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| SPECIES: Scientific [common] | <i>Orthotrichum hallii</i> (Hall's Orthotrichum moss) |
| Forest: | Salmon–Challis National Forest |
| Forest Reviewer: | Jessica M Dhaemers; Brittni Brown; John Proctor |
| Date of Review: | 10/12/2017; 26 February 2018; 01 April 2018 |
| Forest concurrence (or recommendation if new) for inclusion of species on list of potential SCC: (Enter Yes or No) | YES |

FOREST REVIEW RESULTS:

1. The Forest concurs or recommends the species for inclusion on the list of potential SCC:
Yes X No ___
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.) | Source of Information |
|----------------------|------------------------------|---|--|
| 1995 | No data | Middle Canyon Research Natural Area approximately 3.5 miles south of Saddle Mountain. Lost River Ranger District | IDFG Element Occurrence EO Number: 3 EO_ID: 2742 |

- 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 X 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 ___

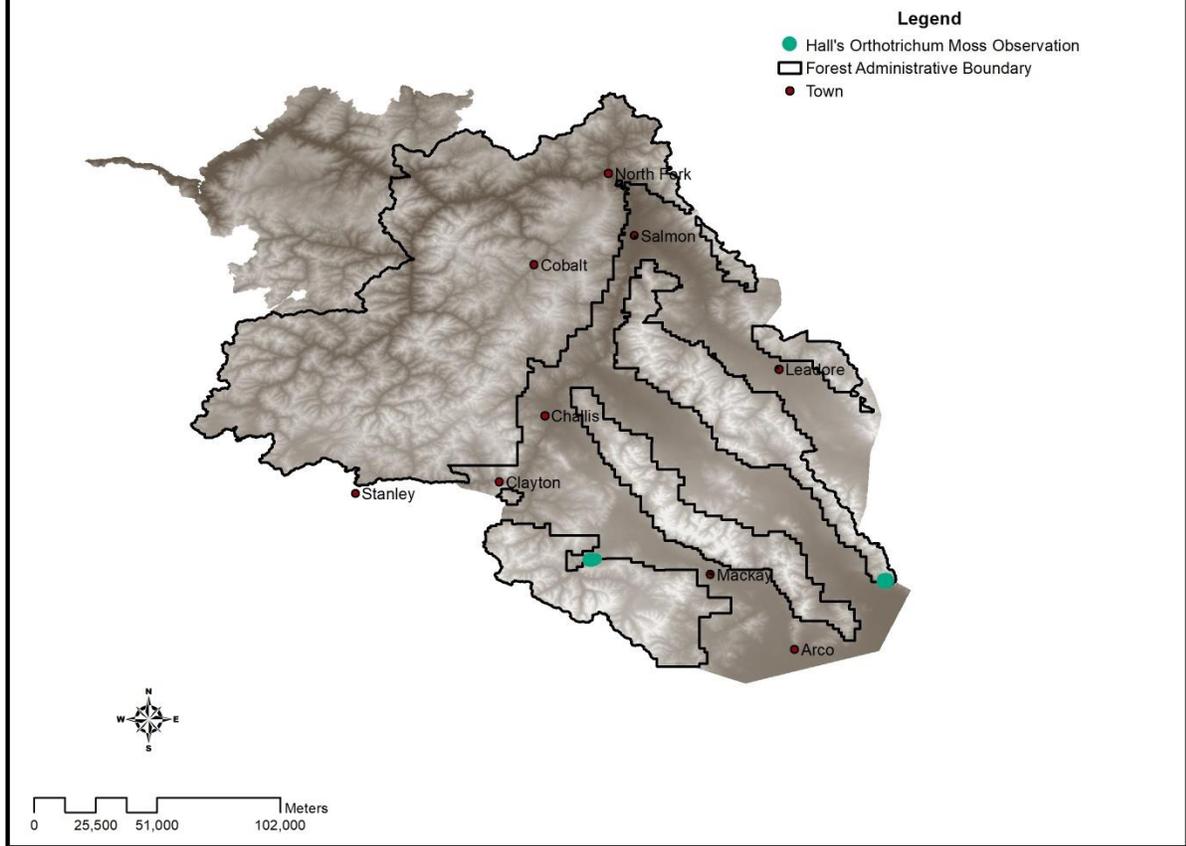
Provide explanation for determination

N/A - Species has known occurrence since 1990.

