

5-YEAR REVIEW

Short Form Summary

Species Reviewed: *Bidens micrantha* subsp. *kalealaha* (kookoolau)

Current Classification: Endangered

Federal Register Notice 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.

Lead Region/Field Office:

Region 1/Pacific Islands Fish and Wildlife Office (PIFWO), Honolulu, Hawaii

Name of Reviewer(s):

Marie Bruegmann, Plant Recovery Coordinator, PIFWO

Jess Newton, Recovery Program Lead, PIFWO

Assistant Field Supervisor for Endangered Species, PIFWO

Methodology used to complete this 5-year 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 June 1, 2010. The review was based on final critical habitat designations for *Bidens micrantha* subsp. *kalealaha* and other species from the islands of Maui and Lanai (USFWS 2003a, b) 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 Samuel Aruch, 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.

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).

Application of the 1996 Distinct Population Segment (DPS) Policy:

This Policy does not apply to plants.

Review Analysis:

Please refer to the final critical habitat designations for *Bidens micrantha* subsp. *kalealaha* published in the Federal Register on January 9, and May 14, 2003 (USFWS 2003a, b) for a complete review of the species' status (including biology and habitat), threats, and management efforts. No new threats and no significant new information regarding the species biological status have come to light since listing to warrant a change in the Federal listing status of *B. micrantha* subsp. *kalealaha*.

At the time of listing in 1992, there were 4 populations of no more than 2,000 total individuals (USFWS 1992). Currently, there are 7 populations and 2,252 to 2,272 total individuals (Medeiros *et al.* 1986, 1998; Perlman 2009; Bernice P. Bishop Museum 2003; Hawaii Department of Land and Natural Resources 2009; Wood 2009).

Historically, *Bidens micrantha* subsp. *kalealaha* was known from Lanai, the south slope of Haleakala on East Maui, and from one location on West Maui. Ganders and Nagata (1983) stated that the distribution of this taxon was on leeward slopes and inner crater walls of Haleakala, East Maui, from 750 to 2,300 meters (2,461 to 7,546 feet) elevation, and at least formerly on leeward Lanai. It was believed to remain only on East Maui in Kahua, Nakula, and Haleakala Crater and Kaupo Gap, on State (Kahikinui Forest Reserve) and Federal (Haleakala National Park) lands within the East Maui Watershed Partnership where a total of four populations with less than 2,000 individuals are known (USFWS 2003b).

In 1993, there were 4 to 6 individuals on West Maui at the Kapunakea Preserve, at 792 meters (2,600 feet) elevation (Hawaii Biodiversity and Mapping Program 2009).

Robert Hobby remembers seeing what is believed to have been *Bidens micrantha* subsp. *kalealaha* on Lanai in the 1960s at Puu Ulaula and Maunalei Gulch (Hawaii Biodiversity and Mapping Program 2009). In 2003, *Bidens micrantha* subsp. *kalealaha* was rediscovered on Lanai, in Waiapaa Gulch, where it had not been seen since 1913. One hundred individuals were seen 700 meters (2,297 feet) from the Palawai Basin entrance by Clyde Imada and Chris Puttock of the Bernice P. Bishop Museum. More individuals were also seen on a steep rocky cliff on the other side of the gulch (Bernice P. Bishop Museum 2003). A fire in November 2006 on Lanai destroyed the habitat, and resulted in the loss of approximately half the remaining wild individuals. In 2007, the surviving individuals were threatened by the browsing activities of Axis deer (*Axis axis*). Shelley James and Clyde Imada of Bernice P. Bishop Museum traveled to Lanai in February 2007 to observe the health of the population in Waiapaa Gulch and found no wild individuals remaining. Subsequently, while working with Bernice P. Bishop Museum on propagation and outplanting of *B. micrantha* subsp. *kalealaha*, staff of the Lanai-based Lanai Institute for the Environment discovered three new sub-populations of *B. micrantha* subsp. *kalealaha* within the recent historical range (Waiapaa Gulch), north of the wild population in Waiapaa Gulch. The northern-most sub-population was conservatively estimated to consist of 40 to 60 individuals ranging from seedlings to adults. One individual had a one inch diameter trunk and was approximately 2.4 meters (8 feet) tall. All populations are growing on steep slopes, and are only accessible via rappelling. Individuals of the southern-most population are growing on a cliff-face within rock cracks. Proximity would indicate that these individuals are of a single gene-pool. In 2008, only two individuals of the original wild population were found growing out of the rock face across the gully, and 10 to 12 mature individuals were observed on steep rock faces north of the original population site. The only remaining mature individuals were inaccessible to browsing deer (Hawaii Department of Land and Natural Resources 2009).

