingly necessary to avoid placing these plant species at further risk from detrimental human activities, such as habitat degradation. It is also important to know which species are facing specific threats and where their populations are secure or threatened.

To understand the stressors or factors that may threaten the persistence of Montana's Plant Species of GCN and other rare plants, the Montana Native Plant Society (MNPS) and MTNHP teamed up in 2006 to collect data on reported threats. Today, the MTNHP tracks reported threat data, and uses NatureServe methods to convey their impact through a State Threat Score (Box 4-3). Below, we summarize the common or serious human activities that can negatively impact one or more populations of Plant Species of GCN, other rare plants, and habitats, thereby increasing their risk of extirpation in Montana.

Altered Hydrological Regimes

The natural volume, flow, and distribution of water within Montana has changed since European settlement. Manmade structures such as dams, irrigation ditches, and diversions can interrupt the natural patterns of flooding and drying. Altering stream channels, especially through straightening, and filling in wetlands

Because they are rooted in place, plants can't move out of the way of an oncoming bulldozer or take shelter until danger passes. And because many rare plants are highly localized, growing only in very specific soils or micro-climates, they are particularly susceptible to being wiped out, often without anyone's knowledge. They are, in effect, hidden in plain sight.

~ Stein and Gravuer, NatureServe 2008

changes the availability of water in terms of timing, duration, and/or volume. Depending upon the species and its biological attributes, modifying hydrology can benefit or hinder the persistence of Plant Species of GCN. Examples of species that require periods of flooding followed by drying in the growing season to carry out their life cycle include Ute Ladies'-tresses, Water Howellia, and Scarlet Ammannia (*Ammannia robusta*) (Fertig et al. 2005; USFS 1997; Scarlet Ammannia Recovery Team 2008).

Invasive Species and Noxious Weeds

Noxious and invasive non-native species cause harm to Plant Species of GCN, other native

Photo Credit: Andrea Pipp

*Photo 4-7. Cheatgrass (*Bromus tectorum*) invading into a native community of Big Sagebrush (*Artemisia tridentata*). Given time the buildup of Cheatgrass litter can alter the natural fire regime of this habitat.*

Box 4-3. NatureServe's Threat Assessment: Factors for evaluating a species' risk (Master et al. 2012).

THREAT DEFINITION

The proximate activity or process that has caused, is causing, or may cause the destruction, degradation, and/or impairment to the species. Threats may be related to human activities or may be natural.

FACTORS TO ASSESS

Intrinsic Vulnerability

The observed, inferred, or suspected degree to which characteristics of the species make it vulnerable or resilient to natural or anthropogenic stresses or catastrophes.

Examples: reproductive rates, time to maturity, dormancy requirements, dispersal patterns.

Threat Categories (Types)

A list of at least 100 major threat types developed by the IUCN:
https://www.iucnredlist.org/resources/threat-classification-scheme

The IUCN list provides consistency for reporting and analysis. For each threat type, timing, scope, and severity are assessed, as follows.

Timing: Past, ongoing, or future. Note that only ongoing threats are used to assign a threat score.
High: Threat is operational (happening now).
Moderate: Threat is likely to be operational within the short term.
Low: Threat is likely to be operational in the long term.
Insignificant: Threat may exist but is not likely to be operational within the scope of this analysis.

Scope: Number of Species Occurrences (SOs) or proportion of all observations across the state affected by the threat type.
Pervasive: 71-100% of total population or area affected
Large: 31-70% of total population or area affected
Restricted: 11-30% of total population or area affected
Small: 1-10% of total population or area affected
Negligible: less than 1% of total population or area affected
Unknown

Severity: Overall decline caused by the threat. Severity is determined at the observation or SO levels.
Extreme: 71-100% decline in observed population
Serious: 31-70% decline in observed population
Moderate: 11-30% decline in observed population
Slight: 1-10% decline in observed population
Negligible: less than 1% decline in observed population.
Neutral or Potential Benefit
Unknown

RANK CALCULATOR

Developed by NatureServe the Conservation Rank Calculator is a tool that automates the process of assigning a species' conservation status rank (G-Rank and S-Rank) and its level of risk to extirpation in Montana while allowing for a manual override.

plants, cultural resources, the economy, and human health (MISC 2024). They threaten native plants because non-natives lack vectors that control their growth and reproduction, such as other organisms that will eat them, cause disease, or heavily compete for water and nutrients. Some noxious and invasive plants colonize niches that were previously unoccupied by native plants, especially in drier habitats such as grasslands and shrublands. Noxious and invasive species are highly successful at capturing nutrients and water and suppressing other plants; they grow and reproduce rapidly. As an example, Spotted Knapweed (*Centaurea stoebe*), a noxious weed, can suppress seed germination

and establishment of Sapphire Rockcress (*Boechera fecunda*), a Plant Species of GCN that is restricted to a Unique Habitat of GCN (Lesica and Shelly 1996; see conservation profiles in Appendices A and B). Some invasive plants, such as Cheatgrass (*Bromus tectorum*) can permanently modify both the ecology and species composition of a native plant community (Photo 4-7). Some other non-native plants, not officially designated as noxious or invasive, can also harm native plants and habitats. Some of these non-native plants are still used for ornamental, agricultural, or rangeland purposes, such as Smooth Brome (*Bromus inermis*), Crested Wheatgrass (*Agropyron cristatum*), and Baby's-breath (*Gypsophila* spp.). Other non-native plants, including some garden plants, may escape cultivation and become problematic in certain parts of the state or under specific environmental conditions.

Federal and state land management agencies, county weed districts, and private landowners play a huge role in managing noxious and invasive non-native plant species in Montana. Montana is fortunate to have several key partners who work with all land management agencies, county governments, and landowners on noxious and invasive species prevention, management, and education (Box 4-4).

Box 4-4. Important partners and resources in Montana for the prevention, education, and control of noxious and invasive species.

Montana Invasive Species Council (MISC)

The Council is a diverse group of scientists and resource managers charged with identifying priority invasive species issues and making recommendations to improve invasive species management (MISC 2024): https://invasivespecies.mt.gov/misc/about-us

Montana Department of Agriculture (MDA)

Designates noxious plant species and provides state coordination, educational resources, early detection and rapid response (EDRR), weed free certification of materials, and funding. Funding supports county and tribal weed programs, research and development, local & statewide educational programs, EDRR program, and local cooperative-landowner cost share projects.

- Montana Noxious Weed Management Plan (MDA 2017): https://agr.mt.gov/_docs/NWTF-docs/MT-Noxious-Weed-Management-Plan--Update-2017.pdf
- Montana Noxious Weed Programs: https://agr.mt.gov/Noxious-Weeds

County Weed Districts

Provides education and assistance to the public on proper plant identification, integrated weed management of noxious weeds, and is responsible for administering the Montana Local County Weed Control ACT: https://leg.mt.gov/bills/mca/title_0070/chapter_0220/part_0210/sections_index.html

Montana Weed Control Association (MWCA)

- A non-profit partner that facilitates long-term, ecologically based, integrated weed management programs (MWCA 2024).
- Provides coordination and education for federal, state, and county professional weed managers, educators, and landowners; website provides contact information for county weed districts. https://www.mtweed.org/

MSU Extension Services

- Schutter Diagnostic Lab: Helps landowners identify plants, diagnose plant diseases and insect damage, and solve other problems: https://www.montana.edu/extension/diagnostics/
- Local Extension offices serve 56 counties and 7 reservations: https://www.montana.edu/extension/localoffices.html

Mining

Mining has been part of Montana's economy since the early 1800s. The General Mining Act of 1872 authorizes and governs prospecting and mining for economic minerals on federally-owned public lands. Passage of this federal law led to the establishment of thousands of mines in Montana, and to our state's nickname as The Treasure State (Anderson 2020). Today, coal, hard rock[7], and opencut[8] mining on public and private lands remains as important components of Montana's economy.

Although mining results in ground disturbance and can negatively impact native plants, laws and policies that govern remediation and reclamation can mandate the use of native plant materials, native soils retention, and other beneficial actions. For example, Woolly Twinpod (*Physaria didymocarpa* var. *lanata*) is a Plant Species of GCN that has been impacted by past mining; a mine company is actively working to propagate and re-establish populations (Glenn 2021). Potential negative impacts from mining activities include trampling and direct removal of plants. Potential indirect negative impacts include habitat disturbance, soil erosion, altered hydrology (volume, duration, and water quality), soil compaction, disruption or elimination of soil biota, concentration of heavy metals, and colonization by invasive species.