If determination is no, stop assessment

Map 1, Hall's orthotrichum moss observations on the Salmon–Challis National Forest (IDFG. 2017. Idaho Fish and Wildlife Information System, Species Diversity Database, Idaho Natural Heritage Data. Accessed February 27, 2017.)

Hall's Orthotrichum Moss Observations on Salmon-Challis NF



September 13, 2017

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 if Other) |
|---------------------|--|
| Global Rank | G4– Apparently Secure (Uncommon but not rare; some cause for long-term concern due to declines or other factors) ¹ |
| State Rank | S1– Critically Imperiled (At very high risk of extinction due to extreme rarity (often 5 or fewer populations), very steep declines, or other factors) ¹ |
| USDA Forest Service | Region 1: Not listed ² Region 4: Not listed ³ |
| USDI FWS | Not listed as a candidate species ⁴ |
| Other | Idaho Native Plant Society: G4S1 RARE ⁵ BLM: Type 3 (These are species that are experiencing significant declines in population or habitat and are in danger of regional or local extinctions in Idaho in the foreseeable future if factors contributing to their decline continues.) ⁶ |

1. Idaho Natural Heritage Program. 2016. IDNHP Tracked Plant Species 2016. Accessed January 12, 2018
2. USFS Region 1. 2011. 2011 Sensitive Species List Idaho and Montana. Website: <http://fsweb.r1.fs.fed.us/wildlife/wwfrp/TEsnew.htm>. Accessed January 10, 2017.
3. USFS Region 4. 2016. Proposed, Endangered, Threatened, and Sensitive Species List. On file. Accessed January 11, 2017.
4. USFWS. 2017. Candidate species believed to or known to occur in Idaho. Website: <https://ecos.fws.gov/ecp0/reports/species-listed-by-state-report?state=ID&status=candidate>. Accessed January 12, 2018.
5. Idaho Native Plant Society. 2016. INPS Rare Plant List May 2016. <https://idahonativeplants.org/rare-plants-list/> Accessed January 10, 2018.
6. BLM. 2016. Bureau of Land Management Idaho Special Status Plants List Aug 2016. On file. Accessed 15 January, 2018.

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

| Species (Scientific and Common Name): <i>Orthotrichum hallii</i> (Hall's Orthotrichum moss) | | | |
|---|------|--|---|
| Criteria | Rank | Rationale | Literature Citations |
| 1 Distribution on Salmon–Challis National Forest | A2 | <p>This species is known from one occurrence on the SCNF (IDFG 2017), located within Middle Canyon at the southern end of the Lemhi Range. Species-specific surveys have not been conducted on the Forest, therefore, the full distribution of the species on the Forest is unknown. Potential habitat (see Criterion 6) is widely distributed and habitat connectivity is limited due to environmental gradients and dispersal among patches is limited (Rank A2).</p> <p>Confidence in Rank: High, Medium, or Low</p> | <p>IDFG. 2017. Idaho Fish and Wildlife Information System, Species Diversity Database, Idaho Natural Heritage Data. Accessed February 27, 2017.</p> |
| 2 Distribution in surrounding geographic area | C | <p>This species is known from Western North America and East Asia (Harpel 2009, NatureServe 2017). In the Pacific Northwest, it is known from California, Idaho, Oregon, Washington, Wyoming, and British Columbia (Harpel 2009). Three other occurrences have been documented in Idaho (IDFG 2017).</p> <p>This species occurs widely outside of the SCNF (Rank C).</p> <p>Confidence in Rank: High, Medium, or Low</p> | <p>Harpel, J.A., 2009. Species Fact Sheet. <i>Orthotrichum hallii</i>. Internet website: http://www.fs.fed.us/r6/sfpnw/issssp/documents/planning-docs/sfs-br-orthotrichum-hallii-2009-03.doc. Accessed on September 20, 2017.</p> <p>IDFG. 2017. Idaho Fish and Wildlife Information System, Species Diversity Database, Idaho Natural Heritage Data. Accessed February 27, 2017.</p> <p>NatureServe. 2017. Comprehensive Species Report. <i>Orthotrichum hallii</i>. Internet website: http://explorer.natureserve.org/servlet/NatureServe?searchName=Orthotric</p> |

