

Draft Amendment to the Recovery Plan for *Hackelia venusta* (Showy Stickseed)

Original Approved: [October 10, 2007](#)

Original Prepared by: Pacific Region, U.S. Fish and Wildlife Service

Date of Draft Amendment: August 2018

Species addressed in Draft Amendment: *Hackelia venusta* (Showy Stickseed)

We have analyzed all of the best available information and find that there is a need to amend the recovery criteria for *Hackelia venusta* (showy stickseed) that have been in place since the recovery plan was completed. In this proposed modification, we discuss the adequacy of the existing recovery criteria, identify amended recovery criteria, and present the rationale supporting the proposed recovery plan modification. The proposed modification is to be shown as an appendix that supplements the recovery plan (USFWS 2007).

BACKGROUND INFORMATION

Recovery plans should be consulted frequently, used to initiate recovery activities, and updated as needed. A review of the recovery plan and its implementation may show that the plan is out of date or its usefulness is limited, and therefore warrants modification. Keeping recovery plans current ensures that the species benefits through timely, partner-coordinated implementation based on the best available information. The need for, and extent of, plan modifications will vary considerably among plans. Maintaining a useful and current recovery plan depends on the scope and complexity of the initial plan, the structure of the document, and the involvement of stakeholders.

An amendment involves a substantial rewrite of a portion of a recovery plan that changes any of the statutory elements. The need for an amendment may be triggered when, among other possibilities: (1) the current recovery plan is out of compliance with regard to statutory requirements; (2) new information has been identified, such as population-level threats to the species or previously unknown life history traits, that necessitates new or refined recovery actions and/or criteria; or (3) the current recovery plan is not achieving its objectives. The amendment replaces only that specific portion of the recovery plan, supplementing the existing recovery plan, but not completely replacing it. An amendment may be appropriate in cases where significant plan improvements are needed, but resources are too scarce to accomplish a full recovery plan revision in a short time.

Although it would be inappropriate for an amendment to include changes in the recovery program that contradict the approved recovery plan, it could incorporate study findings that enhance the scientific basis of the plan, or that reduce uncertainties as to the life history, threats, or species' response to management. An amendment could serve a critical function while awaiting a more comprehensive revised recovery plan by: (1) refining and/or prioritizing recovery actions that need to be emphasized, (2) refining recovery criteria, or (3) adding a species to a multispecies or ecosystem plan. An amendment can, therefore, efficiently balance resources spent on modifying a plan against those spent on managing implementation of ongoing recovery actions.

METHODOLOGY USED TO COMPLETE THE RECOVERY PLAN AMENDMENT

The recovery plan amendment was developed after a thorough review of the best available scientific information by a team of U.S. Fish and Wildlife Biologists in consultation with botanists from the U.S. Forest Service (USFS) and the Washington Department of Natural Resources' Washington Natural Heritage Program (WNHP).

ADEQUACY OF RECOVERY CRITERIA

Section 4(f)(1)(B)(ii) of the Endangered Species Act (Act) requires that each recovery plan shall incorporate, to the maximum extent practicable, "objective, measurable criteria which, when met, would result in a determination...that the species be removed from the list." Legal challenges to recovery plans (see e.g., *Fund for Animals v. Babbitt*, 903 F. Supp. 96 (D.D.C. 1995)) and a Government Accountability Audit (GAO 2006) also have affirmed the need to frame recovery criteria in terms of threats assessed under the five listing factors.

Recovery Criteria

See previous version of downlisting criteria in the Recovery Plan for Showy Stickseed (USFWS 2007, p. 26 – 30).

