Kapisen

Plant Conservation Action group

ISSN: 1659-7346

November 2017 Issue 20

Newsletter

Conservationists need perseverance

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The Plant Conservation Action group (PCA) celebrates its 15th anniversary this year, and simultaneously this is the 20th issue of 'Kapisen', the magazine of PCA. Fifteen years is a long time for a grassroots organisation, and this success builds on a much longer commitment of some local plant conservationists. Two (p. 3 and 11) show how such dedicated local people can be recognized for their work by taxonomists who have named newly discovered plants after them: the fern *Didymoglossum beaverianum* honours Katy Beaver, and new lichen species honour three of them: *Graphis lindsayana* is dedicated to Lindsay Chong Seng, *Porina morelii* to Charles Morel and *Coenogonium beaverae* to Katy Beaver. Another person committed to Seychelles conservation for decades is Karl Fleischmann from Zurich, who was until recently a lecturer in plant biology at the University of Seychelles. Many more could be mentioned, some well known, others helping in the background. Such personalities with enough stamina to continue conservation efforts are the backbone of any conservation succes, as the stories in this issue show.

The future of plant conservation in Seychelles also depends on encouraging the next generation of conservationists. Several PCA members have furthered their knowledge through study. The most recent is James Mougal, who recently returned from UK with an MSc in Conservation Biology. But there are other young Seychellois scientists carrying out research work, here represented by two studies of mangroves (p. 5 and 8). It will be important to provide these young people with the career opportunities and incentives that ensure their continued commitment to conservation.

Progress in restoration projects in particular depends on continuous follow-up work. There has been definite progress in restoration carried out by PCA members (p. 22). That these projects can work has been demonstrated by recent research involving both local and international scientists (p. 16). Another long-term research project focuses on the Coco de mer (p. 13) - a species with a particularly slow life cycle requiring anticipatory action even when potential effects might not be visible for decades. Another aspect of plant conservation that requires continuous dedication is awareness building. PCA still has the challenge of enabling local communities to willingly commit to projects that have long-term objectives (p. 18).

There are important factors that can help to ensure long-term conservation action. One is the presence of strong institutions. PCA as an NGO helps to ensure continuity, and so do government agencies dedicated to conservation - an example is the Seychelles Herbarium, which has been strengthened in recent years. It has now (as Kapisen 20 is being finalised) been transferred to a suitable building with increased space, which will enable it to further expand its work and collections (p. 26). And the Herbarium, together with PCA, ensures that people keep visiting the forests, and make new discoveries (p. 27, 28). Indeed, another important factor that contributes to maintaining enthusiasm is social activities, as illustrated by PCA's regular field trips (p. 30).

Momentum in Seychelles plant conservation is also maintained thanks to overseas PCA members who can represent Seychelles at conferences and relay information back to us (p. 20), or encourage us through their support to not give up (p. 4, 21). We also note and appreciate the increasing importance of regional links within the Western Indian Ocean, in which data can be gathered in different island nations and shared (p. 26 an 21).

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Cover photo: Mangroves at Port Launay, Mahé (Photo: Alvin Alcindor)

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Content

One more endemic plant added to the flora of Seychelles: Fouzer Kati (*Didymoglossum beaverianum*, Hymenophyllaceae, Pteridophyta)

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Who is Fouzer Kati? Where can we see her? How to actually and concretely spot her with our eyes? Fouzer Kati was first discovered on the 24th October 2010, in a remote ravine to the north-west of Morne Blanc. PCA members were on an exploratory field trip, during which several other discoveries were made such as an individual of *Pisonia sechellarum* (the only tree known on Mahé for this species). At this moment, we already suspected that the small fern discovered was a new species, but it is only in 2015 that, after accumulating enough specimens from Mahé, Silhouette and Praslin, we started to investigate the species' identity. In January 2017, Fouzer Kati was accepted as a new species to science and named *Didymoglossum beaverianum*, in honour of Katy Beaver.

Photo 1. The mat-forming *Didymoglossum beaverianum* (Fouzer Kati) typically found on small rocks, in wet ravines between 200 and 500m altitude.

Photo 2. Closer view of a fertile leaf of Fouzer Kati, showing the cup-shaped fructification situated typically at the tip of the leaf and emerging outside of it.

The easiest way to see Fouzer Kati is probably along the trail to Morne Blanc. It grows on small rocks right in the trail, approximately two thirds of the way up. To spot it won't be easy, especially the first time. What you must search for is a rock covered with a mat of many small leaves, all about the same size (4mm long), elliptic, dark green, and arranged in a typically regular pattern (Photo 1). At this point, it is still easy to confuse it with some species of liverworts and bryophytes. To confirm the identification of Fouzer Kati, you'll need to get really close and check individual leaves, searching for some fertile ones bearing the fructifications (spore-producing bodies) that should be like a small cup situated at the tip of the leaves (Photo 2). Another species of *Didymoglossum* often grows near or with Fouzer Kati (*D. cuspidatum*) but differs in having larger leaves and the cup-shaped fructification is at the tip of the leaf, immersed in the blade rather than emerging out of it (Photo 3).

What is amazing with discoveries like the one of Fouzer Kati is that this species had been there since the time of the first explorers, and trails like the one to Morne Blanc have most certainly been used by most visiting botanists, and yet this species had never been noted. The same is true with our previous discovery of the new Baton monsennyer species (*Angiopteris chongsengiana*), which likewise is found on the trails to Morne Blanc, Morne Seychellois and Congo Rouge, but had never been noted, although here the leaves are as long as 3m! This tells us one thing: no one can look at everything, everywhere, all the time. Sometimes your eyes will be on the ground, sometimes on rocks, on trunks, sometimes

Photo 3. View of the diagnostic character of another species of Didymoglossum (*D. cuspidatum*) easily distinguished from Fouzer Kati by having the fructifications immersed in the leaf blade. This species also often has more than 1 fructification per leaf.

on shrubs, and unless your eyes are at the right place at the right moment, the discovery will wait further. Even when your eyes are at the right place at the right moment, your brain is not always in the right mood, i.e. you might be dreaming or thinking of something else and actually not concentrating on what your eyes see. So, as unexpected as it could seem, there are probably still many species that have never been 'seen' or recorded in Seychelles.

But in fact, the potential for plant species discoveries is even bigger than that. Indeed, many species that have been seen, collected and recorded in Seychelles have only been tentatively identified. For example, we recently published Pti baton monsennyer (*Ptisana laboudalloniana*) as a species new to science, but Pti baton monsennyer had actually been discovered already in the early 20th century. At that time, the taxonomic hypothesis regarding the genus *Ptisana* in Africa and surrounding islands was that the same species was widely distributed from central Africa to Madagascar and the Mascarenes, and that this species was simply very variable in its appearance (polymorphic species). Therefore, when *Ptisana* was discovered in Seychelles, it was assumed that it was simply the same polymorphic species. As we rediscovered *Ptisana*, after a whole century, more detailed observations revealed that what was thought to be a widely distributed polymorphic species was actually hiding no less than six species, two of which are still undescribed in mainland Africa.

Therefore, discoveries that seem at first insignificant made in the small, isolated islands of Seychelles can actually have an important impact on the knowledge of African and Asian floras. As a second example, when Fouzer Kati was discovered, we also discovered a second species of *Didymoglossum* quite morphologically similar, which we named in Creole as Pti fouzer ron (*Didymoglossum beccarianum*). As we studied the group of species to which it belonged, it appeared that Pti fouzer ron was not endemic to Seychelles but widely distributed to the east (from Sri Lanka to south-east Asia and Australia) and that its identity (i.e. the current taxonomic hypothesis) had been confused throughout its range with a very rare Bornean endemic species (*D. motleyi*). Discoveries made in Seychelles on the genera *Ptisana* and *Didymoglossum* therefore have an impact on the identity of hundreds of specimens from the west coast of central Africa to the east coast of Australia.

We hope that this article will stimulate more Seychellois researchers and students to become interested in taxonomic studies. The National Herbarium hides many more discoveries in its cabinets, waiting only for somebody to investigate further for possible new species identities. Currently, the focus is on Bwa dou (*Craterispermum microdon,* see page 28), where the National Herbarium team suspects that 3 different species are actually hidden in Seychelles.

References

Senterre, B., Rouhan, G., Fabre, I., Morel, C. & Christenhusz, M.J.M. (2014) Revision of the fern family Marattiaceae in the Seychelles with two new species and a discussion of the African *Ptisana fraxinea* complex. Phytotaxa 158 (1): 57-75.

Senterre, B., Rouhan, G., Morel, C. & Dubuisson, J. Y. (2017) New species and records in the fern genus *Didymoglossum* for the flora of Seychelles, with notes on the Southeast Asian *D. motleyi* complex (Hymenophyllaceae). Phytotaxa 292 (3): 201–217.

Comment on Kapisen 19:

"Kapisen [is] still one of the very best plant conservation newsletters in the world - in my view!"

Stephen Blackmore
Chairman, Botanic Gardens Conservation International (BGCI)

Using GIS and remote sensing techniques to map the mangrove habitat of the Port Launay Wetlands

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Introduction

Despite the established importance of mangroves to tropical coastal environments, there is an alarming and continuous decline of global mangrove area, of which about one third has been lost over the past two decades. Mangrove habitats are under constant threat from activities such as industrial development, tourism, agriculture and aquaculture. Moreover, the global increase in sea-level rise due to climate change also poses a serious threat to mangrove habitats.

The current understanding of the extent, composition, and distribution of mangrove forests of the world is inadequate and there is poor understanding of mangrove ecology. The available global mangrove databases need to be greatly improved and monitoring protocols established for measuring change to mangrove habitats, thereby providing support for effective sustainable management and conservation of these fragile ecosystems.

Remote sensing and GIS are increasingly being used as tools to identify, map and monitor mangrove habitats. Remote sensing is a technology which can be used for extracting information on mangroves by means of satellite systems, with the potential to provide repeated coverage in support of continuous monitoring. Using Geographic Information Systems (GIS) we can store, manage, edit and analyse the spatial and statistical characteristics of the recorded information, including geovisualisation (2D or 3D visualization of information using interactive maps).

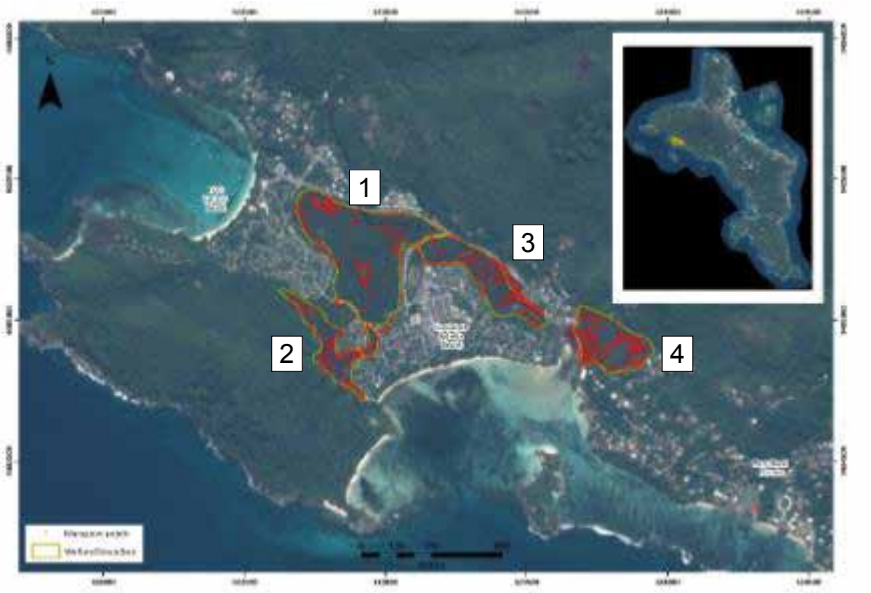
Aldabra Atoll and Port Launay Coastal Wetlands are two high diversity mangrove sites in Seychelles and both are designated Ramsar sites. I chose to work on the Port Launay site which is located in the west of the main island of Mahé and covers an area of 124 hectares. My aim was to use remote sensing and GIS to identify and map the composition and distribution of mangrove species with the possibility of also providing methodology and guidelines that can be applied to other mangrove habitats in the country as well as to other land cover.

Field data collection and use of satellite imagery

The study area was divided into four zones (Fig. 1) and most of the mangrove forests were surveyed on the ground except the river area north of zone 1. Additionally, certain parts were not surveyed due to inaccessibility (dense, thick mangrove especially of *Rhizophora*), time-constraints, bad weather and high tides.

