

Recovery Plan for *Arabis macdonaldiana* (McDonald's rock-cress)

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RECOVERY PLAN AMENDMENT

Best available information indicates the need to amend the recovery criteria for the dated *Arabis macdonaldiana* (McDonald's rock-cress) Recovery Plan originally published in 1984. In this modification the adequacy of existing recovery criteria, the recommendations for amended recovery criteria, and the rationale supporting Recovery Plan modifications are presented. The modifications shall be shown as an addendum that supplements the Recovery Plan, superseding only Section II (pp. 17-22) of the Recovery Plan.

**For
U.S. Fish and Wildlife Service
Pacific Southwest – Region 8
Sacramento, CA**

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Acting

Approved: 
Regional Director, U.S. Fish and Wildlife Service
Pacific Southwest Region

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METHODOLOGY USED TO COMPLETE THE RECOVERY PLAN AMENDMENT

The U.S. Fish and Wildlife Service (Service) prepared this amendment through review of existing Service data, available literature, the most recent 5-year status review, and information provided by the Bureau of Land Management. The review process was informed by the best available science regarding species biology, habitat requirements, and current threats. The recovery criteria were designed to be objective and quantifiable in order to best assess unbiased population conditions. Recovery criteria are measurable metrics intended to help reach recovery goals to ensure sustainable species population(s) viability in the wild that demonstrate resiliency, redundancy, and representation.

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 *Fund for Animals v. Babbitt*, 903 F. Supp. 96 (D.D.C. 1995)) and a Government Accountability Audit (GAO 2006) have also affirmed the need to frame recovery criteria in terms of threats assessed under the five threat factors (Act 4(a)(1)).

Recovery Criteria

The current recovery criteria for the McDonald’s rock-cress can be found in the 1984 McDonald’s rock-cress (*Arabis macdonaldiana*) Recovery Plan (Service 1984, pp. 17-22). Although there is a final Recovery Plan, it does not reflect the most up-to-date information on the species. When the Recovery Plan was finalized in 1984, limited data made it difficult to quantify habitat requirements with enough precision to establish detailed and measureable delisting criteria.

Synthesis

McDonald’s rock-cress is an endangered, long-lived, perennial plant species that occurs in soils derived from ultramafic parent material, containing high levels of heavy metals and low levels of nutrients (Service 2013). In the Recovery Plan for McDonald’s rock-cress, the Service identified criteria necessary for downlisting the species to threatened status; however, no criteria were identified for delisting the species. In the most recent status review, no change in listed status was recommended (Service 2013). Since the 2013 review, limited information regarding distribution and habitat extent and quality had been obtained. However, new information regarding threats has been obtained that suggest the threat of mining has been greatly reduced, but not entirely eliminated based on the expiration of several previously valid mining claims near the populations. Several of the mining claims in the Red Mountain Unit of the South Fork Eel River Wilderness Area (Red Mountain Wilderness) have been forfeited. These forfeited claims cannot be relocated, which reduces the threat of mining in the area. However, there are areas occupied by McDonald’s rock-cress outside of the Red Mountain Wilderness that are still open for mineral entry.

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 the species may be delisted.

Delisting is removal of a species from the Federal Lists of Endangered and Threatened Wildlife and Plants (here forward, Lists). Downlisting is reclassification of a species from an endangered species to a threatened species. The term “endangered species” means any species (species, subspecies, or Distinct Population Segment) which 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.

Revisions to the Lists, including delisting or downlisting a species, must reflect determinations made in accordance with sections 4(a)(1) and 4(b) of the Act. Section 4(a)(1) requires that the Secretary determine whether a species is an endangered species or a threatened species (or not) because of threats to the species. Section 4(b) of the Act requires that the determination be made “solely on the basis of the best scientific and commercial data available.” Recovery Plans provide important guidance to federal agencies, states, and other stakeholders on methods of minimizing threats to listed species, as well as measurable objectives against which to measure progress towards recovery. Recovery Plans provide guidance, and are not regulatory documents in and of themselves.

Recovery criteria should help indicate when we would anticipate that an analysis of the species’ status under section 4(a)(1) would result in a determination that the species is no longer an endangered species or threatened species. A decision to revise the status of, or remove, a species from the Lists, however, is ultimately based on an analysis of the best scientific and commercial data then available, regardless of whether that information differs from the Recovery Plan, which triggers rulemaking. When changing the status of a species, the action is first proposed in the *Federal Register* for public comment and peer review. After consideration and incorporation of public comment and peer review, the action is followed by a second announcement in the *Federal Register* as a final decision.