Synthesis

When the Recovery Plan for *Hackelia venusta* was completed in 2007, a single population of approximately 600 to 700 plants was known to exist. The population was located in Tumwater Canyon on steep slopes in unstable granitic soils adjacent to U.S. Highway 2 (USFWS 2007). A 5-year review of the species was completed in 2011 and determined there had been no significant changes to the population distribution or threats since the writing of the recovery plan, although the population had declined to 283 individuals (USFWS 2011). When the 5-year review was conducted, the relationship of *Hackelia venusta* with several populations of a similar plant (with blue flowers and in the same genus) that occurs at nearby, higher-elevation sites had not yet been resolved. Some botanists considered these plants to be the same species, but they were considered separate species in the original recovery plan and 5-year review assessments (USFWS 2007, 2011). In 2013, these nearby, higher-elevation populations of similar plants were recognized as a different species - Taylor's stickseed (*Hackelia taylorii*) (Harrod *et al.* 2013). Genetic studies were not able to differentiate between *Hackelia taylorii* and *Hackelia venusta* (Wendling and DeChaine 2012). Further genetic research is needed to fully understand the relationship between the two species.

Since the 5-year review in 2011, an additional threat to the species has been identified—trampling of or soil disturbance associated with walking near the plants due to conservation work. Due to the limited occurrence of the species and its apparent dependence on unstable granitic soils on steep slopes, it can be easily damaged by this physical disturbance. Additionally, a previously determined threat—over-collection—appears not to be as significant as there has been little recent evidence to support this concern. Due to trampling and soil disturbance, impact from research and monitoring activities could potentially cause negative impacts to the species. Biologists working on the species are, however, cognizant of the sensitivity of the species and its surroundings and work to reduce human impact by limiting survey frequency and using protocols to reduce impacts from scientific research.

Currently, the only known population is in Tumwater Canyon where it was originally discovered, although two flowering plants still survive from outplanting efforts from 1994 to 1996 in Icicle Creek as of 2018 (personal observation). The last full survey of the Tumwater population was conducted in 2012 and documented 477 individuals (Fertig 2018). Although the outplanting efforts of the 1990s were mostly unsuccessful, new outplanting efforts by the Rare Care Plant Program at the University of Washington Botanic Gardens commenced in 2015 once the program successfully developed protocols for germinating seeds and propagating them *ex situ* in a greenhouse (Taylor, 2008, Gibble 2015). In 2015, 228 plants were outplanted in Tumwater Canyon at 4 subpopulation sites surrounding and adjacent to the core population. Another 39 plants were reintroduced to the Icicle Creek outplanting site (Arnett and Goldner 2017). Survivorship of the 2015 outplantings in Tumwater Canyon in 2016 was 83 percent and declined to 51 percent in 2017 (Gibble 2017). Data are not yet available for the Icicle Creek population or for 2018. The Rare Care Plant Program plans to continue outplanting, seed collecting, and propagation efforts in 2018 and beyond to foster recovery of the species.

AMENDED RECOVERY CRITERIA

Recovery criteria serve as objective, measurable guidelines to assist in determining when an endangered species has recovered to the point that it may be downlisted to threatened, or that the protections afforded by the Act are no longer necessary and *Hackelia venusta* may be delisted. However, the actual change in status (downlisting or delisting) requires a separate rulemaking process based upon an analysis of the same five factors considered in the listing of a species (see Section I-F, Threats/Reasons for Listing in the Recovery Plan for *Hackelia venusta*) (USFWS 2007). Delisting is the removal of a species from the Federal Lists of Endangered and Threatened Wildlife and Plants. Downlisting is the reclassification of a species from endangered to threatened. The term “endangered species” means any species (species, subspecies, or distinct population segment) that is in danger of extinction throughout all or a significant portion of its range. The term “threatened species” means any species that is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range.

The recovery criteria presented below represent our best assessment of the conditions that would most likely result in a determination that delisting of *Hackelia venusta* is warranted as the outcome of a formal five-factor analysis in a subsequent regulatory rulemaking. Achieving the prescribed recovery criteria is an indication that the species is no longer threatened or endangered, but this must be confirmed by a thorough analysis of the five listing factors. We provide delisting criteria for *Hackelia venusta* which were not included in the 2007 Recovery Plan. The 2007 Plan included downlisting criteria, but no delisting criteria due to the lack of information about the species’ biology and habitat requirements, the magnitude of threats, and the precarious location of this population. All downlisting criteria from the previous plan were reviewed and found to be adequate. The current amendment establishes new delisting criteria for the Showy Stickseed in addition to the existing downlisting criteria.

