

5-YEAR REVIEW

Short Form Summary

Species Reviewed: *Flueggea neowawraea* (mehamehame)

Current Classification: Endangered

Federal Register Notice announcing initiation of this review:

[USFWS] U.S. Fish and Wildlife Service. 2010. Endangered and threatened wildlife and plants; initiation of 5-year status reviews of 58 species in Washington, Oregon, California, and Hawaii. Federal Register 75(226):71726-71729.

Lead Region/Field Office:

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

Name of Reviewer(s):

Vickie Caraway, Plant Biologist, PIFWO

Daniel Clark, Oahu, Kauai, Northwest Hawaiian and American Samoa Islands Team
Manager, PIFWO

Marie Brueggemann, Plant Recovery Coordinator, PIFWO
Recovery Program Lead, 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 January 31, 2012. The review is based on a review of current, available information since the last 5-year review for *Flueggea neowawraea* (USFWS 2009). The National Tropical Botanical Garden provided an initial draft of portions of the five-year review and recommendations for conservation actions needed prior to the next five-year review. The document was reviewed by the Plant Biologists, Islands Team Manager, and Plant Recovery Coordinator, followed by the Recovery Program Lead. 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 (http://ecos.fws.gov/tess_public).

Review Analysis:

Please refer to the previous 5-year review for *Flueggea neowawraea* published on April 7, 2009 (available at http://ecos.fws.gov/docs/five_year_review/doc2469.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 *F. neowawraea*.

This long-lived perennial tree occurs on the islands of Oahu, Hawaii, Maui and Kauai. The current status and trends for *Flueggea neowawraea* are provided in the tables below.

New status information:

- On Oahu, Oahu Army Natural Resource Program (OANRP) staff identified four populations on military lands with only 13 wild individuals remaining, and eleven populations on other lands with 24 mature wild individuals. None of the individuals have not been observed reproducing (OANRP 2012a). One large *Flueggea neowawraea* tree at Waianae Kai in the Waianae Mountains was visited in 2011 (Perlman2012).
- On Kauai, the Plant Extinction Prevention Program (PEPP) Coordinator reported 26 individuals in three populations (PEPP 2012). PEPP observed three mature individuals in the back of Kalalau Valley in August of 2010. Two individuals were in moderate health, one was in poor condition and all were non-reproductive (Kishida2011).

Overall, the numbers of individuals have declined from approximately 110 to 130 in the last five-year review to only 76 remaining currently.

New threats:

- Climate change - Climate change may 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 (PICCC) funded climate modeling that will help resolve these spatial limitations. High spatial resolution climate outputs are expected to be available sometime in 2013.

New management actions:

- Reintroduction/translocation implementation
 - Oahu Army Natural Resource Program (OANRP) staff reintroduced 99 juvenile individuals in the Kahanahaiki to Kapuna area, 57 in Makaha, and four to Pualii (OANRP 2012a).
 - The Hawaii Department of Land and Natural Resources, Division of Forestry and Wildlife, reintroduced 46 *F. neowawraea* trees in the Honomalino section of the South Kona Forest Reserve on Hawaii Island in October 2005 (L. Perry, Hawaii Division of Forestry and Wildlife, pers. comm. 2012).
 - Twelve individuals grown from the lone previous Honomalino female tree on of Hawaii Island are doing well. None have flowered or fruited which would allow determination of the sex of these reintroduced individuals, but they are of sufficient size to begin reproduction. One additional tree of undetermined sex was found in the Honomalino section of South Kona Forest Reserve (N. Agorastos, State of Hawaii Division of Forestry and Wildlife, pers. comm. 2012).
- Ungulate exclosures
 - Two populations managed by OANRP are ungulate free (OANRP 2012b).
 - Two small fences were constructed to exclude cattle (*Bos taurus*), pigs (*Sus scrofa*), and goats (*Capra hircus*), but may not be high enough to

exclude deer (*Axis axis*) (H. Oppenheimer, PEPP, pers. comm. 2012). One individual is known to occur on State of Hawaii Department of Hawaiian Homelands property in Kahikinui (K. Bustamente, PEPP, pers. comm. 2012).

- Captive propagation for genetic storage and reintroduction
 - One hundred individual plants are in the OANRP's nursery on Oahu (OANRP 2012c).
 - Eleven individuals from eight populations managed by OANRP have met seed collection goals for genetic storage under the Makua biological opinion (OANRP 2012b).
 - Attempts were made to graft material from the Maui trees onto rootstock from Oahu trees but these attempts were not successful (H. Oppenheimer, PEPP, pers. comm. 2012).

Synthesis:

Stabilizing, downlisting, and delisting objectives are provided in the recovery plan for plants from the Multi-Island plants (USFWS 1999), based on whether the species is an annual, a short-lived perennial (fewer than ten years), or a long-lived perennial. *Flueggea neowawraea* is a long-lived perennial, and to be considered stabilized, 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 25 mature individuals per population.

The stabilization and recovery goals for this species have not been met as no population has 25 mature individuals, no reproduction is occurring in the wild, and, not all threats are being sufficiently managed. Therefore, *Flueggea neowawraea* meets the definition of endangered as it remains in danger of extinction throughout its range.

Recommendations for Future Actions:

- Surveys / inventories - Survey known occurrences on Kauai and Hawaii Island to determine current status and numbers of individuals
- Captive propagation for genetic storage and reintroduction - Continue to collect fruit from all wild and any reintroduced individuals that set seed to add to the genetic diversity of the *ex situ* material.
- Ecosystem-altering invasive plant species control - Control introduced invasive plant species around wild and outplanted individuals.
- Ungulate exclosures - Construct fences around all naturally occurring and reintroduced individuals to control feral ungulates.
- Reintroduction / translocation - Continue reintroducing individuals into protected suitable habitat within historical range.
- Population biology research
 - Investigate techniques to improve natural recruitment, including development and implementation of methods to control black twig borer and other pests.