On East Maui, *Bidens micrantha* subsp. *kalealaha* was observed at 1,585 to 1,951 meters (5,200 to 6,400 feet) elevation, primarily on drainage headwalls between Manawainui and Wailaulau. It also occurred abundantly with *Dubautia platyphylla* when collected in the 1950s from several deep pit craters south of Kahua cabin at about 2,085 meters (6,840 feet) elevation and on a precipitous headwall of a small canyon 183 meters (200 yards) west of Kahua cabin, on the south slope of Haleakala Volcano at 2,134 meters (7,000 feet) elevation (Medeiros *et al.* 1986). Within Haleakala National Park, it occurred sporadically along cliff walls in western Kaupo Gap at 1,829 to 1,951 meters (6,000 to 6,400 feet) and on the inner walls of the crater at about 2,195 to 2,316 meters (7,200 to 7,600 feet) (Medeiros *et al.* 1986). In Haleakala Crater, above Kapalaoa, it occurs at 2,316 meters (7,600 feet); and on the west slope it is cultivated at residences located at 2,073 to 2,134 meters (6,800 to 7,000 feet) elevation (Medeiros *et al.* 1998). In 2007, a few individuals were observed above Poli Poli State Park at 2,152 meters (7,060 feet) elevation (Perlman 2009). In 2009, 200 individuals of *Bidens micrantha* subsp. *kalealaha* were observed in East Maui in the Kula Forest Reserve, along Skyline Road, south of Puu Keokea at 2,073 meters (6,800 feet) elevation (Wood 2009).

On East Maui, *Bidens micrantha* subsp. *kalealaha* grows in subalpine and leeward shrublands from approximately 1,585 to 2,317 meters (5,200 to 7,600 feet) elevation. In subalpine areas, it is associated with *Leptecophylla tameiameiae* (pukiawe), *Sophora chrysophylla* (mamane), *Vaccinium reticulatum* (ohelo), and other native species including *Artemisia mauiensis* (ahinahina), *Carex wahuensis* (no common name [NCN]), *Coprosma ernodeoides* (kukaenenene), *C. montana* (pilo), *Deschampsia nubigena* (hairgrass), *Dodonaea viscosa* (aalii), *Dubautia menziesii* (kupaoa), *Dubautia cf. menziesii* (naenae), *Gahnia* sp. (NCN), *Geranium cuneatum* subsp. *tridens* (hinahina), *Metrosideros polymorpha* (ohia), *Osteomeles anthyllidifolia* (ulei), *Santalum haleakalae* (iliahi), *Schiedea haleakalensis* (NCN), *Silene struthioloides* (NCN), *Stenogyne microphylla* (NCN), and *Viola chamissoniana* subsp. *tracheliifolia* (pamakani) (Medeiros *et al.* 1986, 1998; Perlman 2009).

Bidens micrantha subsp. *kalealaha* also occurs in one of the most valuable areas of native leeward shrubland vegetation within Haleakala National Park on the steep cliffs of western Kaupo Gap at about 1,173 to 2,316 meters (3,850 to 7,600 feet) elevation. The species composition is very likely unique for East Maui. Rare species such as *Viola chamissoniana* subsp. *tracheliifolia*, *Schiedea haleakalensis*, and *Plantago princeps* (luakahi kuahiwi) are found on these cliffs along with *Artemisia mauiensis*, *Chamaesyce celastroides* (akoko), *Dodonaea viscosa*, *Leptecophylla tameiameiae*, *Cyperus hillebrandii* (NCN), *Osteomeles anthyllidifolia*, *Santalum ellipticum* (iliahi), *Sophora chrysophylla*, and *Sporobolus africanus* (rattail). *Dubautia* individuals at this site have characteristics of both *Dubautia menziesii* and *D. linearis* (Medeiros *et al.* 1986, 1998).

Elsewhere on East Maui, in the Kula Forest Reserve along Skyline Road, south of Puu Keokea, the habitat for *Bidens micrantha* subsp. *kalealaha* is *Sophora chrysophylla* subalpine shrub with *Asplenium adiantum-nigrum* (iwa iwa), *A. trichomanes* subsp. *densum*, *Carex wahuensis*, *Coprosma ernodeoides*, *C. montana*, *Deschampsia nubigena*, *Dodonaea viscosa*, *Leptecophylla tameiameiae*, *Luzula hawaiiensis* (wood rush),

Morelotia gahniiformis (NCN), *Osteomeles anthyllidifolia*, *Pellaea ternifolia* (kalamoho lau lii), *Pteridium aquilinum* var. *decompositum* (kilau), and *Santalum haleakalae* (Wood 2009).