Downlisting Recovery Criteria

Downlisting criteria will remain the same as in the Recovery Plan for *Hackelia venusta* (Showy Stickseed) (USFWS 2007, p. 26 – 30).

Delisting Recovery Criteria

Delisting of *Hackelia venusta* may be considered when all of the following conditions, in addition to the downlisting criteria set in the Recovery Plan (USFWS 2007), have been met to address threats to the species:

Recovery Criteria associated with Factor A: Present or Threatened Destruction, Modification, or Curtailment of Habitat or Range

To delist *Hackelia venusta*, threats to the species' habitat must be removed or adequately managed. This will be accomplished when the following has occurred:

A/1: The primary threats are removed or adequately managed in all five populations counted toward recovery in delisting criteria (see also **E/1**).

1. Justification: Given the inherent rarity of the species and sensitivity of its habitat to degradation, consultation with species experts concluded that the primary threats need to be removed or adequately managed for the foreseeable future for all populations counted toward recovery. Recovery criteria for similar federally listed plant species have required 100 percent of primary threats to be removed or adequately managed for the foreseeable future. (USFWS 2015a,b).
2. Primary threats and measures to address each threat:
 - a. Habitat loss due to plant succession in the absence of fire
 - i. Addressed when: Tree and shrub cover is maintained through manual removal and/or controlled (prescribed) burns at a level equal to or more open than that present in 2007 at the location of the original (currently only) population.
 - ii. How to maintain for the foreseeable future: Memorandum of Understanding (MOU) with USFS to conduct overstory and understory thinning at regular intervals (every 1 to 5 years).
 - b. Competition from nonnative plant species
 - i. Addressed when either: Noxious weeds are not present within any *Hackelia venusta* population, are not close enough to pose a significant threat of invasion, or are annually removed.
 - ii. How to maintain for the foreseeable future: MOU with the USFS to conduct annual weed management using Best Management Practices (BMPs). USFS BMPs are developed and implemented where *H. venusta* occurs.
 - c. Herbicide and road de-icer use
 - i. Addressed when: Herbicide and road de-icer use is minimized or avoided, within all populations or close proximity to individual plants.
 - ii. How to maintain for the foreseeable future: MOU (or another agreement) with Washington State Department of

Transportation (WSDOT) to keep levels of de-icer in the soil below levels determined to be harmful near *H. venusta* populations (Chalker-Scott and Brickey 2004). Implement BMPs from the WSDOT rare plant management plan for application of de-icer and herbicide application near *H. venusta* (WSDOT 2000). Implementation of USFS BMPs for herbicide applications in close proximity to populations and individual plants.

d. Mass wasting

- i. Addressed when: All populations are evaluated for the potential of landslide or mass wasting (downslope earth movement). Populations determined to be at high risk will require implementation of conservation measures to minimize mass wasting potential.
- ii. How to maintain for the foreseeable future: Conservation measures implemented to minimize mass wasting potential (i.e., fencing and/or slope stabilization structures) near occupied habitat will be maintained for the foreseeable future by the appropriate entity such as USFS or WSDOT. An MOU or other agreement that commits enforcement of off-trail hiking prohibitions near occupied habitat is implemented by the USFS.

Recovery Criteria associated with Factor B: Overutilization for Commercial, Recreational, Scientific, or Educational Purposes

B/1: Threats to the species through visitation must be removed.

1. Justification: *H. venusta* is potentially vulnerable to habitat damage through substrate disturbance (overcollecting is not currently considered a threat).
2. Major threats and ways to address each threat:
 - a. Monitoring efforts
 - i. Addressed when: Trampling from monitoring efforts is reduced by developing techniques that remove negative impacts to plants (i.e., surveys conducted using drones and/or satellite imagery).
 - ii. How to maintain for the foreseeable future: Develop and implement a monitoring protocol that minimizes impact to plants.

