

<b>SPECIES: Scientific [common]</b>	<i>Anaxyrus boreas</i> [Western (Boreal) Toad]
<b>Forest:</b>	Bridger-Teton National Forest
<b>Forest Reviewer:</b>	Randall Griebel, James Wilder
<b>Date of Review:</b>	2/6/2018; updated 03/28/2025
<b>Forest concurrence (or recommendation if new) for inclusion of species on list of potential SCC: (Enter Yes or No)</b>	YES

**FOREST REVIEW RESULTS:**

1. The Forest concurs or recommends the species for inclusion on the list of potential SCC:  
Yes  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  No   
 If no, provide explanation and stop assessment.
2. Is the Species Known to Occur within the Planning Area? Yes  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	Source of Information
Unknown	1	Greys River Ranger District	Wyoming Natural Diversity Database; USFS Natural Resource Information System; WGFD (January 2018)
2011	1		
1982	2	Kemmerer Ranger District	Wyoming Natural Diversity Database; USFS Natural Resource Information System; WGFD (January 2018)
1993-2017	521 records; thousands of individuals		
Unknown/1934-1965	219	Pinedale Ranger District	Wyoming Natural Diversity Database; USFS Natural Resource Information System; WGFD (January 2018)
1991-2017	803 records; thousands of individuals		
1934-1982	17	Big Piney Ranger District	Wyoming Natural Diversity Database; USFS Natural Resource Information System; WGFD (January 2018)
1994-2017	968 records; thousands of individuals		
Unknown	5	Blackrock Ranger District	Wyoming Natural Diversity Database; USFS Natural Resource Information System; WGFD (January 2018)
1991-2017	440 records; thousands of individuals		
Unknown/1989	4	Jackson Ranger District	Wyoming Natural Diversity Database; USFS Natural Resource Information System; WGFD (January 2018)
1991-2017	112 records; hundreds of individuals		

*\*Numbers are approximations. Due to an overlap in data from multiple datasets, duplicate occupancy records are expected. This is avoided to the extent practicable. The number of records is provided as opposed to the number of individuals; this is because the number of juveniles, metamorphs, and tadpoles in each dataset were too large to count accurately.*

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\_\_\_

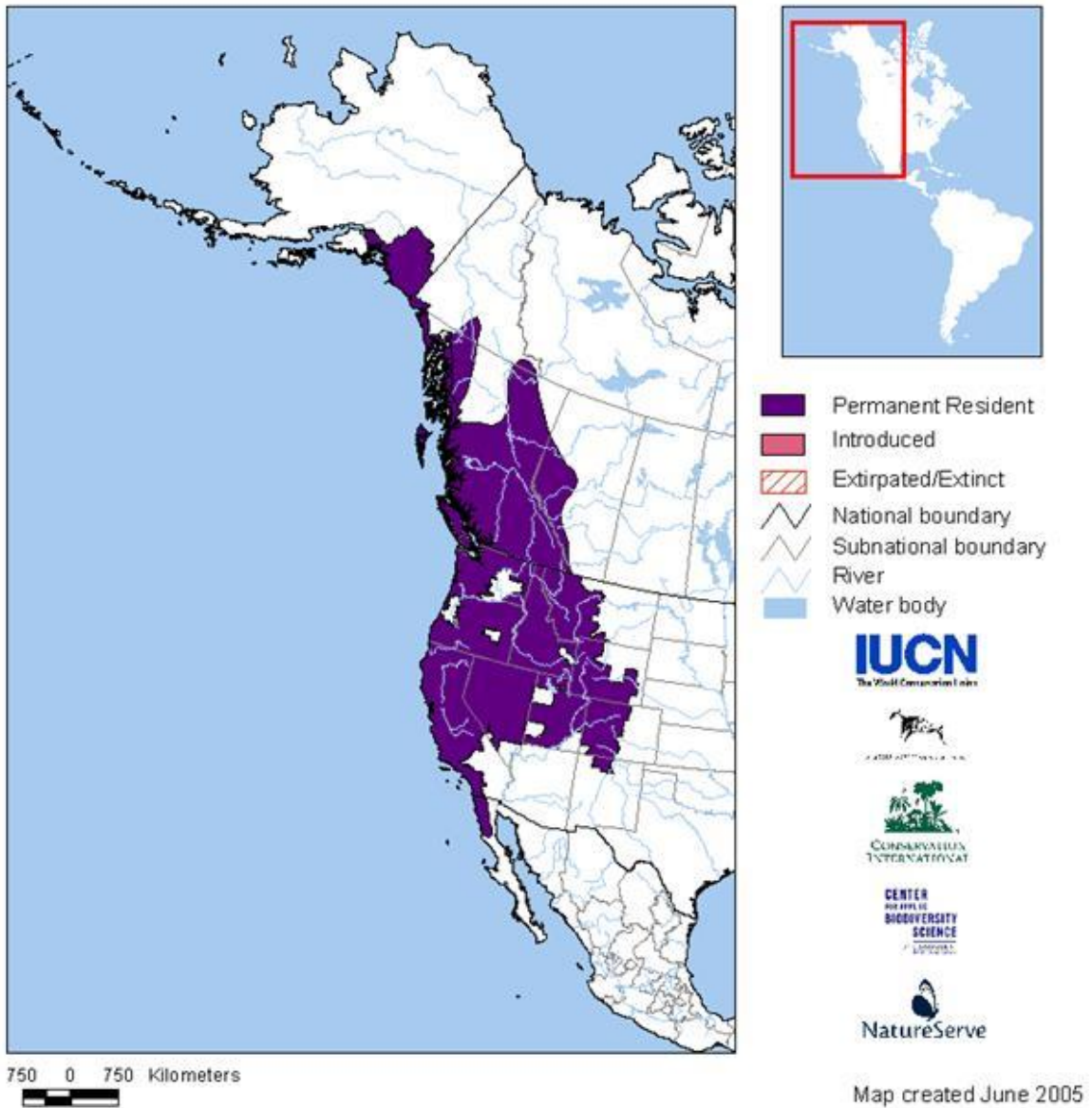
If no, provide explanation and stop assessment

- 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\_\_\_

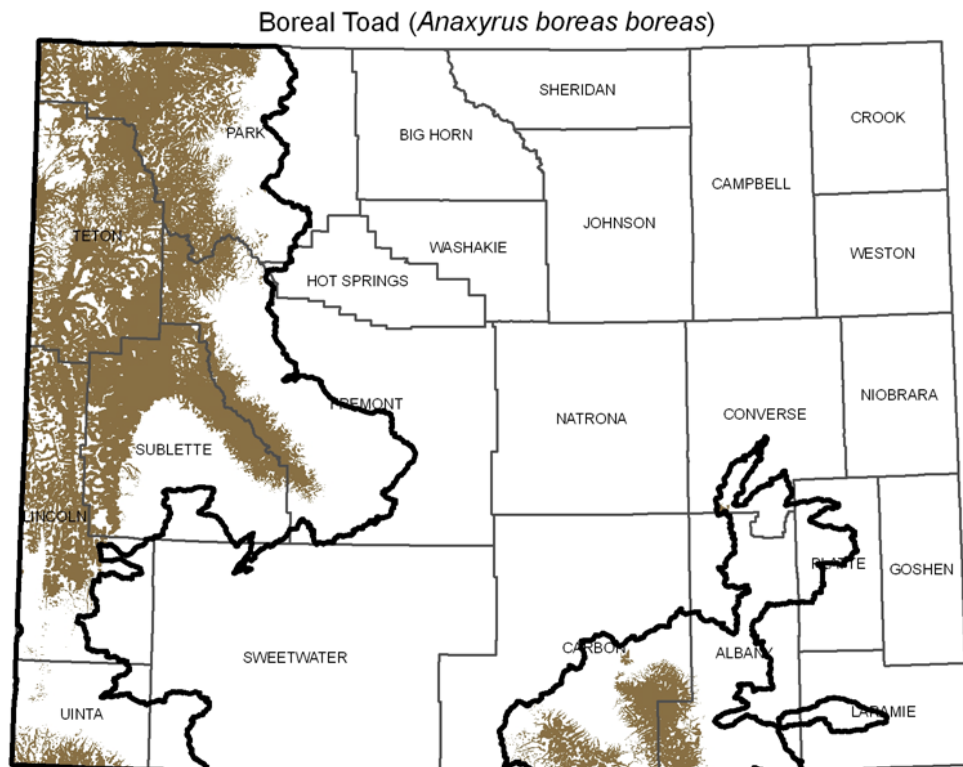
Provide explanation for determination; If determination is no, stop assessment

- d. **Map 1**, Western toad range map of North America



Nature Serve. Accessed January 2018. Western Toad (*Anaxyrus boreas*).

