

SPECIES: Scientific [common]	<i>Asplenium trichomanes-ramosum</i> [Green spleenwort] <i>Syn. Asplenium viride</i> Huds.
Forest:	Bridger-Teton National Forest
Forest Reviewer:	R.Lehman
Date of Review:	5/5/2020; 11/2/2020
Forest concurrence (or recommendation if new) for inclusion of species on list of potential SCC: (Enter Yes or No)	No

FOREST REVIEW RESULTS:

1. The Forest concurs or recommends the species for inclusion on the list of potential SCC:
Yes___ No_X
2. Rationale for not concurring is based on (check all that apply):
Species is not native to the plan area _____
Species is not known to occur in the plan area _____
Species persistence in the plan area is not of substantial concern _____

FOREST REVIEW INFORMATION:

1. Is the Species Native to the Plan Area? Yes_X___ No___
If no, provide explanation and stop assessment.
2. Is the Species Known to Occur within the Planning Area? Yes_X___ No___
If no, stop assessment.

Table 1. All Known Occurrences, Years, and Frequency within the Planning Area

Year Observed	Number of Individuals	Location of Observations (USFS District, Town, River, Road Intersection, HUC etc.)	Habitat	Source of Information¹
8/11/1950	Unknown	U.S.A., Wyoming, Teton County: West base of Corner Mountain, between Granite Springs and Natural Bridge. 43.3708° N, 110.5119° W; uncertainty 1 mi.	Unknown. Phenology: spores	Alan A. Beetle, #11355. (Rocky Mountain Herbarium 2020; SEINet 2020)
8/17/1991	Unknown	Wyoming, Teton County: Bridger-Teton National Forest: East slope Teton Range: ridge on Rendezvous Mountain, S of Aerial	Open ridge with some patches of coniferous forest dominated by <i>Abies lasiocarpa</i> , <i>Picea engelmannii</i> , with some riparian. Phenology:	Stuart Markow, #6023 (Consortium of Pacific Northwest Herbaria 2020; Rocky Mountain

		Tramway Station, ca 2.5 air mi W of Teton Village. T42N R117W S21,22	Fertile. Elev. 9800-10700 ft.	Herbarium 2020; SEINet 2020)
8/16/1994	Unknown	U.S.A., Wyoming, Teton County: Gros Ventre Area: northeast lower slope of Darwin Peak. 43.3996° N, 110.2931° W	Coniferous forest and streamside. Phenology: spores. Elev. 9000-9600 ft.	Ronald L. Hartman, #49413 with Tom Cramer (Rocky Mountain Herbarium 2020; SEINet 2020
6/28/1994	Unknown	U.S.A., Wyoming, Teton County: Gros Ventre Area: Swift Creek trail from Wilderness boundary NNE ca 1.5 air mi, at break of trail with basin area. 43.371° N, 110.391° W	Coniferous forest and stream margins along trail; substrate calcareous. Phenology: spores. Elev. 7400-9400 ft.	Ronald L. Hartman, #46907. (Rocky Mountain Herbarium 2020; SEINet 2020
8/20/2000	Unknown	Wyoming, Teton County: Teton Range: Bridger-Teton National Forest: Jackson Hole Mountain Resort, between Cody Bowl and Rock Springs Bowl, ca 1 air mi W of Teton Village, ca 12.5 air mi NNW of Jackson. 43.5908° N, 110.8753° W; uncertainty 1 mi.	Limestone outcrops, cliffs and crevices, with <i>Oxytropis deflexa</i> var. <i>foliolosa</i> , <i>Draba albertina</i> , and <i>Polystichum lonchitis</i> . Phenology: spores. Elev. 9600 ft.	Charmaine Delmatier, #8335 and #8377 8/2/2000. (Rocky Mountain Herbarium 2020; SEINet 2020)
6/24/2006	Unknown	U.S.A., Wyoming, Teton County: Outside Bridger-Teton National Forest. Grand Teton National Park and Vicinity: Teton Range: north slope of Rendezvous Mountain, ca 10 air mi NW of Jackson; ca 9.5 air mi SW of Moose. 43.5956° N, 110.8803° W; GPS Reading	Dolomite outcrops and slopes. Phenology: spores. Elev. 9635 ft.	David Scott, #1056 with Nancy Bockino (Rocky Mountain Herbarium 2020; SEINet 2020)

¹The Wyoming Natural Diversity Database was also searched, and no additional occurrences were found (WYNDD GIS 2019).

a. Are all Species Occurrences Only Accidental or Transient?