Recovery Criteria associated with Factor C: Disease or Predation

C/1: In order to ensure the long-term recovery needs of *H. venusta*, threats to the species through predation by the biocontrol agent, *Mogulones cruciger*, must be removed. This will have been accomplished if the two recovery criteria for downlisting under Factor C have been met (USFWS 2007). Additional delisting

recovery criteria beyond those for downlisting will not be required under Factor C.

Recovery Criteria associated with Factor D: Inadequacy of Existing Regulatory Mechanisms

D/1: The inadequacy of existing regulatory mechanisms beyond those addressed by the three recovery criteria for downlisting under Factor D (USFWS 2007) or by the MOUs (or other agreements) to manage habitat threats addressed above under Factor A (see also **A/1**) is not known to hinder the recovery of *Hackelia venusta* at this time. Therefore, no additional delisting criteria have been developed for this factor.

Recovery Criteria associated with Factor E: Other Natural or Manmade Factors Affecting Its Continued Existence

E/1: There are at least five stable, self-sustaining populations typically separated by 1.5 miles (Fertig pers. comm., April 20, 2018; NatureServe 2018) or by a geographical barrier such as the Wenatchee River on protected sites where protection of the species is a priority.

1. Justification: According to the most recent surveys, a single population of fewer than 500 plants of *H. venusta* exists currently, making it extremely vulnerable to a single stochastic event (e.g., mass wasting) that could wipe out the world-wide distribution of this listed species. The distribution of *H. venusta* needs to include more than one population and populations need to be separated enough to prevent extinction through a single stochastic event. Additionally, five populations are needed to maintain an acceptable minimum level of genetic diversity within the species (Brown and Briggs 1991, Neel and Cummings 2003).
2. Major threats and ways to address each threat:
 - a. Low seed production
 - i. Addressed when: By definition, if there are at least five stable, self-sustaining populations, this threat has been addressed. How to maintain for the foreseeable future: N/A
 - b. Seedling establishment
 - i. Addressed when: By definition, if there are at least five stable, self-sustaining populations, this threat has been addressed.
 - ii. How to maintain for the foreseeable future: Establish agreements with WNHP for seed collection (only in high seed production years following the methods in the draft *Hackelia venusta* seed collection protocol (Arnett 2007), adapted from the collection guidelines published by the Center for Plant Conservation (1991)). Seeds will be stored at two storage facilities certified by the Center for Plant Conservation. Seeds should be collected at least every 5 years to ensure that seeds in storage are viable.

E/2: To be deemed stable and self-sustaining, a population must maintain a 20-year running average of at least 2,000 adult plants, show evidence of positive or neutral population growth over the same 20-year period, and be sustained through natural regeneration.

1. Justification for 2,000 adult plants per population: The number (2,000 adult plants) of *H. venusta* was chosen in order to prevent inbreeding depression which can occur in small, isolated populations when a deleterious allele becomes fixed (Lynch, Conery, and Burger 1995). If inbreeding depression was to occur, survival and reproduction of *H. venusta* would be greatly reduced furthering the probability of extinction (Falk, Knapp, and Guerrant 2002). The number (2,000 adult plants) was chosen as a conservative estimate in order to balance what is feasible for the available habitat and also as an intermediate value between the lowest and highest estimates given from the following studies: Frankham 1995; Franklin and Frankham 1998; Lande 1995; Lynch, Conery, and Burger 1995; and Burger and Lynch 1997.

