

<b>SPECIES: Scientific [common]</b>	<i>Meesia triquetra</i> [Three-ranked humpmoss]
<b>Forest:</b>	Bridger-Teton National Forest
<b>Forest Reviewer:</b>	<b>J.Irwin 9/30/2020; R.Lehman 10/05/2020</b>
<b>Date of Review:</b>	<b>10/05/2020</b>
<b>Forest concurrence (or recommendation if new) for inclusion of species on list of potential SCC: (Enter Yes or No)</b>	<b>No</b>

**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 Information <sup>1</sup>
1989	Unknown	Wind River Range: South of Timico Lake along Fall Creek. Identified in WR-15, stands 58 and 59.	Fen. 1 percent and 3 percent of total peatland vegetation cover	Cooper and Andrus (1994)
1989	Unknown.	Wind River Range: West of Lake Sequa along Little Fall Creek. Identified in WR-13, stands 15.	Fen. 1 percent of total peatland vegetation cover	Cooper and Andrus (1994)
2011	1 collection	Outside Bridger-Teton National Forest. Fremont County, WY: Southeast portion of Wind River	Vast boggy valley, subalpine <i>Salix</i> sp. - <i>Carex</i> spp. - Sphagnum fen, on soaked peaty soil	Yelena I. Kosovich-Anderson 13031

		Range, Shoshone National Forest, Dickinson Park, valley of Twin Parks Creek, 0.7 mi S of Dickinson Creek Campground.	between hummocks, associated with <i>Sarmentypnum exannulatum</i> , <i>Hypnum lindbergii</i> . Elevation 9300 ft.	(Rocky Mountain Herbarium 2019)
2011	1 collection (Very abundant)	Outside Bridger-Teton National Forest. Fremont County, WY: Southeast portion of Wind River Range, Shoshone National Forest: head of unnamed tributary of Rock Creek.	Vast area of wetlands along the creek, <i>Heleocharis</i> sp. + <i>Carex</i> sp.- <i>Meesia triquetra</i> fen; on soaked peaty soil, associated: <i>Campylium polygamum</i> , <i>Warnstorfia exannulata</i> , <i>Calliergon giganteum</i> . Elevation 9000 ft.	Yelena I. Kosovich-Anderson 11061 (Rocky Mountain Herbarium 2019)
2011	1 collection (Abundant)	Outside Bridger-Teton National Forest. Fremont County, WY: Southeast portion of Wind River Range, Shoshone National Forest: east edge of Canyon Creek, "Meesia triquetra spot".	Vast boggy valley of creek, <i>Salix</i> sp.- <i>Carex</i> spp.- Bryidae fen, on soaked peaty soil, in partial shade. Elevation 9400 ft.	Yelena I. Kosovich-Anderson 11030 (Rocky Mountain Herbarium 2019)
2011	1 collection (Locally very abundant)	Outside Bridger-Teton National Forest. Fremont County, WY: Southeast portion of Wind River Range, Shoshone National Forest: head of unnamed tributary of Rock Creek.	Vast area of wetlands along the creek, <i>Salix</i> sp.- <i>Carex</i> spp. + <i>Heleocharis</i> sp.- Bryidae fen; in pure mats between sedge hummocks, on soaked peaty soil. Elevation 9000 ft.	Yelena I. Kosovich-Anderson 11046 (Rocky Mountain Herbarium 2019)
2011	1 collection	Outside Bridger-Teton National Forest. Fremont County, WY: Southeast portion of Wind River Range, Shoshone National Forest: head of unnamed tributary of Rock Creek.	Vast area of wetlands along the creek, <i>Salix</i> sp.- <i>Carex</i> spp.+ <i>Heleocharis</i> sp.- Bryidae fen; in mixed mats, on soaked peaty soil, associated: <i>Tomentypnum nitens</i> , <i>Warnstorfia exannulata</i> , <i>Calliergon giganteum</i> . Elevation 9000 ft.	Yelena I. Kosovich-Anderson 11043a (Rocky Mountain Herbarium 2019)
2010	1 collection	Outside Bridger-Teton National Forest. Fremont County, WY: Bighorn National Forest,	Saturated soil, base of mound in large patterned basin fen with seep zones	Martin J. Lenz 4404 (Rocky Mountain Herbarium 2019)

		Woodrock Fen, 3.0 air mi ENE of Granite Pass.	and scattered trees over part. Elevation 8915 ft.	
2010	1 collection	Outside Bridger-Teton National Forest: Fremont County, WY: Bighorn National Forest. near south end of Sawmill Lakes, 10.2 air mi E of Granite Pass.	Saturated soil in sparse <i>Carex</i> cover in basin fen with floating mat, springs and seep zones. Elevation 8215 ft.	Martin J. Lenz 4366 (Rocky Mountain Herbarium 2019)

<sup>1</sup>The Consortium of Pacific Northwest Herbaria (Consortium of Pacific Northwest Herbaria 2019) and the SEINet data portal (SEINet 2019) were also searched, and no additional occurrences on the Bridger-Teton National Forest were found.