In contrast to the subalpine habitats of East Maui, on Lanai the population of *Bidens micrantha* subsp. *kalealaha* grows in lowland dry shrubland at 488 to 549 meters (1,600 to 1,800 feet) elevation dominated by *Dodonaea viscosa*. Associated dryland forest species included *Carex oahuensis*, *Diospyros sandwicensis* (lama), *Leptecophylla tameiameia*, *Metrosideros polymorpha*, *Myrsine lanaiensis* (kolea), *Nestegis sandwicensis* (olopua), *Osteomeles anthyllidifolia*, *Pittosporum terminalioides* (hoawa), *Pleomele fernaldii* (hala pepe), *Pteridium aquilinum* var. *decompositum*, *Sida fallax* (ilima), and *Waltheria indica* (uhaloa) (Bernice P. Bishop Museum 2003; Hawaii Department of Land and Natural Resources 2009).

Threats to this species include goats (*Capra hircus*) (Listing Factors A, C, and D), pigs (*Sus scrofa*) (Listing Factors A, C, and D), rats (*Rattus* spp.) (Listing Factor C), and Axis deer (*Axis axis*) (Listing Factors A, C, and D) (Hawaii Department of Land and Natural Resources 2009; Perlman 2009; Wood 2009).

Invasive introduced plants which alter habitat and compete with *Bidens micrantha* subsp. *kalealaha* on East Maui include *Holcus lanatus* (common velvet grass), *Ageratina adenophora* (sticky snakeroot), *Sporobolus indicus* (smutgrass), *Senecio madagascariensis* (fireweed), *Oenothera stricta* (evening primrose), and *Melinis repens* (natal redbtop) (Listing Factors A and E) (Medeiros *et al.* 1986, 1998; Wood 2009).

On Lanai, competing introduced invasive plants include *Melinis minutiflora* (molasses grass), *Lantana camara* (lantana), *Psidium guajava* (common guava), *Schinus terebinthifolius* (Christmasberry), *Cymbopogon refractus* (barbwire grass), *Asclepias physocarpa* (balloon plant), *Emilia* sp. (Flora's paintbrush), *Conyza* sp. (horseweed), and *Psidium cattleianum* (strawberry guava) (Listing Factors A and E) (Bernice P. Bishop Museum 2003; Hawaii Department of Land and Natural Resources 2009).

Apparently this species is highly palatable to feral goats (Listing Factor C). In addition, feral goats have almost destroyed the subalpine woodland habitat of the East Maui region, particularly unfenced areas outside Haleakala National Park. Goats were not believed to be a problem at the remaining Lanai population (Bernice P. Bishop Museum 2003), but Axis deer are (Listing Factors A, C, and D) (Hawaii Department of Land and Natural Resources 2009). Climate change may also pose a threat to *Bidens micrantha* ssp. *kalealaha* (Listing Factors A and E). However, current climate change models do not allow us to predict specifically what those effects, and their extent, would be for this species.

Climate change may also pose a threat to this species (Listing Factors A and E). 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 (PICCC) has currently funded climate modeling that will help

resolve these spatial limitations. We anticipate high spatial resolution climate outputs by 2013.

In 2005, 200 seeds were collected in Haleakala Crater from 15 founders, and 33 immature individuals were reintroduced into Haleakala National Park (Haleakala National Park Resource Management, Vegetation Management 2005). In 2006, 79 immature and 108 mature individuals were reintroduced between 1,961 and 2,347 meters (6,435 and 7,700 feet) elevation (Haleakala National Park Resource Management, Vegetation Management 2006). In 2007, they reintroduced 24 immature and 45 mature individuals at elevations between 1,707 and 2,134 meters (5,600 and 7,000 feet) (Haleakala National Park Resource Management, Vegetation Management 2007). In 2008, about 150 seeds were collected from 10 founder individuals and 55 individuals were reintroduced (Haleakala National Park Resource Management, Vegetation Management 2008; Haleakala National Park 2008). All of the populations within the NP have been fenced (P. Welton, Haleakala National Park, pers. comm. 2010).