Tourism, Plant Collecting, and Motorized Recreational Activities

Montana is a destination state for tourists, especially those looking for outdoor activities. Tourism is a significant portion of Montana's economy and can both help and hinder plant conservation[9]. Tourism can aid plant conservation efforts by increasing public awareness and appreciation for Montana's Plant Species of GCN and other native flora. Habitat-based (camping, hiking, rafting, and others) and plant-based (foraging, viewing, field trips, and others) experiences can bolster Montana's economy, but over-collecting and/or excessive disturbance to native plant species can occur and reduce population viability.

Photo Credit: Andrea Pipp

Photo 4-8. An active gold mine in Silver Bow County, Montana.

[7] Hard Rock are metals and minerals (MTDEQ 2024).
[8] Opencut minerals include bentonite, clay, scoria, soil materials, peat, sand, and gravel (MTDEQ 2024).
[9] The Montana Resiliency Plan aims to help local communities adapt and recover from social, economic, and environmental disruptions: https://redesign-commerce.mt.gov/Business/Programs-and-Services/Tourism-Marketing/Tourism-Grant-Program/Resiliency-Plan-Implementation-Grant-Program

Recreational activities can also negatively impact native habitats and rare plants if not managed properly. Plant collecting, whether for food, floral arrangements, or wildcrafting, can lead to unsustainable practices. Motorized recreation, including off-highway, off-road (ORV), all-terrain (ATV), and four-wheel drive vehicles, motorcycles, and snowmobiles, is increasingly popular and often difficult to regulate or prevent in places where Plant Species of GCN and other rare plants occur. Douglas' Bladderpod (*Physaria douglasii*), a Plant Species of GCN, is known from one general area in northwest Montana where its habitat is also used for motorized recreation (MTNHP Threat Assessment 2021). Thrill-seekers and organized competitions now advocate breaking natural barriers, allowing motorized vehicles into areas previously thought to be inaccessible. In Montana, unauthorized motorized recreation in the Italian Peaks area occurs where several rare plants are found, such as Pink Coil-beaked Lousewort (*Pedicularis contorta* var. *ctenophora*) (MTNHP Threat Assessment 2021).

Residential, Commercial, and Transportation Development

Montana's population is growing denser and urban areas are expanding (US Census Bureau 2024). Expanding residential and urban development, along with associated infrastructure (roads, utilities, trails, and flood-control systems), is reducing and fragmenting important habitat for native plants and plant communities. For Plant Species of GCN, Ute Ladies'-tresses and Velvetleaf Huckleberry (*Vaccinium myrtilloides*) have had a decrease in population size at specific sites due to development (MTNHP Threat Assessment 2021). Exurban development (low-density rural development), which is the fastest-growing land use in the United States, has been found to reduce many native species near homes and increase exotic species, with effects manifested over decades (Hansen et al. 2005). In addition to local impacts, exurban development may alter ecological processes and biodiversity on adjacent and distant public lands. Underlying mechanisms involve alteration of ecological processes and biotic interactions, introduction of invasive species, habitat fragmentation, and increased human disturbance (Hansen et al. 2005).

Photo Credit: Matthew Stewart, 406 Stewart Photography

Photo Credit: Erin Carroll

*Photos 4-9a/b. Columbia Lily (*Lilium columbianum*) grows in moist forest openings of northwest Montana. Where roadways intersect its habitat, these showy plants can be over-harvested by people wanting to make a pretty bouquet or add to their garden. Unfortunately, transplanted native lilies usually die.*

Roads can have a serious negative impact on the natural integrity and habitat suitability of rare plant sites. Along with extirpating populations and destroying habitat, roads contribute to fragmentation that may interfere with natural processes such as pollination and seed dispersal. Other impacts from road construction and maintenance (e.g., mowing and herbicide application) include erosion, sedimentation, increased soil toxicity, and vectors for invasive species spread.

Agricultural Development

Montana's agricultural industry provides a variety of foods for local, national, and international consumption; strengthens local economies throughout the state; and for certain commodities is strongly interdependent with native plant conservation. Proper inventory and use of native plant communities is especially important for livestock production operations in central and eastern Montana. Production of native plant materials – seedstock and live seedlings – that are well-adapted to the state can improve conservation practice technologies and enhance natural resource protection. The Bridger Plant Materials Center[10] in Bridger, Montana has selected and released native grasses, forbs, shrubs, and tree species and germplasm for commercial seed increase and use in revegetation projects through the state (NRCS 2024).

Conversely, agricultural practices that plow native or intact grassland habitat can harm native plants, habitat, and pollinators. In the Northern Great Plains, which includes two-thirds of Montana, intact grasslands continue to be plowed at large-scale and converted to commodity crops (wheat, corn, soybeans, and rice) (WWF 2023). Although some conversion does yield a human food product, a large amount is subsidized by crop insurance programs or ultimately exported solely as biofuel (WWF 2023). However, through collaboration, policies can be improved to conserve land, soil, and water resources (WWF 2023) (see Section 3, Policy/Regulation Conservation Objective, #8). The Plant Species of GCN, Scallop-leaf Lousewort (*Pedicularis crenulata*), has been negatively impacted by agricultural practices that use native riparian meadows for haying operations.

Altered Disturbance Regimes

Some Plant Species of GCN and other native plants require ecological disturbances to sustain their populations. Such native plants rely on a certain amount, frequency, or duration of disturbance to maintain their preferred environmental conditions - stimulate germination or growth, transport seeds, and/or reduce competition with other vegetation. In Montana, the most common, and often natural, disturbance regimes are native and domestic ungulate grazing and browsing, wildland fire, and flooding. Alterations to the historic frequency and intensity patterns of these disturbance regimes can lead to population declines and natural plant succession that will eventually diminish or eradicate the species' required habitat.

Browsing and Grazing

Grasslands, and most of the native species within them, co-evolved with a variety of grazing animals. In Montana, grasslands were historically grazed by large herds of bison, and also by deer, elk, and pronghorn. Today, much of the grassland biome is managed by either a livestock operation on private lands or through grazing permits and leases that authorize use on federal or state public lands that are designated in land use plans. Proper land stewardship seeks to manage livestock and native ungulate grazing with a frequency,

[10] USDA, Natural Resources Conservation Service, Bridger Plant Materials Center, Montana: https://www.nrcs.usda.gov/plant-materials/mtpmc

duration, and intensity that maintains plant diversity and forage levels. Many Plant Species of GCN and other native plants require a certain amount of browsing or grazing, and/or some ground surface disturbance to retain healthy viable populations, early-successional habitat, or other environmental conditions. Plant Species of GCN that require these types of disturbance include Ute-ladies'-tresses, Spalding's Catchfly, and Quaking Aspen (*Populus tremuloides*) (Fertig et al. 2005; USFWS 2007; Rogers 2017).

Ecologically incompatible grazing or browsing practices can result in the overuse or underuse of the grassland (or rangeland). Overuse can result in excessive herbivory of sensitive plants, trampling of vegetation and soil crust biota, and severe soil compaction of the rangeland. Underuse can result in low levels of herbivory of late-seral grassland species, a build-up of plant litter (thatch), and poor levels of nutrient and organic matter cycling. Indirectly, ecologically incompatible grazing practices change soil moisture and texture which affects plant establishment and growth and alters animal communities, including pollinators. Ultimately, it is the plant community composition along with the timing, intensity, duration, and frequency of grazing that determines if the browsing or grazing by livestock or native ungulates is beneficial or harmful to Plant Species of GCN and other targeted native plant species.

