

## **PROFILE paper**

### **Conservation and management of the endangered Fiji sago palm, *Metroxylon vitiense*, in Fiji**

#### **ABSTRACT**

Recovery planning is a key component of many threatened species conservation initiatives and can be a powerful awareness raising tool. One of the largest impediments to conservation efforts in the Pacific region however, is the lack of ecological data and its subsequent effects on the development of feasible and useful recovery plans for threatened species. Without these plans, the understaffed, underfunded and often technically ill-equipped conservation agencies face huge difficulties in planning, prioritizing and conducting conservation activities to adequately protect biodiversity. The Fiji sago palm, *Metroxylon vitiense*, is an endemic endangered palm species whose survival is heavily dependent on a feasible species recovery plan. It is geographically restricted and threatened by habitat destruction and overexploitation for thatch for the tourism industry and palm heart consumption by local consumers. Despite its threatened status, *M. vitiense* is not currently protected by national or international legislation. Recent field surveys and extensive stakeholder consultation have resulted in the production of a species recovery plan highlighting the importance of the species and advocating sustainable harvesting rather than complete bans to promote conservation. This article summarizes the recovery plan and its current effects on the status of *M. vitiense* in Fiji. We also discuss the role of different stakeholders in the conservation of *M. vitiense*, including the absence of significant behavioral changes by the largest consumer - the tourism industry, and the importance of recovery plans for biodiversity conservation in the Pacific.

**KEY WORDS:** Soga; sago; palm; sustainable tourism; threats; management; conservation; local communities

The tropical islands of the Pacific have particularly high proportions of endemic species and subsequently contain three of the world's 39 known global biodiversity hotspots (Mittermeier et al. 2004). With rapidly growing human populations, pressure from natural resource extraction and the imminent impacts of climate change, this unique biodiversity is amongst the most threatened in the world (Woinarski 2010, Kier et al. 2009, Kingsford et al. 2009, Mittermeier et al. 2004). In most Pacific nations this biodiversity crisis is driven by habitat loss and degradation, although other factors, such as invasive species, are also important (Kueffer et al. 2010, Woinarski 2010, Kingsford et al. 2009). These problems are exacerbated by poor community and political awareness of conservation issues and practices (Morrison and Buckley 2010). Despite commitments through National Biodiversity Strategy and Action Plans (NBSAPs) in association with the Convention on Biological Diversity (CBD), the presence of numerous non-government organisations (NGOs) and conservation programs, and increasing availability of funding, rapid habitat degradation and species loss in Pacific Island countries continue (Wardell-Johnson et al. 2011, Lees and Siwatibau 2009, Shearman et al. 2009). As most land in the Pacific (> 80%) is under customary (or traditional) ownership and managed by customary groups (Ward 2000), the limited involvement of local landowners in the conception, planning, implementation and management of conservation projects has also played an important role in the failure of many conservation activities in the region (Hunnam 2002).

As landowners are ultimately responsible for any activities on their land, conservation areas and actions generally cannot simply be implemented by the government or other organizations, but require support and approval by landowning communities. In addition, most rural landowning communities in Pacific countries still possess extensive knowledge of their environment that is extremely valuable for developing appropriate and effective conservation approaches (Raynor and Kostka 2003, Baines and Hviding 1992, Cox and Elmqvist 1991). As a result, most successful conservation programs/activities in the region involve community co-management (Morrison and Buckley 2010, Hunnam 2002).

While local communities are of critical importance in Pacific conservation management, they (in conjunction with Provincial or National government environment agencies) are not always aware of important conservation issues. Recovery planning, which collates quantitative data for species with

expert opinion to identify threats, management priorities and recovery actions, is a key component of many threatened species conservation initiatives and can be a powerful awareness raising tool for all stakeholders during the initial plan proposal and final public consultation phases (Gruber 2010, Schwatz 2008). Awareness raising through the recovery plan process in a Pacific context is more common in the initial stages involving community consultation to generate support for the plan and its associated conservation initiatives.

While recovery planning is a significant component of conservation, one of the largest impediments to conservation efforts in the Pacific region is the lack of ecological data and its subsequent effects on the development of feasible and useful recovery plans for threatened species (Kingsford et al. 2009). Most countries in the region (Australia and New Zealand excepted) do not have National Lists of threatened species nor complete current IUCN Red Lists to highlight and promote threatened and vulnerable taxa (Morrison in press). Even countries with relatively good conservation programs such as Fiji, have very few species recovery plans in place for threatened species management. The absence of such plans exacerbates difficulties faced by the understaffed, underfunded and often technically ill-equipped, conservation agencies in the region to plan, prioritize and conduct conservation activities and therefore adequately protect biodiversity.

The Fiji Sago palm, Soga (*Metroxylon vitiense*) is one example of a species in the region whose conservation and survival is heavily dependent on the development and implementation of a species recovery plan. Soga is endemic to Fiji with natural populations only occurring on the islands of Viti Levu and Ovalau (NFMV 2008a, NFMV 2008b, Rounds 2007, Watling 2005). Historically, it has always been a species with a very restricted distribution – a 60 km coastline and its hinterland in southeast Viti Levu. Despite its small geographic range, Soga was once abundant throughout the Navua and Rewa River Deltas on Viti Levu (Southern 1986, Seeman 1862). Today, only 15 isolated populations (> 0.5 ha) survive in the area, most of which are significantly threatened by habitat destruction and unsustainable harvesting (NFMV 2008a).

Due to its restricted distribution, aspects of its biology and threats from habitat destruction and harvesting, Soga has been classified as Endangered using IUCN criteria with its species assessment currently under review with IUCN. It is not included on the list of endangered species

protected by national legislation in Fiji or any other international lists. Recently (2007-2008), wide-ranging field surveys and consultation with landowners, harvesters and users (thatch and palm heart) have enabled the production of a species recovery plan for Soga.

This recovery plan has been accepted by the Fiji Government to improve the status of Soga in the country and manage its conservation and sustainable use by local communities. This profile paper summarizes the recovery plan, including the decision on whether to pursue a complete ban or a sustainable harvesting approach, discusses its bearing on the conservation of Soga in Fiji and the importance of species recovery plans for biodiversity conservation in the Pacific. In addition, we discuss the need for extensive involvement of local landowning communities in all stages of the recovery plan development process, including community co-management, particularly in areas where local communities are the landowners.