Both downlisting and delisting criteria for the McDonald’s rock-cress supersede those included in the McDonald’s Rock-cress (*Arabis macdonaldiana*) Recovery Plan, as follows:

Downlisting Recovery Criteria

Recovery Plan Downlisting Recovery Criteria

The only quantified recovery goal was that an occupied area as much as 5 square miles may be necessary for downlisting.

Amended Recovery Plan Downlisting Recovery Criteria

McDonald’s rock-cress can be considered for downlisting when:

1. At least ten viable subpopulations are protected and managed to assure their continued existence. Subpopulations include at least 1,000 reproductive individuals (have flowered at least once or are capable of flowering), and a population structure indicating stable or increasing reproductive plant numbers. Subpopulations are polygons or clusters of individuals that are separated by >100 meters.

Justification: Because McDonald's rock-cress is a narrow endemic plant with a limited range, having multiple, distinct populations increases the species' redundancy and thus its ability to withstand catastrophic events such as drought or fire. Ten viable rock-cress subpopulations was determined because of the following:

- a) retaining ten viable subpopulations will increase species redundancy beyond existing levels and represents an increase in species redundancy since the species was listed; and
- b) this is a feasible target considering the amount of unsurveyed, but suitable habitat and the opportunity for reintroduction on Federal lands.

Subpopulations that include 1,000 reproductive individuals were determined to prevent inbreeding depression that can occur in small, isolated populations when a deleterious allele becomes fixed (Lynch et al. 1995). If inbreeding depression were to occur, survival and reproduction of McDonald's rock-cress would be greatly reduced, furthering the probability of extinction (Falk et al. 2001). Minimum viable population size (MVP), 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 MVP can be challenging for many plant species, as it requires genetic and demographic data that are often unknown. 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 (Service 2016; Service 2017). This method is based on the life-history characteristics of the species. Known life history characteristics of McDonald's rock-cress are noted in bold in Table 1. Since McDonald's rock-cress shares attributes between the two MVP categories, an intermediate value of 1,000 reproductive individuals was selected. This is also supported by Lynch et al. (1995), which shows how populations under 1,000 individuals ($N_e=100$) are vulnerable to "mutational meltdown" on time scales of approximately 100 generations.

Table 1. Selection of objectives for minimum viable population (MVP) based on life history characteristics of the species. Objectives in bold represent known McDonald’s rock-cress life history characteristics. Adapted from Pavlik (1996) and Service (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

2. The ten viable subpopulations must be distributed between both soil types that currently support McDonald’s rock-cress (Littlered and Hiltebiden/Dann soils), with at least two viable subpopulations in each of the two soil types from which the species is currently known to occur. For the purposes of this plan, a subpopulation includes at least 1,000 reproductive individuals, and a population structure indicating stable or increasing reproductive plant numbers.

Justification: The subpopulation location requirement, with at least two subpopulations in each of the two soil types where the species is known to occur, attempts to maintain the highest possible level of representation and ecological resiliency for this species. McDonald’s rock-cress is a narrow endemic and has a low level of representation in terms of geographic, ecological, or niche diversity, with few differences in ecological settings across its range except the underlying geologic foundation and soils.

Delisting Recovery Criteria

Current Delisting Recovery Criteria

None

Amended Delisting Recovery Criteria

McDonald’s rock-cress can be considered for delisting when the criteria for downlisting are fulfilled, with the following additions:

1. Over a 20-year survey period, monitoring demonstrates a stable or increasing trend in abundance and distribution over the entire Red Mountain population (or across the minimum ten subpopulations). During a minimum of 80 percent of the survey period (i.e., 16 years), an estimated population of 10,000 reproductive individuals will remain extant across all subpopulations. Monitoring will demonstrate a minimum average patch

occupancy rate (number of subpopulations with occupied habitat divided by total number of subpopulations) of 60 percent.