- Assess genetic variability within extant populations.
- Study *Flueggea neowawraea* populations with regard to population size and structure, geographical distribution, flowering cycles, pollination vectors, seed dispersal agents, longevity, specific environmental requirements, limiting factors, and threats.
- Alliance and partnership development - Initiate planning and contribute to implementation of ecosystem-level management and restoration to benefit this species.

Table 1. Status and trends of *Flueggea neowawraea* listing through current 5-year review.

| Date | No. wild individuals | No. outplanted | Stabilization Criteria identified in Recovery Plan | Stabilization Criteria Completed? |
|-------------------------|-----------------------------|-----------------------|---|--|
| 1994 (listing) | 127-167 | 0 | All threats managed in all 3 populations | No |
| | | | Complete genetic storage | No |
| | | | 3populations with 25 mature individuals each | No |
| 1998 (recovery plan) | 124-195 | 1 | All threats managed in all 3 populations | No |
| | | | Complete genetic storage | No |
| | | | 3 populations with 25 mature individuals each | No |
| 2003 (critical habitat) | 62-100 | 0 | All threats managed in all 3 populations | No |
| | | | Complete genetic storage | No |
| | | | 3 populations with 25 mature individuals each | No |
| 2009 (5-yr review) | 108-128 | 72 | All threats managed in all 3 populations | Partially |
| | | | Complete genetic storage | Partially |
| | | | 3 populations with 25 mature individuals each | No |
| 2013 (5-yr review) | 76 | | All threats managed in all 3 populations | Partially (Table 2) |
| | | | Complete genetic storage | No |
| | | | 3 populations with 25 mature individuals each | No |

Table 2. Status of threats to *Flueggea neowawraea* and ongoing conservation efforts.

| Threat | Listing factor | Current Status | Conservation/ Management Efforts |
|---|-----------------------|-----------------------|---|
| Ungulates – cattle, goats, deer and pigs degrade habitat | A, C, D | Ongoing | Partially |
| Military training activity | E | Ongoing | Partially |
| Black twig borer (<i>Xylosandrus compactus</i>)/fungus (<i>Fusarium solani</i>) and Chinese rose beetle (<i>Adoretus sinicus</i>) | C | Ongoing | None |
| Rat predation | C | Unknown | Unknown |
| Barriers to cross pollination leading to reduced reproduction | E | Ongoing | None |
| Fire – habitat modification and plant destruction | A, E | Ongoing | Partially |
| Invasive introduced plants | A, E | Ongoing | Partially |
| Climate change | A, E | Increasing | None |

References:

See previous 5-year review for a full list of references (USFWS 2007). Only references for new information are provided below.

Kishida, W. 2012. Kishida 5 year reviews 2012. Plant Extinction Prevention Program, Kalaheo, Hawaii 1 page. Unpublished.

[OANRP] Oahu Army Natural Resources Program. 2012a. Oahu implementation plan - population unit status for *Flueggea neowawraea*. 2 pages. Unpublished.

[OANRP] Oahu Army Natural Resources Program. 2012b. Genetic storage summary. 1 page. Unpublished.

[OANRP] Oahu Army Natural Resources Program. 2012c. Nursery inventory summary. 1 page. Unpublished.

Perlman, Steve. 2012. 5 year review data 2012. National Tropical Botanical Garden, Kalaheo, Hawaii. 2 pages. Unpublished.

Plant Extinction Prevention Program. 2012. Plant Extinction Prevention Program annual report, fiscal year 2012 (July 1, 2011-June 30, 2012). 169 pages. Unpublished.

[USFWS] U.S. Fish and Wildlife Service. 1999. Recovery plan for the multi-island plants. U.S. Fish and Wildlife Service, Portland. 206 pages + appendices

[USFWS] U.S. Fish and Wildlife Service. 2009. *Flueggea neowawraea* (mehamehame) 5-year review summary and evaluation. U.S. Fish and Wildlife Service, Honolulu, Hawaii. 8 pages. Available online at <http://ecos.fws.gov/docs/five_year_review/doc2469.pdf>.

Personal Communications:

Agorastos, Nick. 2012. Natural Area Reserve Specialist, State of Hawaii Department of Land and Natural Resources, Division of Forestry and Wildlife, Hilo. E-mail to Margaret Clark, National Tropical Botanical Garden, dated May 7, 2012. Subject: *Flueggea* - 5 yr review data?

Bustamente, Keahi. 2012. Maui Nui Field Technician, Plant Extinction Prevention Program. E-mail to Margaret Clark, National Tropical Botanical Garden, dated March 08, 2012. Subject: *Flueggea neowawraea*.

Keir, Matthew. 2012. Oahu Army Natural Resource Program. E-mail to Margaret Clark, National Tropical Botanical Garden, dated March 21, 2012. Subject: 5 year reviews - next batch of species.

Oppenheimer, Hank. 2012. Maui Nui Coordinator, Plant Extinction Prevention Program. E-mail to Margaret Clark, National Tropical Botanical Garden, dated March 08, 2012. Subject: *Flueggea neowawraea*.

Perry, Lyman. 2012. Hawaii Department of Land and Natural Resources, Division of Forestry and Wildlife, Hilo. E-mail to Margaret Clark, National Tropical Botanical Garden, dated May 01, 2012. Subject: *Flueggea* - 5 yr review data.

U.S. FISH AND WILDLIFE SERVICE
SIGNATURE PAGE for 5-YEAR REVIEW of *Flueggea neowawraea*
(mehamehame)

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

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