Wildland Fire

Native plant species, including those of GCN, vary in their response to natural wildland fires. Some plant species, such as perennials, can survive a wildfire if their underground buds or roots are not killed. Other species, such as annuals, may not survive if the fire is very intense and causes high soil surface temperatures. Fire can set back the successional development of the vegetation, thereby thinning or reducing plant densities; this can stimulate new growth. For some habitats, the absence of fire can lead to the advancement of succession, increasing plant densities or changing plant species composition through time. In grasslands, the absence of

Photo Credit: Andrea Pipp

*Photo 4-10. A botanist conducts a revisit in 2015 to a Water Howellia (*Howellia aquatilis*) pond. In 2003 this site was completely surrounded by the Crazy Horse Fire, a stand-replacement wildfire.*

fire can lead to dense thatch, lower species diversity, and impede seed germination. It is the timing, intensity (temperature), severity (degree to which a fire consumes vegetation), and duration of a wildland fire, among other environmental factors, that determines how individual species and the whole plant community responds. Plant Species of GCN that can respond positively to natural fire regimes include Spalding's Catchfly, Quaking Aspen, and Lemhi Beardtongue (*Penstemon lemhiensis*). (Lesica 1999; Rogers 2017; Stucki et al. 2013).

Many Indigenous peoples used fire or "Cultural Burning" since time immemorial, to improve the vitality of grasslands and forests and strengthen their resilience (Longknife 2024). Cultural burning has been banned in some states (Longknife 2024). Cultural burning was once a lost tradition, but is now practiced and taught to the young by "Fire Keepers"(Longknife 2024).

Flooding

Refer to the Altered Hydrological Regime in this subsection of the Strategy.

Climate Change

Climate change is one of the greatest threats to the conservation of species and ecosystems and it is having serious impacts across the globe (Neely et al. 2009). The US Global Change Research Program defines climate change as "Changes in average weather conditions that persist over multiple decades or longer. Climate change encompasses both increases and decreases in temperature, as well as shifts in precipitation, changing risk of certain types of severe weather events, and changes to other features of the climate system." (Whitlock et al. 2017).

The Montana Climate Assessment[11] aims to synthesize, evaluate, and share credible and relevant scientific information about climate change in Montana (Whitlock et al. 2017). A few of the major findings from the 2017 assessment are:

- From 1950 to 2015, annual average temperatures as measured by daily minimums, maximums, and averages, have risen across the state by 2 to 3 degrees Fahrenheit.
- From 1951 to 2010, the growing season in Montana increased by 12 days.
- From 1950 to 2015, there have been no historical changes in average annual precipitation, but there are changes in average seasonal precipitation. Average winter precipitation has decreased by 0.9 inch, especially in the western and central portions of the state. Spring precipitation has increased by 1 to 2 inches, especially in the eastern portion of the state.
- The state is projected to continue to warm in all geographic locations, seasons, and under all emission scenarios throughout the 21st century.
- The number of days in a year when daily temperatures exceed 90 degrees Fahrenheit and the number of frost-free days are expected to increase across the state.
- Across the state, precipitation is projected to increase in winter, spring, and fall and decrease in summer.
- Local site and forest stand conditions will influence the effect of increased ambient temperatures on individual tree species, but increased extreme heat will negatively impact species and forest-wide processes.

[11] 2017 Montana Climate Assessment and 2021 Climate Change and Human Health in Montana reports: https://montanaclimate.org/

- Temperature will drive the direct effects of climate change on individual tree species in energy-limited forests.
- Moisture levels will drive the direct effects of climate change on individual tree species in water-limited forests
- Over the long-term, the speed and magnitude of climate change may mean that higher forest mortality and reductions in forest distribution will be outpaced by gains in forest growth and productivity leading to a net loss in forested areas in the state.

In 2021 the MTNHP conducted a Climate Change Vulnerability Index (CCVI) study on 232 of Montana's SOC vascular plants. The CCVI uses published literature and a scoring system to rapidly assess the vulnerability of a species to climate change (NatureServe 2016) (Box 4-5). The study concluded that of the 232 SOC plants, 45 species (19%) scored as extremely vulnerable, 64 species (28%) as highly vulnerable, 82 species (35%) as moderately vulnerable, and 41 species (18%) as lowly vulnerable to climate change. The study also found that alpine plants in Glacier National Park are less vulnerable to climate change than those in the Beartooth Plateau because the park exhibits less change in moisture and temperature regimes. In addition, species that live in places that exhibit a wide range in precipitation levels are not as vulnerable to climate change. For example, Alpine Poppy (*Papaver radicatum* ssp. *kluanensis*) is less vulnerable to climate change than other alpine plants in this study. A full report has not been written, but CCVI scores can be found on the Montana Field Guide[12] species' profile.

Climate change is directly and indirectly affecting native plant habitats and species, including Plant Species of GCN. In Montana, the density of 28 arctic-alpine and boreal plant species representing 46 populations that occur at the southern margin of their ranges was monitored from 1988 to 2014 (Lesica and Crone 2017). Over the 20-year analysis period, plant abundance declined by an average of 2.3% per year across all populations. Variation among species and within populations of the same species were also observed. However, the degree of plant density decline was greater than the increase. Plant density declined more for dicotyledonous species than for pteridophytes or monocots. The strong overall declining trend occurred simultaneously with warming summer temperatures and/or decreasing precipitation. Included in this study were 5 Plant Species of GCN: English Sundew (*Drosera anglica*), Pod Grass (*Scheuchzeria palustris*), Hudson's Bay Bulrush (*Trichophorum alpinum*), Tufted Club-

Photo Credit: Tim-Spoelma

*Photo 4-11. Western White Pine (*Pinus monticola*) trees grow in a research plantation on the Swan River State Forest in 2012.*

[12] MTNHP Montana Field Guide: https://fieldguide.mt.gov/

rush (*Trichorphorum cespitosum*), and Flatleaf Bladderwort (*Utricularia intermedia*).

The full impacts of climate change on Plant Species of GCN and other native species are complex. For example, the effects of climate change were one of four factors that led to the decision to list Whitebark Pine as threatened under the ESA (USFWS 2022). The analysis found, in order of impact, that White Pine Blister Rust, a fungal disease caused by *Cronartium ribicola*, Mountain Pine Beetle (*Dendroctonus ponderosae*), and altered fire regimes are not only major stressors on Whitebark Pine, but individually are also influenced by shifting weather patterns, due to climate change (USFWS 2022). Hence, climate change is directly and indirectly influencing Montana's native plant species, plant communities, and habitats.

Box 4-5. NatureServe's Climate Change Vulnerability Index (NatureServe 2016).

Purpose: The index uses a scoring system that integrates a species' predicted exposure to climate change within a defined assessment area (Montana) with four elements that associate with climate change sensitivity. For three elements, multiple factors are assessed using published studies and expert judgement.

1) Exposure to Local Climate Change
   - Measured by examining the magnitude of predicted temperature and moisture change across the species' Montana range.
   - Downscaled climate predictions made using Climate Wizard: https://www.climatehubs.usda.gov/hubs/southwest/tools/climate-wizard
2) Indirect Exposure to Climate Change
   - Exposure to sea level rise
   - Distribution relative to natural and anthropogenic barriers
   - Predicted impact of land use changes resulting from human responses to climate change
3) Species-Specific Sensitivity
   - Dispersal and movements
   - Predicted sensitivity to temperature and moisture changes
   - Restriction to uncommon geological features or derivatives
   - Reliance on interspecific interactions
   - Genetic factors
   - Phenological response
4) Documented or Modeled Responses to Climate Change
   - Documented response to recent climate change
   - Modeled future change in range or population size
   - Overlap of modeled future range with current range
   - Occurrence of protected areas in modeled future distribution
   - Factors not considered
   - Confidence

Results & Index Score Definitions

Extremely Vulnerable: Abundance and/or range extent in Montana extremely likely to substantially decrease or disappear by 2050.

Highly Vulnerable: Abundance and/or range extent in Montana is likely to decrease significantly by 2050.

Moderately Vulnerable: Abundance and/or range extent in Montana is likely to decrease by 2050.

Not Vulnerable/Presumed Stable: Available evidence does not suggest that abundance and/or range extent in Montana will change (increase/decrease) substantially by 2050. Actual range boundaries may change.

Not Vulnerable/Increase Likely: Available evidence suggests that abundance and/or range extent in Montana is likely to increase by 2050.

Insufficient Evidence: Information about a species' vulnerability is inadequate to calculate an Index score.