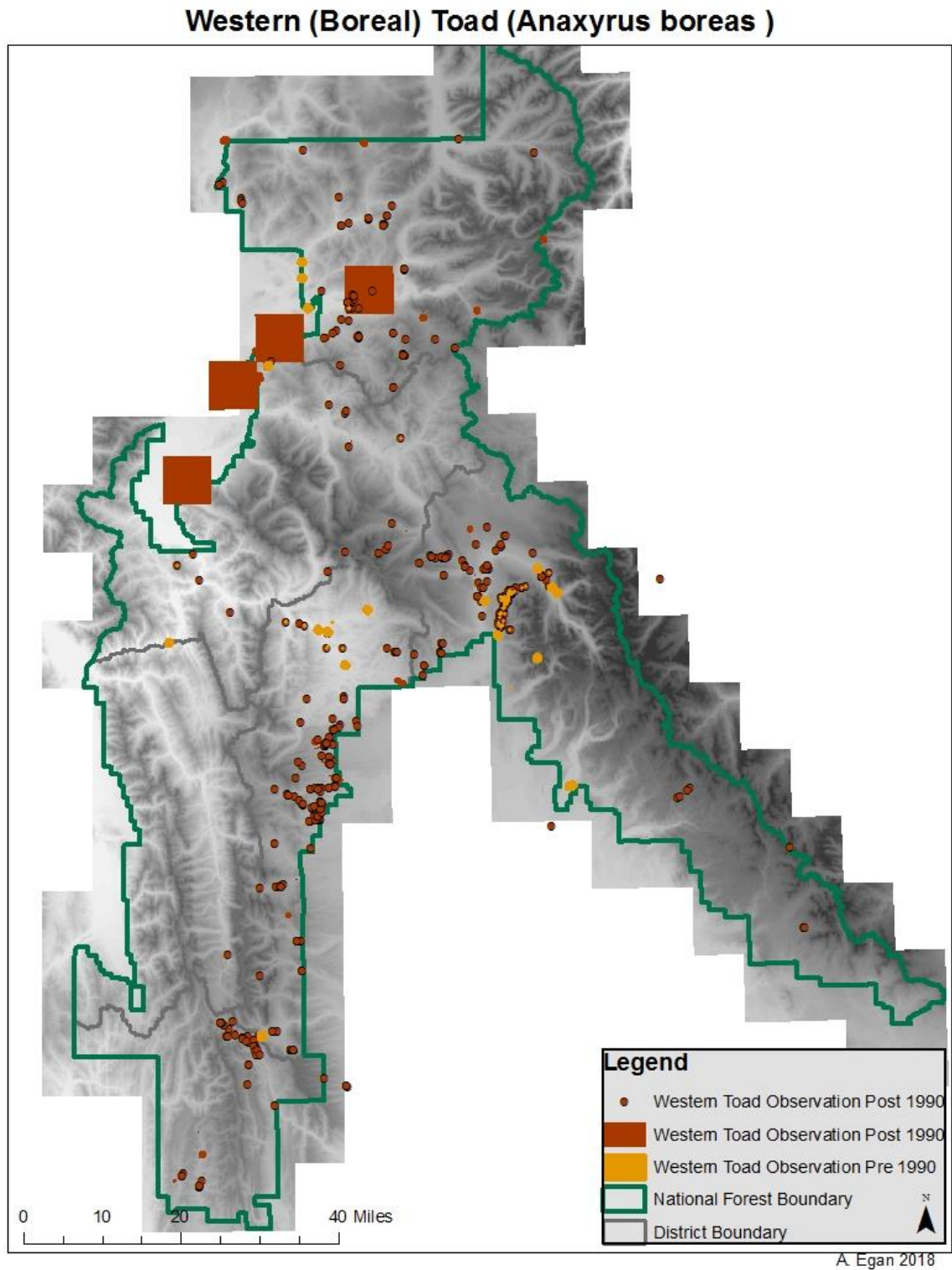
e. **Map 2**, Range and predicted distribution of *Anaxyrus boreas* in Wyoming.



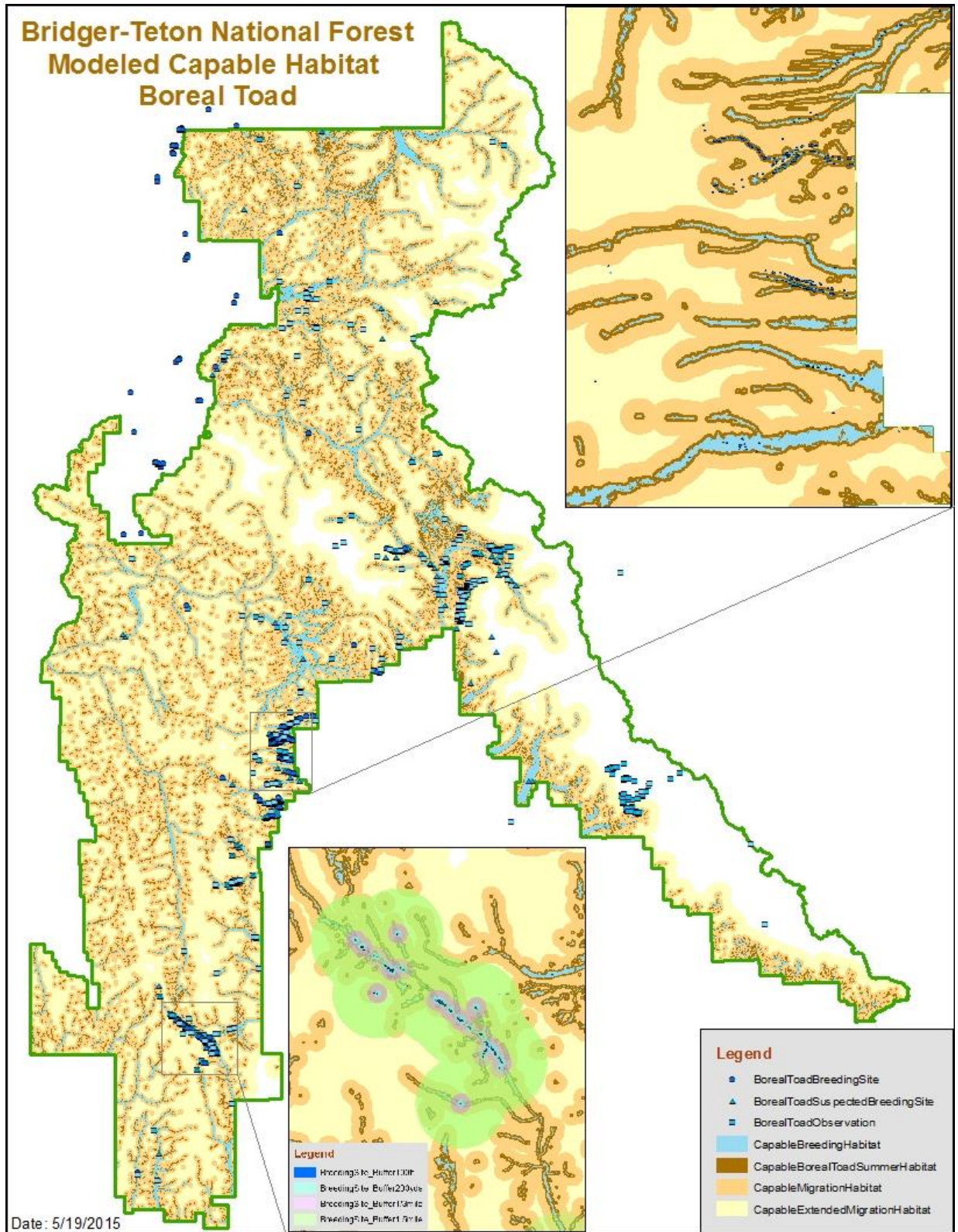
SOURCE: Digital maps of ranges and predicted distributions for Wyoming Species of Greatest Conservation Need: April 2010. Wyoming Natural Diversity Database. University of Wyoming, Laramie, Wyoming. Note that brown indicates the predicted distribution of the species; heavy black lines indicate outermost boundaries of possible occurrence.

Wyoming Game and Fish Department. 2017. State Wildlife Action Plan. Western Toad (*Anaxyrus boreas*).