Yes___ No X

If yes, document source for determination and stop assessment.

- b. For species with known occurrences on the Forest since 1990, based on the number of observations and/or year of last observation, can the species be presumed to be established or becoming established in the plan area?

Yes No

If no, provide explanation and stop assessment

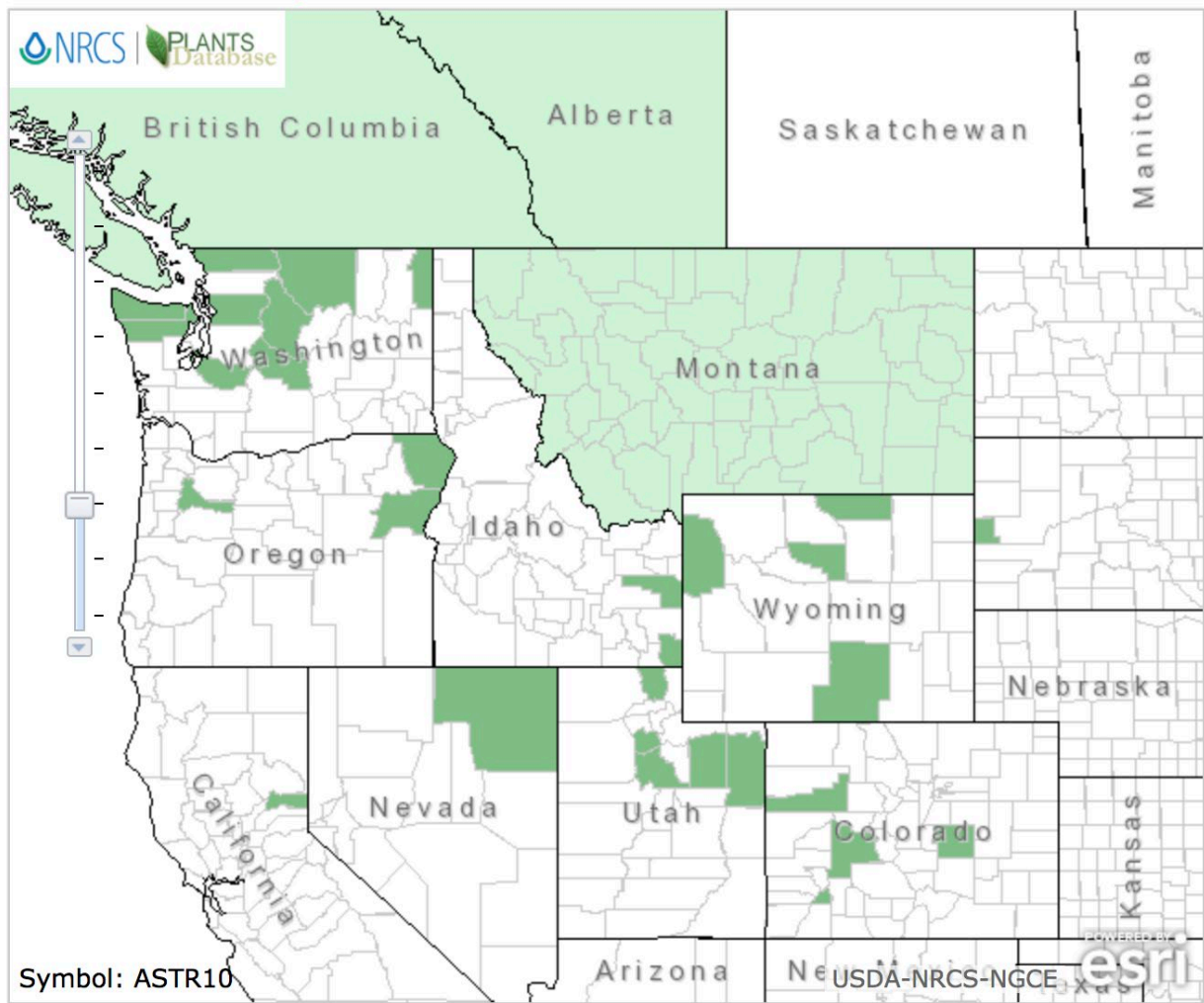
- c. For species with known occurrences on the Forest predating 1990, does the weight of evidence suggest the species still occurs in the plan area?

Yes No

N/A—occurrences have been documented since 1990.

