U.S. Fish & Wildlife Service

Recovery Outline

Photo: Randi Riggs/USFWS/2018

Species Name:	Umtanum Desert buckwheat, *Eriogonum codium*
Species Range:	Washington, Benton County
Recovery Priority Number:	5
Listing Status:	Threatened (78 FR 23984, April 23, 2013)
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1) Background

Umtanum Desert buckwheat (*Eriogonum codium*), also known as basalt desert buckwheat, is a low, tufted, herbaceous perennial plant with an aboveground woody stem. It has small leaves densely covered in white, short, matted hairs on both surfaces; and lemon-yellow flower clusters that sit atop a 2- to 9-centimeter (cm) (0.79- to 3.54-inch [in]) long woolly main stem or branch (Camp and Gamon 2010, p. 122). The woolly appearance of its flowers and seeds are distinctive for this *Eriogonum* species.

Florence Caplow and Kathryn Beck discovered and described Umtanum Desert buckwheat in 1995 (Reveal *et al.* 1995). However, the earliest specimen collected by C.Z. McKinnon and C. Kemp on June 15, 1993, was inadvertently misidentified. The specimen's identification was corrected in 2018. This collection was not a paratype (non-type specimen cited in original description) and did not extend the known range of the species (Fertig 2018. p. 26). Umtanum Desert buckwheat is recognized as a distinct species and there is no known controversy concerning its taxonomy (78 FR 23984).

Umtanum Desert buckwheat is State-listed as Endangered, with a GI global rating and an SI State ranking (critically imperiled and particularly vulnerable to extinction, globally and Statewide). The U.S. Fish and Wildlife Service (Service) federally listed this species as threatened under the Endangered Species Act on April 23, 2013 (78 FR 23984)

The single population of Umtanum Desert buckwheat is highly restricted in its distribution. It occurs solely within the semi-arid shrub-steppe of the Hanford Reach National Monument (HRNM), located in Benton County in southcentral Washington. The population occurs in a narrow (25- to 150-meter (m) or 82- to 492-feet (ft)), discontinuous band, atop a 1.6-kilometer (1-mile) long portion of the eastern end of Umtanum Ridge (78 FR 23984). It occurs at elevations between 329 m (1,080 ft) and 390 m (1,280 ft), on flat to gently sloping substrates that generally face north (Newsome and Goldie 2017, p.1). Despite extensive survey efforts conducted over the years, additional populations have not been found on similar lithosol soil types (*i.e.*, shallow soils without distinct horizons consisting of partly weathered rock fragments) within the lower Columbia River Basin (78 FR 23984).

The historical distribution of the species is unknown, but it is likely Umtanum Desert buckwheat has been confined to its current location for the last 150 years (78 FR 23984). Umtanum Ridge is located in the northern portion of the Rattlesnake Unit of the HRNM. This portion of the Rattlesnake Unit where the species occurs is on a parcel that was historically called the McGee Ranch, and has also previously been known as the McGee Unit or the southern portion of the McGee Ranch/Riverlands Unit. Below, we refer to this area as the former McGee Unit. It encompasses an area extending from Highway 24 in the south to the northern side of Umtanum Ridge in the north, where it abuts the Columbia River floodplain.

The habitat of Umtanum Desert buckwheat has hot dry summers and cold winters, which presents a difficult environment for establishment of new plants and conducting habitat restoration activities. Umtanum Ridge is subject to strong canyon winds, with annual precipitation of less than 15 cm (5.9 in) (Reveal *et al*. 1995, p. 354). Average temperatures range approximately from -1 °Celsius (C) (30° Fahrenheit (F)) in January to 24 °C (75°F) in July.

This buckwheat species occurs exclusively on soils derived from the exposed Lolo Flow of the Priest Rapids Member of the Wanapum Basalt Formation. Its native soil is a lithosol with weathered pebble- and gravel-sized pieces of vesicular volcanic material that possess a high porosity and permeability and a particular mineral content (Reveal *et al.* 1995, p. 354). It is not known whether the chemical composition of Lolo Flow lithosols is the only reason for Umtanum Desert buckwheat's close association with this soil, or if other factors are influencing this association in combination (78 FR 23984).