For the survey, a random sampling method was adopted to record the location (x, y coordinates) of species which would be used for classifying the satellite image. Tree species were recorded

Two views of the Port Launay mangrove showing (left, K Beaver) *Rhizophora* (Mangliye rouz) and (right, A Alcindor) *Sonneratia* (Mangliye fler) and the river running through the site.



Field work at Port Launay Coastal Wetland

Figure 1. The Port Launay mangrove area (shown in red and yellow). All seven of Seychelles mangrove species are found at the Port Launay site: *Rhizophora mucronata, Bruguiera gymnorrhiza, Sonneratia alba, Avicennia marina, Lumnitzera racemosa, Xylocarpus granatum* and *Ceriops tagal*

individually (single point) or, if within a stand, based on the location and extent of the stand. The survey was done by walking along accessible paths, along the perimeter of the mangrove or on occasions through the mangrove forest. The sampling was based on visual interpretation of dominance of a particular species within a given area, and the extent of a dominant species was recorded until there was a change in the species community. Dominance was based on the frequency and density of a particular species in a given area. Photographs were also taken throughout the survey for documentation.

Field data collection was conducted in July and August 2014 through collaboration with the Centre for GIS and the Seychelles National Parks Authority (SNPA), with 6-8 persons working in two groups. As well as recording GPS positions and percentage dominance, the growth stage (juvenile, mature, ageing) and health status were also noted, along with tide level and weather conditions. All seven species of mangroves were recorded within the study area, along with mixed vegetation or open space. A total of 1514 GPS points were recorded.

Satellite-based remote sensing is essential for cost effective, repeatable mapping and monitoring of mangroves. In this study, multispectral imagery, i.e. separate registration of different colors, was used to discriminate the composition of the mangrove species. Prior to the actual classification, the image was processed to focus only on the Port Launay wetlands area thereby eliminating extraneous data. Consequently, subsequent processing is speeded up due to the smaller amount of data to process. Additionally, a mask was applied to the image subset to narrow down the spectral variability and thus limit the number of pixels being considered during the

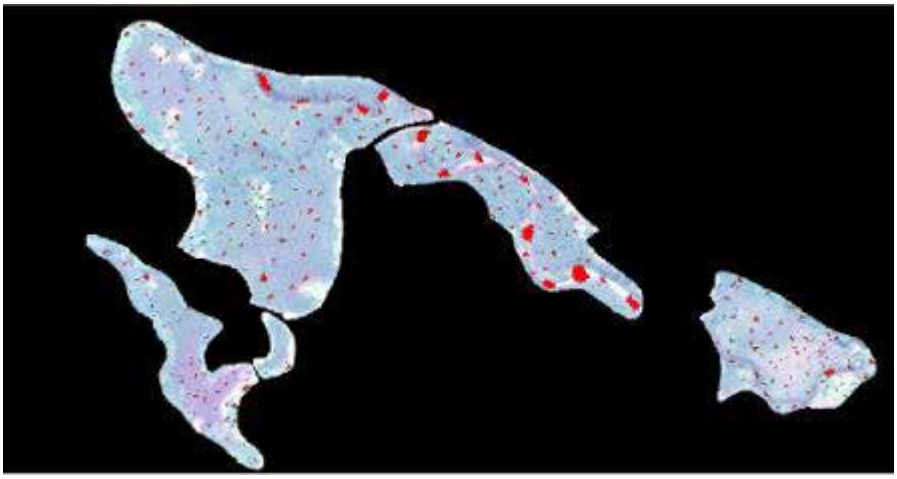


Figure 2. Training areas (shown in red) within the Port Launay mangrove study areas.

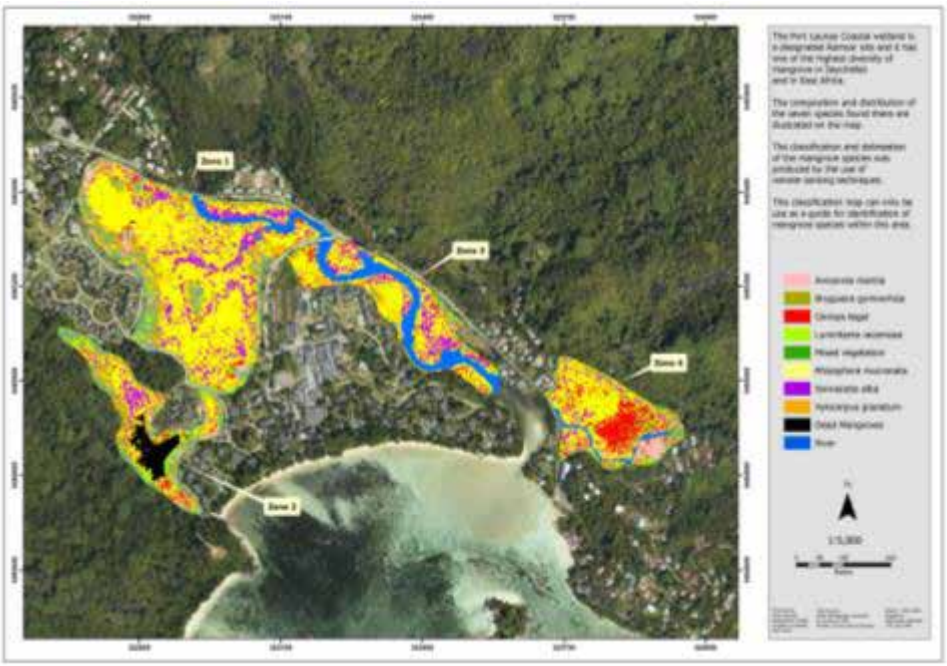


Figure 3.
Map illustrating the distribution and vegetation species composition of the mangrove wetlands at Port Launay.

classification process. The overall objective of image classification procedures is to categorise pixels with the same spectral signatures into groups, which then form classes that represent land cover. To do this, 'training areas' are used - areas of pixels with known class type can 'train' the computer to recognise the various classes. Its success requires appropriate reference data such as field surveys. The training areas (see Fig. 2) were digitised on the map and a set of statistics describing the spectral response pattern of each mangrove species to be classified in the image was created.

It is important that the location of training areas should be well distributed throughout the image and conveniently placed with respect to distinctive features. This allows for accurate identification of spectral classes of the mangrove vegetation.

Results

The results obtained indicate that mangrove species were identified with a good degree of accuracy. Seven mangrove species were successfully identified and this information was converted into a cartographic representation (a visual map) to illustrate the distribution and composition of the mangrove species found in the Port Launay coastal wetlands (Fig. 3).

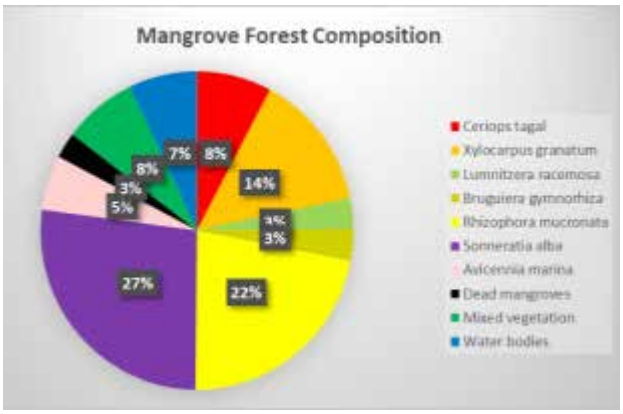


Figure 4. Species coverage in the Port Launay mangrove

The results of the field surveys indicated that *Rhizophora* (Mangliye rouz) and *Sonneratia* (Mangliye fler) are the most dominant species, occupying nearly 50% of the total area, and both species are well distributed throughout the four zones of the study area. *Xylocarpus* (Mangliye ponm) occupies 14% and is more prominent in Zones 1, 3 and 4. *Ceriops* (Mangliye zonn) with 8% is denser in Zone 4 though it is also well distributed in Zones 1 and 3. Both *Bruguiera* (Mangliye lat) and *Lumnitzera* (Mangliye pti fey) occupy only 3% of the total area (see Fig. 4).

Note that the spatial distribution shown in Fig. 3 reveals significant clustering among the species. Mangrove stands do exhibits strong zonation patterns based on biotic and abiotic factors, and therefore in order to understand the spatial distribution of each species, future studies should explore variables such as soil type, level of salinity, proximity to water bodies or distance from the coast.

The results of this study show that remote sensing applications can be a reliable tool for mapping mangroves in Seychelles and the extracted information can contribute to a local, regional and global mangrove inventory.

Aldabra's mangroves at the forefront of MSc thesis

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Mangrove forests occur almost all around the lagoon shores of Aldabra Atoll, one of Seychelles' World Heritage Sites managed by Seychelles Islands Foundation (SIF). These forests are an important reason why Aldabra is also listed as a Wetland Site of International Importance under the Ramsar Convention. Mangroves on Aldabra support populations of several globally threatened terrestrial and marine plants and animals; some of which are endemic to the Seychelles. In spite of their recognised importance, there is presently limited information on the structural properties of the mangrove habitat on Aldabra. Accordingly, I decided under the University of Zurich-Aldabra Research Platform (ZARP) to focus on the mangroves of Aldabra (Figure 1) for my Master thesis.

Mangrove stand structure and species composition

Firstly, to address the research gap on mangrove stand structure and species composition on Aldabra, I conducted fieldwork at the remote eastern end of Grand Terre, Aldabra's largest island (Figure 1), where more complex patterns of mangrove species distribution and structure are evident. In particular Bras Cinq Cases has an extensive mangrove forest. Together with two other SIF staff we surveyed 39 plots of 5m by 5m (Figure 2). In each plot, we recorded for any mangrove trees above 2m high: (1) species identity, (2) diameter at breast height (DBH), and (3) height. Mangroves <2m were considered as juveniles and their density was recorded per plot.

I recorded three mangrove species at Bras Cinq Cases out of seven species known to occur on the atoll. The most important species in the stand (considering frequency, density and dominance) was *Rhizophora mucronata* (mangliye rouz) followed by *Ceriops tagal* (mangliye zonn) and *Avicennia marina* (mangliye blan). Height ranges of species were similar, with *R. mucronata* having the largest variation in height. *A. marina* individuals occupied on average 6 times the area occupied by stems (basal area) of other species (Table 1).

Table 1. Summary of structural variables per species found at Bras Cinq Cases, Aldabra Atoll.

Species	Total no. of trees	Density (trees/ ha)	Mean ± sd	
			Height (m)	Tree basal area (m^2)
Avicennia marina	23	236	4.4±1.4	0.037±0.041
Ceriops tagal	100	1026	3.8±1.2	0.004±0.003
Rhizophora mucronata	138	1415	3.9±1.5	0.006±0.006

A total of 261 adult mangroves and 1200 seedlings were surveyed at Bras Cinq Cases. There was considerable variation in tree size between plots (Table 2). The tallest mangrove tree recorded was 8.10 m and the largest had a stem diameter of 47.4 cm (*A. marina*). The seedling density in the stand was 12,308 stems/ha indicating a high regeneration rate and recruitment potential of mangrove species at Bras Cinq Cases.

By combining all structural attributes, I was able to compute a stand complexity index which is commonly used to compare structural complexity of mangrove stands in different places. Interestingly, the structural complexity of the fringe mangrove stand (tide dominated) at Bras Cinq Cases is comparable to mature fringe mangrove forest stands in Central America.

My study has highlighted the structural variation

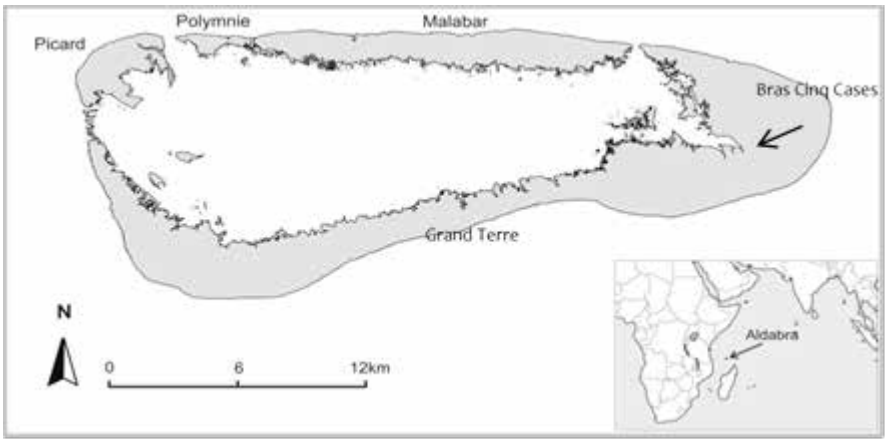

Figure 1.
Aldabra Atoll showing the main islands and location of study site at Bras Cinq Cases. Inset indicates location of Aldabra in the Indian Ocean. Source: Šúr et al. (2013).