If determination is no, stop assessment

Map 1, *Asplenium trichomanes-ramosum* range in Wyoming and surrounding states (NRCS 2020).

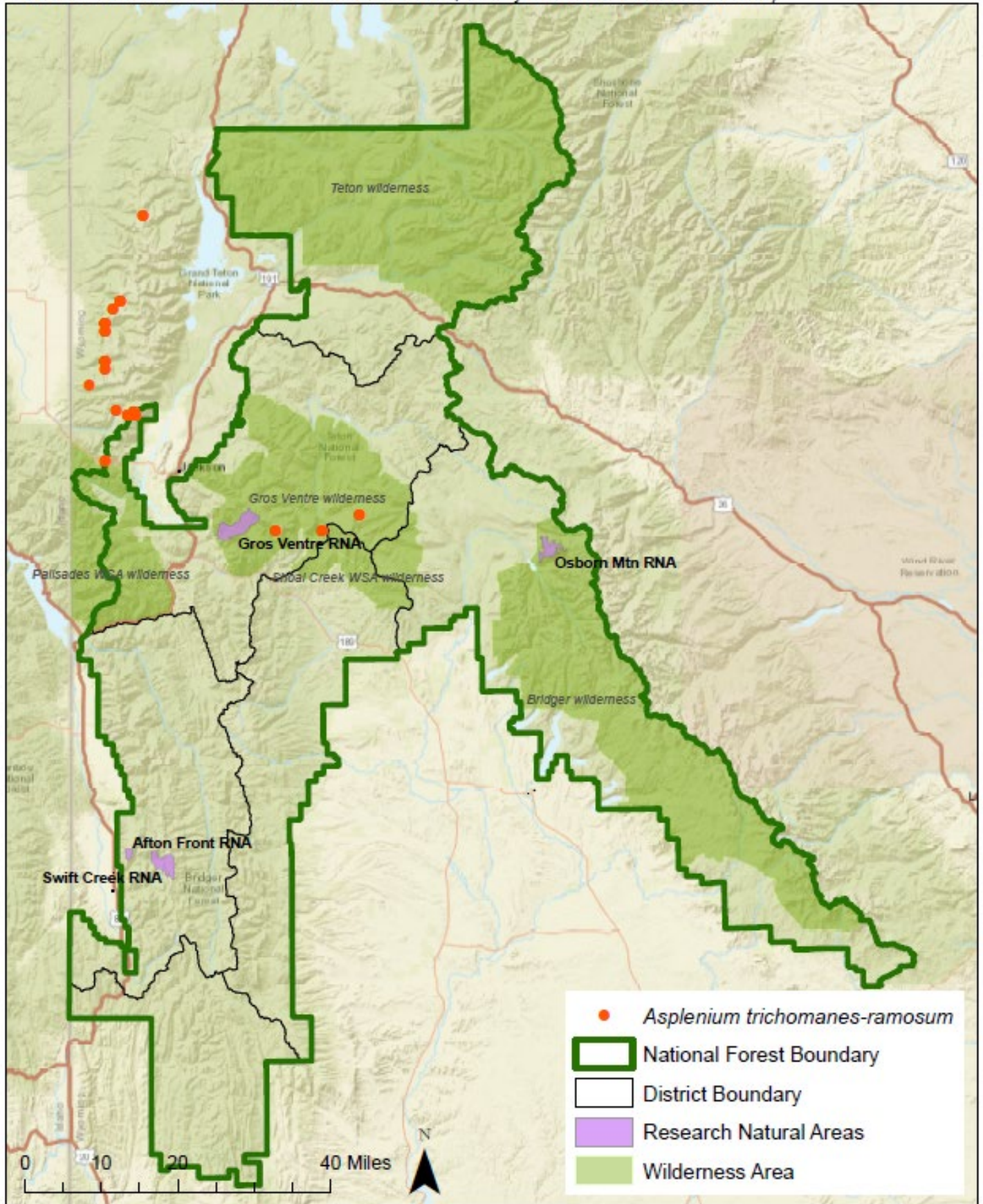


- | | | | |
|---|---|---|--|
| Native | Introduced | Both | Absent/Unreported |
| Native, No County Data | Introduced, No County Data | Both, No County Data | |

Native Status:

- | | | | | | | | | | |
|---|--|--|--|--|---|---|--|---|--|
| L48 | AK | HI | PR | VI | NAV | CAN | GL | SPM | NA |
|---|--|--|--|--|---|---|--|---|--|

Map 2. *A. trichomanes-ramosum* occurrences in Bridger-Teton National Forest vicinity (SEINet 2020; Consortium of Pacific Northwest Herbaria 2020; Rocky Mountain Herbarium 2020).