The Umtanum Desert buckwheat population is very small, in decline, and recruitment is extremely low. The population was censused in 1995, 1997, 2005, 2011, 2018, and 2019. Population estimates have ranged between 5,228 plants (in 1997) and 2,515 plants (in 2018). The

2019 census estimated a population of 3,016 plants (higher than in 2018, but likely resulting from improved survey technique rather than a true population increase as very few small plants were observed (W. Fertig, pers. comm 2019)).

Caplow, Kaye and Arnett (2007, p. 3) reported an annual rate of decline of less than 1 percent. The factors responsible for the decline in the population have not been fully studied or explained. However, the population has high flower production, low germination rates, high seedling mortality, and high variability of growth between individuals and between years (Caplow 2005, p. 1). During 9 years of monitoring, only four or five seedlings within the largest clump of the population survived beyond germination (Caplow *et al.* 2007, p. 3). Since 2007, the demographic monitoring plots, located within the largest group of plants, continue to reflect a similar slow population decline with minimal recruitment (78 FR 23984). Kaye's 2007 population viability analysis, based on 10 years of data, determined there was little or no risk of a 90 percent population decline within the next 100 years, approximately a 13 percent chance of a decline of 50 percent over the next 50 years, and a 72 percent chance of a 50 percent decline within the next 100 years (78 FR 23984). This analysis did not take into account stochastic events such as wildland fires.

More frequent and larger fires than those that occurred prior to the 1900s are producing a less stable environment, have killed a significant portion of the population in the last 20 years, and continues to threaten its existence. Individual plant losses result from each fire that burns over the population. Before the 1900s, fires were likely small, intense, and occurred at a 32- to 70-year interval (USFWS 2001, p. 23). Invasive annual grasses are established in and adjacent to the population; act as a fuel source producing more frequent, larger, and intense wildland fires; and compete with buckwheat seedlings for resources. (See Wildfire under the Primary Threats section.)

Further information about the geography, climate, landscape setting, and identifying characteristic of this species and factors affecting the species is available in the final listing rule for *Eriogonum codium* (78 FR 23984).

Type and Quality of Available Information to Date

Important Information Gaps:

- **Seedling Survival and Recruitment Data**
  - Study of seedling survival and recruitment needed.
- **Knowledge of Habitat Parameters**
  - Soil chemistry. Goff, as cited in Reveal *et al*. (1995), generally characterized the chemical composition of the basalt flow on Umtanum Ridge in early Hanford Site geologic studies. It is not known if the Umtanum Desert buckwheat's association with the Lolo Flow is related to the particular chemical composition of the soils in the flow; however, the distribution of plants along the flow correlate with the presence of the exposed top of the flow (Reveal *et al*. 1995, p. 354).
  - Microsite characteristics and importance of snow holding capacity.
  - Testing of planting techniques.

- **Historic Distribution and Potential Habitat Maps**
  - Identification of suitable outplanting sites.
  - Population inventories of similar basalt flow ridges along the Columbia River in southcentral Washington (Arnett 2013). The Joint Base Lewis McChord – Yakima Training Center (JBLM-YTC) has conducted surveys (records requested). Mapping and re-inventory of the entire Lolo Flow on Umtanum Ridge may be necessary, if the last surveys are outdated or any suitable habitat areas have not been surveyed. Extensive surveys have been conducted from 1994 to 1997 (Beck and Caplow 2006, p. 38; Sackschewsky and Downs 2001); however, additional areas may warrant closer scrutiny and many rare plant occurrences have not been revisited since the 1990s (Arnett and Goldner 2017, p. 52).
- **Demography of the population**
  - Relationship between plant size and age not fully understood. In 1995, there was a wide range of sizes and age classes within the population (Reveal *et al.* 1995; p. 354). Dunwiddie, Beck and Caplow (2000, p. 62) noted there were fewer plants in the smallest size classes (plants <100 cm^2) than expected in a typical size distribution.
- **Insect predator and flower predation studies**
  - Since viable seeds are very limited in the flowers and soil seed bank, understanding more about seed predation by western harvester ants (*Pogonomyrmex occidentalis*) and flower predation may be important for a seed conservation strategy.
- **Pollination studies**
  - A species-specific pollinator is not suspected. A variety of insect pollinators have been observed on the buckwheat's flowers, but pollinator abundance has not been assessed and pollination of this buckwheat has not been fully studied (78 FR 23984).