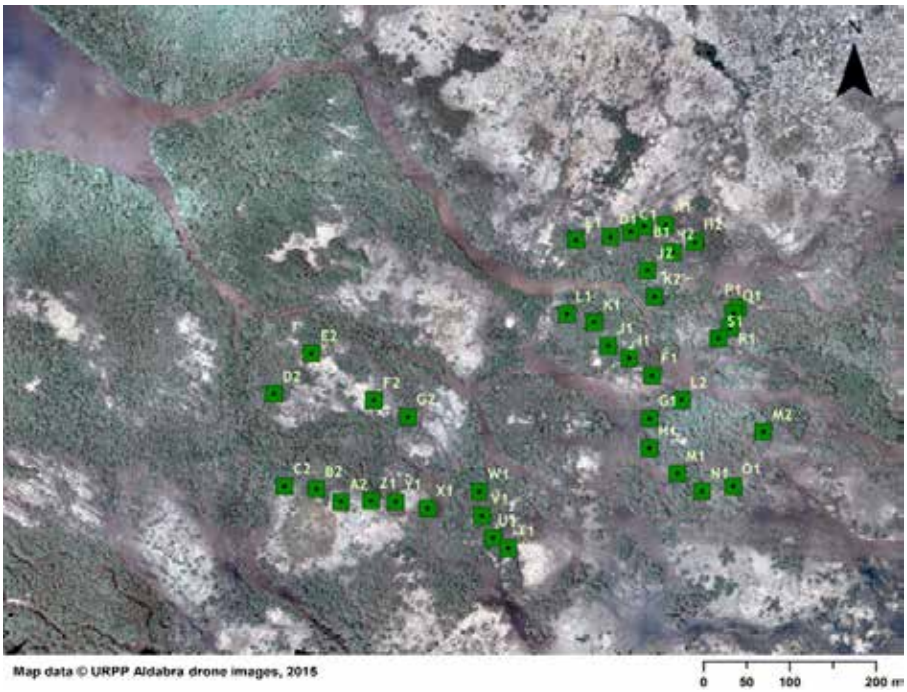

Figure 2.
Plot locations at the Bras Cinq Cases, Grand Terre. Plots were aligned to a set direction starting at random locations within the forest (usually lagoon), and were equally spaced from one another, so as to provide maximum coverage along the respective directions.

and species composition of an extensive mangrove stand on the atoll. But I'm not stopping here as I plan to replicate my field research and gather similar information in other mangrove stands on Aldabra!

Is the extent of the mangrove habitat changing?

The second objective of my research was to understand how the extent of Aldabra's low-lying mangrove habitat is changing over time. My main hypothesis was that at longer time scales, total mangrove extent on Aldabra is decreasing: because of low sediment availability on the atoll, which meant the forest floor is not able to build itself in time, to keep pace with rising sea levels. To test the hypothesis, I analysed a time series of Landsat satellite imagery from 1995 to 2009 at the scale of the whole atoll.

Over a period of 15 years from 1995 to 2009, mangrove extent on the atoll varied considerably between sites. In some places mangroves extended while in other places there was a retreat. Overall, a small net gain of 174 hectares of mangrove habitat was detected. Mangrove vegetation was especially dynamic at its landward margins, whereby expansion into new suitable areas and/or considerable retraction occurred. On Grand Terre, changes appear to be more sporadic, whereby some regions have persistent mangrove areas and others experience intermittent mangrove expansion and retraction. Nevertheless, there is a clear eastern expansion evident since 2003 on Grand Terre South East, at the expense of exposed surfaces (Figure 3). No substantial retraction of mangrove was observed from the seaward margin, suggesting that mangroves on Aldabra are currently resilient to impacts of climate change (especially sea-level rise) and persistent in colonising new suitable areas over time.

While mangrove stands on the coast of East Africa and many other parts of the world are experiencing net loss in extent, on Aldabra a net increase was reported even as trends in mangrove extent were highly variable. My study underlines the importance of Aldabra Atoll as an undisturbed baseline, where strict management policies have played a role in mangroves persisting and colonising new suitable areas over time. This resilience takes time to manifest so that even if a net increase in habitat extent might paint a different, more optimistic picture than is normally the case, continued efforts should go towards monitoring the coastline for change. As

Table 2. Variation in overall mangrove stand structure of 5x5 m plots at Bras Cinq Cases, Aldabra.

	Height (m)	DBH (cm)	Tree Basal Area (m^2)	Density (trees/ha)	Plot Basal Area (m^2/ha)
Mean ± se	3.87±0.08	8.4±0.3	0.0079± 0.001	2677±400	21.67± 2.47
Min-Max	1.50-8.10	1.3-47.4	0.0001-0.1767	400-10000	1.99-70.67

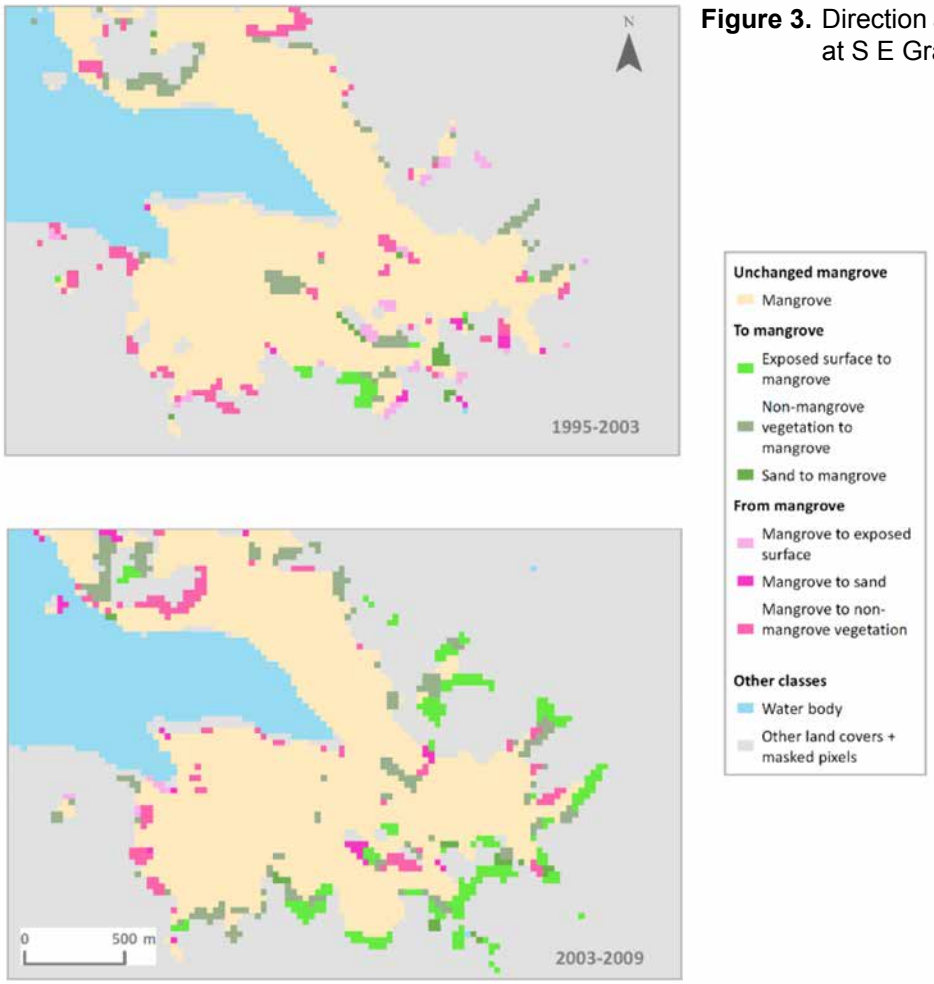

Figure 3. Direction and nature of mangrove habitat change at S E Grande Terre, Aldabra (A. Constance)

such the primary recommendation to come out of my work is that satellite data is continuously used to monitor habitat change trends in mangrove habitats, as they are important sentinels of climate change impacts in this UNESCO World Heritage Site.

Mangrove - magic or access nightmare?

The overall experience of my Master's thesis is a memorable one. My research design meant that I had to work on two very different yet complementary objectives, with methods of in-situ and remote sensing techniques involved. Particularly memorable was the time I spent camping at Cinq Cases to collect data for my research. On average, it took one hour for us to survey a plot, which sometimes occurred at knee-high water level, involved manoeuvring in and around mangrove roots higher than the average person, and on occasion the abundant mud-dwelling crabs taking a bite at your submerged feet! In spite of the harsh conditions of conducting surveys in Aldabra's mangroves, I felt privileged to have seen such pristine, intact, somewhat magical mangrove areas where few people, if any, have ever ventured.

Mangrove - magic or access nightmare? (SIF)

This bit is relatively easy! (SIF)

Unravelling an unexpected lichen diversity in Seychelles

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The study of lichens in Seychelles is relatively recent compared with many taxonomic groups (see Box on p. 12) and as such there are many new things to be learnt about this important but often neglected group (see Kapisen 10 p. 13-15).

In 2015, I decided to visit Seychelles with my wife Doris and my son Cédric. Although our main aim was to explore the natural richness of this wonderful country and to learn about the people and their culture, as a lichenologist I could not resist linking tourism with lichen exploration, and I asked for an official permit to collect lichens. I came into contact with Katy Beaver from the Plant Conservation Action group (PCA) and she encouraged me to collect lichens from all taxonomic and ecological groups, not only from those on which I am personally working. She also helped me to get the necessary permits, a task which is made easier with the support of local scientists. Katy explained that, although much has already been done, the lichen diversity in Seychelles is still poorly known, and that the help of foreign taxonomists is required until there is a trained Seychellois lichenologist. Therefore it is important that visiting lichenologists share their knowledge with local biologists.

We visited Mahé for one week (including a small excursion to Thérèse island), and Praslin and La Digue during the second week. The best places where I was able to collect lichen samples were the Jardin du Roi in Mahé where the owner, Mrs. Michelline Georges, kindly allowed me to collect; Morne Blanc (Mahé) where I had the privilege to be accompanied and guided by Katy; Glacis Noir in Praslin; and Veuve Reserve in La Digue. We had a bad experience when we visited Sauzier Waterfall in Mahé: local young men are waiting for tourists, guide them to the waterfall, and then request an exaggerated amount of money that we had no other choice than to pay.

Although this was not a full time collecting trip, the results are extraordinary. I was able to collect a total of 323 specimens, of which all identified material is deposited in the herbarium of the Seychelles Natural History Museum (SEY), with duplicates in my private herbarium, and a selection of duplicates in other large herbaria (mainly B, BR, DUKE, HAL and LG - see list of acronyms below). Most scientific results have recently been published in the journal Herzogia (Diederich et al. 2017). A total of 16 species collected in Seychelles were described as new, including *Coenogonium beaverae* Lücking & Diederich, *Graphis lindsayana* Lücking & Diederich and *Porina morelii* Aptroot & Diederich, dedicated with great thanks and recognition to Katy Beaver and two other PCA members: Lindsay Chong-Seng (long associated with management and protection of biodiversity in Seychelles) and Charles Morel (Curator of the Seychelles National Herbarium (SEY) in Victoria). An additional 49 species were new records for Seychelles, of which 29 were even new to Africa. All in all, this brings the Seychelles lichen flora to over 500 recorded species!

The beautiful new species *Coenogonium beaverae* Lücking & Diederich was collected near Sauzier waterfall, Mahé. It has been dedicated to Katy Beaver (PCA), a particularly active environmentalist in Seychelles. Scale bar = 0.5 mm.

Yet, the Seychelles lichen flora is still poorly known and many additional taxa surely await discovery. The identification of many specimens and species needs critical re-evaluation based on new scientific knowledge. The ecological affinities and geographical distribution of many taxa are hardly known and it is only now becoming possible to consider using lichen diversity and richness as a key factor in assessing natural habitat protection.

List of herbarium acronyms

B = Botanic Garden and Museum, Berlin, Germany; **BR** = Botanic Garden Meise, Belgium; **DUKE** = Duke University, Durham, North Carolina, USA; **HAL** = Martin Luther University of Halle-Wittenburg, Germany; **LG** = University of Liège, Belgium

What is urgently needed in Seychelles is for young people to get interested in lichens, youth who will learn to know the different species and build up a much larger reference collection in their national herbarium, who will have the courage to become experienced in lichen taxonomy, and who will guide people engaged in nature protection to use lichens in future monitoring and conservation projects.

