5-YEAR REVIEW

Short Form Summary

Species Reviewed: *Spermolepis hawaiiensis* (no common name)

Current Classification: Endangered

Federal Register Notice announcing initiation of this review:

[USFWS] U.S. Fish and Wildlife Service. 2013. Endangered and threatened wildlife and plants; Initiation of 5-year status reviews of 44 species in Oregon, Hawaii, Guam, and the Northern Mariana Islands. Federal Register 78(24):8185-8187.

Lead Region/Field Office:

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

Name of Reviewer(s):

Chelsie Javar-Salas, Plant Biologist, PIFWO
Marie Bruegmann, Plant Recovery Coordinator, PIFWO
Kristi Young, Programmatic Deputy Field Supervisor, 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 March 4, 2013. The review was based on a review of current, available information since the last 5-year review for *Spermolepis hawaiiensis* (USFWS 2010). The evaluation by Chelsie Javar-Salas, Plant Biologist, was reviewed by the Plant Recovery Coordinator. It was subsequently reviewed and approved by the Programmatic Deputy Field Supervisor.

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 at: *http://ecos.fws.gov/tess_public*.

Review Analysis:

Please refer to the previous 5-year review for *Spermolepis hawaiiensis* published on August 27, 2010 (available at: *http://ecos.fws.gov/docs/five_year_review/doc3350.pdf*) for a complete review of the species' status, threats, and management efforts. No significant new information regarding the species' biological status has come to light since listing to warrant a change in the Federal listing status of *S. hawaiiensis*.

This annual herb in the parsley family (Apiaceae) is endangered and known from Kauai, Oahu, Molokai, Lanai, Maui, and Hawaii Island (Constance and Affolter 1999; USFWS 1999). The status and trends for *Spermolepis hawaiiensis* are provided in the tables below.

New status information:

- When critical habitat was designated on Oahu, there were four populations totaling several hundred to thousands of individuals of *Spermolepis hawaiiensis*, which are dependent on annual weather conditions (USFWS 2012a).
- In 2012, there were 9 populations totaling a few thousand individuals of *Spermolepis hawaiiensis* on Lanai, Molokai, and Maui (USFWS 2012b). On Lanai, there were 3 populations totaling between 500 and 600 individuals. On Molokai, there are thousands of individuals at Makolelau and Kapuaokoolau (USFWS 2012b). On Maui, there is one population at Kanaio containing possibly 1,000 individuals and at least 3 populations on West Maui that may total over 1,000 individuals (USFWS 2012b). A recent fire at Olowalu burned at least 50 individuals (USFWS 2012b).
- In 2011, a single individual of *Spermolepis hawaiiensis* was opportunistically discovered in the Hawaii Volcanoes National Park Kahuku Unit (Hawaii Volcanoes National Park 2013). This was a new record for Kahuku and the only known plant in the park since it was extirpated in the 1940s (Hawaii Volcanoes National Park 2013). The plant died shortly after being discovered, however seeds were collected and propagated in the nursery at Hawaii Volcanoes National Park. A small cage approximately 1 meter by 1 meter (3 feet by 3 feet) was constructed around the dead plant to protect any potential natural regeneration of seedlings from the seedbank from the effects of feral sheep. Seeds from individuals propagated in the nursery (F1 generation) have been collected and propagules have germinated from those F1 seeds as well.
- There are four known disconnected groups of individuals of *Spermolepis hawaiiensis* at Pohakuloa Training Area (PTA): Puu Papapa in the Keamuku Maneuver Area, the western portion of Training Area 22, older substrates of Kipuka Alala, and the recently documented group in Action Area F within the Impact Area (S. Evans, Colorado State University Center for Environmental Management of Military Lands, pers. comm. 2012). Surveys conducted in the Kipuka Alala fence units at PTA during 2004 to 2011 documented *S. hawaiiensis* to occur over approximately 100 to 120 hectares (250 to 300 acres) (S. Evans, pers. comm. 2012). The majority of plants found during these surveys were found in 2004, largely because of increased detectability of individuals stemming from significant rainfall in 2003 and 2004. Subsequent surveys to assess recruitment found plants to be absent from these previously known distributions. In 2012, surveys showed *S. hawaiiensis* distributions had expanded by approximately 120 hectares (300 acres) for a total of at least 223 to 243 hectares (550 to 600 acres) at PTA (S. Evans, pers. comm. 2012).
- Despite reporting that distributions of *Spermolepis hawaiiensis* has expanded since 2012 at PTA, no population estimate was provided in the last 5 years (U.S. Army Garrison Pohakuloa [U.S. Army] 2010, 2012, 2013, 2014, 2015). Therefore, an estimated population status for *S. hawaiiensis* at PTA will be extrapolated based on the surveys conducted during 2011 to 2014 and the number of locations detected (U.S. Army 2012, 2013, 2014, 2015). Based on those surveys and the number of locations recorded, the estimated population of *S. hawaiiensis* at PTA is 1,356 individuals (U.S. Army 2012, 2013, 2014, 2015).

