

Kapisen

Plant Conservation Action group



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Newsletter



Data Collection in Seychelles

Data collection in Seychelles

Many of the articles and stories in this issue refer in one way or another to the importance of accurate and comprehensive data for environmental management. Local conservationists and in particular botanists have in the past few years made enormous progress in collecting, storing and sharing accurate data about the plants and habitats of Seychelles locally.

One example is found in an article about a new digital system for recording and sharing observations of the different plant and animal species we find in Seychelles (p. 3-4), particularly useful when we explore unfamiliar areas. The system is most useful when good photos and a precise GPS position can be recorded. This is just one of the projects carried out with assistance of the Seychelles Herbarium, which is now situated in more spacious surroundings (p. 19).

Another quite different example of accuracy is where careful and precise measurements can be made using specialised equipment, as has been necessary to work out how Seychelles Pitcher plants (*Lal Yann potao*) capture their insect prey (p. 5-6). In contrast, the requirements for carrying out broad-scale surveys of previously un-researched habitats such as marine seagrass beds are different - large maps and aerial photographs may be used as well as field exploration (p. 7-8). But if the surveys are going to be useful in the future and assist decisions about seagrass habitat management, they still require observation and measurement on the ground. Smaller surveys (p. 11-12) might require less complicated field work but, as with the seagrass surveys, useful information comes only when the data is collected and recorded accurately.

An interesting example of monitoring work is provided by research into the control of invasive species in the World Heritage Site of Vallée de Mai (p. 9-10). When results are different from what you expect, it might be easy to try to 'explain them away' as some sort of 'mistake', whereas in fact the results may be telling you something vital that you don't yet understand about animal behaviour or about a plant's response to herbicide treatment.

When we go on field explorations or carry out scientific field work we may get so absorbed in work or conversations that we forget some basic 'rules' about walking in nature. So a PCA member has put together some guidelines (p. 13) to remind us of the need for respect - towards nature, towards each other and for the future of our natural environment. We trust that we followed such guidelines on a recent PCA field trip! (p. 21).

PCA News includes updates about PCA project work, including restoration (p. 16), management of a very prickly invasive plant (p. 17), and an interesting example of regional cooperation in the production of an annual calendar (p. 15). Although we have had few recent opportunities to increase awareness about plant conservation in the general population, our regular community partners are constantly learning, and recently we took a group of excited children to a beautiful vegetation restoration site (p. 14). In order to reach out further, PCA has just started a Facebook page (see link below), still at an early stage in its development.

Also in this issue, we have brought back some entertainment in the form of an Activity page (p. 18) and two amusing drawings from a young Seychellois artist (p. 12 and 22). And as usual, Kapisen is completed with a list of new environmental literature (p. 24).

Editorial Team: Katy Beaver, Eva Schumacher and Christoph Kueffer

Cover photo: Restoration work at Vallée de Mai (see page 9) (Photo: Seychelles Islands Foundation)

The digital pdf version of Kapisen can be downloaded:

www.pcaseychelles.org/kapisen.html

www.seychelles.ethz.ch/Partnership/Kapisen.html

Email: pca.seychelles@gmail.com

Facebook: www.facebook.com/pcagroup2018

Tel: +248 4241104 or +248 2637533

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An iNaturalist project to link people and biodiversity knowledge in Seychelles

Bruno Senterre (PCA, IBC), Pierre-André Adam (ICS), François Baguette (ICS), Lindsay Chong-Seng (PCA), Elvina Henriette (TRASS), James Mougai (SNPA), Charles Morel (SEY) & Tarah Padayachy (SEY)

bsenterre@gmail.com



Identity photo of 'Seychelles Bio Gallery' on iNaturalist (B Senterre).

Plant Conservation Action group (PCA) is known for having led the so-called 'Herbarium Project' and the 'Key Biodiversity Areas (KBA) Database' from 2011 to 2014 (Kapisen 13; 16, p4-5). One of the products was the Seychelles Plant Gallery (www.seychellesplantgallery.com). PCA has been trying to share its database and get more people to contribute to it with photos and species occurrence data, but has been limited by technical issues. In response to that, PCA has now embarked on a new project called 'National Network on Biodiversity Data Exchange for Improved KBA Management' (funded by the Critical Ecosystem Partnership Fund - CEPF) which aims to convert the KBA database into an online multi-users format and to develop formal collaborations with National partners such as Island Conservation Society (ICS), the National Herbarium (SEY), the Seychelles National Parks Authority (SNPA), as a starting point.

Our vision consists in having a professional database for the management of a wide range of biodiversity-related data for which appropriate management tools

are sometimes missing or not optimal. Secondly, we want to link that database with a tool aimed for the people of Seychelles and visitors, to help them contribute information to the scientific community and to facilitate feedback on species identification. We suggest to achieve this by using an existing tool that has already proven very powerful worldwide: iNaturalist.

What is iNaturalist?