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| | | | hum+hallii . Accessed on September 20, 2017. |
| 3 Dispersal Capability | B | <p>Specific studies for the dispersal capability of this species have not been conducted. However, some generalizations can be made from bryophytes in general and applied to this species.</p> <p>Asexual reproduction is common in most bryophytes and dispersal distances may be limited even in those that reproduce through spores. (Stoneburner et al. 1992). Although bryophytes are capable of being transported hundreds of miles, successful establishment is the exception and not the rule (Pocz and van Zanten 1981). Plant competition has also been cited as the most important factor in preventing the successful colonization of an area (Pocz and Van Zanten 1981).</p> <p>While this species has the potential to disperse widely through landscapes, this species usually only disperses through suitable habitat (Rank B).</p> <p>Confidence in Rank: High, Medium, or Low</p> | <p>Pocz T., van Zanten B.O. 1981. Distribution and dispersal of bryophytes. <i>Adv. Bryol.</i> 1:479-562. Internet website: https://www.researchgate.net/publication/290842887_Distribution_and_dispersal_of_bryophytes. Accessed on September 19, 2017.</p> <p>Stoneburner A, Lane D.M., Anderson L.E. 1992. Spore dispersal distances in <i>Atrichum angustatum</i> (Polytrichaceae). <i>Bryologist</i> 95:324-328. Internet website: https://www.jstor.org/stable/3243491?seq=1#page_scan_tab_contents. Accessed on September 18, 2017.</p> |
| 4 Abundance on the Salmon–Challis National Forest | A | <p>One populations is known from the Lemhi Range, with an unknown population size. The density and number of populations would indicate that this species is rare and that stochastic and other factors could lead to potential imperilment (Rank A).</p> <p>Confidence in Rank: High, Medium, or Low</p> | IDFG. 2017. Idaho Fish and Wildlife Information System, Species Diversity Database, Idaho Natural Heritage Data. Accessed February 27, 2017. |
| 5 Population Trend on the Salmon– Challis National Forest | D | <p>There is one EO on the Forest but it has not been monitored consistently and no population data is available that would provide an indication as to trends in population size (Rank D).</p> <p>Confidence in Rank: High, Medium, or Low</p> | |

Species (Scientific and Common Name): *Orthotrichum hallii* (Hall's Orthotrichum moss)

