

Editorial

Habitat Restoration – Experiences from the Field

Dear readers,

One of the ultimate goals of plant conservation is to conserve all plants as self-sustaining and ecologically interacting populations in their natural environment. *Ex situ* conservation in Botanic Gardens such as the Biodiversity Center at Barbarons is a last resort for saving threatened species, but an ecologically alive plant is a plant that lives in the wild.

Therefore the conservation of plants in the wild and the restoration of habitats with and for the plants of the Seychelles has been identified as a priority for management and research in the Seychelles National Strategy for Plant Conservation (Kapisen 2) and the follow-up Plant Conservation Research Agenda (Kapisen 7, p. 4).

This issue of Kapisen reviews some of the achievements made over the past few years in a number of ongoing habitat restoration projects in Seychelles. We have reported in several previous issues about the North Island project. The most recent monitoring (p. 4) shows both impressive successes and the need for large-scale, continuous efforts to control invasive plants. On Aride, another small offshore island, the forest is now completely dominated by native species, but the needs of a very rare and unique plant, Wright's Gardenia, may need further vegetation management in the future (p. 12). The restoration of upland forests has proven more difficult than in the coastal and lowland zone. However, the experiences made by the National Park Service over many years in the Mare aux Cochons restoration site in the centre of the Morne Seychellois National Park indicates that guick successes are also possible, given sufficient resources (p. 8). Recent fires on Praslin and Ste Anne have reminded us that we are not only faced with the challenge to restore habitats recovering from past disturbances but fires may contribute to further degradation every day. Vegetation rehabilitation after forest fires is particularly challenging, as the experiences of Willy André, the former Director of Forestry, shows (p. 3).

Concrete actions that matter to native plants and forests are a priority of PCA. Another of our goals is to get as many Seychellois as possible from all walks of life interested in the plant life of Seychelles. PCA has also been active in this regard recently as reports from a number of outreach activities (p. 16) and field trips (p. 18) show. And once again this Kapisen includes a couple of cartoons (p. 7 and 21) and a game (p. 15) for our youthful readers.

Christoph Kueffer, Katy Beaver & Eva Schumacher Editors

The electronic pdf version of Kapisen can be ordered from boga@seychelles.net or downloaded from www. plantecology.ethz.ch/publications/books/kapisen



Photo front cover

Privately restored glacis area at Ma Josephine (K. Beaver).

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Vegetation Rehabilitation after Forest Fire

By Willy ANDRE willyandre31@yahoo.com

We have had two extensive forest fires this year, one at Fond d'Albaretz on Praslin, which affected 4.2 hectares of prime native vegetation, and the other at the summit of Ste Anne Island, where some 40 hectares was burned, including large areas with endemic palms and shrubs. It reminded me what a great threat fire is to our native vegetation and how important it is to try to repair the damage. Having worked with Forestry for many years and as a past Director of Forestry, I wish to share some of our experience with dealing with post-fire rehabilitation.

The most important factors that determine the impact of a forest fire in Seychelles are the depth of the litter layer and the intensity of the fire. When there is not much leaf litter on the ground, the fire passes quickly and some of the native palms survive. But if the layer of leaf litter is deep, the fire will be hot and may kill many trees. Once a fire has laid bare an area, soil erosion can be a serious consequence, with much or all of the top soil being lost after heavy rainfall. Subsequently the underlying red earth is baked hard by the sun, creating a hard pan which is difficult for plant roots to penetrate.

Once a forest fire has been extinguished, the most important thing is to act fast, particularly if the rainy season is approaching. Rehabilitation should start as soon as possible otherwise soil erosion will be severe, especially on steep slopes. One of the first things to be done is to identify the vulnerable areas with a steep gradient. The most inexpensive erosionprevention method is to erect barriers along the contours, using burnt debris left from the fire. The number of barriers will depend on how much material is available.

If the fire was hot and fast, seeds in the ground (the soil seed bank) may well be alive and when the rains come they will sprout and grow. However, if there is no cover, heavy rain will destroy small naturally growing seedlings. So creating the barriers really is the most important step to take after a fire. Deliberate planting will also be necessary to speed up the rehabilitation. If the fire was a slow one, the seed bank may be destroyed, so deliberate planting will be essential.

In either case it is best to select suitable young plants that are already growing in a permanent nursery, and get these into the ground before the rains start. However, it will also be necessary to commence further propagation straight away. Seedlings of any native species that are already available can be used, as long as there are people willing to plant them! The best place to plant young native trees and shrubs is just above the barriers, where there is some shelter and where water and nutrients will accumulate. Whether planted seedlings grow well may depend on the amount of rainfall in the next months. Post-planting maintenance will be required to prevent weeds from smothering the young native plants, which should also be mulched at the same time. Once a cover of plants is present, native palms may make a natural comeback. However, it is also possible that alien tree species will spread into burnt areas quickly after a fire, e.g. on Mahé, Albizia can become a problem as it loves the ash left by a fire (the major spread of Albizia in the 1960s may have resulted from a very extensive fire in 1958).

In the past, rehabilitation was often carried out with Mahogany and Takamaka because there was already an abundant supply of seedlings propagated for forestry purposes. On Praslin, Prindefrans (*Chrysobalanus*) and Kalis dipap (*Tabebuia*) were used to provide good vegetation cover, which was considered the most essential achievement of the rehabilitation. Prindefrans gives better cover more quickly, but this fast growth later becomes a problem because the species tends to invade other areas and suppresses native plant growth. It can also be a fire hazard in itself. Kalis dipap takes more effort and a longer time to establish but produces woodland with fire retardant properties and plenty of small leaf litter. Kalis dipap is also an excellent timber tree.



The fire at Fond d'Albaretz created open space and much ash (M Hertach).

Forest Fire



Children help to replant native species after the Fond d'Albaretz fire (M Hertach).

Planted alien species are nowadays considered somewhat problematic (see textbox, p. 11), and native alternatives with the same characteristics need to be found. Native palms may seem the obvious species to use, but as young palms do not grow well unless there is some shade, it is important to plant them close to the post-fire barriers and use species such as Latannyen fey (*Phoenicophorium*) and Palmis (*Deckenia*) as they survive better. Plants that seem to grow well in more open areas are Bwadrenet (*Dodonaea*), Lerb Razwar (*Lophoschoenus*) and Lerb Koupan (*Scleria*). After a cover is established, further planting is required to produce a more natural

North Island Rehabilitation Update: Some Successes and Learning Experiences

By Katy BEAVER, Sonja HASSOLD and Sandra SULSER

kbeaver@seychelles.net, sonja.hassold@gmail.com

North Island was abandoned as a coconut plantation in the 1970s and neglected for more than 20 years (Kapisen 4, p. 6). Consequently thousands of coconuts germinated and other alien species also increased significantly in abundance. When Wilderness Safaris took over in 1997, a completely rehabilitated natural environment was envisioned, with native species predominating. Obviously such a vision takes time to realise but since 2003 North Island has been carrying out a programme of mix of species. It will help in the future to have a bank of suitable native seedlings available for postfire planting immediately after a fire and also for later filling in. More work is required to identify other suitable native species that should be in this native plants 'bank'. An alternative approach in the future, for burnt areas on private property where there was little native vegetation before the fire, may be to set up agro-forestry systems, which can provide good forest cover and useful timber, with agricultural crops in between the trees.

