5-YEAR REVIEW

Short Form Summary

Species Reviewed: *Tetramolopium rockii* (no common name)

Current Classification: Threatened

Federal Register Notice announcing initiation of this review:

[USFWS] U.S. Fish and Wildlife Service. 2016. Endangered and threatened wildlife and plants; initiation of 5-year status reviews of 76 species in Hawaii, Oregon, Washington, Montana, and Idaho. Federal Register 81(29): 7571–7573.

Lead Region/Field Office:

Region 1/Pacific Islands Fish and Wildlife Office (PIFWO), Honolulu, Hawai‘i

Name of Reviewers:

Cheryl Phillipson, Biologist, PIFWO
Lauren Weisenberger, Plant Recovery Coordinator, PIFWO
Gregory Koob, Conservation & Restoration Team Manager, PIFWO

Methodology used to complete this 5-year review:

This review was conducted by staff of the Pacific Islands Fish and Wildlife Office (PIFWO) of the U.S. Fish and Wildlife Service (USFWS) beginning in August 2017. The review was based on a review of current, available information since the last 5-year review for *Tetramolopium rockii* (USFWS 2011). The evaluation by Cheryl Phillipson, Biologist, was reviewed by Lauren Weisenberger, Plant Recovery Coordinator, and Gregory Koob, Conservation and Restoration Team Manager.

Background:

For information regarding the species listing history and other facts, please refer to the Fish and Wildlife Service's Environmental Conservation On-line System (ECOS) database for threatened and endangered species (*http://ecos.fws.gov/tess_public*).

Review Analysis:

Please refer to the previous 5-year review for *Tetramolopium rockii* published in the Federal Register on September 20, 2011 (available at *http://ecos.fws.gov/docs/five_year_review/doc3875.pdf*) for a complete review of the species' status, threats, and management efforts. We are not aware of any significant new information regarding the species' biological status since listing to warrant a change in the Federal listing status of *T. rockii*.

This short-lived perennial shrub in the Asteraceae (sunflower) family is threatened and endemic to Moloka‘i. The current status and trends for *Tetramolopium rockii* are provided in the tables below.

New Status Information:

- There are at least 10,000 individuals of *Tetramolopium rockii* var. *rockii*, and 2,000 of variety *calcisabulorum* along the northwest coast of Molokaʻi from Kaʻa Gulch to Kahinaʻakalani, and from ʻĀlau to Makaliʻi in the Kalaupapa National Historical Park. Numbers vary widely depending on rainfall (Bakutis 2018a, in litt.; Bakutis 2018b, in litt.; Haase 2018, in litt.; National Park Service (NPS) 2015).
- In 2016, the IUCN reported extreme fluctuations in population size for both varieties (Chau 2016).
- In 2016, seven critical habitat units in the coastal ecosystem designated on Molokaʻi for *T. rockii* (4,222 ac; 1,549 ha) (81 FR 17790, March 30, 2016).

New Threats:

- Climate change loss or degradation of habitat—We previously reported that climate change may pose a threat to this species, anticipating an analysis by 2013. The assessment conducted by Fortini *et al*. (2013) concluded that *Tetramolopium rockii* is highly vulnerable to the impacts of climate change, with a vulnerability score of 0.893 (on a scale of 0 being not vulnerable to 1 being extremely vulnerable to climate change). In addition, this species has no overlap between current and future climate envelopes, and is unlikely to tolerate expected changes in climate at its current location. This means that this species must persist within suitable microrefugia, or move to newly available climate-compatible areas to avoid extinction. Therefore, additional management actions are needed to conserve this taxon into the future, such as locating key microsites that overlap with current and future climate envelopes for outplanting efforts.
- This species may hybridize in a narrow zone of contact along the dunes (Lowrey *in* Wagner *et al.* 1999).

New Management Actions:

- Surveys and inventories—PEPP (Plant Extinction Prevention Program) and The Nature Conservancy (TNC) conducted recent surveys to determine the approximate range and numbers of individuals of both varieties of *Tetramolopim rockii* (Bakutis 2018b, in litt.).
- Ungulate monitoring and control—
    - A portion of the known population at Moʻomomi Preserve area is within the fence; however, axis deer are still present within the fenced area (TNC 2018; Bakutis 2018, in litt.).
    - Individuals are within a fence in the Kalaupapa National Historical Park (NHP) (NPS 2015).
- Invasive plant monitoring and control—Both the Moʻomomi Preserve and Kalaupapa NHP are monitored with nonnative plant removal (NPS 2015; TNC 2018).
- Captive propagation for genetic storage and reintroduction—
    - Kalaupapa NHP reported thousands of seeds in storage (Kalaupapa NHP 2014).

