

Serianthes nelsonii
(Hayun lagu)

**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: *Serianthes nelsonii* (Hayun lagu)

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5-YEAR REVIEW
***Serianthes nelsonii* (Hayun lagu)**

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 April 8, 2010. The review was based on the Recovery plan for *Serianthes nelsonii* (USFWS 1994), as well as a review of current, available information. The Bernice Pauahi Bishop Museum 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 a recovery biologist and the Plant Recovery Coordinator. The document was then reviewed by the Recovery Program Leader 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. 2010. Endangered and threatened wildlife and plants; 5-year review status of 69 species in Idaho, Washington, Hawaii, Guam, and the Commonwealth of the Northern Mariana Islands. Federal Register 75(67):17947-17950.

1.3.2 Listing history

Original Listing

FR notice: USFWS. 1987. Endangered and threatened wildlife and plants; determination of endangered status for *Serianthes nelsonii* Merr. (Hayun Lagu or Tronkon Guafi). Federal Register 52(32):4907-4910. (Including correction of tabular error: Federal Register 52(42):6651.)

Date listed: February 18, 1987

Entity listed: Species

Classification: Endangered

Revised Listing, if applicable

FR notice: N/A

Date listed: N/A

Entity listed: N/A

Classification: N/A

1.3.3 Associated rulemakings:

Critical habitat was not designated for *Serianthes nelsonii*, due to the potential of vandalism or unauthorized collection if the locations were released to the public.

1.3.4 Review History:

Species status review [FY 2011 Recovery Data Call (August 2011)]:
Declining

Recovery achieved:

1 (0-25%) (FY 2007 Recovery Data Call)

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

5

1.3.6 Current Recovery Plan or Outline

Name of plan or outline: USFWS. 1994. Recovery plan for *Serianthes nelsonii*. U.S. Fish and Wildlife Service, Portland, Oregon. 60 pages. Available online at

<<http://www.fws.gov/pacificislands/recoveryplans.html>>.

Date issued: February 2, 1994

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

No

2.1.2 Is the species under review listed as a DPS?

Yes

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

No

2.2 Recovery Criteria

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

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?

Yes

No

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

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, B, C, D, and E) affecting this species is presented in Section 2.3.2 and Table 2.

Downlisting and delisting recovery objectives are provided in the recovery plan for *Serianthes nelsonii* (USFWS 1994). Consideration for downlisting *S. nelsonii* to threatened status should begin after browsing by ungulates and insect infestations are controlled or stopped on Rota and Guam, and the species has increased to a total of at least two populations on each island. Each population should contain at least 500 reproductive individuals in order to capture and retain the majority of the genetic variability of the population, and to help ensure that each individual population is not eliminated by small scale catastrophic events.

This recovery objective has not been met.

Serianthes nelsonii may be considered for delisting when at least four populations on each island, each with a 10-year average of 500 or more reproductive plants is established. A total of at least four populations per island provides for increased long-term genetic viability and increased protection against extinction due to catastrophic events. The populations should have age structures comprised of a large proportion of adult trees and a healthy number of seedlings and immature trees. The actual breakdown of the percentages of each age class will be determined later. In order to provide some protection for the species against localized catastrophic events, populations on Rota should be separated by at least 1 kilometer (0.621 miles), and at least one of the four Guam populations should be located in southern Guam.

This recovery objective has not been met.

2.3 Updated Information and Current Species Status

2.3.1 Biology and Habitat

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

Wiles *et al.* (1996) reported that little was known about the life history and demographic aspects of *Serianthes nelsonii*. The species evidently has always been rare (Merrill 1919; Stone 1970), but it is easily distinguished by its rusty brown young foliage (Stone 1970). *Serianthes nelsonii* is one of the largest native trees in the Mariana Islands (USFWS 2009), with individual trees of up to 36 meters (118 feet) tall having been noted on Rota, with trunk diameters of up to 183 centimeters (72 inches). As of 2009, populations of the species were reported to remain senescent, with little or no successful regeneration (USFWS 2009). The pollination mechanism of the species is unconfirmed, although Mariana fruit bats (*Pteropus mariannus*) have been observed feeding on its flowers (Wiles *et al.* 1996; USFWS 2009). Seed dispersal appears to be limited, as seedlings have been found only near mature trees.