- 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

N/A—No occurrences since 1990.

- 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?

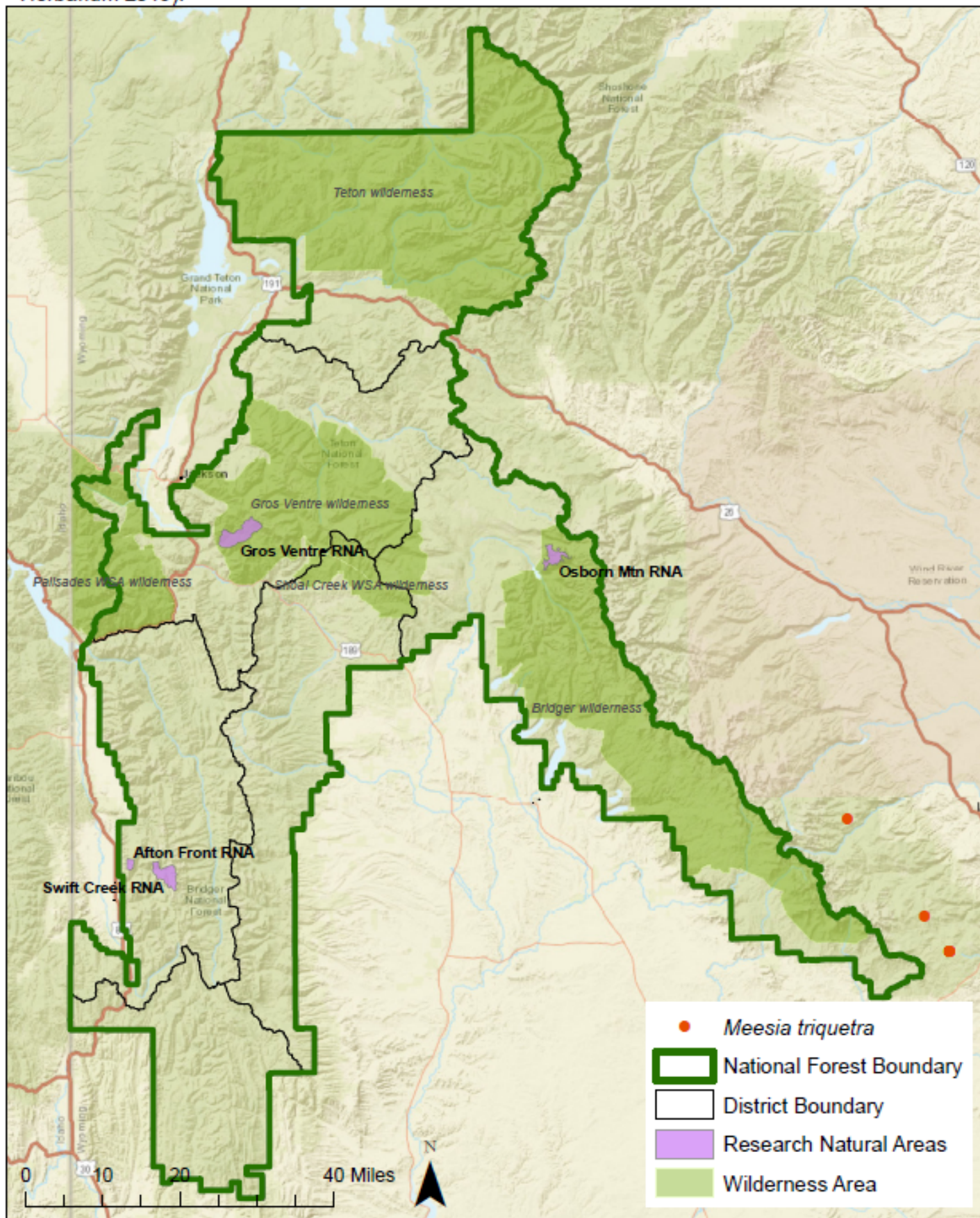
Yes X No\_\_\_

Provide explanation for determination

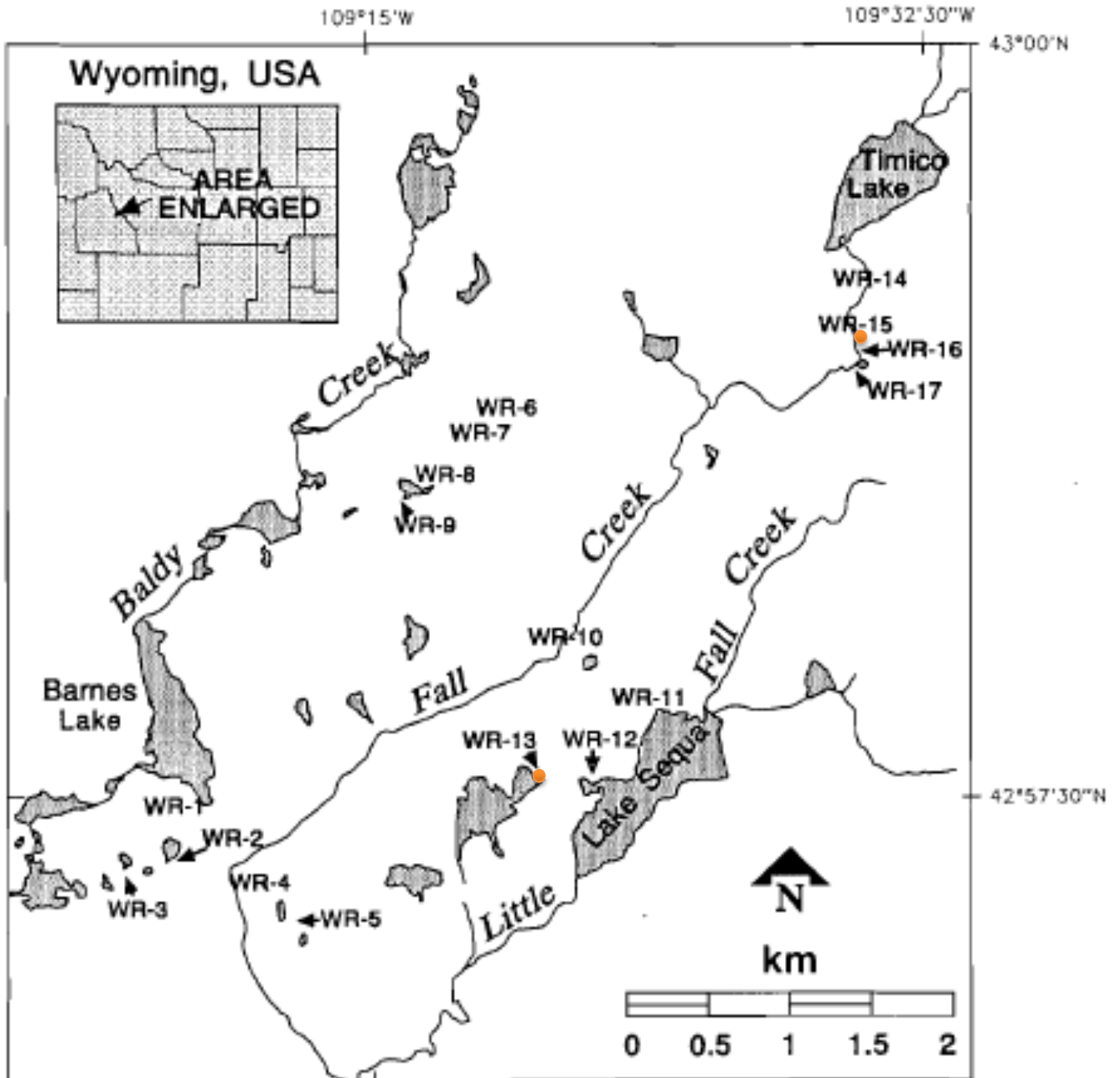
Although the last observation of this species on the Bridger-Teton National Forest was from 1989, suitable habitat (fens and wetlands) is present across the Forest. Additionally, since fens and wetlands are generally protected on Forest Service lands, there is no information to suggest that the 1989 populations no longer exist.

