

5-YEAR REVIEW
Short Form Summary
Species Reviewed: *Cycas micronesica* (Fadang)

Current Classification: Threatened

Federal Register Notice announcing initiation of this review:

[USFWS] U.S. Fish and Wildlife Service. 2022. Endangered and Threatened Wildlife and Plants; Initiation of 5-Year Status reviews for 167 Species in Oregon, Washington, Idaho, Montana, California, Hawaii, Guam, and the Northern Mariana Islands. Federal Register 87(90): 28031–28034, May 10, 2022.

Lead Region/Field Office:

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

Name of Reviewer:

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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 (Service) beginning in October 2023. The review was based on a review of current, available information since the last 5-year review for *Cycas micronesica* (USFWS 2020). The evaluation by Nicole Imamura, Biologist, and Dawn Bruns, Biologist, was reviewed by Lauren Weisenberger, Plant Recovery Coordinator, and Megan Laut, Recovery Program 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/ecp/species/9763>).

Review Analysis:

Please refer to the previous 5-year review for *Cycas micronesica* published in the Federal Register on August 19, 2020 (available at https://ecos.fws.gov/docs/tess/species_nonpublish/9763.pdf) for a complete review of the species' status, threats, management efforts, and references cited. 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 *C. micronesica*.

This long-lived (40-year lifespan), dioecious gymnosperm in the Cycadaceae family is threatened and is native to the islands of Guam, Rota, Pagan, Palau, and Yap (Hill et al. 2004, p.280; Keppel et al. 2008, p.1006; Cibrian-Jaramillo et al. 2010, pp. 2372-2375;

Marler 2013, in litt.; Figures 2 and 3). The status and trends for *Cycas micronesica* are provided in the tables below.

New Status Information:

- Applying an ongoing estimated 8.1 percent rate of annual *Cycas micronesica* population decline, we calculated only 344,000 individuals (between 123,000 to 538,000) remained on Guam in 11 populations in 2022 and as few as 52,133 individuals may persist in four populations on Rota (USFWS 2023, p. 3). Our further application of the 8.1 percent annual decline rate indicates there may be as few as 290,529 *C. micronesica* remaining on Guam today. Overall, these estimates indicate the range-wide population may have declined 30 percent since the 2020, 5-year review.
- *Cycas micronesica* surveys conducted on Naval Base Guam, Andersen Air Force Base, Camp Blaz, and Off-DoD areas observed a total of 1,047 individuals throughout the 2022-2023 fiscal year (NAVFAC 2023, p.20).
- At the time of listing in 2015, there were an estimated 290,050 individuals in seven populations on Palau and Yap. No new information has been published on the status of *Cycas micronesica* populations in Palau and Yap since 2015. However, based on the 8.1 percent per year rate of decline observed on Guam, fewer than 136,000 individuals are estimated to occur in an unknown number of populations across Palau and Yap (USFWS 2023, p. 23).
- According to the 2022 draft recovery plan, the delisting criteria for *Cycas micronesica* included a minimum number of 10 populations of 400 individuals protected from threats including ungulates, wildfire, and invasive invertebrates such that the populations remain stable via natural reproduction for a period of 20 years (USFWS 2022, pp. 36-37).

New Threats:

- The cycad blue butterfly, *Chilades pandava*, also known for its impact towards the decline and mortality of *Cycas micronesica*, is now found in Guam and Rota. Previously, damage to cycads from this butterfly had only been observed on Guam (USFWS 2023, p.17). The presence of pests and observed impacts towards the cycad on Yap remain unknown.
- *Phellinus noxius*, a fungus that is known to cause brown root rot disease in the roots and lower trunks of trees in tropical regions, has become widespread throughout the Pacific including Guam, Rota, Palau, and Yap (Cannon et al., 2022, p.2). While this pathogen is known to have a broad host range on tropical vegetation, it has affected cycad populations including the Taiwan cycad or *Cycas taiwaniana* (Ann et al. 2002). Although this pathogen has not been observed on *Cycas micronesica* individuals, its presence in Micronesia has the potential to cause damage towards the remaining cycad populations.