This is a free network linking scientists and naturalists, with a focus on people interactions. Basically, it is the Facebook of the naturalist. You can upload observations from photos on your computer or from anywhere with your smartphone, in which case, your phone will automatically provide the precious information on the location of your observations. Alternatively you can decide to obscure the exact latitude and longitude of your observation, and make them available only to the 'curators' of a project you decide to join. This way, potential poachers won't be able to know the exact location of a rare orchid, for example, but the detailed data will still be in the national biodiversity database, thereby contributing to better management of biodiversity resources.

Because iNaturalist is a social network, you will also benefit from the community by receiving identifications on your observations. This is a win-win situation: scientists can receive more data from citizens (citizen science) and in exchange citizens' observations can be identified by scientists, a good way to stimulate the community and share expertise with other experts in an open way.

How to participate?

To participate, first connect to <http://www.inaturalist.org> and create your personal user account. Then join the project 'Seychelles Bio Gallery' and start adding observations from your computer. To participate with your smartphone install the free app 'iNaturalist' and go out to make observations. As you do so, don't forget to add your observation to the 'Seychelles Bio Gallery' project, and if possible fill in the few project-specific information fields.

What kind of observations to contribute?

You can typically contribute three types of observations: (1) species that you would like to identify through the iNaturalist community; (2) a rare native species that you know; (3) a species from your garden or from road sides which you think is a newly introduced species or for which you are observing an 'invasive' behaviour (escaping from cultivation).

*Carausius scotti**Cleome viscosa*

Seychelles wolf snake



A moss

Figure 1: Examples of photos and names that could be uploaded to the Seychelles iNaturalist site (B Senterre).

How to provide good quality data (location coordinates and photos)?

The main information contributed by iNaturalists is the species identity and its exact geographic location. Therefore you should try to get these two pieces of information as accurately as possible. To provide information on the species identification, it is important to capture nice photos that illustrate well the species' characters so that the species can be correctly identified. You can achieve that by taking your time to observe your plant or animal before you photograph it and taking close up photos of its characters. If you collect data with your smartphone, photo quality might not always be great, so a good practice is to add photos taken with a proper camera. In forested areas, or where you have no signal, the geographic position provided by the phone may be very approximate. You can correct this issue by describing precisely the location and by correcting the coordinates from your computer using help from Google maps directly within iNaturalist.

How to contribute to a dynamic community?

We are new to the iNaturalist community, so we still have much to learn. But from the advice that we have gathered so far, the success of an iNaturalist community does not just rely on motivated observers and motivated identifiers. It also relies, like any other social network, on motivated animators posting for example favourite observations of the month or linking to Facebook discussions.

We would like to encourage everybody to participate in one way or another, and to share ownership of this iNaturalist project.

Useful reference

O'Brien, Colleen. "App Combines Computer Vision and Crowdsourcing to Explore Earth's Biodiversity, One Photo at a Time." Conservation news, August 30, 2017: <https://news.mongabay.com/wildtech/2017/08/smartphone-app-combines-computer-vision-and-crowdsourcing-to-explore-earths-biodiversity-one-photo-at-a-time/>

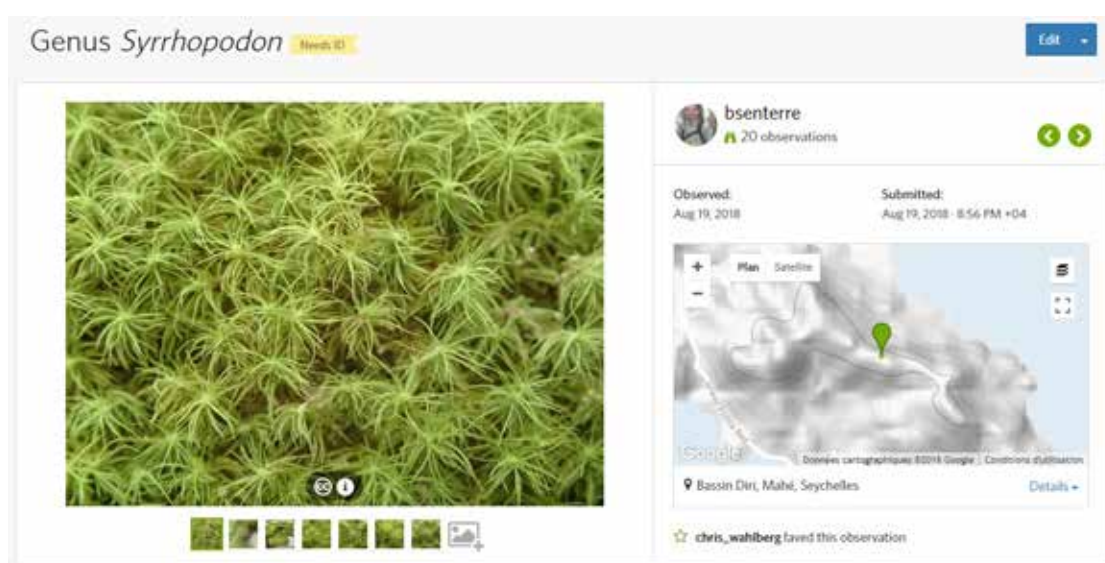


Figure 2: View of the details of an observation made during the last PCA field trip. The author of the observation can easily add photos or correct the geographic coordinates (from a GPS or from zooming on the Google map).