The new salmon coloured *Opegrapha salmonea* Ertz & Diederich has been described from La Digue, Mahé and Praslin, where it grows on coastal trees, frequently on coconut trunks. As it is always sterile, the inclusion in *Opegrapha* is provisional: freshly collected specimens will be needed for DNA sequencing, allowing phylogenetic analyses to place the species in the right genus. To our knowledge, this beautiful and eye-catching species has never been collected in other countries and might be endemic to Seychelles.

The new lichenicolous (= lichen inhabiting) fungus *Abrothallus ramalinae* Diederich, described from Glacis Noir, Praslin, has black spore-bearing apothecia developing on the body (thallus) of a lichen belonging to the genus *Ramalina*. We know the species also from Australia, New Guinea and New Zealand. Although lichenicolous fungi are not lichens themselves, they are usually studied by lichenologists, and are frequently included in lichen checklists. Scale bar = 0.2 mm.

History of lichen taxonomy in Seychelles

Serious lichen exploration in Seychelles started only in the early 1990s, although a number of scientists had made small collections prior to that. Following the website *Recent Literature on Lichens* (nhm2.uio.no/lichens/rll.html), the first published references to lichens from the archipelago go back to Eriksson (1992) who reported *Psoroglaena cubensis* Müll. Arg. from Mahé, and Henssen & Thor (1994) who described the new *Dichosporidium latisporum* Thor & Henssen from Vallée de Mai in Praslin. Shortly after, Mark Seaward and André Aptroot started important projects with a view to enlarging knowledge about Seychelles lichens: Seaward et al. (1996, 2002) reported 45 species from Aldabra; Seaward & Aptroot (2003) studied 141 species (of which 129 were identified to species level) on Silhouette Island; and Seaward & Aptroot (2004) described four new species from Mahé and Silhouette. The first checklist (Seaward & Aptroot 2006) included 241 lichen taxa (incl. 219 determined to species level). A second checklist (Seaward & Aptroot 2009) reached a total of 376 species recorded from 28 islands (mainly Aldabra, Mahé, Praslin and Silhouette). Schumm & Aptroot (2010) published a *Seychelles Lichen Guide* with beautiful macroscopical and microscopical photographs of 218 lichen species (of which many were collected, however, in other tropical countries, and some, such as *Dictyonema glabratum* certainly do not occur in Seychelles). All these papers encouraged further lichenologists to publish additional notes on Seychelles lichens, and following M. Seaward (pers. comm.), the number of species known in 2014 reached 440.

References

Diederich, P., Lücking, R., Aptroot, A., Sipman, H. J. M., Braun, U., Ahti, T. & Ertz, D., 2017 New species and new records of lichens and lichenicolous fungi from the Seychelles. Herzogia 30: 182-236.

Eriksson, O. E., 1992 *Psoroglaena cubensis* and *Flakea papillata* gen. et sp. nov., two corticolous lichens with a pantropical distribution. Syst. Ascomycetum 11: 11–27.

Henssen, A. & Thor, G., 1994 Developmental morphology of the "Zwischengruppe" between Ascohymeniales and Ascoloculares. In: Hawksworth, DL (ed.): Ascomycete Systematics. Problems and Perspectives in the Nineties. NATO Advanced Science Institutes Series, Plenum Press, New York, pp. 43–56.

Schumm, F. & Aptroot, A., 2010 Seychelles Lichen Guide. Süssen, Germany: Beck OHG.

Seaward, M. R. D. & Aptroot, A., 2003 Lichens of Silhouette Island (Seychelles). Bibl. Lichenol. 86: 423–439.

Seaward, M. R. D. & Aptroot, A., 2004 Four Seychelles lichens new to science. Lichenologist 36: 119–124.

Seaward, M. R. D. & Aptroot, A., 2006 A preliminary checklist of lichens for the Seychelles Group. Journ. Hattori Bot. Lab. 100: 765–781.

Seaward, M. R. D. & Aptroot, A., 2009 Checklist of lichens for the Seychelles group. Bibl. Lichenol. 99: 335–366.

Seaward, M. R. D., Hambler, C. & Aptroot, A., 1996 Bryophytes and lichens of Aldabra.Trop. Bryol. 12: 29–33.

Seaward, M. R. D., Aptroot, A. & Harrington, F. A., 2002 The lichens of Aldabra, with comments on their distribution. Bryologist 105: 473–477.

Exciting results from a Coco de Mer PhD project

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The extraordinary Coco de Mer palm stands out in the plant world for many reasons. Its huge green leaves, each spanning up to 10 m across and with petioles up to 10 m long, form a dense crown in the canopy, where the palm towers above other plants. It is the dominant species in the ancient palm forests of Praslin and Curieuse. The male palms produce huge catkins with up to 170 individual sweet-smelling flowers that provide an important food source for a number of endemic animals such as the Giant bronze gecko (*Ailuronyx trachygaster*). The Coco de Mer's giant fruits contain usually a single bilobed seed (nut) - the largest in the world (sometimes weighing up to 18 kg). These nuts have been treasured for centuries and their unique shape makes them popular with tourists - as a result they fetch a high market value (up to €450). The Coco de Mer has traditionally been shrouded in myth and legend, and many aspects of its biology and ecology have remained elusive.

Why is it important to understand the ecology of the Coco de Mer?

Coco de Mer was only ever found growing naturally on two islands in Seychelles and one islet, but forest fires and extensive timber and nut harvesting have caused serious decline. Today, only a few substantial populations remain and there is very little natural regeneration. As a result, the species is classified as 'Endangered'. To effectively conserve this ecologically, economically and culturally important palm, we need to uncover more of its mysteries.

De-husked Coco de Mer nut (E Morgan)

The aim of my PhD project, based at ETH Zurich, Switzerland, was to study the genetic and demographic processes that underlie reproduction in the Coco de Mer. In partnership with Seychelles Islands Foundation, and in collaboration with Seychelles National Parks Authority, Ravine de Fond Ferdinand Nature Reserve and Global Vision International, I spent almost four years using a suite of molecular tools to answer questions about this iconic species that might otherwise have taken decades using other methods.

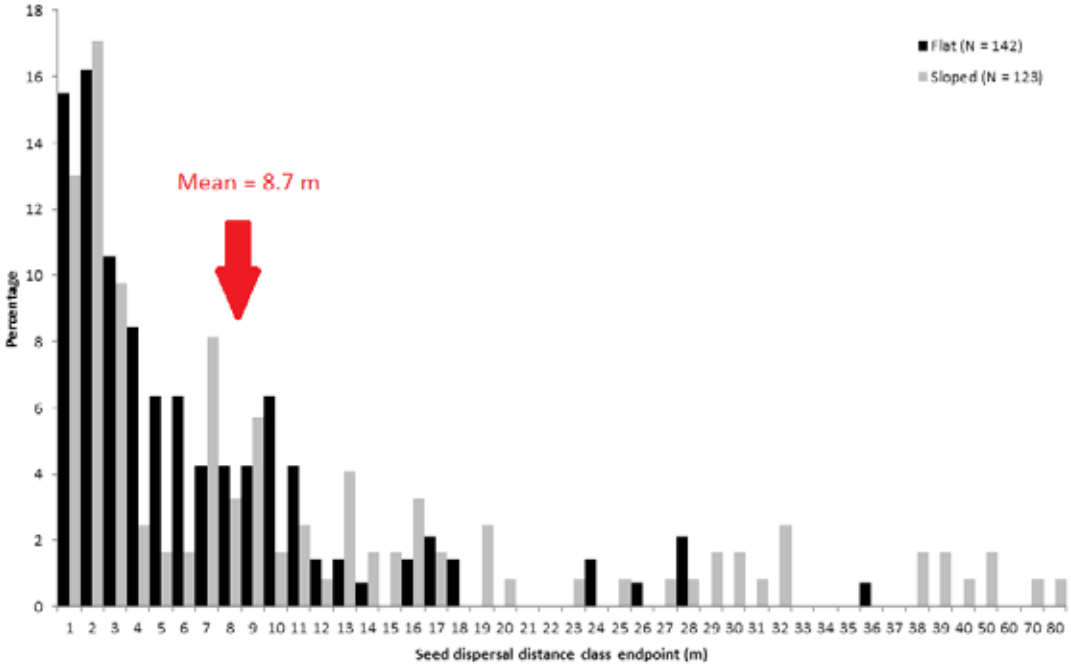
Emma Morgan during her fieldwork in 2015 climbing to collect leaf samples for genetic analysis (L Latorre Pineiro)

How far do Coco de Mer seeds and pollen disperse, and how does this affect its genetic structure?

Seed and pollen dispersal are important processes that influence the genetic structure and reproductive success of a species. Due to the large size of the Coco de Mer seeds, they can only be dispersed by gravity, but how far exactly is this? By genotyping established plants and carrying out maternity analyses, we were able to identify the mother tree of each young Coco de Mer plant. We found that most seeds were found directly under the canopy (1-3 m from the trunk of the mother) while some were found far away. Topography had a significant effect on seed dispersal, with plants on steep slopes exhibiting the longest distances (Morgan *et al.* 2017a). Pollen dispersal was also rather limited, with 80% of pollen flow occurring at distances of less than 80 m. This limited seed and pollen dispersal contributed towards the strong genetic structure detected in all populations. Levels of inbreeding were high and individuals growing in close proximity of each other were on average, highly related. Despite the high levels of inbreeding, genetic diversity was moderate to high in all sampled populations across Praslin and Curieuse. This can probably be attributed to occasional long-distance pollen flow that maintains genetic connectivity over evolutionary timescales.

What factors influence female reproduction?

Given that Coco de Mer grows on nutrient-poor soils, it has evolved a unique mechanism that enables it to filter nutritious matter and water down its trunk, thereby improving its own nutrient supply (Edwards *et al.* 2015). By studying the inflorescences on female trees, we found that the available soil nutrients (nitrogen and potassium) set the upper limit to the numbers of flowers that could be produced. Reproductive output was highly variable among females, but plants growing in closed dense forest in the south of Praslin were more likely to produce fruits than those growing in the open shrubland in the north of the island. When fruits were present, the fruit set was likely to be higher when the nearest male tree was closer. This demonstrates the importance



Frequency distribution of realised seed dispersal distances in Coco de Mer. Average dispersal distance across all sampled sites in Vallee de Mai, Fond Peper, Fond Ferdinand and on Curieuse was 8.7 ± 0.7m (Morgan *et al*. 2017a).

of pollen availability for fruit production in Coco de Mer, and many trees, even in closed forest, are likely to be pollen-limited. Many females produce inviable, elongated fruits which substantially reduce the overall fruit set. However, the reason why these are produced remains a mystery for the time being (Morgan *et al.* 2017b).

Are male and female plants produced in equal proportions?

Most adult populations of the dioecious Coco de Mer have unbalanced sex ratios but it was not previously known whether male and female seeds are produced in unequal proportions, or whether mortality rates differed among the sexes. With my colleagues, as well as Mathias Scharmann (also ETH Zurich), we developed new genetic markers that enable us, for the first time ever, to identify the sex of immature plants without having to wait several decades for the first flowers to be produced.

We discovered that male and female plants are produced in almost equal proportions, and we detected no effect of the environment on the sex ratio. Female trees may be more susceptible to environmental stress and as a result, die earlier than the males, but it is likely that the patterns of sex ratios in the adults may not be entirely natural, but largely manipulated by humans.

Conclusion

The Coco de Mer is both an ecological keystone species and a flagship species for conservation. My PhD thesis (Morgan 2016) contributes to a growing body of knowledge on the wide range of ecological processes that interact to shape the genetic and demographic structure of the palm, and the findings will be used to guide its conservation management. We recommend that the systematic moving of seeds around the forest should be avoided because of the unknown potential consequences of disrupting the natural genetic and demographic structure. Future studies investigating the pollination, germination and establishment consequences of moving seeds to alternative sites will help to inform management. Understanding how canopy openness and habitat quality influence local pollinator communities and their mobility will be critical to conserving patterns of genetic diversity *per se* rather than preventing inbreeding. Research on the Coco de Mer is ongoing, with many more interesting questions arising as we delve deeper into the mysteries of the magnificent Seychelles Coco de Mer.