CONSERVATION GOALS & OBJECTIVES FOR PLANT SPECIES OF GREATEST CONSERVATION NEED

The intent of the *Strategy* is to promote the collective and coordinated stewardship of Montana's Plant Species of GCN to ensure their viability and persistence. To effectively conserve Plant Species of GCN requires a fusion of academic and pragmatic approaches, so solutions are both innovative and realistic (Given 1994). Effective conservation also depends upon public attitudes, good cost-effective techniques, and developing a range of approaches (Given 1994). These approaches include developing a plant species conservation scorecard; enhancing public education; improving habitat protection and restoration; recognizing or incorporating Native Americans' botanical knowledge; and collaborating on policies that can be applied across jurisdictions. Here in the Plant Species of GCN section of the *Strategy,* we present goals and suggest overarching voluntary objectives from four areas that are pillars of plant species conservation:

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

Photo Credit: Bruce Selyem

*Photo 4-12. Mealy Primrose (*Primula incana*) grows in moist to wet alkaline meadows. Plants are sustained by balance between proper hydrological conditions and vegetative disturbance.*

The conservation objectives and actions were developed from 2019 to 2024 by a large partnership of biologists, ecologists, botanists, land managers, educators, researchers, and retired professionals working for federal and state land management agencies, Tribal nations, academia, non-governmental organizations, and others (see Table 1 on page *iii*). The objectives are based on agency reports, published literature, professional expertise, and field observations. In addition, conservation objectives from other strategies were reviewed and cross-walked with this *Strategy*[13] to relay the idea that tactics can promote collaboration. Working within and across jurisdictional boundaries, these voluntary conservation objectives are intended to empower land managers, landowners, non-governmental conservation leaders, and individuals who want to contribute to or collaborate on efforts that help sustain Montana's Plant Species of GCN and other native plants across the Montana landscape.

[13] Montana Forest Action Plan (Montana Forest Action Advisory Council 2020): https://dnrc.mt.gov/_docs/forestry/Montana_Forest_Action_Plan_12.22.2020.pdf
Montana State Wildlife Action Plan (MFWP 2015): https://fwp.mt.gov/binaries/content/assets/fwp/gisresources/docs/swap/70169.pdf

Information Needs [Inventory, Monitoring, Research]

Conservation Goal

Through inventory, monitoring, and research, improve scientific understanding of species' interactions and of the natural history, distribution, and population trends for Plant Species of Greatest Conservation Need.

Conservation Objectives

1) Support MTNHP to work with federal, state, and Tribal botanists and land managers to develop a statewide Vascular Plant SOC-PSOC Conservation Scorecard that also includes Plant Species of GCN. Once established, strive to update it every five years. The interactive product (spreadsheet or GIS data layer) would provide a baseline of conditions on the species' distribution, population parameters, types of habitats, level of threats, level of land management protection, and other factors to determine an overall state conservation score of under-conserved, weakly conserved, moderately conserved, or effectively conserved. The scorecard would help identify and prioritize target species for protection, management actions, conservation actions, surveying, monitoring, and filling data gaps. Potential data fields and metrics to use include, but are not limited to:
   - Plant name(s)
   - Global and State Ranks
   - Federal, State, Tribal, and/or local designation
   - Population: measures of statewide population size
   - Habitat categories
   - Distribution categories
   - Threat score, CCVI Index, and/or other metrics of species-level stressors
   - Species Occurrence (SO) score: number, quality rating, and distribution of SOs
   - Landscape Integrity: a measure that captures the intensity of development around SOs
   - Land ownership category: federal, state, private, etc.
   - Land management classifications: wilderness, state trust, Research Natural Area, etc.
   - Other land designations: conservation easement, IPA, etc.
   - Overall conservation score

2) Develop a shared resource to identify and prioritize basic information needs for Priority 2 Plant Species of GCN. Actions include:
   a. Create shared lists or spreadsheets on the *Strategy*'s web page that highlight accomplishments and data gaps relative to information needs. Sharing data products on inventory, monitoring, and research as well as identifying greatest inventory needs could further conservation efforts for the specific Priority 2 Plant Species of GCN. A potential template to use can be found on the *Strategy*'s webpage.
   b. Identify at a coarse level which species are in greatest need of inventory and prioritize locations for inventory, such as by SO, land management unit, or other.
   c. Compile a list of established monitoring protocols and identify the species, authors, and organization.

d. Compile a list of pertinent research with references and links for each species.

e. Compile a list of Best Management Practices, conservation strategies, or other management guidelines for each species, and provide full references or links.

3) Work collaboratively with federal, state, Tribal, and private landowner partners to acquire necessary field data to review and revise the following ranks for Plant Species of GCN using MTNHP/NatureServe methodologies:

a. Subnational Ranks (S-Ranks). An S-Rank indicates the overall risk to extirpation in the state by collectively evaluating the plant's rarity, population trends, and level of threats.

b. Species Occurrence Ranks (SO-Ranks). Strive to update SO Ranks on a five- to ten-year cycle. 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 references sites, and aiding management decisions.

c. State Threat Score and rationale. Update the State Threat Score every five years, or as warranted by current data. 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 (Master et al. 2012).

4) Help ensure the MTNHP continues to share acquired information and data in a timely fashion with partnering organizations, including federal, state, and local government agencies, Tribal Nations, and NGOs, through communication, data-sharing agreements, funding, and information requests.

Photo Credit: Megan Hessling

*Photo 4-13. Coordinated efforts between the US Forest Service, Montana Native Plant Society, and recreationalists are helping to acquire necessary data that could aid in the conservation of Douglas Bladderpod (*Physaria douglasii*).*

Information Needs [Inventory, Monitoring, Research]

5) Through collaboration, develop survey protocols and standards that apply within and across jurisdictional boundaries where the Plant Species of GCN is found in Montana. For species that have current protocols, review and revise as warranted. Protocols are best developed by people with species-specific knowledge, management authority, and other vested interests.

6) For federal, state, and other partners, consider posting agency reports, status assessments, monitoring protocols, research publications, and other products relevant to Plant Species of GCN on the MTNHP's webpage for the Montana Native Plant Conservation Strategy. Sharing assessment, status, and monitoring reports makes them more accessible to scientists, land managers, decision-makers, and the public.

7) Conduct field-based inventories for each Plant Species of GCN to fill data gaps and increase knowledge about its geographic range, distribution, population size, habitat condition, threats, and status:

   a. Revisit known locations to acquire current mapping and information on population parameters, habitat condition, and threats. Revisit known locations of Plant Species of GCN at least once every ten years to acquire information on presence/absence, population parameters, threats, and habitat condition. Provide information to the land management agency or landowner. See also c and d below.

   b. Conduct surveys in areas of potential or modelled habitat to determine presence, after first securing landowner permission.

   c. Consider providing both positive and negative survey results for the targeted species to the MTNHP for inclusion in the statewide plant and animal database; ensure that landowners and land managers grant permission to share the data.

   d. Consider collecting and submitting field-based data using MTNHP's forms and tools[14].

   e. Collect additional site metrics such as soil, geology, hydrology, associated species, terrain features, population demographics, and other information. Collecting data beyond species presence helps botanists and other land managers revise rankings, improve predictive suitable habitat models, and assist with other conservation tasks.

   f. Document new locations with a voucher specimen, if the population is large and after ensuring that best practices for collection[15], and land management or landowner regulations are followed. Submit to an appropriate Montana or Tribal herbarium (see also Section 4, Outreach and Education Conservation Objective #4; Section 3, Protection and Restoration Conservation Objective #13, and Section 7).

[14] MTNHP Observation Forms and Tools: https://mtnhp.mt.gov/submit/

[15] Online sources to find "best practices for plant collecting", including these websites:
- MNPS: https://mtnativeplants.org/wp-content/uploads/2018/07/MNPS-Guidelines-for-Collecting-Native-Plants-.pdf
- University of Montana Herbarium, How to Press a Plant: https://www.umt.edu/herbarium/documents/education/how-press-plants.pdf

Information Needs [Inventory, Monitoring, Research]

8) Where management, human activities, or potential threats occur in vicinity of a Plant Species of GCN, consider designing a monitoring or research study to evaluate any cause and effect. Cause-and-effect monitoring and research studies can inform future mitigation strategies, effects analyses, project planning, and assist in developing best management practices for the target plant. Types of activities or threats to monitor include, but are not limited to:
   - Forestry prescriptions
   - Noxious weed or invasive species incursions
   - Herbicide treatments
   - Wildland fire or prescribed fire treatments
   - Motorized vehicle use
   - Livestock grazing prescriptions
   - Recreational use and/or potential impacts

9) Consult the technical reference *Measuring and Monitoring Plant Populations* (Elzinga et al. 1998) when developing management questions and designing research studies and monitoring projects (refer to Resources section).