## **Study area and species description**

The Republic of the Fiji Islands consists of approximately 300 islands located roughly 3000 km east of Australia in the Pacific Ocean (between 16° and 20°S, 177° and 175°E). There are four main islands in the group: Viti Levu, Vanua Levu, Taveuni and Kadavu (Figure 1). Natural populations of Soga have only recorded from the islands of Viti Levu and Ovalau (Figure 1). Although once widespread within its restricted distribution, today only 15 isolated populations (> 0.5 ha) remain in small pockets on the coastal plains, with three significant inland populations along the Navua River (Figure 1). The small, single Ovalau population is believed to be a relict population from the last ice age when Ovalau was connected to Viti Levu by means of a land bridge. There is at least one small population on Vanua Levu but this is considered to be an introduced population (Watling 2005).

Another sago species *Metroxylon warburgii* is found on the Fijian island of Rotuma where it has a long cultural history of sustainable starch manufacture use (McLatchey and Cox 1992). This species has been introduced from Rotuma to several locations in Viti Levu and Vanua Levu. No naturally established stands of *M. warburgii* are known.

### ***Metroxylon vitiense* (Soga) biology**

Soga is a robust, monocarpic palm with a large single trunk growing to about 15 m. Monocarpic palms differ from most palms in that no fruit are produced during the normal lifespan of the tree (Watling 2005). After 15-25 years a large flowering structure is produced above its crown on which several fruit develop. As the fruit matures, all the leaves die, the fruit drops to the ground and then the adult palm dies. The fruit are large, typically 9 cm in length and float, and therefore are readily dispersed by water (Watling 2005). Flying foxes (*Pteropus* spp.) and large parrots (*Prosopieia personata*) are also dispersal agents.

Soga normally occurs in dense stands on alluvial, poorly-drained plains landward of coastal swamps but inland populations on alluvial flats adjacent to major rivers are also known. All known populations are below 30 m.a.s.l with the exception of one near the Upper Navua River gorge below Nabukelevu which is situated at 100 m.a.s.l (Rounds 2007). This stand and another on the banks of the Navua River below the gorge are not mono-specific stands but occur mixed within native forest.

### **Current population status**

Fifteen mono-specific stands of Soga are known with a combined original area of approximately 450 ha. Of these, only one (Nukusere, 15 ha) is likely to be safe at the present time (Table 1). Another, Culanuku (20 ha) has been restored by the local community and NGO volunteers and with continued community support will likely survive. The others have varying chances of survival, but all will need a range of management interventions from cessation of harvesting to intensive weed removal and drainage reversal. Another approximately 450 ha of Soga is mixed with native forest and mahogany plantation on the banks of the Navua River in the vicinity of Upper Navua gorge. These populations are likely to retain some Soga in the long term, although the Namaratu site will be severely damaged when the mahogany plantation which has overplanted it, is harvested. The other two sites are partly within the Upper Navua Conservation Area (Fiji's first and sole Ramsar site). This population is receiving active conservation attention from Rivers Fiji Ltd., a rafting tourism company operating in the Navua Gorge.

## Causes of Decline and Threats

Unlike some *Metroxylon* species, Soga never produces suckers and so seeds are the only agent of regeneration. The long period between seed germination and a single fruiting event is a reproductive method which renders even large populations of Soga vulnerable to sudden and dramatic disturbance. Unlike Rotumans and Fiji's neighbors in Vanuatu, Fijians do not have a cultural history of Soga use. Although Fijians used Soga extensively as thatching material during the twentieth century, it is quite likely that its use as such was learned from Solomon Islanders resident in Fiji, as indeed the people of Deuba explicitly told the anthropologist Geddes during his stay at Deuba village, from 1942 to 1943. Geddes relates that “. . . *the use of the leaf itself is comparatively recent, having been learnt from indentured Solomon islanders....*” (Geddes 2000). Currently, Soga is rarely if ever used for thatching materials for Fijian houses, because it is very labour intensive and because of the increased use of corrugated iron as a roofing material. As a result there has been no opposition by landowners to loss of natural Soga populations. The distribution of Soga has dramatically decreased to its current relict populations primarily through a gradual drainage of coastal swamps and clearing of coastal forests for agriculture, gardens and pastures. Removal of the normal closed canopy and swamp drainage dramatically increases the ability of invasive weeds and creepers to outcompete young palms and prevents the establishment of germinating palms. Lowering the water table enables the occasional penetration of fire during dry seasons, as well livestock, both of which seriously impact juvenile Soga (NFMV 2008a).

Until relatively recently, these threats acted at a gradual rate on a steadily diminishing stock of Soga. Within the last thirty years however, this gradual swamp habitat destruction and modification has been replaced by dramatic new threats in the form of (i) large scale coastal drainage schemes (Wainikalou and Toquru), (ii) new residential and agricultural subdivisions (Pacific Harbour), (iii) the growth of a non-traditional ‘palm-heart’ trade; and (iv) the introduction of unsustainable leaf harvesting for thatching brought about by demand from the tourism industry (NFMV 2008a).

## **Drainage and subdivision**

Drainage of sago wetlands until the 1970s primarily occurred as an inevitable consequence of the increasing need for agricultural land and the intensification of agricultural production. In the 1970s, the largest drainage activities occurred around Pacific Harbour when 400 ha of sago and other wetlands were drained for the Pacific Harbour residential, resort and golf course development. The most severe recent loss (since 2005) has been through the subdivision and drainage of the largest remaining population (approximately 200 ha) of Soga at Dakunikoro, Pacific Harbour for residential development. Many regenerating and some adult palms remain at Dakunikoro but a drainage system has been installed, roads constructed and most lots are already sold and clearing has commenced. The process cannot be reversed and the whole population must be considered lost.

## **Palm heart trade (Figure 2)**

A report on the palm heart trade was commissioned by NatureFiji-MareqetiViti (NFMV 2008c). Data gathered during the survey suggests that at least 200 palms are felled per week between all the vendors involved in the trade to cater for palm heart consumers. This number may increase up to 250 trees during special religious or cultural events rendered important for Indo-Fijians.

