Tetramolopium rockii
(no common name)

5-Year Review
Summary and Evaluation

U.S. Fish and Wildlife Service
Pacific Islands Fish and Wildlife Office
Honolulu, Hawaii

5-YEAR REVIEW

Species reviewed: *Tetramolopium rockii* / no common name

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5-YEAR REVIEW
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1.0 GENERAL INFORMATION

1.1 Reviewers

Lead Regional Office:
Region 1, Endangered Species Program, Division of Recovery, Jesse D`Elia, (503) 231-2071

Lead Field Office:
Pacific Islands Fish and Wildlife Office, Loyal Mehrhoff, Field Supervisor, (808) 792-9400

Cooperating Field Office(s):
N/A

Cooperating Regional Office(s):
N/A

1.2 Methodology used to complete the review:

This review was conducted by staff of the Pacific Islands Fish and Wildlife Office of the U.S. Fish and Wildlife Service (USFWS), beginning on March 16, 2009. The review was based on final critical habitat designations for *Tetramolopium rockii* and other species from the islands of Molokai (USFWS 2003) as well as a review of current, available information. The National Tropical Botanical Garden provided an initial draft of portions of the review and recommendations for conservation actions needed prior to the next five-year review. The evaluation of Tamara Sherrill, biological consultant, was reviewed by the Plant Recovery Coordinator. The document was then reviewed by the Recovery Program Lead and the Assistant Field Supervisor for Endangered Species before submission to the Field Supervisor for approval.

1.3 Background:

1.3.1 Federal Register (FR) Notice citation announcing initiation of this review:

[USFWS] U.S. Fish and Wildlife Service. 2009. Endangered and threatened wildlife and plants; initiation of 5-year reviews of 103 species in Hawaii. Federal Register 74(49):11130-11133.

1.3.2 Listing history

Original Listing
FR notice: USFWS. 1992. Endangered and threatened wildlife and plants; determination of endangered or threatened status for 16 plants from the island of Molokai, Hawaii. Federal Register 57(196):46325-46340.
Date listed: October 8, 1992
Entity listed: Species
Classification: Threatened

Revised Listing, if applicable
FR notice: N/A
Date listed: N/A
Entity listed: N/A
Classification: N/A

1.3.3 Associated rulemakings:

USFWS. 2003. Endangered and threatened wildlife and plants; final designations and nondesignations of critical habitat for 42 plant species from the island of Molokai, Hawaii; final rule. Federal Register 68(52):12982-13141.

Critical habitat was designated for *Tetramolopium rockii* in four units totaling 288 hectares (712 acres) on Molokai. These designations include habitat on State and private lands, with less than 1 hectare (3 acres) on Federal land (USFWS 2003).

1.3.4 Review History:

Species status review [FY 2010 Recovery Data Call (September 2010)]: Stable

Recovery achieved:
3 (75-100%) (FY 2007 Recovery Data Call – most recent year reported)

1.3.5 Species' Recovery Priority Number at start of this 5-year review:

14

1.3.6 Current Recovery Plan or Outline

Name of plan or outline: U.S. Fish and Wildlife Service. 1996. Recovery plan for the Molokai plant cluster. U.S. Fish and Wildlife Service, Portland, Oregon. 143 pages.
Date issued: September 26, 1996.

Dates of previous revisions, if applicable: N/A

2.0 REVIEW ANALYSIS

2.1 Application of the 1996 Distinct Population Segment (DPS) policy

2.1.1 Is the species under review a vertebrate?

____ ***Yes***
__X_ ***No***

2.1.2 Is the species under review listed as a DPS?

____ ***Yes***
__X_ ***No***

2.1.3 Was the DPS listed prior to 1996?

____ ***Yes***
____ ***No***

2.1.3.1 Prior to this 5-year review, was the DPS classification reviewed to ensure it meets the 1996 policy standards?

____ ***Yes***
____ ***No***

2.1.3.2 Does the DPS listing meet the discreteness and significance elements of the 1996 DPS policy?

____ ***Yes***
____ ***No***

2.1.4 Is there relevant new information for this species regarding the application of the DPS policy?

____ ***Yes***
__X_ ***No***

2.2 Recovery Criteria

2.2.1 Does the species have a final, approved recovery plan containing objective, measurable criteria?

__X_ ***Yes***
____ ***No***

2.2.2 Adequacy of recovery criteria.

2.2.2.1 Do the recovery criteria reflect the best available and most up-to date information on the biology of the species and its habitat?