- f. **Map 3**, Map of Western toad occurrences on the Bridger-Teton National Forest (Wyoming Natural Diversity Database, USFS Natural Resource Information System, & WGFD [January 2018])



g. **Map 4**, Modeled capable habitat for Western (Boreal) toads on the Bridger-Teton National Forest (Egan 2015)



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)
<p><b>NatureServe Global Status</b></p>	<p><b>G4— Apparently Secure</b></p> <p><i>Uncommon but not rare; some cause for long-term concern due to declines or other factors. Secure. Large range in much of the western United States and western Canada; locally common, but rapid losses and declines have occurred in many populations across the range for unknown reasons, even in relatively pristine environments.</i></p>
<p><b>NatureServe State Status</b></p>	<p><b>S1— Critically Imperiled</b></p> <p><i>At very high risk of extinction due to extreme rarity (often 5 or fewer populations), very steep declines, or other factors.</i></p>
<p><b>WGFD</b></p>	<p><b>NSS1 (Aa), Tier I</b></p> <p><i><u>Population Status:</u> Imperiled - Population size or distribution is restricted or declining and extirpation is possible</i>  <i><u>Limiting Factors:</u> Extreme - Limiting factors are severe and continue to increase in severity</i>  <i><u>Tier I:</u> High priority</i></p> <p><i>[The WGFD's Species of Greater Conservation Need (SGCN) designation process is based upon its <b>Native Species Status (NSS)</b> classification system that compares population and limiting factor variables using a 16 cell matrix. As a species moves from a placement closest to the upper left corner of the matrix (Aa/NSS1) toward the lower right corner (Dd/NSS7) the species' population status in Wyoming is considered more secure. Numerical scores were assigned to each of these variables and summed to provide a total score (i.e. NSS3). SGCN were placed into one of three tiers based on their total score: Tier I – highest priority, Tier II – moderate priority, and Tier III – lowest priority.]</i>            (WGFD - Wyoming Species of Greatest Conservation Need)</p>
<p><b>WYNDD</b></p>	<p><b>Species of Concern</b></p> <p><i>Species vulnerable to extirpation at the global or state level due to:</i></p> <ul style="list-style-type: none"> <li><i>a. their rarity (e.g., restricted distribution, small population size, low population density)</i></li> <li><i>b. inherent vulnerability (e.g., specialized habitat requirements, restrictive life history)</i></li> <li><i>c. threats (e.g., significant loss of habitat, sensitivity to disturbances)</i></li> </ul> <p>(Wyoming Natural Diversity Database - Species of Concern)</p>

<p><b>USDA Forest Service</b></p>	<p><b>Region 4: Sensitive Species</b></p> <p><i>Those plant and animal species identified by a Regional Forester for which population viability is a concern, as evidenced by</i></p> <ul style="list-style-type: none"> <li><i>a. Significant current or predicted downward trends in population numbers or density.</i></li> <li><i>b. Significant current or predicted downward trends in habitat capability that would reduce a species' existing distribution.</i></li> </ul> <p>(FSM 2670.5 – Threatened, Endangered &amp; Sensitive Species)</p>
<p><b>UDI FWS</b></p>	<p><b>No Special Status</b></p>
<p><b>WY BLM</b></p>	<p><b>Sensitive</b></p> <p><i>1. Sensitive species must be native species found on BLM-administrated lands for which BLM has the capability to significantly affect the conservation status of the species through management, and either:</i></p> <ul style="list-style-type: none"> <li><i>a. There is information that a species has recently undergone, is undergoing, or is predicted to undergo a downward trend such that the viability of the species or a distinct population segment of the species is at risk across all or a significant portion of the species range, or</i></li> <li><i>b. The species depends on ecological refugia or specialized or unique habitats on BLM-administrated lands, and there is evidence that such areas are threatened with alteration such that the continued viability of the species in that area would be at risk.</i></li> </ul> <p><i>2. All federally designated candidate species, proposed species, and delisted species in the 5 years following their delisting shall be conserved as Bureau sensitive species</i></p> <p>(BLM Wyoming Sensitive Species Policy and List; March 31, 2010)</p>
<p><b>IUCN</b></p>	<p><b>NT - Near threatened</b></p> <p><i>A taxon is Near Threatened when it has been evaluated against the criteria but does not qualify for Critically Endangered, Endangered or Vulnerable now, but is close to qualifying for or is likely to qualify for a threatened category in the near future.</i></p> <p>(IUCN – Red List Categories and Criteria)</p>

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

Species (Scientific and Common Name): <i>Anaxyrus boreas</i> [Western (Boreal) Toad]		
Criteria	Rationale	Literature Citations
Distribution on Bridger-Teton National Forest	<p>The Western (Boreal) toad range overlaps much of the northwestern United States including the Bridger-Teton National Forest (Map 1). In Wyoming, the Western (Boreal) toad inhabits wet areas within foothills, montane, and subalpine zones from 6,500 to 11,500 feet in elevation (WGFD 2017). The range and predicted distribution for the Western toad, as identified by WNDD (Map 2), shows potential suitable habitat for this species throughout most, if not all, of the BTNF. Western (Boreal) toads are typically found in association with water such as beaver ponds and streams. However, this species often nocturnally visits more terrestrial habitats to forage and migrate (WGFD 2017).</p> <p>A majority of existing Western (Boreal) toad populations and potential toad habitat in this portion of the Rocky Mountains exists on National Forest System lands and in National Parks (DeLong 2015). On the Bridger-Teton National Forest, the species is known to occur on all 6 of the Ranger Districts (Map 3). However, much of the Western toad distribution on the BTNF is unknown and known occupancy locations appear to be clustered. For example, the majority of the Western toad observations on the Kemmerer and Big Piney Ranger Districts are grouped along portions of a single watershed, even where suitable habitat has been identified and surveyed throughout other areas of the districts.</p>	<p>DeLong, D. 2015. Literature Review and Analysis of Scientific Information for the Conservation Assessment for Columbia Spotted Frogs and Boreal Toads on the Bridger-Teton National Forest. Bridger-Teton National Forest, Jackson, Wyoming.</p> <p>Wyoming Game and Fish Department. 2017. State Wildlife Action Plan. Western Toad (<i>Anaxyrus boreas</i>).</p> <p>Wyoming Natural Diversity Database (January 2018)</p>
Abundance on the Bridger-Teton National Forest	<p>The current distribution and abundance of Western (Boreal) toads on the BTNF are not fully known. With respect to historic distribution and abundance, the WNDD (2011) database lists approximately 735 historic breeding sites within the Greater Yellowstone Ecosystem from 1892 to present; a large majority of these are after 1997 (DeLong 2015).</p> <p>Boreal toads were formerly widespread and common, but have declined dramatically in the last three decades in many portions of its extensive range in western North America (Carey 1993, Corn 1994, Rose et al. 1995, Muths 2005, as cited by DeLong 2015). Western (Boreal) toad populations in the Rocky</p>	<p>DeLong, D. 2015. Literature Review and Analysis of Scientific Information for the Conservation Assessment for Columbia Spotted Frogs and Boreal Toads on the Bridger-Teton National Forest. Bridger-Teton National Forest, Jackson, Wyoming.</p> <p>NatureServe. 2025. NatureServe Explorer: An online encyclopedia of life [web application]. NatureServe, Arlington, Virginia. Available at:</p>

Species (Scientific and Common Name): <i>Anaxyrus boreas</i> [Western (Boreal) Toad]		
Criteria	Rationale	Literature Citations
	<p>Mountains have been in a state of severe decline in areas where they were once abundant, and the species is considered imperiled due to greatly restricted numbers; thus, extirpation is possible (DeLong 2015). For the state of Wyoming the species is considered to be “Extremely Rare” (WGFD 2017)</p> <p>Robust population trends are not available for Western (Boreal) toad in Wyoming (as described below). However, available information indicates that Western toad distribution and abundance has substantially declined in Wyoming since the 1970s (WGFD 2017, NatureServe 2025). Although Western (Boreal) toads were likely once common in suitable habitat on the BTNF, their distribution and abundance has declined, substantially in places (DeLong 2015).</p>	<p><a href="http://explorer.natureserve.org">http://explorer.natureserve.org</a>. (Accessed: April 03, 2025).</p> <p>Wyoming Game and Fish Department. 2017. State Wildlife Action Plan. Western Toad (<i>Anaxyrus boreas</i>).</p>
Population Trend on the Bridger-Teton National Forest	<p>According to the WGFD, the population status for the Western toad is imperiled due to greatly restricted numbers and extirpation is possible. Rocky Mountain populations in Colorado and Wyoming have undergone a drastic decline since the 1970s (Corn et al. 1989; Hammerson 1989, 1992, 1999; Carey 1993, as cited in Nature Serve (2018)). Because Western (Boreal) toads only recently began to be monitored on the BTNF and because there is too little historical data to assess population trends, it is not clear when populations declined on the BTNF, how quickly they declined, and how precipitous the declines have been (DeLong 2015).</p> <p>Western toads are rare in the plan area, occupying ~5-15% of surveyed sites (Wallace and Tronstad 2019, RMAP 2025). Current occupancy is highest in the Gros Ventre and adjacent northwestern portion of the Wind River range (Wallace and Tronstad 2019). Preliminary results from the Rocky Mountain Amphibian Project in the Bridger-Teton do not show a consistent trend in species occupancy since 2014 (RMAP 2025).</p> <p>Hossack et al. (2015) studied population trends of amphibians in areas surrounding the BTNF, including Glacier, Yellowstone, Grand Teton, and Rocky Mountain National Parks. Their studies supported earlier work (Corn et al.</p>	<p>Corn, P. S., Hossack, B. R., Muths, E., Patla, D. A., Peterson, C. R., and A. L. Gallant. 2005. Status of amphibians on the Continental Divide: surveys on a transect from Montana to Colorado, USA. <i>Alytes</i> 22:85–94.</p> <p>DeLong, D. 2015. Literature Review and Analysis of Scientific Information for the Conservation Assessment for Columbia Spotted Frogs and Boreal Toads on the Bridger-Teton National Forest. Bridger-Teton National Forest, Jackson, Wyoming.</p> <p>Hossack, B. R., Gould, W.R., Patla, D.A., Muths, E., Daley, R., Legg, K., and P. S. Corn. 2015. Trends in Rocky Mountain amphibians and the role of beaver as a keystone species. <i>Biological Conservation</i> 187:260–269.</p> <p>Muths, E. 2003. Home range and movements of boreal toads in undisturbed habitats. <i>Copeia</i> 1:160-165.</p>

