THREATENED ENDEMIC PLANTS OF PALAU

19

CONSERVATION INTERNATIONAL

Pacific Islands

BIODIVERSITY CONSERVATION
LESSONS LEARNED TECHNICAL SERIES

19 Threatened Endemic Plants of Palau

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CONSERVATION INTERNATIONAL
Pacific Islands

CRITICAL ECOSYSTEM PARTNERSHIP FUND

The **Critical Ecosystem Partnership Fund** is a joint initiative of l'Agence Française de Développement, Conservation International, the European Union, the Global Environment Facility, the Government of Japan, the MacArthur Foundation and the World Bank. A fundamental goal is to ensure civil society is engaged in biodiversity conservation.

ABOUT THE BIODIVERSITY CONSERVATION LESSONS LEARNED TECHNICAL SERIES

This document is part of a technical report series on conservation projects funded by the Critical Ecosystem Partnership Fund (CEPF) and the Conservation International Pacific Islands Program (CI-Pacific). The main purpose of this series is to disseminate project findings and successes to a broader audience of conservation professionals in the Pacific, along with interested members of the public and students. The reports are being prepared on an ad-hoc basis as projects are completed and written up.

In most cases the reports are composed of two parts, the first part is a detailed technical report on the project which gives details on the methodology used, the results and any recommendations. The second part is a brief project completion report written for the donor and focused on conservation impacts and lessons learned.

The CEPF fund in the Polynesia-Micronesia region was launched in September 2008 and will be active until 2013. It is being managed as a partnership between CI Pacific and CEPF. The purpose of the fund is to engage and build the capacity of non-governmental organizations to achieve terrestrial biodiversity conservation. The total grant envelope is approximately US$6 million, and focuses on three main elements: the prevention, control and eradication of invasive species in key biodiversity areas (KBAs); strengthening the conservation status and management of a prioritized set of 60 KBAs and building the awareness and participation of local leaders and community members in the implementation of threatened species recovery plans.

Since the launch of the fund, a number of calls for proposals have been completed for 14 eligible Pacific Island Countries and Territories (Samoa, Tonga, Kiribati, Fiji, Niue, Cook Islands, Palau, FSM, Marshall Islands, Tokelau Islands, French Polynesia, Wallis and Futuna, Eastern Island, Pitcairn and Tokelau). By late 2012 more than 90 projects in 13 countries and territories were being funded.

The Polynesia-Micronesia Biodiversity Hotspot is one of the most threatened of Earth's 34 biodiversity hotspots, with only 21 percent of the region's original vegetation remaining in pristine condition. The Hotspot faces a large number of severe threats including invasive species, alteration or destruction of native habitat and over exploitation of natural resources. The limited land area exacerbates these threats and to date there have been more recorded bird extinctions in this Hotspot than any other. In the future climate change is likely to become a major threat especially for low lying islands and atolls which could disappear completely.

For more information on the funding criteria and how to apply for a CEPF grant please visit:

- www.cepf.net/where_we_work/regions/asia_pacific/polynesia_micronesia/Pages/default.aspx
- www.cepf.net

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CRITICAL ECOSYSTEM PARTNERSHIP FUND

CONSERVATION INTERNATIONAL Pacific Islands

Location of the project in the Polynesia-Micronesia Biodiversity Hotspot

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Lessons Learned

A big lesson that is relevant to the conservation of all species that are poorly known is that prior to assuming a population inventory is necessary to obtain a more accurate threat assessment, some species simply need to be verified taxonomically. That is, to verify that they are valid species to begin with. In this case, we had to actually go there to realize this so it worked out but we had no intentions of checking the taxonomic status of some of the species. This came about by circumstance. The lesson here is that confirmation of species delimitations should be a preliminary step towards assessing the threatened status of species in regions that have not been intensively surveyed. This can be integrated into a tiered planning stage– e.g. collecting samples and photos to send away for verification to a taxonomic expert would be a pre-requisite to conducting a population survey to collect abundance data.

Another major lesson was that IUCN assessment can be very difficult for species that have not been studied very much or have limited collection records, in places like Palau. We ultimately found a way around this data limitation by coming up with a biome wide approach that applied to a group of species that were all restricted to a specific habitat type. We then used data on the decline of that habitat since data on decline in species populations simply did not exist.

Project Design Process

Aspects of the project design that contributed to its success/shortcomings.

One aspect that contributed to this projects success was the focus on taking a close look at a few poorly known species while simultaneously aiming to progress knowledge on a broader scale. Biodiversity surveys always turn up unexpected results, so in this case the design worked out very well. During the population inventory of specific species we were able to remove several other species off the 'data deficient' category simply because we covered enough ground to become familiar with the distribution of other taxa as well.

We were perhaps a bit ambitious to aim at getting so many species successfully listed on the IUCN red-list, but in the end our effort to overcome the data limitations resulted in some great international collaborations across academic disciplines with a good published result. The relationships that this collaboration fostered enabled us access to a better dataset that we now think surmounted the original problem.

Given the nature of grants, often being that you don't actually get the money for quite some time after the application process, it really helped to plan for a short period of intensive work, spread out over a couple years. This allowed the fieldwork to commence when schedules permitted and enabled a much longer stay in the field location than originally planned. This worked really well in the end.

Lessons Learned *cont.*

Project Implementation

Aspects of the project execution that contributed to its success/shortcomings.

For expedition type projects that are based on inventory or collection data but also aim to make conservation progress, it really helped to be able to stay in the community for an extended period of time, rather than just going in, getting the data, and leaving. This establishes, or in this case rejuvenated relationships, that are instrumental in the long-term nature of conservation work. It also enabled us to go beyond the project aims.

Acknowledgments

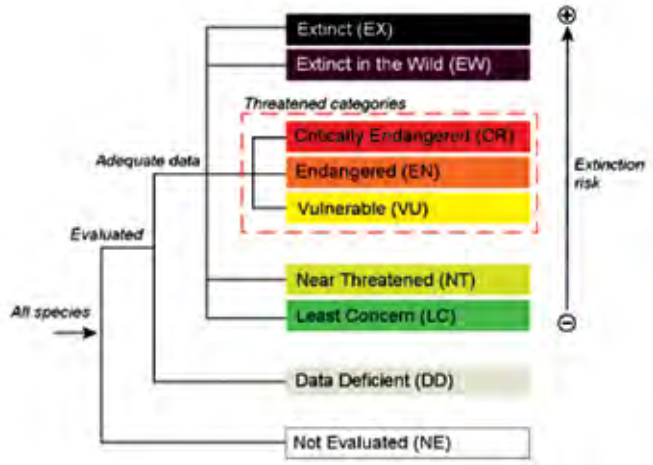
The following institutions and people are gratefully acknowledged for supporting this CEPF project and ongoing research on plant biodiversity and conservation in Palau; Ann and Clarence Kitalong, Naito Soaladaob, Marcello Brel, Ron Leidich, Jolie Liston, Akiko Iida, Tim Utteridge, Timothy Gallaher, Michael Thomas, Alan Olsen, Van Ray Tadao, Mike Balick, Art Whistler, David Lorence, Andrew Lowe, The Belau National Museum and its board of directors, The Nature Conservancy, Palau's state government offices, The New York Botanical Garden, The National Tropical Botanical Garden, The Australian Tropical Herbarium, and James Cook University.

Introduction

The Pacific is the largest biodiversity hotspot region on earth and is arguably the most vulnerable to extinctions. Islands have historically been exceptionally vulnerable to extinctions. In 2004 the IUCN determined that out of all known recorded extinctions from mammals, birds, amphibians, reptiles, and molluscs; 72% were island species.

Although the abundance of endemic and rare plants with restricted distributions in the Pacific is widely acknowledged, little is known about them. Palau, at the western most edge of this region has approximately 130-135 endemic plant species confined to only 453 km^2. Previous estimates of plant endemism rates for this region have proven to be overestimated by far (Costion & Lorence 2012). Many of these plants are rare, restricted in distribution, and/or very poorly known. Approximately 15% of these are only known from the type collections. A preliminary IUCN red-list assessment of all endemic plant species for Palau (Costion et al. 2009) found that for over 60% of them data was insufficient for establishing a red-list category.

Progress towards a complete IUCN Red Listing of endemic plants in this region is imperative, as threats to the island from development and invasive species are increasing. The lack of a complete understanding of which plant taxa are threatened, and to what degree, remains a significant barrier to effective biodiversity conservation in Micronesia's most diverse flora. This challenge was addressed in this CEPF project by targeting specific taxa for further collection and population inventory while progressing knowledge on the threatened status of the entire flora by investigating human impact through time on the Palau islands.



IUCN Red List category structure.