- Overall, the numbers of individuals have declined from the approximately 10,200 to 13,100 wild individuals reported in the previous 5-year review to approximately 5,156 to 6,156 wild individuals in 2015.

New threats:

- Stochastic events – Drought mortality or reduced viability – Drought may exacerbate the effects of ungulates and has direct adverse impacts on *S. hawaiiensis* (U.S. Army 2010).

New management actions:

- Surveys / inventories
  - In 2009, a new population containing several 100 individuals of *S. hawaiiensis* was found in Olowalu Valley on West Maui while surveying for *Tetramolopium capillare* (Plant Extinction Prevention Program [PEPP] 2009).
  - In 2009, a new population of *S. hawaiiensis* (number of individuals not provided) was discovered on Molokai while surveying for *Pritcharida munroi* (PEPP 2010).
  - During 2011 to 2012, approximately 18.25 square kilometers (300 acres) were surveyed at PTA (U.S. Army 2013). Surveys were completed within the following fence units: *Haplostachys haplostachya* (67 hectares [165 acres]), *Kadua coriacea* (393 hectares [969 acres]), Kipuka Alala North (431 hectares [1,066 acres]), Puu Nohona O Hae (79 hectares [195 acres]), Puu Papapa (28 hectares [68 acres]), and *Silene hawaiiensis* (18 hectares [44 acres]). During that survey, approximately 389 locations were recorded of *Spermolepis hawaiiensis* (U.S. Army 2013).
  - The survey of the Infantry Platoon Battle Course alternative was completed in September 2012 and 332 locations of *S. hawaiiensis* were recorded (U.S. Army 2012).
  - Approximately 173 locations of *S. hawaiiensis* were recorded within the installation wide survey area (U.S. Army 2014). Most of the locations were found within the Kipuka Alala Fence Units. Additionally, approximately 302 new locations were recorded within the impact area during surveys for the U.S. Army's proposed Infantry Platoon Battle Area (U.S. Army 2014). These new locations greatly increase the previously documented distribution for this species.
  - In 2014, surveys conducted in previously un-surveyed areas and previously surveyed areas discovered approximately 160 locations of *S. hawaiiensis* (U.S. Army 2015).
- Ungulate monitoring and control
  - All known individuals of *S. hawaiiensis* at PTA are protected within the Kipuka Alala north and south fence units and the Puu Papapa fence unit (U.S. Army 2010, 2014). The Kipuka Alala north and south fence units are considered ungulate-free (U.S. Army 2014).
  - The fences at Puu Waawaa Forest Reserve were monitored in 2013 (State of Hawaii Department of Land and Natural Resources [DLNR] 2014). Additional fencing was added to gates to prevent the ingress of ungulates into the fenced unit (DLNR 2014).
- Invasive plant monitoring and control