- **Treatment of Uncertainties:**
  - There is uncertainty about whether all the outlying plant clusters were included in every census from 1997 to 2012; therefore, the variation in numbers between censuses is not interpreted as a precise record of change in population size (Arnett 2013, p. 3). Population demographics sampling procedures have been modified to address these differences and the difficulty of identifying individual plants growing on top of one another or with buried branches; however, the protocol needs to be assessed for sensitivity to trampling of seedlings, possibly expanded to areas outside the main clump of plants, and used for several years to collect consistent data for future population viability analyses.
  - There is uncertainty about the factors driving the lack of recruitment observed over 21 years of data collection in the largest part of the population, including whether contaminated soil is present within the main population.
  - It is uncertain whether environmental contaminants from past farming and military activities in and near the former McGee Unit are affecting seedling survival and/or plant growth. Concern remains regarding environmental contaminants (legacy pesticides in the soil) documented in the final listing and Level I contaminant survey conducted in 2000 that have not been fully resolved on the former McGee Unit. The Service's Level I Contamination Survey recommended conducting a Level III contaminants survey and included requests for more soil testing, information about site activities, and data collection. A Level III contaminants survey was not

completed. Meanwhile, Umtanum Desert buckwheat recruitment has been almost non-existent for the last 21 years in the main part of the population (the location of the demographic study). Also, Caplow's study of cheatgrass (*Bromus tectorum*) impacts, which used soil from the main part of the population, failed to produce any seedlings despite using the same nursery, same seed stock, and same successful propagation technique as her germination study which yielded 71 percent mean seed viability and produced a number of seedlings (Caplow 2005, appendix A).

- The area within the former McGee Unit is under primary jurisdiction of the U.S. Department of Energy (DOE). The area containing the population should eventually be transferred to the Service for resource management, but there is currently no timeframe for that to occur. Planning and execution of recovery actions on the former McGee Unit require DOE approval and permission for access for each individual involved. The DOE is also responsible for cultural clearance of management actions and tribal consultation.
- The Yakama Nation has asserted that Umtanum Ridge is a place of traditional cultural value for their people. The Yakama's specific cultural use of the area is not fully known; however, the Umtanum Desert buckwheat is said to have medicinal uses in their culture (R. Michel, pers. comm. 2018). The long-term effect of this claim is unknown. However, this designation should be considered in planning of ground disturbing recovery actions and wildfire restoration activities.

Brief Life History:

Umtanum Desert buckwheat is a slow growing, long-lived plant. Dunwiddie *et al.* (2000) concluded that *Eriogonum codium* can live more than 100 years, has high flower production, low germination rates, high seedling mortality, and high variability of growth between individuals and years.

Flowering occurs from May through September (Dunwiddie *et al.* 2000, p 59). Five years following germination, the plant begins to produce seed. Seed set occurs in about 10 percent of flowers observed and seedling survival is 2 percent or less in the first year. The plant may be capable of limited self-pollination, although the percentage of seed set in the absence of pollinators appears to be low (Beck 1999, p. 30). A variety of insect pollinators have been observed on Umtanum Desert buckwheat, including ants, beetles, flies, spiders, moths, butterflies, and a bumble bee (78 FR 23984). Strong winds likely disperse seeds away from suitable germination sites (Dunwiddie *et al.* 2000, p. 67). Harvester ants were observed gathering a substantial amount of seed (Dunwiddie *et al.* 2000, p.66).

Seedling data from 1996 to 2012 demonstrated extreme variation in seedling production from year to year and showed very low survival of seedlings beyond the spring in which they germinate (Arnett 2013, p. 2).