Project Objectives and Achievements

1. Achieve IUCN red-listing status for all sufficiently known endemic plant species (approximately 51 species).
2. Reduce the data deficiency gap for Palau's endemic plant species by approximately 10%.
3. Population size and relative abundance for four threatened plant species with small, restricted ranges is clarified and documented.
4. A long-term strategy is developed with local stakeholders to address the data deficiency gap for all remaining endemic plants in Palau.
5. A national database of all historic plant collection records from Palau is updated to enable species distribution mapping and prioritization of poorly collected localities.

1. Achieve IUCN red-listing status for all sufficiently known endemic plant species (approximately 51 species).

Our first IUCN submission attempt was rejected due to our methodology extending beyond the 100-year time frame for data on habitat/population decline. Instead of seeing this as a setback we saw it as an opportunity and published our findings in *Biological Conservation* (Costion et al. 2012) calling for the conservation community to consider long term declines of species not just declines in the short term. A second attempt of IUCN submission for Palau's endemic flora, using data that only recently became available with the completion of project collaborator Akiko Iida's thesis, is now in review. The data and methodology used in this second attempt is very rigorous and extensive and more importantly fits within IUCN's 100-year time frame limitation so should get accepted.

Two separate IUCN assessments have been submitted to IUCN for *Parkia parvifoliola* and *Ponapea palauensis* for threatened status using the results from the fieldwork from this project. These assessments are now in review.

2. Reduce the data deficiency gap for Palau's endemic plant species by approximately 10%.

In 2009, 61% of Palau's endemic plants were considered 'DD' data deficient (Costion et al. 2009) which is approximately 79 species. Since 10% of 79 is 7.9, to meet our target we needed to increase knowledge for 8 species. We aimed to do this through both targeted collections of poorly known taxa and through opportunistic findings while conducting the population inventories (Objective 3). If our second IUCN submission attempt is accepted then we over-achieved this aim by far. Regardless of IUCN recognition we can confidently report that knowledge on the distribution, abundance and/or species boundaries was increased for a total of 16 species. We thus increased knowledge on at least 20% of the data deficient species. Below is a summary of the findings for each of one.

1. ***Selaginella palauensis*** HOSOK. – This is a rare inconspicuous plant, known only from one mountain top locality on a moist basalt outcrop. We recently distinguished this plant from two other recognized endemic *Selaginella* species in Palau by studying the type and comparing existing collections at BNM (photo of type specimen below). The other two species of Palau endemic *Selaginella*, *Selaginella dorsicola* and *Selaginella pseudo-volkensii*, may actually be only one valid species represented by two names. This will require follow up study by an expert in the genus.

Type specimen of *Selaginella palauensis*; http://tai2.ntu.edu.tw/index.php .

2. ***Polyalthia merrillii*** KANEH. – Fairly common, small to medium sized tree, occurring throughout the limestone Rock Islands; inland forest, not adjacent coast. Prior to this project, this species was only known from the type collection and had not been photographed before.

Polyalthia merrillii in fruit.

3. ***Ponapea palauensis*** KANEH. – Very small range of occurrence with a rare and scattered distribution within this area. During the project we were able to photograph active pollinators on the flowers, an unidentified bee or wasp. Further work is required to identify the pollinator to species. However, loss of pollinators or lack of cross pollination does not appear to be a problem for this threatened palm.

Ponapea palauensis flower and immature fruits with pollinator.

4. ***Pandanus lorencei*** HUYNH. – This species is now believed to be a synonym of the widespread, non-endemic, *Pandanus tectorius* and is in line for subsequent revision.

Pandanus tectorius growing in coastal strand forest.

5. ***Pandanus palawensis*** MARTELLI – This species is now believed to be a synonym of the Palau endemic *Pandanus aimiriikensis,* which may be restricted to volcanic islands, and is in line for subsequent revision.

Herbarium specimen of *Pandanus aimiriikensis* collected from Babeldaob.

6. ***Pandanus peliliuensis*** KANEH. – This species was previously thought to be endemic to Peleliu but recent genetic work (now in progress) suggests it may be the same species as *Pandanus aimiriikensis*. Since it is morphologically distinct from the volcanic island populations of *Pandanus amiriikensis* it is under current investigation. This species was widespread and abundant on the island of Peleliu and throughout the limestone islands.

Herbarium specimen of Pandanus sp. collected from Peleliu.

7. ***Rauvolfia insularis*** MARKGR. – A new record of this rare species was discovered in one of the last remaining forested areas of Koror's volcanic islands. It is also known from a few localities with a very patchy distribution on the southeastern part of Babeldaob. Its occurrence on the remnant forest in Koror suggests it may have previously had a more widespread population.

Rauvolfia insularis growing along the edge of forest in eastern Babeldaob.

8. ***Sterculia palauensis*** KANEH. – This species occurs throughout the limestone islands of Palau but not in high numbers. It has been observed in the limestone islands of Airai down to the southern most Rock Islands, suggesting it is well distributed across the limestone islands. The trees can form medium to large sized buttresses.

Sterculia palauensis in fruit, growing in coastal beach forest on the Rock Islands.

9. ***Anacolosa glochidiiformis*** KANEH. & HATUS. – This medium to large tree species was photographed for the first time during the project, and is now represented in the BNM herbarium collection. Data is still lacking to determine its abundance but it is known to occur on both volcanic and limestone substrates in Palau so it may require a lower priority for conservation.

Anacolosa glochidiiformis flower.

10. ***Ophiorrhiza palauensis*** VALETON – This species occurs commonly throughout the limestone islands and in wet areas of Babeldaob. It is a small semi-woody herb or small understory shrub.

11. ***Timonius corymbosus*** VALETON – This species occurs commonly throughout the limestone islands, particularly on the high inland karst ridges, but also occasionally along the coast.

Timonius corymbosus flower, occurring on the Rock Islands. Photo credit: Ron Leidich.

12. ***Timonius mollis*** VALETON – This species is common throughout Babeldaob occurring in both forest and open savanna areas. It can occur as a short shrub in open savanna or a tall, medium sized tree in closed forest. It is often confused with the closely related *Timonius subauritus* but can be distinguished by its much longer persistent calyx and often (though not consistent) more pubescent growth.

Herbarium specimen of *Timonius mollis* collected from Babeldaob.

13. ***Timonius salsedoi*** FOSBERG & SACHET – This species is now moved from 'Critically Endangered' to 'Data Deficient.' It is difficult to distinguish in the field from the other *Timonius* species in Palau. Molecular studies are now being conducted to see if it is genetically distinct. (See Objective 3).

Herbarium specimen of *Timonius* sp. collected from population on Malakal island.

14. ***Planchonella calcarea*** (HOSOK.) P. ROYEN – This species occurs along the limestone bluffs throughout the rock islands and can be confused with the closely related *Pouteria obovata*. It is known only from few collections but appears to occur throughout the limestone islands.

Planchonella calcarea collected from limestone bluff on the Rock Islands.

15. ***Cayratia palauana*** (HOSOK.) SUESSENG. – Collections of a *Cayratia* species matching the type of *Cayratia palauana* were made during the project. This species was previously only known to us from the type collection. It was only found at two sites in the Rock Islands, both disturbed sites, one an exposed site adjacent to a radio tower, the other an exposed area adjacent a tree-fall and cliff. It was also observed on Peleliu, which is all secondary recovering limestone forest with many breaks in the canopy. It is currently recognized as endemic species to the limestone islands of Palau, but due to its preference for disturbed sites (often an indicator of a recently introduced taxon) its taxonomic status is worthy of further investigation.

Type specimen of *Cayratia palauana*, left, accessed online (http://tai2.ntu.edu.tw/index.php): and recent collection, right.

16. ***Medusanthera laxiflora*** (MIERS) R. A. HOWARD – There has been previous uncertainty regarding whether this species is a Palau endemic under the name *Medusanthera caroliensis* or if it is synonymous with the more widespread species *Medusanthera laxiflora*. Recent collections and photographs were made and sent away for expert identification and confirmed it to be the non-endemic *M. laxiflora*.

Flower of *Medusanthera laxiflora*.

3. Population size and relative abundance for four threatened plant species with small, restricted ranges is clarified and documented.

Ponapea palauensis KANEH.

Prior to this project the complete distribution of this species was not known. We surveyed the entire range of potential habitat for this species across Palau's limestone islands and found it to have a very restricted distribution, 6.93 km^2 (see figure below). Quantitative data was collected within the existing population and the total population size is estimated to be approximately only 622 mature individuals. Our data qualifies this species for Vulnerable status under IUCN Criterion D(1,2). The species also comes close to qualifying for Critically Endangered status under IUCN Criterion B1,2(a,b(v)) however further follow up quantitative studies are required to give it a higher listing priority. A complete IUCN red list assessment was submitted for this species and a complete write up of the study has been accepted for publication in the first issue of *Pacific Science* 2013.

Presence (red) and absence (blue) of *Ponapea palauensis*, photo (right) of damaged crown from invasive cockatoos that are causing the species to decline.