A note can be made about the supposed fire hazard of Bracken fern (*Dicranopteris*), which at one time was eradicated from hill slopes because it tends to burn very quickly. However, usually only the top part of the plant burns and the great mattress of roots beneath remains more or less untouched. An exception is Bracken growing in bouldery areas where the soil is in small pockets and fire may go on smouldering for some days. In fact Bracken can be a great asset when it grows on poor soil as the spongy root mattresses soak up and hold rain water which is released slowly into the surrounding soil and thereby helps nearby plants. These root mattresses can be as much as 3-4 metres thick in depressions!

vegetation rehabilitation, for which PCA currently acts as advisor (Kapisen 5, p. 14). PCA's collaboration with North Island was fostered through the Island's involvement with the ICS-FFEM Rehabilitation of Island Ecosystems project. The ICS-FFEM project ensured the eradication of rats (completed 2005, see Kapisen 6, p. 16) and more recently has enabled the introduction of two threatened animal species, the Seychelles White-Eye (Zosterops modestus, 2007) and a freshwater terrapin (Pelusios subniger, 2008). These conservation efforts targeting rare species are of significance to the vegetation rehabilitation programme too. According to the ecosystem approach on which North Island's 'Vegetation Management Plan 2007-2011' (VMP) is based, native plant species will form the basis of life for rare animals, e.g. by providing berries for the White-Eye. It is important for instance to ensure that alien trees which provide food sources and nesting sites are not removed until suitable natives are there to take over these roles.

Continuous vegetation monitoring

PCA, partly through links with ETH Zurich in Switzerland, carries out monitoring of the vegetation (Kapisen 4, p. 6; Kapisen 6, p. 16). Monitoring is an essential tool in assessing the successes and failures of the rehabilitation programme, and the efficacy of specific rehabilitation techniques. The VMP has a built-in evaluation process, which depends significantly on this monitoring and allows for adjustments in the rehabilitation programme. Many lessons are being learned and can also be taken on board in the VMP.

The long term monitoring covers the four main habitat zones: beach fringe and coastal plateau, mixed Takamaka forest, hill slopes (including glacis) and inland wetlands. However, of the four annually monitored habitats, only one type (the beach fringe/ coastal plateau) has already been rehabilitated to any extent. This is because the first phase of the island's vegetation rehabilitation has been carried out in the easily accessible areas and those which are most likely to be seen and appreciated by the hotel resort visitors. This includes the hotel complex, which lies on the large plateau on the eastern side of the island, together with the low hill road (known as the Saddle) that leads to the coastal plateau on the western side of the island where there is also a long beach/coastal fringe. Most of these zones are not focal areas for the annual monitoring. As a result, although the annual monitoring is revealing changes that are taking place in one of the rehabilitated areas (part of the long beach of the western coast), mostly it shows changes in habitats where no rehabilitation has yet been carried out, e.g. most of the hill slopes. However, as an adjunct to the annual monitoring programme, PCA set up a programme to monitor the soil seed bank (seeds remaining in the soil) after the initial clearing of the alien vegetation. Associated photographs (see p. 6) show rehabilitation progress in those parts of West Beach covered by PCA's monitoring programme. The photos were taken over a period of 2 1/2 years from the same point, using a standard height and direction (small variations in the view result from slightly different cameras being used).

In the following we discuss vegetation changes in some of the rehabilitation plots, based on the monitoring work of PCA and two Master students from ETH Zurich, Sonja Hassold and Sandra Sulser, who carried out the annual vegetation monitoring in 2007 under the supervision of Dr. Karl Fleischmann from the Institute of Integrative Biology, ETH. Two of the sites are from the beach fringe and coastal plateau zone. One site, Honeymoon Beach, has not yet been managed, while the other site, West Beach, has been intensively managed. On the steep hill slopes, three sites are monitored. In this zone rehabilitation is only now starting. The monitoring in the wetland and Takamaka Forest zones will be reported in a future issue of Kapisen.

Honeymoon Beach (see photos below)

One specific example of the results of non-intervention on the coastal fringe is shown at Honeymoon Beach, which lies at the southern end of the western beach. Over the past three years the amount of coconut saplings has strongly increased. Coconuts growing on the hill above Honeymoon Beach aggravate the situation by producing a lot of nuts, which roll down into the slight depression just behind the beach fringe. The coconut saplings create a lot of shadow, unsuitable for the growth of native seedlings already present. Seedlings and saplings of the indigenous Takamaka (Calophyllum inophyllum) were more affected than Bonnenkare (Barringtonia asiatica) and showed a higher decrease in abundance than in the last two years of monitoring. However, there is still sufficient Takamaka and Bonnenkare rejuvenation if shading by coconut seedlings and saplings is actively reduced. The rehabilitation of this area is planned for 2009.



Part of West Beach not far from Honeymoon Beach, where there is regular maintenance but no other rehabilitation (S Hassold).

North Island

West Beach – from the PCA seed bank monitoring (see photos on the right)

In August 2006 this area of land had just been cleared of young coconuts and a mixture of weedy alien species, and several small newly planted natives can be seen (prominent are Bwadroz, *Thespesia* on the left and Vakwa bordmer, *Pandanus balfouri* on the right).

By February 2007, after the rainy season, the growth of the natives is significant, particularly the Bwadroz on the left of the photo. But already one of the major obstacles to this type of spaced planting of native plants is showing up - the regrowth of weedy herbs and creepers (in particular Bonbon plim, *Passiflora foetida*). These compete with the young natives for space, water, nutrients and light, and creepers often threaten to smother them. Regular maintenance is therefore essential, but it is labour and time intensive.

As can be seen from the photos of October 2007 and February 2008, even after regular maintenance the weeds continue to re-grow, although the species mix changes as a result. Whereas in February 2007 the main problem was Bonbon Plim, by October 2007 cutting of this creeper allowed Koket (*Turnera angustifolia*) to grow in abundance. Notice the strong growth of the Bwadroz trees on both sides of the photo. Notice also the coconut seedlings in October 2007 and fallen coconuts in February 2008, which reveals a problem species that also requires regular maintenance.

It is interesting to compare the photos from August 2006 and September 2008, both taken towards the end of the dry season and when recent maintenance had been carried out. The growth of natives has been significant and the whole place looks much more vegetated and "bushy" - and that is in just two years.