On Lanai, staff from Bernice P. Bishop Museum and Lanai Institute for the Environment worked together with students from the Lanai schools to collect seeds and propagate this species for reintroduction. A 557 square meters (6,000 square feet) exclosure fence was constructed in Waiapaa Gulch near the wild populations of *Bidens micrantha* subsp. *kalealaha*, and an irrigation tank and pipes were installed. Within the fenced area 500 seedlings of *B. micrantha* subsp. *kalealaha* and other associated native species were reintroduced. Management of invasive introduced plants is ongoing. Initial survival was approximately 80 percent, and all surviving seedlings were extremely healthy when checked in spring of 2009. A second project by Lanai Institute for the Environment staff was to repair a fenced area in Awehi Gulch, and to reintroduce 500 seedlings. Another 500 seedlings are being grown in the Lanai Institute for the Environment shadehouse for future reintroductions in the two exclosures. Educational outreach and employment of Lanai High School students, invasive species control in exclosures, monitoring of wild individuals for seed collection, and propagation and outplanting of seedlings by Lanai Institute for the Environment staff will continue (Hawaii Department of Land and Natural Resources 2009).

Stabilizing, downlisting, and delisting objectives are provided in the recovery plan for the Maui plant cluster (USFWS 1997), based on whether the species is an annual, a short-lived perennial (fewer than ten years), or a long-lived perennial. *Bidens micrantha* subsp. *kalealaha* is a short-lived perennial, and to be considered stabilized, which is the first step in recovering the species, the taxon must be managed to control threats (*e.g.*, fenced) and be represented in an *ex situ* (off-site) collection. In addition, a minimum of three populations should be documented on islands where they now occur or occurred historically. For the species to be considered stable, each of these populations must be naturally reproducing and increasing in number, with a minimum of 50 mature individuals per population. To be considered for downlisting, the taxon must be protected from all threats (*e.g.*, fenced, weeding, etc.) with a minimum of 300 mature individuals per population. These levels must be sustained for a period of 5 consecutive years. Species-specific recovery actions may still be required.

The downlisting goals for this species have not been met. While there are at least 3 Maui populations and 1 outplanted Lanai population with greater than 300 mature individuals (Table 1), all threats are not being managed (Table 2). Therefore, *Bidens micrantha* subsp. *kalealaha* meets the definition of endangered as it remains in danger of extinction throughout its range.

Recommendations for Future Actions:

- Survey to determine current status of all wild and reintroduced populations.
- Implement seed collection for propagation and storage for all populations.
- Propagate for reintroduction and augmentation.
- Monitor and assess populations on East Maui in the Kula Forest Reserve and near Poli Poli State Park for management actions needed.
- Fence Lanai populations, and develop and implement fire management plans.
- Work with Hawaii Division of Forestry and Wildlife and other land managers to initiate planning and contribute to implementation of ecosystem-level restoration and management to benefit this species.
- Assess the modeled effects of climate change on this species, and use to determine future landscape needed for the recovery of the species.

References:

Bernice P. Bishop Museum. 2003. Rediscovery of *Bidens micrantha* subsp. *kalealaha* on Lanai. *Herbarium Pacificum News* 12(1):1.

Haleakala National Park Resource Management, Vegetation Management. 2005. Annual report for threatened and endangered species permit TE-018078. Haleakala National Park Resource Management, Makawao, Hawaii. 7 pages. Unpublished.

Haleakala National Park Resource Management, Vegetation Management. 2006. Annual report for threatened and endangered species permit TE014497-10. Haleakala National Park Resource Management, Makawao, Hawaii. 5 pages. Unpublished.

Haleakala National Park Resource Management, Vegetation Management. 2007. Annual report for threatened and endangered species permit TE014497-10. Haleakala National Park, Makawao, Hawaii. 4 pages. Unpublished