Parkia parvifoliola HOSOK.

Population inventory for this species proceeded as planned. A population size estimate was conducted after collecting quantitative data from 39 transects within the central population. The maximum extent of occurrence of the central population was determined to be 4.1 km^2 however it is likely smaller. Although further fieldwork would be required to define the complete boundary of the population to calculate the exact total land area, with the existing data we were able to estimate a minimum and maximum number of total mature individuals. This data was used in combination with a synthesis of previous datasets for a separate IUCN assessment that nominates this species with Endangered status.

A summary of the IUCN assessment for *Parkia parvifoliola* is as follows:

This species is restricted to the island of Babeldaob on the Palau archipelago. Within this range, it is almost entirely restricted to one central population, which is no more than 4.1 km^2. Only a few outlier individuals from the central population have been recorded from multiple comprehensive surveys of Babeldaob between 1997 and 2007. The central population is located in the state of Ngeremlengui in the upper watershed of the Ngaramiskang river. The extent of occurrence and area of occupancy are both < 10 km^2, which would put this species in the Critically Endangered Category however, it is not restricted to one locality. No information on population trends on the extant population is available however oral knowledge strongly indicates that early Palauans used this species as a timber tree in the past.

Total distribution of *Parkia* in Palau, primarily restricted to one population.

Recent concern was raised by Fortune-Hopkins (2009), world *Parkia* expert and monograph author (Fortune-Hopkins 1994), regarding the pollination biology of this species. Fortune noted that the flowers of *Parkia parvifoliola* are notably small for the genus and particularly too small to be pollinated by the only known nectar feeding bat in Palau, *Pteropus marianus pelewensis* (most species of *Parkia* throughout the range of the genus are pollinated by bats). Fortune hypothesized that the loss of a former pollinator for this species (potentially an extinct smaller species of bat) may explain its rarity. This hypothesis inspired our pollination study on this species. Visits to flowering trees were conducted over a two-week period from late afternoon to dusk. Multiple generalist pollinators were observed and photographed including the Micronesian honey eater, *Myzomela rubrata*, the European honey bee, *Apis mellifera,* a species of blowfly *Chrysosomya* sp., and at least two other undetermined insects (potentially a flowerfly (Syrphidae), and a wasp or leaf cutter bee). It is unlikely that loss of any alleged former pollinators has affected cross-pollination of this species as it is being pollinated by multiple species including both native species and a recent introduction, the European honey-bee.

The primary threat to this species is habitat loss from human activity. This threat has been proven to be ongoing since the arrival of humans on the islands (Costion et al. 2012). Fires are also a serious threat to Palau's intact forest. These fires are set deliberately by humans to maintain the savanna areas or accidentally and even sometimes for recreation. Savanna areas are present around the central population of *Parkia*. Other threats to this species include invasive species. Large populations of the invasive tree *Falcataria moluccana* are present just outside the central population of *Parkia*. In Palau, as has occurred in other Pacific islands such as Hawaii, *Falcataria* grows higher than all the native trees and takes over.

The area that the main population occurs in has recently been designated as a protected area. However, to date no funding or budget has been approved of or endorsed to support a management plan. Even if the reserve is finally established it may not have any direct impact on loss of forest cover due to human caused fires or prevent the spread of invasive species that are potentially a major threat.

Our justification for this species to be eligible for Endangered status is based on its small range and a decline of habitat quality. The central population of Parkia is surrounded by heavily disturbed areas including open, degraded savanna, and forest areas that are infested with the invasive tree, *Falcataria moluccana*. Studies on the expansion or contraction of forest boundaries in this specific locality are needed to monitor the stability of the species in face of threats from fire and invasive species. This species also qualifies for IUCN Vulnerable status due to 99% of its population being restricted to one population that is no more than 4.1 km^2 in total area.

Myzomela rubratra visiting *Parkia* flowers at dusk.

Myzomela rubratra feeding on nectar from *Parkia* flowers.

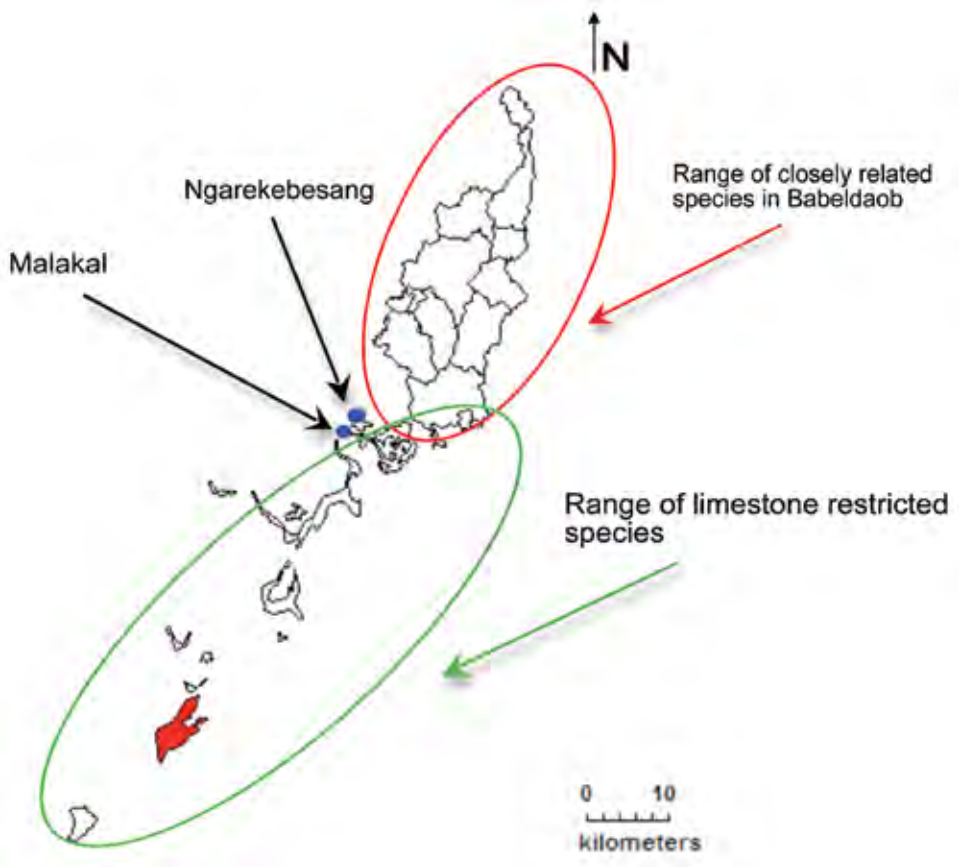
The European honeybee visiting *Parkia* flowers.

The European honeybee visiting *Parkia* flowers.

Undetermined species of flies visiting *Parkia* flowers.

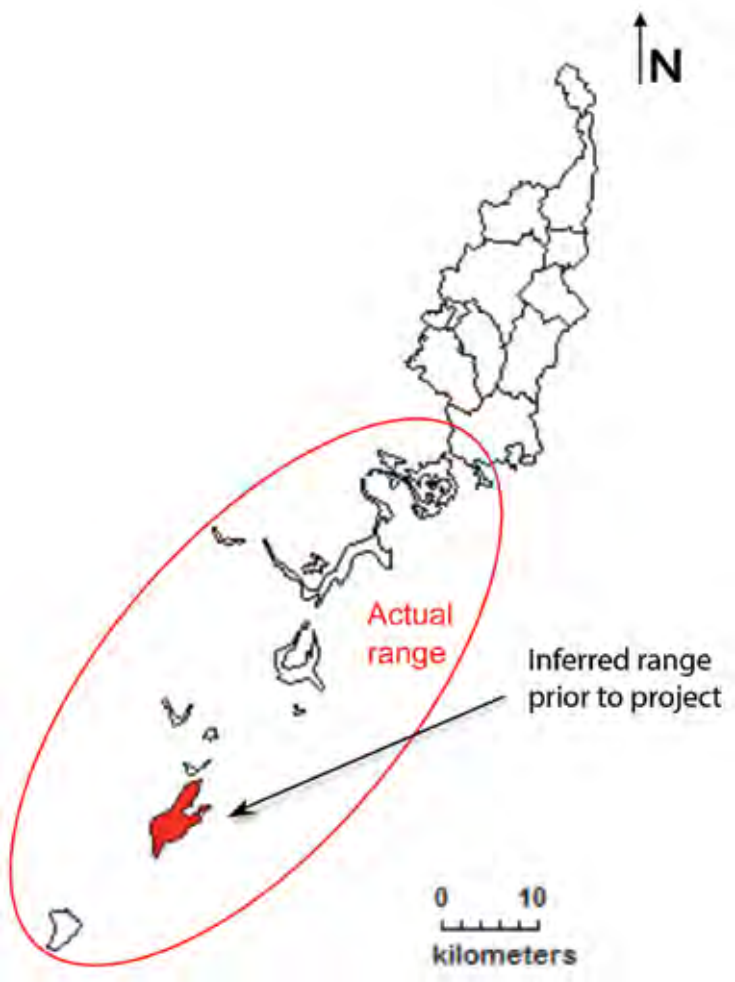
Timonius salsedoi FOSBERG & SACHET

Population survey of this species proved to be challenging with clear identification of it as a distinct species from its close relatives *T. mollis* and *T. subauritus* very difficult in the field. This alleged species is part of a species complex and occurs in the convergence zone between species endemic to Babeldaob and species endemic to the limestone islands. We surveyed the island of Malakal extensively and sampled from several *Timonius* sp. plants present. A population of *Timonius* sp. that appears to match the description of *Timonius salsedoi* was also found in the only other area of extant forest on Koror's volcanic islands, the island of Ngerekebesang. Genetic analysis and further morphological study of these samples are required to determine if the populations in Koror are distinct from the abundant populations in Babeldaob. This species by necessity must be down-listed from 'Critically Endangered' status to 'Data Deficient' until further information is available.