Tight cluster of non-mature Coco de Mer plants growing around an adult female Coco de Mer (E Morgan)

Female Coco de Mer bearing a mixture of developing normal fruits and inviable abnormal fruits (E Morgan)

References

Edwards PJ, Fleischer-Dogley F, Kaiser-Bunbury CN (2015) The nutrient economy of *Lodoicea maldivica*, a monodominant palm producing the world's largest seed. *New Phytologist* 206:990-999

Morgan EJ (2016) Genetic and demographic processes underlying reproduction in *Lodoicea maldivica*, the largest-seeded plant in the world. PhD Thesis, ETH Zurich. http://dx.doi.org/10.3929/ethz-a-010861630

Morgan EJ, Kaiser-Bunbury CN, Edwards PJ, Fleischer-Dogley F, Kettle CJ (2017a) Keeping it in the family: strong fine-scale genetic structure and inbreeding in *Lodoicea maldivica*, the largest-seeded plant in the world. *Conservation Genetics, DOI: 10.1007/s10592-017-0982-2*

Morgan EJ, Kaiser-Bunbury CN, Edwards PJ, Fleischer-Dogley F, Kettle CJ (2017b) Tracing Coco de Mer's reproductive history: pollen and nutrient limitation reduce fecundity. *Ecology and Evolution*, in press

Does ecological restoration work? Insights from a glacis site near Morne Blanc, Mahé

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In the January 2014 issue of Kapisen (No. 16, p. 6-7) our team of international and local researchers posed a question: Does the restoration of degraded habitats, which is a common method to mitigate or reverse biodiversity loss, result in more robust and 'intact' native plant and animal communities? Now, another three years later, we believe that we have found and described an important piece of the puzzle that brings us closer to answering this question. In a recent publication, Kaiser-Bunbury and colleagues (2017) summarised intriguing findings on the response of pollinators (mainly insects, but also birds and reptiles) and the service they provide (i.e. pollination) to vegetation restoration.

Most plant species rely on animals for pollination services to reproduce and sustain plant populations. As a result of, for example, development and intensified land use, pesticide application and invasive alien species, pollinators are declining worldwide. This directly affects the long-term survival of plant populations in these degraded landscapes. In Seychelles, the last remaining native plant communities on inselbergs ('glacis') are threatened, too, by the encroachment of invasive

Restoration team in action (C Kaiser-Bunbury)

Pollination team at work (C Kaiser-Bunbury)

alien plant species. The dense growth of invasive coco plum (Prindefrans, *Chrysobalanus icaco)*, Kannel *(Cinnamomum verum*), Fo watouk (*Clidemia hirta*), Gouyavdesin (*Psidium cattleianum*) and Bwa zonn (*Alstonia macrophylla*) not only outcompetes native plants for nutrients, water and light, but also prevents native flowers from attracting pollinators and delivering high-quality pollen for reproduction. So, over time the situation for native plants worsens.

Conservation practitioners and forest managers try to break this reinforcing invasion cycle by removing alien plants and planting native plants in these areas, e.g. on Cousine and Cousin, North Island (Kapisen 9, p.4-7; 12, p.12-13), or in smaller patches at Mare aux Cochon on Mahé (Kapisen 9, p.8-10). Despite good intentions, the control of invasive plants as a tool in ecological restoration has two potential drawbacks: firstly, the removal of the majority of plants from invaded areas often causes an abrupt change in the microclimate and in solar radiation, which many remaining native plants cannot adjust to. A study on Seychelles inselbergs found that between 10-20% of adult native plants die (the amount varies with the removal technique) as a direct result of invasive alien plant control (Kaiser-Bunbury et al. 2015). Therefore, to limit the initial negative impact of the loss of adult plants, restoration projects must embrace a long-term management strategy that includes regular weeding and planting of native seedlings.

Secondly, we do not know whether restoration has the desired effects on both the plant community itself, which is actively manipulated, and the associated animal species that deliver critical services to the native plants (e.g. pollination, seed dispersal). To overcome the second drawback, we established together with the Seychelles National Parks Authority a large-scale field experiment and studied the effects of restoration (the removal of invasive alien plants) on insect, bird and reptile pollinators.

Insect pollinator on palm flower (C Kaiser-Bunbury)

Specifically, the research aimed to understand how interactions between native plants and their pollinators are affected by the removal of alien plants. We found that restoration increased pollination quantity and quality, the number of plant-pollinator interactions, the number of pollinator species, and thereby the overall resilience of native inselberg fauna and flora. It was encouraging to record a relatively fast response of the pollinator assemblage to restoration. In fact, we detected the effects less than one year after restoration, which suggests that plant-pollinator interactions can be used to monitor management success and provide feedback for adaptive management. The direct outcome was that native plants in restored plant communities produced more fruit, which is a critical step towards the long-term restoration aim of creating self-sustaining native plant communities (Kaiser-Bunbury et al. 2017).

Green gecko visiting endemic shrub (C Kaiser-Bunbury)

With this research we could show that the removal of invasive plants has positive direct and indirect effects on native plants and pollinating animals. Some conclusions for conservation and management that we can draw from this work are:

1. Glacis are high-biodiversity areas that respond well and quickly to restoration. Future nature conservation projects should consider the restoration of glacis vegetation both locally and in a landscape context;
2. Interpreting the results of this study in light of other research (e.g. from Mauritius and New Zealand) on the effect of restoration on biodiversity, it is paramount that the restoration effort is continued with maintenance weeding;
3. By removing the thicket of alien plants between native plants we improve pollination quality and quantity. This can be done everywhere: in private and public gardens, on hotel premises, on small islands, in natural, agricultural and built-up areas;
4. Conservation authorities can use fast-responding ecological interactions (e.g. pollination, seed dispersal, feeding relationships) to assess the success of management strategies.

Future studies will have to show whether these results are applicable elsewhere. We will use the experimental setup and the restored glacis in Seychelles as a foundation to investigate other processes related to plant reproduction, such as seed dispersal, seed predation, and flower herbivory. With this work we hope to continue to shed light on the complex response of ecosystems to human deliberate or unintentional interventions.

Acknowledgements

The authors would like to thank the restoration team from the Forestry and National Parks Authority sections at Grand Anse, Sans Souci and Le Niol, and the pollination team (Sabrina van de Velde, Paola Acuña) who worked extremely hard over a full 8-month period, and SNPA, Ministry of Environment, Energy and Climate Change and PCA for logistic and administrative support.

References

Kaiser-Bunbury, C.N., Mougal, J., Valentin, T., Gabriel, R. & Blüthgen, N. (2015) Herbicide application as a habitat restoration tool: impact on native island plant communities. *Applied Vegetation Science*, 18, 650-660.

Kaiser-Bunbury, C.N., Mougal, J., Whittington, A.E., Valentin, T., Gabriel, R., Olesen, J.M. & Blüthgen, N. (2017) Ecosystem restoration strengthens pollination network resilience and function. *Nature*, 542, 223-227.

The human side of a restoration project

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How easy it is to have great ideas and start a restoration project with enthusiasm! But when the maintenance work seems to need doing over and over again, it can become discouraging. At the Tea Tavern glacis restoration site (p. 16-17 and Kapisen 16, p. 6-7; 18, p. 17-18; 19, p. 21), in spite of best efforts and good methodologies, alien invasive plants do re-grow (e.g. cocoplum, lemongrass) and alien seedlings sprout up from seeds already in the soil (e.g. bwa zonn, cinnamon) or are brought in from outside the area by birds (fo watouk).

We know that vegetation restoration is a long-term process; so how has enthusiasm been maintained for this particular restoration project? For the scientist who set up the original restoration research project, the reward has been exciting results which he has been able to publish (see references on p. 17). But he relied to a great extent on field workers and volunteers. How is it for them? PCA set out to get reactions from the people who have been involved in the hard field work - as Seychelles Nation Parks Authority (SNPA) staff, NGO members and volunteers over the past few years.

Some SNPA staff have become passionate about their work at the restoration site: “I do it with love and joy. I care about nature. I see baby native plants like lalyann potao and I want to protect these little ones.” But for others it is just a job, even if they like to be out in the open air doing physical work rather than being stuck in an office. One of the fieldwork supervisors explained: “Yes, sometimes it is hard but even though the alien clearance work was very tough, now I see the results of all our efforts, it is beautiful. I am happy. I love this place.”

But it takes considerable persistence! Decision makers sometimes take a while to appreciate the effects of good long-term restoration work - as opposed to short-term quick actions such as planting native seedlings and saplings after a bush fire, controlling aliens in a small area, or planting natives and assuming that they will grow. The persistence of some of the SNPA staff associated with this project has been truly wonderful (enthusiasm and encouragement from the researcher also helped to keep things going when the initial work proved quite a struggle!).

What about the Port Glaud community members who have participated on a voluntary basis? Yes, it is true that they do not have to do the really hard work of clearing, but nevertheless to have the same people turning up on a fairly regular basis to do weeding, is an accomplishment, and they can become attached to the place as part of their district’s heritage too. On a visit this year, after a gap of some months, their reaction was encouraging to hear: “Wow! Things are looking so good since we were last here!” said one. “And we can see all of South Mahé now!” said another. One young man who had not been involved before expressed these thoughts: “I never thought my Seychelles can be so beautiful. Going on the walk there showed me that I don’t have to go to any other country to see the beauty of creation to its fullest. I’m just happy I got the chance to help restore the garden of my Seychelles.”

Some of the SNPA team clearing aliens and planting natives (C Kaiser-Bunbury)

Early days: PCA and community members weeding when the site was newly cleared (PCA)

Most of the Ephelia hotel volunteers (see p. 24 and 25) had never visited the site before. They found it very interesting to learn and understand about the glacis vegetation restoration project. What impressed them was how people, animals and plants interact with each other in ways which can be so negative for the environment, and how important it is for motivated people to restore areas where necessary. One person said it was amazing to find a place like this.

One of the tourism representatives who was taken around the site wrote afterwards “It has now tempted me to take my kids there for a walk during their holidays.”

On a recent visit, PCA members who have previously visited the site at various times, noted how much more effort has gone into the restoration work over the past months, including planting of many native seedlings. But they also realised how much still needs to be done to keep the alien seedlings in control. So we hope to alternate with the community group to make sure some weeding gets done every month or so, working in a different part of the site each time.

When you invest time and energy in something on a regular basis, it becomes part of you. You care for it and enjoy it. You learn to love the place for what it is, for what it can become. In the long run, I think we all know that the hard work will achieve the results we want to see - a beautiful place, easily accessible, full of native plants and animals forming a really healthy, properly functioning native habitat. And in the process all of us have learnt so much!

PCA and community members in the thick of it!

Ephelia staff and SNPA leader celebrate their work

State of the World's Plants Symposium and Report

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Once a year Royal Botanic Gardens Kew publishes a report entitled "State of the World's Plants" (https://stateoftheworldsplants.com). In association with the release of the report, a symposium at Kew in London highlights the major themes that were the focus of the different chapters of the report. I attended this year's symposium and found many interesting links with plant conservation in Seychelles.

New plant discoveries in Madagascar

The first session was dedicated to Madagascar - a plant region that illustrates the on-going global trend of new plant species discoveries. Worldwide over 1700 new vascular plant species were recognized in 2016. In Seychelles it is also evident that many new plant species still wait to be discovered. Currently, the team of the Seychelles Herbarium together with Bruno Senterre, as well as other botanists from overseas, describe new fern, moss and lichen species every year (see p. 3 and p. 11).

Madagascar is an Eldorado for botanists. According to the latest data Madagascar is home to 11,138 native species of vascular plant with 83% being endemic, occurring nowhere else on Earth. On-going intensive work on the flora of Madagascar often influences our understanding of the Seychelles flora - some species that were considered endemic to Seychelles have been found in Madagascar as well, others have received a new name, and we have learnt more about the relationships between plants in the Western Indian Ocean. For instance, one new discovery in Madagascar in 2016 was *Seychellaria barbata*, which belongs to a small genus of tiny plants growing on the forest floor that was first discovered in Seychelles (the endemic *Seychellaria thomassetii)* (Nuraliev et al. 2016). *Seychellaria* plants are brownish or purple not green. Without the green chlorophyll, they derive their energy by collaborating with fungi instead of using sunlight and photosynthesis. Another recent example is demonstrated by Gostel et al. (2017) who showed that the Seychelles endemic *Schefflera procumbens* is more closely related to other Schefflera species in Africa than to the Madagascar species.

The endemic *Seychellaria thomassetii* (K Beaver)

For Madagascar an important new finding has been that their grass flora is very old and that there are many endemic grass species that were previously unknown (Vorontsova, et al. 2016). The grasses of Seychelles still lack a thorough treatment, maybe there are surprises waiting here as well?

Urgency for plant conservation

The second session had the provocative title: "The immediate risk of extinction: climate change won't matter if everything has already died out…". We in Seychelles are well aware that many native and endemic plant species are at the brink of extinction. One threat that was particularly highlighted at the conference was plant trade that is regulated through the international CITES agreement. A major challenge is that new plant uses can emerge rapidly, for instance through a renewed obsession with traditional medicine, health supplements and other lifestyle products, or through horticulture, all apparent in Seychelles at present.