Hill slopes

The three hill sides are heavily invaded by alien plant species but rehabilitation is only now becoming a priority because hill slopes are less accessible and rehabilitation is much more difficult. Many of the hillsides are still dominated by coconuts, but other alien invasive species have become more abundant over the last three years, in particular juveniles of Prindefrans (*Chrysobalanus icaco*), Agati (*Adenanthera pavonina*) and Vyeyfiy (*Lantana camara*). It is therefore assumed that these species will maintain or even increase their abundance in



All photos by K Beaver.

North Island

the future. This may be worrying but rehabilitation is a long process, which is why priorities have to be set. Vegetation rehabilitation on Congoment hill was initiated in 2008, and in 2008/9 partial rehabilitation of glacis areas and boulder fields will start on Bernica hill, where relicts of native vegetation can still be found, providing perfect niches for the re-introduction of endemic palms, Vakwa (*Pandanus*) and figs (*Ficus*). It is on these slopes that rehabilitation methodology experiments are now commencing, e.g. using water-absorbent gel around seedling roots, creating barriers to prevent coconuts rolling downhill, and seed scattering.



Hill slopes are more difficult to rehabilitate (S Hassold).

Conclusions

In the five years since 2003, the vegetation rehabilitation programme is showing very positive results, with about 10% of the island's 201 hectares fully or partially rehabilitated. Since the start of management the diversity of indigenous and endemic species has increased. One example of such a rehabilitated site is provided by West Beach. However, in areas not rehabilitated and maintained, alien species have maintained or even increased their abundance over the same period of time, particularly Coconut, Prindefrans, Agati, Vyeyfiy and Bwa zonn. One of the main learning experiences of the programme has been the necessity of regular, often labour intensive, maintenance. The more areas are rehabilitated, the more the burden of maintenance becomes, which has a significant impact on progress for new areas. Nevertheless, our findings indicate that a rehabilitation project can be successful if considerable efforts in terms of vegetation clearing, re-planting and habitat management can be invested. An additional benefit of the ICS-FFEM project has been the building of positive partnerships, through which valuable learning experiences have been shared.

Issue 9



Peter's Plants

Habitat Restoration in Mare aux Cochons (Morne Seychellois National Park) – Part Two

By Hansel SIMARA¹, Terence VALENTIN¹, Eva SCHUMACHER², Christoph KUEFFER²

- 1) National Park Unit of the Ministry of Environment, Natural Resources and Transport (MENRT), jacobisrael4@hotmail.com & ras_valentin@yahoo.com
- 2) Institute of Integrative Biology, ETH Zurich, eva.schumacher@env.ethz.ch & kueffer@env.ethz.ch

Introduction

In the Mare aux Cochons area in the center of the Morne Seychellois National Park the National Park Unit of the Seychelles Ministry of Environment, Natural Resources and Transport has been experimenting for over 10 years with restoring alien species dominated upland forests. In the last issue of Kapisen (Kapisen 8, p. 12-14) we introduced the history and general background of the restoration project. In this second part of the article we will discuss some of the practical experiences of the restoration process.

The growth of a new palm forest in the Belize opening

Belize, a grassland of 25-50 m by 200 m on a plateau, proved to be a very challenging area for replanting with native species. The plants are fully sun-exposed. Because of the poor soil (a mixture of gravel and laterite), water runs off and filters through, and nutrients are easily washed out. Competition by an alien grass (Gazontrel, Brachiaria umbellata) posed an additional problem. The area was replanted with different species of palms and some other native species 12 years ago. At the lower end, where some humus is found in the soil, a dense palm forest of c. 3 meters height developed. Today the soil is covered with palm leaf litter, which prevents the growth of grasses. By contrast, in the upper area, the planted palm seedlings are stunted and only c. 50 cm high. In an experimental trial a nitrogenphosphorus-potassium (NPK) fertilizer was used to increase the growth rate but with no success. An important observation was that the two palm species Latannyen milpat (Nephrosperma vanhoutteana) and also Palmis (Deckenia nobilis) adapted better to these sun-exposed conditions than the other native palms. Some of the other natives such as Bwa

merl (Aphloia theiformis) and Bwa dir (Canthium bibracteatum) grew fast, but they sometimes lost many of their leaves because of attack by insects or other pests. In the case of Bwa zoliker (Pittosporum senecia) one problem was that this species is collected for medicinal purposes and is therefore not ideal for replanting in sites that are regularly walked, although naturally regenerating seedlings of Bwa zoliker are increasingly found. During dry seasons all species seem to be affected to some degree by drought and lose leaves, and palms are apparently also more vulnerable to attack by rats and insects such as rhinoceros beetles (Oryctes monoceros) during this season. In particular, rats seem to chew the heart of the palms partly to access a water source. A few invasive woody species, such as Faux Watouk (Clidemia hirta), have spread into the opening.

The experiences in the Belize opening indicate that large openings can be successfully rehabilitated with a dense planting of native palms, especially Latannyen milpat and Palmis, where a soil with at least some humus is present that holds water and nutrients. In cases where the soil is eroded and red laterite is exposed, replanting with native species becomes very difficult. Other native species should be tried under such conditions, e.g. Bwa sandel (Dracaena reflexa), Bwa dir, which have proven successful in some areas, or also Bwadrenet (*Dodonaea viscosa*) or Lerb razwar (Lophoschoenus hornei) (see article on p. 3). Additionally, it would be interesting to experiment with using water-absorbing gel around the roots of seedlings when they are planted, to see if they are better able to survive.

Replanting of small gaps

Five experimental gaps of c. 15 by 15 m² (area c. 225 m²) were established in the Kannel dominated forest in the experimental area (see Kapisen 8, p. 12-14). These gaps were set up by clearing all alien adult trees (mainly Kannel) with chainsaws and the fallen trees were then removed and piled up at the edge of the gap. For replanting, two different schemes were used. For the first replanting scheme seedlings or saplings were planted under the shade of re-sprouting Kannel trunks. The hypothesis is that the re-sprouting Kannel protects the young plants from direct sunlight, and can later easily be removed without damaging the native vegetation below. In this case we replanted the gap sparsely with about 1 plant per 3 square meters. For the second replanting scheme (Photo A), we replanted an area of about 20 square m in the centre of each gap with a mixture of

Mare aux Cochons

about 10 endemic species. Here the plants were not spaced out and 8-10 plants per square meter were planted.