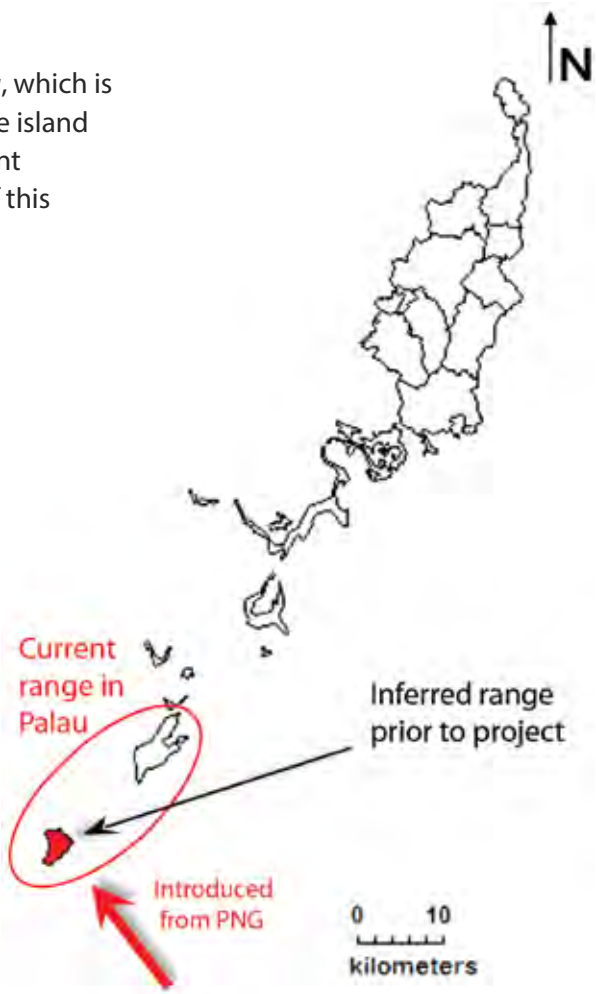
Pandanus peliliuensis KANEH.

This species is now believed to occur throughout the limestone rock islands. Quantitative data was collected on this species across the island of Peleliu but analysis of this data is postponed until confirmation of its taxonomic status is complete. Timothy Gallaher, from the University of Hawaii, is conducting genetic work to delimit species boundaries within the genus *Pandanus* on Palau. The results of this work will contribute towards a revision of the genus for Micronesia. Preliminary lab results place this species very close to *Pandanus aimiriikensis*. There are two base pair differences distinguishing the two. We are not yet sure if they are two separate species but for now, based on field observations from the survey, the species is definitely not endemic to the island of Peleliu. It either occurs abundantly throughout the limestone islands of Palau, or is a synonym of *Pandanus aimiriikensis*, which occurs on Babeldaob, and thus should be down-listed for high conservation priority.



Maesa canfieldiae FOSBERG & SACHET

This species is now determined to be *Maesa tetrandra*, which is native to New Guinea and was likely introduced to the island of Angaur during the movement of military equipment from PNG to Palau during WWII. Additional records of this species were collected on the island of Peleliu during the project, suggesting that it is spreading north. Its occurrence only adjacent to the airport in Peleliu and similarly its occurrence only in disturbed areas on the island of Angaur raised the initial doubt to it being a valid endemic species. The updated taxonomy will be published in a peer reviewed journal in collaboration with Dr. Tim Utteridge from the Royal Botanic Gardens, Kew.



Herbarium specimen of *Maesa tetrandra* collected from Angaur, previously determined as *M. canfieldiae*.

4. A long-term strategy is developed with local stakeholders to address the data deficiency gap for all remaining endemic plants in Palau.

We hosted a series of meetings and a full day symposium of which numerous participants attended. Several representatives from different local agencies gave presentations on existing datasets on biodiversity data in Palau. It became clear that there are many datasets and networks of plots from different types of inventories that have been done. Most of these are unpublished. It was decided that the best next step is to consolidate all of these different inventory datasets into one database of presence/absence data. Also a list of 'DD' taxa is to be distributed with information on identification tips to subsequent visiting researchers and inventory efforts. This was determined to be the most appropriate plan given the scale of conducting nation wide inventories for species that have been elusive to experts and the lack of trained botanists on island. A small grant will be sought out to fund the synthesis of a small report that consolidates all available information on the pending 'DD' endemic plant species. This will then be distributed for use in subsequent field studies in Palau.

5. A national database of all historic plant collection records from Palau is updated to enable species distribution mapping and prioritization of poorly collected localities.

Prior to conducting the field work for this project we were contacted by Michael Thomas from the University of Hawaii, who informed us of his NSF funded project to database and scan all herbarium specimens held in herbariums across the Pacific. This initiative was clearly consistent with Objective 5 and went way beyond achieving our initial aim. Michael visited the Belau National Museum during our fieldwork and he completed scanning half of the BNM collection.

We used our funds to support the labor to get these specimens data based and processed and then re-organised and curated in the herbarium to better facilitate completion on his next visit.
When this project is complete, all of Palau's herbarium specimens will be publically available through the website www.pacificherbaria.org. All the data entry is standardized and will enable efficient and accurate mapping of all collection records per species. We also trained BNM staff in the use of free GIS programs for mapping species from point locality data.

A total of 214 collections (Appendix) were made throughout the course of the fieldwork and at least one duplicate of each was accessed by BNM. Duplicates were also sent to the National Tropical Botanic Gardens, Kauai, The New York Botanic Garden, The Royal Botanic Gardens Kew, Tulane University, The University of Hawaii, and the Australian Tropical Herbarium. Many of the collections made were previously absent from the BNM collection. These collections and ongoing collecting activities provide valuable data on the distribution of Palau's species.