Minimum Viable Population (MVP) size, the smallest number of individuals required for 95 percent probability of survival over 100 years (Mace and Lande 1991), is often used as the recovery objective for populations of listed species. However, determining the MVP can be challenging for many plant species as it requires genetic and demographic data that is often not known. Therefore, we used an alternative method to estimate likely MVP (Table 1) developed by Pavlik (1996), which has also been used to estimate MVP for other similarly rare, listed species (USFWS, 2016c; USFWS 2017). This method is based on the life-history characteristics of the species. Using this methodology, a perennial plant that is woody and self-fertilizing with high fecundity and survivorship (with life history characteristics mostly in column A of Table 1) would have an MVP in the range of 50 to 250 individuals. A plant with life history characteristics that fall mostly in column B would have an MVP value between 1,500 to 2,500 individuals. Known life history characteristics of *H. venusta* are noted in bold in Table 1. MVP size for *H. venusta* is estimated at 2,000 individuals due to the following species' characteristics: outcrossing, herbaceous, low fecundity, low survivorship, ruderal successional status, no known ramet production, and unknown seed duration.

Table 1. Selection of objective for minimum viable population (MVP) size based on life history characteristics of the species. Adapted from Pavlik (1996) and USFWS (2017).

Life History Characteristic	A. 50 individuals	B. 2,500 individuals
longevity	perennial --->	annual
breeding system	selfing --->	outcrossing
growth form	woody --->	herbaceous
fecundity	high --->	low
ramet production	common --->	rare or none
survivorship	high --->	low
seed duration	long --->	short
environmental variation	low --->	high
successional status	climax --->	seral or ruderal

Justification for 20-year average: The lifespan of *H. venusta* is approximately 10 years. If the populations are stable and increasing for a time period of twice the lifespan of the plant, species experts can be confident that the population is stable and capable of regeneration. A stable and increasing population over a 20-year average was determined to be a reasonably conservative criteria considering the time period required for a stable or increasing population for delisting for similarly rare plants ranges from 10 to 60 years (see e.g., USFWS 2015b (10 years), USFWS 2016b (20 years), USFWS 2015a and 2016a (25 years), and USFWS 2017 (60 years)). Climate patterns in the Pacific Northwest are strongly influenced by the effects of the El Niño/Southern Oscillation (ENSO) with a period of 2 to 7 years and the Pacific Decadal Oscillation (PDO) pattern, with irregular periods lasting 20 to 30 years (Mote *et al.* 2003). Compounding these two drivers of climate in the Pacific Northwest are the current and future effects of anthropogenic climate change. ENSO and PDO can result in long periods of drier or wetter than average conditions, which could impact the stability of rare species with extremely limited ranges and habitat requirements such as *H. venusta*. Climate change and the PDO can cause significant, long-term changes to the forests of the Pacific Northwest via less precipitation in the summers and increased probability for forest fires, which could negatively impact rare plants like *H. venusta* (Hessl 2004, Mote *et al.* 2003, W. Fertig, pers. comm. April 13, 2018). Therefore, a time period of 20 years for *H. venusta* to have five stable or increasing populations is likely needed to assess whether the species can be stable and resilient without the protection of the Act even during periods of changing climate patterns. However, if five populations maintain a 10-year running average of at least 2,000 adult plants, the Service at that time may reevaluate the necessity of the 20-year running average criterion.

All classification decisions consider an analysis of the following five factors: (1) is there a present or threatened destruction, modification, or curtailment of the species' habitat or range; (2) is the species subject to overutilization for commercial, recreational scientific or educational purposes; (3) is disease or predation a limiting factor; (4) are there inadequate existing regulatory mechanisms in place outside the Act (taking into account the efforts by states and other organizations to protect the species or habitat); and (5) are other natural or manmade factors affecting its continued existence. When delisting or downlisting a species, we first propose the action in the *Federal Register* and seek public comment and peer review on our analysis. Our final decision is announced in the *Federal Register*.

Rationale for Recovery Criteria

Justification for the amended recovery criteria is included above within the Delisting Recovery Criteria section.