Invasive plant management

Another session was related to invasive plants and in particular their management. Data gathered through the State of the World's Plants Report demonstrated that there is a great lack of actual data on the effectiveness of different management and invasive species control measures. It is often not known what works and what does not work. Seychelles can be proud to be a leader in recent years in experimenting with and documenting habitat restoration efforts (e.g. Kapisen 9, p. 4, 8; Kapisen 12, p. 1, 12; Kapisen 16, p. 6, 11).

Medicinal plants

Another session focused on medicinal plants and one speaker was the current President of the Republic of Mauritius, Dr. Ameenah Gurib-Fakim, a

Fruits (on the left) and flowers (on the right) of the endemic Bwa merl (*Aphloia theiformis*) (K Beaver)

botanist whose previous scientific work focused on the medicinal plants of the Western Indian Ocean. One medicinal plant that she mentioned is also well known to us: Bwa merl (*Aphloia theiformis*) which is native to the Mascarenes and Seychelles (as well as Madagascar). The leaves of the species contain Aphloiol, which is used in beauty products such as anti-aging or sun protection creams. Yves Rocher, for instance, says it is proud to use in its products Aphloiol from Aphloia leaves collected in the wild in Madagascar (http://www.yves-rocher.ch/control/com/fr/CH/l-herbier-digital/l-aphloia). Next time you see a tourist who looks a bit too young to be true, consider this: it might well be thanks to Bwa merl leaves!

The State of the World's Plants Symposium and Report demonstrated to me that we struggle in plant conservation in Seychelles with many challenges that are equally important elsewhere. There was no shortage of bad news about the dire situation of plants, but there was also hope - the biggest being that more and more people care for plants and do their best to help them. Often the help comes from collaborative projects and thanks to grassroots action, as was nicely illustrated at the symposium through several talks given by plant conservationists from Madagascar.

Literature

Gostel, M. R., Plunkett, G. M. & Lowry, P. P. (2017) Straddling the Mozambique Channel: molecular evidence for two major clades of Afro-Malagasy Schefflera (Araliaceae) co-occurring in Africa and Madagascar. *Plant Ecology and Evolution* 150(1): 87-108.

Nuraliev, M. S., M. R. Cheek, A. S. Beer. 2016. *Seychellaria barbata* (Triuridaceae), a new species from Marojejy National Park, Madagascar. *Phytotaxa* 268/4: 229-243.

Vorontsova, M.S., Besnard, G., Forest, F., Malakasi, P., Moat, J., Clayton, W.D., Ficinski, P., Savva, G.M., Nanjarisoa, O.P., Razanatsoa, J., Randriatsara, F.O., Kimeu, J.M., Luke, W.R.Q., Kayombo, C. & Linder, H.P. (2016). Madagascar's grasses and grasslands: anthropogenic or natural? *Proceedings of the Royal Society B*. DOI: 10.1098/rspb.2015.2262.

Comment on Kapisen 19:

"I always enjoy receiving 'Kapisen' and send my congratulations on another great issue. It always helps me to feel very well informed and connected to all you are doing and achieving for plant conservation in the Seychelles."

Peter Wyse Jackson
President, Missouri Botanical Garden

PCA Restoration Project updates

Forest restoration site at Jardin du Roi

Contributed by Bettina Grieser-Johns, PCA member

As part of PCA's 3-year Forest Restoration project at the Jardin du Roi, Anse Royale (Kapisen 18, p. 4-5), invasive alien species such as Santol (*Sandoricum koetjape*), cinnamon (*Cinnamomum verum*) and Albizia (*Falcataria moluccana*) saplings were removed, and additional native palms and other species grown in the Jardin du Roi nursery were planted.

By February 2016 the lower sections of one of the trail paths were almost completely overgrown with alien creepers (Fig. 1 and 2) so Jardin du Roi staff cleared both sides of the path, after which some of the remaining 200 seedlings (mostly palms) could be planted.

Figure 1. Right side of path

Figure 2. Left side of path

In another part of the restoration site (the 'Santol clearing'), which had been weeded by the herbarium team in June 2016 (Kapisen 19, p. 24) the seedlings planted in 2015 continued to grow well including some natural regrowth (Fig. 3 and 4) but were again almost overgrown by Albizia, Bwa zonn (*Alstonia macrophylla*) and Santol seedlings. Between October 2016 and May 2017, 128 person-hours of weeding were carried out, the Santol clearing was extended, and all the remaining seedlings were planted, the last ones in April 2017.

Figure 3. Bwa merl (*Aphloia theiformis*) seedling - note encroaching aliens behind

Figure 4. Natural regrowth of bwa dir rouz (*Pyrostria bibracteata*) in the clearing

The work carried out at Jardin du Roi underlined the fact that regular weeding of invasive species is essential to ensure the planted seedlings (and natural native regrowth) have space to develop; if this is done, the planted seedlings can do very well. Problems that were encountered along the way included vandalism - on several occasions planted seedlings were deliberately ripped out in the periods between weeding visits, and thrown onto a heap together with the black plastic seedling bags that had been left in place to mark planting spots and the perforated bottles used to water the seedlings. As a consequence, we stopped marking the planting spots. Obviously some awareness raising and education is still required among the garden's neighbours.

Figure 5. Santol clearing in February 2017

Figure 6. A *Gynura sechellensis* seedling growing well near the Santol clearing

In May 2017, the French group Victoria Accueil joined PCA for a weeding activity. Seven dedicated participants worked hard to clear an area where there is great potential for natural regrowth once the invasives are removed. The 'before and after' pictures speak for themselves (Fig. 7 and 8).

Figure 7. Before

Figure 8. After

Particular thanks go to Elke Talma, Lindsay Chong-Seng, Charles Morel, Andrew Grieser Johns, Volker Zil, Eva Eckstein and the Victoria Accueil group for their help with weeding and planting on various occasions.

Also of note is a second monitoring of the Jardin du Roi permanent plots, carried out by a Seychellois student, Corianna Julie studying in South Africa, as part of her BSc research project. We hope to include an article about her work in the next issue of 'Kapisen'.

Glacis vegetation restoration site near the Tea Tavern at Morne Blanc

Contributed by Mariette Dine and Katy Beaver, PCA members

This project is based on conserving biodiversity through habitat restoration whilst involving the community in the long-term (Kapisen 18, p. 17-18; 19, p. 21). At the start of the project, the area was mostly covered with coco plum and cinnamon but after a few years of intensive work and support from the three main partners - PCA, Seychelles National Parks Authority (SNPA) and the Port Glaud community (see p. 18-19) - the Tea Tavern glacis area has become a successful restoration site (see p. 16-17) and an interesting nature trail with the added attraction of unique pitcher plants and splendid views for both local and overseas visitors.

Between May and August 2017, SNPA has carried out some major maintenance work and several community activities have been organized. In May and August, the group was composed of members of the Port Glaud Seventh Day Adventist community, which has been actively involved in the removal of invasive species and also taken part in plant identification and nursery training days. The group was surprised and pleased to see how much had been accomplished since their last visit, but realized that there is still a lot more work to be done, so they set off with enthusiasm. The mornings were educational and pleasant, as well as hard work, as the adults and children learnt more about the different plants they have helped to rehabilitate, such as Palmis and Bwa rouz, just by helping to pull out invasive seedlings. At the same time, the older participants shared their traditional knowledge of native plants, such as how long ago Kapisen wood was used as a construction material for houses and furniture.

SNPA staff carrying out maintenance work (PCA)

Weeding out alien seedlings (M Dine)

Community members in May (PCA)

'I'm strong too!' (PCA)

PCA members joined the August activity and everyone helping to remove Bwa zonn and Fo watouk seedlings, being careful not to trample on any native seedlings that were coming up. Thanks to all the effort put in by the various partners, the researchers have been able to show that the native plants are producing more flowers and more fruits now that they have less competition from aliens.

In June a strong and active group of staff from the Ephelia Resort and Spa at Port Launay assisted with improving the nature trail, making it easier and safer for walking, as well as more resistant to soil erosion. They were guided in this job by Unels Bristol, a local environmental contractor, who completed the work. PCA articles about both the May and June activities were published in local newspapers and the trail is now being promoted amongst local tourism personnel.


Carrying logs for path reinforcement (Ephelia staff)


Rock steps = easier and safer walking (PCA)


New path signs (KB)

An attempt to eradicate an alien invasive plant

Contributed by Ian Charlette, PCA member

In 2017, PCA received funding for a pilot study on the eradication of *Acacia concinna* (Rons in Creole) under the "Invaz'iles Project", which focuses on preventing and managing the spread of invasive species on islands and is implemented by IUCN with European Community funds (although PCA has to provide some of the funds too).

The project plans to tackle the infestation at the 12 scattered sites located by PCA members and by means of an appeal to land owners on Mahé Island (e.g. see Fig. 2). The main challenge with this *Acacia* is that it is a creeping plant with very tangled branches and incredibly numerous thorns that cause the plant to cling to clothes and hair and can cause considerable bruising (Fig. 1).


Figure 1. Close up of *Acacia concinna*


Figure 2. Infestation at Quincy in north Mahé

A pre-trial site was established at another site in north Mahé at Anse Etoile (see Fig. 3). The site was quite different from most of the other identified sites, as it is on a slope and was covered with different types of vegetation; but the advantage was that the soil was quite moist, given the presence of streams on either side of the site.


Figure 3. The pre-trial site at Anse Etoile.

Experience gathered so far has shown that it is necessary to have an efficient work force so that a minimum of cutting is carried out and herbicide is applied to the main stem only (and thence spreads to the rest of the plant). Although the herbicide appears to have caused high mortality, the site requires monitoring and may need further herbicide application and 2-3 monthly re-visits during the coming year, especially after the rainy season. It is also crucial to have prior contact with neighbours to give them enough time to understand the activities that fall under the project.

The project also aims to build up human resource capacity and create awareness, as well as to encourage community participation. Local plant nurseries will be encouraged to make suitable plants available for rehabilitation of the sites.

Seychelles Herbarium News

Charles Morel and Tarah Padachy, Herbarium staff
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New opportunities and equipment

Previous and current Kapisen articles attest to the fact that our plant collection is expanding and new species are being found. To identify unknown plant material, several methods can be used - working through identification keys; the use of published plant descriptions, illustrations and photographs; and comparison with properly identified herbarium specimens. However, for the observation of many diagnostic features, a good microscope is essential. For this reason, the Herbarium Team had made it a priority to acquire a good research microscope with a camera. An opportunity arose to purchase the microscope after we received permission from the Plant Conservation Action group (PCA) to use funds donated to the NGO by a local business (ECA Image) through Seychelles' Corporate Social Responsibility programme. Fortunately, one of our PCA members currently overseas, Christopher Kaiser-Bunbury, facilitated the purchase and shipment of the equipment on behalf of the Herbarium. We expect to boost our research and identification output with this new tool.

More opportunities arose after Charles (the herbarium curator), who is a member of the Indian Ocean Commission (COI) regional herbarium network, attended the AETFAT (Association for the Taxonomic Study of the Flora of Tropical Africa) Congress held in Nairobi in May 2017. AETFAT currently has over 1000 plant scientist members from all over the world who together share interests in plants of tropical Africa. It promotes global cooperation to advance its science and nurture upcoming researchers in the discipline.

....Charles using the camera (Herbarium Team)

Through this initiative the herbarium staff received additional training in Brahms (software for managing herbarium collections) and digitizing herbarium specimens. And through the COI regional herbarium network, the herbarium also received equipment for doing this digitization, including a new digital camera and tripod stand, a laptop and a new GPS! We also received a significant quantity of customized specimen barcode rolls as a donation from the Bews Herbarium (South Africa). They have offered future assistance for finalizing the specimen management database in due course. So, with all this new training and equipment we are ready to progress....!

.....However, the herbarium has had a major problem for some time - space constraint. Without more space it is impossible to expand our collection and carry out other necessary work (Kapisen 19, p.19). Several possible locations failed to materialise or proved unsuitable (including the old Court House mentioned in the previous Kapisen) and we began to despair. Now, as Kapisen 20 is finalised, a new location has been found. This time we are really hopeful that it all works out well... more news in the next Kapisen issue!

Tarah using the new microscope.....