Limiting Life History Characteristics:

- *E. codium* is a very long-lived plant that grows, matures, and declines very slowly, occasionally losing branches as it matures.
- *E. codium* is not fire tolerant. It does not re-sprout after being burned and its leaves, branches, flowers, and seeds die from even mild scorching.
- Plant growth is highly variable between individuals and between years.
- It may be capable of limited self-pollination, although the percentage of seed set in the absence of pollinators appears to be low.
- Plants can bloom and not set seed at 18 months of age in an eastern Washington garden environment, but plants produce flowers with mature achenes at 5 years of age *in situ*.
- Seed production is highly variable from year to year, but thousands of seeds can be produced annually within the population (Beck 1999, p. 21).
- Seed set occurs in about 10 percent of observed flowers.
- Seed viability is nearly 70 percent in fresh or properly stored seed, but drops sharply after the first year it is in the soil, suggesting a transitory to short-term persistent seed bank (Caplow 2005, p. 6). Typically, banked seed does not germinate if more than a year old (Caplow 2005, p. 6).
- Seeds germinate in spring and a few in summer or fall.
- There is no clear correlation between temperature or precipitation and seedling production or survival (Caplow 2003, section 2, p. 4; Caplow 2005, p. 9).
- *E. codium* has a transitory to short-term persistent seed bank (2005 Caplow, p. 6).
- Seedling survival is 2 percent or less in the first year and has remained so for 20 years.
- Plants can be easily damaged or killed by trampling or crushed by mechanized travel. The branches are very brittle and easily break and the seedlings are very small.

Primary Threats:

- ***Wildland Fire*** – Wildland fire is the most significant threat to *E. codium* and may be the primary factor controlling the distribution of the species (Beck 1999, p. 31). The plant is very intolerant of fire, and direct and indirect losses of plants from wildland fires have been significant. An estimated 10 to 20 percent of the population died from a wildfire in 1996 (Dunwiddie *et al.* 2000, p. 62). After the Silver Dollar Fire in July 2017, 63 percent of the population had plants that were lightly, partially, or entirely burned (Fertig 2018, p 24). Wildfires typically occur every year on or near HRNM. Private lands surrounding the former McGee Unit are not within a fire district; therefore, fires starting to the west have a high potential for growth and spread eastward before initial suppression starts. These fires often exhibit extreme and erratic fire behavior due to fuel and wind conditions common to the area (Newsome and Goldie 2016, p. 1). Fuel from grasses, forbs and shrubs in and adjacent to the buckwheat are currently low to moderate and not contiguous. Wildfires on the former McGee Unit are under the jurisdiction of the DOE and its fire department. The Central Washington National Wildlife Refuge Complex (Refuge; formerly part of the Mid-Columbia National Wildlife Refuge Complex) assists the DOE in fire response under mutual aid agreements.

- ***Invasive Annual Plants*** –Invasive nonnative plants are a significant threat to Umtanum Desert buckwheat. Cheatgrass and other invasive annual grasses compete with the buckwheat for resources, increase fuel loading within and adjacent to occupied habitat, and expose Umtanum Desert buckwheat to hotter and more frequent fires; while setting up a cycle of continued invasion by more cheatgrass and invasive annual plants. Cheatgrass has invaded areas within and immediately adjacent to the buckwheat population. The buckwheat population is now partially to heavily infested with cheatgrass (Newsome and Goldie 2016, p. 1). After the wildfire in 2017, no restoration of the area occurred. Post-wildfire restoration, and the cultural clearance and Tribal coordination for the restoration actions, is the responsibility of the DOE.

- ***Low Recruitment*** – Extremely low seedling survival is contributing to low recruitment and the population is trending downward; however, the factors and mechanisms responsible for low seedling survival are not well understood. Seed predation by western harvester ants and the removal of flowers by an unknown species were identified as ongoing threats that could be contributing to low recruitment (78 FR 23984).

- ***Small Population Size*** – The total population of Umtanum Desert buckwheat is approximately 3,016 plants as of 2019, reflecting recent mortality due to effects of a wildfire that burned through the population in 2017. The plant's genetics are unstudied.

Current Biological Status of the Species:

- **Overview:** *Historical and current distribution, population sizes, rates of decline, etc.* Umtanum Desert buckwheat's current distribution comprises a single population, located along the eastern end of Umtanum Ridge within the Rattlesnake Unit of the HRNM. Its historical distribution is unknown. As of 2019, the population totaled 3,016 plants. The population is trending downward at an annual mortality rate of less than 1 percent. However, this buckwheat is also vulnerable to stochastic events, such as wildfire and drought, which can influence "annual mortality rate" and have not yet been included in the population trend analyses.

- **3 Rs (Resiliency, Representation, and Redundancy):**

  What is the current status of the 3 Rs for this species?