Tree selection for palm heart harvesting is based on trunk size of the palm tree. Theoretically, older trees (10 years or more) with a mean dbh of 50-60 cm contain the heaviest weight of palm heart and are selected where possible for harvesting. However, young palms have a valuable heart, and vendors state that individual trees are ready for harvesting at about 4 – 6 years of age which is well below the known age for fruiting (15 years). Unlike other commercial palm heart industries elsewhere that use species which have suckers so the palm is not killed when the main trunk is harvested (McClatchey et al. 2005), harvesting of Soga for palm heart results in the death of the tree.

As harvesting for Soga palm heart takes place without regard for propagation or regeneration, and the fact that it was not traditionally consumed by indigenous Fijians, the harvesting of roughly 200-250 palms a week represents a new and serious threat to extant populations.

## Harvesting for thatch

Historically insignificant in indigenous Fijian communities, there has been a sudden and dramatic increase in the demand for Soga thatch from the tourism industry to provide a ‘traditional bure’ look (Figure 3) which has increased exponentially over the past 10 years. Currently, shingles which are Soga leaflets folded over a c.a.1 m length of bamboo are the standard thatching method (Figure 4c), and are sold exclusively to the tourism industry as local communities prefer to use corrugated iron in the construction of village houses. Shingles used to sell for \$0.80 to \$2.00 each, mainly to middle men who supply resorts directly or to contractors for the tourism industry. In 2010, the price has risen to between \$3-5 per shingle, because of the lack of supply and an increased awareness of the value of the Soga thatch industry by Soga landowners. Shingles generally last 4-5 years before needing replacement and may need to be replaced more frequently after cyclones or periods of extended bad weather. The current value of the thatch industry is estimated to be FJ\$3 million annually and provides cash income opportunities for approximately 300 participants, mainly women in rural villages (NFMV 2008d).

There are two methods used for the harvesting of fronds for thatching. The first involves felling of large trees using axes and chainsaws (Figure 4). Palms are selected based on the number of fronds they bear and the condition of the fronds. Harvesters prefer more fronds per palm, and leaflets that are wide and long as this reduces the amount needed for each shingle. Up to 10 shingles can be produced from one palm. This method enables the Soga palm heart to be harvested as well. The second method is the harvesting of fronds from standing juvenile palms. This is easier but the number of quality leaves per palm is far fewer and more work is required in finding suitable juvenile trees for harvesting than adult trees. It has also led to a drop in the quality of shingles as the fronds of juvenile palms have narrower and less long-lasting leaflets.

Excessive leaf removal and/or felling for thatch (and the palm heart trade) opens up the canopy of Soga stands and introduces a serious threat of weed invasion by the vine *Merremia peltata* and other creepers which can outcompete Soga for resources such as light and nutrients as well

smother young palms and even kill adults before they fruit. In addition, the heavy removal of leaves from juvenile palms stunts their growth and keeps them in a permanent juvenile condition.

## **Conservation management of Soga**

### **Past and current management**

Soga has always been regarded as abundant without any systematic monitoring to support this assumption. In 1993 Fiji's National Environment Strategy recommended that the Soga be the subject of a new protective mechanism suitable for species of cultural interest (GoF 1993). This would involve the introduction of a ban on the commercial sale of these species pending extensive awareness raising, after which they could be considered for total protection. Since then and despite the recommendations for a protective mechanism, Soga has received no conservation management at all, and unlike Fiji's other endemic palms it is not protected under the Endangered Species Protection Act (2002). As Soga was never a part of the traditional agricultural or agro-ecological system in Fiji like palms in neighboring countries such as Vanuatu and Samoa, it was seen as expendable in the face of demand for the land on which it occurred for other purposes. Consequently, Soga was not considered seriously endangered until the results of an MSc thesis by Isaac Rounds (2007) demonstrated that the rush for sago palm thatch for the tourism industry had led to massive unsustainable harvesting and a significant decline in population size and viability.

### **Future management plans for Soga**

The future management plans for Soga are based on the recently completed Soga recovery plan (2010-2015) prepared by NatureFiji-MareqetiViti which was endorsed by the Fiji Department of Environment in June 2010 (NFMV 20010). The sustainable harvesting approach rather than outright prohibition recommended in the recovery plan is not without its critics who believe that if Soga is as rare as is claimed, its use must be banned. While simple in theory, in reality in the face of a steadily increasing human population, absence of indigenous cultural values/uses of Soga and the demand for the accessible but marginal areas where Soga is found, Soga will not survive unless there is a use or a

market for it, except in some strictly protected sites. Hence, NatureFiji-MareqetiViti's recommended conservation approach, which is to stimulate the market for thatch, but by using sustainable harvesting methods.

The management recommendations listed in the recovery plan are categorized into five main groups.

*1) Update listing of Soga at both the international and national level*

The first critical step in the management of Soga is to update its threatened status at both the international and national level. The status of Soga on the IUCN Red List is currently being evaluated and based on its current distribution and ongoing threats, it should be listed as Critically Endangered (CR A4d or B2abv) or Endangered under IUCN threat criteria. Following evaluation, the Soga will be added to the list of species covered by the Fiji Endangered Species Protection Act (2002) which includes all species listed by IUCN.

*2) Public awareness/ working with communities*

*(a) Local landowning communities*

Since 2007, NatureFiji-MareqetiViti has held a series of forums and workshops for landowners, harvesters and consumers on the Soga issue and the various threats to the species. As a result of this ongoing work, Soga landowners are now aware of the endangered, endemic and restricted distribution of the Soga and are much better informed of the value of the Soga thatch industry. Until mid 2010 when the Serua Provincial Office stepped in to control the thatch trade in Serua Province, the thatch procurement was run by the harvesters and the middlemen, not by the landowners. This intervention has not happened in other provinces and landowners in these other areas are not adequately compensated for the supply of a valuable commodity which may explain the limited interest in some communities to conserve and sustainably harvest Soga.

To date, actions taken to improve the participation of local landowners in Soga conservation include preparing a register of landowners of all known remaining Soga sites and involving these landowners in formal and informal consultative discussions to understand their interest or use of Soga.