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APPENDIX

HERBARIUM SPECIMENS

COLLECTED DURING THE PROJECT

FAMILY	SPECIES	COLLECTION NUMBER	DATE	LOCALITY
Annonaceae	*Polyalthia merrillii*	Costion 3254	5/11/11	Koror, rock islands in Ngermid complex
Sapotaceae	*Pouteria obovata*	Costion & Kitalong 3255	5/11/11	Koror, rock island cliff near trail going up to Gobi lake
Pandanaceae	*Pandanus kanehirae*	Costion & Kitalong 3256	7/11/11	Airai, along compact road at landward edge of mangrove swamp
Pandanaceae	*Pandanus kanehirae*	Costion & Kitalong 3257	7/11/11	*As above*
Pandanaceae	*Pandanus kanehirae*	Costion & Kitalong 3258	7/11/11	*As above*
Pandanaceae	*Pandanus kanehirae*	Costion & Kitalong 3259	7/11/11	*As above*
Pandanaceae	*Pandanus kanehirae*	Costion & Kitalong 3260	7/11/11	*As above*
Pandanaceae	*Pandanus kanehirae*	Costion & Kitalong 3261	7/11/11	*As above*
Pandanaceae	*Pandanus kanehirae*	Costion & Kitalong 3262	7/11/11	*As above*
Pandanaceae	*Pandanus kanehirae*	Costion & Kitalong 3263	7/11/11	*As above*
Pandanaceae	*Pandanus kanehirae*	Costion & Kitalong 3264	7/11/11	*As above*
Pandanaceae	*Pandanus kanehirae*	Costion & Kitalong 3265	7/11/11	*As above*
Pandanaceae	*Pandanus tectorius*	Costion & Kitalong 3266	7/11/11	Ngatpang, along compact road, at junction with road to Ngchesar
Rubiaceae	*Psychotria diospyrifolia*	Costion 3267	10/11/11	Malakal Island, on exposed basalt
Rubiaceae	*Timonius subauritus*	Costion 3268	10/11/11	Malakal Island, edge of forest and clearing
Orchidaceae	*Eulophia pulchra*	Costion 3269	11/11/11	Ngeremlengui state, along compact rd. under Parkia tree
Pandanaceae	*Pandanus aimiriikensis*	Costion 3270	12/11/11	Malakal Island, edge of forest and clearing
Rubiaceae	*Timonius sp.*	Costion 3271	12/11/11	Malakal Island, along ridge in forest
Rubiaceae	*Timonius sp.*	Costion 3272	12/11/11	Malakal Island, along ridge in forest
Rubiaceae	*Timonius sp.*	Costion 3273	12/11/11	Malakal Island, along ridge in forest
Pandanaceae	*Pandanus dubius*	Costion 3274	13/11/11	Ngaraard, just north of elementary school & village
Pandanaceae	*Pandanus dubius*	Costion 3275	13/11/11	*As above*
Pandanaceae	*Pandanus dubius*	Costion 3276	13/11/11	*As above*
Pandanaceae	*Pandanus dubius*	Costion 3277	13/11/11	*As above*
Pandanaceae	*Pandanus dubius*	Costion 3278	13/11/11	*As above*
Pandanaceae	*Pandanus dubius*	Costion 3279	13/11/11	*As above*
Pandanaceae	*Pandanus dubius*	Costion 3280	13/11/11	*As above*
Pandanaceae	*Pandanus dubius*	Costion 3281	13/11/11	*As above*
Pandanaceae	*Pandanus dubius*	Costion 3282	13/11/11	*As above*
Pandanaceae	*Pandanus dubius*	Costion 3283	13/11/11	*As above*
Pandanaceae	*Pandanus dubius*	Costion 3284	15/11/11	Angaur
Pandanaceae	*Pandanus dubius*	Costion 3285	15/11/11	Angaur
Pandanaceae	*Pandanus dubius*	Costion 3286	15/11/11	Angaur
Pandanaceae	*Pandanus dubius*	Costion 3287	15/11/11	Angaur
Pandanaceae	*Pandanus dubius*	Costion 3288	15/11/11	Angaur
Pandanaceae	*Pandanus dubius*	Costion 3289	15/11/11	Angaur
Pandanaceae	*Pandanus dubius*	Costion 3290	15/11/11	Angaur, next to wildcats memorial
Pandanaceae	*Pandanus dubius*	Costion 3291	15/11/11	Angaur, next to wildcats memorial
Pandanaceae	*Pandanus dubius*	Costion 3292	15/11/11	Angaur, next to wildcats memorial
Pandanaceae	*Pandanus dubius*	Costion 3293	15/11/11	Angaur, next to wildcats memorial
Pandanaceae	*Pandanus dubius*	Costion 3294	16/11/11	Peleliu
Pandanaceae	*Pandanus dubius*	Costion 3295	16/11/11	Peleliu
Pandanaceae	*Pandanus dubius*	Costion 3296	16/11/11	Peleliu
Pandanaceae	*Pandanus dubius*	Costion 3297	16/11/11	Peleliu

FAMILY	SPECIES	COLLECTION NUMBER	DATE	LOCALITY
Pandanaceae	*Pandanus dubius*	Costion 3298	16/11/11	Peleliu
Pandanaceae	*Pandanus dubius*	Costion 3299	16/11/11	Peleliu
Pandanaceae	*Pandanus sp. (aff. peliliuensis)*	Costion 3300	17/11/11	Peleliu
Pandanaceae	*Pandanus sp. (aff. peliliuensis)*	Costion 3301	17/11/11	Peleliu
Pandanaceae	*Pandanus sp. (aff. peliliuensis)*	Costion 3302	17/11/11	Peleliu
Myrsinaceae	*Maesa canfieldiae*	Costion 3303	17/11/11	Peleliu, in secondary forest next to airport
Pandanaceae	*Pandanus sp. (aff. peliliuensis)*	Costion 3304	17/11/11	Peleliu
Pandanaceae	*Pandanus sp. (aff. peliliuensis)*	Costion 3305	17/11/11	Peleliu
Pandanaceae	*Pandanus sp. (aff. peliliuensis)*	Costion 3306	17/11/11	Peleliu
Pandanaceae	*Pandanus sp. (aff. peliliuensis)*	Costion 3307	17/11/11	Peleliu
Pandanaceae	*Pandanus sp. (aff. peliliuensis)*	Costion 3308	18/11/11	Peleliu
Pandanaceae	*Pandanus sp. (aff. peliliuensis)*	Costion 3309	18/11/11	Peleliu
Pandanaceae	*Pandanus sp. (aff. peliliuensis)*	Costion 3310	18/11/11	Peleliu
Pandanaceae	*Pandanus sp. (aff. peliliuensis)*	Costion 3311	18/11/11	Peleliu
Pandanaceae	*Pandanus sp. (aff. peliliuensis)*	Costion 3312	18/11/11	Peleliu
Pandanaceae	*Pandanus sp. (aff. peliliuensis)*	Costion 3313	18/11/11	Peleliu
Pandanaceae	*Pandanus sp. (aff. peliliuensis)*	Costion 3314	18/11/11	Peleliu
Pandanaceae	*Pandanus sp. (aff. peliliuensis)*	Costion 3315	18/11/11	Peleliu
Pandanaceae	*Pandanus sp. (aff. peliliuensis)*	Costion 3316	18/11/11	Peleliu
Pandanaceae	*Pandanus sp. (aff. peliliuensis)*	Costion 3317	18/11/11	Peleliu
Pandanaceae	*Pandanus sp. (aff. peliliuensis)*	Costion 3318	18/11/11	Ngarechbus, island just across from Peleliu
Pandanaceae	*Pandanus sp. (aff. peliliuensis)*	Costion 3319	18/11/11	*As above*
Pandanaceae	*Pandanus sp. (aff. peliliuensis)*	Costion 3320	18/11/11	*As above*
Pandanaceae	*Pandanus sp. (aff. peliliuensis)*	Costion 3321	18/11/11	*As above*
Pandanaceae	*Pandanus sp. (aff. peliliuensis)*	Costion 3322	18/11/11	*As above*
Pandanaceae	*Pandanus sp. (aff. peliliuensis)*	Costion 3323	18/11/11	*As above*
Pandanaceae	*Pandanus sp. (aff. aimiriikensis)*	Costion 3324	19/11/11	Airai, road into Ngerimel Dam, population growing along dirt road up to dam
Pandanaceae	*Pandanus sp. (aff. aimiriikensis)*	Costion 3325	19/11/11	*As above*
Pandanaceae	*Pandanus sp. (aff. aimiriikensis)*	Costion 3326	19/11/11	*As above*
Pandanaceae	*Pandanus sp. (aff. aimiriikensis)*	Costion 3327	19/11/11	*As above*
Pandanaceae	*Pandanus sp. (aff. aimiriikensis)*	Costion 3328	19/11/11	*As above*
Pandanaceae	*Pandanus sp. (aff. aimiriikensis)*	Costion 3329	19/11/11	*As above*
Pandanaceae	*Pandanus sp. (aff. aimiriikensis)*	Costion 3330	19/11/11	*As above*
Pandanaceae	*Pandanus sp. (aff. aimiriikensis)*	Costion 3331	19/11/11	*As above*
Pandanaceae	*Pandanus sp. (aff. aimiriikensis)*	Costion 3332	19/11/11	*As above*
Pandanaceae	*Pandanus sp. (aff. aimiriikensis)*	Costion 3333	19/11/11	*As above*
Rubiaceae	*Timonius sp.*	Costion 3334	22/11/11	Malakal
Pandanaceae	*Pandanus sp. (aff. aimiriikensis)*	Costion 3335	22/11/11	Malakal
Pandanaceae	*Pandanus sp. (aff. aimiriikensis)*	Costion 3336	22/11/11	Malakal
Pandanaceae	*Pandanus sp. (aff. aimiriikensis)*	Costion 3337	23/11/11	Ngchesar, along rd going to mouth of Ngardok river
Pandanaceae	*Pandanus sp. (aff. aimiriikensis)*	Costion 3338	23/11/11	*As above*
Rubiaceae	*Timonius mollis*	Costion 3339	23/11/11	*As above*
Fungi	*Entoloma sp.*	Costion 3340	23/11/11	Ngchesar
Pandanaceae	*Pandanus sp. (aff. aimiriikensis)*	Costion 3341	25/11/11	Koror, rock islands
Pandanaceae	*Pandanus sp. (aff. aimiriikensis)*	Costion 3342	25/11/11	Koror, rock islands