If determination is no, stop assessment

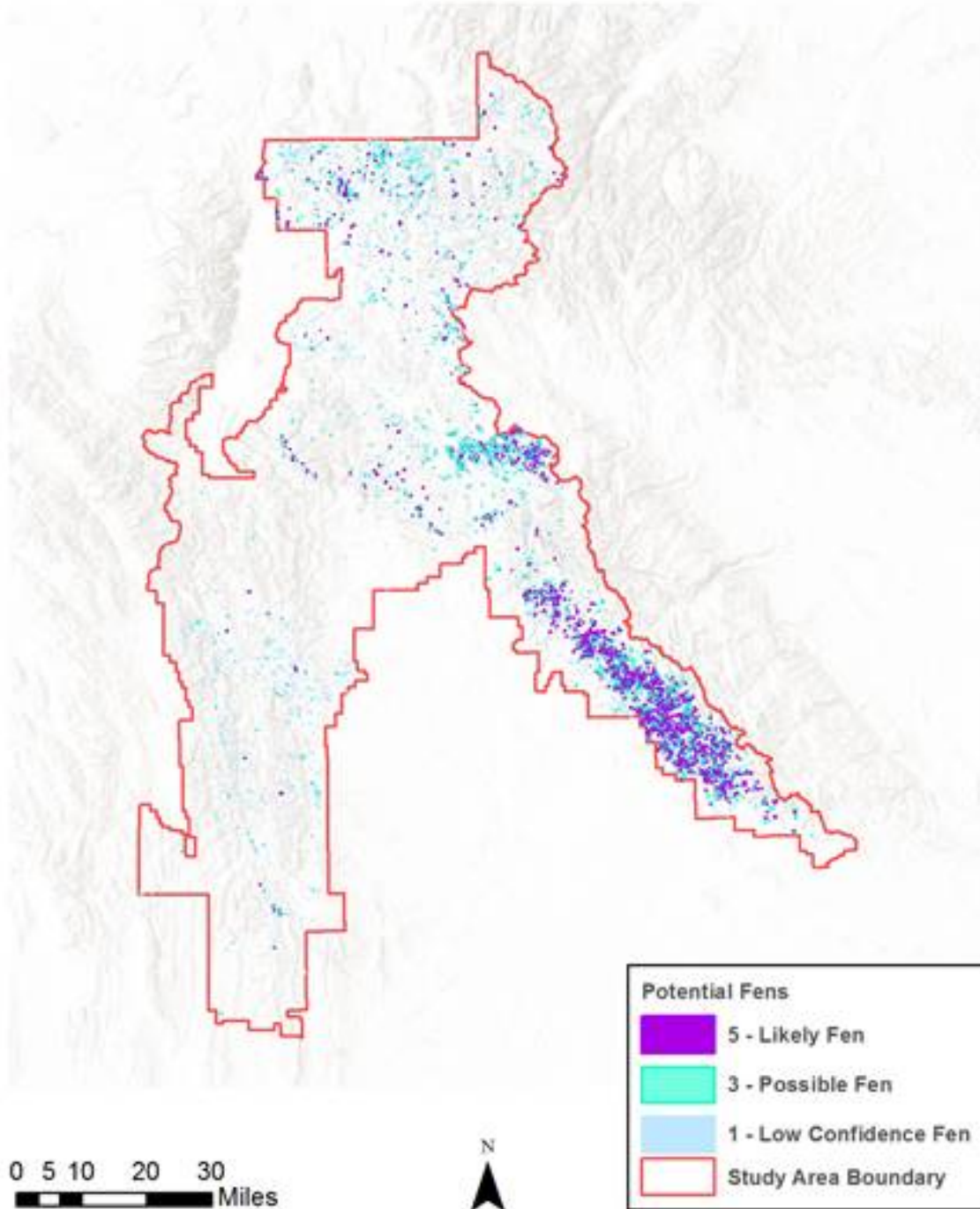
**Map 1, *M. triquetra* occurrences in Bridger-Teton National Forest vicinity (Rocky Mountain Herbarium 2019).**



Map 2, 1989 occurrences in WR-13 and WR -15 from Cooper and Andrus (1994) .



**Map 3, Fen distribution on the Bridger-Teton National Forest (Smith and Lemly 2018).**



Fen potential based on confidence value of 1, 3 or 5

5, Likely fen. Strong photo signature of fen vegetation, fen hydrology, and good landscape position. All likely fens should contain peat of 40cm or more throughout the entire area of the mapped feature.

3, Possible fen. Some fen indicators present (vegetation signature, topographic position, ponding or visibly saturated substrate), but not all indicators present. Some may be weak or missing. Possible fens may or may not have the required peat depth of 40cm, but may have patchy or thin peat throughout.

1, Low confidence fen. At least one fen indicator present, but weak. Low confidence fens are consistently saturated areas that do not show peat signatures in the aerial photography, but may contain fen or peat.