3. Is There Substantial Concern for the Species' Capability to persist Over the Long-term in the Plan Area Based on Best Available Scientific Information?

Table 2. Status summary based on existing conservation assessments

Entity	Status/Rank (include definition)
NatureServe Global Status	G4—Apparently Secure <i>At fairly low risk of extinction or elimination 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.</i>
NatureServe State Status	S2—Imperiled <i>At high risk of extirpation in the jurisdiction due to restricted range, few populations or occurrences, steep declines, severe threats, or other factors.</i>
WYNDD	Plant Species of Concern G4/S2S3 <i>Species vulnerable to extirpation at the global or state level due to:</i> <i>a. their rarity (e.g., restricted distribution, small population size, low population density)</i> <i>b. inherent vulnerability (e.g., specialized habitat requirements, restrictive life history)</i> <i>c. threats (e.g., significant loss of habitat, sensitivity to disturbances)</i> (Wyoming Natural Diversity Database - Species of Concern)
USDA Forest Service	Not listed in Region 4
USDOI FWS	Not listed
USDOI BLM	Not listed
IUCN	Least Concern <i>A taxon is Least Concern when it has been evaluated against the criteria and does not qualify for Critically Endangered, Endangered, Vulnerable or Near Threatened. Widespread and abundant taxa are included in this category.</i>

Christenhusz et al. 2017, Heidel 2018, NatureServe 2020, WYNDD 2020a

Table 3. Status summary based on best available scientific information.

Criteria	Rationale
Distribution on the Bridger-Teton National Forest	<i>Asplenium trichomanes-ramosum</i> is known from 7 occurrences on the Bridger-Teton National Forest, 6 of which were discovered since 1990. Occurrences are in the central to west-central portion of the Forest (Table 1, Map 2). This information suggests populations are somewhat sparse and isolated on the Forest.

Criteria	Rationale
Distribution outside the Bridger-Teton National Forest	<p><i>Asplenium trichomanes-ramosum</i> is a circumboreal species of subarctic and alpine areas in Canada and Eurasia (USFS 2002). It occurs from Alaska to Northwest Territories, south to California, Colorado and the Black Hills of South Dakota; also known in Greenland, and from Ontario to Newfoundland, south from Wisconsin to Maine. In Wyoming, it is known from 15 occurrences from the Big Horn, Gros Ventre, Medicine Bow, and Teton Ranges (Carbon, Sheridan, Teton, and Washakie counties) (WYNDD 2020b).</p>
Abundance on the Bridger-Teton National Forest	<p>Individual populations are often small and highly localized, with fewer than 50 clusters of plants. One report, however, stated this can be "the most frequently encountered fern of mesic limestone crevices in the Teton-Darby Canyon area" of the western Teton Range (WYNDD 2020b). Overall abundance in Wyoming is thought to be rare (Heidel 2018); it may also be rare on the Bridger-Teton National Forest, but more surveying is needed.</p>
Population Trend on the Bridger-Teton National Forest	<p>Overall, this species is apparently secure within its primary range (NatureServe 2020). Population trends in Wyoming are unknown (WYNDD 2020b), but may be stable (Heidel 2018). Trends on the Bridger-Teton National Forest cannot be assessed due to lack of data.</p>
Habitat Trend on the Bridger-Teton National Forest	<p>Habitat for this species is typically shaded, moist, calcareous rock outcrops, such as limestone, dolomite, or shale cliffs, and talus slopes, escarpments, and boulder-strewn woodlands (USFS 2002). It occurs at elevations of 0 to 4000 m (FNA 2020). It usually requires a moist to seepy rock substrate (USFS 2002). It commonly occurs in association with dense, mixed beds of bryophytes, but has been reported growing in relatively dry, unvegetated, exposed conditions (USFS 2002). Wyoming populations are typically on limestone outcrops located in Engelmann spruce-subalpine fir forest at 5800-9900 ft. It is usually found in shaded crevices of north-facing cliffs in moist, montane environments (Fertig 2000; WYNDD 2020b).</p> <p>In general, because alpine vegetation and barren rock mainly occur in designated wilderness, roadless, or remote areas where human interference disturbance is minimal, alpine communities are considered to be relatively stable where human interference disturbance is minimal, alpine communities are considered to be relatively stable.</p> <p>To further analyze trends in habitat, aerial imagery and a USFS GIS database of existing grazing allotments, invasive plant populations, historical wildfires, trails, roads, Wilderness Areas, and Research Natural Areas (RNAs) was assessed at each occurrence (USFS GIS 2020, Google Earth Pro 2020).</p> <p>Beetle #11355, Hartman #46907, and Hartman #49413, located in the in the central portion of the Forest, are within the Gros Ventre wilderness area, indicating that effects from anthropogenic activities are likely minimal for these populations. Additionally, no roads exist near these occurrences, which further confirms the low potential for human effects. Proximity (within approximately 1 mile) of these three occurrences to non-motorized hiking trails may slightly increase potential for human presence and trampling impacts, but because occurrences are in remote, rugged locations, they likely seldom see human visitors. Additionally,</p>