Pitcher plant research in Paradise

Ulrike Bauer

School of Biological Sciences, University of Bristol, UK
ulrike.bauer@bristol.ac.uk

The Seychelles harbour a wealth of unique biodiversity but as far as botanical curiosities go, the pitcher plants (*Nepenthes pervillei*) are right at the top of the list of things to see, maybe only second in fame to the magnificent Coco de Mer. For a scientist who has spent her entire career investigating tropical pitcher plants, the Seychelles pitcher plant is truly remarkable: one of the evolutionarily oldest known species of *Nepenthes* that has survived in perfect isolation from its over 160 mostly SE Asian relatives, on two tiny granitic islands in the middle of a vast ocean.

In September 2016, I had the opportunity to stop over on Mahé Island on my way to Madagascar, and visited the pitcher plants on the Copolia glacis. I was instantly fascinated by the unusual plants, and the idea was born to come back and do some research in the Seychelles. Upon my return to the UK, I approached the daunting task of planning a research trip and obtaining the necessary permits - a procedure that I had experienced as exceedingly complicated in SE Asia - and I didn't even know anyone in the Seychelles yet! Thankfully, my fears were unnecessary and I was met with an overwhelmingly positive and supportive response from everyone at the SBS, SNPA, PCA, ICS and the Seychelles Herbarium. The (then) Minister of

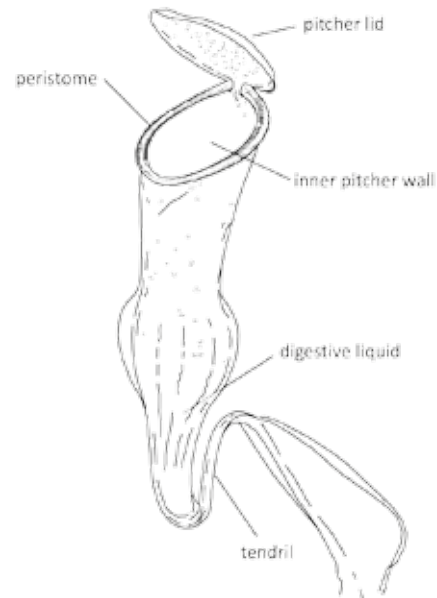


Illustration of a *Nepenthes pervillei* pitcher highlighting the different trap components.

Environment, Energy and Climate Change even offered us a place to stay!

One year after my initial visit, I once more landed at the Seychelles International Airport, this time with two massive bags full of research equipment, and a colleague and a field assistant in tow. During the next five weeks, we visited multiple pitcher plant sites and spent countless hours collecting pitcher contents. As a scientist, I am mostly interested in how the traps of the pitcher plants work, and how that impacts the ecology of the plants. Generally, pitcher plants capture insects in their cup-shaped leaves and digest them in a specialised liquid at the bottom of these "pitchers". The insects provide a rich source of nutrients for the plant, in particular nitrogen and phosphorus which are important macronutrients for all plants. "Normal" plants obtain these nutrients from the soil, via their roots. By tapping into an alternative nutrient source, pitcher plants can thrive on extremely poor soils and even on sheer rock faces with no soil at all.

The pitcher trap essentially works as a passive pitfall trap: insects are attracted by colour cues, sweet scent, and copious nectar secretion; they slide off the extremely slippery trapping surfaces and end up in the fluid-filled cavity. Slippery surfaces are found on the pitcher rim and the inner pitcher wall, and sometimes also on the underside of the pitcher lid. The pitcher rim is unusual for a plant surface in that it is extremely wettable. When it rains or when the air humidity is high, a thin water film forms on the surface, on which insects slip like a car tyre on a wet



The research team (author on the right) amongst *N. pervillei* plants on the Copolia glacis (U Bauer).



Pitcher plants on the summit of Mt. Pot-a-Eau, Silhouette Island (U Bauer).

road. The inner pitcher wall is also often extremely slippery; however, in this case the slipperiness is independent of wetness and instead based on an antiadhesive wax crystal coating. Prey retention is facilitated by the pitcher fluid which can be extremely viscoelastic and sticky, almost like egg-white.

Little is known about how exactly the Seychelles pitcher plant traps its prey, or even which animals it captures. The purpose of our study was therefore to investigate both the prey spectrum and the capture mechanisms of *Nepenthes pervillei*. We visited plants in 7 sites across Mahé and Silhouette: Mt. Sebert, Trois Frères, Copolia, Tea Tavern glacis, Congo Rouge and an unnamed site in the foothills of Morne Seychellois above Mare aux Cochon, on Mahé, and Mt. Pot-a-Eau on Silhouette. We collected prey samples from pitchers in all of these sites and are currently in the painstaking process of sorting them all and trying to locate experts to help with their identification. From what we can see so far, the prey composition and biodiversity varies considerably between sites. Nevertheless, and consistent with what is known for other *Nepenthes* species, ants are the most abundant individual prey component.