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

<b>Entity</b>	<b>Status/Rank (include definition)</b>
<b>NatureServe Global Status</b>	<b>G5—Secure</b> <i>Common; widespread and abundant</i>
<b>NatureServe State Status</b>	<b>NR—Unranked</b> <i>National or subnational conservation status not yet assessed.</i>
<b>WYNDD</b>	<b>In Review</b>
<b>USDA Forest Service</b>	<b>R4 Sensitive Species</b> <i>Those plant and animal species identified by a Regional Forester for which population viability is a concern, as evidenced by</i> <i>a. Significant current or predicted downward trends in population numbers or density.</i> <i>b. Significant current or predicted downward trends in habitat capability that would reduce a species' existing distribution</i>
<b>USDOI FWS</b>	Not listed
<b>USDOI BLM</b>	Not listed
<b>IUCN</b>	<b>NT—Near Threatened</b>

Sources: WYNDD 2019; Heidel 2018; USDA Forest Service Regions 2 and 4 Sensitive Species Lists; NatureServe 2019



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

Criteria	Rationale
<p>Distribution on the Bridger-Teton National Forest</p>	<p>Surveys conducted in 1989 documented <i>Meesia triquetra</i> in two of seventeen peatland complexes in the Wind River Range (Cooper and Andrus 1994). Although this species has not been observed on the Bridger-Teton National Forest since 1989, several more recent occurrences have been documented on nearby areas of the Shoshone and Bighorn National Forests (Table 1, Rocky Mountain Herbarium 2019).</p> <p>Additionally, suitable habitat for <i>M. triquetra</i> likely exists on the Bridger-Teton National Forest. Map 2 shows the distribution of potential fens on the Bridger-Teton National Forest (Smith and Lemly 2018). A high number of potential fens are located in the vicinity of the Wind River Range area and may serve as potential habitat for the species. Fen distribution patterns showed a strong elevation gradient, with 89percent of potential fens falling between 8,000 and 11,000 feet, as well as hotspots for fens in the North Fork Silver Creek, Upper Boulder Creek, Upper Pole Creek, and Washakie Creek-East Fork River (Smith and Lemly 2019).</p> <p>Based on the scarcity of occurrences, <i>M. triquetra</i> is likely limited a few small localities on the Bridger-Teton National Forest; however, the distribution of potential fen locations suggests that habitat may exist across the Forest, particularly at elevations of 8,000 and 11,000 feet and around the North Fork Silver Creek, Upper Boulder Creek, Upper Pole Creek, and Washakie Creek-East Fork River (Smith and Lemly 2019).</p>
<p>Distribution outside the Bridger-Teton National Forest</p>	<p><i>Meesia triquetra</i> has a circumboreal distribution: it is found in Northern Europe, northern Asia, Greenland, Canada, and the northern United States (iNaturalist 2019). Some discoveries have also been reported from Oceania (iNaturalist 2019). It is therefore, widely distributed outside the Forest, though limited to its specific habitat within its range (i.e., fens).</p>
<p>Abundance on the Bridger-Teton National Forest</p>	<p><i>Meesia triquetra</i> is frequent where appropriate habitat is available (Flora of North America 2019), and several occurrences on nearby areas of the Shoshone and Bighorn National Forests were reported as abundant or very abundant (Table 1, Rocky Mountain Herbarium 2019). Although there are no known occurrences on Bridger-Teton National Forest since 1989, suitable habitat likely exists across the Forest; based on local abundance on nearby Forests, <i>M. triquetra</i> may also be locally abundant on the Bridger-Teton National Forest.</p> <p><i>Meesia triquetra</i> was a target species for a recent botany inventory in select fens, including 16 fen sites, of the Caribou-Targhee and Bridger-Teton National Forests, but was not documented on either forest (Heidel 2019).</p>

Criteria	Rationale
	<p>Other surveys and habitat assessments have not identified this species on Bridger-Teton National Forest, including:</p> <ul style="list-style-type: none"> <li>• Afton Front Research Natural Area Bridger-Teton National Forest (Fertig and Jones 1994a)</li> <li>• Horse Creek Research Natural Area Bridger-Teton National Forest (Fertig and Jones 1994b)</li> <li>• Swift Creek Research Natural Area Bridger-Teton National Forest (Fertig and Jones 1994c)</li> <li>• Sensitive plant surveys and status of rare plant species on Bridger-Teton National Forest, 1997-1998 (Fertig 1999)</li> <li>• Rare Species and Riparian Vegetation of the Snake River Basin in Wyoming (Jones et al. 2001)</li> <li>• Survey for <i>Stephanomeria fluminea</i> on the Bridger-Teton National Forest (Markow 2004)</li> <li>• Wyoming Plant Species of Concern on Caribou-Targhee National Forest: 2007 Survey Results Teton and Lincoln counties, Wyoming (Mancuso and Heidel 2008)</li> <li>• A Floristic Inventory of Grand Teton National Park, Pinyon Peak Highlands, and Vicinity, Wyoming U.S.A (Kesonie and Hartman 2011)</li> <li>• Blackrock Creek Wild and Scenic River Botany Survey (Johnson 2011)</li> <li>• Sensitive and rare plant species inventory in the Salt River and Wyoming Ranges, Bridger-Teton National Forest (Heidel 2012)</li> <li>• Teton to Snake Fuels Management Project Botany Report and Biological Evaluation (Englebert 2013)</li> <li>• Botany inventories in select fens of the Caribou-Targhee and Bridger-Teton National Forests (Heidel 2019)</li> </ul>
Population Trend on the Bridger-Teton National Forest	There is not enough information to assess population trends for <i>M. triquetra</i> on the Bridger-Teton National Forest because no occurrences have been documented on the Forest since 1989.
Habitat Trend on the Bridger-Teton National Forest	<p><i>Meesia triquetra</i> occurs in wetland sites, specifically, within wet woods in the wettest portions of what are called "extreme rich fens" (i.e., fens having surface waters with high pH and calcium concentrations). This species is thought to be a "rich fen indicator of high fidelity." Associates include <i>Scorpidium</i> spp. and <i>Drepanocladus revolvens</i> (iNaturalist 2019).</p> <p>Mapping of potential fens based on digital aerial photography and topographic maps identified 9,503 potential fen locations on the Bridger-Teton National Forest, indicating a rich resource of fen wetlands that may provide potential habitat for fen obligates such as <i>Meesia triquetra</i>. The potential fen locations had an average size of 1.44 acres and covered a total of 13,708 acres or 0.4 percent of the total Forest land area (Smith and Lemly 2018). 89 percent of all potential fen locations and 94 percent of likely fen locations</p>