In 2008, NFMV drew up Sustainable Harvesting Guidelines for Soga which were translated into the vernacular and circulated to each community and freehold landowner. These guidelines were well received and have since been endorsed by all stakeholders including the Department of Environment and the National Environment Council. The guidelines have been officially adopted by the Serua Provincial Council which took charge of all commercial dealings for Soga thatch in late 2010 however, they have not always been used in the field. The Trust Deed for an Association of Soga palm landowners is close to being accepted and this should enable the landowners to largely control the marketing of Soga thatch and ensure a better financial return.

(b) Provincial authorities

Eleven of the known Soga populations are in the Serua Province, three in Namosi Province and two in Tailevu Province. Working with the communities is best undertaken with the understanding and support of the provincial authorities. Consequently, a good understanding by the provincial authorities of the threatened status of the Soga and the need for management and use restrictions is vitally important. Such understanding and support will provide the foundation for working with the communities.

Potential actions to improve the inclusion of all concerned Provincial Offices include (i) conducting formal presentations to the Namosi and Tailevu provincial authorities which have not yet been approached (the Serua provincial authority has been included from the start of the project and is a key member of the Recovery Team), (ii) to undertake landowner and community consultations together with provincial authority personnel, and (iii) involve the provincial authorities in the review and development of the Species Recovery Plan.

(c) Freehold landowners

Some of the remaining Soga populations occur on freehold land (land owned by individuals or corporate bodies) and it is possible that there are some populations that are currently unknown. A special relationship between the conservation authorities and the freehold landowners is required to allow for effective protection of these populations. Some freehold landowners are actively conserving

remaining Soga stands and some have indicated they wish to undertake restoration activities, the most important of which will be to block the drainage lines and revert to high water tables.

Potential actions to improve the participation of freehold landowners in Soga conservation are similar as to those for local community landowners.

### 3) *Soga users*

#### (a) Thatch users – the tourism industry

Through awareness materials (reports and a DVD produced by NFMV) and targeted presentations by NFMV to local tourism chapters and at national tourism meetings, the tourism industry has been made aware of the endangered status of the Soga and the major effect unsustainable harvesting for thatch is having on natural populations. NFMV believes that unless drastic measures are taken to move to sustainably harvested Soga, the thatch industry *per se* will be completely lost within a decade (Watling *pers. comm.*). However, despite this information, there has been little or no observed change in the overall behaviour of the industry, although there are exceptions.

Potential actions to reduce the impacts of the tourism industry on Soga include (i) the preparation of sustainable harvesting guidelines and a methodology for enforcing its compliance, (ii) engagement with the tourism industry to achieve agreement on the purchase of sustainably harvested Soga, (iii) identify alternative thatch species that would meet the tourist industry demands for “cultural appearance”, and (iv) highlight to the industry the sustainable tourism marketing and promotional benefits associated with using sustainably harvested Soga.

#### (b) Thatch users - architects

Soga thatch is an ‘in-vogue’ artifact of pseudo-cultural reference used in tourism projects and consequently often included in architect plans. Activities to ensure that Fiji’s architects are fully aware of the endangered status of the Soga and the major effect harvesting for thatch is having on natural populations have already been conducted. These included the preparation and dissemination of written Soga awareness material by NFMV to the professional body of architects and the presentation of the Soga issue at a meeting of the body. This information was well-received by the body and to

date there have been no new resorts built using Soga. However, there are reports that one new integrated resort may be doing so with 95% of its construction yet to be completed.

(c) Palm heart users

The Soga palm heart trade is a serious contributor to the decline of accessible Soga populations. In order to promote the sustainable harvest and use of Soga by palm heart harvesters and vendors, a register of palm heart collectors and the location of their sales has been produced as well as the identification of Soga populations or stands from which Soga could continue to be harvested until such time as alternatives are available. Currently, a workable mechanism by which the trade of Soga palm heart can be controlled is being prepared, along with the provision of awareness materials for collectors and an explanation of the moves to protect the Soga and to substitute it with an alternative, commercial palm heart species.

The peach palm, *Bactris gasipaes* which is currently grown as an introduced, commercial crop in Hawaii and other parts of the world, has been identified as a suitable substitute for Soga palm heart as well as a crop which can be widely grown by rural communities to supply the tourism sector as a new crop (NFMV 2008c). To date the biosecurity requirements for peach palm and its importation have been completed, seeds imported from Hawaii, germinated and planted out in a facility run by NFMV which includes a seed orchard of 100 selected spineless palms, and 850 palms as a prototype commercial palm heart orchard. The intention is to maintain Fiji's peach palm population as a spineless one, and so only spineless seedlings will be allowed to grow (10-15% of the seeds germinate with spines). These spineless seedlings will be distributed to current Soga palm harvesters as well as other interested farmers as a commercial crop.

In order to highlight the unsustainable harvesting of Soga and the need to switch to an alternative species, palm heart consumers have been made aware of the threatened status of Soga, the Government's plan to put a moratorium on the sale of Soga palm heart and the plans to introduce a new species to the market. NFMV has held a public meeting in Suva specifically advertised for palm heart consumers and published articles in the national newspapers on the issue.

#### *4) Conservation actions*

##### *(a) Prioritize populations*

As there is great variation in the status of the remaining Soga stands and their potential for protection and/or restoration, there is a need to prioritize management actions for the different populations. Currently all known populations are being ranked based on criteria including population size, threats, land tenure, and landowner attitudes. Based on this ranking, populations of national significance will be identified and prioritized for restoration and/or protection management.

##### *(b) Biological inventories*

While the largest stands of Soga are currently known, it is possible that there may be additional smaller stands which could benefit from management. Consequently, surveys are currently underway to locate Soga populations in suitable habitats throughout Fiji.

##### *(c) Threat analyses*

As the different populations of Soga occur in areas with different landowners and threats, protection and management options will vary with the circumstances of the stands and the attitude of the landowners. Plans are underway by NFMV to approach the owners of Soga stands to discuss options for legal and physical protection of the populations as well as welcome any approaches from landowners with suitable sites. Following these discussions, Stand Management Plans will be prepared by NFMV and implemented by Provincial Councils and the Department of Environment in consultation with the landowners.

##### *(d) Ex-situ populations*

Given the precarious nature of the majority of the existing Soga stands, naturalized ex-situ stands are an important conservation strategy and should be used to maintain the genetic diversity of the species. Currently there is a project to identify landowners with suitable sites and interest in the establishment of ex-situ populations. NFMV with the National Trust for Fiji has established an ex-situ population of

about 120 sago trees in suitable habitat in the Garrick Reserve. Following this, maintenance of the existing genetic structure of the species will be planned in the different naturalized populations.