Different species of pitcher plant may rely predominantly on different individual trap components for capturing prey. For example, a number of Southeast Asian species lack the slippery wax layer on the inner pitcher wall but have evolved spectacularly large and steep pitcher rims. Others have abandoned insect trapping altogether and instead evolved large wide open pitchers that collect the droppings of mammals and birds. One species has even turned the pitcher lid, normally no more than a natural roof to prevent the trap from flooding,

into a spring that shoots insects into the trap when it rains heavily. Previous research (Bauer et al. 2012) suggests that evolutionarily old (“basal”) species tend to have simple, non-specialised pitchers with relatively small rims and a well-developed slippery wax layer on the inner wall. We performed a series of field and laboratory experiments to investigate whether *N. pervillei* conforms to this pattern, and which trap components are crucial for trapping success. We are still in the process of analysing the results from these experiments, but so far it looks likely that *N. pervillei* utilizes multiple trapping mechanisms successfully, with all pitcher parts playing a role in prey capture. This might provide a “safety net” that ensures that a trap remains functional even if an individual surface or structure is damaged or lost. An alternative explanation could be that individual trap components are specialised to target different subsets of the prey spectrum. In either case, it might help *N. pervillei* to occupy a broader niche and survive successfully in a very small and geographically isolated island habitat.

Even when all our data will be finally analysed, the Seychelles pitcher plant will likely still pose more questions than answers. We felt privileged to work with these wonderful plants in such a truly paradisiac setting, and look forward to presenting our full results in a future edition of Kapisen. We experienced the Seychelles as a welcoming and extremely supportive place for visiting scientists - not a given in the modern world! And where else can you finish a hot and sweaty research day with a dip in the crystal-clear sea, a tasty Creole BBQ and a cold bottle of Seybrew? We hope to be back...

Mapping the Seagrass Ecosystems of the Seychelles Outer Islands

Jeanne A. Mortimer, Conservation Biologist,
Seychelles

jeanne.a.mortimer@gmail.com

The Republic of Seychelles hosts some of the most extensive and productive seagrass ecosystems in the Western Indian Ocean. Seagrasses are flowering plants that grow and disperse their pollen and seed underwater. This is a rather unique feature among plants - even among aquatic plants most species disperse pollen and seeds above water. Some 60 species of seagrass belonging to five families have been described worldwide, with the highest levels of biodiversity in the Indo-Pacific. Seychelles may host as many as 12 species belonging to three families.

Seagrass meadows provide critical ecological services. They are highly productive and provide food and shelter for commercially important fish species, and habitat and forage for sea turtles. Because seagrasses take up carbon dioxide and give off oxygen they actively remove carbon dioxide from sea water, causing the water to become less acidic. In this way seagrass meadows serve as 'blue carbon sinks' that play a role in reducing climate change and protecting nearby coral reefs from acidification. Because tropical seagrasses are likely to tolerate higher temperatures, they may remain productive even as the climate warms.



Figure 2 Members of Poivre Expedition team (Jean-Claude Camille (ICS) and Tiffany Chang-Lai Seng (Department of Environment, MEECC)) examining a seagrass quadrat on the shallow reef flats of Poivre Atoll (J.A. Mortimer).

Although seagrasses are a national treasure, they have so far been poorly studied in Seychelles. One of the goals of the *GOS-UNDP-GEF Expansion and Strengthening of the Protected Areas subsystem of the outer islands of Seychelles and its integration into the broader land and seascape project* (GOS-UNDP-GEF Outer Islands Project) is to focus attention on seagrasses. Target activities include assessment and monitoring of seagrass habitats at Poivre, Desroches, Alphonse/St. François, and Farquhar Atolls.

The ecosystem assessments are being conducted primarily by personnel of Island Conservation Society (ICS), but training of young Seychellois personnel (e.g. from Department of Environment (MEECC)) is also a priority. The protocol was devised by ICS in collaboration with members of the Plant Conservation Action group (PCA). It includes a) instructions on how to assess the health and status of seagrass beds using methods advocated by the "Seagrass Watch" programme (www.seagrasswatch.org), b) keys to seagrass identification, and c) instructions on how to prepare seagrass herbarium specimens. The Seychelles National Herbarium is building a collection of seagrass reference specimens.

A seagrass assessment was conducted on Poivre Atoll during a week-long expedition in early December 2017. Figure 1 shows the locations of the 475 quadrat points sampled at Poivre between 5 and 7 December 2017 on shallow water reef flats at low tide. Our methodology employs a 50cm x 50cm



Figure 1 Locations of seagrass quadrat sampling at Poivre Atoll in December 2017 (Google Earth image).



Figure 3 A seagrass quadrat used to survey the seagrass ecosystems. Data are collected on the seagrass, algae, invertebrates and other features found inside the quadrat (J.A. Mortimer).

quadrat square that is thrown randomly onto the seabed. We then record percent total seagrass cover, which seagrass species occur in what proportions, whether macroalgae or invertebrates are present, and any evidence of seagrass cropping by animals such as green turtles. Figure 2 shows members of the Poivre expedition team checking out a seagrass quadrat, and Figure 3 is a photograph of a seagrass quadrat.