Photo Credit: Andrea Pipp

*Photo 4-14. Montana's iconic riparian forests face threats from non-native invaders. In the floodplain, Plains Cottonwood (*Populus deltoides*) grows well, but is met with competition from Salt Cedar, (*Tamarix ramosissima*), a noxious weed. Along the riverbank Russian Olive, a regulated weed, establishes.*

Information Needs [Inventory, Monitoring, Research]

10) Support, fund, or conduct research on specific Plant Species of GCN that focus on, but is not limited to:
    - reproductive biology (e.g., pollination, breeding system, seed dispersal mechanisms)
    - life history (e.g., germination requirements, growth, survival to reproduction)
    - ecology (e.g., edaphic [soil] requirements and mycorrhizal fungi relationships)
    - important environmental processes needed for survival (e.g., fire, hydrological disturbances)

11) Conduct systematics and genetic research of Plant Species of GCN. Priority species include, but are not limited to:
    - Red Alder - *Alnus rubra*: Montana's populations occur at the eastern edge of its range. It is unclear whether Montana's populations are genetically pure species or hybrids.
    - Howell's Gumweed - *Grindelia howellii*[16]: Well-designed research studies that further examine the genetic relationships of species within the *Grindelia* genus, including *Grindelia howellii*, would help manage and protect this plant.

12) Identify and prioritize research needs for Plant Species of GCN that would bolster policy decisions and share these priorities with the academic community and other partners.
    - The USFS has produced species conservation assessments for many plants in the Pacific Northwest and Great Plains regions that provide a sound scientific foundation for management.
    - The USFWS relies on information from inventory, monitoring, and research to guide its Species Status Assessment (SSA) process, which:
        - Provides the scientific background to support ESA decisions, including listing, consultations, status reviews, and recovery plans;
        - Describes the biological and ecological requirements for a species' survival and reproduction, along with its current conditions and potential extinction risks; and,
        - Identifies key knowledge gaps that inventory, monitoring, and research can help address.

13) Conduct Montana-based research to examine plant responses to climate change for Plant Species of GCN and other species with federal or state designations.

14) Write a report on the 2021 Climate Change Vulnerability Index study that assessed 232 SOC vascular plants, and make it available on the MTNHP Strategy's web page.

15) Contribute information to help MTNHP determine or update Climate Change Vulnerability Index scores for Plant Species of GCN and other SOC and PSOC vascular plants. Obtain, read, and share with MTNHP scientific publications that address plant responses to climate for these vascular plants and their close relatives. See also Section 4, Challenges Faced by Plant Species of Greatest Conservation Need, Climate Change.

[16] Readers interested in *Grindelia howellia* should also consult Williams and White (2017): https://archive.org/details/GrindeliahowelliiGenetics-MontanaMTNHP-USFS2018/mode/2up

Conservation Goal

Secure on-the-ground, site-specific habitat and/or management protection or restoration for Plant Species of Greatest Conservation Need - on public and private lands - and adopt measures for off-site conservation in case native populations are extirpated.

Conservation Objectives and Actions

1) Promote Montana native plant materials that are state-, Tribal-, or locally- sourced for use in landscaping, restoration, remediation, and reclamation projects. Advocate also for the expansion of locally accessible plant material sources throughout the state. Restoring land with accessible state and locally sourced native plant materials increases the probability of their use, creates native habitats, and directly or indirectly benefits Plant Species of GCN and other native plants. Refer also to Section 3, Information Needs Conservation Objective #6 and Protection and Restoration Conservation Objective #5.

Photo Credit: Bruce Selyem

*Photo 4-15. Yellow Beeplant (*Cleome lutea*) has an annual life cycle which requires disturbance to maintain populations.*

2) For Tribal nations in Montana, consider collaborating or partnering with the Montana Department of Natural Resources and Conservation (MTDNRC) nursery as a place to grow-out or increase production of culturally significant plants. The MTDNRC nursery works with all Tribes in Montana and can assist in increasing capacity and providing land for Tribal projects and species. The MTDNRC nursery does not need to retain any Tribal plant materials.

3) Work with the Montana Department of Transportation and the US Army Corps of Engineers to revise goals and credits when a native plant that has cultural value is found and the population can be protected at a wetland mitigation site or bank. Plants that have cultural value are determined by Tribes in Montana as being of great importance as a medicinal, ceremonial, and/or food plant. Restoring wetlands to promote the retention of culturally valued native plants helps ensure wetland function, native species persistence, and the maintenance of Indigenous peoples economies, Traditional Knowledge (TK) systems, and livelihoods. The retention of culturally valued native plants can be done in wetland projects that are on and off Tribal lands.

4) Minimize impacts caused by over-collecting of Plant Species of GCN, their close relatives, and other native plants on with federal, state, Tribal, and other lands. Over-collecting of native plants, especially orchids, ferns, and lilies, reduces population sizes and can hinder reproduction, animal pollinator habitat, and cause other harm. Wildland plants can be harvested or over-collected by people: interested in horticulture, hobby trading, and herbal trading; making voucher specimens for herbaria; and foraging to eat or process foods. Tactics to prevent or minimize over-collecting of plants include, but are not limited to:
   a. Apply the 1-in-20 rule, ensuring that for every collected individual at least 20 others remain untouched[17]. Increase the 20-plant minimum for species with slow reproductive rates, populations that exhibit poor viability, populations that are not widely dispersed, or in other situations.
   b. Monitor to quantify potential impacts from over-collecting, and use results to guide management on the land decisions.
   c. Develop and implement Best Management Practices or other guidelines for sustainable collection of wild native plants on lands in your jurisdiction.
   d. Propagate Plant Species of GCN and other native plants from sustainable methods of seed collecting or from plant materials sourced by the Montana Conservation Seedling Nursery, Tribal nurseries, academic institutions, or other reliable sources.
   e. Comply with all applicable laws and regulations, including landowner policies and federal, state, and Tribal acts, public land policies, harvesting prohibitions, and permitting requirements.
5) Prevent, minimize, and control the spread of noxious and invasive plants and animals, especially in the vicinity of Plant Species of GCN and their habitats, and along roads, trails and other vectors that intersect with their locations. Actions include, but are not limited to:
   a. Support weed managers and landowners in their efforts to obtain the best data and learn how to identify Plant Species of GCN.
   b. Promote the application of national campaigns, specifically, PlayCleanGo[18] and CleanDrainDry[19].
   c. Take action to stop the introduction and spread of existing and new noxious, invasive, and other non-native species. Landowners and others can get help with species identification, prevention, management, and education from state and county agencies (see Box 4-4) such as:
      - MSU Extension Offices and Schutter Diagnostic Lab
      - County weed districts
      - Montana Department of Agriculture
      - Montana Invasive Species Council

[17] 1-in-20 Rule: https://herbarium.eku.edu/sites/herbarium.eku.edu/files/files/CollectingEthics.pdf
[18] PlayCleanGo - Learn more at: https://playcleango.org/
[19] CleanDrainDry – Learn more at: https://fwp.mt.gov/conservation/aquatic-invasive-species

d. Promote the use of native plant species and sustainably-grown materials in revegetation projects.

e. Use certified weed-free materials in restoration, remediation, and reclamation projects, and when recreating (horseback trail riding; camping; rodeo events; and others) on public lands.

f. Where native species cannot be acquired or used in landscaping, plant non-invasive tree, forb, and grass species.

g. Protect undisturbed native plant communities, especially those with Plant Species of GCN, through on-the-ground habitat protection.

h. Seek federal- or state-level funding for noxious or invasive species control in Important Plant Areas.

i. Work cooperatively with federal, state, county, Tribal, and/or other landowners to control and manage existing noxious and invasive species, especially in areas with Plant Species of GCN.

j. Consult the most current Montana Noxious Weed Management Plan[20] when addressing noxious weed management relative to Plant Species of GCN and other native plants. Addressing actions that further strategies for non-native and native plant species will help maximize conservation efforts across organizations and jurisdictional boundaries.