    - The National Tropical Botanical Garden (NTBG) reported 2,000 seeds collected from Mo‘omomi in 1990; 100 seeds collected from plants east of Mo‘omomi in 2009, and 250 seeds collected from plants along the coastal strand of Kalaupapa peninsula in 2001 (NTBG 2017).
- Stochastic events—Build resiliency and redundancy—
    - Currently, no individuals will be reintroduced in Mo‘omomi Preserve until all axis deer are removed from the fenced area (TNC) 2018).
    - Mokio Land Trust plans to outplant *Tetramolopium rockii* into the Mokio management area in the near future (Haase 2018, in litt.).
    - Kalaupapa NHP reported reintroduction of five individuals and dispersal of seeds at five locations in 2014.

Synthesis:
Currently, there are approximately 10,000 individuals of *Tetramolopium rockii* var. *rockii*, and 2,000 individuals of *T. rockii* var. *calcisabulorum* along the northwest coast and at Kalaupapa NHP on Moloka‘i; however, numbers are highly dependent on rainfall. A landscape-based assessment of climate change vulnerability for native plants of Hawai‘i using high resolution climate change projections was made by Fortini *et al.* (2013) and their analysis showed that *T. rockii* is highly vulnerable to the effects of climate change, in that this species is unlikely to tolerate expected changes in climate at its current location. Collection and storage of seeds is ongoing. It is uncertain how possible hybridization between the two varieties may affect this species.

Stabilizing (interim), downlisting, and delisting objectives were provided in the Recovery Plan for the Moloka‘i Plant Cluster (USFWS 1996), and have been updated according to the draft revised recovery objective guidelines developed by the Hawai‘i and Pacific Plants Recovery Coordinating Committee (HPPRCC 2011). The HPPRCC identifies an additional initial objective, the Preventing Extinction Stage, in addition to the Interim Stabilization, Delisting, and Downlisting objectives. Furthermore, life history traits such as breeding system, population size fluctuation or decline, and reproduction type (sexual or vegetative), have been included in the calculation of goals for the number of populations and reproducing individuals for each stage. The goals for each stage remain grouped by life span defined as annual, short-lived perennial (fewer than 10 years), or long-lived perennial.

Tetramolopium rockii is a short-lived perennial shrub that has a tendency to decline. To prevent extinction, which is the first step in recovering the species, the taxon must be managed to control threats (*e.g.*, fenced) and have 50 individuals (or the total number of individuals if fewer than 50 exist) from each of three populations represented in *ex situ* (secured off-site, such as a nursery or seed bank) collections. In addition, a minimum of three populations should be documented on Moloka‘i. Each of these populations must be naturally reproducing (i.e., viable seeds, seedlings, saplings) and increasing in number, with a minimum of 150 mature, reproducing individuals per population.

The preventing extinction goals for this species have not been met (Table 1) as; although there are thousands of individuals throughout four subpopulations, this recent survey

shows a decline in the number of individuals, genetic representation is incomplete (Table 1), and threats are not being sufficiently managed throughout the range of the species (Table 2). Therefore, *Tetramolopium rockii* meets the definition of Threatened, as it is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range.

Recommendations for Future Actions:
Hybridization is reported as a possible threat to these varieties; however, we are not aware of any significant new information regarding the species' biological status since the last 5-year review in 2011. Thus, the following recommendations for future actions are added or reiterated for the 5-year review for 2018.

- Surveys and inventories—Continue to monitor populations using the baseline survey to track how the populations change over time.
- Ungulate monitoring and control—Remove feral ungulates from within existing large-scale fences surrounding naturally occurring individuals.
- Invasive plant monitoring and control—Control established ecosystem-altering nonnative invasive plant species around populations of *T. rockii*.
- Captive propagation for genetic storage and reintroduction—
    - Collect material for genetic storage and propagation for reintroduction.
    - Propagate for augmentation of existing populations if needed.
- Reintroduction and translocation—
    - Reintroduce individuals into suitable habitat protected from threats.
    - Research weather conditions and possible conservation actions most favorable for natural regeneration in the wild.
    - Research effects of possible hybridization between the two varieties.
- Climate change adaptation strategy—Assess the modeled effects of climate change on this species and use to determine future landscape needed for the recovery of the species.
- Alliance and partnership development—Work with land managers to initiate planning and contribute to ecosystem-level restoration and management to benefit this species.

Table 1. Status and trends of *Tetramolopium rockii* from listing through current 5-year review.

Date	No. wild individuals	No. outplanted	Delisting Criteria identified in Recovery Plan	Delisting Criteria Completed?
1992 (listing)	174,000	0	Protected from all threats	No
			Total number of individuals sustained or exceeded for five years	No
			Species-specific recovery no longer required	No
1996 (recovery plan)	174,000	0	Protected from all threats	No
			Total number of individuals sustained or exceeded for five years	No
			Species-specific recovery no longer required	No
2003 (critical habitat)	174,000	0	Protected from all threats	Partially
			Total number of individuals sustained or exceeded for five years	Unknown
			Species-specific recovery no longer required	No
2011 (5-year review)	1,000s	0	Protected from all threats	Partially
			Total number of individuals sustained or exceeded for five years	Unknown, no surveys conducted
			Species-specific recovery no longer required	No
2016 (critical habitat)	1,000s	0	Protected from all threats	Partially

			Total number of individuals sustained or exceeded for five years	Unknown
			Species-specific recovery no longer required	No
Date	**No. wild individuals**	**No. outplanted**	***Preventing Extinction Criteria identified by HPPRCC**	***Preventing Extinction Criteria Completed?**
2018 (5-year review)	1,000s	5, plus scattered seeds in five locations	All threats managed in all three populations	Partially
			Complete genetic storage	Partially
			Reproduction (*i.e.* viable seeds, seedlings) at all three populations	No
			Three populations with 150 mature individuals each	Yes

* The Preventing Extinction Stage was established in 2011. Prior to 2011, the Interim Stabilization Stage was the first stage towards recovery (now it is the second after Preventing Extinction).