Figure 5 ICS conservation personnel (Licia Calabrese and Tom Collier) planning the locations of quadrat sampling at Farquhar Atoll (J.A. Mortimer).

At Poivre Atoll we were able to revise previous misconceptions about the species composition of seagrasses at that atoll and found the dominant seagrasses to be *Thalassodendron ciliatum* and *Thalassia hemprichii*, with occasional patches of *Cymodocea rotundata*. We found lots of evidence of cropping by green turtles (*Chelonia mydas*).



Figure 4 Locations of seagrass quadrat sampling at Farquhar Atoll in March 2018. Farquhar is a deep atoll that measures 20 km from end to end (Google Earth image).

We surveyed remote Farquhar Atoll during 22 to 28 March 2018. Farquhar is a very large atoll measuring 20 km from end to end. Surveying the seagrass habitats of Farquhar was much more difficult because the meadows are deeper and needed to be surveyed using mask and snorkel with constant boat cover. Figure 4 is a map of Farquhar that shows the locations of the points we surveyed. Figure 5 shows members of the Farquhar Expedition planning the locations of quadrat sampling. Some of the Farquhar survey points were chosen on site, while others were GPS locations known to be foraging sites of post-nesting female green turtles satellite tracked from Diego Garcia atoll in the Chagos Archipelago to their adult feeding habitat at Farquhar atoll. Most of the seagrass on Farquhar comprised beds of *Thalassodendron ciliatum* without any other seagrass species present; but we did find patches of *Thalassia hemprichii*. In all cases, *Thalassia* was heavily cropped by green turtles. The turtles consume both species but prefer *Thalassia* when it is available.

The data gathered during our seagrass surveys are being incorporated into benthic marine habitat maps of Poivre, Desroches, Alphonse/St. Francois and Farquhar atolls under the GOS- UNDP-GEF-Outer Island project. These habitat maps are based on freely available satellite imagery, except for those of Farquhar after Cyclone Fantala that needed to be specially purchased. The habitat maps will depict seagrass beds, coral reefs and other submarine features and will provide a better understanding of these important ecosystems.

Halting the march of invasive alien plants and ants in Vallée de Mai

Sarah Atkinson
Seychelles Islands Foundation
spc@sif.sc (contact via Jennifer Appoo)

Invasive alien species (IAS) are species which occur outside their natural geographic distribution and cause detrimental impacts to their new environment. They are one of the biggest threats currently facing biodiversity, along with climate change and habitat destruction. In the Vallée de Mai, a World Heritage Site on Praslin Island, Seychelles Islands Foundation (SIF) has been tackling some of the most problematic IAS in this palm forest with new techniques through the Inva'Ziles project, an IUCN-implemented, EU-funded initiative operating across the Western Indian Ocean. SIF's pilot project has been to integrate different IAS control measures, with a strong focus on plants and yellow crazy ants (*Anoplolepis gracilipes*) which affect a wide range of Seychelles fauna.

Two of the invasive plants of most concern were tackled during May-July 2018: coco-plum (*Chrysobalanus icaco*) and strawberry guava (*Psidium cattleianum*). These were primarily managed in the firebreak around the perimeter of the Vallée de Mai, where they were most abundant and posed a constant threat of spreading into the Vallée. Both of these species are a problem across Seychelles, dominating large areas, particularly of disturbed land.

It is estimated that more than 2000 plants of both species together were removed from the boundary of Vallée de Mai during the Inva'Ziles project – some by hand-pulling of small seedlings, others by cutting the stem and treating the stump with herbicide. This was arduous work and took many weeks. Children from the Eco-Club of Praslin's International School, and Friends of Vallée de Mai were a huge help, thoroughly enjoyed getting their hands dirty, and made a big difference! (See figure 1). The result is a significant reduction in both species within the Vallée de Mai and around the site's boundary, making ongoing control more feasible. With long-term monitoring and control of growth from the seed-bank, both of these species can be eradicated from the core of the site, and kept in check around the boundary.

In addition to the above mentioned, well-known methods for controlling these two species, we also trialled a technique novel for Seychelles for treating



Figure 1 Friends of Vallée de Mai assisting in the removal of coco-plum seedlings in the firebreak (S Atkinson).

woody IAS plants: basal bark treatment. This involved painting a 25% herbicide mix with biodiesel (made from 95% vegetable oil and 5% diesel) directly onto the trunk of the tree. Although it can take months to have an effect, it is a great way of treating trees without the disturbance to the habitat that felling would cause. Like much of the work undertaken by the Inva'Ziles project, there will be longer term monitoring and a continuation of the control work beyond the end of the project.