Photo Credit: Connie Geiger

Photo 4-16. Autumn comes to the high country in the Seeley-Swan region of Montana. Periodic fires help to maintain diverse, shrub meadows and huckleberries!

k. Assess the cumulative risk of invasion by invasive non-native vascular plants for low, moderate, and optimally suitable habitats for all Plant Species of GCN.

6) Consider expanding the MNPS's Important Plant Areas Program (IPA)[21] as a tool towards a more comprehensive, systematic approach to identify sites of outstanding rare and unique plant assemblages across Montana. A more comprehensive, systematic approach to identifying potential IPAs could be done by using the MTNHP botany database and stratifying the state by land ownership category, land management classification, National Vegetation classification plant community level, or other stratification.

7) Improve coordination between MNPS and MTNHP to jointly determine the best ways to disseminate IPA information, particularly for use in environmental reviews, project, planning, and other stewardship activities.

[20] Montana Noxious Weed Management Plan (MDA 2017): https://agr.mt.gov/_docs/NWTF-docs/MT-Noxious-Weed-Management-Plan--Update-2017.pdf

[21] MNPS Important Plant Areas: https://mtnativeplants.org/important-plant-areas/

8) Develop partnerships between federal, state, non-profit, or private organizations with at least one botanical garden, seed storage facility, or arboretum in the western US. Botanical gardens, arboretums, and seed storage facilities can support Plant Species of GCN through research on rare plant physiology and genetics, reintroductions into the wild, seed collecting and banking, and other topics geared toward preventing extinctions. Potential organizations to partner with include, but are not limited to:
   - State of Montana Arboretum, University of Montana, Missoula, Montana[22]
   - Rae Selling Berry Seed Bank, Portland State University, Oregon[23]
   - Denver Botanical Gardens[24]
   - Plant Germplasm Introduction Test and Research Unit, Pullman, Washington[25]
   - National Laboratory for Genetic Resource Preservation, Fort Collins, Colorado
   - Tribal seed storage facilities in Montana

9) Advocate, initiate, or participate in the development of a native plant restoration working group to provide guidance and support for native plant restoration and management, especially where projects involve Plant Species of GCN. Refer to Section 3, Protection and Restoration Conservation Objective, #5.

10) Promote the understanding and use of the Reserved Treaty Rights Lands Program (RTRL)[26], a funding program administered by the Bureau of Indian Affairs (BIA), between Montana's Tribes and landownerships outside of Tribal properties. The program includes a focus on federal, state, private and other lands where excluding fire has compromised the resiliency and health of priority Tribal natural resources. For example, RTRL is helping the Confederated Salish and Kootenai Tribes, The Nature Conservancy, and the MT/Dakotas Bureau of Land Management restore Common Camas (*Camassia quamash*) populations.

11) Identify historic and potential contemporary refugia for climate adaptation, migration, or potential persistence of target Plant Species of GCN.

12) Prioritize Plant Species of GCN that are on the margin of their range in Montana for conservation and restoration related projects. For example, sustainable seed collecting in populations at the margin of their range could help preserve the plant's genetic material for future planting or other projects.

13) Prioritize restoration or reforestation in buffer areas around Plant Species of GCN, where human activities have negatively impacted habitat. Restoring adjacent habitats can aid the target species' ability to disperse or expand, possibly avoiding in-breeding and other genetic-related problems.

---

[22] State of Montana Arboretum: https://www.umt.edu/arboretum/

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

[24] Denver Botanic Gardens: https://www.botanicgardens.org/

[25] Washington State University: https://www.ars.usda.gov/pacific-west-area/pullman-wa/plant-germplasm-introduction-and-testing-research/docs/facilities-pullman-seed-storage/

[26] Reserved Treaty Rights Lands Program (RTRL): https://www.bia.gov/sites/default/files/dup/assets/public/pdf/idc1-030969.pdf

Outreach and Education

Conservation Goal

Facilitate the stewardship of Plant Species of Greatest Conservation Need through education, outreach, and coordination.

Conservation Objectives and Actions

1) Coordinate with the *Montana Native Plant Conservation Strategy*'s Strategy Stewards Committee to establish species-specific working groups that would develop and write the conservation profile for each of the remaining Plant Species of GCN. Refer also to Section 1, Box 1-2 and Section 3, Information Needs Conservation Objectives, #2 and #3. The following guidelines should be applied to develop and write each profile:

   a. The completed conservation profiles for five Plant Species of GCN serve as the template (see Appendix A).

   b. In developing the *Strategy*, we found that statewide species-specific working groups, meeting virtually or in person, are the best way to gather information, discuss needs, problems, and issues, formulate conservation objectives, and develop a useful conservation profile.

Photo Credit: Bruce Selyem

Photo 4-17. Giant Helleborine (Epipactis gigantea) *is a Plant Species of GCN that is fairly well studied and in need of a Montana Conservation Profile.*

   c. The working group should include people who share a vested interest in the species, its habitats, or the lands where it resides, and offer a spectrum of perspectives that are relevant, such as from the areas of botany, management, culture, administration, regulation, education, research, agriculture, business (extractive industries, land developers, utilities, plant nurseries, etc.), conservation, and others.

   d. Members of the working group could come from, but are not limited to, the following individuals or organizations:

   - Private industry, businesses, consultants, landowners, retired individuals
   - Federal land management agencies
   - State land management agencies and other programs (MTNHP, etc.)
   - County planning departments; other cooperators
   - Tribal nations, including Elders, traditionalists, ethnobotanists, plant gatherers, biologists, cultural directors, and administrators
   - Non-government conservation organizations
   - Academic institutions
   - Conservation societies, clubs, landowner associations, and other groups

2) Develop a shared resource to identify and prioritize educational materials for Priority 2 Plant Species of GCN. Actions could include:

   a. Create shared lists on the Strategy's webpage that highlight developed materials and identify data gaps relevant to outreach and education. Sharing developed educational materials could further conservation efforts for the specific Priority 2 Plant Species of GCN. A potential template to use for sharing information on Priority 2 Plant Species of GCN can be found on the Strategy's web page.

   b. Identify which species most need educational materials.

   c. Compile a list of developed educational materials, identify the species, authors, and organizations, and provide full references or links.

3) Develop or share educational materials that address the ways in which over-collecting plants can harm wild populations of Plant Species of GCN, their close relatives, and other native plants. See also Protection and Restoration Conservation Objectives, #4 in this section.

4) On Tribal lands and other cultural sites, acknowledge and respect traditional protocols for handling plants, plant parts, and seeds, whether for management, personal Indigenous use, restoration, or the collection of herbarium specimens. Several Tribes are very concerned about the indiscriminate collection of cultural plants for commercial use by pharmaceutical, alternative medicine, and other industries. As an example, the promotion of Narrow-leaved Purple Coneflower (*Echinacea angustifolia*) in the 1990s led to potential over-collecting of wild populations and prompted a three-year moratorium on the harvest of wild medicinal plants on state lands for [MCA 77-1-136]: Bitterroot (*Lewisia rediviva*); Narrow-leaved Purple Coneflower; lady's slipper (all species of *Cypripedium*); Fernleaf Biscuitroot (*Lomatium dissectum*); osha (all species of Ligusticum); sundew (all species of *Drosera*); and Western Trillium or Beth Root (*Trillium ovatum*).

5) Promote the MNPS' IPA Program[21] to bring recognition to locations where there are outstanding rare and unique plant occurrences, including Plant Species of GCN. The goal of this program is to identify the most important sites for plant conservation across Montana using consistent criteria (MNPS 2023). An IPA is a recognition by MNPS. Ways to promote and expand the program include, but are not limited to:

   a. Ensure that information on Montana's IPA list is shared with Plantlife International[27]. Montana's IPA program is part of an international effort led by Plant Life International, who maintains a worldwide database. Contributing to a global database strengthens the network of IPAs, furthering conservation efforts at state, national, and international levels.

   b. Encourage inclusion by all landowners (federal, state, Tribal, private, local, and others) in the IPA assessment and nomination process. Seeking input and permissions by all landowners pertinent to the specific IPA fosters support and concerted effort to retain the integrity of the IPA designation.