  - **Resiliency – Low** – The population's and individual plants' ability to withstand stochastic events such as landslides and wildland fires is low. The single population of Umtanum Desert buckwheat is small, has low recruitment, is slowly declining, and is not widespread. Its habitat quality has declined due to repeated fires and subsequent invasion of invasive annual grasses. The plant is fire intolerant and grows very slowly. Its historic habitat is unknown.
  - **Representation – Low** –The species ability to adapt to change is low. This plant is found on a specific substrate within an area that has been protected from land use

changes since 1943. Its geographic, ecological, and niche diversity appear to be low. Its genetic diversity is unknown.

- **Redundancy – Low** – This species' ability to withstand catastrophic events is low. It has one known population comprised of five subgroups that are all relatively close to each other. The total population occupies a small area (0.79 hectares [ha] or 1.9 acres [ac]). Its designated critical habitat is approximately 2 ha (5 ac).

Conservation Actions to Date:

Demographic Study

- Since 1997, data collection and analysis for plant growth, number of plants, reproduction, and survival have continued in permanent plots within the main part of the population. The Washington Natural Heritage Program leads this demographics study.

Seed Banking

- 1997, 2001, and 2002 - Seed from 3 years of collection (1,509 seeds) are stored at the Rae Selling Berry Seed Bank located at Portland State University (formerly Berry Seed Bank) for the purposes of maintaining a secure source of seed and preserving the genome. Half of these seeds (755 seeds) are stored in the U.S. Department of Agriculture (USDA) National Laboratory of Genetic Resources Preservation in Fort Collins, Colorado, for security, per Rae Selling Berry Seed Bank's seed storage protocol. Seed viability of the accessions is periodically tested, while they are stored.

- 2017 – An unknown number of seeds were sent by the Refuge to be stored at Miller Seed Vault located at the University of Washington Botanic Garden. There are two accessions of seed at this bank.

Propagation and Seedling Studies

- Rain Shadow Nursery in Kittitas, Washington, developed propagation techniques in 2002 and 2003 (Caplow 2005, p 8).

- Seed germination trials, seed bank characterization, investigation of supplemental watering of seedlings, and an aborted study of Umtanum Desert buckwheat's response to cheatgrass were conducted from 2002 through 2005 (Caplow 2005, Executive Summary). Caplow's cheatgrass study was aborted because no seedlings germinated, despite using the same seed cohort, methods and nursery as the successful seed germination trials (Caplow 2005, p. 7).

- From 2010 to 2016, Refuge staff conducted experimental outplantings on the HRNM to establish plants outside of the extant population, determine if plants could survive in similar habitats away from Umtanum Ridge, and attempt to protect some plants from wildfire. Refuge personnel and volunteers harvested seed, propagated plants in north Richland, planted 548 first-year seedlings at 11 sites (102 plants on Yakima Ridge and 446 plants on Saddle Mountain) and monitored their survival and seedling production (Arnett and Goldner 2017, pp 26-27). Outplanting began in 2011, in sites outside of the

currently occupied areas, but in sites with similar site conditions. A few plants survived for as long as 32 months. The overall survival of all outplanted seedlings was 7 percent, as of 2017 (Newsome and Goldie 2017, p 10). As of 2018, a few of the outplanted seedlings remained alive, although not all the sites were visited that year (Newsome, H., pers. comm. 2018). Caplow (2005, p. 8) noted that site characteristics and environmental conditions appear to be important for plant survival and, perhaps, some unknown factor is needed for germinant survival in the extant population, such as seed depth or other factors. Newsome recommended conducting soil testing and investigation of site parameters such as temperature, wind, humidity at the microsite level (Newsome and Goldie 2016, pp 11).

Plant and Habitat Protection

- The DOE governs access to the plant's habitat on the former McGee Unit. The area is fenced along Highway 24, gated, and posted to exclude public entry, due to Hanford Site security and safety issues, which in effect protects the plants from trampling, collection, and unauthorized motorized vehicles. Recreation and livestock grazing are prohibited in the area within the former McGee Unit and the area closure is actively enforced. All collection of natural material, including petrified wood, is prohibited. Human access through the area along the Columbia River below Umtanum Ridge is restricted by fencing and a gated powerline access road.