- Haleakala National Park Resource Management, Vegetation Management. 2008. Annual report for threatened and endangered species permit TE014497-10. Haleakala National Park, Makawao, Hawaii. 4 pages. Unpublished.
- Haleakala National Park. 2008. Report on controlled propagation of listed and candidate species, as designated under the U.S. Endangered Species Act. Haleakala National Park, Makawao, Hawaii. 15 pages. Unpublished.
- Hawaii Biodiversity and Mapping Program. 2009. Program database. Hawaii Biodiversity and Mapping Program, Honolulu, Hawaii. Accessed on March 1, 2010.
- Hawaii Department of Land and Natural Resources, Division of Forestry and Wildlife. 2009. Final report: LIP-25 removal, stabilization and recovery of *Bidens micrantha* subsp. *kalealaha* on Lanaihale, Lanai landowner incentive program tier-2 annual performance report. Hawaii Department of Land and Natural Resources, Division of Forestry and Wildlife, Honolulu, Hawaii. 14 pages. Unpublished.
- Medeiros, A., L. Loope and R. Holt. 1986. Status of native flowering plant species on the south slope of Haleakala, East Maui, Hawaii. Cooperative National Park Resources Studies Unit, University of Hawaii, Manoa, Department of Botany and U.S. Department of the Interior, National Park Service Haleakala National Park. 240 pages.
- Ganders, F.R. and K.M. Nagata. 1983. Relationships and floral biology of *Bidens cosmoides* (Asteraceae). *Lyonia* 2(3):23-31.
- Medeiros, A.C., L.L. Loope, and C.G. Chimera. 1998. Flowering plants and gymnosperms of Haleakala National Park; Technical Report 10. Haleakala National Park, Makawao, Hawaii. 181 pages.
- Perlman, S. 2009. *Bidens micrantha* subsp. *kalealaha*. National Tropical Botanical Garden, Kalaheo, Hawaii. 1 page. Unpublished.
- [USFWS] U.S. Fish and Wildlife Service. 1992. Endangered and threatened wildlife and plants; determination of endangered or threatened status for 15 plants from the island of Maui, Hawaii; final rule. *Federal Register* 57(95):20772-20782.
- [USFWS] U.S. Fish and Wildlife Service. 1997. Recovery plan for the Maui plant cluster (Hawaii). U.S. Fish and Wildlife Service, Portland, Oregon. 130 pages + appendices.
- [USFWS] U.S. Fish and Wildlife Service. 2003a. Endangered and threatened wildlife and plants; final designation of critical habitat for three plant species from the island of Lanai, Hawaii; final rule. *Federal Register* 68(6):1220-1274

[USFWS] U.S. Fish and Wildlife Service. 2003b. Endangered and threatened wildlife and plants; designation of critical habitat for 60 plant species from the Islands of Maui and Kahoolawe, Hawaii; final rule. Federal Register 68(93):25934-26165.

Wood, K.R. 2009. Notes on *Bidens micrantha* subsp. *kalealaha*. National Tropical Botanical Garden, Kalaheo, Hawaii. 1 page. Unpublished.

Personal Communications:

Welton, Patti. 2010. Botanist, Resources Management, Haleakala National Park, Makawao, Hawaii. E-mail to Margaret Clark, National Tropical Botanical Garden, dated April 21, 2010. Subject: *Bidens micrantha* subsp. *kalealaha* management within Haleakala National Park.

Table 1. Status of *Bidens micrantha* subsp. *kalealaha* from listing through 5-year review.

Date	No. wild indivs	No. outplanted	Downlisting Criteria identified in Recovery Plan	Downlisting Criteria Completed?
1992 (listing)	2,000	0	All threats managed in all 5-7 populations	No
			Complete genetic storage	No
			5-7 populations with 300 mature individuals each	No
1997 (recovery plan)	2,000	0	All threats managed in all 5-7 populations	No
			Complete genetic storage	No
			5-7 populations with 300 mature individuals each	No
2003 (critical habitat)	< 2,000	0	All threats managed in all 5-7 populations	Partially
			Complete genetic storage	No
			5-7 populations with 300 mature individuals each	No
2010 (5-year review)	2,200 +	~600	All threats managed in all 5-7 populations	Partially (Table 2)
			Complete genetic storage	Partially
			5-7 populations with 300 mature individuals each	Partially: 3 populations on Maui and 1 reintroduced population on Lanai

Table 2. Threats to *Bidens micrantha* subsp. *kalealaha*.

Threat	Listing factor	Current Status	Conservation/ Management Efforts
Ungulates – habitat modification and predation	A, C, D	Ongoing	Partial; East Maui population fenced, exclosure built at Waiapaa and Awehi Gulches for Lanai reintroductions
Rats – predation	C	Ongoing	No
Invasive introduced plants	A, E	Ongoing	Partial; within exclosures on Lanai
Climate change	A, E	Increasing	No

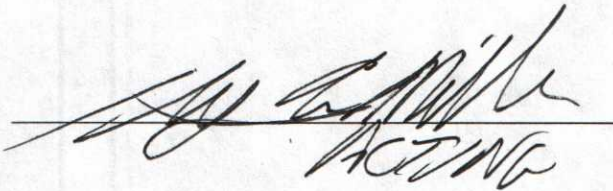
U.S. FISH AND WILDLIFE SERVICE
SIGNATURE PAGE for 5-YEAR REVIEW of *Bidens micrantha* subsp. *kalealaha*
(kookoolau)

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
- No Change in listing status

Field Supervisor, Pacific Islands Fish and Wildlife Office



ACTING

Date 8/2/11