Species (Scientific and Common Name): <i>Anaxyrus boreas</i> [Western (Boreal) Toad]		
Criteria	Rationale	Literature Citations
	<p>2005) documenting a decrease in amphibian abundance from north to south along the continental divide (Rocky Mountains) due to population declines over recent decades. They found that Western (Boreal) toads declined between 2002 and 2011 in (collectively) Yellowstone and Grand Teton National Park – areas adjacent to the BTNF – but no change for Glacier National Park. Western (Boreal) toads were too rare in Rocky Mountain National Park to study population trends, likely related to declines caused by chytrid fungus (Muths et al. 2003). While population trend data is lacking on the BTNF as of currently, this study suggests that based on nearby populations trends, Western toads on adjacent Forest lands are also in decline.</p> <p>Western (Boreal) toads are classified by Region 4 as a sensitive species due to viability concerns and because they are only found within habitats that encompass a small portion of the landscape. Western (Boreal) toads are on the WGFD’s list of Species of Special Conservation Concern with a NSS Cell rating of NSS1 (Aa), and are classified as a Tier I species because of a declining population trend and/or habitat in need of conservation management actions (WGFD 2017). Western toads are also on the sensitive species list of the Wyoming Natural Heritage Program, and the statewide population is ranked as S1 (critically imperiled) (NatureServe 2018). Critically imperiled is defined as “Critically imperiled in the jurisdiction because of extreme rarity or because of some factor(s) such as very steep declines making it especially vulnerable to extirpation from the jurisdiction.”</p> <p>Among the many factors that may be contributing to declines are habitat loss, habitat alteration, pollutants, climate change, and disease (Patla 2001, WGFD 2010:438, Keinath and McGee 2005, as cited in DeLong 2015). Disease may be exacerbating population declines; in particular, chytrid fungus is thought to be the cause of recent mass die-offs in parts of Wyoming and other parts of the southern Rocky Mountains and is considered to be the major contributing factor to population declines (WGFD 2010).</p>	<p>Nature Serve. Accessed 2018. Western Toad (<i>Anaxyrus boreas</i>).</p> <p>Rocky Mountain Amphibian Project. 2025. Available at <a href="https://www.wyomingbiodiversity.org/index.php/community-science/rocky-mountain-amphibian-project/results">:https://www.wyomingbiodiversity.org/index.php/community-science/rocky-mountain-amphibian-project/results</a>. (Accessed: March 20, 2025).</p> <p>Wallace, Z., and L. Tronstad. 2019. Factors affecting the distribution of amphibians in western Wyoming. Report prepared for Wyoming Game and Fish Department, Fisheries Division by University of Wyoming, Wyoming Natural Diversity Database.</p> <p>Wyoming Game and Fish Department. 2017. State Wildlife Action Plan. Western Toad (<i>Anaxyrus boreas</i>).</p>

Species (Scientific and Common Name): <i>Anaxyrus boreas</i> [Western (Boreal) Toad]		
Criteria	Rationale	Literature Citations
Habitat Trend on the Bridger-Teton National Forest	<p>Western toads are more likely to occupy wetlands with higher calcium concentrations, which on the BTNF are associated with calcite sandstone bedrock (Wallace and Tronstad 2019). In the Greater Yellowstone ecosystem, breeding sites include shallow-water edges of ponds and lakes (typically in water depths of 4-8 inches), stream and river edges where water is pooled or very slow moving, oxbow ponds, thermal pools and streams, flooded meadows, ephemeral pools, abandoned and active beaver-impounded ponds, and man-made impoundments including reservoirs and quarries (Patla 2001, as cited in DeLong 2015). Western toads at Barrile et al.'s (2021) study sites on the BTNF bred almost exclusively in beaver ponds, the availability of which has been declining over the past few decades (Hossack et al., 2015). Map 4 show the locations of known existing Western (Boreal) toad observations and breeding sites on BTNF modeled capable breeding, summer and migration habitat*, indicating that there is more capable breeding habitat than currently is being used by Western (Boreal) toads. Results of capable habitat modeling are coarse scale and it is recognized that species likely favor a certain set of conditions that may only be found within a subset of the conditions represented by modeled capable breeding habitat (DeLong 2015).</p> <p>Summer habitat, as depicted in Map 4, is represented by the zone in which Wyoming toads can forage and venture from riparian zones. A large majority of adult and juvenile toads remain within about 100 yards of surface water, not including during migration when they can move much further from water (DeLong 2015). Summer habitat also includes riparian habitat and, therefore, encompasses much of the modeled breeding habitat (as described above). Other habitats used during this period range from silver sagebrush and shrubby cinquefoil (riparian habitat not included in capable breeding habitat) to mountain big sagebrush and mountain shrubland to aspen to open conifer habitat.</p> <p>A relatively large proportion of Western toads have been found to migrate as far as 1½ miles (and further) between breeding sites and summer habitat.</p>	<p>Wallace, Z., and L. Tronstad. 2019. Factors affecting the distribution of amphibians in western Wyoming. Report prepared for Wyoming Game and Fish Department, Fisheries Division by University of Wyoming, Wyoming Natural Diversity Database.</p> <p>DeLong, D. 2015. Literature Review and Analysis of Scientific Information for the Conservation Assessment for Columbia Spotted Frogs and Boreal Toads on the Bridger-Teton National Forest. Bridger-Teton National Forest, Jackson, Wyoming.</p> <p>Barrile G.M. , A.D. Chalfoun, A.W. Walters. 2021. Livestock grazing, climatic variation, and breeding phenology jointly shape disease dynamics and survival in a wild amphibian. Biol. Conserv., 261, Article 109247</p> <p>Hossack, B. R., Gould, W.R., Patla, D.A., Muths, E., Daley, R., Legg, K., and P. S. Corn. 2015. Trends in Rocky Mountain amphibians and the role of beaver as a keystone species. Biological Conservation 187:260–269.</p>

Species (Scientific and Common Name): <i>Anaxyrus boreas</i> [Western (Boreal) Toad]		
Criteria	Rationale	Literature Citations
	<p>Because they tend to remain closer to water and because a majority remain within 1/3 mile of breeding sites, Map 4 shows migration habitat split between “Migration Habitat” (<math>\leq 1/3</math> mile from capable breeding habitat) and “Extended Migration Habitat” (<math>\leq 1\frac{1}{2}</math> miles from capable breeding habitat). Migration habitat currently includes all cover types.</p> <p>The Bridger-Teton National Forest provides a considerable amount of breeding, summer, and migration habitat for the Western (Boreal) toad. As depicted in the capable breeding, summer, and migration habitat model for the Western (Boreal) toad (Map 4), more suitable habitat is available to the species than actually used.</p> <p>*Greater detail regarding the capable breeding habitat model for the Western (Boreal) toad can be found in DeLong 2015.</p>	
Threats to the Species and its Habitat on the Bridger-Teton National Forest	<p>Factors that appear to have caused or contributed to population declines of Western (Boreal) toads in the Rocky Mountains are disease, habitat loss, habitat alteration, climate change, increased ultraviolet radiation, acid and mineral pollution from mining, and other pollutants (Patla 2001, Muths 2005, WGFD 2010b, Keinath and McGee 2005, as cited in DeLong 2015). Adams et al. (2013:3) asserted that “Primary hypotheses to explain global amphibian declines are land use change, disease, global climate change, and interactions of these factors with each other or with other stressors like contaminants or habitat degradation [Collins and Crump 2009]. These risk factors, as described in more detail below, are prevalent on the BTNF.</p> <p><u><i>Disease, Climate Change, and UV Radiation</i></u></p> <p>Disease and parasites appear to be leading factors that are contributing to toad population declines throughout the western U.S. Chytrid fungus (<i>Batrachochytrium dendrobatidi</i>) is thought to be one of the main causes, likely acting synergistically with other stressors, of mass die-offs in Colorado, Utah, Wyoming, and Montana (DeLong 2015). According to WGFD, the Western toad populations appear to be in a state of severe decline and chytrid fungus is considered to be the major contributing factor. Carey (1993) hypothesized that</p>	<p>Adams, M. J., D. A. W. Miller, E. Muths, P. S. Corn, E. H. Campbell Grant, L. L. Bailey, G. M. Fellers, R. N. Fisher, W. J. Sadinski, H. Waddle, S. C. Walls. 2013. Trends in amphibian occupancy in the United States. PLOS ONE (<a href="http://www.plosone.org/article/info%3Adoi%2F10.1371%2Fjournal.pone.0064347">http://www.plosone.org/article/info%3Adoi%2F10.1371%2Fjournal.pone.0064347</a>, accessed 7-5-2013).</p> <p>Adams, M. J., Pearl, C. A., McCreary, B., Galvan, S. K., Wessel, S. J., Wente, W. H., Anderson, C. W., and A. B. Kuehl. 2009. Short-term effect of cattle exclosures on Columbia spotted frog (<i>Rana luteiventris</i>) populations and habitat in northeastern Oregon. Journal of Herpetology 43:132-138.</p> <p>Bancroft, B. A., N. J. Baker, and A. R. Blaustein. 2008. A meta-analysis of the effects of ultraviolet B radiation and its synergistic interactions with pH,</p>