Criteria	Rationale
	<p>none of these occurrences are within perimeters of active grazing allotments or major fire events or in close proximity to non-native species' invasions.</p> <p>The remaining occurrences in the west-central portion of the Forest (Merrill #1181, Markow #6023, Scott #1056, Delmatier #8377, Delmatier #8335) are not within wilderness areas, and thus do not receive the same protections from anthropogenic effects. Merrill 1181 is approximately 0.3 miles from State Highway 22, and habitat may experience impacts from increased human presence and motor vehicle use. Markow #6023, Scott #1056, Delmatier #8377, and Delmatier #8335 are all in close proximity (within ~1 mi) to Teton Village Road, which provides access to the nearby Teton Village ski resort. Habitat for these populations is likely impacted by low levels of motor vehicle use as well as human presence from recreators such as backcountry skiers. None of these occurrences are within perimeters of active grazing allotments or major fire events. However, Scott #1056, Delmatier #8377, Delmatier #8335 are near (within ~1 mi) several small invasions of non-native plants (<i>Linaria dalmatica</i>, <i>Carduus nutans</i>, <i>Hyoscyamus niger</i>) and may experience effects such as habitat degradation and competition for resources.</p> <p>Alpine communities are possibly the ecosystems in the region that are most at risk from the effects of climate change because of their shrinking habitat. According to Intermountain Adaptation Partnership assessments, alpine communities have a high sensitivity to climate change, a low adaptive capacity, and very high vulnerability to climate change (Halofsky, et al. 2018). Climate change is expected to cause increasingly warmer and wetter conditions, with worsening summer drought, and alpine areas may transition from snow-dominated to rain-dominated. An extended growing season is projected to occur in the alpine which can result in interspecific competition for resources, changes in plant community composition and displacement of rare plant populations where they currently occupy specific niches (Halofsky et al. 2018).</p> <p>Alpine systems are dependent on snowfields and gradual snowmelt to maintain moisture for vegetation. Warming temperatures, increased drought, and changes in the depth and persistence of snowpack, surface water flow, and timing of peak runoff are projected to greatly affect alpine habitat in the Intermountain Region (Halofsky et al. 2018). The composition and distribution of alpine ecosystems will be affected by decreasing snowpack. For high-elevation vegetation, climate change may affect seed germination and survival by modifying moisture availability and therefore result in reduced plant success. Specific effects will depend on vulnerability thresholds of the characteristic species and the rate and magnitude of changes over time. Reduced snowpack with warming is likely to cause major changes in alpine plant communities (Halofsky, et al. 2018).</p> <p>Some loss of alpine vegetation communities, especially mesic meadows, attributed to upslope migration of trees and shrubs may occur (Halofsky et al. 2018). Some, subalpine communities may have potential to migrate higher in elevation as a response to changing conditions, but this may be limited by underdeveloped</p>