Wildland Fire Protection and Response

- The DOE and Hanford Fire Department manage fire response on the former McGee Unit of the HRNM. Cooperating fire management agencies, including the Service, respond to fires that could threaten the population, but wildfire conditions and behavior are extreme in this area and surrounding private lands are not within a fire protection district. Firefighting entities know the plant's location and vulnerabilities associated with fire suppression activities, and seek to avoid negative impacts to the plant during fire suppression. The DOE and the Refuge provide resource advice to incident command teams engaged in fire suppression on the HRNM, including plant protection recommendations. Protection of rare plants and habitats are included in the *Wildland Fire Management Plan 2014 for Mid-Columbia River National Wildlife Refuge Complex* (USFWS 2014, p. 5).

- Bare dirt fuel breaks are maintained inside the fenced property along Highway 24.

Recovery Priority Number:

The Recovery Priority Number is five (5) based on the following:

- **High degree of threat** - One small population of 3,016 individuals occurs over a small area. The species is not fire resilient and its habitat is prone to wildfires and invasive annual plant invasion.
- **Low potential for recovery** – Recruitment in the wild is extremely low. The cause of low seedling survival is unknown. Potential loss from wildland fire is high and imminent. The habitat is not under total jurisdiction and management of the Service due to unresolved potential contaminant and unexploded ordnance concerns.

2) Interim Recovery Program

Interim Recovery Strategy:

The initial recovery strategy for Umtanum Desert buckwheat will be centered on conducting actions that would protect the extant population from wildfires, reduce the presence of invasive annual plants, develop a seed collection strategy, and collect information needed to develop a propagation and outplanting strategy. The seed management and propagation/outplanting plans are necessary for Service propagation policy compliance and will be designed to preserve genetic diversity, create subpopulations that are less vulnerable to catastrophic events, and reverse population decline, particularly by increasing recruitment.

Action Plan:

Interim Recovery Action Plan – Prioritized in order of need for the species' recovery.

Preliminary Recovery Actions		
Recovery Actions	***Threats Addressed***	***Contributions to Recovery***
1. Work with the DOE to rehabilitate the burned area within the former McGee Unit to treat cheatgrass and re-establish native grass and shrubs to reduce soil erosion and invasion of non-native grass and weeds within and surrounding the population.	*Invasive weed competition, Risk of wildfire*	*Reduces fire fuels and invasive weed competition*
2. Improve access to the former McGee Unit for firefighting purposes. Make road improvement to accommodate use by fire engines.	*Loss from wildland fire*	*Reduces risk of catastrophic loss from wildland fires*
3. Continue coordination with and providing technical assistance to private landowners and Tribal, State, and Federal partners working to improve fire protection in unprotected and under-protected areas that spread fires to Umtanum Ridge.	*Loss from wildland fire*	*Reduces risk of catastrophic loss from wildland fires*
4. Re-institute strict protocols to reduce the risk of seedling trampling during plant surveys and activities near the population.	*Low recruitment; small population size*	*Reduces the risk of extinction, improves recruitment data collection*
5. Establish an Umtanum Desert Buckwheat Working Group to utilize botanical and restoration expertise from recovery partners, begin coordinated planning and implementation of recovery actions, and revise this action plan periodically.	*Extinction of the population*	*Begins collaborative recovery planning and implementation of recovery actions utilizing all available botanical and restoration expertise*
6. Develop and implement a seed collection and conservation strategy with objectives to increase the population size and/or reintroduce new populations, as well as preserve genetic material, should the one population in the wild become extinct and because viable seed is not abundant. Determine number of seed and viability of seed in Miller Seed Vault.	*Extinction of the extant population; small population; potential genetic drift*	*Reduce the risk of losing the genome and population, potentially increase genetic diversity of the remaining population; create new populations more capable of withstanding stochastic events*
7. Create a seed production garden to increase seed production ex situ *and reduce loss of seedlings. Develop and test* in situ *planting techniques. Test outplanting seedlings in spring instead of fall or winter. Modify planting strategy and possibly plant older seedlings when available.*	*Low recruitment; small wild population*	*Reduces the risk of extinction, reduces loss of seedlings from trampling, and potentially increases population size and number of populations*