Justification: A stable or increasing population size indicates that threats overall are not adversely affecting the population. In order to provide enough data for a rigorous statistical analysis, a minimum period of 20 years will be required to determine the demographic trends necessary to support a future delisting decision. A recovery minimum of 10,000 reproductive individuals within this population, in addition to a stable or increasing population trend, should provide adequate conservation of the species into the foreseeable future. Reaching a minimum recovery goal (10,000 reproductive individuals) every year of the survey period is highly unlikely due to localized variability at the subpopulation level. Reaching the minimum numeric goal 80 percent of the survey period (16 years) allows for this variability while still providing for a viable population. Maintaining an annual average patch occupancy rate of 60 percent allows for localized stochastic variability at the subpopulation level, while ensuring redundancy at the population level so catastrophic events do not cause population level extinction.

2. At least 10 subpopulations of 1,000 or more reproductive individuals should be protected and managed in perpetuity to reduce or eliminate threats to the species, or perpetual endowments are secured for management necessary to maintain the continued existence of the species. Agreements for the protection and appropriate management of the self-sustaining subpopulations should be in place. Perpetual protection on public land will be assured via management plans. Formal stewardship agreements (e.g., conservation easements or similar instruments) should be in place to ensure perpetual long-term, species-appropriate management on privately owned land.

Justification: The definition of “*protected*” sites includes management of subpopulations on federal or state lands as part of an approved management plan, or formal stewardship agreements for private landowners that include management and monitoring of the subpopulations and habitat. Management must include measures to reduce or alleviate relevant threats to McDonald’s rock-cress. A dramatic decline in fire frequency has allowed conifer encroachment or establishment of dense shrub stands in many areas of former suitable habitat. Active management may be necessary to maintain open habitat. The need for such agreements, plans, easements, or memoranda of agreement is supported by the habitat needs of the species. Without commitment to and implementation of this management, portions of, or entire sub-populations, that are located away from rocky ridgetops, may decrease through shrub and conifer shading and displacement and become unsuitable for rock-cress reproduction. Strategies will be developed to deal with any new threats that become evident during the 20-year monitoring period. Effectiveness of the habitat management strategy will be assessed based on the condition of the species.

3. Lands in public ownership (federal lands) should consider land use allocations compatible with managing habitats to maintain or enhance McDonald’s rock-cress occupied habitat. Habitat management plans (HMPs) should be developed and implemented that include restoration opportunities, use restrictions, and/or management

actions for the conservation of sensitive, threatened, and endangered plants and wildlife resources. Approved HMPs should include a minimum of a 100-meter (300-foot) surface disturbance buffer around occupied McDonald's rock-cress habitat, and would prioritize avoidance of occupied habitat and assist in connectivity for pollination between subpopulations.

Justification: Land use threats (e.g., surface mining and development) threaten the continued existence of McDonald's rock-cress, thus assurances (that may include forfeiture or withdraw of mineral entry) and a HMP that addresses all five listing factors into agency management plans would ensure that McDonald's rock-cress would persist post-delisting. The South Fork Eel River Wilderness, established with the passage of the Northern California Coastal Heritage Wilderness Act (NCCHWA 2006), contains a large portion of the McDonald's rock-cress habitat. The federal lands designated as wilderness by this act are withdrawn from all forms of location, entry, and patent under the mining laws. However, previously established mining claims are still valid unless forfeited.

4. An *ex situ* collection of plant material is established in a Center for Plant Conservation-affiliated botanic garden. A soil seedbank would typically provide a strategy for a species to regenerate populations in the face of stochastic events as well as natural senescence; however, this species is known to be susceptible to high rates of seed predation.

Justification: An *ex situ* seedbank would provide assurance that a population could be reseeded should long-term drought, fire, excessive seed predation, or other stochastic events make it necessary.

5. A monitoring plan to cover a minimum of 10 years post-delisting of McDonald's rock-cress has been approved by the Pacific Southwest Regional Director and is ready to be implemented at the time of delisting.

Justification: A post-delisting monitoring plan is necessary to ensure the ongoing conservation of the species and the continuing effectiveness of management actions.

Rationale for Amended Recovery Criteria

All classification decisions consider the following five factors: A) is there a present or threatened destruction, modification, or curtailment of the species' habitat or range; B) is the species subject to overutilization for commercial, recreational, scientific, or educational purposes; C) is disease or predation a factor; D) 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 E) are other natural or manmade factors affecting its continued existence. When delisting a species, the Service first proposes the action in the *Federal Register* and seeks public comment and peer review. The final decision is announced in the *Federal Register*.