The replanting was done with plant material of different origins. Firstly, seedlings and saplings grown in nurseries in Le Niol and Sans Souci were used. These young plants had a height of 20-50 cm when being planted out and were between 6 to 8 months old. Most of the planting was done at the start of the rainy season between October and November, which is ideal because the soil is not hard to work with and the rain waters the plants. The seeds were collected in the period between February and April, when most native species are fruiting. The high transport cost is one main problem of this method. All these palms had to be carried from Le Niol Forestry station to Mare aux Cochons first by a transport and then by men (c. 1 hour walk). Another problem is the risk of spreading diseases, weeds and pests (e.g. spiralling white fly, Clidemia seeds in the soil, root pathogens such as nematodes). Spiralling white fly has already been found in the nursery and in the field on several endemic species, such as Koko maron (Curculigo sechellensis) and Bwa merl, but fortunately does not seem able to reproduce on these hosts. Clidemia seedlings were found scattered in the whole pilot area, and may increasingly become a problem. Table 1 lists the species that were used for replanting, and other species growing naturally in the gaps. Besides the planting of seedlings from the nursery, seeds were collected in the field and sowed directly into the gaps. This method is appropriate for species with a high abundance of fruits in the field, and with a high germination rate. For some species, sowing worked better in specific microhabitats. In particular, Bwa rouz (Dillenia ferruginea) germinated and grew well on mosses and decomposing wood.

At the planting site, the forest floor was completely weeded. In the case of palms, the palm heart and all the lower parts of the stem were covered with soil because rats occasionally eat the palm heart. However, sometimes rats even removed the soil and the plants died of rat damage. Every introduced plant was marked with a number, and the number of leaves and the height were measured and recorded.

Our observations so far indicate that fast growing species are Palmis, Latannyen milpat, Bwa merl, Bwa kasan-d-montanny, Bwa dir rouz, Watouk (although probably not a native species) and Bwa sandel. Bwa pomn, Kafe maron pti fey and Kafe maron gran fey are very slow growing or not performing well. The native vegetation that was already present before the replanting assisted in our restoration efforts. Some



of the pre-established native saplings responded with increased growth after light increased in the gaps (e.g. Kapisen *Northea hornei*, Bwa bannann *Gastonia crassa*).

We encountered several problems in the plots. In particular, invasive plants colonised the gaps very fast. For instance, in one of our plots we counted the number of Albizia seedlings 11 months after the formation of the gaps and found 100 to 200 seedlings of Albizia per square meter! These seedlings had a height of 10 to 50 cm. The majority was 40 to 50 cm high (Photo B). Before setting up the plot there were no Albizia seedlings. The seedlings germinated from the natural bank of seeds in the soil. Attack by a chewing insect was noted on a Bwa Bannann sapling and some palms were killed by rats but generally the plants are healthy. Rat attacks seem to be most pronounced in a gap with Vakwa trees, possibly because the rats are attracted by Vakwa fruits on the ground.

Mare aux Cochons

The formation of small gaps seems to favor a number of native fast-growing species, but weeding of invasive species, in particular Albizia and Bwa zonn (*Alstonia macrophylla*), adds to management costs. As an alternative to the formation of small gaps, the thinning of a Kannel canopy and replanting under the canopy has been tried (see Part 1, Kapisen 8, p. 12-14). Detailed growth measurements and longer term observations will clarify which one of the two strategies, i.e. establishment of small gaps or replanting under a full or partially thinned alien canopy, will be more successful and how this may differ for different native species.

Replanting of Vakwa parasol (*Pandanus hornei*) in a regularly flooded opening

One area in the restoration area is a grassland that is regularly flooded. We decided to replant it with Vakwa parasol. We removed the grass in small plots of c. 30 cm diameter, and put a Vakwa seed in each plot (Photo C). The seeds germinated readily and the saplings are growing well (Photo D). These preliminary experiences indicate that wet and regularly flooded alien grasslands can be successfully replanted with Vakwa. However, Vakwa stands are typically composed of only this one species and no other species regenerate in the deep litter layer. Vakwa trees are valuable as habitat for epiphytes and animals and produce fruits that are eaten by fruit bats, but they do not facilitate a succession towards a species-rich native vegetation. Additionally, Latannyen lat may be tried in wet areas, but it has to establish well before it can survive lenghty flooding.



Conclusions

The experiences from the Mare aux Cochons restoration area show that there are native plant species that grow fast and can relatively quickly form a native vegetation cover if the conditions are appropriate (some shade, some humus in the soil). Large gaps should be avoided and appropriate techniques for replanting sun-exposed openings on degraded laterite soil have still to be identified. The major obstacle to the full restoration of the Mare aux

 Table 1
 Species used with the different restoration techniches.

Species used for replanting	Additional naturally growing species in the gaps
Bwa merl Aphloia theiformis	Kapisen Northea hornei
Latannyen fey Phoenicophorium borsigianum	Bwa mon per <i>Pouteria obovata</i>
Latannyen milpat Nephrosperma vanhoutteana	Vakwa parasol Pandanus hornei
Palmis Deckenia nobilis	Bwa bannann <i>Gastonia crassa</i>
Kafemaron pti fey Erythroxylum sechellarum	Bwa bannann <i>Gastonia sechellarum</i>
Kafemaron gran fey Paragenipa wrightii	Watouk Melastoma malabathricum
Bwa kalou <i>Memecylon eleagni</i>	Bwa koulev Psychotria pervillei
Bwa rouz Dillenia ferruginea	Latannyen oban Roscheria melanochaetes
Bwa zoliker Pittosporum senacia subsp.wrightii	
Bwa ponm <i>Syzygium wrightii</i>	
Bwa dir rouz Canthium bibracteatum	
Bwa sandel Dracaena reflexa	
Bwa kasandmontanny Timonius sechellensis	
Vakwa parasol Pandanus hornei	

Kapisen

Acacia mangium

Cochons is currently the very limited funding and lack of personnel. At present, the National Park Unit rarely has free resources to work in the area, and few volunteers are currently involved in the restoration activities. The first results show that restoration efforts can be successful in upland forests, and hopefully funding will increase so that tourists and Seychellois can soon walk again through a strip of completely native vegetation on their day trip to Mare aux Cochons!

Photos by E Schumacher.

Acacia mangium (Black Wattle) – A major new invasive species introduced for post-fire rehabilitation

By Christoph KUEFFER

Many of the most problematic invasive woody species in the Seychelles have been introduced for erosion control and habitat rehabilitation after major disturbances such as deforestation or fire (Kueffer and Vos 2004). These species have a particularly high potential to become invasive because they were specifically selected to grow on the very nutrient-poor and highly weathered soils of the Seychelles (Kueffer 2006). Recently, some of the earlier introductions for this purpose, e.g. Prindefrans (*Chrysobalanus icaco*), have been replaced with new alien species such as *Acacia mangium* or *Acacia polystachya* (Kueffer and Vos 2004). This may have been a move from bad to worse, especially in the case of *Acacia mangium*.



A sapling of Acacia mangium (M Hertach).

Acacia mangium is one of the most problematic invasive plants in the Comoros (Vos 2004). It is a nitrogen-fixing, fast growing tree that can reach 30 m height and is suspected to be allelopathic, i.e. exudes substances that are harmful to other plants. Black wattle is native to the same region as Albizia (*Paraserianthes falcataria* or *Falcataria moluccana*): northern Queensland, the Moluccas and Papua New Guinea. Nitrogen-fixing trees from this region may be particularly problematic in Seychelles because they may have special adaptations to maintain nitrogen-fixation on phosphorus-poor soils (Kueffer 2006; Kueffer et al. 2008). Juveniles are already widely naturalized on Praslin, and *Acacia mangium* may become as problematic on Praslin as Albizia already is on Mahé.