Species (Scientific and Common Name): <i>Anaxyrus boreas</i> [Western (Boreal) Toad]		
Criteria	Rationale	Literature Citations
	<p>some environmental factor or synergistic effects of more than one factor may stress toads, causing suppression of the immune system or indirectly causing immunosuppression by effecting elevated secretion of adrenal cortical hormones (Nature Serve 2018). This effect on the immune system and the cold body temperatures inability to fight disease, may be leading to other deadly infections.</p> <p>However, Barrile et al. (2021b) found that wild Western toads used moist, sheltered habitats when free of disease but moved to warmer, more open, but exposed habitats when infected, indicating that some wild amphibians have the capacity to actively seek warmer, more open microhabitats in a facultative manner when infected with Bd. Small-scale microhabitat manipulation to create warm patches, therefore, may provide a potentially effective mitigation action against Bd (for warm-adapted hosts) and possibly other amphibian diseases.</p> <p>Chytrid disease was detected in 2000 among Western (boreal) toads on the National Elk Refuge (NER) in Jackson Hole (Patla 2000b). Chytrid was found on 2 of 7 toad specimens, and was thought to be the first documentation of the disease in northwest Wyoming. Green cautions in his pathology report that "The diagnosis of chytridiomycosis has potentially dire implications for all species of frogs and toads in the NER and, possibly, western Wyoming" (D.E. Green, case report # 16918, 001, USGS National Wildlife Health Center, Madison, WI).</p> <p>Estes-Zumpf et al. (2014) sampled amphibians on the BTNF (using 280 samples skin swabs) for the presence of chytrid fungus, a pathogen now widely distributed on the Forest. The fungus was detected in Western (Boreal) toads, Columbia spotted frogs, and Boreal chorus frogs. Chytrid fungus was documented at many Western toad breeding locations on the BTNF and was particularly prevalent among amphibians within the Wind River Range, Pinedale Ranger District. Chytrid fungus appears to pose the largest threat on</p>	<p>contaminants, and disease on amphibian survival. Conservation Biology 22:987-996.</p> <p>Barrile G.M. , A.D. Chalfoun, A.W. Walters. 2021. Livestock grazing, climatic variation, and breeding phenology jointly shape disease dynamics and survival in a wild amphibian. Biol. Conserv., 261, Article 109247</p> <p>Barrile, G. M., Chalfoun, A. D., and A. W. Walters. 2021b. Infection status as the basis for habitat choices in a wild amphibian. The American Naturalist, 197(1), 128-137.</p> <p>Barrile G.M. , A.W. Walters, A.D. Chalfoun. 2022. Stage-Specific Environmental Correlates of Reproductive Success in Boreal Toads (<i>Anaxyrus boreas boreas</i>). Journal of Herpetology 56(1), 34-44. <a href="https://doi.org/10.1670/21-023">https://doi.org/10.1670/21-023</a></p> <p>Bartelt, P. E. 1998. Natural history notes: <i>Bufo boreas</i> mortality. Herpetological Review 29:96. (cited by Patla 2000, Patla and Keinath 2005)</p> <p>Bartelt, P. E. 2000. A biophysical analysis of habitat selection in western toads (<i>Bufo boreas</i>) in southeastern Idaho. PhD dissertation, Idaho State University, Pocatello, Idaho. (cited by Patla 2000 and Keinath and McGee 2005)</p> <p>Blaustein, A. R., Hoffman, P. D., Hokit, D. G., Kiesecker, J. M., Walls, S. C., and J .B Hays. 1994. UV repair and resistance to</p>

Species (Scientific and Common Name): <i>Anaxyrus boreas</i> [Western (Boreal) Toad]		
Criteria	Rationale	Literature Citations
	<p>the BTNF and negative impacts have shown to be exacerbated where other stressors are affecting populations (DeLong 2015). On the BTNF, toad metapopulations may have already succumbed to the effects of either chytrid fungus by itself or in combination with other stressors. With possible reductions of about 5–7%/year in existing metapopulations of Western (Boreal) toads infected by chytrid fungus on the BTNF (Pilliod et al. 2010) and assuming that increased mortality due to chytrid fungus does not itself lead to extinction of metapopulations, the stage is set for combinations of other stressors — which may have not caused population declines in the absence of chytrid fungus — for some metapopulations to trend toward extinction (Corn 2003, Forson and Storfer 2006, Gray et al. 2007, Gray et al. 2009, Gahl and Calhoun 2010, Groner 2012, Adams et al. 2013, Gallana et al. 2013, Reeve et al. 2013, as cited in DeLong 2017).</p> <p>Die-offs from this disease may occur over several months, manifested as steady mortality that is not easily detected unless weekly or bi-weekly surveys are conducted on amphibians. Affected populations in other areas have declined &gt;90% in one year, and there are no known cases of recovery of populations following decimation by the chytrid fungus.</p> <p>Chytrid fungus is common in the Rocky Mountains—Muths et al. (2008) detected the fungus at 64% of 97 study sites and in 23% of 1,151 Western (Boreal) toads sampled. Murphy et al. (2009) found the fungus at all of the 10 Western toad breeding sites sampled in the Jackson Hole area, with a mean prevalence of 64.5%. Muths et al. (2011) compared the mortality and recruitment of uninfected adult male toads at a study site in Colorado to infected toads on a site on the Blackrock Ranger District on the BTNF. Survival of uninfected toads was greater, but recruitment lower in Colorado, suggesting compensation between the 2 vital rates and that amphibian populations challenged with the disease were not necessarily doomed to extinction. However, it is not clear whether the sites had similar effects of stressors and why recruitment at the Colorado site was lower.</p>	<p>solar UV-B in amphibian eggs: a link to population declines? Proc. Natl. Acad. Sci. USA. 91: 1791-1795.</p> <p>Blaustein, A. R. and L. K. Belden. 2005. Chapter 14: ultraviolet radiation. Pages 87-88 in Lannoo, M. (ed.). Amphibian declines: the conservation status of United States species. University of California Press, Berkely, California.</p> <p>Bull, E. 2009. Dispersal of newly metamorphosed and juvenile western toads (<i>anaxyrus boreas</i>) in nertherstern Oregon, USA. herpetological conservation and biology. Pg.236-247.</p> <p>Burton, E. C., Gray, M. J., Schmutzer, A. C., and D. L. Miller. 2009. Differential responses of postmetamorphic amphibians to cattle grazing in wetlands. Journal of Wildlife Management 73:269-277.</p> <p>Daszak, P. L., Berger, A. A., Cunningham, A. D., Hyatt, D. E., Green, and R. Speare. 1999. Emerging infectious diseases and amphibian population declines. Emerg. Infect. Dis. 5:735–748.</p> <p>DeLong, D. 2015. Literature Review and Analysis of Scientific Information for the Conservation Assessment for Columbia Spotted Frogs and Boreal Toads on the Bridger-Teton National Forest. Bridger-Teton National Forest, Jackson, Wyoming.</p>