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:

The type specimen of *Serianthes nelsonii* was taken from the “Upe District and hills back of Abu” (Merrill 1919), an area now occupied by the Andersen Air Force Base (Wiles *et al.* 1996). The “hills” mentioned by Merrill (1919) probably refer to Mt Tenjo and Mt Alutom, which now consists mostly of grassland savanna, *Leucaena leucocephala* (tangantangan), and pockets of degraded ravine forests (Wiles *et al.* 1996).

At the time of its listing, *Serianthes nelsonii* was known from only a single tree on Guam (USFWS 1987). After listing, the number of wild trees reported for Guam and their locations have varied. The highest estimate was six mature trees (Wiles *et al.* 1996). Two wild trees were growing until 1992 before one was destroyed by Typhoon Omar (USFWS 2009). Recent reports confirm that only a single wild tree is currently known to exist (Torres-Santana 2010; M. Bruegmann, USFWS, pers. comm. 2010), which occurs at Ritidian Point on Anderson Air Force Base and the Guam National Wildlife Refuge overlay (Hess and Pratt 2006; USFWS 2009; A. Brooke, U.S. Navy, Guam, pers.

comm. 2010a). In 2006, another mature tree and three seedlings were noted on Anderson Air Force Base within a small fence (Hess and Pratt 2006) but these individuals have all perished (A. Brooke, pers. comm. 2010a, b). In contrast, three saplings that were reintroduced into an enclosure on Anderson Air Force Base are still surviving (A. Brooke, pers. comm. 2010b). A number of factors have resulted in a nearly complete lack of regeneration of the species in its native habitat in recent years (USFWS 2009).

No historical accounts of the distribution or abundance of *Serianthes nelsonii* are known for Rota (Wiles *et al.* 1996). In 1984, not long before the species was federally listed (USFWS 1987), 64 trees were known on Rota, spread among 8 subpopulations, with regeneration occurring in only a single subpopulation (USFWS 1994). The regenerating population contained 40 to 50 small seedlings and two that were somewhat taller and probably from a previous cohort (USFWS 1994). In 1992, a total of 121 individuals, occurring in 16 subpopulations, were estimated for (mostly) the western part of Rota (Wiles *et al.* 1996). The most recent reports for Rota suggest that the population may consist of only 60 to 80 trees (USFWS 2010). The reduced number of individuals compared to a few years earlier probably is due in part to damage from a typhoon in 2006 (Hess and Pratt 2006) and the fact that almost no regeneration has been occurring among native populations (USFWS 2009).

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

No new information.

2.3.1.4 Taxonomic classification or changes in nomenclature:

The genus *Serianthes* is a member of the pea family (Fabaceae, subfamily Mimosoideae) comprising approximately 18 species that range from Thailand to New Caledonia (Mabberley 2008). *Serianthes nelsonii* Merrill is an endemic tree to Rota and Guam (USFWS 1987, 2009; Morton *et al.* 2000).

The earliest known collections of *Serianthes nelsonii* were made by Alfred Marche, who explored the Mariana Islands in the late 1880s (USFWS 1987). However, the species was first described from material sent from Guam to Merrill (1919) in the

Philippines, who named the species after Peter Nelson, then working for the Guam Department of Agriculture. The holotype in Manila was destroyed during World War II; it is unknown whether a lectotype has been chosen to replace the destroyed holotype.

No phylogenetic or cytogenetic studies have focused on the taxonomy or genetics of *Serianthes nelsonii*. The most complete study of *S. nelsonii* was by Wiles *et al.* (1996).

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.):

No new information.