| Criteria | Rank | Rationale | Literature Citations |
|--|----------|---|---|
| <p>6 Habitat Trend on the Salmon–Challis National Forest</p> | <p>B</p> | <p>This species is usually found on limestone or calcareous sandstone with occasional occurrences on granite, quartzite, or basalt (Harpel 2009). The elevation range for this species is 2,300 feet or higher. On SCNF this species occurs between 6,700 and 7,500 feet in elevation (IDFG 2017). The SCNF population is located in the Middle Canyon Research Natural Area (RNA). The Code of Federal Regulations 36 CFR 251.23 states that “Research Natural Areas will be retained in a virgin or unmodified condition except where measures are required to maintain a plant community which the area is intended to represent.” With an RNA designation, the habitat supporting Middle Canyon population is likely to remain in a stable condition.</p> <p>A review of aerial imagery does not show any ground disturbing activities that would indicate the direct removal of habitat or individuals (Google Earth 2017). A review of fires on SCNF from the IDFG (2017) database has no record of fires occurring after 1995 near the population. No mining activities appear to be occurring near either population (Google Earth 2017). The rock substrate associated with habitat for this species is locally abundant and there appears to be stable amounts of suitable quality habitat (Rank B). Confidence is low given the lack of specific monitoring of the two occurrences.</p> <p>Confidence in Rank: High, Medium, or Low</p> | <p>Google Earth. 2017. Salmon–Challis National Forest. Internet website: https://www.google.com/earth/. Accessed on September 19, 2017.</p> <p>Harpel, J.A., 2009. Species Fact Sheet. <i>Orthotrichum hallii</i>. Internet website: http://www.fs.fed.us/r6/sfpnw/issssp/documents/planning-docs/sfs-br-orthotrichum-hallii-2009-03.doc. Accessed on September 20, 2017.</p> <p>IDFG. 2017. Idaho Fish and Wildlife Information System, Species Diversity Database, Idaho Natural Heritage Data. Accessed February 27, 2017.</p> |
| <p>7 Vulnerability of Habitats on the Salmon–Challis National Forest</p> | <p>B</p> | <p><i>O hallii</i> is most vulnerable to changes in climate.</p> <p>To project the future climate and impacts to resources in the Intermountain Region including the Salmon-Challis, the Intermountain Adaptation Partnership (IAP) used Representative Concentration Pathway [RCP] 4.5 and 8.5, which capture a moderate and high future warming, respectively (Halofsky et al. 2018). Although pathways</p> | <p>Behrens, P.N., R.E. Keane, D.L. Peterson, and J.J. Ho. 2018. Chapter 6: effects of climatic variability and change on forest vegetation. In Halofsky, J.E., D.L. Peterson, J.J. Ho, N.L. Little, L.A. Joyce, editors. 2018. Changes in climate vulnerability and adaptation in the Intermountain</p> |

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| | | <p>predicting lower warming exist, the 4.5 and 8.5 pathways were chosen by the IAP because they are, in comparison, well studied providing a large set of projections that enhance our understanding of the possible range in future climate. Thus, this represents best available science for our Forest with regard to a warming climate.</p> <p>Although uncertainty exists about the magnitude and rate of changes in climate (For a discussion of this see Behrens et al. 2018), warming temperatures are the most certain consequence of increased CO₂ in the atmosphere. By 2100, median minimum temperature in the Middle Rockies subregion, which includes the Salmon-Challis, is projected to rise about 5°F under the moderate warming scenario and about 10°F under the high warming scenario. Regardless of scenario, the greatest departure from historical seasonal minimum temperatures occurs in the summer. Annual precipitation projections are highly variable with no discernible trend under moderate warming and a slight increasing trend with high warming (Joyce and Talbert 2018).</p> <p>Under changes in climate scenarios, sagebrush steppe habitats and adjacent rocky outcroppings, where <i>O. hallii</i> may occur, are projected to experience an increased risk of wildfires and greater risk of invasive species invasion (which tend to become more frequent with wildfires outside of natural fire regimes in this habitat type) (Halofsky et al. 2018). The invasion of cheatgrass can increase the fire-return intervals, further exasperating threats. Warmer temperatures and decreased precipitation may also impact communities that support <i>O hallii</i>. Changes in soil moisture due to reduced snowpack and earlier snowmelt could also drive changes in rock-face microhabitats.</p> <p>While changes in climate will result in habitat modification, it is likely to</p> | <p>Region. Gen. Tech. Rep. RMRS-GTR-XXX. Fort Collins, CO: US Department of Agriculture, Forest Service, Rocky Mountain Research Station.</p> <p>Google Earth. 2017. Salmon–Challis National Forest. Internet website: https://www.google.com/earth/. Accessed on September 19, 2017.</p> <p>Halofsky, J.E., D.L. Peterson, J.J. Ho, N.L. Little, L.A. Joyce, editors. 2018. Changes in climate vulnerability and adaptation in the Intermountain Region. Gen. Tech. Rep. RMRS-GTR-xxx. Fort Collins, CO: US Department of Agriculture, Forest Service, Rocky Mountain Research Station.</p> <p>Joyce, L.A. and M. Talbert. 2018. Chapter 3: Historical and projected climate. In Halofsky, J.E., D.L. Peterson, J.J. Ho, N.L. Little, L.A. Joyce, editors. 2018. Changes in climate vulnerability and adaptation in the Intermountain Region. Gen. Tech. Rep. RMRS-GTR-xxx. Fort Collins, CO: US Department of Agriculture, Forest Service, Rocky Mountain Research Station.</p> |