Species (Scientific and Common Name): <i>Anaxyrus boreas</i> [Western (Boreal) Toad]		
Criteria	Rationale	Literature Citations
	<p>There are other diseases found throughout the Rocky Mountains that may be influencing the survival of amphibians in addition to chytrid fungus. Another fungal disease, a fish pathogen <i>Saprolegnia ferax</i>, is associated with hatchery fish. This disease has been found to cause very high mortality to Western (Boreal) toad embryos (Blaustein et al. 1994, Maxell 2000). Bacterial diseases are also of concern for Western (Boreal) toads, particularly <i>Aeromonas hydrophila</i>, which causes the disease known as red-leg in amphibians. Recent research at Idaho State University found that high conductivity water protects tadpoles from infection in laboratory tests, potentially explaining the high correlation of high conductivity waters and active toad breeding sites in portions of the Greater Yellowstone Ecosystem (Hawk 2000 in Patla 2001).</p> <p>New viral diseases have also been implicated as the cause of amphibian mass deaths, most often attacking tadpoles and salamander larvae; and some of these viruses affect both fish and amphibians (Daszak et al. 1999). A mass die-off of salamander larvae near Bondurant in northwest Wyoming in 1999 (Patla 2000a) may have been caused by a ranavirus (diagnosed by D.E. Green, case report #164 14, 001-005. USGS National Wildlife Health Center).</p> <p>Limb malformations in toads have been linked directly to trematode infections by <i>Ribeiroia ondatrae</i> (Johnson et al. 2001; Johnson et al 2002), although the impacts of these infections on reproduction, and the magnitude of the infections across the breeding range, require further study (Nature Serve 2018). Although more research is needed, analysis suggests that malformations may increase mortality in larval amphibians prior to and during metamorphosis.</p> <p>Climate change and increasing UV radiation are receiving increasing attention as a possible contributing factors to the decline of amphibian populations, including Western (Boreal) toads (Hatch and Blaustein 2000, Blaustein and Beldon 2005, Reaser and Blaustein 2005, Muths 2005, Bancroft et al. 2008, McMenamin et al. 2008, Bull 2009 in DeLong 2015). McMenamin et al.</p>	<p>Donker, N. T., and J. M. Fryxell. 1999. Impact of beaver foraging on structure of lowland boreal forests of Algonquin Provincial Park, Ontario. <i>For. Ecol. Manage</i> 118:83–92.</p> <p>Duellman, W. E., and L. Trueb. 1986. <i>Biology of amphibians</i>. McGraw-Hill, New York. 670 pp.</p> <p>Estes-Zumpf, W., Z. Walker, and D. Keinath. 2014. Western amphibian monitoring initiative. State Wildlife Grant Final Completion Report. A report to the Wyoming Game and Fish Department. On file Wyoming Natural Diversity Database, University of Wyoming, Laramie, Wyoming, USA.</p> <p>Fleischner, T. L. 1994. Ecological costs of livestock grazing in western North America. <i>Conservation Biology</i> 8:629-644.</p> <p>Hammerson, G. A. 1999. <i>Amphibians and reptiles in Colorado</i>, 2d edition. University Press and Colorado Division of Wildlife, Niwot, CO. 484 pp.</p> <p>Hatch, A.C. and A. R. Blaustein. 2000. Combined effects of UV-B, nitrate, and low pH reduce the survival and activity level of larval cascades frogs (<i>Rana cascadae</i>). <i>Archives of Environmental Contamination and Toxicology</i> 39(4):494-499.</p> <p>Hossack, B. R., Gould, W.R., Patla, D.A., Muths, E., Daley, R., Legg, K., and P. S. Corn. 2015. Trends in Rocky Mountain</p>

Species (Scientific and Common Name): <i>Anaxyrus boreas</i> [Western (Boreal) Toad]		
Criteria	Rationale	Literature Citations
	<p>(2008:16988) documented that "...recent climate warming and resultant wetland desiccation are causing severe declines in 4 once-common amphibian species native to Yellowstone. Climate monitoring over 6 decades, remote sensing, and repeated surveys of 49 ponds indicate that decreasing annual precipitation and increasing temperatures during the warmest months of the year have significantly altered the landscape and local biological communities." In addition to climate changes, increased UV radiation and the synergistic effects of UV radiation in combination with other factors including acidification, shallower waters, certain pathogens, lowered pH, fire retardant, and a polycyclic aromatic hydrocarbon, have also contributed to amphibian population declines. Currently there are no mitigation measures to reduce these effects and there is no information showing these factors are not negatively affecting Western (Boreal) toads on the BTNF.</p> <p><u>Timber Harvest</u> Amphibians are particularly vulnerable to timber harvesting impacts especially when the impacts occur within their dispersal range from breeding sites, and during the late-summer when adults migrate into upland forested habitats. The impacts of timber harvest on Western (Boreal) toads depends greatly on the timing, method, spatial extent, configuration and location of harvest activities relative to Western (Boreal) toad habitats (Maxell 2000).</p> <p>Timber harvest and the removal or reduction of the canopy and downed woody debris decreases the amount of moist sites available to toads, and therefore reduces toad habitat. This has implications to Western toads by limiting the areas in which they can find appropriate conditions to regulate body temperatures and conserve body fluid while foraging and dispersing. Clearcuts may influence Western (Boreal) toad use of migration corridors due to the lack of moisture and increased heat within the clearcut (Bartelt 2000 <i>in</i> McGee and Keinath 2004). Due to tree removal, the structure and composition of shrub understories may be enhanced or reduced. Shrub understory structure is valuable because it provides important microhabitats for Western (Boreal)</p>	<p>amphibians and the role of beaver as a keystone species. <i>Biological Conservation</i> 187:260–269.</p> <p>Lambert, B. A., Schorr, R. A., Schneider, S. C., and Muths, E. 2016. Influence of demography and environment on persistence in toad populations. <i>The Journal of Wildlife Management</i>, 80(7), 1256–1266. <a href="https://doi.org/10.1002/jwmg.21118">https://doi.org/10.1002/jwmg.21118</a></p> <p>Lefcort, H., Meguire, R. A., Wilson, L. H., and W. F. Ettinger. 1998. Heavy metals alter the survival, metamorphosis, and antipredatory behavior of Columbia spotted frog (<i>Rana luteiventris</i>). <i>Archives of Environmental Contamination and Toxicology</i> 35:447-456</p> <p>Loeffler, C. (ed.). 2001. Conservation plan and agreement for the management and recovery of the southern Rocky Mountain populations of the boreal toad (<i>Bufo boreas boreas</i>), Boreal Toad Recovery Team. Colorado Division of Wildlife, Denver, Colorado.</p> <p>Maxell, B. A. 2000. Management of Montana's amphibians: a review of factors that may present a risk to population viability and accounts on the identification, distribution, taxonomy, habitat use, natural history, and the status and conservation of individual species. Report to the U.S. Forest Service, Region 1. Order Number 43-0343-0-0224. University of Montana, Missoula, Montana.</p>

Species (Scientific and Common Name): <i>Anaxyrus boreas</i> [Western (Boreal) Toad]		
Criteria	Rationale	Literature Citations
	<p>toads that assist in thermoregulation by providing water and heat energy (Bartelt 2000).</p> <p>In 18 studies reviewed by deMaynadier and Hunter (1995) they found that anurans were less abundant on 6-month-to-40 year old clearcuts as compared to abundance on uncut control plots (McGee and Keinath 2004). Bartelt (2000 <i>in</i> Patla 2001) conducted research on Western toad movements and habitat selection on the Targhee NF (1993-1995) and found that habitat structure directly affects micro-environmental conditions, which in turn has considerable effects on toad behavior and movement. Bartelt (2000) found that excessive cover removal can decrease toad habitat because of the drying of micro-habitats, also toads avoid the interior of clearcuts and other regeneration harvest treatment areas. Limited amounts of timber removal may however be of some benefit to toads where the openings in the canopy of cool, closed forests creates or increases the number of basking sites.</p> <p>Timber removal and vegetation treatments also have the potential to disturb stream habitat due to an increase in sedimentation, and is one of the greatest impacts timber harvesting has on amphibian species. Additionally, timber removal activities typically include the development and maintenance of roads. These actions may increase erosion and sedimentation in adjacent streams and wetlands, resulting in negative impacts to the species. Soil compaction from harvesting activities may reduce rodent burrows, used by Western toads as over-wintering hibernacula. In general, timber harvest activities that negatively affect the quality or quantity of wetlands within their current range can have negative effects on the species.</p> <p><u>Roads and Motorized Trails</u></p> <p>During dispersal and migration, Western (Boreal) toads are likely to encounter roads and motorized trails throughout the Forest. Additionally, there are numerous system routes that are currently near breeding locations and non-system motorized routes are increasing across the Forest. An abundance of</p>	<p>McGee M., and D. Keinath. 2004. Species assessment for boreal toad (<i>Bufo boreas boreas</i>) in Wyoming. United States Department of the Interior, Bureau of Land Management, Wyoming State Office, Cheyenne, Wyoming. 86pp.</p> <p>McMenamin, S. K., E. A. Hadley, and C. K. Wright. 2008. Climate change and wetland desiccation cause amphibian decline in Yellowstone National Park. PNAS 105:16988-16993.</p> <p>Murphy, P. J., St-Hilaire, S., Bruer, S., Corn, P. S., and C. R. Peterson. 2009. Distribution and pathogenicity of <i>Batrachochytrium dendrobatidis</i> in boreal toads from the Grand Teton area of western Wyoming. EcoHealth 6:109–120.</p> <p>Muths, E. 2005. <i>Bufo boreas</i> Baird and Girard, 185(b) western toad. Pages 392-396 <i>in</i> Lannoo, M. (ed.). Amphibian declines: the conservation status of United States species. University of California Press, Berkely, California.</p> <p>Muths, E., Pilliod, D. S., and L. J. Livo. 2008. Distribution and environmental limitations of an amphibian pathogen in the Rocky Mountains, USA. Biological Conservation 141:1484–1492.</p> <p>Muths, E., Scherer, R. D., and D. S. Pilliod. 2011. Compensatory effects of recruitment and survival when amphibian populations are perturbed by disease.</p>