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

The species appears to prefer limestone substrates, although some historical collections are known from southern Guam over volcanic substrate in ravine forests (Wiles *et al.* 1996). On Guam it occurs from 120 to 175 meters (400 to 575 feet) elevation in ravine forests (southern part of the island) or limestone forests. On Rota the species occurs from 150 to 420 meters (490 to 1,385 feet) elevation in limestone forests (M. Bruegmann, pers. comm. 2010).

Species associated with *Serianthes nelsonii* in the limestone forests on Guam include *Aglaia mariannensis* (mapunyao), *Guamia mariannae* (paipai), *Ficus prolixa* (nunu), *Neisosperma oppositifolia* (fagot), *Hernandia nymphaeifolia* (nonak), *Mammea odorata* (chopak), and *Pisonia grandis* (omumu) (Torres-Santana 2010; USFWS 2009). Species often found in the understory include *Cycas circinalis* (cyad), *Morinda citrifolia* (Indian mulberry), *Cycas micronesica* (cyad), *Wikstroemia elliptica* (capit atayaki), *Eugenia* sp., *Flagellaria indica* (bejuco halum-tano), and *Asplenium nidus* (galak) (USFWS 2009; Torres-Santana 2010). Wiles *et al.* (1996) report that a large number of epiphytic plants grow on *S. nelsonii*, including many species of ferns, orchids, with species of *Dischidia*, *Ficus*, *Freycinetia*, and *Peperomia* growing in the

crowns of the trees. A large arthropod fauna has been documented to feed on *Serianthes nelsonii* (Wiles *et al.* 1996).

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:

Threats:

- Ungulate degradation of habitat (USFWS 1994, 2009; Wiles *et al.* 1996)
 - Feral pigs (*Sus scrofa*)
 - Philippine deer (*Cervus mariannus*)
- Established ecosystem-altering invasive plant species degradation of habitat (Torres-Santana 2010)
 - *Leucaena leucocephala* (tangantangan or koa haole)
 - *Mikania scandens* (climbing hemp vine)
 - *Passiflora suberosa* (corkystem passion flower)
 - *Polygonum perfoliata* (mile-a-minute vine)
 - *Triphasia triflora* (limeberry)
 - *Vitex parviflora* (no common name)
- Agricultural and urban development – Habitat loss due to development (USFWS 2009)

Current conservation efforts:

- Ungulate control:
 - The U.S. Navy also is developing a plan to reduce ungulate numbers on Guam (USFWS 2009), which may benefit *Serianthes nelsonii*; however, it has not begun mitigation of habitat loss through fencing, ungulate removal, and replanting (M. Brueggemann, pers. comm. 2010).
- Ungulate exclosure:

- On Guam, the Anderson Air Force base constructed a 24 hectare (60 acre) fenced enclosure for the conservation of native species, including *S. nelsonii* (USFWS 1994).
- Staff of the Guam National Wildlife Refuge constructed a small fenced enclosure around the last remaining wild individual of *S. nelsonii* on Guam (Torres-Santana 2010; A. Brooke, pers. comm. 2010c).
- As of 2010, small units of approximately 4 hectares (10 acres) are fenced on Guam to exclude ungulates and assist in restoration efforts (USFWS 2009).

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

None reported.

2.3.2.3 Disease or predation:

Threats:

- Ungulate predation or herbivory (USFWS 2009; Wiles *et al.* 1996)
 - Feral pigs
 - Philippine deer
- Invertebrate predation or herbivory (USFWS 2009; USFWS 1994)
 - Mealybugs have been reported to eat various parts of this species and seedlings (*Dysmicoccus brevipes*, *D. neobrevipes*, *Ferrisia virgata*, and *Planococcus* sp.)
 - Caterpillars of the butterfly species *Eurema blanda*, which cause defoliation
 - Termites are a threat to the species and have attacked at least three individuals on Guam and contributed to the death of those trees
 - Insect predation on seed pods on the Rota, but no seed predation has been reported on Guam

Current conservation efforts:

- Invertebrate control research – Since 1994, entomologist from the College of Agriculture and Life Sciences at University of Guam have been conducting studies on the insect communities and herbivory of *S. nelsonii* (USFWS 1994).
- Threats management and control – In 1989 and 1990, the Marianas Audubon Society attempted to control insect pests by spraying Malathion and applying Tanglefoot to a cultivated tree on the University of Guam campus (USFWS 1994); however, the effectiveness of this management action was not reported.