__X_ ***Yes***
____ ***No***

2.2.2.2 Are all of the 5 listing factors that are relevant to the species addressed in the recovery criteria?

__X_ ***Yes***
____ ***No***

2.2.3 List the recovery criteria as they appear in the recovery plan, and discuss how each criterion has or has not been met, citing information:

A synthesis of the threats (Listing Factors A, C, D, and E) affecting this species is presented in section 2.3.2 and Table 2. Listing Factor B (overutilization for commercial, recreational, scientific, or educational purposes) is not known to be a threat to this species.

Stabilizing, downlisting, and delisting objectives are provided in the recovery plan for the Molokai plant cluster (USFWS 1996), based on whether the species is an annual, a short-lived perennial (fewer than 10 years), or a long-lived perennial. *Tetramolopium rockii* is a short-lived perennial that was listed as threatened. To be considered for delisting, the taxon must be protected from all threats (*e.g.*, fenced, weeding, etc.) and the total number of individuals must remain at current levels or increase. These levels must be sustained or exceeded for a period of no less than 5 consecutive years. Species-specific recovery actions must no longer be required.

This recovery objective has not been met.

2.3 Updated Information and Current Species Status

Tetramolopium rockii was listed as threatened in 1992. Two varieties are recognized: *Tetramolopium rockii* var. *calcisabulorum* and *T. rockii* var. *rockii*, both of which are endemic to the island of Molokai (USFWS 1992).

2.3.1 Biology and Habitat

2.3.1.1 New information on the species' biology and life history:

No new information.

2.3.1.2 Abundance, population trends (e.g. increasing, decreasing, stable), demographic features (e.g., age

structure, sex ratio, family size, birth rate, age at mortality, mortality rate, etc.), or demographic trends:

Tetramolopium rockii var. *calcisabulorum* is known from Moomomi Preserve on the north coast of Molokai from 5 to 73 meters (15 to 240 feet) elevation where it was noted as abundant in 1991 (Wood 2010). Steve Perlman of the National Tropical Botanical Garden visited the population of *Tetramolopium rockii* var. *calcisabulorum* at Moomomi every other year or so from 1987 to 2006, and found large numbers of individuals, fluctuating from hundreds to thousands (Perlman 2010).

Tetramolopium rockii var. *rockii* also grows on the north coast of Molokai, at Moomomi and east to Naaukahihi to Kahinaakalani and Kalawao on the Kalaupapa Peninsula. Thousands of individuals, predominately seedlings, were seen there from 1991 to 2001 at 5 to 33.5 meters (16.4 to 110 feet) elevation. On Hawaiian Home Lands east of Moomomi, *Tetramolopium rockii* var. *rockii* was seen growing abundantly in 2009 (Hawaii Biodiversity and Mapping Program 2009; Tangalin 2009; Wood 2010).

2.3.1.3 Genetics, genetic variation, or trends in genetic variation (e.g., loss of genetic variation, genetic drift, inbreeding, etc.):

Two studies have examined genetic changes involved in the origin and diversification of Hawaiian *Tetramolopium* species. Few or no reproductive barriers are expected in island taxa because diversification of the species is very recent. One study, however, found some post mating barriers. This may be related to protecting genomic regions from recombination in order to maintain coadapted gene complexes (Whitkus 1998). A further genetic analysis of the evolutionary change in sex expression in Hawaiian *Tetramolopium* species indicates that apparent simple genetic changes underlying sex expression parallels a major evolutionary diversification in these species and may have initiated the divergence (Whitkus *et al.* 2000).

2.3.1.4 Taxonomic classification or changes in nomenclature:

There is some discussion of species experts in the field that the genus requires further taxonomic analysis, but no work on this

has been done to date (Guy Hughes, Kalaupapa National Historic Park, pers. comm. 2010).

2.3.1.5 Spatial distribution, trends in spatial distribution (e.g. increasingly fragmented, increased numbers of corridors, etc.), or historic range (e.g., corrections to the historical range, change in distribution of the species within its historic range, etc.):

Tetramolopium rockii var. *rockii* was first discovered on West Molokai at Moomomi about 80 years ago. It is still found there and also grows from Kapalauoa to Kahinaakalani, north of Kalawao on the Kalaupapa Peninsula. *Tetramolopium rockii* var. *calcisabulorum* was only reported west of Moomomi, from Manalo Gulch to Kalani, along with *T. rockii* var. *rockii* where their ranges overlapped. This one known population of *Tetramolopium rockii* var. *calcisabulorum* and scattered populations of *T. rockii* var. *rockii* extended over about seven kilometers (4.5 miles) along the island's northern coast. Twelve miles to the east, a population of *T. rockii* var. *rockii* at Kalawao covered approximately 35 hectares (95 acres). At the time of listing, these populations were estimated to number a total of 174,000 individuals in four populations (USFWS 1992, 1996, 2003). Apparently, population numbers fluctuate considerably from year to year, but currently remain in the thousands within the species' very limited range.