FAMILY	SPECIES	COLLECTION NUMBER	DATE	LOCALITY
Pandanaceae	*Pandanus dubius*	Costion 3343	25/11/11	Koror, rock island near Koror
Pandanaceae	*Pandanus dubius*	Costion 3344	25/11/11	Koror, rock island near Koror
Pandanaceae	*Pandanus dubius*	Costion 3345	25/11/11	Koror, rock island near Koror
fungi	*Undet.*	Costion 3346	26/11/11	German lighthouse trail, near the top
Myrsinaceae	*Discocalyx palauensis?*	Costion 3347	25/11/11	Koror, rock islands
Myrsinaceae	*Discocalyx mezii*	Costion 3348	25/11/11	Koror, rock island near Koror
Pandanaceae	*Pandanus tectorius*	Costion 3349	30/11/11	Koror, rock islands
Pandanaceae	*Pandanus dubius*	Costion 3350	30/11/11	Koror, rock islands
Annonaceae	*Polyalthia merrillii*	Costion 3351	1/12/11	Koror, rock islands
Sapotaceae	*Planchonella calcarea*	Costion 3352	1/12/11	Koror, rock islands
Sapotaceae	*Pouteria obovata*	Costion 3353	1/12/11	Koror, rock islands
Rubiaceae	*Psychotria sp.*	Costion 3354	1/12/11	Koror, rock islands
Vitaceae	*Cayratia palauana*	Costion 3355	1/12/11	Koror, Ulong island
Dioscoreaceae	*Dioscorea sp.*	Costion 3356	1/12/11	Koror, Ulong island
Urticaceae	*Pipturus argenteus*	Costion 3357	1/12/11	Koror, Ulong island
Euphorbiaceae	*Claoxylon sp.*	Costion 3358	29/11/11	Koror, rock island
Rubiaceae	*Timonius subauritus*	Costion 3359	20/12/11	Aimeliik, along road to Nekken
Rubiaceae	*Timonius mollis*	Costion 3360	20/12/11	Aimeliik, along old abandoned road from Airai to Aimeliik
Rubiaceae	*Timonius mollis*	Costion 3361	20/12/11	*As above*
Rubiaceae	*Timonius subauritus*	Costion 3362	20/12/11	Aimeliik, along road to Nekken
Rubiaceae	*Timonius subauritus*	Costion 3363	20/12/11	Aimeliik, along road to Nekken
Rubiaceae	*Timonius subauritus*	Costion 3364	20/12/11	*As above*
Rubiaceae	*Timonius subauritus*	Costion 3365	19/12/11	Airai, savanna around the reservoir
Rubiaceae	*Timonius subauritus*	Costion 3366	19/12/11	*As above*
Rubiaceae	*Timonius mollis*	Costion 3367	19/12/11	*As above*
Rubiaceae	*Timonius mollis*	Costion 3368	19/12/11	*As above*
Rubiaceae	*Timonius mollis*	Costion 3369	19/12/11	*As above*
Rubiaceae	*Timonius subauritus*	Costion 3370	19/12/11	*As above*
Rubiaceae	*Timonius mollis*	Costion 3371	19/12/11	*As above*
Rubiaceae	*Timonius sp.*	Costion 3372	19/12/11	Airai reservoir
Rubiaceae	*Timonius subauritus*	Costion 3373	19/12/11	*As above*
Rubiaceae	*Timonius sp.*	Costion 3374	19/12/11	*As above*
Rubiaceae	*Timonius mollis*	Costion 3375	19/12/11	*As above*
Rubiaceae	*Timonius mollis*	Costion 3376	19/12/11	*As above*
Rubiaceae	*Timonius sp.*	Costion 3377	21/12/11	Malakal
Rubiaceae	*Timonius sp.*	Costion 3378	21/12/11	Malakal
Rubiaceae	*Timonius sp.*	Costion 3379	21/12/11	Malakal
Rubiaceae	*Timonius corymbosus var. corymbosus*	Costion 3380	21/12/11	Malakal
Rubiaceae	*Timonius subauritus*	Costion 3431	2/01/12	Airai, reservoir, just below reservoir dam along stream
Rubiaceae	*Timonius subauritus*	Costion 3432	2/01/12	*As above*
Rubiaceae	*Timonius subauritus*	Costion 3433	2/01/12	*As above*
Rubiaceae	*Timonius mollis*	Costion 3434	2/01/12	*As above*
Rubiaceae	*Timonius subauritus*	Costion 3435	2/01/12	*As above*
Rubiaceae	*Timonius subauritus*	Costion 3436	2/01/12	Airai, reservoir, just below reservoir dam along stream
Rubiaceae	*Timonius subauritus*	Costion 3437	2/01/12	*As above*

FAMILY	SPECIES	COLLECTION NUMBER	DATE	LOCALITY
Rubiaceae	*Timonius corymbosus*	Costion 3438	12/01/12	Koror State, Ngeruktabel Island
undet.	*Undet.*	Costion 3439	12/01/12	Koror state, Rock island, Nikko Bay
fungi	*Undet.*	Costion 3440	12/01/12	Koror State, Ngeruktabel Island
Undet.	*Undet.*	Costion 3441	12/01/12	*As above*
Pandanaceae	*Pandanus macrojeanneretia*	Costion 3442	13/01/12	Ngchesar, Ngarsul, along Ngardok river tributary, near entrance to Jungle Cruise reception,
Pandanaceae	*Freycinetia sp.*	Costion 3443	13/01/12	*As above*
Pandanaceae	*Pandanus sp. (aff. peliliuensis)*	Costion 3444	15/01/12	Koror, Ngermid
Pandanaceae	*Pandanus sp. (aff. peliliuensis)*	Costion 3445	15/01/12	Koror, Ngermid
Apocynaceae	*Sarcolobus retusus*	Costion 3446	15/01/12	Koror, Ngermid
Urticaceae	*Laportea ruderalis*	Costion 3447	15/01/12	Koror, Ngermid
Rubiaceae	*Timonius corymbosus*	Costion 3448	15/01/12	Koror, Ngermid
Araceae	*Spathiphyllum commutatum*	Costion 3449	10/01/12	Ngeremlengui, along old Japanese road, past the waterfall
Pandanaceae	*Pandanus sp. (aff. macrojeanneretia)*	Costion 3450	10/01/12	Ngeremlengui, along old Japanese road, before the waterfall
Sellaginellaceae	*Sellaginella sp.*	Costion 3452	10/01/12	*As above*
Rubiaceae	*Hedyotis divaricata*	Costion 3451	10/01/12	*As above*
Rubiaceae	*Hedyotis sp.*	Costion 3453	10/01/12	*As above*
Araliaceae	*Osmoxylon pachyphyllum*	Costion 3454	10/01/12	*As above*
Pandanaceae	*Pandanus macrojeanneretia*	Costion 3455	12/01/12	*As above*
Rubiaceae	*Hedyotis cornifolia*	Costion 3456	12/01/12	*As above*
Sapotaceae	*Manilkara udoido*	Costion 3457	12/01/12	Ngeremlengui, along Parkia transect 32, high ridgeline
Olacaceae	*Anacolosa glochidiiformis*	Costion 3458	12/01/12	Ngeremlengui, along Parkia transect 31, high ridgeline
Pandanaceae	*Pandanus dubius*	Costion 3459	25/01/12	Kayangel atoll
Pandanaceae	*Pandanus tectorius*	Costion 3460	25/01/12	Kayangel atoll
Malvaceae	*Triumfetta procumbens*	Costion 3461	25/01/12	Kayangel atoll
Pandanaceae	*Pandanus tectorius*	Costion 3462	25/01/12	Kayangel atoll
Pandanaceae	*Pandanus tectorius*	Costion 3463	25/01/12	Kayangel atoll
Pandanaceae	*Pandanus tectorius*	Costion 3464	25/01/12	Kayangel atoll
Pandanaceae	*Pandanus tectorius*	Costion 3465	25/01/12	Kayangel atoll
Pandanaceae	*Pandanus tectorius*	Costion 3466	25/01/12	Kayangel atoll
Pandanaceae	*Pandanus tectorius*	Costion 3467	25/01/12	Kayangel atoll
Pandanaceae	*Pandanus tectorius*	Costion 3468	25/01/12	Kayangel atoll
Pandanaceae	*Pandanus tectorius*	Costion 3469	25/01/12	Kayangel atoll
Pandanaceae	*Pandanus tectorius*	Costion 3470	25/01/12	Kayangel atoll
Stemonuraceae	*Medusanthera laxiflora*	Costion 3471	30/01/12	Koror, Rock Islands, Dolphins Pacific resort area
Rubiaceae	*Psychotria hombroniana*	Costion 3472	30/01/12	*As above*
Apocynaceae	*Dischidia hahliana*	Costion 3473	30/01/12	*As above*
Salicaceae	*Casearia sp.*	Costion 3474	30/01/12	*As above*
Sapindaceae	*Tristiropsis obtusangula*	Costion 3475	30/01/12	*As above*
Fabaceae	*Parkia parvifoliola*	Costion 3476	2/02/12	Ngeremlengui
Annonaceae	*Goniothalmus carolinensis*	Costion 3477	3/02/12	Ngeremlengui, off of old japanese road going to waterfall
Olacaceae	*Anacolosa glochidiiformis*	Costion 3478	2/02/12	Ngeremlengui
Pandanaceae	*Pandanus sp. (aff. aimiriikensis)*	Costion 3479	2/02/12	Ngeremlengui
Pandanaceae	*Pandanus sp. (aff. aimiriikensis)*	Costion 3480	2/02/12	Ngeremlengui