LITERATURE CITED

- Arnett, J. and A. Goldner. 2017. Monitoring federally listed and candidate plant taxa in Washington state 2016. Natural Heritage Report 2017-03. Prepared for Region 1, U.S. Fish and Wildlife Service. Washington Natural Heritage Program, Department of Natural Resources, Olympia, Washington. 63 pp + app.
- Arnett, J. 2007. *Hackelia venusta* (showy stickseed) Report on Monitoring, Inventory, and Reintroduction. Natural Heritage Report 2007-02. Prepared for Region 1, U.S. Fish and Wildlife Service. Washington Natural Heritage Program, Department of Natural Resources, Olympia, Washington. 31 pp + app.
- Brown, A.H.D. and J.D. Briggs. 1991. Sampling strategies for genetic variation in ex situ collections of endangered plant species. Pp. 99-119. In: D.A. Falk and K.E. Holsinger, eds. Genetics and Conservation of Rare Plants. Oxford University Press, New York.
- Burger, R. and M. Lynch. 1997. Evolution and extinction in a changing environment: a quantitative-genetic analysis. *Evolution* 49:151-163.
- Center for Plant Conservation. 1991. Genetic sampling guidelines for conservation collections of endangered plants. In Genetics and Conservation of Rare Plants. Eds. D. A. Falk and K.E. Holsinger, pp. 225-238. Oxford University Press. New York.
- Chalker-Scott, L. and J. Brickey. 2004. Determination of the effects of anti-icer compounds upon the rare plant *H. venusta*. Thesis Report for Washington State Transportation Center (TRAC) University of Washington, Prepared for the Biology Program, Washington State Department of Transportation.
- Falk D.A., Knapp E.E., Guerrant E.O. 2001. Introduction to restoration genetics. Society for Ecological Restoration. 33 pp.
- Fertig, Walt. Pers. comm. April 13, 2018. Botanist, Washington Natural Heritage Program, Washington Department of Natural Resources, Olympia, Washington.
- Fertig, Walt. Pers. comm. April 20, 2018. Botanist, Washington Natural Heritage Program, Washington Department of Natural Resources, Olympia, Washington. Message to Randi Riggs. E-mail.
- Fertig, W. 2018. Status of Federally Listed Plant Taxa in Washington State, 2017. Natural Heritage Program Report Number: 2018-02. Prepared for Region 1, U.S. Fish and

- Wildlife Service. Washington Natural Heritage Program, Department of Natural Resources, Olympia, Washington. 75 pp.
- Franklin, I. and R. Frankham. 1998. How large must populations be to retain evolutionary potential? *Animal Conservation* 1:69-73.
- [GAO] Government Accountability Office. 2006. Endangered species recovery. GAO-06-463R. April 6, 2006. 27 pp.
- Gibble, W. 2015. *Hackelia venusta* (Showy Stickseed) Recovery Project. Prepared for U.S. Fish and Wildlife Service Region 1. Rare Plant Care and Conservation University of Washington Botanic Gardens. 49 pp.
- Gibble, W. 2017. Progress report for August 2, 2016 through September 30, 2017 FWS Cooperative Agreement F16AC00646. Washington Rare Plant Care and Conservation, University of Washington Botanic Gardens, Seattle, Washington. 2 pp.
- Harrod, R., L. Malmquist, and R. Carr. 2013. *Hackelia taylori* (Boraginaceae), a new species from north central Washington State (U.S.A.). *J. Bot. Res. Inst. Texas* 7(2):649-657.
- Hessl, A.E., D. McKenzie and R. Schellhaas. 2004. Drought and Pacific Decadal Oscillation linked to fire occurrence in the inland Pacific Northwest. *Ecological Applications* 14(2):425-442.
- Lande, R. 1995. Mutation and Conservation. *Conservation Biology* 9:782-791.
- Lynch, M., J. Conery, and R. Burger. 1995. Mutation Accumulation and the Extinction of Small Populations. *The American Naturalist* 146:489-518.
- Mace, G. M. and Lande, R. 1991. Assessing Extinction Threats: Toward a Reevaluation of IUCN Threatened Species Categories. *Conservation Biology* 5:148-157.
- Frankham, R. 1995. Inbreeding and Extinction: A Threshold Effect. *Conservation Biology* 9:792-799.
- Mote, P.W., Parson, E.A., Hamlet, A.F. 2003. Preparing for Climatic Change: The Water, Salmon, and Forests of the Pacific Northwest. *Climatic Change* 61:45-88.
- NatureServe. 2018. NatureServe Web Service. Arlington, VA. U.S.A. Available <http://help.natureserve.org/biotics/Content/Methodology/PlantEOSpecs.htm> (Accessed: April 20, 2018).
- Neel, M.C. and M.P. Cummings. 2003. Effectiveness of conservation targets in capturing genetic diversity. *Conservation Biology* 17(1):219-229.
- Pavlik, B.M. 1996. Chapter 6: Defining and measuring success. Pp. 127-155. In, D.A. Falk, C.I. Millar, and M. Olwell. Restoring diversity, strategies for reintroduction of endangered plants. Island Press, 505 pp.