2.3.1.6 Habitat or ecosystem conditions (e.g., amount, distribution, and suitability of the habitat or ecosystem):

Tetramolopium rockii has a sprawling habit, growing in dry lithified coastal sand dunes in *Sida fallax* (ilima) mixed shrubland, with associated native species such as *Boerhavia repens* (alena), *Cassytha filiformis* (kaunaoa pehu), *Chenopodium oahuense* (aheahea), *Cuscuta sandwichiana* (kaunaoa), *Euphorbia degeneri* (akoko), *Euphorbia skottsbergii* var. *skottsbergii* (akoko), *Heliotropium anomalum* var. *argenteum* (hinahina-ku-kahakai), *Ipomoea indica* (koali awa), *Ipomoea pes-caprae* subsp. *brasiliensis* (pohuehue), *Jacquemontia ovalifolia* subsp. *sandwicensis* (pau-o-Hiiaka), *Melanthera integrifolia* (nehe), *Scaevola taccada* (naupaka), *Sesbania tomentosa* (ohai), *Sesuvium portulacastrum* (akulikuli), and *Waltheria indica* (uhaloa) with various lichens including *Buellia* sp. and *Caloplaca* sp. and grasses and sedges including

Fimbristylis cymosa (mauu aki aki), *Panicum torridum* (kakonakona), and *Sporobolus virginicus* (aki aki) (Canfield 1990; Perlman 2010; Tangalin 2009).

2.3.1.7 Other:

No new information.

2.3.2 Five-Factor Analysis (threats, conservation measures, and regulatory mechanisms)

2.3.2.1 Present or threatened destruction, modification or curtailment of its habitat or range:

Feral deer (*Axis axis*) trample native plants including *Tetramolopium rockii* var. *calcisabulorum* at Moomomi Preserve (Ed Misaki, The Nature Conservancy Hawaii, pers. comm. 2010). Deer are also a threat to *Tetramolopium rockii* var. *rockii* wherever the species is not protected by fenced exclosures at Kalaupapa (G. Hughes, pers. comm. 2010). Invasive introduced plant species modify the habitat and compete for resources with both varieties of the species. These invasive plants include *Atriplex semibaccata* (Australian saltbush), *Cenchrus ciliaris* (buffelgrass), *Chenopodium murale* (lamb's quarters), *Cynodon dactylon* (Bermuda grass), *Dactyloctenium aegyptium* (beach wiregrass), *Digitaria ciliaris* (Henry's crabgrass), *Lantana camara* (lantana), *Leucaena leucocephala* (haole koa), *Urochloa maximum* (Guinea grass), *Melinis repens* (Natal redtop), *Prosopis pallida* (kiawe), *Setaria parviflora* (perennial foxtail), and *Sporobolus indicus* (smutgrass). *Lantana camara* grows in dense patches. *Prosopis pallida* forms dense thickets in this coastal zone. Weedy grasses can also out-compete *Tetramolopium rockii* (Canfield 1990; Perlman 2010; Tangalin 2009).

2.3.2.2 Overutilization for commercial, recreational, scientific, or educational purposes:

Not a threat.

2.3.2.3 Disease or predation:

Deer, rats (*Rattus* spp.), and feral goats (*Capra hircus*) are considered threats at Moomomi, and deer are considered a threat at Kalaupapa (Perlman 2010; E. Misaki, pers. comm. 2010).

Although deer have not been observed to directly browse on this species, however deer do browse on other native plants at Moomomi, including the endangered *Sesbania tomentosa*, and trample all native plants (E. Misaki, pers. comm. 2010). Cattle (*Bos taurus*) browsing was reported to be a threat to *Tetramolopium rockii* in 1991 (Wood 2010) but cattle have since been removed from Moomomi Preserve (E. Misaki, pers. comm. 2010).

2.3.2.4 Inadequacy of existing regulatory mechanisms:

No new information.

2.3.2.5 Other natural or manmade factors affecting its continued existence:

The introduced invasive plant species discussed in section 2.3.2.1 above are also a threat to *Tetramolopium rockii* because they compete with the species for water, light, and nutrients.

Climate change may also pose a threat to this species. However, current climate change analyses in the Pacific Islands lack sufficient spatial resolution to make predictions on impacts to this species. The Pacific Islands Climate Change Cooperative has currently funded climate modeling that will help resolve these spatial limitations. We anticipate high spatial resolution climate outputs by 2013.

Tetramolopium rockii var. *rockii* grows in a fenced ungulate-proof exclosure in Kalaupapa and seems to be increasing at the Kalaupapa National Historical Park wherever it is protected by small exclosures (G. Hughes, pers. comm. 2010).