Preliminary Recovery Actions		
Recovery Actions	***Threats Addressed***	***Contributions to Recovery***
8. Consider conducting another study that would count seedlings in areas outside the main population clump to ensure monitoring is not negatively affecting recruitment	*Low recruitment; small population size*	*Reduces the risk of extinction, improves recruitment data collection*
9. Conduct a remote sensing study to determine if an unmanned aerial system (UAS) can be used to census and monitor growth of the population and plants. Evaluate whether this technique can accurately detect different size classes while reducing plant loss and damage.	*Reduce trampling and loss of plants*	*Reduces the risk of extinction, reduces the loss of seedlings from trampling, and potentially increases population size and number of populations*
10. Develop a conservation partnership with the Yakama Nation to enlist their support and assistance in recovery actions and strengthen cultural ties to the plant that would lead to long-term preservation. Eriogonum codium *grows within the Yakama Nation ceded lands.*	*Extinction of the extant population*	*Develop a conservation partnership with Native people who are vested in management of the habitat and plant long-term*
11. Inventory and manage annual plant invasion (cheatgrass and other invasive plants), particularly through post-fire restoration activities to keep the invasive plant seedbank low. Weed around seedlings and juveniles. Investigate the use of herbicides to control annual grasses.	*Loss from wildland fire; Invasive annual plant competition*	*Reduces plant competition, fire fuel, and risk of catastrophic loss from wildland fires*
12. Maintain existing fuel breaks and install additional fuel breaks to protect the population from wildfire, including along the powerline access road that climbs Umtanum Ridge from the substation below the ridge to address fires that may originate from substation infrastructure and human activities associated with Hwy 24.	*Loss from wildland fire*	*Reduces risk of catastrophic loss from wildland fires*
13. Conduct another population viability analysis that includes all the data available to date. Consider stochastic events in relation to the population viability analysis.	*Extinction of the population*	*Reduces the risk of extinction, informs decisions on recovery of the population, particularly in relation to other species at risk*

Preliminary Recovery Actions		
Recovery Actions	***Threats Addressed***	***Contributions to Recovery***
14. Conduct studies to determine factors and mechanisms responsible for low recruitment and low seedling survival, including low seed production, low seed or pollen viability, low seedling vigor and survival, local abundance of plant pollinators, and effects of insect seed and flower predation. Conduct pollinator studies to determine if pollinator abundance and servicing of buckwheat specifically is low and affecting seed viability of Umtanum Desert buckwheat. Conduct an improved pollinator exclusion study to determine definitively whether the plant is self-pollinating and pollinated by wind, as recommended by Beck (Beck 1999, p.30). Collect and analyze microsite characteristics and use the information to improve in situ planting site selection and seedling survival. Determine if snow holding capacity on occupied sites is important for seedling survival. Continue to monitor seedling survival and recruitment to determine trend, gain more information on seedling survival and recruitment, and update the population viability assessment. Determine where suitable outplanting sites are located and how extensive they are by determining the relationship of the Lolo Flow lithosols to Umtanum Desert buckwheat. Revise the potential habitat geospatial model developed by Newsome and Goldie (2016) with additional, updated or more precise data, to re-evaluate potential outplanting sites	*Low recruitment*	*Reduces the risk of extinction, information will aid in increasing population size and number of populations*
15. Conduct non-invasive surface soil testing. Determine mineral composition of soil in specific occupied areas and locate sites with similar soil characteristics. Use the information to guide outplanting efforts and to locate potential suitable habitat. Test for possible contaminants (e.g., organochlorides) in all subsets of the population, to gather information for propagation and ensure that soil health is not a factor contributing to low recruitment.	*Low recruitment*	*Reduces the risk of extinction, information will aid in increasing population size and number of populations*
16. Conduct studies of age, size, and growth rate of plants, to determine the time period represented by few plants in smaller age classes and possible causes of low productivity years. Improve understanding of the relationship of plant size to age in order to better define age classes of the population.	*Low recruitment*	*Reduces the risk of extinction, information will aid in increasing population size and number of populations*
17. Review survey data and conduct inventories of similar basalt flow ridges along the Columbia River in southcentral Washington to look for additional populations. Identify and conserve key potential habitat areas that may have been historical habitat.	*Reduce potential habitat loss, improve future distribution, and potentially improve habitat quality*	*Conserve areas for future habitats.*
18. Contact the Eriogonum Society to enlist them as conservation partners on recovery actions and study of the plant. This group has an interest specifically in Eriogonum species and has members in Washington.	*Extinction of the extant population*	*Develop partnership in conducting recovery actions, particularly scientific research and public outreach.*

3) Preliminary Steps for Recovery Planning

Will a recovery plan be developed? A recovery plan will be developed after the 5-year review is completed in Fiscal Year 2020.