Criteria	Rationale
	<p>soils at higher altitudes. Furthermore, the rate of climatic change in alpine communities may outpace the ability of species to shift their distribution (Ash et al. 2016; Dirnbock et al. 2011). Other communities may already exist at the highest elevations in the BTNF and, therefore, may have limited upward migration potential.</p> <p>Rare plant populations that may be small, isolated, tied to snowpack abundance and distribution timing changes of spring thaw and fall frost cycles, and/or have limited dispersal capacity, are highly vulnerable to impacts from environmental change including reductions in pollination. Changes in temperature and precipitation may also lead to greater variability in forb flowering, which could create an asynchronistic effect with native pollinator emergence (Halofsky et al. 2018; Miller-Struttman et al. 2015), leading to decreased reproduction in native plants. As pollinators are critical for successful reproduction and seed set for approximately 85% of flowering species globally (Hatfield et al. 2012), this asynchronistic effect may have profound implications.</p> <p>Given this information, it is likely that habitat at and surrounding Beetle #11355, Hartman #46907, and Hartman #49413 has experienced low impacts from natural and anthropogenic disturbances, whereas habitat at and surrounding Merrill #1181, Markow #6023, Scott #1056, Delmatier #8377, and Delmatier #8335 has likely experienced moderate impacts from natural and anthropogenic disturbances. Climate change effects could lead to declining conditions, as described above.</p>
<p>Threats to the Species and its Habitat on the Bridger-Teton National Forest</p>	<p>Immediate threats are inferred to be low in the ruggedness of the species' outcrop habitat. Possible threats may be logging and trampling. It may also be threatened by commercial and hobby collecting at least elsewhere in its range (Fertig 2000; WYNDD 2020b).</p> <p>Population size appears to be small and highly localized, making the species vulnerable to chance disturbances. Those occurrences found within the Gros Ventre Wilderness Area is highly protected and receives little use (Fertig 2000). Habitat for these occurrences receives minimal disturbance from forest management activities including recreation, motorized vehicle travel, and vegetation treatments. Habitat for the remaining occurrences is not within a protected wilderness area, and likely is impacted by higher levels of impacts from anthropogenic disturbance and forest management activities.</p>
<p>Life history and demographic characteristics of the species</p>	<p><i>Asplenium trichomanes-ramosum</i> is a perennial fern with short, creeping, rhizomes covered with blackish scales (FNA 2020; WYNDD 2020b). It reproduces by spores that ripen June to September (USFS 2002). Most diploid ferns strongly favor outbreeding in which two gametophytes produced by spores from different plants must be present for fertilization to occur (USFS 2002).</p> <p>In studies of spore dispersal and biogeography of <i>Asplenium</i> species, it has been documented that most spores (approximately 95%) fall in the immediate vicinity (within 1 to 10 meters) of the parent plant. Distribution patterns of <i>A. trichomanes-ramosum</i> within the outcrop areas studied in Michigan seem to</p>

Criteria	Rationale
	<p>support the notion that the expansion and maintenance of local colonies is likely achieved through short-distance dispersal mechanisms. The average distance between rocks was only 108 centimeters (USFS 2002).</p> <p>This species is consistently observed on northern exposures and in significantly higher numbers on the cooler, moister northeastern faces of the rocks, typically rooted in thick bryophyte mats (USFS 2002). Thus, it appears that dispersal and subsequent establishment is most successful when substrate is in close enough proximity that a number of spores reach safe sites and adequate moisture is available to the plants as they grow to reproductive age (USFS 2002).</p>
Date: 3/18/20 Reviewer: L. Chipman	

Summary and Recommendations

Species (Scientific and Common Name): *Asplenium trichomanes-ramosum*

Asplenium trichomanes-ramosum (Green spleenwort) is listed as S2 (Imperiled) and G4 (Apparently Secure) globally. Wyoming Natural Diversity Database lists the species as a Species of Potential Concern. Wyoming populations are typically on limestone outcrops located in Engelmann spruce-subalpine fir forest at 5800-9900 ft. It is usually found in shaded crevices of north-facing cliffs in moist, montane environments (Fertig 2000; WYNDD 2020b). The species is known from 5-10 (7) records on the Forest, indicating the species is relatively sparse on the forest. Populations tend to be small and isolated.

The analysis suggests that habitat for *A.trichomanes-ramosum* likely experiences low to moderate effects from natural and anthropogenic disturbances where it is found in the Gros Ventre wilderness area with a higher potential of threats (ski hill development, motorized vehicles, recreationalist, invasive plants) where it is found in west-central portion of the Forest. Trend information is lacking or not available at the time of this assessment.

Population size appears to be small and highly localized for all known occurrences, making the species vulnerable to chance disturbances; however, given the species suitable habitat it is likely the species will persist within the planning area. In general, few threats exist to the species suitable habitat of shaded crevices of north-facing cliffs in moist, montane environments. Based on this analysis, it is recommended that *Asplenium trichomanes-ramosum* not be included as a SCC.

Evaluator: Rose Lehman Date: 11/02/2020

References

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