- A management plan for control of *Passiflora tarminiana* (banana poka) in habitat occupied by *S. hawaiiensis* within the Kipuka Alala south fence unit was developed and implemented in 2008 at PTA (U.S. Army 2010). In 2010, transects were surveyed and all individuals of *P. tarminiana* located along transects were controlled.
- During 2013 to 2014 at the Puu Waawaa Forest Reserve, invasive plants removed around reintroduced plants included *Cenchrus setaceus* (fountain grass), *Lantana camara* (lantana), *Ricinus communis* (castor bean), and *Chenopodium murale* (nettleleaf goosefoot) (DLNR 2014). Small invasive tree seedlings were also removed, including *Grevillea robusta* (silver oak), *Schinus molle* (pepper tree), *Olea europaea* subsp. *europaea* (European olive), and *Jacaranda mimosifolia* (jacaranda) (DLNR 2014).

- Captive propagation for genetic storage and reintroduction
  - There are three individuals and one seed flat containing numerous individuals of *S. hawaiiensis* in the nursery at Hawaii Volcanoes National Park (2014).
  - There are hundreds of seeds in storage and 23 plants growing at Maui Nui Botanical Gardens (2014).
  - The Lyon Arboretum's Seed Conservation Laboratory (2014) has more than 3,500 seeds in storage.
  - The Lyon Arboretum's Micropropagation Laboratory (2013) has approximately 56 propagules in storage.
  - The National Tropical Botanical Garden (2014) has approximately 1,495 seeds in storage from Kauai and Maui.
  - There are more than 5,000 seeds in storage at the Volcano Rare Plant Facility from founders at PTA (2014).
  - During 2011 to 2012, 132 seeds were collected from a single founder located within the Infantry Platoon Battle Area at PTA for genetic storage (U.S. Army 2013).
  - During 2012 to 2013, more than 29,000 seeds from 5 accessions representing 3 groups and 5 founders of *S. hawaiiensis* were collected and placed in long-term storage at PTA (U.S. Army 2014). There are now more than 559,000 seeds in storage from 69 accessions representing 3 groups and 42 founders in long-term storage at PTA (U.S. Army 2014). Field collections of genetic resources at PTA are usually small and infrequent due to the ephemeral nature of the species. The vast majority of seed in *ex situ* storage is from plant growing in the greenhouse (U.S. Army 2014).
- Captive propagation protocol development – Propagation trials were conducted at PTA to determine appropriate storage and propagation techniques for *S. hawaiiensis*. The trials indicated that seeds of *S. hawaiiensis* germinate readily at a rate of more than 50 percent (U.S. Army 2015). Seed longevity for *S. lanceolata* is unknown (U.S. Army 2015).
- Population viability monitoring and analysis
  - In 2010, a new monitoring methodology was implemented at PTA where previously known locations of *S. hawaiiensis* were sampled on a monthly basis to determine if there is a seasonal component that leads to this species germination or if there are specific moisture availability thresholds that elicit germination