Type of recovery plan: Single species

Who will develop the recovery plan: Umtanum Desert buckwheat lead biologist, Central Washington Field Office, U.S. Fish and Wildlife Service

Plan for stakeholder role/involvement:

Stakeholder	Representation	Role/Involvement
U.S. Fish and Wildlife Service, Ecological Services, Central Washington Field Office, Wenatchee, WA	Federal	Lead and oversight for recovery planning and implementation; completes listing/recovery documents; funding source for data and recovery actions
U.S. Fish and Wildlife Service, Central Washington National Wildlife Refuge Complex, Burbank, WA	Federal	Species lead for recovery action implementation, including propagation; natural resource data source; species expertise; funding source for data and recovery actions
Department of Energy, Hanford Site, Richland, WA	Federal	Primary land manager; controls habitat access; a natural resource data source; funding source for data and recovery actions; responsible for consultation with tribes and for cultural resources issues/clearances associated with recovery/management actions
Department of Defense, Army, JBLM-YTC, Selah, WA	Federal	Management of potential habitat on JBLM-YTC; partner in wildfire management
Confederated Tribes and Bands of the Yakama Nation; Natural Resources Department; Toppenish, WA	Tribal	Information regarding cultural use of the plant and its habitat; potential assistance in recovery actions; primary tribal stakeholder
Cheryl Shippentower, Plant Ecologist Confederated Tribes of the Umatilla Indian Reservation; Pendleton, OR	Tribal	Obtain information regarding cultural use of the plant and its habitat
Nez Perce Tribe; Natural Resources Department; Lapwai, ID	Tribal	Obtain information regarding cultural use of the plant and its habitat
Rex Buck, Band Leader, Priest Rapids Band of the Wanapum, Beverly, WA	Tribal	Obtain information regarding cultural use of the plant and its habitat
Rare Plants Botanist, Washington Natural Heritage Program, Washington	State	Provide rare plant botany expertise; Washington Natural Heritage Program holds existing monitoring and study data;

Stakeholder	Representation	Role/Involvement
Department of Natural Resources, Olympia, WA		lead for demographics studies; (an original conservation partner)
Mission Support Alliance, a private industry contractor for DOE that integrates the multi-contract clean-up of the Hanford Site, including natural resource data collection, analysis, planning, and management; Richland, WA	Non-government organization	Natural resource expertise and data sharing
Washington Native Plants Society, Olympia, WA; a State society devoted to appreciation and conservation of Washington's native plants and their habitats through study, education, and advocacy.	Non-government organization	Partner in rare plant conservation and study; botany expertise; assistance in recovery actions; (an original conservation partner)
The Eriogonum Society; a national society devoted to protection, propagation, study, and appreciation of *Eriogonum* species	Non-government organization	Partner in rare plant conservation and study; possible partner for funding; assistance in recovery actions

Recovery Planning Milestones:

2019: Recovery outline completed
2019: 5-year review to be drafted
2020: 5-year review to be completed and need for species status assessment to be evaluated
2020: Draft recovery plan to be completed
2021: Recovery plan to be completed

Approved

Robyn Thorson

Date AUG 2 0 2019

Regional Director, Pacific Region

U.S. Fish and Wildlife Service

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PERSONAL COMMUNICATIONS

Fertig, W. (State Rare Plant Biologist), Washington Natural Heritage Program, Olympia, WA), pers. comm. Email regarding *Eriogonum codium* census results for 2019. July 15, 2019.

Michel, R. (Archeologist, USFWS, Burbank, WA), pers. comm. Phone call discussing Yakama Nation tribal uses and coordination. September 11, 2018.

Newsome, H. (Supervisory Wildlife Biologist, USFWS, Burbank, WA), pers. comm. In-person conversation relaying findings of outplanting site visit conducted in 2018. October 30, 2018.