An effective invasive species management system in Seychelles should prevent introduction of such potentially highly problematic species in the future, and when the risk of an already introduced species is recognized the species should immediately be eradicated. Hopefully there is still enough time to control *Acacia mangium,* in contrast to Faux Watouk (*Clidemia hirta*) where eradication attempts on Mahé failed (Kapisen 1, p. 11-13).

Kueffer, C. 2006. Impacts of woody invasive species on tropical forests of the Seychelles, Diss. ETH No. 16602, Department of Environmental Sciences, ETH Zurich.

Kueffer, C., G. Klingler, K. Zirfass, E. Schumacher, P. Edwards and S. Güsewell 2008. Invasive trees show only weak potential to impact nutrient dynamics in phosphorus-poor tropical forests in the Seychelles. *Functional Ecology* **22**: 359–366

Kueffer, C. and P. Vos 2004. Case Studies on the Status of Invasive Woody Plant Species in the Western Indian Ocean: 5. Seychelles. Forestry Department, Food and Agriculture Organization of the United Nations, Rome, Italy.

Vos P. 2004. Case Studies on the Status of Invasive Woody Plant Species in the Western Indian Ocean: 2. The Comoros Archipelago (Union of the Comoros and Mayotte). Forestry Department, Food and Agriculture Organization of the United Nations, Rome, Italy.

Monitoring of Wright's Gardenia (*Rothmannia annae*) on Aride Island

By Olivier PUTALLAZ and David FÜRSINGER Institute of Integrative Biology, ETH Zurich olivier.putallaz@gmail.com, david@frogstyle.ch

Introduction

Aride Island is a small offshore island (1.7 km by 0.6 km) situated c. 9 km northwest of Praslin. It has been protected as a nature reserve since 1973 and is managed by the Island Conservation Society (ICS). The island is composed of a coastal plateau and rocky hillsides of a maximal altitude of 134 m above sea level. Before the 1970s the coastal plateau was managed as a coconut plantation. Today, after removing most of the coconuts and replanting with native trees, it is a coastal forest dominated by Bwa mapou (Pisonia grandis) and other native coastal species such as Takamaka (*Calophyllum inophyllum*) and Bodanmyen (*Terminalia catappa*). Bwa mapou is also the dominant species on the hillside, together with other native species such as Lafous pti fey (Ficus reflexa) and Bwa dile (Euphorbia pyrifolia) (Fig. 1). Aride is an important seabird reserve including the world's largest colony of Lesser Noddies, the world's only woodland colony of Sooty Terns, and one of the Indian Ocean's largest colony of Roseate Terns. In many regards Aride is similar to other small offshore seabird islands such as Cousin or Cousine islands.



Fig 1 Typical habitat of Wright's Gardenia on Aride Island (O Putallaz).

But for plant conservation it is of particular relevance because it harbours one, possibly two, rare endemic Seychelles plants. One is a type of wild cucumber of the genus *Peponium* not yet well described, but is possibly an endemic variety of *P. vogelii* (Friedmann 1986). The most important flagship plant of Aride is Wright's Gardenia or Bwa Sitron (*Rothmannia annae*, Rubiaceae) a unique endemic tree of three to sometimes six meters, which now occurs naturally only on Aride. *Rothmannia* is famous for its beautiful flowers with a rich aromatic scent (Kaiser 2004) (Fig. 2).



Fig 2 The magnificent and perfumed *Rothmannia* flower (O Putallaz).

100 years ago Rothmannia trees were still found on a number of islands but populations became extinct on all of these except Aride (Friedmann 1986, Wise 1998). In the currently accepted IUCN Red List of Threatened Species (NPTS 1998) this species is considered as vulnerable (VU), i.e. it is facing a high risk of extinction in the wild in the near future. However, this might be underestimated, since a recent reassessment of the woody endemic plants of the granitic Seychelles islands (Huber and Ismael 2006, and see Kapisen 6, p. 15-16) assesses the conservation status of the species as critically endangered (CR), particularly because of its currently very limited distribution, but also because the reasons for its extinction on other islands than Aride are not known. Several censuses of all specimens (adults and large saplings) have been carried out since the 1980s. The most recent one was a survey completed in 2006 with a total count of 904 mature individuals (Sampson and Sampson 2006). These surveys suggest that the population size of Rothmannia has still been in decline over the past decades.

Rothmannia



Fig 3 Distribution of the transects and the permanent monitoring plots on the island. The transect lines are represented with vertical green lines. The red squares represent the permanent monitoring plots within the Rothmannia growth zone. The area in blue corresponds to the zone where Rothmannia trees were observed during the 1995 census.

The objective of this half year study (Fürsinger and Putallaz 2007) was to design adequate vegetation monitoring methods that can be repeated in the future by local workers, volunteers or students (Fig. 3). The ultimate aim was to achieve a better understanding of processes that influence the island's vegetation and especially the rejuvenation and distribution of *Rothmannia*. We used three different monitoring methods, namely two transect (step-point, point-centered quarter) and one plot sampling method (Mueller-Dombois and Ellenberg 1974). Within the plots we counted both the number of juveniles and adults of all species, measured their sizes, and took a standardized photo of the vegetation (see Fürsinger and Putallaz 2007 for detailed methodology).

Results

Our results showed a significant predominance of adult trees and saplings of Bwa mapou on the plateau as well as on the hillside, which is the habitat of *Rothmannia*. We recorded the presence of large areas with almost monospecific stands of Bwa mapou. Besides Bwa mapou, Lafous pti fey was the second most common species on the hillside, and *Rothmannia* adults were the third most frequent in this habitat. *Rothmannia* trees were mostly found in areas with a rather open canopy and a shallow soil layer, and they show a clumpy distribution.

In order to investigate the survival of *Rothmannia* in the future, it is essential to look at its rejuvenation. For this, we counted each life form (seedlings, saplings and adults) separately. We found a high abundance of seedlings indicating a prolific production of viable seeds, but only very few saplings (i.e. juveniles of > 0.5 meters height). There were at least 10-times more seedlings than saplings. The abundances of saplings and adults were similar.

Conclusions

The primary aim of this study was the design of a suitable monitoring methodology. We hope that our study facilitates future monitoring of the vegetation and in particular *Rothmannia* on Aride Island.

Our results show that while seedling abundance is high, sapling abundance of Rothmannia is low, indicating a high juvenile mortality. It is important to study the factors that impede the regeneration of Rothmannia (compare recommendations by Tyzack 1987) given the continuous decline of the population size of the species (Sampson and Sampson 2006). There are several factors that may be implicated in the high sapling mortality.