New Management Actions:

- Monitoring and surveys—Joint Region Marianas (JRM) continues to maintain six, 1-acre, permanent fenced *Cycas micronesica* plots (Achae Point, Ritidian, Tarague Basin, Golf Course, Tarague North, and Tarague South) excluded by

- ungulates and monitored monthly by the Guam Plant Extinction Prevention Program (GPEPP) (JRM INRMP 2023, in litt., p. 153).
- 613 *C. micronesica* seeds have been collected for *ex situ* propagation.
 - 190 seeds germinated at the University of Guam (UOG) nursery between June 2022- June 2023.
 - UOG field plots had 36 cycad trees knocked down and 346 cycads severely defoliated post-typhoon Mawar.
 - Majority of the defoliated cycads grew new shoots and leaves by July 2023.
- Control of predation by nonnative invertebrates—The *Rhyzobius lophanthae* scale predator has extended the lives of many mature *Cycas micronesica* plants. However, the size differential between *R. lophanthae* and *Aulacaspis yasumatsui* (*Aulacaspis* scale) limits the ongoing efficacy of biocontrol effects, as the *Aulacaspis* scale can find locations on *C. micronesica* plants that *R. lophanthae* is unable to access (Marler and Lawrence 2012, p.34).
 - Efforts are ongoing to identify the next steps to potentially conduct a smaller biocontrol effort to introduce *Cybocephalus nipponicus* and *Aphytis lingnanensis* as a contingency while awaiting the outcome of larger biocontrol attempts (Richardson 2024, in litt).
 - Invasive pest management—With the overlapping presence of the *Aulacaspis* scale and butterfly larvae found on eight *Cycas micronesica* individuals in plots on Tinian (JRM INRMP 2020, in litt.), the infected individuals have been treated one week each month with insecticide while remaining cycads have been maintained and monitored (USFWS 2020a, in litt).
 - The FY2023 Recovery Challenge grant has been incremental in funding cycad *Aulacaspis* scale predator surveys to help create baseline information for biocontrol, conducting *C. micronesica* genetic analysis to inform breeding/outplanting plans, propagation, and research.
 - Dr. Ronald Cave is currently leading *Aulacaspis* scale surveys, conducting surveys of predators and parasitoids, and quantification of *Aulacaspis* scale abundance (CNMI DLNR 2022, p.34).
 - Collection and propagation for genetic storage and reintroduction— Pollen collection, storage, and viability studies are ongoing to evaluate the reproduction of *Cycas micronesica*. Research will include DNA analysis, hand pollination, seed harvest, and propagation protocols.
 - As of FY23, DNA markers that can be used to sex *C. micronesica* plants were confirmed (JRM INRMP 2023, in litt. p. 156).
 - Coordination efforts with the Montgomery Botanical Center and the Missouri Botanical Garden are ongoing for *C. micronesica* genetic fingerprinting (JRM INRMP 2023, in litt. p. 153-154)
 - As of April 2020, 215 *C. micronesica* plants remain in the MBC living collection. These individuals were grown from 93 individuals from 22 locations, contributing to preserving the genetic diversity for the species (Calonje, 2020).

- Habitat protection—An island-wide Habitat Conservation Plan for Guam that would provide a collaborative and comprehensive approach to endangered species conservation on non-federal lands remains in development (USFWS, 2020).

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

Date	No. wild individuals	Preventing Extinction Targets identified by HPPRCC	Preventing Extinction Targets Completed?
2015 (Listing)	900,000-950,000 estimated	All threats managed in all three populations	No
		Complete genetic storage	Partial. DOD collected seeds throughout Guam and Rota.
		3 populations with 50 reproducing individuals each	Yes
		3 populations with 200 reproducing individuals each	No; we do not have data indicating how many reproducing individuals there are at each population
2020 (5-year review)	<700,000 range wide; 396,133 (Marianas) + < 290,950 (Palau and Yap) estimated	All threats managed in all three populations	No, <i>in situ</i> research for <i>Aulacaspis</i> scale treatment ongoing
		Complete genetic storage	Partial, MBC collected seed from Guam and Rota from an unknown
		3 populations with 50 mature individuals each	Yes
2024 (5-year review)	< 500,000 range wide; 290,529 (Guam) + 52,133 (Rota) + est. < 136,000 (Palau and Yap)	All threats managed in all three populations	No, <i>in situ</i> research for <i>Aulacaspis</i> scale treatment ongoing. Ungulate fences are under repair and construction.
		Complete genetic storage	Partial

		Natural reproduction at all 3 populations	No; reproductive success is hindered, in large part by ungulates and <i>Aulacaspis</i> scale.
		3 populations with 50 mature individuals each	Partially; we do not have data indicating how many reproducing individuals there are at each population

Table 2. Threats to *Cycas micronesica* and ongoing conservation efforts.