Another target IAS was the yellow crazy ant (YCA). Although relatively tiny, YCA are a big issue for endemic fauna. YCA are a tramp ant species, known for a more 'nomadic' lifestyle and as a formic acid spraying ant. They are best known for causing the deaths of millions of crabs and thousands of seabirds on Christmas Island, Australia. Many people at the Vallée de Mai have encountered YCA attacking native live animals, such as caecilians, snakes and centipedes. During the black parrot nesting season YCA have also been observed in nest cavities and on chicks. Often the chicks are dead and it is likely that the YCA caused the deaths. Additionally YCA tend honeydew-producing scale insects, which can affect the growth of plants on which the scale insects are 'farmed'. To combat these issues, we undertook two trials on site.



Figure 2 Yellow Crazy Ant on a Seychelles house snake *Lamprophis geometricus* (S Atkinson).

First we investigated ways of preventing YCA getting to the tree canopy and therefore into black parrot nests. To do this we wrapped individual tree trunks in one of four 'restriction' methods – cling wrap sprayed with furniture polish; cling wrap with a coating of car grease; a layer of Vaseline petroleum jelly smeared around the trunk; or cloth bandages soaked in eucalyptus oil. We also had a number of 'control' trees which had no method applied, to compare the effectiveness. Each tree was filmed for 30 seconds and the number of YCA counted (before and after treatment). The restriction method was applied and then checked every two days and the specific method 'topped-up'. After eight days the restriction methods were removed and the trees filmed again and the number of YCA counted. These counts were repeated at 15 and 22 days from the start of the trial. The comparison between the counts gave an indication of how effective each method was.

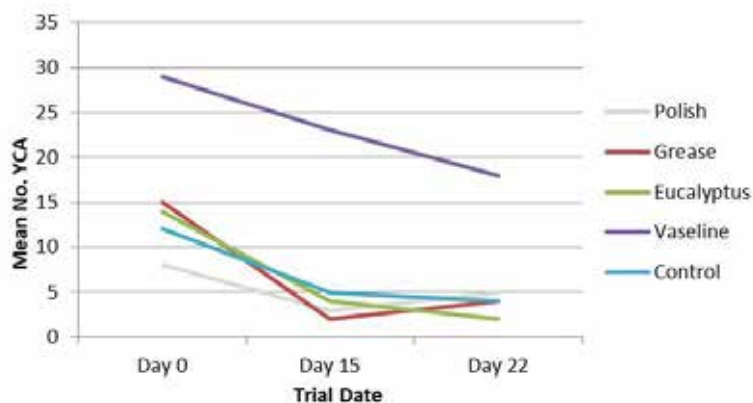


Figure 3 Change in the mean number of Yellow Crazy Ants seen on trees allocated a treatment during the canopy restriction trial (S Atkinson).

The number of YCA on each trial tree varied considerably during the trial, but overall the most effective method appeared to be eucalyptus oil, with an 80% decline in the presence of YCA on treatment trees during the trial (see figure 3). This could thus prove to be a very useful method for preventing YCA from accessing black parrot nests. It should be noted that this was a small-scale trial and the results have not been statistically analysed due to the small sample size.

The next trial involved some very space-age looking devices! KM AntPro bait stations (see figure 4) use boric acid – a naturally occurring substance – as a slow acting poison, which is mixed with a tasty sugar and protein bait. YCA find the bait stations during their foraging trips, fill up on the poison-bait mixture and take it back to their nest, feeding other ants. Each ant can make multiple trips, feeding an



Figure 4 Yellow Crazy Ant bait station in situ in Vallée de Mai (S Atkinson).

estimated 12 ants each time before the boric acid takes effect.

The design of the bait stations prevents anything larger than an ant from accessing the boric acid bait. We used pitfall trap surveys before and after the bait stations were deployed to determine effectiveness. We split Vallée de Mai into two halves, placing approx. 40 bait stations in a relatively even grid, approximately 30m apart. In the northern half, the pitfall surveys initially showed a promising 58% decline in YCA. So far so good, but after six weeks we moved the bait stations to the southern half of the site and here, the pitfalls showed a dramatic 455% *increase* in YCA numbers four weeks after bait station deployment. This was a complete shock! However, there are many possible reasons for this increase and after another pitfall survey six weeks after deployment showed only a 2% increase in pre-deployment numbers. This really shows how mobile tramp ants are and how little we know about the ecology and behaviour of some IAS in Seychelles. We are already aware that these bait stations will not be an easy solution, but more of a long-term control strategy. We are not aiming to eradicate YCA from Praslin or even Vallée de Mai but to keep their numbers low enough to reduce impacts on the native fauna and flora. The use of bait stations will continue long into the future to hopefully reduce the population of YCA in Vallée de Mai and lessen their impacts on endemic fauna.

This project has highlighted the value of IAS management in the overall conservation of such special and important locations. The Inva'Ziles project has boosted the importance of the issue of IAS to all working and visiting Vallée de Mai. While the interventions may not have the immediate effects hoped for, such work highlights the need for constant monitoring and new research into IAS which have already established in Seychelles.