First, a high clumping of juveniles below adult trees indicates that seed dispersal is low. Intraspecific competition among juveniles or between juveniles and adults, or the sharing of species-specific pest among juveniles and adult trees of *Rothmannia*, may therefore lead to the high juvenile mortality (so called Connell-Janzen effect). The natural disperser of the seeds (possibly giant tortoises or the extinct green parakeet) is not present anymore and the only option left may be that humans disperse the seeds.

Rothmannia

Second, Bwa mapou and to a lesser extent Lafous pti fey are dominating the core habitat of Rothmannia. Further, the understorey is often invaded by matforming herbs such as *Asystasia* spp. These species may compete with Rothmannia seedlings for light or belowground resources (water, nutrients). Even if Bwa mapou and Lafous pti fey are native species, their high abundance may not be natural but may be the result of the completely anthropogenically transformed landscape of the former coconut plantations. Bwa mapou in particular is a good belowground competitor thanks to ectomycorrhizal symbiosis.

Third, above- or below-ground pathogens or pests may affect the survival of Rothmannia seedlings. Future research should study the effect of shading and belowground competition on the growth and survival of Rothmannia juveniles and check for possible pathogens or pests.

As the production of viable seeds is high, ex situ propagation is a promising strategy to ensure the survival of the species. Propagation is already happening on Silhouette and Frégate, where small and growing populations now exist, but on other islands it has not always been successful, although the Biodiversity Centre on Mahé now has mature plants. In the field, removal of understorey vegetation such as Asystasia spp. around Rothmannia juveniles, and dispersal of seeds away from clumps around adult trees should be tested in a first step to improve regeneration of the species on Aride. Reintroduction of the species to other islands where it was formerly present - if possible other small islands that are ratfree, should urgently be considered to reduce the risk of extinction due to a catastrophic event on Aride such as a pest outbreak or a fire.

In conclusion, our study confirms concerns raised previously that Wright's Gardenia (*Rothmannia annae*) needs urgently active conservation measures to assure the long-term survival of this enigmatic Seychelles endemic species!

Acknowledgements

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References

- Friedmann, F. 1986. Fleurs et arbres des Seychelles. Paris: Orstrom.
- Fürsinger, D. and O. Putallaz 2007. Vegetation Monitoring on Aride Island (Seychelles). Semester Thesis, Institute of Integrative Biology, ETH Zurich, Switzerland.
- Huber, M and S. Ismail 2006. Suggested IUCN red list status of the endemic woody plants of the Inner Seychelles. Master Thesis. Institute of Integrative Biology, ETH Zurich, Switzerland.
- Kaiser, R. 2004. Vanishing flora lost chemistry: the scents of endangered plants around the world. Chemistry & Biodiversity 1: 13-27.
- Mueller-Dombois D. and H. Ellenberg 1974. Aims and Methods of Vegetation Ecology. John Wiley and Sons.
- Nature Protection Trust of Seychelles (NPTS) 1998. Seychelles Red Data List. *Rothmannia annae*.
- http://www.iucnredlist.org/ Downloaded on 17 December 2007.
- Sampson B. and E. Sampson 2006. Aride Island. Annual Report. Unpublished report. Island Conservation Society (ICS), Victoria, Seychelles.
- Tyzack. S. 1987. Notes on Wright's gardenia (*Rothmannia annae*), Aride Island, Seychelles. Results of a population census, with notes on fertilisation, germination and dispersal. Management Recommendations. Aride Island Internal Report.
- Wise, R. 1998. A Fragile Eden: Portraits of the Endemic Flowering Plants of the Granitic Seychelles. Princeton: Princeton University Press.

Activity Corner

By Katy BEAVER kbeaver@seychelles.net

Poems? I cannot write poems maybe not, but this kind of 'poem' is not so difficult Have a try anyway! You can choose any plant and the name can be in Creole, English or French.

The best ones sent to PCA editor Katy Beaver will be printed in our next issue (send in by the end of April 2009 - so you have plenty of time - how about the New Year holiday to try something?).





The following 'poem' is sung to the tune "Doe, a deer, a female deer; Ray, a drop of golden sun.....", the song from "A Sound of Music"; but you can choose any song you like, or not sing it to a song at all.

P, a palm, the straightest tree

A, an Araucaria

L, Lafous, with figs galore

M, a Mango growing wild

for Intsia (Gayak)

S, a Santol on the hill

 ${f T}$, a Takamaka, strong... and that leaves us with an

Erythroxylum

Kapisen

PCA News

PCA News



The "Seychelles Plant Conservation Research Agenda", which PCA was instrumental in bringing to fruition, was officially launched on 16 June 2008 by Joel Morgan, Minister for Environment, Natural Resources and Transport, when Lindsay Chong-Seng, Chairperson of PCA, handed over copies of the document. The agenda was developed to ensure there is a clear road map and list of priorities for plant conservation research over the next seven years. It will serve also as a tool for botanists when applying for research funding from international agencies. The Minster said that "the Agenda is another story of meaningful partnership between the Department of Environment and a nongovernmental organisation.....We need more of these partnerships where people join together to achieve something positive for our environment."

Minister Morgan (left) and Lindsay Chong-Seng browse through a copy of the Research Agenda ("Nation" newspaper).

PCA decided it was about time to reveal ourselves and our work to the general public in a more open way. So we participated at two events this year, with a stall that celebrated native plants and showed what the organisation does. The first event was the **Earth Day Festival** on 20 April, and the second was the three-day **National Agricultural and Horticultural Show**, 20-22 June. Our displays not only showed in photos and leaflets what we do as an organisation but also provided activities that both children and adults could try out, to test their knowledge of Seychelles plants in a fun way. Almost all PCA members were able to help to 'man' the stall at the two events and it is felt that we were successful in attracting quite a bit of attention, with many people trying out the activities, especially children.



Children enjoying the Plant Sudoku game (see Kapisen 8, p.6) ("Nation" newspaper).



Do you know these plants? Most people could recognise the fruits and medicinal plants (K Beaver).

Apart from a couple of field expeditions (see p. 18), our latest PCA event to which others have been invited has been a **presentation on orchids** by Cousine Island's Conservation Officer, Kevin Jolliffe, an orchid lover for more than 20 years and with much knowledge of wild South African orchids. Kevin gave an overview of orchid biology and ecology, explaining what makes orchids so unique and why they need to be conserved in many parts of the world, including Seychelles. The fact that many orchids require a specialised pollinating insect makes them very vulnerable to extinction, since if the insect becomes extinct (e.g. through pesticide use or loss of the plant its larva feeds on), so will the orchid that depends on it. Kevin showed pictures of all the species that have been recorded in Seychelles and emphasised that knowing what to look for and where to look is the first step to understanding what is required for their conservation in this country, as there is still much that we do not know about our local species, many of which are rather small and apparently insignificant.