Charles (1st left) with other regional participants at the AETFAT congress in Nairobi, Kenya

A new species for Silhouette

François Baguette, who is the Island Conservation Society's Conservation Officer on the island of Silhouette, reports of another exciting discovery:

Under the Critical Ecosystem Partnership Fund (CEPF) project that started on Silhouette Island in July 2016, Key Biodiversity Area explorations are organized on a regular basis. In collaboration with partners, the Island Conservation Society (ICS) attempts to reduce knowledge gaps about species interaction in Silhouette National Park.

In this context, the ICS Team, accompanied by Dr. Bruno Senterre, an expert botanist, started a 2-day exploration to the northern slope of Mont Dauban. The team left the village of La Passe early morning to start the trail to Anse Mondon, an old village located in the North of the island. From there, the real exploration through the tropical forest started, up along the northern slope of the 2nd highest peak of Seychelles. After a few hours of exploration, the team was rewarded by the sighting of rare species like *Trilepisium gymnandrum*, *Polyscias seychellarum*, *Goodyera sechellarum* or *Phaius tetragonus*.

Asplenium petiolatum (F Baguette)

A. petiolatum close up (B Senterre)

But the real discovery occurred the next day, walking down the Machabee River. Located on the trunk of a Latannyen fey (*Phoenicophorium borsigianum*), surrounded by mosses at 1.5m above the ground, the team discovered the first known individual of *Asplenium petiolulatum* on Silhouette Island! This rare species of fern was previously known from only 3 individuals in Seychelles, growing on Mahé Island (Kapisen 19, p.22). It lives in ravine forest at mid altitude, and as for many of the fern species in Seychelles very little is known about it.

Asplenium petiolulatum is also recorded from Madagascar, Reunion, Comoros and Mauritius. The characteristics of the Silhouette specimen correspond well with that proposed in the "Flore des Mascareignes" (Badré 2008). However, *Asplenium* being a very difficult and broad genus (700 species), the identification as "*A. petiolulatum*", proposed by B. Senterre, is preliminary and will require more detailed taxonomic investigation in order to verify or to correct. More exploration should also be done to improve our knowledge on the species distribution and its morphology in Seychelles, which will help with verifying the species identity. At present, only four individuals from two locations are known in Seychelles.

Reference

Badré, F. (2008) Flore des Mascareignes: Ptéridophytes 1, Psilotacées à 26, Marsiléacées. IRD Editions. 462 pp. http://horizon.documentation.ird.fr/exl-doc/pleins_textes/ed-06-08/010047723.pdf

Bwa dou in the news

In June, PCA members Andre Dufrenne and Mariette Dine went on a trip to Praslin Island in search of the rare Bois dou (*Craterispermum microdon,* considered Critically Endangered). Andre had been assigned to collect samples from different locations on Praslin needed by local Herbarium staff in order to compare the plants with those found on Mahé. Samples were taken at three different elevations, one at Fond B'offay and two at Glacis Noir. Whilst on their way up Glacis Noir they noticed that the notorious introduced "hairy caterpillars" were also present on Cocoplum (Prindefrans, a common invasive species).

Andre with Bwa dou at Glacis Noir (M Dine)

But the other news about Bwa dou is disheartening. On the last PCA field trip to the old nature trail at La Reserve, which has been highlighted as worthy of formal protected area status (Kapisen 19, p 11-13), a mature tree of this rare, slow-growing species was found recently felled. Numerous smaller cut branches were left strewn around but the top part of the trunk was removed completely, presumably by people providing local herbalists with plant material from which to prepare medicine. The lower trunk had been left intact, apparently for later cutting or in the hope that it would re-sprout for future collection. While PCA respects the use of plant medicine locally, the over-collection of this rare plant is partly driving its potential extinction, as there is little natural regeneration and it has proved difficult to propagate *ex situ*. An article about the incident was published in a local daily newspaper to raise awareness.

Cut trunk of Bwa dou at La Reserve (C Morel)

Exploration of the southern coast of Mahé

Lindsay Chong-Seng has been pleasantly surprised to find small pockets of interesting native flora along the headlands in the very south of Mahé Island. Amongst the more exciting finds were three stands of the endemic Bwa kafoul trwa fey (*Allophylus sechellensis*) and the indigenous Jasmine (*Jasminum fluminense* subsp. *mauritianum*), both of which are relatively rare but still holding on in this area. Vakwa bordmer (*Pandanus balfourii*) was also present - another endemic which is decreasing rapidly due to land development.

Although the whole area was previously covered with economically important coconuts and cinnamon, and extensively planted with fruit trees and bamboo, Lindsay found native vegetation patches with endemic palm and shrub species along some ridges and in boulder fields. Also some interesting indigenous species were located, such as Gayak (*Intsia bijuga*), Lafous (*Ficus spp*.), Bwa siro (*Premna serratifolia*) and Bwadrenet (*Dodonaea viscosa*).

photos see next page

Exploration of the southern coast of Mahé (photos)

Bwa kafoul trwa fey (C Morel)

Gayak (K Beaver)

Taxonomic changes

A number of changes have recently been made to Latin names of Seychelles endemic plant species as a result of phylogenetic studies, amongst which is one of the endemic Bwa dir species and Koko maron:

The three Bwa dir species (previously placed in the genus *Canthium*) had already been changed in 2009 to *Pyrostria bibracteata* (Bwa dir rouz), *Peponidium carinatum* (Bwa dir blan) and *Peponidium sechellense* (**Bwa dir depei**). Now further studies (Kainulainen & Razafimandimbison et al. 2016 - see page 33) have confirmed the two *Peponidium* species as being in that genus but *Peponidium sechellense* has been changed to ***Peponidium celastroides***, the reason being that it has been shown to be the same as a previously described species from Madagascar. It is therefore now considered indigenous rather than endemic.

Bwa dir depei (H Elzein)

Koko maron (PCA)

Koko maron was only recently changed from *Curculigo seychellensis* to *Friedmannia seychellensis* (Kapisen 19, p. 17-18) but it turned out that this genus name had already been used for a green alga. The same name cannot be given to more than one plant genus; consequently the genus name had to be changed again and is now ***Neofriedmannia seychellensis*** (Kocyan & Wiland-Szymanska, 2016 - see page 34).

PCA Field trips

Exploration of Mont Ternay, west coast of Mahé

It is strange how few members choose to join the exploratory field trips! True, these are often more adventurous, going well away from existing trails, but often with many rewarding or exciting discoveries. Three of our intrepid explorers were photographed by the fourth member of this expedition (Elke Talma). Amongst interesting finds were some very nice Bwadfer (*Vateriopsis seychellarum*).




PCA excursion to Mt Sebert

Contributed by Bettina Grieser-Johns, PCA member

In April, a field trip to Mt Sebert was led by PCA members Charles Morel and Lindsay Chong-Seng and included other members, family, five guests from Victoria Accueil and visiting consultant Alan Tye.

Starting from the PUC pumping station at Cascade, the trail leads up the mountain on a concrete staircase. Lindsay seized the opportunity to point out noteworthy plants along the way, such as a flowering Bwakwiyer (*Tabernaemontana coffeoides*) and a Gayak tree (*Intsia bijuga*). He also noted tree species that used to be and still are cultivated in the Seychelles as fruit trees, such as Ponm gouvernman (*Syzygium malaccense*), Santol (*Sandoricum koetjape*) and Chinese guava (*Psidium cattleianum*), with samples provided for tasting by gracious permission of the owner. Having regained some of our strength after this steep ascent, we were ready to continue along the winding but thankfully shady path further up the mountain. The forest here was rather disappointing, obviously heavily used in the past and therefore it is still dominated by cinnamon, as documented by the old distillery we passed about half way up the mountain. Lindsay explained to the fascinated audience that the construction materials were carried on people's backs all the way from the valley, including the heavy metal pieces required for the actual distillery. Only the occasional native palm relieved the dominance of the introduced species.

Only when we were almost up on the glacis did the forest composition change noticeably, announced by seedlings of Bwa kalou (*Memecylon elaeagni*), Kolofant (*Soulamea terminalioides*), Bwa sandel (*Dracaena reflexa*) and Bwa merl (*Aphloia theiformis*). After some scrambling up the glacis we had a well-deserved rest under a large boulder that provided a minimum of shade. Wandering about, I had my first real encounter with Bwazasmen (*Excoecaria benthamiana*) - only because Charles told me what it was and I took pictures of the very characteristic 3-lobed fruit. Lindsay told us how poisonous the sap is.


Lindsay's introduction to the trail


View of St Anne Marine Park from the staircase

Bwazasmen with fruit and a small female flower

Lunch with a view

Further up, the guides led us to a spot right on the edge of the cliff with a gorgeous view over the St Anne Marine National Park where we had lunch. Getting up onto the actual top was an adventure in itself, but our thoughtful guide Charles had brought along a rope and helped people up a huge boulder with hardly any discernible footholds. But the effort was well worth it - not only did we have a gorgeous view in all directions - Southern Mahé, Victoria, Morne Seychellois, airport at our feet - but the plant life up there is just amazing, with interesting endemic plants wherever you look.

Charles helping people with a rope

Vakwa montanny (*Pandanus multispicatus*)

Mangliye granbwa

For me personally the most exciting was Mangliye granbwa (*Glionnetia sericea*) because I hadn't come across it before and because, with that name, I'd have expected it by the coast (Mangliye means mangrove in English), not up a glacis! So I learned from our guides that this is NOT a mangrove plant but a member of the Rubiaceae family and arguably the most beautiful tree in Seychelles! After seeing the flowers, I think I agree with that claim.

However, I also found the fruit bodies of the Vakwa marron (*Pandanus sechellarum*) very impressive, as were the pitcher plants (*Nepenthes pervillei*), the jellyfish tree (*Medusagyne oppositifolia*) and the characteristic Kolofant seeds that I'd never seen before. All in all, a very interesting and educational walk, thoroughly enjoyed by all participants (I think!).

Kolofant fruits

View of Morne Seychellois in the background

Plant Conservation Action group – who we are and what we do

When we started: November 2002

Who we are: We are a voluntary membership organisation (NGO), with an executive committee elected every two years. We have meetings every two months and regular field trips.

Our mission: PCA mobilises action for the scientific research and conservation of plant species, and promotes community awareness of the fundamental importance of plants in Seychelles.

What we do:

- Plant species identifications
- Advice on vegetation rehabilitation
- Vegetation surveys and management plans
- Collaborative research and monitoring
- Hands-on training in practical plant conservation
- Promote awareness about plants and conservation
- Field trips for members and plant enthusiasts
- Advocate for plant conservation

Our current projects: "Restoring endangered 'glacis' vegetation"; "Pilot study – eradication of *Acacia concinna*"

Website: www.pcaseychelles.org **See also:** www.seychellesplantgallery.com

Contacts: pca.seychelles@gmail.com; Telephone +248 4241104 or +248 2637533

New Literature

Adamson, E. A. S., Saha, A., Maddock, S. T., Nussbaum, R. A., Gower, D. J. & Streicher, J. W. (2016) Microsatellite discovery in an insular amphibian (*Grandisonia alternans*) with comments on cross-species utility and the accuracy of locus identification from unassembled Illumina data. *Conservation Genetics Resources* **8**(4): 541-551.

Ahti, T., Pino-Bodas, R., Flakus, A. & Stenroos, S. (2016) Additions to the global diversity of Cladonia. *Lichenologist* **48**(5): 517-526.

Ashwal, L. D., Wiedenbeck, M. & Torsvik, T. H. (2017) Archaean zircons in Miocene oceanic hotspot rocks establish ancient continental crust beneath Mauritius. *Nature Communications* **8**. Doi: 10.1038/ncomms14086

Bauret, L., Rouhan, G., Hirai, R., Perrie, L., Prado, J., Salino, A., Senterre, B., Shepherd, L., Sundue, M., Selosse, M.-A. & Gaudeul, M. (in press): Molecular phylogeny and historical biogeography of the fern genus *Rumohra* (Dryopteridaceae) based on an exhaustive species sampling. *Botanical Journal of the Linnean Society.*

Bolotov, I. N., Matyot, P., Bippus, M., Spitsyn, V. M., Kolosova, Y. S. & Kondakov, A. V. (2016) Redescription of Thalassodes antithetica Herbulot, 1962, an endemic moth from Inner Seychelles (Lepidoptera: Geometridae: Geometrinae). *Zootaxa* **4139**(1): 135-139.

Braithwaite, C. J. R. (2016) The giant tortoise, Aldabrachelys, and its bearing on the biogeography and dispersal of terrestrial biota in the Western Indian Ocean. *Palaeogeography Palaeoclimatology Palaeoecology* **461**: 449-459.