Threat	Listing factor	Current Status	Conservation/ Management Efforts
Agricultural, military training and urban development loss and degradation of habitat	A	Ongoing	Partial, development of HCP, REPI habitat protection
Invasive animal destruction and degradation of habitat	A	Ongoing	Partial, ungulates have been eradicated from some fenced areas, more are planned
Established ecosystem-altering invasive plant modification and degradation of habitat	A	Ongoing	Partial, fenced plots with invasive plant removal established on AAFB and NMS
Fire destruction or degradation of habitat	A	Ongoing	Limited
Typhoons and climate change degradation of loss of habitat	A	Ongoing	None
Predation/ herbivory by nonnative invertebrates (ungulates)	C	Ongoing	Partial, ungulates have been eradicated from some fenced areas, more are planned
Cycad <i>Aulacaspis</i> scale predation	C	Ongoing	Pesticide research ongoing in <i>in situ</i> test plots
Inadequate existing regulatory mechanisms	D	Ongoing	None
Ordnance and live fire training	E	Ongoing	Partial, range fire management plan in development

Synthesis:

Since the last 5-year review, the *Cycas micronesica* range wide population may have declined by 30 percent, in large part due to *Aulacaspis* scale insect impacts to adult and seedling plants and ungulate impacts to seedlings. Our estimates indicate few as 290,529

wild individuals of *C. micronesica* may remain on Guam, 52,133 plants may persist on Rota, and 136,000 or fewer individuals may occur on Palau and Yap. Ungulate exclusion, control of the *Aulacaspis* scale, genetic storage, propagation and out planting are occurring on a small scale on Guam. Research has been initiated to find a biological control agent to suppress *Aulacaspis* scale, and to conduct genetic fingerprinting to help enhance the chances of survival of *Cycas micronesica*.

Preventing extinction, interim stabilization, and delisting criteria for the species are provided in the 2022 Draft Recovery Plan based on Hawai'i and Pacific Plants Recovery Coordinating Committee (HPPRCC) Revised Recovery Objective Guidelines (HPPRCC 2011, entire). *Cycas micronesica* is a long-lived dioecious, obligate outcrosser and these life history traits informed the Recovery Plan's assessments of conservation needs for this species.

To prevent extinction, which is the first milestone 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 that are well managed. In addition, a minimum of a total of three populations should be documented on Guam, Rota, Palau and Yap where they now occur or occurred historically and each of these populations must be naturally reproducing (i.e., viable seeds, seedlings,) with a minimum of 50 mature, reproducing individuals per population.

The preventing extinction goals for this species have not been achieved (see Table 1b), although there are at least three populations with greater than 50 individuals, these populations are in steep decline, and not reproducing, due to *Aulacaspis* scale, ungulates, and other threats, and genetic storage is incomplete (see Table 1b and Table 2). Although preventing extinction goals are partially met, efforts to manage ongoing threats are still needed to reach at preventing extinction goals of recovery. Therefore, *Cycas micronesica* 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:

No significant new information regarding the species' biological status has been reported since the last 5-year review in 2020. Thus, the following recommendations for future actions are updated or reiterated for the 5-year review for 2024.

- Surveys and inventories—
 - The historical range of *Cycas micronesica* should be surveyed.
 - Monitor populations of *Cycas micronesica* to assess population health and stability
 - Determine suitable locations for reintroductions.
- Ungulate monitoring and control—Continue to maintain fenced exclosures and construct new fences to protect individuals from the negative impacts of browsing by ungulates.

- Invasive nonnative plant monitoring and control—Continue control of established ecosystem-altering nonnative invasive plant species, and those that compete with *Cycas micronesica*.
- Site and habitat protection—Develop and implement effective control measures to reduce the impact of illegal collection or over-visitation.
- Fire prevention and control—Continue to develop and implement fire prevention management plans.
- Climate change adaptation strategy—Research suitability of habitat for viability of species, including where to conduct translocations in the future due to the impacts of climate change.
- Predator and herbivore monitoring and control—Determine and implement effective methods to control insect pests, including the cycad *Aulacaspis* scale.
- Captive propagation for genetic storage and reintroduction—Continue and maintain collection and propagation efforts for maintenance of genetic stock and for reintroduction.
- Build resiliency, redundancy, and representation — Increase species’ viability through habitat restoration, threat control, and reintroduction and translocation into suitable habitat that is being managed for known threats to this species to reduce impacts of development, herbivory by invertebrates and ungulates, typhoons and other stochastic events, and direct damage by ordnance and live-fire training in the Marianas.
- Research—
 - Conduct genetic studies to determine genetic variation within the population (and between populations) and plan an effective breeding program. Continue furthering research in DNA analysis to learn of different hand pollination, seed harvest, and propagation protocols.
- Alliance and partnership development—Continue to work with partners and other land managers in planning and implementation of ecosystem-level restoration and management to benefit this species.

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U.S. FISH AND WILDLIFE SERVICE
SIGNATURE PAGE for 5-YEAR REVIEW of *Cycas micronesica* (Fadang)

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

For Field Supervisor, Pacific Islands Fish and Wildlife Office

Date _____