- Taylor, N. J. 2008. Reproductive Biology of *Hackelia venusta* (Piper) St. John (Boraginaceae). A thesis submitted in partial fulfillment of the requirements for the degree of Master of Science, University of Washington.
- [USFWS] U.S. Fish and Wildlife Service. 2007. Recovery Plan for *Hackelia venusta* (Showy Stickseed). U.S. Fish and Wildlife Service, Portland, Oregon. xii + 60 pages.
- [USFWS] U.S. Fish and Wildlife Service. 2015a. Recovery plan for *Arctostaphylos pallida* (pallid manzanita). U.S. Fish and Wildlife Service, Pacific Southwest Region, Sacramento, California. vi + 39 pp.
- [USFWS] U.S. Fish and Wildlife Service. 2015b. Recovery Plan for *Clarkia imbricata* (Vine Hill Clarkia) U.S. Fish and Wildlife Service, Pacific Southwest Region, Sacramento, California. vi + 34 pp.
- [USFWS] U.S. Fish and Wildlife Service. 2016a. Recovery Plan for the Santa Rosa Plain: *Blennosperma bakeri* (Sonoma sunshine); *Lasthenia burkei* (Burke's goldfields); *Limnanthes vinculans* (Sebastopol meadowfoam); California Tiger Salamander Sonoma County Distinct Population Segment (*Ambystoma californiense*). U.S. Fish and Wildlife Service, Pacific Southwest Region, Sacramento, California. vi + 128 pp.
- [USFWS] U.S. Fish and Wildlife Service. 2016b. Recovery Plan for the Tamaulipan Kidney-petal (Texas Ayenia; *Ayenia limitaris*). U.S. Fish and Wildlife Service, Albuquerque, New Mexico.
- [USFWS] U.S. Fish and Wildlife Service. 2016c. Species status assessment of Guadalupe Fescue (*Festuca ligulata* Swallen), Version 1.0. U.S. Fish and Wildlife Service Southwest Region, Albuquerque, New Mexico. 52 pp. + 3 appendices.
- [USFWS] U.S. Fish and Wildlife Service. 2017. Texas Coastal Bend Shortgrass Prairie Multi-species Recovery Plan: Including Slender Rush-Pea (*Hoffmannseggia tenella*) and South Texas Ambrosia (*Ambrosia cheiranthifolia*). Albuquerque, New Mexico. 115 pages.
- Washington Department of Transportation. 2000. Final management plan for rare plant species in Tumwater Canyon, Wenatchee National Forest, and best management practices. Environmental Affairs Office, Spokane, Washington.
- Wendling, B. M. and E. G. DeChaine. 2012. A Molecular Analysis of *Hackelia venusta* (Boraginaceae) and Related Taxa presented at the 2012 conference "Conserving Plant Biodiversity in a Changing World: A View from Northwestern North America at the University of Washington, WA.