Species (Scientific and Common Name): <i>Anaxyrus boreas</i> [Western (Boreal) Toad]		
Criteria	Rationale	Literature Citations
	<p>scientific information suggests there are negative impacts of roads, motor-vehicle trails, motorized use, and dispersed roadside camping on survival rates of amphibians due to crushing and increased potential for desiccation, reductions in habitat connectivity, altered hydrology, and reduction in water quality (DeLong 2015). Many amphibian researchers have noted Western (Boreal) toad mortality due to vehicle traffic (Maxell 2000, McGee and Keinath 2004, Patla and Keinath 2005). Bartelt (2000 <i>in</i> Patla 2001) found several adult toads killed by vehicles on unpaved forest roads in the course of his study on the Targhee National Forest, and noted that the removal of females can have large effects on population persistence. Patla (2001) and Bull (2009) show that national forest roads — similar to situations on the BTNF — have a reasonably high potential to increase mortality and reduce habitat connectivity, particularly where roads and motor-vehicle trails are near breeding wetlands. Other negative impacts from roads on Western (Boreal) toads includes noise disturbance, chemical contamination, and increased sedimentation.</p> <p><u>Livestock Grazing</u></p> <p>Livestock grazing can adversely affect important aquatic and terrestrial Western (Boreal) toad habitat through a large variety of impacts including reduced survival due to trampling and lowered water quality, negative impacts on herbaceous habitat (humid microsites, hiding/escape cover, insect habitat), lowered water tables, altered plant species composition, accelerated water-level declines, and reductions in the prevalence of burrows removal or reduction of herbaceous and shrub cover, stream bank collapse, soil compaction, and reduction of beaver and burrowing rodent populations (DeLong 2015). Furthermore, Western (Boreal) toad mortality due to trampling can be considerable. Bartelt (1998 and 2000) observed the death of many hundreds of toad metamorphs at a breeding site on the Targhee National Forest when a band of sheep was driven through the area. Toad mortality resulted from trampling during the event and from desiccation later. Bartelt noted, that because toad reproduction was already greatly constrained by years of drought conditions, this event in 1995 (a rare wet year) probably</p>	<p>Journal of Animal Ecology 48:873–879.</p> <p>Nature Serve. Accessed 2018. Western Toad (<i>Anaxyrus boreas</i>).</p> <p>Padgett, W. G., A. P. Youngblood, and A. Winward. 1989. Riparian community type classification of Utah and southeastern Idaho. U.S. Dept. of Agriculture, Forest Service, Intermountain Region, R4-Ecol-89-01.</p> <p>Patla, D. A. 2000a. Amphibians of the Bridger-Teton National Forest: species distributions and status. Unpublished report, prepared for the Bridger-Teton National forest. Herpetology Laboratory, Idaho State University, Pocatello. 44pp.</p> <p>Patla, D. A. 2000b. Amphibians of the National Elk Refuge, Jackson Hole, Wyoming. Part 2. Report to USDI National Elk Refuge. Idaho State U, Pocatello, ID.</p> <p>Patla, D. A. 2001. Conservation assessment for the boreal toad (<i>bufo boreas boreas</i>) on the Bridger-Teton National Forest, Wyoming.</p> <p>Patla, D. A. and D. Keinath. 2005. Columbia spotted frog (<i>Rana luteiventris</i> formerly <i>R. pretiosa</i>): a technical conservation assessment. Prepared for the USDA Forest Service, Rocky Mountain Region, Species Conservation Project. 87pp.</p> <p>Reaser, J. K. and A. Blaustein. 2005. Chapter 11: repercussions of global</p>

Species (Scientific and Common Name): <i>Anaxyrus boreas</i> [Western (Boreal) Toad]		
Criteria	Rationale	Literature Citations
	<p>destroyed half the toad reproduction for the past decade at the breeding area and therefore had major implications (Bartelt 1998 and 2000). While livestock grazing use can create openings beneficial to tadpoles, metamorphs, and adults, particularly where basking may have positive implications to Chytrid fungus eradication, this one potential benefit is outweighed by the much larger number of negative effects.</p> <p>Livestock effects on water quality through urination, defecation and trampling, can reduce dissolved oxygen levels, increase eutrophication of water, increase turbidity, and increase nitrates, ammonia, and fecal coliforms (Maxell 2000, Keinath and McGee 2005, Patla and Keinath 2005, Burton et al. 2009). Although conservative levels of livestock grazing do not necessarily have biologically meaningful effects on toads (Adams et al. 2009, Roche et al. 2012); long-term effects, similar to those on the BTNF, may decrease riparian vegetation – which filters water and increases stream bank stability– and overtime results in degraded riparian and wetland areas that may become unsuitable for Western toads. Livestock grazing may also remove important vegetative cover that provides microhabitats for Western toads, which are important for thermoregulation (Bartelt 2000). In riparian areas, over-use and trampling by livestock, in combination with lowered water tables, can lead to major reductions in sedge canopy cover over time (Youngblood et al 1985, Padgett et al. 1989), which in turn adversely affects Western (Boreal) toads. Loss of bankside willows may result in reduced beaver activity or dispersal of beavers; a species whose activities are responsible for the establishment of amphibian breeding habitats (Donker and Fryxell 1999, Russell et al. 1999). Grazing may also reduce the number of insect prey that amphibians depend on (Fleischner 1994) and cause soil compaction in riparian areas, eliminating the ability for amphibians to burrow underground in order to prevent desiccation or freezing (Duellman and Trueb 1986, Swanson et al. 1996).</p> <p>Cattle grazing on the BTNF reduced vegetation cover in and around breeding ponds, which resulted in lower levels of dissolved oxygen (Barille et al. 2022).</p>	<p>change. Pages 60-63 in Lannoo, M. Amphibian declines: the conservation status of United States species. University of California Press, Berkeley, California.</p> <p>Roche, L. M., Roche, B., Allen-Diaz, D. J., Eastburn, and K. W. Tate. 2012. Cattle grazing and Yosemite toad (<i>Bufo canorus</i> Camp) breeding habitat in Sierra Nevada meadows. <i>Rangeland Ecology and Management</i> 65:56-65.</p> <p>Russell, K. R., Moorman, C. E., Edwards, J. K., Metts, B. S., and D. C. Guynn. 1999. Amphibian and reptile communities associated with beaver (<i>Castor canadensis</i>) ponds and unimpounded streams in the piedmont of South Carolina. <i>Journal of Freshwater Ecology</i> 14:149-158.</p> <p>Skaar, D. R., Arnold, J. L., Koel, T. M., Ruhl, M. E., Skorupski, J. A., and H. B. Treanor. 2017. Effects of Rotenone on Amphibians and Macroinvertebrates in Yellowstone. <i>Yellowstone Science</i> 25(1).  <a href="https://www.nps.gov/yell/learn/ys-25-1-effects-of-rotenone-on-amphibians-and-macroinvertebrates-in-yellowstone.htm">https://www.nps.gov/yell/learn/ys-25-1-effects-of-rotenone-on-amphibians-and-macroinvertebrates-in-yellowstone.htm</a>.</p> <p>Swanson, D. L., Graves, B. M., and K. L. Koster. 1996. Freezing tolerance/intolerance and cryoprotectant synthesis in terrestrially overwintering anurans in the Great Plains, USA. <i>Journal of Comparative Physiology B</i> 166:110–119.</p> <p>U.S. Forest Service (USFS). 2004. Greys River Landscape Scale Assessment.</p>

Species (Scientific and Common Name): <i>Anaxyrus boreas</i> [Western (Boreal) Toad]		
Criteria	Rationale	Literature Citations
	<p>Low levels of dissolved oxygen were associated with a low probability of tadpole metamorphosis. Grazing-induced habitat changes are therefore likely to negatively influence tadpole metamorphosis both via indirect effects on dissolved oxygen, and direct effects on vegetation cover, which also serves as feeding sites and escape cover from predators. Given the probable adverse effects of grazing-induced reductions in vegetation cover to the metamorphosis of Western Toad tadpoles, managers could work with ranchers to alter the timing, duration, and density of cattle in and around breeding ponds during the period of tadpole development (July–August).</p> <p>Grazing and trampling results in changes in plant species composition, which includes the spacing of individual plants, and can affect amphibian use in these areas. In particular, broad-level changes in plant species composition (i.e., shifts from one community to another) and changes in the abundance of particular plant species on a site, both of which influence plant height and spacing and ultimately cover, are important to Western toads (Patla and Keinath 2005). Examples on the BTNF include conversion of a moist meadow or wet sedge meadow community to a plant community dominated by Kentucky bluegrass (as described by Youngblood et al. 1985 for the Greys River area) or conversion of native moist meadow and silver sagebrush communities to those dominated by nonnative bluegrasses (Youngblood et al. 1985, USFS 2004). Such changes in plant species composition contributes to the decrease in Western toad habitat across the BTNF.</p> <p>In general however, levels of grazing intensity currently permitted on the BTNF may not reach those required to meaningfully alter boreal toad habitat, either positively or negatively (Barille et al. 2021).</p> <p><u>Atmospheric Nitrogen</u> Nitrate and ammonia concentrations are increasing in lakes, ponds, and wetlands in at least parts of the BTNF due in part to increases in atmospheric nitrogen (DeLong 2015). An increase in nitrate and ammonia concentrations</p>	<p>Bridger-Teton National Forest, Greys River Ranger District, Afton, Wyoming.</p> <p>Wyoming Game and Fish Department. 2017. State Wildlife Action Plan. Western Toad (<i>Anaxyrus boreas</i>).</p> <p>Youngblood, A. P., W. G. Padgett, and A. H. Winward. 1985. Riparian community type classification of eastern Idaho – western Wyoming. U.S. Department of Agriculture, Forest Service, Intermountain Region, R4-Ecol-85-01.</p>