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:

Threats:

- Hurricanes – Direct damage to individuals and habitat degradation by typhoons (Hess and Pratt 2006; USFWS 1994, 2009)
- Low numbers (Guam Plant Extinction Prevention Program 2012).
- Fire – Wildfires killed two individuals in the Tarzan River valley of southern Guam in the late 1970s (USFWS 1994, 2009), a region more prone to wildfires compared to the northern part of the island (Wiles *et al.* 1996).
- 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) has currently funded climate modeling that will help resolve these spatial limitations. We anticipate high spatial resolution climate outputs by 2013.

Current conservation efforts:

- Captive propagation for genetic storage and reintroduction:

- Staff at the Guam National Wildlife Refuge has propagated 17 saplings of *S. nelsonii* that are ready for reintroduction into protected habitat (Torres-Santana 2010; A. Brooke, pers. comm. 2010c).
- In 2007, the Guam Forestry Nursery had 28 individuals of *S. nelsonii* in storage collected from Rota and Guam (Guam Forestry Nursery 2007).
- Efforts to propagate *Serianthes nelsonii* have been summarized by USFWS (2009). Such efforts date back to 1997 or 1998, when the University of Guam began collaborating with the U.S. Air Force, the Division of Fish and Wildlife of the Guam Department of Agriculture, and the Department of Land and Natural Resources in the Commonwealth of the Northern Mariana Islands. Seeds collected on Rota in 2006 germinated easily in a Guam Department of Agriculture nursery (USFWS 2009). Further reintroductions were delayed because of known invasive species such as white fly, scale, feral ungulates, and *Polygonum perfoliata*.
- Captive propagation protocol development:
 - Richardson and Marutani (1997) reported that clipping the seeds prior to germination led to 100 percent germination. In contrast, treatments involving the use of hot water and acid scarification using sulfuric acid were unsuccessful.
 - The species can be propagated by seeds and cuttings. James Manglona, Department of Lands of Natural Resources on Rota, prefers to germinate the species by cuttings (Koob 2005).
- Reintroduction / translocation protocol development - Seedlings are said to grow moderately slowly (Koob 2005). The Forestry Division on Rota grows seedlings in their nursery for 1 to 1.5 years before they are reintroduced.
- Reintroduction / translocation implementation – Three known saplings were reintroduced from about the year 2000, but they were browsed by Philippine deer a few

years later when the fence was breached (USFWS 2009; A. Brooke, pers. comm. 2010c).

- Existing population management and restoration – Staff at the Guam National Wildlife Refuge are currently managing the last remaining wild individual of *Serianthes nelsonii* on Guam within a small fenced enclosure (Torres-Santana 2010; A. Brooke, pers. comm. 2010c).
- Surveys / inventories:
 - In 1992, the Forestry Section of the Department of Natural Resources assisted with census work for *S. nelsonii* on Rota (USFWS 1994).
 - Staff from the Division of Aquatic and Wildlife Resources searched for additional trees at Anderson Air Force Base on Guam (USFWS 1994).

2.4 Synthesis

The downlisting goals for this species have not been met, as there is no population that contains at least 500 reproductive individuals (Table 1). In addition, not all threats are being managed and efforts to increase its population size on both islands have had limited success (Table 2). Therefore, *Serianthes nelsonii* meets the definition of endangered as it remains in danger of extinction throughout its range.

Table 1. Status of *Serianthes nelsonii* from listing through 5-year review.