(e) Sustainable harvesting practices

In order to develop sustainable harvesting of Soga for both the thatch and palm heart industries, there is a need to advocate for the recognition of Soga as a forest product whose harvesting is then subject to management by the Forestry Department. As previously mentioned, sustainable harvesting guidelines have been prepared, translated into Fijian and widely distributed as the best practices for the industry as well as a means to ensure compliance (NFMV 2008d).

5) *Research*

(a) Genetic variation

The Soga is currently fragmented into at least 15 populations which, given the current state of knowledge, are believed to have no chance of interbreeding, including a number of sites with very few individuals remaining. Maintaining the genetic diversity within the species is important for its restoration as a secure, thriving member of the wetland forest ecosystem. Research priorities in this area are (i) to document the genetic variation from as many populations as possible, (ii) to determine the implications of this variation in the conservation management of the species and, (iii) prepare a management plan to preserve the existing genetic variation.

(b) Invasive species

As Soga stands are easily invaded by native vines such as *Merremia peltata* and *Mikania micrantha* and other plants such as the pond apple *Annona glabra*, there is an urgent need to assess the importance of this problem in conjunction with canopy opening through harvesting and drainage.

(c) Ecosystem value

Currently we do not fully understand the role that Soga plays in its ecosystem at natural levels of abundance and ecosystem composition (predators, dispersal, pollinators, etc.). Given the former

abundance of Soga, this role may be substantial. A detailed study of the synecology of Soga needs to be undertaken including the variation in the current natural populations.

## **Lessons learned from the species recovery plan for Soga conservation**

There are several lessons to be learned from the on-going Soga conservation project. First, it is very easy for under-resourced regulatory authorities and local communities in the Pacific to be completely unaware of important conservation issues or ill-equipped to address them which can lead to species loss without outside intervention. In Fiji, the Soga is an endangered endemic species restricted to relatively few remaining sites and undergoing completely uncontrolled exploitation for two products. As such, its conservation deserves serious government intervention and widespread stakeholder support given Fiji's Convention on Biological Diversity (CBD) responsibilities. This intervention and support have not taken place and if it was not for the intervention of a domestic NGO (NFMV), it is not clear whether the conservation and recovery of Soga would have happened. It is clear however, that with the sudden escalation in unsustainable harvesting brought about by the tourist industry's whimsical desire for sago thatch, Soga could soon have been extirpated from all accessible locations. Surviving perhaps, only in the stands where it is mixed with native forest and on inaccessible sites adjoining the Navua Gorge.

The second lesson learned from this project is that assumptions should not be made as to allies in conservation recovery plans. In our example we continue to be surprised at how the tourism industry has not grasped a readily available "green initiative" and moved to assist in procuring only sustainably harvested Soga thatch. The assumption should be that the tourism industry is driven by primarily economic factors and an external economic driver, either through fines or increases in potential income associated with green tourism initiatives, will be needed to address social or environmental concerns.

The third lesson learned is that collaborations and partnerships are essential for the development of species recovery plans that benefit all stakeholders and subsequently increase the likelihood of successful species conservation. One of the more serious issues confronting NFMV

when it initiated the conservation campaign was whether to pursue a complete ban on both thatch or palm heart harvesting of Soga, or whether to pursue a sustainable harvesting approach. NFMV after discussions with some stakeholders decided to pursue the sustainable harvesting approach in the belief that landowners would understand and respond to the situation and that the main users, the tourism industry, would quickly respond positively. However, the current situation is that unless the estimated FJ\$3million/annum sago thatch industry is maintained through sustainable harvesting and the extant Soga stands restored, the industry will be completely lost within a decade and together with it, cash income opportunities for approximately 300 participants, mainly women in rural villages. Not all landowners have moved to take responsibility for the management of their Soga, but the Serua Provincial Authority has been bold and decisive in its actions, with NFMV acting as a technical adviser.

Underpinning, the whole initiative has been the wide consultation undertaken in 2007-2008 by NFMV and the subsequent drawing up of a species recovery plan which all stakeholders have subscribed to in principle and which is now endorsed by the Government. For key agencies, such as the Provincial Authorities and the associated regulatory authorities (i.e. Departments of Forestry, Agriculture, Fijian Affairs, Environment, etc.), the plan has played a key role. The direction which was adopted for Soga – sustainable use rather than a rigid ban on all exploitation could not have been articulated and accepted by all without the plan.

### **Importance of species recovery plans for species conservation in the Pacific**

In situations where the regulatory authorities are weak as a result of a lack of resources compounded by a pervasive inability to enforce regulations, a species recovery plan can be a focus for all stakeholders involved in the conservation of a particular species (Clark et al. 2002, Boersma et al. 2001). Previous studies examining whether species recovery plans improved species status (e.g., Bottrill et al. 2011, Taylor et al. 2005) however, have demonstrated that the presence of a recovery plan for a species does not necessarily influence the actions implemented or whether the species receive conservation attention. These studies have however, demonstrated that there are often other

unintended benefits arising from the recovery plan process including the generation of new or updated information on species, rediscovery of other missing species, leverage of funds and raised awareness of conservation issues among stakeholders (Bottrill et al. 2011). Consequently, the actual implementation and monitoring of the recovery plan actions and recommendations to evaluate plan effectiveness are as important as developing and producing the recovery plan itself (Boersma et al. 2001).

Species recovery plans have been successfully developed and implemented by stakeholders in Fiji for several critically endangered species including the Fiji Crested Iguana (*Brachylophus vitiensis*), the Fiji Petrel (*Pseudobulweria macgillivrayi*) and the Fiji Flying Fox (*Mirimiri acrodonta*). These plans have been tailored for each species in relation to their specific biology and threats, involved extensive consultation with all stakeholders, identified specific management protocols and personnel to monitor plan success through species recovery, and utilized opportunities for adaptive management through plan revision when new information becomes available, all of which are key features of effective recovery plans. The species recovery plan for Soga has followed these good examples, though it is difficult at this stage to determine whether the key component to date is increased understanding and awareness originating in the plan or the increased benefits accruing to landowners from cutting out the middlemen traders. Future monitoring of management effectiveness in the in-situ recovery of Soga is necessary to ensure that not only does the plan result in the successful conservation of Soga in Fiji, but that it also serves as a good example of how focused action and commitment through a species recovery plan can have significant benefits for threatened species conservation throughout the Pacific region.