In the Nature Conservancy's Moomomi Preserve, *Tetramolopium rockii* var. *calcisabulorum* is protected from vehicle traffic by roads and railings. Cattle are still maintained outside the Preserve and fences are regularly checked, although deer still exist inside the cattle fence. A monitoring project to observe the effects of excluding deer from native vegetation is underway (E. Misaki, pers. comm. 2010).

The National Tropical Botanical Garden has seeds in storage from both varieties of *Tetramolopium rockii*, and several hundred seeds of *Tetramolopium rockii* var. *rockii* collected in 2009 were sent to the National Center for Genetic Resource

Preservation at Fort Collins, Colorado as part of a backup seed storage project for the National Park Service (National Tropical Botanical Garden 2009; Margaret Clark, National Tropical Botanical Garden, pers. comm. 2010).

2.4 Synthesis

Stabilizing, downlisting, and delisting objectives are provided in the recovery plan for the Molokai plant cluster (USFWS 1996), based on whether the species is an annual, a short-lived perennial (fewer than ten years), or a long-lived perennial. *Tetramolopium rockii* is a short-lived perennial that was listed as threatened. To be considered for delisting, the taxon must be protected from all threats (*e.g*., fenced, weeding, etc.) and the total number of individuals must remain at current levels or increase. These levels must be sustained or exceeded for a period of no less than five consecutive years. Species-specific recovery actions must no longer be required.

The delisting interim stabilization goals for this species have not been met. The species has not been surveyed to determine whether numbers are declining or stable (Table 1), and all threats are not being managed (see Table 2). Therefore, *Tetramolopium rockii* is likely to become endangered in the foreseeable future throughout all or a significant portion of its range, and therefore, continues to meet the definition of threatened.

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

Date	No. wild indivs	No. outplanted	Delisting Criteria identified in Recovery Plan	Stability Criteria Completed?
1992 (listing)	174,000	0	Protected from all threats	No
			Total number of individuals sustained or exceeded for 5 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 5 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 5 years	Unknown
			Species specific recovery no longer required	No
2010 (5-year review)	thousands	0	Protected from all threats	Partially (Table 2)
			Total number of individuals sustained or exceeded for 5 years	Unknown: no surveys conducted
			Species specific recovery no longer	No

			required	

Table 2. Threats to *Tetramolopium rockii*.

Threat	Listing factor	Current Status	Conservation/ Management Efforts
Ungulates – habitat modification and herbivory	A, C, D	Ongoing	Partially: fenced at Moomomi and small fences at Kalaupapa
Rats – herbivory	C	Ongoing	No
Invasive introduced plants	A, E	Ongoing	Partially: some weed control at Moomomi and Kalaupapa
Climate change	A, E	Increasing	No

3.0 RESULTS

3.1 Recommended Classification:

____ Downlist to Threatened
____ Uplist to Endangered
____ Delist
____ *Extinction*
____ *Recovery*
____ *Original data for classification in error*
__X_ No change is needed

3.2 New Recovery Priority Number:

Brief Rationale:

3.3 Listing and Reclassification Priority Number:

Reclassification (from Threatened to Endangered) Priority Number: ____
Reclassification (from Endangered to Threatened) Priority Number: ____
Delisting (regardless of current classification) Priority Number: ____

Brief Rationale:

4.0 RECOMMENDATIONS FOR FUTURE ACTIONS

- Collect material for genetic storage and propagation for reintroduction.

- Propagate for augmentation of existing populations if needed.
- Research weather conditions and possible conservation actions most favorable for natural regeneration in the wild.
- Establish a baseline survey to determine the current population census of the species and track, if and how, the populations are changing over time.
- Control introduced invasive plant species around wild plants.
- Control rats in the vicinity of these populations.
- Remove feral ungulates from within existing large-scale fences surrounding naturally occurring individuals.
- Conduct taxonomic study to determine if this is a valid species.
- Assess the modeled effects of climate change on this species, and use to determine future landscape needed for the recovery of the species.

5.0 REFERENCES

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Hughes, Guy. 2010. Natural Resources Chief, Kalaupapa National Historical Park, Kalaupapa, Hawaii. Telephone conversation by Tamara Sherrill, dated January 10, 2010. Subject: *Panicum faurei* var. *carteri* and *Tetramolopium rockii*.

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U.S. FISH AND WILDLIFE SERVICE
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

Appropriate Listing/Reclassification Priority Number, if applicable: _____

Review Conducted By:
Chelsie Javar, Fish and Wildlife Biologist
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Date SEP 2 0 2011