In addition to minimizing and ameliorating the threats identified above, the recovery criteria for the McDonald's rock-cress address the conservation principles of the "three R's": representation, resiliency, and redundancy (Wolf et al. 2015). Based on the best available information that

includes the input and data from species experts during the Service's recovery criteria review, these amended recovery criteria provide quantifiable measures for identifying and implementing recovery actions, a means to measure progress towards recovery, and the ability to recognize when recovery is reasonably achieved.

Resiliency

Resiliency ensures that populations are sufficiently large and variable to withstand stochastic events. A stable or increasing trend in abundance indicates that annual mortality is compensated by recruitment events, and at the scale of the population, this indicates the resiliency of subpopulations. A minimum of 1,000 individuals per subpopulation has emerged as a conservation metric for plant taxa with similar life history traits to McDonald's rock-cress (Pavlik 1996; Service 2016; Service 2017). This number allows for the maintenance of genetic diversity (representation), within each subpopulation and across the species. A monitoring plan designed and implemented to provide the data necessary to identify statistically significant trends at the population and species level is necessary to demonstrate resiliency.

Redundancy

Redundancy provides for security against extinction from catastrophic events that could impact an entire population or multiple populations. An annual patch occupancy rate of 60 percent allows for annual variability in localized patch occupancy due to stochastic events, while ensuring sufficient redundancy to withstand catastrophic events.

Representation

Maintaining populations across a range of environmental conditions builds representation into the conservation framework at the species level by requiring at least two functioning populations in two distinct soil types spread across the species range. A minimum of 10 subpopulations (1,000 individuals per subpopulation minimum) will ensure genetic diversity is maintained across the species range. Sufficient representation ensures that effects due to small population size and genetic threats have been ameliorated. Maintaining the genetic diversity is important for maximizing the likelihood that the species will be able to adapt to environmental changes over time. Species that are well distributed across their range are considered less susceptible to extinction and more likely to be viable than species confined to a small portion of their range (Carroll et al. 2010; Redford et al. 2011)

Based on the best available information that includes input and data from species experts during the Service's recovery criteria review, these amended recovery criteria provide quantifiable measures for identifying and implementing recovery actions, a means to measure progress towards recovery, and the ability to recognize when recovery is achieved.

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APPENDIX A – SUMMARY OF PUBLIC, PARTNER, AND PEER REVIEW COMMENTS RECEIVED

Summary of Public Comments

We published a notice of availability in the *Federal Register* on August 6, 2019 (84 FR 151) to announce that the draft recovery plan was available for public review, and to solicit comments by the scientific community, state and federal agencies, tribal governments, and other interested parties on the general information base, assumptions, and conclusions presented in the draft revision. An electronic version of the draft amendment was posted on the Service's Species Profile website (<https://ecos.fws.gov/ecp0/profile/speciesProfile?sId=6849>). We also developed and implemented an outreach plan that included (1) publishing a news release on our national webpage (<https://www.fws.gov/news/>) on August 5, 2019, (2) sending specific notifications to Congressional contacts in California's 2nd congressional district, and (3) sending specific notifications to key stakeholders in conservation and recovery efforts. These outreach efforts were conducted in advance of the *Federal Register* publication to ensure that we provided adequate notification to all potentially interested audiences of the opportunity to review and comment on the draft amendment.

We did not receive any comments in response to our request.

Summary of Peer Review Comments

We solicited independent peer review between the draft and final revision in accordance with the requirements of the Act from California Department of Fish and Wildlife and academic and scientific groups. Criteria used for selecting peer reviewers included their demonstrated expertise and specialized knowledge related to McDonald's rock-cress, rare plants, and population ecology. The qualifications of the peer reviewers are in the decision file and the administrative record for this recovery plan amendment.

In total, we solicited review and comment from four peer reviewers and two partner agencies. We received comments from no peer reviewers and one partner reviewer. The partner reviewer was from the Bureau of Land Management, Arcata Field Office. In general, the draft recovery plan revision was well received by the reviewer and garnered positive comments. The reviewer provided additional specific information; we thank the reviewer for these data and we have added the information where appropriate.

We considered all substantive comments, and to the extent appropriate, we incorporated the applicable information or suggested changes into the final revised recovery plan. We appreciate the input from the commenter, which helped us to consider and incorporate the best available scientific and commercial information during development and approval of the final revised recovery plan.