(U.S. Army 2010). If plants were found during the monthly sampling period a more intensive distributional survey would be conducted to determine the extent of the species' occurrence and to estimate abundance. Unfortunately, no plants were found in 2010 and the new monitoring methodology was not utilized. The lack of plants may have been due to prolonged drought conditions that have affected most species at PTA throughout 2010 (U.S. Army 2010).
    - At site 214 within the Kipuka Alala South fence unit, monitoring of the site in 2014 tallied a single reintroduced individual and approximately 10 naturally recruited immature individuals (U.S. Army 2015).
    - Near Saddle Road on State-owned lands, natural recruitment of approximately 25 mature individuals was observed in 2014 (U.S. Army 2015).
    - At Puu Waawaa Cone Unit on State-owned lands monitoring conducted in 2014 recorded natural recruitment of more than 500 mature individuals of *S. hawaiiensis* (U.S. Army 2015).
    - On County-owned lands in North Kona, natural recruitment was not observed at this site in 2014 (U.S. Army 2015).
- Reintroduction / translocation
    - In 2013, approximately 4,300 seeds were broadcasted at Puu Waawaa Cone Unit on State-owned lands (U.S. Army 2014).
    - During 2002 to 2012 at site 214 within the Kipuka Alala south fence unit, 20 individuals were reintroduced to the site (U.S. Army 2015). In 2014, a single individual of *S. hawaiiensis* was reintroduced at the site (U.S. Army 2015).
    - Near Saddle Road on State-owned lands, 4 individuals were reintroduced during 2002 to 2012, no individuals were added in 2014, and no plants remained in 2014 (U.S. Army 2015).
    - At Puu Waawaa Cone Unit on State-owned lands, three individuals were reintroduced during 2005 to 2012 (U.S. Army 2015). In 2014, no reintroduced individuals remained.
    - On County-owned lands in North Kona, eight individuals were reintroduced during 2008 to 2012 and no reintroduced individuals remained in 2014 (U.S. Army 2015).
    - During 2013 to 2014, 118 individuals of *S. hawaiiensis* were reintroduced at Puu Waawaa Forest Reserve (DLNR 2014).
- Listing and critical habitat designation
    - Sixteen units of critical habitat were designated in the lowland dry and dry cliff ecosystems on Oahu for *S. hawaiiensis* (USFWS 2012a).
    - Two units of critical habitat for *S. hawaiiensis* were proposed in the lowland mesic and montane mesic ecosystems on Molokai (USFWS 2012b). On Maui, critical habitat for *S. lanceolata* was proposed in six units in the lowland dry ecosystem. On Lanai, three units of critical habitat for *S. hawaiiensis* were proposed in the lowland dry and lowland mesic ecosystems. The final rule for critical habitat designations has not been published at the time of this review.
- Climate change adaptation strategy – Fortini *et al*. (2013) conducted a landscape-based assessment of climate change vulnerability for native plants of Hawaii using high resolution climate change projections. Climate change vulnerability is defined as the relative inability of a species to display the possible responses necessary for

persistence under climate change. The assessment by Fortini *et al*. (2013) concluded that *S. hawaiiensis* has a low vulnerability to the impacts of climate change.

Synthesis:
Stabilizing, downlisting, and delisting objectives are provided in the recovery plan for the multi-island plants (USFWS 1999), based on whether the species is an annual, a short-lived perennial (fewer than 10 years), or a long-lived perennial. *Spermolepis hawaiiensis* is an annual, and to be considered stable, the taxon must be managed to control threats (e.g., fenced) and be represented in an *ex situ* (at other than the plant's natural location, such as a nursery or arboretum) collection. In addition, a minimum of three populations should be documented on islands where they now occur or occurred historically. Each of these populations must be naturally reproducing and increasing in number, with a minimum of 100 mature individuals per population.

The interim stabilization goals for this species have been partially met, in terms of containing three populations with a minimum of 100 mature individuals per population.

For downlisting, a total of five to seven populations of *Spermolepis hawaiiensis* should be documented on islands where they now occur or occurred historically. Each of these populations must be naturally reproducing, stable or increasing in number, and secure from threats, with a minimum of 500 mature individuals per population. Each population should persist at this level for a minimum of five consecutive years before downlisting is considered.

The downlisting goals for this species have not been met, as only three of the known populations may contain more than 300 mature individuals (Table 1). In addition, all threats are not being sufficiently managed throughout all of the populations (Table 2). Therefore, *Spermolepis hawaiiensis* meets the definition of endangered as it remains in danger of extinction throughout its range.

Recommendations for Future Actions:
- Surveys / inventories – Survey geographical and historical range for a current assessment of the species' status.
- Captive propagation for genetic storage and reintroduction – Continue collection of genetic resources for storage, propagation, and reintroduction into protected suitable habitat within historical range.
- Ungulate monitoring and control – Maintain existing exclosures and monitor for potential incursions.
- Invasive plant monitoring and control – Eradicate invasive introduced plants within ungulate exclosures and maintain exclosures free of invasive plants.
- Population viability monitoring and analysis – Continue monitoring wild and reintroduced individuals.
- Fire monitoring and control – Develop and implement a fire management plan at the existing exclosures.
- Climate change adaptation strategy – Research the suitability of habitat for reintroducing this species in the future due to the impacts of climate change.