## **Acknowledgements**

NatureFiji-MareqetiViti (NFMV) wishes to thank its project officers and assistants, Kolinio Moce, Laisiasa Waqairatu and Vilititati Seru who have been at the forefront of the work with the Soga communities. NFMV is extremely grateful to the Pacific Development and Conservation Trust and the British High Commission for funding over several years which has enabled the Soga project to

progress steadily with far reaching potential benefits both for the conservation of the endangered Soga and rural landowners and thatch harvesting communities. Guy Castley and two anonymous reviewers provided valuable comments on an earlier draft of this manuscript.

## **Literature Cited**

- Axford JC, Hockings MT, Carter RW (2008) What constitutes success in Pacific Island community conservation areas? *Ecology and Society* 13(2): 45-60.
- Baines G., Hviding E (1992) Traditional environmental knowledge from the Marovo area of the Solomon Islands. In: Johnson M (ed) *Lore. Capturing traditional environmental knowledge*. Dene Cultural Institute and the International Development Institute, Ottawa, pp 91-110.
- Bottrill MC, Walsh JC, Watson JEM, Joseph LN, Ortega-Argueta A, Possingham HP (2011) Does recovery planning improve the status of threatened species? *Biological Conservation* 144: 1595–1601.
- Clark JA, Hoekstra JM, Boersma PD, Kareiva P (2002) Improving U.S. Endangered Species Act recovery plans: key findings and recommendations of the SCB Recovery Plan Project. *Conservation Biology* 16: 1510-1519.
- Cox PA, Elmqvist T (1991) Indigenous control of tropical rainforest reserves: an alternative strategy for conservation. *Ambio* 20: 317-321.
- Geddes WR (2000) *Deuba: A Study of a Fijian Village*. Institute of Pacific Studies, University of the South Pacific, Suva.
- GoF (1993) *The National Environment Strategy: Fiji*. Government of Fiji & the World Conservation Union, Suva, 102pp.
- Gruber JS (2010) Key principles of community-based natural resource management: a synthesis and interpretation of identified approaches for managing the commons. *Environmental Management* 45: 52-66.
- Hunnam P (2002) *Lessons in conservation for people and projects in the Pacific Islands region*. United Nations Development Programme, New York.

- IUCN (2001) IUCN Red List Categories and Criteria: Version 3.1. IUCN Species Survival Commission. IUCN, Gland, Switzerland and Cambridge, UK.
- Kier G, Kreft H, Lee TM, Jetz W, Ibsch PL, Nowicki C, Mutke J, Barthlott W (2009) A global assessment of endemism and species richness across island and mainland regions. *Proceedings of the National Academy of Natural Sciences, USA* 106: 9322-9327.
- Kingsford RT, Watson JEM, Lundquist CJ, Venter O, Hughes L, Johnston EL, Atherton J, Gawelm M, Keith DA, Mackey BG, Morley C, Possingham HP, Raynor B, Recher HF, Wilson K A (2009) Major conservation policy issues for biodiversity in Oceania. *Conservation Biology* 23: 834–840.
- Kueffer C, Daehler CC, Torres-Santana CW, Lavergne C, Meyer J-Y, Otto R, Silva L (2010) A global comparison of plant invasions on oceanic islands. *Perspectives in Plant Ecology, Evolution and Systematics* 12: 145-161.
- Lees A, Siwatibau S (2009) Strategies for effective and just conservation: the Austral Foundation's review of conservation in Fiji. *Current Conservation* 4: 21-23.
- McClatchey WC, Cox PA (1992) Use of Sago Palm *Metroxylon warburgii* in the Polynesian Island, Rotuma. *Economic Botany* 46: 305-309.
- McClatchey W, Manner HI, Elevitch CR (2005) *Metroxylon amicarum*, *M. paulcoxii*, *M. sagu*, *M. salomonense*, *M. vitiense*, and *M. warburgii* (sago palm). In: Elevitch CR (ed.) *Species Profiles for Pacific Island Agroforestry*. Permanent Agriculture Resources (PAR), Holualoa, Hawaii.
- Mittermeier, R A, Gil PR, Hoffman M, Pilgrim J, Brooks T, Mittermeier CG, Lamoreux J, da Fonseca GAB (2004) Hotspots revisited: Earth's biologically richest and most threatened terrestrial ecoregions. *Agrupación Sierra Madre*, Mexico City, Mexico.
- Morrison C (in press). Impacts of tourism on threatened species in the Pacific: a review. *Pacific Conservation Biology*.
- Morrison C, Buckley R (2010) Oceania. In: Buckley R (ed) *Conservation Tourism*. CABI Publishing, Cambridge, pp 78-87.

- NFMV (2008a) Notes on the Threatened Status of Soga, the Fiji Sago Palm *Metroxylon vitiense*. NatureFiji-MareqetiViti, Unpublished Report available from NatureFiji-MareqetiViti.
- NFMV (2008b) Fiji Sago Palm Conservation and Sustainable Utilisation Project – Report on Phase 1. NatureFiji-MareqetiViti, Unpublished Report available from NatureFiji-MareqetiViti.
- NFMV (2008c) A Report on the Edible Palm Heart Trade of the Fiji Sago Palm *Metroxylon vitiense*. NatureFiji-MareqetiViti. Unpublished Report available from NatureFiji-MareqetiViti.
- NFMV (2008d) Guidelines for the Sustainable Harvesting of the Fiji Sago Palm. NatureFiji-MareqetiViti, Unpublished Report available from NatureFiji-MareqetiViti.
- NFMV (2010) Soga: Fiji Sago Palm *Metroxylon vitiense* Recovery Plan 2010-2015. NatureFiji-MareqetiViti Report Number 2010/06.
- Raynor B, Kostka M (2003) Back to the future: using traditional knowledge to strengthen biodiversity conservation in Pohnpei, Federated States of Micronesia. *Ethnobotany Research and Applications* 1: 55-63.
- Rounds I (2007) Conservation, Management and Ethnobotany of Sago (*Metroxylon vitiense*) in South East Viti Levu, Fiji Islands. MSc. Thesis, University of the South Pacific, Fiji.
- Seeman B (1862) Viti: an account of a government mission to Vitian or Fijian Islands in the years 1860-61. Cambridge. (Reprinted in 1973), Colonial History Series No. 85.
- Schwartz MW (2008) The performance of the Endangered Species Act. *Annual Review of Ecology and Systematics* 39: 279–299.
- Shearman P L, Ash J, Mackey B, Bryan JE, Lokes B (2009) Forest conversion and degradation in Papua New Guinea 1972-2002. *Biotropica* 41: 379-390.
- Southern W (1986) The late Quaternary environmental history of Fiji. PhD. Thesis Australian National University, Canberra.
- Taylor MFJ, Suckling KF, Rachlinski JJ (2005) The effectiveness of the Endangered Species Act: a quantitative analysis. *Bioscience* 55: 360–367.
- Ward RG (2000) Land tenure in Pacific Islands: changing patterns and implications for land acquisition. In: Resettlement policy and practice in South East Asia and the Pacific. Asia Development Bank, Sydney, pp 75-87.