Forest restoration monitoring at Jardin du Roi

Corianna Julie

BSc student, Nelson Mandela University, South Africa

coriannajulie@gmail.com

The restoration of ecosystems has recently taken a new direction. In situations where, for example, secondary forest is long established, alien species have come to be considered an integral component of the ecosystem. This concept of treating secondary forests as novel ecosystems was used in the restoration of forest at Jardin du Roi on Mahé, Seychelles, where the aim was to increase the native species abundance within a forest composed of a mixture of native and alien trees. This study was part of my BSc training at Nelson Mandela University in South Africa. Amongst others, I focused on the effects of alien species removal on both native and alien seedling recruitment, as well as sapling and adult tree growth.

The mid-altitude forest restoration efforts were carried out as part of a GEF Biodiversity mainstreaming project at Jardin du Roi, Anse Royale, run jointly by PCA and the Jardin du Roi (2014-2016) (Kapisen 18, p4-5; 20, p22-23). Before the restoration intervention sixteen 2x2m monitoring quadrats were established,



Figure 2 Representative photos of a restored plot (above) and an unrestored plot (below).

8 of them in the area to undergo the restoration, and the remaining 8 in an unrestored area as the control. The intervention involved the removal of some alien invasive trees and minimal native seedling planting. Subsequent to the initial removal of alien trees, weeding was done every month during the first year, but became less frequent after a year, due mainly to staffing issues at Jardin du Roi.

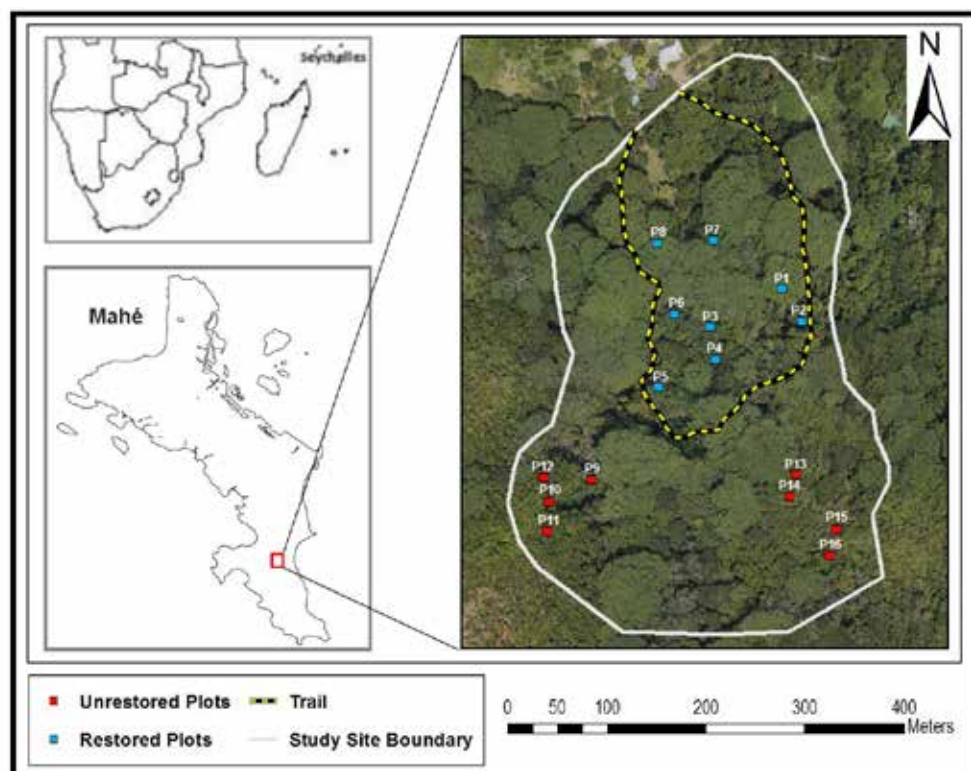


Figure 1 Jardin du Roi forest restoration site map and nature trail and monitoring plot positions (Julie, 2017).

The initial monitoring was carried out in 2014 by PCA members and University of Seychelles undergraduate students and consisted of counting the number of seedlings, saplings, and adults of all plant species in the 16 plots. All these plots were revisited 3 years later, in 2017 and surveyed in the same way as in 2014 - this time by myself with field assistance from one PCA member.

Basic results:

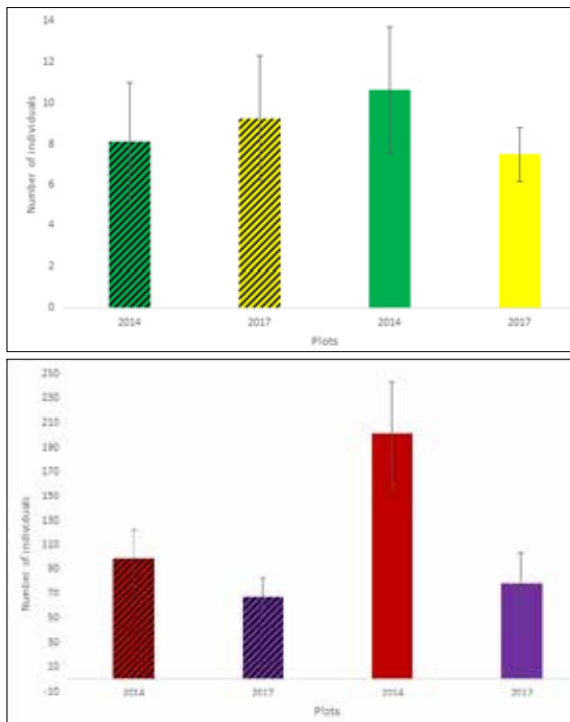


Figure 3 Native species (chart above) and Alien species (chart below) in the restored (diagonal stripes) and unrestored plots (without stripes) for 2014 and 2017. (Julie, 2017)