Exciting and inspirational workshop facilitated by Eden Project

Some PCA members were involved in an important local workshop on environmental awareness and education, 10 - 12 June, which was facilitated by one of our long-time partners the Eden Project, UK. Eden's connection to the Seychelles spans many years and projects, including the development of propagation techniques for endemic plants - work carried out by Dr Alistair Griffiths of Eden and Damien Doudée of the Biodiversity Centre (See Kapisen 2, p. 6-7).

Eden Project has been extraordinarily successful in the UK, through its education and awareness programmes, in engaging the local community and the public to take environmental action, to make changes in their lifestyles or to become more aware of environmental issues and choices. Seychelles wanted to learn from their experience in order to develop a 5-year environmental education and awareness strategy for sustainability for the country. Although several awareness programmes have been successful here, it was felt by many people that a fresh approach was needed.

During the workshop's preparation, Alistair worked in close collaboration with PCA's Katy Beaver as consultant and the Education, Information and Communications Section of the Ministry of Environment, Natural Resources and Transport and a number of sponsors were found. Alistair, who is a conservation scientist/ horticulturalist, brought with him four other Eden people: Andy Jasper (sociologist/market researcher), Sue Hill (artist), Justine Quinn (researcher/communicator) and Sam Kendall (teacher/educator), of whom he says: *"The mixture of disciplines was deliberately chosen as I felt that the different ways of thinking would be truly powerful as a collective."* And yes, it really was powerful! The Eden team shared their experiences with us and used a variety of participatory methods - from inviting participants to create their future Seychelles by making mini islands using a tray of sand and a range of natural and waste materials, to the sharing of stories, and making pledges for future action. The workshop was fun, positive, productive, and made the most of the creative Seychellois culture. A highlight for the Eden team was hearing and singing along to the environment song created by a small group in just ten minutes with a guitar, some cardboard boxes and a range of other improvised instruments!

Most of the approximately 50 participants, who were from government (many sections), NGOs, parastatals, media, private business and the arts, were enthused enough to stay for the full 3 days (usually workshops experience a noticeable reduction in attendance by day 3!) The inspiration that the Eden team gave them will stay with them for a long time and most certainly help with the development of the education and awareness strategy for Seychelles, which will be the eventual outcome.

Comments from participants were revealing. People were often surprised and delighted "by the playful and interactive nature of the workshop". They realised the importance of using the senses and "allowing people to take/feel things personally" and to "reach people on an emotional as well as intellectual level". They also learnt techniques for "how to get people to go from knowing to doing - at least a more targeted strategy" and also "how to monitor success of developments". Perhaps for many participants the workshop can be summed up this way "That each and everyone of us has an important and pivotal role to play in their daily lives to secure the future of our country and contribute towards the fight in global biodiversity conservation and sustainability".



Participants sharing ideas. Two model islands visible on the floor (Eden Project).



The creative song group in action (Eden Project).

Excursion to "Msye Anri" hill at Intendence

By Barry Danile NOURICE Tamil Nadu Agriculture University Barnou04@yahoo.co.uk

As an Agriculture student studying at the Tamil Nadu Agriculture University in India for a B.Sc. degree, my fourth year project was to research the work of environmental NGOs back home in the Seychelles. PCA was one of the NGOs I linked up with and I was invited by the chairman to join the PCA team for an excursion which took place in the far south of Mahé, to a hill known as "Msye Anri", which is found just above "Anse Cachée". The excursion began at the fish market situated at Quatre Bornes in the Takamaka district. In vehicles, we went down to the start of trail and started the walk uphill above "Anse Cachée". The walk was not an easy one as we had to cross many difficult areas with considerable danger.

We were joined by a group of personnel from North Island. This is one of the forty granitic islands of Seychelles located around the two main islands, Mahé and Praslin. The owners of this resort island are undertaking a project called "Noah's Ark". The plan is to turn back the island's environmental clock two hundred years through rehabilitation (see p. 4), by re-introducing many of the indigenous and endemic Seychelles species slowly over time. Visitors will be able to enjoy viewing some of this endangered vegetation and wildlife. PCA is acting as an advisor for the rehabilitation.



PCA members get ready for the hike (B Nourice).



Bwa Fourmi (Wielandia elegans) (B Nourice).

The walk was a second attempt by the PCA to try and locate Potao (Pitcher plant) in that area. Speculation has it that even recently, people have found them growing in this area. Unfortunately we never came across any. "Better luck next time"! The other aim of the walk was to give the group of personnel from North Island an understanding of the differences between the flora of North Island and the flora of Mahé and also some of the similarities.

During the walk many plant species were identified, some of which are already being used for the rehabilitation process on North Island and others that could be taken into consideration as potential species. Some of the species are shown in the photographs.

Notes from the Field

We were given useful information on the types of vegetation present in that area. I will have to state that Ms. Katy and Mr. Lindsay are very much up-to-date with the Seychelles flora. They were able to give us the habit, scientific name, family name, and other scientific aspects of the each plant that were asked about.

The most fascinating observation made during the visit was the small flowering plant known as *Seychellaria*. This small plant was found at the top of the hill under the dense palm canopy waiting for the camera to reveal its beauty to the rest of the world. *Seychellaria* enjoys a medium humid condition and a loose soil texture. I thought I had found all that needed to be found in the Seychelles floral world but *Seychellaria* proved me wrong.



Seychellaria thomassetii (B Nourice).

The walk which started at 9:00am, came to an ended at 1:30 pm in the afternoon. What a day it was! I felt very fortunate for having tagged along with the PCA team; the excursion was an eye opening opportunity for me, to know what is being done for the protection of our fragile plant ecosystem. I would like to thank the PCA team for this life changing opportunity. I enjoyed every bit of it. It was such a great opportunity to learn about the long forgotten treasures of the Seychelles floral world.