- Wardell-Johnson GW, Sander J, Keppel G (2011) Climate change impacts on the terrestrial biodiversity and carbon stocks of Oceania. *Pacific Conservation Biology* 17: 220-240.
- Watling D (2005) Palms of the Fiji Islands. Environmental Consultants Fiji Ltd. Suva, Fiji.
- Woinarski JCZ (2010) Biodiversity conservation in tropical forest landscapes of Oceania. *Biological Conservation* 143: 2385-2394.

## Figure Legends

**Figure 1.** Location of natural populations of *Metroxylon vitiense* on Viti Levu and Ovalau, Fiji.

**Figure 2.** Various stages of palm heart harvesting; (a) trees felled, (b) leaves and bark removed, (c) palm heart ready for sale.

**Figure 3.** Tourist **buress** thatched with Soga

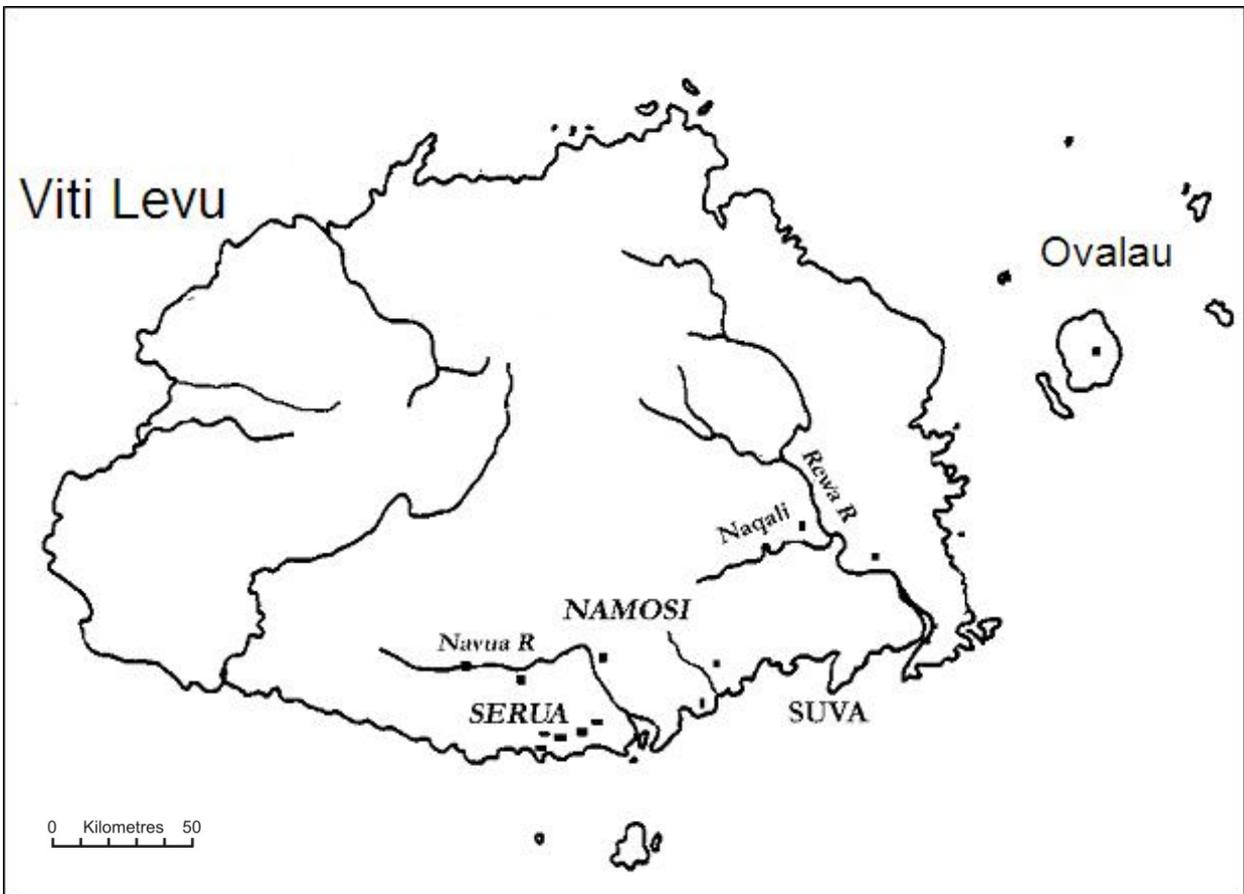
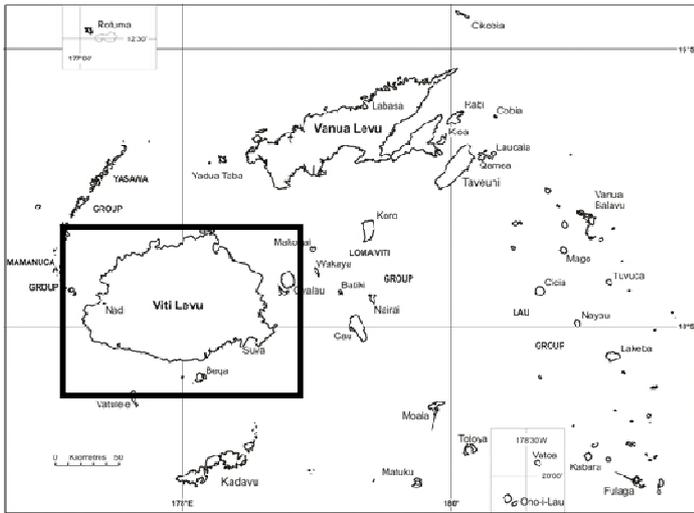
**Figure 4.** Various stages of Soga shingle preparation for sale to the tourism industry; (a) trees felled and fronds removed, (b) leaflets stripped from fronds, (c) leaflets sorted into similar sizes, and (d) shingles ready for sale.