Date	No. wild individuals	No. outplanted	Downlisting Criteria identified in Recovery Plan	Downlisting Criteria Completed?
1987 (listing)	65	0	2 populations with 500 mature individuals on each island	No
			Control or stop browsing ungulates and insect infestations on Rota on Guam	No
1994 (recovery plan)	122	0	2 populations with 500 mature individuals on each island	No
			Control or stop browsing ungulates and insect infestations on Rota on Guam	Partially
2012 (5-year review)	60-80	3	2 populations with 500 mature individuals on each island	No
			Control or stop browsing ungulates and insect infestations on Rota on Guam	Partially (see Table 2)

Table 2. Threats to *Serianthes nelsonii* and ongoing conservation efforts.

Threat	Listing factor	Current Status	Conservation/ Management Efforts
Ungulates – Degradation of habitat and herbivory	A, C	Ongoing	Partially: Feral ungulate control on U.S. Navy lands and fenced exclosures constructed on Guam
Established ecosystem-altering invasive plant species degradation of habitat	A	Ongoing	No
Agricultural and urban development	A	Ongoing	No
Invertebrate predation or herbivory	C	Ongoing	Partially: Invertebrate control research at the University of Guam and invertebrate control on a cultivate tree by University of Guam
Hurricanes – Typhoons	E	Ongoing	No
Fire	E	Ongoing	No
Low numbers	E	Ongoing	Partially: Captive propagation for genetic storage and reintroduction, reintroduction / translocation implementation, and existing population management and restoration
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

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

- Captive propagation for genetic storage and reintroduction:
 - Continue to collect seeds from all existing populations and send to at least two or three different venues for propagation.
 - Augment the species with specimens from Rota to encourage genetic mixing of the Guam population.
- Captive propagation protocol development – Protect seed pods with a fine mesh covering to prevent predation by arthropods before seeds mature.
- Reintroduction / translocation implementation:
 - Reintroduce the 17 individuals of *Serianthes nelsonii* grown in cultivation at Guam National Wildlife Refuge into native habitat that are protected from threats, apart from the last wild specimen of *S. nelsonii*.
 - Propagate and maintain up to 100 individuals of *S. nelsonii* to a pest-resistant size and reintroduce into various protected areas within Guam’s National Wildlife Refuge.
- Ungulate enclosure – Protect all wild individuals on Guam by constructing ungulate-proof fenced enclosures.
- Ungulate control – Continue to protect all populations against disturbances from feral ungulates.
- Invertebrate control research – Research and identify the effects of invertebrate predation on seeds and seedlings of *S. nelsonii*. If determined to be a limiting factor, develop and implement control measures to protect the species.

- Population biology research – Research the use of mechanical pollination to enhance outbreeding of the species.
- Surveys / inventories – Resurvey the historical range of the species to determine if previously unknown or newly reestablished populations exist.
- Threats research:
 - Research what factors are limiting the natural recruitment of individuals in Guam.
 - Assess the modeled effects of climate change on this species, and use to determine future landscape needed for the recovery of the species.
- Ecosystem-altering invasive plant species control – Control invasive introduced plant species within fenced exclosures.
- Site / area / habitat protection – Develop and implement effective measures to reduce the impacts of agricultural and urban development and hurricanes (typhoons).
- Fire protection – Develop and implement a fire management plan for all populations.
- Existing population management and restoration – Identify and determine whether the Department of Lands and Natural Resources Forestry Division or the CNMI Fish and Wildlife Division will be responsible for the recovery of *S. nelsonii* on Rota.
- Alliance and partnership development – Continue to work with Guam National Wildlife Refuge, and other land managers to continue implementation of ecosystem-level restoration and management to benefit this species.

5.0 REFERENCES

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Personal communications

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U.S. FISH AND WILDLIFE SERVICE
5-YEAR REVIEW of *Serianthes nelsonii* (Hayun lagu)

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
Marie Bruegmann, Plant Recovery Coordinator
Jess Newton, Endangered Species Recovery Program Leader
Kristi Young, Assistant Field Supervisor for Endangered Species

Field Supervisor, Pacific Islands Fish and Wildlife Office

for

Jess Newton

Date 8/28/2012