Criteria	Rationale
	<p>occurred between 8,000 to 11,000 ft in elevation. North Fork of Silver Creek, Upper Boulder Creek, Upper Pole Creek, and Washakie Creek-East Fork River contained particularly high numbers of likely fens (Smith and Lemly 2018). Most potential fens on the Bridger-Teton National Forest showed little sign of human disturbance, particularly at higher elevations (Smith and Lemly 2018), and fens and wetlands are generally protected on National Forests.</p>
<p>Threats to the Species and its Habitat on the Bridger-Teton National Forest</p>	<p>Fens are fragile habitats susceptible to impacts from livestock grazing, hydrologic alteration, construction and continued use of roads, and peat mining. Rich fen habitats are especially susceptible to modification. The surface water chemistry of rich fens is sensitive to climatic and anthropogenic influences (iNaturalist 2019).</p> <p>Despite these potential threats, most potential fens in Bridger-Teton National Forest showed little sign of human disturbance, particularly at higher elevations (Smith and Lemly 2018). Additionally, fens and wetlands receive considerations and protections from disturbances through forest management direction and water regulations. These considerations and protections would avoid or minimize adverse effects to special status fen obligate plants, such as <i>M. triquetra</i>, where they occur.</p> <p>Climate change is a primary threat for fen and wetland communities. Climate related effects and drying of wetlands could reduce habitat and viability for rare species. Warming temperatures and reduced snowpack may result in the loss of high-elevation riparian and wetland habitats, resulting in drier, less productive systems. With rising temperatures, frigid snow- and water-dependent ecosystems in the upper portions of watersheds will have very little room to move upslope. Elevating temperatures will increase competition from riparian species now occurring at lower elevations, and smaller snowpacks will increase competition from upland species that occupy drier sites. According to the Intermountain Adaption Partnership assessments, high-elevation riparian and wetland communities have a moderate to high sensitivity to climate change, a low to moderate adaptive capacity, and high vulnerability to climate change (Halofsky et al. 2018).</p> <p>To analyze trends in occupied 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 on the Forest (USFS GIS 2019, Google Earth Pro 2019). The locations of the 1989 occurrences were estimated based on the descriptions in Table 1 (Cooper and Andrus 1994).</p> <p>The 1989 occurrences of <i>M. triquetra</i> are within the Bridger Wilderness Area. A Wilderness Area is “an area of undeveloped Federal land retaining its primeval character and influence, without permanent improvements or human habitation, which is protected and managed so as to preserve its natural conditions” (Wilderness Act of 1964), indicating that effects from anthropogenic activities area likely minimal.</p>