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| | | <p>result in ecological patterns similar to the range of historical conditions (Rank B).</p> <p>Confidence in Rank: High, Medium, or Low</p> | |
| 8 Life History and Demographics | A | <p>While there is little known about the life history of <i>O. hallii</i>, the protonema, bud and shoot formation are typical for all moss development (Harpel 2009).</p> <p>Asexual reproduction is common in most bryophytes and a large percentage of species are sterile and propagate vegetatively (Frahm 2007). It is shown there is no difference in the effectiveness between generative and vegetative propagation (Frahm 2007). Bryophytes also produce small spores which can disperse great distances and even sterile species have transcontinental ranges (Frahm 2007). However, even given the capability to reproduce asexually and disperse long distances, there are many examples of species with very limited distributions which are explained by narrow ecological niches, age of taxa, local extinction, or historical events such as ice ages (Frahm 2007). Species may also lose the ability for dispersal for unknown reasons (possibly genetic) which may ultimately lead to extinction (Frahm 2007).</p> <p>This species appears to be limited to a narrow ecological niche and without other populations available for outcrossing, may be vulnerable to reduced vigor due to inbreeding. Furthermore, as there are no other documented populations nearby, there are virtually no opportunities for increasing genetic diversity (IDFG 2017).</p> <p>This species has a low reproductive rate and has high mortality susceptibility due to its narrow ecological range and populations may not recover rapidly from disturbance events (Rank A).</p> | <p>Frahm, J.P. 2007. Diversity, dispersal and biogeography of bryophytes (mosses). Internet website: https://page-one.live.cf.public.springer.com/pdf/preview/10.1007/978-90-481-2801-3_4. Accessed on September 19, 2017.</p> <p>Harpel, J.A., 2009. Species Fact Sheet. <i>Orthotrichum hallii</i>. Internet website: http://www.fs.fed.us/r6/sfpnw/issssp/documents/planning-docs/sfs-br-orthotrichum-hallii-2009-03.doc. Accessed on September 20, 2017.</p> <p>IDFG. 2017. Idaho Fish and Wildlife Information System, Species Diversity Database, Idaho Natural Heritage Data. Accessed February 27, 2017.</p> |

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| Criteria | Rank | Rationale | Literature Citations |
| | | Confidence in Rank: High, Medium , or Low | |
| <p>Summary and recommendations: This species has a Global Rank of G4 (Apparently Secure) and a State Rank of S1 (Critically Imperiled). This species is known from one population on the SCNF, indicating that the species is likely susceptible to stochastic events on the Forest.</p> <p>More research is needed regarding the life history or dispersal mechanisms for this species, however, it is suspected to have a low reproductive rate and high mortality susceptibility. With only one documented population on the Forest, it is assumed that genetic diversity is low. This species primarily occurs on limestone and sandstone but may also be found on granite, quartzite, and basalt outcrops in xeric habitats. The quantity and quality of habitat for this species is currently assumed stable. The long-term effects of changes in climate may adversely impact populations.</p> <p>There is substantial concern for the capability of <i>Orthotrichum hallii</i> to persist over the long-term on the Salmon-Challis, therefore, it is recommended as a SCC.</p> <p>Evaluator(s): Dan Morta</p> | | | Date: September 20, 2017 |