New Literature

Recent literature relevant to Seychelles' plant life and conservation

- Ali, J. R. and J. C. Aitchison 2008. Gondwana to Asia: Plate tectonics, paleogeography and the biological connectivity of the Indian sub-continent from the Middle Jurassic through latest Eocene (166-35 Ma). *Earth-Science Reviews* **88**: 145-166.
- Baret, S., L. Cournac, C. Thébaud, P. Edwards, and D. Strasberg. 2008. Effects of canopy gap size on recruitment and invasion of the non-indigenous *Rubus alceifolius* in lowland tropical rain forest on Réunion. *Journal of Tropical Ecology* **24**:337–345.
- Bory, S, P. Lubinsky, A. M. Risterucci et al. 2008. Patterns of introduction and diversification of *Vanilla planifolia* (Orchidaceae) in Reunion Island (Indian Ocean). *American Journal of Botany* **95**: 805-815.
- Cheke, A. and J. Hulme 2008. Lost Land of the Dodo. An Ecological History of Mauritius, Réunion & Rodrigues. Yale University Press, New Haven and London.
- Collier, J.S., V. Sansom, O. Ishizuka, R.N. Taylor, T.A. Minshull and R.B. Whitmars 2008. Age of Seychelles– India break-up. *Earth and Planetary Science Letters* **272**: 264-277.
- Fleischer-Dogley, F., B.E. Fischer, A. Fischer 2008. Coco de Mer Myths and Eros of the Sea Coconut. Seychelles Islands Foundation, Seychelles.
- Fleischer-Dogley, F., B.E. Fischer, A. Fischer 2008. Coco de Mer: Mythos und Eros der Meereskosnuß. Edition a.B.Fischer.
- Fuchs, J., J-M. Pons, S. Goodman, V. Bretagnolle, M. Melo, R. Bowie, D. Currie, R. Safford, M. Virani, S. Thomsett, H. Alawi, C. Cruaud and E. Pasquet 2008. Tracing the colonization history of the Indian Ocean scops-owls (Strigiformes: *Otus*) with further insight into the spatio-temporal origin of the Malagasy avifauna. *BMC Evolutionary Biology* 8: 197. http://www.biomedcentral.com/1471-2148/8/197
- Fürsinger, D. and O. Putallaz 2007. Vegetation Monitoring on Aride Island (Seychelles). Semester Thesis, Institute of Integrative Biology, ETH Zürich.
- Gerlach, J. 2008. Preliminary conservation status and needs of an oceanic island fauna: the case of Seychelles insects. *Journal of Insect Conservation* **12**: 293-305.
- Gerlach, J. 2008. Climate change and identification of terrestrial protected areas in the Seychelles Islands. *Biodiversity (Tropical Conservancy, Canada)* **9**: 24-29.
- Gerlach, J. 2008. Setting conservation priorities a key biodiversity areas analysis for the Seychelles Islands. *The Open Conservation Biology Journal* **2**: 44-53.
- Hansen, D. M., C. N. Kaiser, and C. B. Müller. 2008. Seed dispersal and establishment of endangered plants on oceanic islands: the Janzen-Connell model, and the use of ecological analogues. *PLoS One* **3**:e2111. doi: 2110.1371/journal.pone.0002111.
- Kaiser-Bunbury C. N. and C. B. Müller 2009. Indirect interactions between invasive and native plants via pollinators. *Naturwissenschaften* In press. DOI 10.1007/s00114-008-0481-x
- Kueffer, C., and G. Hirsch Hadorn. 2008. How to achieve effectiveness in problem-oriented landscape research the example of research on biotic invasions. *Living Reviews in Landscape Research* **2**: 2. http://www.livingreviews.org/lrlr-2008-2
- Kueffer, C., G. Klingler, K. Zirfass, E. Schumacher, P. Edwards, and S. Güsewell. 2008. Invasive trees show only weak potential to impact nutrient dynamics in phosphorus-poor tropical forests in the Seychelles. *Functional Ecology* **22**:359–366.
- Maunder, M., A. Leiva, E. Santiago-Valentín, D. W. Stevenson, P. Acevedo-Rodríguez, A. W. Meerow, M. Mejía, C. Clubbe, and J. Francisco-Ortega. 2008. Plant conservation in the Caribbean island biodiversity hotspot. *Botanical Review* **74**:197–207.
- Micheneau, C, B S Carlsward, M. F. Fay et al. 2008. Phylogenetics and biogeography of Mascarene angraecoid orchids (Vandeae, Orchidaceae). *Molecular Phylogenetics and Evolution* **46**: 908-922.
- Monticelli, D., J. A. Ramos, J-L Doucet 2008. Influence of woodland cover on habitat selection and reproductive parameters of tropical roseate terns: implications for colony management. *Endangered Species Research* **4**: 257-266.

New Literature

- Moolna, A. 2008. Preliminary observations indicate that giant tortoise ingestion improves seed germination for an endemic ebony species in Mauritius. *African Journal of Ecology* **46**: 217-219.
- Riddle, B. R., M. N. Dawson, E. A. Hadly, D. J. Hafner, M. J. Hickerson, S. J. Mantooth, and A. D. Yoder. 2008. The role of molecular genetics in sculpting the future of integrative biogeography. *Progress in Physical Geography* **32**:173–202.

[includes paragraph on the biogeographical history of Madagascar with relevance to the Seychelles]

- Riviere, J N, J Hivert, J, L Schmitt et al. 2008. Role of tree ferns in flowering plant settlement in the tropical montane rainforests of La Reunion (Mascarene Archipelago, Indian Ocean). *Revue d'Ecologie La Terre et La Vie* **63**: 199-207.
- Schumacher, E., C. Kueffer, M. Tobler, V. Gmür, P. J. Edwards, and H. Dietz. 2008. Influence of drought and shade on seedling growth of native and invasive trees in the Seychelles. *Biotropica* **40**:543–549.
- Schumacher, E., C. Kueffer, P. J. Edwards, and H. Dietz. 2009. Influence of light and nutrient conditions on seedling growth of native and invasive trees in the Seychelles. *Biological Invasions*: onlineEarly. DOI 10.1007/s10530-10008-19371-10536.
- Serusiaux, E, R. Lucking, L. B. Sparrius 2008. *Opegrapha viridistellata* (Roccellaceae), a new foliicolous lichen species from the Paleotropics. *Mycotaxon* **104**: 223-227.
- Wanless, R. M., P. A. R. Hockey 2008. Natural history and behavior of the Aldabra Rail (*Dryolimnas [cuvieri]* aldabranus). Wilson Journal of Ornithology **120**: 50-61.

Peter's Plants



Bwa sousouri

PCA matters





Seychelles Plant Conservation Research Agenda

The Seychelles Plant Conservation Research Agenda, a response to the National Strategy for Plant Conservation, is now complete and ready for distribution.

Edited by PCA members, it is the outcome of an international workshop held in Victoria in 2007.

An electronic version of the Seychelles Plant Conservation Research Agenda can be downloaded here:

www.plantecology.ethz.ch/publications/books/kapisen

Local and international experts are most welcome to consider how they can contribute to the achievement of the targets!

Soon available! Reprints of plant identification guides



Reprints of two plant identification guides are to be released in January. Originally published by the Ministry of Education, their distribution has until now been very limited. The reprinted books will be available from local book sellers and other outlets at a reasonable price. Profits from sales will go to PCA, so by buying copies of these books you will be supporting plant conservation!



Join PCA!

Any person interested in plant conservation in the Seychelles, either from the Seychelles or somewhere else in the world, is invited to join the Plant Conservation Action group (PCA). As a member you support plant conservation in the Seychelles, get Kapisen - the PCA newsletter - twice a year sent to you by e-Mail, and get regular invitations to events and field excursions.

For joining PCA, contact Lindsay Chong-Seng (Chairperson) or Denis Matatiken (Secretary) at

E-Mail: boga@seychelles.net

Phone: (+248) 241 104 & Fax: (+248) 266 903



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