Species (Scientific and Common Name): <i>Anaxyrus boreas</i> [Western (Boreal) Toad]		
Criteria	Rationale	Literature Citations
	<p>results in the increased probability of less-than-suitable water quality being produced by livestock grazing use. These elevated concentrations of nitrogen and ammonia levels in areas throughout the BTNF may result in negative implications to Western (Boreal) toad tadpoles.</p> <p><u>Fire and Fuels Management</u>            Current drought patterns, natural wildfires, and enhanced emphasis on fuels management projects on National Forest System lands has likely elevated the significance of this risk factor on amphibian populations and habitats . As pointed out by Maxell (2000), little or no direct information is available about the impacts of fire and fire management on amphibians, particularly in the intermountain west. The fire-adapted nature of forests (conifer and aspen) on the BTNF suggest that natural fire regimes pose little threat to the persistence of native amphibians. However, fire or management activities that reduce the amount of coarse woody debris may be detrimental to toads, as discussed in more detail under “<i>Timber Harvest</i>”. Furthermore, wild and prescribed fires, particularly near breeding sites, may result in amphibian mortality. Large, high-intensity fires– like those on the BTNF on occasion– may result in sediment delivery to downstream breeding sites, in turn, decreasing toad reproduction.</p> <p>Both positive and negative impacts on Western (Boreal) toad habitat is likely. While fire and fuels management can result in negative threats to Western (Boreal) toad, a reductions in the occurrence and spread of fires can negatively impact toads by reducing non-forested habitat (e.g., moist meadows, willow communities), reducing spring flows (which can affect duration of water in breeding wetlands), excessive shading of breeding pools, and reductions in the distribution and abundance of aspen. Reductions in the distribution and abundance of aspen is a likely contributor to reductions in the distribution of beaver pond complexes which provide suitable habitat for Western (Boreal) toads.</p> <p><u>Introduced Species</u></p>	

Species (Scientific and Common Name): <i>Anaxyrus boreas</i> [Western (Boreal) Toad]		
Criteria	Rationale	Literature Citations
	<p>An introduced population of bullfrogs exists at Kelly Warm Springs in Grand Teton National Park, but bullfrogs are not known elsewhere in the Greater Yellowstone Ecosystem including the BTNF. Bullfrogs would likely be restricted to thermal waters if they exist on the BTNF. However, if introduced to areas on the Forest, bullfrogs could adversely affect native amphibians through predation, competition, or disease transmission.</p> <p>Introduction of non-native fish or introducing fish into historically fishless habitats may have less harmful effects on toads than on other more palatable amphibian species, but the effects of fish introduction on toads have not yet been investigated thoroughly (Hammerson 1999). Low abundance and reduction in the distribution of toads in otherwise suitable habitat on the BTNF has been linked to the introduction of non-native fish into formerly fishless lakes that supported amphibian breeding (DeLong 2015). The potential for the spread of diseases harmful to amphibians from introduced fish or from the water they reside, or on the boots and gear of fishermen, is an important concern. Control of unwanted fish through the use of chemical pesticides such as rotenone and antimycin poses strong risks to larval amphibians (Skaar et al. 2017).</p> <p><u><i>Herbicides, Pesticides, and Other Chemicals</i></u></p> <p>The biphasic (aquatic and terrestrial) characteristic of the Western toad and the permeability of their skin renders them potentially vulnerable to levels and types of chemicals that have been judged safe for other organisms. As noted by Maxell (2000), there are no requirements for testing the toxicity of pesticides and herbicides on amphibians. Effects resulting from pesticides and herbicides include direct toad mortality, sub-lethal effects including behavioral changes and reduced disease resistance, and risks from non-active components of supposedly safe pesticides and herbicides. Rotenone has the potential to have severe negative impacts on tadpoles. To the extent rotenone has been used in waters of the BTNF near breeding Western (Boreal) toads is currently unknown.</p>	

Species (Scientific and Common Name): <i>Anaxyrus boreas</i> [Western (Boreal) Toad]		
Criteria	Rationale	Literature Citations
	<p><u><i>Oil, Gas and Mineral Development</i></u></p> <p>Oil and gas development has the potential to impact water quality in wetlands used by Western (Boreal) toads if occupied wetland habitat were to exist near developed sites (Loeffler 2001, Patla and Keinath 2005). Patla and Keinath (2005) reported that threats from oil and gas development and mineral extraction "...include environmental contaminants produced by tailings, released groundwater, mining/transport accidents, acid drainage, and leaching of additional metals from stream and soil substrates." Contaminated settling ponds can be used by toads, exposing them to accumulated heavy metals, some of which (e.g., copper) are acutely toxic to tadpoles (Loeffler 2001). Lefcort et al. (1998) describe the dramatic impact of heavy metals on the terrestrial and aquatic environment in northern Idaho, where soils, rivers, and lakes have high levels of metals. They report that "only remnant, nonrecruiting populations of anurans" occur in the upper reaches of the contaminated Silver Valley. Lefcourt et al. (1998) tested the effects of heavy metals (i.e., lead, zinc, cadmium, and combinations) on spotted frog tadpoles and found that they reduced the survival, growth, and fright response of tadpoles." In addition to water quality impacts from normal operations (above), spills can occur, which could result in adverse impacts to toads. While oil and gas development is occurring on the BTNF, the extent to which such activities are having negative impacts to Western (Boreal) toads is unknown.</p> <p><u><i>Loss of Wetland Habitat</i></u></p> <p>Amphibian breeding sites can be lost or adversely affected by climate change, timber harvest activities, recreation/development, livestock grazing, mining, water source development and impoundment. Concerns for amphibians, including the risk factors as described above, include wetland habitat loss and disturbance, hydrological changes, sedimentation, and water contamination. Reductions in the distribution of beaver pond complexes can also contribute to lower distribution and abundance of Western (Boreal) toads. Efforts to maintain beaver populations and preserve dispersal pathways between toad</p>	

Species (Scientific and Common Name): <i>Anaxyrus boreas</i> [Western (Boreal) Toad]		
Criteria	Rationale	Literature Citations
	breeding ponds could be critical for the long-term reproduction and persistence of WesternToads. Protecting resident beavers from trapping, relocating problem beavers from other areas, and maintaining abandoned ponds may help increase the quality and quantity of toad breeding habitat and improve recruitment rates (Lambert et al., 2016).	
<p><b>Summary and recommendations:</b></p> <p>The Bridger-Teton National Forest is within the range of the Western (Boreal) toad, almost entirely. The species is found throughout the BTNF, and while there are gaps across the Forest where occupancy is unknown, suitable habitat for the Western toad is present forest-wide. There is current uncertainty of the Western toad population trend and abundance on the BTNF. However, rigorous survey efforts within the past few years are contributing to the data necessary to assess Western toad populations on the BTNF.</p> <p>While population trend data is absent on the BTNF, scientific literature suggests that Western toad populations are in decline. This species is highly vulnerable to environmental elements and the risk factors, as described in greater detail above, contribute significantly to the viability of this species and its persistence on the BTNF over the long-term. Multiple stressors - including disease, climate change, timber harvest, livestock grazing, motorized use, recreation, and invasive species introduction all result in potential impacts to Western toads, either directly or indirectly through habitat loss or degradation on the BTNF. These risk factors are likely contributing to reduced distribution and abundance of Western (Boreal) toads on the BTNF.</p> <p>The numerous risk factors identified for the Western toad, the evidence suggesting Western toad populations are in decline on the Bridger-Teton National Forest, and the uncertainty of such population trends on the Forest, suggests that there is a substantial concern for the species' capability to persist over the long-term within the planning unit. For these reasons, it is recommended that the Western (Boreal) toad is a Species of Conservation Concern for the Bridger-Teton National Forest.</p> <p>Evaluator(s): Ashley Egan, Randall Griebel</p>		Date: February 2, 2018