- Alliance and partnership development – Initiate planning and contribute to implementation of ecosystem-level restoration and management to benefit this taxon.

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

Date	No. wild indivs	No. outplanted	Downlisting Criteria identified in Recovery Plan	Downlisting Criteria Completed?
1994 (listing)	1,000-1,000+	0	All threats managed in all 5-7 populations	No
			Complete genetic storage	No
			5-7 populations with 500 mature individuals each	No
			Naturally reproducing, stable, & increasing in number	Unknown
			Stable for 5 consecutive years	Unknown
1999 (recovery plan)	2,000-6,000	0	All threats managed in all 5-7 populations	Partially
			Complete genetic storage	Partially
			5-7 populations with 300 mature individuals each	No
			Naturally reproducing, stable, & increasing in number	Unknown
			Stable for 5 consecutive years	Unknown
2003 (critical habitat)	5,800-12,000	0	All threats managed in all 5-7 populations	Partially
			Complete genetic storage	Partially
			5-7 populations with 300 mature individuals each	No
			Naturally reproducing, stable, & increasing in number	Unknown
			Stable for 5 consecutive years	Unknown
2010 (5-yr review)	10,200-13,100	>24,000 seeds scattered	All threats managed in all 5-7 populations	Partially
			Complete genetic storage	Partially
			5-7 populations with 300 mature individuals each	No
			Naturally reproducing, stable, & increasing in number	Unknown
			Stable for 5 consecutive years	Unknown
2012 (critical habitat)	>200 - 1,000+ (Oahu)	n/a	All threats managed in all 5-7 populations	Partially
			Complete genetic storage	Partially
			5-7 populations with 300 mature individuals each	No

Date	No. wild indivs	No. outplanted	Downlisting Criteria identified in Recovery Plan	Downlisting Criteria Completed?
			Naturally reproducing, stable, & increasing in number	No
			Stable for 5 consecutive years	No
2012 (proposed critical habitat)	>3,600 (Molokai, Maui, Lanai)	n/a	All threats managed in all 5-7 populations	Partially
			Complete genetic storage	Partially
			5-7 populations with 300 mature individuals each	No
			Naturally reproducing, stable, & increasing in number	No
			Stable for 5 consecutive years	No
2015 (5-yr review)	5,156-6,156	120 (535 natural recruits)	All threats managed in all 5-7 populations	Partially
			Complete genetic storage	Partially
			5-7 populations with 300 mature individuals each	No
			Naturally reproducing, stable, & increasing in number	No
			Stable for 5 consecutive years	No

Table 2. Threats to *Spermolepis hawaiiensis* and ongoing conservation efforts.

Threat	Listing factor	Current Status	Conservation/ Management Efforts
Ungulates – degradation of habitat and herbivory	A, C, D, E	Ongoing	Partially, PTA is fenced
Invasive introduced plants	A, E	Ongoing	Partially, weed control ongoing at PTA
Landslides and flooding loss or degradation of habitat	A	Ongoing	None
Drought	E	Ongoing	None
Fire	E	Ongoing	Partially, tied to weed control efforts at PTA
Military activities	E	Ongoing	Partially, ESA consultations at PTA
Climate change	A, E	Increasing	None

References:

See previous 5-year review for a full list of references (USFWS 2010). Only references for new information are provided below.

Constance, L. and J. Affolter. 1999. *Apiaceae*. In: Manual of the flowering plants of Hawaii. Wagner, W.L., D.R. Herbst, and S.H. Sohmer (eds). University of Hawaii Press and Bishop Museum Press, Honolulu, Hawaii.