FAMILY	SPECIES	COLLECTION NUMBER	DATE	LOCALITY
Pandanaceae	*Pandanus tectorius*	Costion & Kitalong 3481	7/11/11	Ngatpang, along compact road, at junction with road to Ngchesar
Pandanaceae	*Pandanus tectorius*	Costion & Kitalong 3482	7/11/11	*As above*
Pandanaceae	*Pandanus tectorius*	Costion & Kitalong 3483	7/11/11	*As above*
Pandanaceae	*Pandanus tectorius*	Costion & Kitalong 3484	7/11/11	*As above*
Pandanaceae	*Pandanus tectorius*	Costion & Kitalong 3485	7/11/11	*As above*
Pandanaceae	*Pandanus tectorius*	Costion & Kitalong 3486	7/11/11	*As above*
Pandanaceae	*Pandanus tectorius*	Costion & Kitalong 3487	7/11/11	Ngatpang, along compact road, at junction with road to Ngchesar
Pandanaceae	*Pandanus tectorius*	Costion & Kitalong 3488	7/11/11	*As above*
Pandanaceae	*Pandanus tectorius*	Costion & Kitalong 3489	7/11/11	*As above*
Phyllanthaceae	*Cleistanthus carolinianus*	Costion 3490	15/02/12	Koror, Ngermid
Cannabaceae	*Celtis paniculata*	Costion 3491	15/02/12	Koror, Ngermid
Anacardiaceae	*Buchanania*	Costion 3492	15/02/12	Koror, Ngermid
Rubiaceae	*Timonius korrensis*	Costion 3493	16/02/12	Koror, Malakal island in remnant forest
Rubiaceae	*Timonius*	Costion 3494	16/02/12	
Rubiaceae	*Timonius*	Costion 3495	16/02/12	
Rubiaceae	*Timonius*	Costion 3496	16/02/12	
Apocynaceae	*Rauvolfia insularis*	Costion 3497	18/02/12	Koror, Ngarakebesang, remnant forest behind PPR
Rubiaceae	*Timonius*	Costion 3498	18/02/12	*As above*
Rubiaceae	*Timonius*	Costion 3499	18/02/12	*As above*
Rubiaceae	*Timonius*	Costion 3500	18/02/12	*As above*
Rubiaceae	*Timonius*	Costion 3501	18/02/12	*As above*
Rubiaceae	*Timonius*	Costion 3502	18/02/12	*As above*
Rubiaceae	*Timonius*	Costion 3503	18/02/12	*As above*
Rubiaceae	*Timonius*	Costion 3504	25/02/12	Koror, last island before KB bridge on left, half limestone, half volcanic
Rubiaceae	*Timonius*	Costion 3505	25/02/12	*As above*
Rubiaceae	*Timonius*	Costion 3506	25/02/12	*As above*
Rubiaceae	*Timonius*	Costion 3507	25/02/12	*As above*
Rubiaceae	*Timonius*	Costion 3508	25/02/12	*As above*
Euphorbiaceae	*Cleidion sessile Kaneh. & Hatus.*	Costion 3509	26/02/12	Koror, Rock Islands, Ponapea population
Annonaceae	*Polyalthia merrillii Kaneh.*	Costion 3510	23/02/12	Koror, Rock Islands, old Palauan settlement area with Japanese WWII remains
Rutaceae	*Melicope palawensis (Lauterb.) T.G. Hartley*	Costion 3511	23/02/12	*As above*
Apocynaceae	*Lepiniopsis trilocularis Mgf.*	Costion 3512	23/02/12	*As above*
Rubiaceae	*Timonius corymbosus var. takamatsui Val. (Fosb. & Sach)*	Costion 3513	23/02/12	Koror, Rock islands
Elaeocarpaceae	*Elaeocarpus rubidus Kaneh.*	Costion 3514	23/02/12	Koror, Rock Islands, old Palauan settlement area with Japanese WWII remains
Myrsinaceae	*Discocalyx palauensis Hosok.*	Costion 3515	26/02/12	*As above*
Rutaceae	*Melicope*	Costion 3516	26/02/12	*As above*
Olacaceae	*Olax sp.*	Costion 3517	28/02/12	Koror, Rock Islands, near cemetary reef

CEPF Large Grant Final Project Completion Report

Threatened Endemic Plants of Palau

Organization Legal Name

University of Adelaide

Project Title

Threatened Endemic Plants of Palau

Date of Report

30-June-2011

Report Author and Contact Information

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CEPF Region

Polynesia-Micronesia Hotspot

Strategic Direction

3. Safeguard and restore threatened species

Grant Amount

$36,050

Project Dates

May 1, 2010 – Apr 30, 2012

Implementation Partners for this Project

Please explain the level of involvement for each partner

The Belau National Museum was the primary host and collaborator for this project providing office space, field-lab space, access to the natural history collections, and use of truck for field work. The BNM herbarium curator, Ann Kitalong, assisted with field logistics, planning and organization of meetings and vehicle logistics. The BNM natural history section technician Van Ray Tadao assisted periodically with field work and routinely with logistics in the field-lab and collections and the Natural History Section manager, Alan Olsen, helped with determining species IDs for insect photos during the pollinator study. PALARIS, Palau's national GIS service assisted with mapping presence absence data and estimating total area of occurrence for species inventoried. The local state government of Ngeremlengui provided field assistance for the Parkia survey. We also hosted a couple meetings to stimulate interest and initiate action on long term biodiversity inventory and progressing Palau's Endangered Species Act. Members from several of Palau government organizations and NGOs attended these meetings including: Palau Conservation Society, Palau Forestry, the Bureau of Agriculture, The Nature Conservancy, Ministry of Arts and Culture and PALARIS.

Conservation Impacts

Please summarize the overall results/impact of your project.

PLANNED LONG-TERM IMPACTS

3+ years (as stated in the approved proposal): Progress in understanding of Palau's endemic plant biodiversity is obtained through a network of local community members and international research collaborators. Knowledge of species distributions of all Palau's endemic plants is achieved through standardized long term survey methodologies and coordinated data management. These resulting data will enable researchers and community members to make better informed decisions about biodiversity conservation in Palau and network with other small island nations in the Pacific with similar biotas and threats.

Actual Progress Toward Long-term Impacts at Completion:

SUMMARY

Numerous collaborations were established throughout the course of this project (see below). Specific progress in the knowledge of the species distributions was obtained for a total of 15 of Palau's endemic plants (See pp 9–17) and through our hosted meetings and public talk at the Belau National Museum we communicated the aims and preliminary results of the project thereby emphasizing the importance of a continued effort to document Palau's endemic flora. Through our collaboration with the University of Hawaii, our aim to progress Palau's capacity for databasing its biodiversity collections was achieved beyond our original aspirations. With local agencies we discussed options and methods for long-term survey efforts to continue this work and it was determined that ample internal funds were available through Palau's green tax initiative to support the continuation of such work. Progress in getting a local agency to take the lead on starting a new proposal written up was not made during the project term however, a NSF grant was submitted in collaboration with the New York Botanic Garden to fund further collecting in Palau in previously unexplored areas.

Several new collaborations were established with international research collaborators through this grant. These include:

Jolie Liston, Senior research scientist, Australian National University

Jolie collaborated with us on our paper 'Using the ancient past to establish threat in poorly inventoried regions' (Costion et al. 2012) by providing an extensive dataset of archaeological evidence which helped form the basis of our argument for long term decline in forest cover on the Palau islands and the anthropogenic origin of savannas. This unique paper advocated an interdisciplinary approach combining expertise of two traditionally separate disciplines; botany and archaeology, and the consideration of population declines extending beyond the modern era into the archaeological record.

Akiko Iida, PhD student, University of Tokyo, Japan

Akiko collaborated on the 'Using the ancient past to establish threat in poorly inventoried regions' paper by also providing modern evidence of forest cover loss. After this project was complete we used the data from her PhD thesis to form the basis of a second IUCN submission attempt for Palau's endemic plants. Her thesis compiled an extensive dataset on forest cover loss since the Japanese era from 1921 to current and enabled us to justify listing of Palau's endemic plants as Vulnerable under IUCN Criterion A2(c).