Table 2. Threats to *Tetramolopium rockii* and ongoing conservation efforts.

Threat	Listing factor	Current Status	Conservation/ Management Efforts
Ungulate degradation of habitat	A	Ongoing	Partial, fencing at Mo‘omomi PR and Kalaupapa NHP
Established ecosystem altering invasive plant species degradation of habitat	A	Ongoing	Partial, nonnative plant control at Mo‘omomi PR and Kaluapapa NHP
Climate change degradation or loss of habitat	A	Ongoing	None
Rodent predation or herbivory	C	Ongoing	None
Ungulate predation or herbivory	C	Ongoing	Partial, fencing at Mo‘omomi PR and Kalaupapa NHP

References:
See the previous 5-year review for a full list of references (USFWS 2011). Only references for new information are provided below.

Bakutis, A. 2018a, in litt., Email regarding status of *Tetramolopium rockii* on Molokaʻi, 26 FEB 2018.

Bakutis, A. 2018b, in litt. Email regarding status of *Tetramolpium rockii* varieties on Molokaʻi, 30 AUG 2018.

Chau, M. 2016. *Tetramolopium rockii.* The IUCN Red List of Threatened Species 2016: e.T80220991A80220996. *http://dx.doi.org/10.2305/IUCN.UK.20162.RLTS.T80220991A80220996.en.*

Fortini, L., J. Price, J. Jacobi, A. Vorsino, J. Burgett, K. Brinck, F. Amidon, S. Miller, S. Gon II, G. Koob, and E. Paxton. 2013. A landscape-based assessment of climate change vulnerability for all native Hawaiian plants. Technical report HCSU-044. Hawaiʻi Cooperative Studies Unit, University of Hawaiʻi at Hilo, Hawaiʻi. 134 pp.

Haase, W. 2018, in litt., Email regarding status of *Tetramolopium* at Mokio, Molokaʻi, 27 FEB 2018.

[HPPRCC] Hawaiʻi and Pacific Plants Recovery Coordinating Committee. 2011. Revised recovery objective guidelines. 8 pp.

Kalaupapa National Historical Park. 2014. Controlled propagation database.

Lowrey, T. 1999. 66.*Tetramolopium* Nees. *In* Manual of the Flowering Plants of Hawaiʻi, W.L. Wagner, D.R. Herbst, and S.H. Sohmer (eds.), University of Hawaiʻi Press and Bishop Museum Press, Honolulu. Pp. 361–369.

National Park Service. 2015. State of the park report, Kalaupapa National Historical Park, Hawaiʻi. State of the Park Series No. 21, National Park Service, Washington, D.C. 58 pp.

[NTBG] National Tropical Botanical Garden. 2017. Seed storage report.

[TNC] The Nature Conservancy of Hawaiʻi. 2018. Moʻomomi Preserve, Molokaʻi, Hawaiʻi FY2018 Semiannual Progress Report, to the Dept of Land and Natural Resources, Natural Area Partnership Program, Feb 2018. 20 pp.

[USFWS] U.S. Fish and Wildlife Service. 2011. *Tetramolopium rockii* 5-year review summary and evaluation. USFWS Pacific Islands Fish and Wildlife Office, Honolulu, HI. *https://ecos.fws.gov/docs/five_year_review/doc3875.pdf.*

[USFWS] 2016. Endangered and threatened wildlife and plants; initiation of 5-year status reviews of 76 species in Hawai‘i, Oregon, Washington, Montana, and Idaho. Federal Register 81(29): 7571–7573, February 12, 2016.

[USFWS] 2016. Endangered and threatened wildlife and plants; designation and nondesignation of critical habitat on Molokai, Lanai, Maui, and Kahoolawe for 135 species; final rule. Federal Register 81 (61): 17790–18110, March 30, 2016.

U.S. FISH AND WILDLIFE SERVICE
SIGNATURE PAGE for 5-YEAR REVIEW of *Tetramolopium rockii* (no common name)

Pre-1996 DPS listing still considered a listable entity? N/A

Recommendation resulting from the 5-year review:

_____	Delisting
_____	Reclassify from Endangered to Threatened status
_____	Reclassify from Threatened to Endangered status
X	No Change in listing status

For **Field Supervisor, Pacific Islands Fish and Wildlife Office**

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