Criteria	Rationale
	<p>There are no mapped nonnative plant invasions within the vicinity (approximately 5 miles) of the 1989 occurrences; it is, therefore, unlikely that invasive plants have impacted the populations or surrounding habitat.</p> <p>A large (approximately 37,376 acres) wildfire occurred within the vicinity of the 1989 occurrences in 1988, a year before the occurrences were documented. The fire likely altered habitat through changes in the physical and chemical properties of soils, and plant productivity, which may persist years after the fire (Sulwiński et al. 2017).</p> <p>Several non-motorized trails are within the vicinity of the 1989 occurrences. It is possible that trail use has increased human presence into the species' habitat, which could cause habitat degradation and damage to individuals (e.g., through trampling). However, since the population is within the Bridger Wilderness Area, human presence and associated disturbance should be minimal.</p> <p>No active grazing allotments overlap the 1989 occurrences. However, they lie within closed allotments, indicating that grazing occurred in the area in the past, possibly since the occurrences were recorded. Past grazing may have had effects on habitat and individuals such as soil compaction, vegetation reductions, water quality degradation, and trampling. Additionally, as active grazing allotments cover a large portion of the Forest area, it is possibly that impacts from grazing could occur in potential habitat where occurrences have not been documented.</p> <p>The above analysis suggests that habitat for <i>M. triquetra</i> has likely experienced low to low–moderate effects from natural and anthropogenic disturbances.</p>
Life history and demographic characteristics of the species	<p><i>Meesia triquetra</i> grows in small tufts or cushions. Plants are acrocarpous (having clustered upright stems and the reproductive parts borne at the tip of a stem) and dioicous (gametophytes produce only sperm or eggs but never both) (iNaturalist 2019). Asexual reproduction is widespread in bryophytes, and many bryophyte species reproduce exclusively asexually (Frey and Kürschner 2011). Asexual diaspores play a key role in dispersal, habitat colonization, and bryophyte community dynamics. They may also increase chances of survival and re-establishment under unfavorable conditions or environmental conditions (Frey and Kürschner 2011).</p>
Date: L. Chipman Reviewer: 9/26/19	

## Summary and Recommendations

Species (Scientific and Common Name): *Meesia triquetra* (Three-ranked humpmoss)

*Meesia triquetra* does not have a state conservation rank but is listed as G5 (secure) globally. It has a circumboreal distribution and occurs in wetland sites, specifically, within wet woods in the wettest portions of what are called "extreme rich fens". Mapping of potential fens on the Forest using digital aerial photography identified 9,503 potential locations, with an average size of 1.44 acres and covering a total of 13,708 acres. These potential fens occur mostly between 8,000 and 11,000' elevation, with probable hotspots in the North Fork Silver Creek, Upper Boulder Creek, Upper Pole Creek, and Washakie Creek-East Fork River (Smith and Lemly 2019). Despite the abundance of potential fens on the forest, *M. triquetra* is known from just two occurrences in the Bridger Wilderness from 1989. Botanical inventory in 2018 of select fen locations did not report new occurrences. Botanical surveys in 2010 and 2011 on the nearby Shoshone and Bighorn National Forests yielded several populations reported as abundant or very abundant. There is not enough information to assess population trends for *M. triquetra* on the Bridger-Teton National Forest.

Habitat assessment suggests low-low moderate effects from natural and anthropogenic disturbances. Fens are fragile habitats susceptible to impacts from livestock grazing, hydrologic alteration, construction and continued use of roads, and peat mining. Despite these threats, most potential fens showed little sign of human disturbance. Additionally, fens and wetlands receive consideration and protection from disturbances through forest management direction and water regulations. These considerations and protections will avoid or minimize adverse effects to special status fen obligate plants, such as *M. triquetra*, where they occur. Climate driven changes to fen hydrology are therefore the primary threat for fen and wetland communities on the Forest.

The vicinity of the 1989 occurrence has no known invasion by nonnative plants. The area lies within a closed grazing allotment, indicating that while grazing may have once affected the habitat, it is no longer a concern. Several non-motorized trails access the area, but given the wilderness status, visitation and recreational impact is minimized. Given the above consideration, it is recommended that *Meesia triquetra* not be added as a SCC due to its existing protections for potential habitats, and apparent lack of threats at the historically known locations.