[27] Plantlife International IPAs: https://www.plantlife.org.uk/protecting-plants-fungi/important-plant-areas/

c. Continue to share IPA site maps and information with MTNHP for displaying in Map Viewer[28]. On the Map Viewer web page, partnering agencies and organizations can find IPA mapping and information for use in their environmental reviews, projects, planning efforts, and other stewardship activities. Access is password-protected.

d. Continue to write articles in the MNPS Kelseya newsletter on a specific IPA and the program.

e. Host MNPS field trips to an IPA, and consider co-hosting with other conservation organizations, such as the Audubon Society, Wild Montana, and others.

f. Consider creating a brochure to create awareness and further the IPA mission in Montana.

6) Arboretums and botanical gardens can showcase native plants, including rare species and culturally important plants, and provide educational experiences for the public. Potential organizations to partner with include, but are not limited to:

- State of Montana Arboretum, University of Montana, Missoula, Montana[29]
- Denver Botanical Gardens[30]

7) Fund efforts for MTNHP to revise Plant Species of GCN profiles on the Montana Field Guide. Current MTNHP standards update and expand known information on life history, ecology, wildlife-plant interactions, identification, biological characteristics, economics, management, threats, taxonomy, and other interesting information; create links to the Strategy and other online information; and improve readability.

8) Support the development of species-specific conservation assessments produced by federal agencies. Link existing conservation assessment documents in the *Strategy's* webpage, Montana Field Guide species' profile, and other important places. The USFS has produced species conservation assessments for many plants in Region 1 to provide a sound scientific foundation for management. The USFWS develops status reports for plants to document conservation status and inform listings. These documents are extremely useful for making conservation decisions and informing research.

9) Consult the most current Montana Noxious Weed Management Plan[31] when addressing noxious weed educational efforts relative to Plant Species of GCN and other native plants. Addressing actions that further strategies for non-native and native plant species will help maximize conservation efforts across organizations and jurisdictional boundaries.

[28] MTNHP Map Viewer: https://mtnhp.org/mapviewer/
[29] State of Montana Arboretum: https://www.umt.edu/arboretum/
[30] Denver Botanic Gardens: https://www.botanicgardens.org/
[31] Montana Noxious Weed Management Plan (MDA 2017): https://agr.mt.gov/_docs/NWTF-docs/MT-Noxious-Weed-Management-Plan--Update-2017.pdf

Conservation Goal

Improve conservation of Montana's Plant Species of GCN through public participation and implementation of existing policies and regulations in cooperation with public land managers, private landowners, and other interested stakeholders.

Conservation Objectives

1) Integrate Plant Species, Unique Habitats, and Plant Communities of GCN into the next major revision (year 2025) of the Montana State Wildlife Action Plan (SWAP)[32] (Refer to Section 1, Need for a Statewide Native Plant Conservation Strategy, #3). As with all SWAPs, the Montana SWAP addresses eight required elements laid out by the US Congress, is updated every 10 years, and also serves as a funding mechanism whereby potential sources of federal funding can be appropriated towards conservation for species and habitats determined to be of GCN.

2) Through partnership and working collaboratively with MFWP, develop projects to ensure that approved Congressional funding for plants, such as passage of RAWA[33], is allocated and used on Plant Species of GCN. Refer also to Section 1, Need for the Strategy, #3.

3) Adhere to State of Montana laws governing the regulation of wildcrafting [MCA-76-10[34]] of Plant Species of GCN. This law governs the collection, harvesting, and removal of uncultivated plants and plant parts for the purpose of selling, trading, or exchanging the material for profit. Refer also to Section 3, Policy and Regulation Conservation Objective, #3.

Photo Credit: Tara Luna

*Photo 4-18. Looking through the branches of a Whitebark Pine (*Pinus albicaulis*) snag to a valley of Quaking Aspen (*Populus tremuloides*) communities in Montana.*

[32] State Wildlife Action Plans (SWAP): https://www.fishwildlife.org/afwa-informs/state-wildlife-action-plans
[33] See Acronyms and Resources sections of the *Strategy*.
[34] MCA-77-10: https://leg.mt.gov/bills/mca/title_0760/chapter_0100/part_0010/sections_index.html

4) Acknowledge and adhere to Tribal laws, ordinances, regulations, and policies, and protect TK 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.

5) Through federal and state agency collaboration, continue to expand the Montana Natural Area System[35] by identifying and nominating existing and potential natural area sites to the board of land commissioners [MCA 79-12-104(1)] for possible designation, in accordance with MCA 76-12, the Montana Natural Areas Act of 1974. A natural area system coordinates the management of individual areas toward common goals that promote recreation, education, research, aesthetic enjoyment, and the unpredictable utility of individual species (Roush in Loope and Bird 1986).

6) Support state legislation that addresses Montana native plant conservation and threats imposed by noxious weeds and invasive species. Examples of past legislative efforts in Montana include, but are not limited to:
   - Montana House Bill 410 - introduced in 2021 - would have provided state policy to seed or plant native pollinator-friendly plants.
   - Montana House Judiciary Bill 17 - signed into law in 2021 - permanently establishes a Montana Noxious Weed Awareness Week in the first full week of June each year.

7) Work with federal agencies to help private landowners get compensation for their land protection actions through the USFWS recovery crediting system (Tollefson 2008) and/or other mechanisms.

8) Work with the Montana Department of Transportation and the US Army Corps of Engineers to revise goals and credits when a Plant Species of GCN is found and the population can be protected at a wetland mitigation site or bank. Consider modifying engineering designs or water management systems to ensure persistence when a Plant Species of GCN is found in wetland mitigation sites and banks.

9) Contact local federal, state, county, and city agencies and determine the best ways to comment on proposed projects and planning efforts. Review and comment on issues related to the biodiversity and health of native plants, native plant communities, and Plant Species of GCN.

10) Recognize, become informed, and adhere to Tribal policies, laws and regulations that protect, conserve or manage native plants and vegetation, including Plants of GCN. Also recognize and understand that each Tribe has its own set of laws and regulations.

[35] A natural area system contains an integrated group of areas which in their entirety protect representative examples of all the state's natural systems and guarantees the continued existence of the full array of the state's biotic diversity (Roush in Loop and Bird (eds.) 1986).

REFERENCES

Anderson, Jacey. 2020. "Public Health, Economic Well-Being, and Mining in Montana." - (PhD thesis, Department of History and Philosophy, Montana State University, Bozeman, MT.) https://www.montana.edu/stes/blog/montana-mining.html [Accessed 26 March 2024]

Comer, Patrick, Don Faber-Langendoen, R. Evans, S. Gawler, C. Josse, G. Kittel, S. Menard, M. Pyne, M. Reid, K. Schulz, K. Snow, and J. Teague. 2003. Ecological Systems of the United States: A Working Classification of US Terrestrial Systems. NatureService, Arlington, VA.

Edmo, T. 2024. Personal Communication. Climate Change Coordinator. Blackfeet Environmental Office. Blackfeet Nation. Browning, MT.

Elzinga, Caryl L., Daniel W. Salzer, and John W. Willoughby. 1998. Measuring and Monitoring Plant Populations. BLM Technical Reference 1730-1. Bureau of Land Management, National Business Center, Denver, CO. https://www.ntc.BLM.gov/krc/system/files/legacy/uploads/3342/technical%20reference.pdf

Fertig, Walter, Rick Black, and Paige Wolken. 2005. *Rangewide Status Review of Ute Ladies'-Tresses (Spiranthes diluvialis).* September 30th. Prepared for the US Fish and Wildlife Service and Central Utah Water Conservancy District.

Glenn, Mike. 2021. Interview with Mike Glenn. Vegetation Ecologist, Montana Department of Environmental Quality, Helena, MT. June 25th. Conducted by Andrea Pipp, Montana Natural Heritage Program, Helena, MT. -

Given, David R. 1994. *Principles and Practice of Plant Conservation*. Portland, OR: Timber Press. 292 pp.

Hansen, A., R. Knight, S. Powell, K. Brown, P. Gude, and K. Jones. 2005. "Effects of Exurban Development on Biodiversity: Patterns, Mechanisms, and Research Needs." Ecological Applications 15(6): 1893-1905.

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

Lesica, Peter, and Elizabeth Crone. 2017. "Arctic and boreal plant species in decline at their southern range limits in the Rocky Mountains." *Ecology Letters* 20(2): 166-74.