Dr. Michael Thomas, the Curator of the University of Hawaii's herbarium

Michael received a NSF grant to database all herbarium specimens in the Pacific Islands and make the data publically available through a website (www.pacificherbaria.org). This was an enormous contribution towards the aims of this project. The data will all be standardized across the Pacific and facilitate progress in understanding distribution of species, their taxonomic boundaries, and networking between small Pacific institutions.

Timothy Gallaher, PhD student, University of Hawaii

Timothy is making a very big direct contribution to the aims of this project by defining species boundaries of Palau's *Pandanus* species through genetic techniques. This in-kind contribution is helping both the immediate short-term goals of the project and the long- term impacts.

Dr. Tim Utteridge, Royal Botanic Gardens Kew

Tim is an expert in the plant family Myrsinaceae, and made a direct contribution to this project by helping identify Palau's allegedly single island endemic *Maesa canfieldiae* as a different species, native to New Guinea, that was introduced to Palau during WWII. Tim will also be reviewing other collections made during the project including the status of Palau's *Medusanthera* of which there has been uncertainty regarding if it is a Palau endemic or more widespread species

Dr. Michael Balick, Vice President, New York Botanical Garden

Michael Balick has been conducting research on the ethnobotany of Palau for several years in collaboration with the Belau National Museum. He visited Palau during our CEPF project, and invited us to contribute to his next book on the ethnobotany of Palau. Plans were made to include a chapter in this book on the folk taxonomy of Palau's endemic plants. This chapter includes new names in the Palauan language for plants that previously did not have vernacular names. This outcome in particular will have many benefits to the local community and enable locals to identify and conserve their endemic flora better.

Dr. David Lorence, Director of Science, National Tropical Botanic Gardens, Kauai

David Lorence, has helped with identification of plant collection in Micronesia for many years. He is also a Rubiaceae expert and will be helping delimit species boundaries for Palau's *Timonius* complex, including *Timonius salsedoi*, which is allegedly endemic to the tiny island of Malakal.

Professor Steve Darwin, Tulane University, New Orleans

Steve Darwin is a world expert on the genus *Timonius*, Rubiaceae, and has agreed to collaborate on a revision of Palau's *Timonius* species, which will be a subsequent outcome of the data and collections made during the CEPF project.

Dr. Art Whistler, adjunct professor for the University of Hawaii

Art has been collaborating with local researchers in Palau for several years now and continued to provide assistance with identifying collections throughout the duration of this CEPF project. He also provided helpful comments and advice during the IUCN submission process.

Professor Andrew Lowe, Department head, University of Adelaide

Andrew provided instrumental comments and direction for increasing the international profile of our CEPF project during the write up stage of the paper we published in the international scholarly journal *Biological Conservation* and continues to help promote this work in other outlets.

Dr. Wayne Law, Post Doctoral Research Fellow, New York Botanic Garden

During the CEPF project, Craig Costion and Ann Kitalong were invited by Wayne Law to be senior research personnel on an NSF proposal, which aims to survey unexplored areas of the interior of Babeldaob Island in Palau.

PLANNED SHORT-TERM IMPACTS: 1 TO 3 YEARS

The report and accompanying data will increase local knowledge of Palau's endemic plants and enable many to be officially listed on the IUCN red list website. Palau's government and conservation authorities will have more knowledge to pursue future legislation for protecting endangered plant species and for the identification key biodiversity areas to be included into Palau's Protected Area Network (PAN legislation).

Actual Progress Toward Short-term Impacts at Completion:

Progress was obtained on the local knowledge of all species specified in the project proposal for specific inventory including 15 additional species. Furthermore we took bringing the results of science to the community to a new level by devising names in the Palauan language for all of Palau's endemic plants through consultation with local elders. IUCN submission was rejected on the first attempt due to our methodology extending beyond the 10 year or 3 generation time frame for data on habitat/population decline. Instead of seeing this as a setback we saw it as an opportunity and published our findings in *Biological Conservation* calling for the conservation community to consider long term declines of species not just declines in the short term. A second attempt of IUCN submission for Palau's endemic flora, using a methodology consistent with the IUCN Criteria framework, is now in review. The outcome of this assessment will ultimately affect legislation for threatened species in Palau. In either case, much progress was made during the course of the project by promoting the need to monitor threatened species, particularly Palau's endangered palm, *Ponapea palauensis*. It is now written up in the Koror state government strategic plan to support local research and conservation efforts of this threatened species.

Describe the success or challenges of the project toward achieving its short-term and long-term impact objectives

Please refer to PART 1 of this publication – **Project Objectives and Achievements –** for full detail of all project components and their planned vs actual achievements:

COMPONENT 1 Achieve complete IUCN red-listing status for all sufficiently known endemic plant species (approximately 51 species).

COMPONENT 2 Reduce the data deficiency gap for Palau's endemic plant species by approximately 10%.

COMPONENT 3 Population size and relative abundance for four threatened plant species with small, restricted ranges is clarified and documented.

COMPONENT 4 A long-term strategy is developed with local stakeholders to address the data deficiency gap for all remaining endemic plants in Palau.

COMPONENT 5 A national database of all historic plant collection records from Palau is updated to enable species distribution mapping and prioritization of poorly collected localities.

Were any components unrealized? If so, how has this affected the overall impact of the project?

For Component 1, yes and no. Initially our attempt to get all endemic plants (for which sufficient data is available) IUCN listed failed but shortly before the end of our project a new dataset became available that overcame the data limitations we had initially. Our second attempt will still be in review by IUCN at the time of submitting this report.

For Component 3, one of the four species, *Timonius salsedoi*, by necessity must be left unresolved until further genetic work can be done. The project however enabled thorough collection of samples that will allow this work to be done sufficiently. The species *Pandanus peliliuensis* is also pending some lab results from genetic work in progress. These results should provide an outcome fairly soon. Based on the morphology, we feel confident that this species is not endemic to the island of Peleliu and is abundant across the limestone islands, thus the primary objective is complete. Given that we surveyed five instead of four species (as was planned in proposal) and only one is left unresolved, Component 2 is for the most part fully realized.

For Component 4, we hoped to see more local initiative to identify a specific funding source and initiate a grant proposal but this will happen on its own time. The stage is set for making it happen in any case, which was what we committed to do.

Please describe and submit (electronically if possible) any tools, products, or methodologies that resulted from this project or contributed to the results.

Included in this publication:

- List of herbarium specimens collected during the project *(refer to Appendix).*

A series of additional reference materials were included as Annexes in the report submitted to CEPF:

- Costion, C., J. Liston, A. H. Kitalong, A. Ida, and A. J. Lowe. 2012. Using the ancient past for establishing current threat in poorly inventoried regions. *Biological Conservation* 147:153-162. *Published paper, which was developed from rationale of our first IUCN submission attempt.*
- Second IUCN assessment submission, derived from data from Akiko Iida's doctoral dissertation.
- Complete IUCN assessment for *Ponapea palauensis.*
- Complete IUCN assessment for *Parkia parvifoliola.*
- Hosted meeting and symposium agenda, notes, and list of participants.
- *The folk taxonomy of Palau* – A list of new and existing names for Palau's endemic plants in Palauan.

These supplementary materials can be made available upon request.

Lessons Learned

Please refer to LESSONS LEARNED on page 7 of this publication.

Additional Funding

Additional donor who supported this project and any funding secured for the project as a result of the CEPF grant or success of the project:

Donor	Type of funding
University of Adelaide	In-kind donation

Sustainability/Replicability

Summarize the success or challenge in achieving planned sustainability or replicability of project components or results.

The nature of the species specific inventory work may not always require follow up work, however continued effort towards progressing knowledge on Palau's endemic flora would be the sustainability goal. Since this project was closely allied with the Belau National Museum sustainability was achieved. BNM will continue to receive support from other sources to expand their collections, database, and knowledge of Palau's flora.

Summarize any unplanned sustainability or replicability achieved.

One of the most interesting unplanned outcomes of this project was the list of Palauan names for Palau's endemic plants. Prior to the project very few of Palau's endemic plant species had vernacular names. We felt that ensuring that each taxon had a local name was crucial to engaging the community in the long-term goals of our work. We spent a few weeks sitting with a few knowledgeable Palauan elders and showed them all the information we had about each species, and let them come up with names for each one in the Palauan language. Although at the time of report submission, this manuscript is still in review, we feel in the long run this may be one of the most influential outcomes of the project. Without a local name it is hard for people to relate to the need to conserving something they don't know anything about, but once a species has a Palauan name, people will relate to it immediately and want to know more about it. This side-project was not part of our initial short-term objectives, but we thought the potential long- term community impact made it worthwhile.

Information Sharing and CEPF Policy

CEPF is committed to transparent operations and to helping civil society groups share experiences, lessons learned, and results. Final project completion reports are made available on our website, www.cepf.net*, and publicized in our newsletter and other communications.*

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