**Table 1.** Status of remaining Soga populations (NatureFiji-MareqetiViti Register of Sago Palm Forest and Landowners).

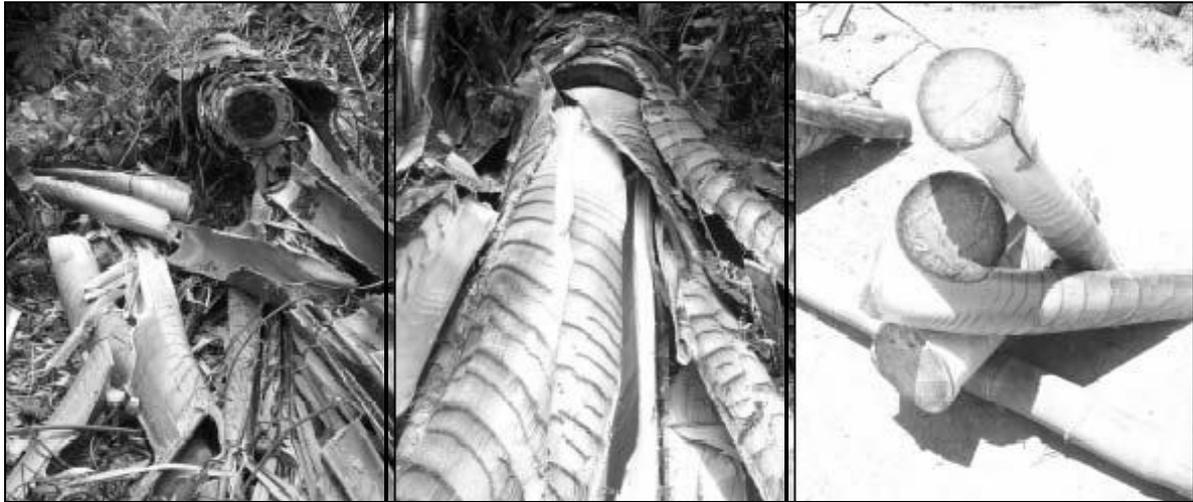
Province	Tikina	Village	Name of land	Area (Ha)	Comment on Condition of Site
<i>Community-owned land</i>					
Serua	Serua	Nabukelevu	Kabani	c.100	Low density, mixed with native forest Access difficult, only via old logging tracks. Within Fiji's designated RAMSAR site. Active landowner awareness and other conservation measures being undertaken by Rivers Fiji Ltd. and NFMV.
		Culanuku	Wainilekutu N	20	Over 95% of adults felled for thatch and palm heart. Originally considered likely beyond recovery, but now successfully restored through active management between Culanuku community and NFMV
			Wainilekutu S	4	Over-harvested, weed infested including grassland, probably beyond recovery
	Batiwai	Nakorovou	Wainaleka	25	Parts may recover with restoration
			Galoa	20	Adults felled, harvesting of regeneration; invasive weeds taking hold, probably beyond recovery without significant intervention. The Navua Provincial Office has initiated a project to work at this site but mainly through replanting.
		Wainiyabia	Sigasiganilaca	100	Low density, mixed with native forest, part in Navua Gorge Conservation Area southern bank. On-going logging close by. Active landowner awareness and other conservation measures being undertaken by Rivers Fiji Ltd. and NFMV.
		Nakorovou	Namaratu	250	Low density, mixed with native forest and over planted with mahogany by Fiji Hardwood Corporation. Majority will be badly damaged and access gained by third parties during harvesting.
Wainiyabia	Matavuralevu	60	Very severely over-harvested, nearly all adults felled. Now weed infested – unlikely to survive unless it undergoes restoration management		
	Namosi	Veivatuloa	Lobau	10	Harvested beyond recovery
Wainikoroiluva		Nukusere	?15	Access only by boat off Navua River. Not yet visited, reported to be in good condition, probably the best remaining dense sago stand	
Tailevu	Verata	Sote	Uluinakalevu	15	May recover with restoration but heavy recent harvesting
		Nameka	Nabuni	10	May recover with restoration but heavy recent harvesting

Lomaiviti	Ovalau I.		?	Reported; not yet surveyed. Presumed natural population (Watling 2005)
<b><i>Private Sago Forests (Freehold land)</i></b>				
Namosi	Toguru	Toguru	5	Harvested beyond recovery
Serua	Wainiyabia	Wainiverau	20	Harvested beyond recovery
	Pacific Harbour	Dakunikoro	200	Subdivided and drained – beyond recovery, though some individual lot owners are being advised by NFMV as to how to restore and maintain Soga on the sites.
	Pacific Harbour	Qaraniqio	20	Reasonable condition, will recover with conservation management. However, owners are reported to be selling the site for subdivision.
Cakaudrove	St Bede's		2	Small, but not affected by harvesting. Weed infested but could be restored. Presumed to be an established population outside its normal range (Watling 2005), an introduced population
Vanua Levu				

---



**Figure 1.** Location (black squares) of natural populations of *Metroxylon vitiense* on Viti Levu and Ovalau, Fiji.



A

B

C

**Figure 2.** Various stages of palm heart harvesting (a) trees felled, (b) leaves and bark removed, (c) palm heart ready for sale.



**Figure 3.** Tourist bures thatched with Soga



A

B



C

D

**Figure 4.** Various stages of Soga shingle preparation for sale to the tourism industry; (a) trees felled and fronds removed, (b) leaflets stripped from fronds, (c) shingles ready for sale, and (d) transport of shingles to resort.