Evaluator: Jessica Irwin Date: 9/30/2020

## References

- Consortium of Pacific Northwest Herbaria. 2019. Specimen data search. Available at: <http://pnwherbaria.org>.
- Cooper and Andrus. 1994. Patterns of vegetation and water chemistry in peatlands of the west central Wind River Ranger, WY, USA. *Canadian Journal of Botany*. Vol 72. Pages 1586-1597.
- Englebort, Cynthia 2013. Teton to Snake Fuels Management Project: Botany Report and Biological Evaluation. Prepared for Jackson Ranger District, Bridger-Teton National Forest, by TEAMS Planning Enterprise Unit. April 2012. Updated May 2013.
- Fertig, W. and Jones, G.P. 1994a. Establishment Record for Afton Front Research Natural Area within Bridger-Teton National Forest, Teton County, Wyoming. Prepared for the U.S. Forest Service.
- Fertig, W. and Jones, G.P. 1994b. Establishment Record for Horse Creek Research Natural Area within Bridger-Teton National Forest, Teton County, Wyoming. Prepared for the U.S. Forest Service.
- Fertig, W. and Jones, G.P. 1994c. Establishment Record for Swift Creek Research Natural Area within Bridger-Teton National Forest, Teton County, Wyoming. Prepared for the U.S. Forest Service.
- Fertig, W. 1999. Sensitive plant surveys and status of rare plant species on Bridger-Teton National Forest, 1997-1998. Report prepared by the Wyoming Natural Diversity Database, Laramie, Wyoming.
- Fertig, W. 2000. Status of Plant Species of Special Concern in US Forest Service Region 4 in Wyoming. Prepared for the U.S. Forest Service, by the Wyoming Natural Diversity Database, University of Wyoming. Laramie, WY.
- Flora of North America. 2019. *Meesia triquetra* (Linnaeus ex Jolyclerc). Available at: [http://www.efloras.org/florataxon.aspx?flora\\_id=1&taxon\\_id=200001545](http://www.efloras.org/florataxon.aspx?flora_id=1&taxon_id=200001545). Accessed on September 20, 2019.
- Frey, W and H. Kürschner. 2011. Asexual reproduction, habitat colonization and habitat maintenance in bryophytes. *Flora - Morphology, Distribution, Functional Ecology of Plants*. Volume 206, Issue 3, March 2011, Pages 173-184.
- Google Earth Pro, 2019. Aerial photo and mapping analysis. Software version 7.3.2.5776 (64-bit).
- Halofsky, Jessica E.; Peterson, David L.; Ho, Joanne J.; Little, Natalie, J.; Joyce, Linda A., eds. 2018. Climate change vulnerability and adaptation in the Intermountain Region. Gen. Tech. Rep. RMRS-GTR-375. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. Part 1. pp. 1–197.
- Heidel, B. 2012. Sensitive and rare plant species inventory in the Salt River and Wyoming Ranges, Bridger-Teton National Forest. Wyoming Natural Diversity Database. Laramie, WY.
- Heidel, B. 2019. Botany inventories in select fens of the Caribou-Targhee and Bridger-Teton National Forests. Report prepared for the USDA Forest Service – Region 4 by the Wyoming Natural Diversity Database - University of Wyoming, Laramie, Wyoming.
- iNaturalist. 2019. Threeranked Humpmoss (*Meesia triquetra*). Available at: <https://www.inaturalist.org/taxa/148218-Meesia-triquetra>. Accessed on September 20, 2019.
- Jones, G.P., R.S. Smith, W.F. Fertig, D.A. Keinath, M.L. Neighbours, L.A. Welp and G.P. Beauvais. 2001. Rare Species and Riparian Vegetation of the Snake River Basin in Wyoming. Prepared for the U.S. Bureau of Reclamation, by the Wyoming Natural Diversity Database, University of Wyoming. Laramie, WY.
- Kesonie, D. and Hartman, R. 2011. A Floristic Inventory of Grand Teton National Park, Pinyon Peak Highlands, and Vicinity, Wyoming U.S.A. *Journal of the Botanical Research Institute of Texas* 5(1) pages 357 – 388.
- Markow, S. 2004. Survey for *Stephanomeria fluminea* on the Bridger-Teton National Forest Prepared for the

Bridger-Teton National Forest and the Region 4 Forest Service Office, by the Wyoming Natural Diversity Database, University of Wyoming. Laramie, WY.

Mancuso, M. and B. Heidel. 2008. Wyoming Plant Species of Concern on Caribou-Targhee National Forest: 2007 Survey Results Teton and Lincoln counties, Wyoming. Prepared for Caribou-Targhee National Forest by Wyoming Natural Diversity Database, Laramie, WY.

National Resources Conservation Service (NRCS). 2019. *Meesia triquetra* (L. ex Jolycl.) Ångstr. Internet website: <https://plants.usda.gov/core/profile?symbol=METR70>. Accessed on September 23, 2019.

NatureServe. 2019. NatureServe Explorer: An online encyclopedia of life [web application]. Version 7.1. NatureServe, Arlington, Virginia. Internet website: <http://explorer.natureserve.org>.

Rocky Mountain Herbarium Specimen Database. 2019 University of Wyoming, Department of Botany. Laramie, WY. Internet website: <http://rmh.uwyo.edu/data/search.php>. Accessed on September 23, 2019.

SEINet. 2019. SEINet data portal. Available at: <http://swbiodiversity.org/seinet/collections/index.php>.

Smith, G. and J. Lemly. 2018. Fen Mapping for the Bridger-Teton National Forest. Colorado Natural Heritage Program, Colorado State University, Fort Collins, Colorado.

Sulwiński, M, M. Mętrak, M. Suska-Malawska. 2017. Long-term fire effects of the drained open fen on organic soils. *Archives of Environmental Protection*. 43(1): 11–19.

Wyoming Natural Diversity Database. 2019. Wyoming Natural Diversity Database; Data Explorer. Laramie, WY: University of Wyoming.