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. Hawaii Cooperative Studies Unit, University of Hawaii at Hilo, Hawaii. 141 pages.

Harold L. Lyon Arboretum Micropropagation Laboratory. 2013. Report on controlled propagation of listed and candidate species, as designated under the U.S. Endangered Species Act. Micropropagation storage Microsoft Access database. University of Hawaii at Manoa, Honolulu, Hawaii. Unpublished.

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[DLNR] State of Hawaii Department of Land and Natural Resources. 2014. Department of Land and Natural Resources, Division of Forestry and Wildlife, Section 6 annual performance report for plant restoration and enhancement, threatened, endangered, candidate, and species of concern outplanting, Hawaii (dry amd nesic forest restoration); interim report. July 1, 2013 – June 30, 2014. Unpublished report submitted to the U.S. Fish and Wildlife Service, Pacific Islands Fish and Wildlife Office, Honolulu, Hawaii.

[U.S. Army] U.S. Army Garrison Pohakuloa. 2010. Natural Resources Program, annual report, Pohakuloa Training Area, Island of Hawaii. 01 October 2009 to 30 September 2010. U.S. Army Garrison Pohakuloa LTC Rolland C. Niles, Commanding December 2010. Prepared in cooperation with the Center for Environmental Management of Military Lands, Colorado State University.

[U.S. Army] U.S. Army Garrison Pohakuloa. 2012. Survey for threatened and endangered plant species on the site of the proposed Infantry Platoon Battle Course alternative, United States Army Garrison Pohakuloa Training Area, Hawaii. Submitted in partial fulfillment of Cooperative Agreement Award W9126G-10-2-0014 from the Fort Worth District of the United States Army Corps of Engineers by the Center for Environmental Management of Military Lands, Colorado State University, Fort Collins, Colorado. October 2012.

[U.S. Army] U.S. Army Garrison Pohakuloa. 2013. FY 2012 annual report for the Natural Resources Office, Pohakuloa Training Area, Island of Hawaii. 01 October 2011 to 30 September 2012. Prepared in cooperation with the Center for Environmental Management of Military Lands, Colorado State University.

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[U.S. Army] U.S Army Garrison Pohakuloa. 2015. FY 2014 annual report for the natural resources office, Pohakuloa Training Area, Island of Hawaii. 84 pages. Unpublished report submitted to the U.S. Fish and Wildlife Service, Pacific Islands Fish and Wildlife Office, Honolulu, Hawaii.

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[USFWS] U.S. Fish and Wildlife Service. 2012a. Endangered and threatened wildlife and plants; endangered status for 23 species on Oahu and designation of critical habitat for 124 species; final rule. Federal Register 77(181):57648-57862.

[USFWS] U.S. Fish and Wildlife Service. 2012b. Endangered and threatened wildlife and plants; listing 38 species on Molokai, Lanai, and Maui as endangered and designating critical habitat on Molokai, Lanai, Maui, and Kahoolawe for 135 species; proposed rule. Federal Register 77(112):34464-34775.

Volcano Rare Plant Facility. 2014. Report on controlled propagation of listed and candidate species, as designated under the U.S. Endangered Species Act. Unpublished.

Personal communication:

Evans, Steve. 2012. Botanical Program Manager, Colorado State University-Center for Environmental Management of Military Lands, Pohakuloa Training Area Natural Resources Office. Memorandum to Tim Langer, Pacific Islands Fish and Wildlife Office, dated October 18, 2012. Subject: New information regarding *Spermolepis hawaiiensis* at Pohakuloa Training Area in action area F – potential effects to *S. hawaiiensis* from construction, operation, and maintenance of an infantry platoon battle area.

U.S. FISH AND WILDLIFE SERVICE
SIGNATURE PAGE for 5-YEAR REVIEW of *Spermolepis hawaiiensis* (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:_____

for **Programmatic Deputy Field Supervisor, Pacific Islands Fish and Wildlife Office**

Maine M Bluegman Date 2015-08-20