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.

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

Loop, Donna. and Joan Bird (eds.). 1986. Montana natural areas conference proceedings. October 14-16. The Nature Conservancy, Big Sky Field Office. Helena, Montana. 159 p.

Longknife, Jr., Dennis. 2024. Personal Communication. Environmental Protection Department, Fort Belknap Indian Community, Harlem, MT.

Master, L. L., D. Faber-Langendoen, R. Bittman, G. A. 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 Invasive Species Council (MISC). 2024. Website's About Us webpage. https://invasivespecies.mt.gov/misc/about-us [Accessed April 2024]

Montana Department of Agriculture (MDA). 2017. Montana Noxious Weed Management Plan. MDA, Helena, MT. https://agr.mt.gov/_docs/NWTF-docs/MT-Noxious-Weed-Management-Plan--Update-2017.pdf

Montana Department of Environmental Quality (MTDEQ). 2024. Mining program overview. Helena, MT. https://deq.mt.gov/mining/index [Accessed 26 March 2024]

Montana Invasive Species Council (MISC). 2024. Montana Invasive Species Council Charter. Helena, MT. https://invasivespecies.mt.gov/misc/ [Accessed 26 March 2024]

Montana Native Plant Conservation Strategy-Criteria, Species, and Habitats Subcommittee. 2021. Meetings, document review, and electronic mail correspondences. February 3 to March 31. Available from Andrea Pipp, Botanist, Montana Natural Heritage Program, Helena, MT.

Montana Natural Heritage Program (MTNHP). 2024a. Queries of Species Snapshot app. Helena, MT. https://mtnhp.org/SpeciesSnapshot/?Vector=&Species=&Rank= [Accessed 22 March 2024]

Montana Natural Heritage Program (MTNHP). 2024b. Data queries from the MTNHP Botany Database from 2020 to 2024. Helena, MT.

Montana Natural Heritage Program (MTNHP). 2024c. Query of the Ecological Systems database. March 22nd. Helena, MT.

Montana Natural Heritage Program (MTNHP). 2024d. Data analysis of species, land ownership, and ecological systems stored in the MTNHP databases. April. Helena, MT.

Montana Natural Heritage Program (MTNHP). 2021. Montana Climate Change Vulnerability Index (CCVI) study. Prepared by Scott Mincemoyer, Helena, MT. Prepared for MTNHP, Helena, MT.

Montana Natural Heritage Program (MTNHP) Threat Assessment. 2021. State Threat Score Assignment and Assessment of Reported Threats from 2006 to 2021 for State-listed Vascular Plants. Botany Program, MTNHP, Helena, MT.

Montana's State Wildlife Action Plan (Montana's SWAP). 2015. Montana Fish, Wildlife & Parks, 1420 East Sixth Avenue, Helena, MT 59620. 441 pp.

Montana Weed Control Association (MWCA). 2024. Website. https://www.mtweed.org/

Natural Resources Conservation Service (NRCS). 2024. Information on Montana-Bridger Plant Materials Center. https://www.nrcs.usda.gov/plant-materials/mtpmc [Accessed 26 March 2024]

NatureServe. 2016. Guidelines for Using the NatureServe Climate Change Vulnerability Index. June 1st. Release 3.02. Arlington, VA. 65 pages. https://www.natureserve.org/sites/default/files/guidelines_natureserveclimatechangevulnerabilityindex_r3.02_1_jun_2016.pdf

NatureServe - Explorer. 2024. NatureServe Explorer. NatureServe, Arlington, VA. https://explorer.natureserve.org/

Neely, Betsy, Susan Panjabi, Eric Lane, Paige Lewis, Carol Dawson, Andrew. Kratz, Brian Kurzel, Tim Hogan, Jill Handwerk, Sarada Krishnan, Jennifer Neale, and Nicola Ripley. 2009. *Colorado Rare Plant Conservation Strategy*. Developed by the Colorado Rare Plant Conservation Initiative. The Nature Conservancy, Boulder, Colorado. 117 pp.

Rogers, P.C. 2017. Guide to Quaking Aspen ecology and management with emphasis on Bureau of Land Management Lands in the Western United States. Logan, UT: Western Aspen Alliance, Wildland Resources Department and Ecology Center, Utah State University. https://western-aspen-alliance.org/files/AspenFieldGuide_050817_final4.pdf [Accessed 8 March 2023]

Roush, Jon. 1986. "A Natural Area System for Montana: Making the Vision A Reality". *In* Loop, Donna.; and Joan Bird (eds.). 1986. Montana Natural Areas Conference Proceedings. October 14-16. The Nature Conservancy, Big Sky Field Office. Helena, Montana. 159 p.

Scarlet Ammannia Recovery Team. 2008. *Recovery strategy for the Scarlet Ammannia* (Ammannia robusta) *in British Columbia and Ontario*. Peterborough, ON: Prepared for the British Columbia Ministry of Environment, Victoria, BC, and the Ontario Ministry of Natural Resources. 20 pp.

Status of Tribes and Climate Change Working Group (STACCWG), Marks-Marino, D. (ed.). 2021. Status of Tribes and Climate Change Report, Institute for Tribal Environmental Professionals, Northern Arizona University, Flagstaff, AZ.

Stein, Bruce A., and Kelly Gravuer. 2008. Hidden in Plain Sight: The Role of Plants in State Wildlife Action Plans. NatureServe, Arlington, Virginia. 28 pp.

Stucki, Devin, and Thomas Rodhouse, J. Lyon, L. Grant. 2013. "Natural Resource Conservation in a Cultural Park: Evaluating the Importance of Big Hole National Battlefield to the Endemic Lemhi Penstemon (*Penstemon lemhiensis*)." *Natural Areas Journal* 33(1): 50-58.

Tollefson, C. 2008. Secretary Kempthorne announces new conservation mechamism for Threatened and Endangered Species. Press release. US Fish and Wildlife Service, Washinton, D.C.

United States Census Bureau. 2024. Quick Facts for Montana. https://www.census.gov/quickfacts/fact/table/MT/PST045223 [Accessed 25 March 2024]

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). 2001. Endangered and threatened wildlife and plants; final rule to list the plant *Silene spaldingii* (Spalding's Catchfly) as a threatened species. Federal Register 66:51598-51606.

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

US Fish and Wildlife Service (USFWS). 2020. Post-delisting Monitoring Plan for Water Howellia (*Howellia aquatilis*). Helena, Montana. 33 pp.

U.S. Fish and Wildlife Service. 2021 (USFWS). 90-Day Finding Petition Review Form for *Physaria pachyphylla*. Federal Docket Number: FWS-R6-ES-2021-0117. Washington D.C.

US Fish and Wildlife Service (USFWS). 2022. Endangered and Threatened Wildlife and Plants; Threatened Species Status with Section 4(d) Rule for Whitebark Pine (*Pinus albicaulis*). 50 CFR Part 17. Federal Register 87(240):76882-76917. Washington D.C.

Whitlock, Cathy, Wyatt F. Cross, Bruce Maxwell, Nick Silverman, and Alisa A. Wade. 2017. 2017 Montana Climate Assessment. Bozeman and Missoula MT: Montana State University and University of Montana, Montana Institute on Ecosystems. 318 p. doi:10.15788/m2ww8w. https://live-mca-site.pantheonsite.io/sites/default/files/thumbnails/image/2017-Montana-Climate-Assessment-lr.pdf

Williams, Evelyn and Abigail White. 2017. Howell's Gumweed (Grindelia howellii) Genetic Diversity and Conservation Lab Report. National Forest Genetics Laboratory (NFGEL) Project #333. Prepared by Chicago Botanic Garden, Glencoe, Illinois under contract with NFGEL, Placerville, California. Prepared for Karen Stockmann, USFS Botanist, Lolo National Forest, Missoula, MT. https://archive.org/details/GrindeliahowelliiGenetics-MontanaMTNHP-USFS2018/mode/2up

World Wildlife Fund (WWF). 2023. Plowprint. https://files.worldwildlife.org/wwfcmsprod/files/Publication/file/6wlbsmxokc_PlowprintReport_2023_final.pdf?_ga=2.40396642.1303365568.1711488292-508164714.1711488292 [Accessed 26 March 2024]