Burt, A. J., Gane, J., Olivier, I., Calabrese, L., De Groene, A., Liebrick, T., Marx, D. & Shah, N. (2016) The history, status and trends of the Endangered Seychelles Magpie-robin *Copsychus sechellarum. Bird Conservation International* **26**(4): 505-523.

Cheke, A. S., Pedrono, M., Bour, R., Anderson, A., Griffiths, C., Iverson, J. B., Hume, J. P. & Walsh, M. (2017) Giant tortoises spread to western Indian Ocean islands by sea drift in pre-Holocene times, not by later human agency - response to Wilme et al. (2016a). *Journal of Biogeography* **44**(6): 1426-1429.

Diederich P, Lücking R, Aptroot A, Sipman HJM, Braun U, Ahti T & Ertz D. (2017) New species and new records of lichens and lichenicolous fungi from the Seychelles. *Herzogia* **30** (1) 182-236.

Dubuisson, J.-Y., Bauret, L., Grall, A., Rouhan, G., Rakotondrainibe, F., Senterre, B., Said, A.H., Pynee, K., Ebihara, A. & Hennequin, S. (in press): Revision of fern genera *Abrodictyum* C.Presl and *Trichomanes* L. (Hymenophyllaceae, Polypodiidae) in western Indian Ocean, description of a new *Abrodictyum* species for Madagascar and biogeographical hypotheses. *Phytotaxa.*

Feare, C. J., van der woude, J., Greenwell, P., Edwards, H. A., Taylor, J. A., Larose, C. S., Ahlen, P. A., West, J., Chadwick, W., Pandey, S., Raines, K., Garcia, F., Komdeur, J. & de Groene, A. (2017) Eradication of common mynas Acridotheres tristis from Denis Island, Seychelles. *Pest Management Science* **73**(2): 295-304.

Gane, J. & Burt, A. (2016) Longevity and survival of the Endangered Seychelles Magpie Robin *Copsychus sechellarum*. *Ostrich* **87**(1): 81-83.

Gostel, M. R., Plunkett, G. M. & Lowry, P. P. (2017) Straddling the Mozambique Channel: molecular evidence for two major clades of Afro-Malagasy Schefflera (Araliaceae) co-occurring in Africa and Madagascar. *Plant Ecology and Evolution* **150**(1): 87-108.

Hansen, D.M., Austin, J.J., Baxter, R.H., de Boer, E.J., Falcón, W., Norder, S.J., Rijsdijk, K.F., Thébaud, C., Bunbury, N.J. and Warren, B.H. (2017). 'Origins of endemic island tortoises in the western Indian Ocean: a critique of the human-translocation hypothesis'. *Journal of Biogeography* **44**(6):1430-1435.

Haverkamp PJ, Shekeine J, de Jong R, Schaepman M, Turnbull LA, Baxter R, Hansen D, Bunbury N, Fleischer-Dogley F & Schaepman-Strub G. (2017) Giant tortoise habitats under increasing drought conditions on Aldabra Atoll – Ecological indicators to monitor rainfall anomalies and related vegetation activity. *Ecological Indicators* **80**: 354-362.

Hawlitschek, O., Garrido, S. R. I. & Glaw, F. (2017) How marine currents influenced the widespread natural overseas dispersal of reptiles in the Western Indian Ocean region. *Journal of Biogeography* **44**(6): 1435-1440.

Jeffery, L. & Rotter, R. (2016) Sustenance, nourishment, and cultivation: plants as living cultural heritage for dispersed Chagossians in Mauritius, Seychelles, and the UK. *Journal of the Royal Anthropological Institute* **22**(2): 296-313.

Kainulainen K. & Razafimandimbison SG. (2016) New taxonomic combinations in West Indian Ocean Vanguerieae (Rubiaceae). *Phytotaxa* **282** (4) 267-272.

Kainulainen K, Razafimandimbison SG, Wikström N, & Bremer B. (2017) Island hopping, long-distance dispersal and species radiation in the Western Indian Ocean: historical biogeography of the Coffeeae alliance (Rubiaceae). *Journal of Biogeography* DOI: 10.1111/jbi.12981

Kaiser-Bunbury CN, Mougal J, Whittington AE, Valentin T, Gabriel R & Blüthgen N. (2017) Ecosystem restoration strengthens pollination network resilience and function. *Nature* **542**: 223-227

Kocyan A & Wiland-Szymańska J. (2017) A new name and a new combination for *Friedmannia* nom. illeg. (Hypoxidaceae). *Phytotaxa* **291** (3): 239-239.

Kopeczky, R. & Gemel, R. (2016) First record of Lamprophis geometricus (SCHLEGEL, 1837), on the Seychelles Island of La Digue (Indian Ocean). *Herpetozoa* **28**(3-4): 178-180.

Larridon, I., Bauters, K., Semmouri, I., Viljoen, J.-A., Prychid, C.J., Muthama Muasya, A., Bruhl, J.J., Wilson, K.A., Senterre, B. & Goetghebeur, P. (in press): Molecular phylogenetics of the genus Costularia (Schoeneae, Cyperaceae) reveals multiple distinct evolutionary lineages. - *Molecular Phylogenetics and Evolution.*

Lockwood, J. L. (2016) Providing the voice of experience for managing invasive species. *Biological Invasions* **7**(18): 2117-2118. [Book review of: Gérard Rocamora and Elvina Henriette 2015. Invasive alien species in Seychelles. University of Seychelles Island Biodiversity and Conservation Centre and Biotope Editions, Anse Royale, Seychelles].

Maddock, ST (2016) Systematics and Phylogeography of Seychelles Amphibians. Doctoral thesis, UCL (University College London). http://discovery.ucl.ac.uk/1476198/

Mejias, M. A., Wiersma, Y. F., Wingate, D. B. & Madeiros, J. L. (2017) Distribution and at-sea behavior of Bermudan White-tailed Tropicbirds (Phaethon lepturus catesbyi) during the non-breeding season. *Journal of Field Ornithology* **88**(2): 184-197.

Morel, C., Chong-Seng, L., Padayachy, T. & Senterre, B. (2016): Foundation course in plant identification to support the implementation of forest rehabilitation. - Consultancy Report, Plant Conservation Action group (PCA), Victoria, Seychelles. 69 pp.

Morgan EJ. (2016) Genetic and demographic processes underlying reproduction in *Lodoicea maldivica*, the largest-seeded plant in the world. PhD Thesis, ETH Zurich. http://dx.doi.org/10.3929/ethz-a-010861630

Morgan EJ, Kaiser-Bunbury CN, Edwards PJ, Fleischer-Dogley F & Kettle CJ (2017) Keeping it in the family: strong fine-scale genetic structure and inbreeding in *Lodoicea maldivica*, the largest-seeded plant in the world. *Conservation Genetics*, DOI: 10.1007/s10592-017-0982-2

Morgan EJ, Kaiser-Bunbury CN, Edwards PJ, Fleischer-Dogley F & Kettle CJ. (2017) Tracing coco de mer's reproductive history: pollen and nutrient limitation reduce fecundity. *Ecology & Evolution*. 00:1–12. https://doi.org/10.1002/ece3.3312

Neuwirth G & Aptroot A. (2016) *Cryptothecia stockeri* (Arthoniales, Arthoniaceae), a new corticolous lichen species from the Seychelles. *Herzogia* ***29*** (1) 97-102.

Neuwirth G, Aptroot A & Stocker-Wörgötter E. (2017) *Platythecium seychellense,* a new species in the family Graphidaceae (lichenized Ascomycota: Ostropales) from the Seychelles and a world key to the genus. *The Lichenologist* **49** (1) 85-91.

Neuwirth G & Stocker-Wörgötter E. (2017) *Tapellaria palaeotropica* (Pilocarpaceae), a new foliicolous lichen species from the Seychelles, and a world key to the genus. *The Lichenologist* **49** (3) 253-258.

Niedbala, W. (2017) Ptyctimous mites (Acari, Oribatida) of Madagascar and neighbouring islands. *Acarologia* **57**(1): 3-205.

Patiño J, Whittaker RJ, Borges PAV, Fernández-Palacios JM, Ah-Peng C, Araújo M, Ávila SP, Cardoso P, Cornuault J, de Boer EJ, de Nascimento L, Gil A, González-Castro A, Gruner DS, Heleno R, Hortal J, Illera JC, Kaiser-Bunbury CN, Matthews TJ, Papadopoulou A, Pettorelli N, Price JP, Santos AMC, Steinbauer MJ, Triantis KA, Valente L, Vargas P, Weigelt P & Emerson BC. 2017. A roadmap for island biology: 50 fundamental questions after 50 years of *The Theory of Island Biogeography*. *Journal of Biogeography* **44**: 963-983

Razafimandimbison SG, Kainulainen K, Wikström N, & Bremer B. (2017) Historical biogeography and phylogeny of the pantropical Psychotrieae alliance (Rubiaceae), with particular emphasis on the Western Indian Ocean Region. *American Journal of Botany* **104**(9): 1407-1423

Rocha S, Perera A, Bunbury N, Kaiser-Bunbury CN & Harris DJ. (In press) Speciation history and species-delimitation within the Seychelles Bronze geckos, *Ailuronyx* spp.: molecular and morphological evidence. *Biological Journal of the Linnean Society.*

Rocha, S., Perera, A., Silva, A., Posada, D. & Harris, D. J. (2016) Evolutionary history of Trachylepis skinks in the Seychelles islands: introgressive hybridization, morphological evolution and geographic structure. *Biological Journal of the Linnean Society* **119**(1): 15-36.

Sass-Gyarmati, A. (2017) *Bazzania konratiana* sp nov (Marchantiophyta: Lepidoziaceae) from Madagascar. *Cryptogamie Bryologie* **38**(2): 119-124.

Senterre, B. (2016): Practical plant identification training guide. - Biological principles and interactions in tropical ecology (Course Code SENV1102E) - Unit 2: Patterns and processes in Ecology - Topic 1: Biodiversity. Anse Royale, Seychelles, 2016/05/03, Pp. 67. - University of Seychelles (UniSey).

Senterre, B. & Chong-Seng, L. (2016): Biodiversity assessment and rehabilitation potential of forests in the Mare aux Cochons catchment (Mahé, Seychelles). - Ecosystem-based adaptation to climate change in Seychelles (EBA project). Consultancy Report, Government of Seychelles, United Nations Development Programme, Victoria, Seychelles. 23 pp. + 61 pp. annexes pp.

Senterre, B. & Wagner, M. (2016): Standardization of data collection and creation of a biodiversity database: a PostgreSQL-PostGIS database for Island Conservation Society (Seychelles). - Consultancy Report, Government of Seychelles, United Nations Development Programme, Victoria, Seychelles. 40 pp.

Senterre, B., Rouhan, G., Morel, C. & Dubuisson, J. Y. (2017) New species and records in the fern genus Didymoglossum for the flora of Seychelles, with notes on the Southeast Asian D-motleyi complex (Hymenophyllaceae). *Phytotaxa* **292**(3): 201-217.

Techer, M. A., Clemencet, J., Simiand, C., Preeaduth, S., Azali, H. A., Reynaud, B. & Delatte, H. (2017) Large-scale mitochondrial DNA analysis of native honey bee *Apis mellifera* populations reveals a new African subgroup private to the South West Indian Ocean islands. *BMC Genetics* 18. Doi: 10.1186/s12863-017-0520-8

Techer, M. A., Clemencet, J., Simiand, C., Portlouis, G., Reynaud, B. & Delatte, H. (2016) Genetic diversity of the honeybee (*Apis mellifera* L.) populations in the Seychelles archipelago. *Insect Conservation and Diversity* **9**(1): 13-26.

Toussaint, E. F. A., Fikacek, M. & Short, A. E. Z. (2016) India-Madagascar vicariance explains cascade beetle biogeography. *Biological Journal of the Linnean Society* **118**(4): 982-991.

Yao, Z. Y., Dong, T. T., Zheng, G., Fu, J. Z. & Li, S. Q. (2016) High endemism at cave entrances: a case study of spiders of the genus Uthina. *Scientific Reports* **6**. Doi: 10.1038/srep35757

Zimkus, B. M., Lawson, L. P., Barej, M. F., Barratt, C. D., Channing, A., Dash, K. M., Dehling, J. M., Du Preez, L., Gehring, P. S., Greenbaum, E., Gvozdik, V., Harvey, J., Kielgast, J., Kusamba, C., Nagy, Z. T., Pabijan, M., Penner, J., Rodel, M. O., Vences, M. & Lotters, S. (2017) Leapfrogging into new territory: How Mascarene ridged frogs diversified across Africa and Madagascar to maintain their ecological niche. *Molecular Phylogenetics and Evolution* **106**: 254-269.