A decrease in the species number of both native and alien plants was recorded in the unrestored plots. There was a slight increase in the number of native species in the restored plots between 2014 and 2017, and a decrease in the number of alien species. This shows that restoration did work, although not as significantly as desired. There is a sharp contrast between the native species abundance in the unrestored plots, which might indicate that the presence of alien species serves as an inhibitor of the growth of native plants. However, it must be noted that native seedlings take more time to grow into an adult stage, compared to alien species. Therefore, a demographic change in native species would take longer than four years (period of the study).

Reference

Julie, C., 2017. Assessing the effectiveness of partial removal of alien invasive plants on the restoration of the native plants: An Experimental case study of the Jardin Du Roi Forest, in Seychelles. Nelson Mandela University. South Africa



Drawing by Zoë Chong-Seng

Out and About – walking in the forests

Marie-Thérèse Purvis, PCA Member, purvismt@gmail.com

It's always good to get outdoors and enjoy a walk in the hills and forests around us. Whether it's for fun, fresh air, exercise or learning more about the forests and the environment, there's an element of peace and renewal in walking a nature trail.

To make sure we can all enjoy the outdoors, it's important that we all try to respect and protect the forests and countryside while enjoying a walk. Here are some tips to consider when you're out there:

Protect the natural environment

- Stick to the paths and trails and avoid creating new ones. There may be unseen holes or sudden cliffs if you stray off the path. Also, you may crush delicate plants and small animals without realizing it.
- Take all your litter home and leave no trace of your visit.
- Leave all plants as you find them – avoid pulling on or uprooting plants along or near the trails as this may eventually cause erosion, or you may, inadvertently, destroy a rare plant.
- Go in groups smaller than 15 if possible, to avoid damaging paths and vegetation, and disturbing animals.

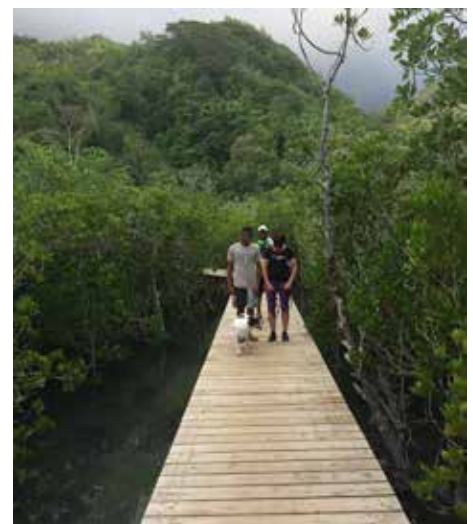
Respect other people

- Consider other people in the local community and ask for permission to walk through people's private property.
- Always bear in mind – other visitors wish to enjoy the forests and countryside as much as you do; so avoid doing anything that may have an impact on them, or put them in danger.

Consider your personal safety and that of others

- Take note of weather conditions and forecasts – rain can make paths very slippery.
- Make sure you are properly prepared, equipped and clothed for the terrain and for the activity.
- Tell others of your intended route and estimated time of return.
- Make sure all children are properly supervised.
- Keep dogs under effective control, if you decide to take dogs along.
- Keep away from work sites and working machinery.
- Do not climb trees to pick fruits and never light fires.

Enjoy your walk!



PCA News

New PCA members and research

Over the past year, PCA has gained and lost members, as is normal, but the gains have been greater, which is good for the NGO! We have welcomed several members from overseas, including two researchers who will be continuing studies of the experimental glacis (inselberg) habitat sites which were studied over several years by Christopher Kaiser-Bunbury and his team (see for example Kapisen 20, p 16-17). They are Alba Costa Lorenzo and Arturo Lonighi, who will be carrying out PhD work at the 8 glacis sites, 4 of which were restored (removal of alien plant species) and 4 remained unrestored. They will focus on getting a better understanding of the effects of restoration on community interactions, such as pollination and seed dispersal, and the dynamic relationships between selected species. Mathematical models will also be developed to help bring about long-term and sustainable management of restored glacis communities.



Arturo and Alba on the recent PCA field trip (PCA).

Future PCA members and researchers?

There have not been many opportunities, nor the capacity for much outreach and awareness work by PCA members recently. The Invaz'iles project (see p. 17) has enabled a limited number of contracted workers and land owners to know more about the alien invasive prickly creeper, *Acacia concinna*. Also numerous local and overseas visitors have visited the new Nature Trail at the Tea Tavern glacis restoration site (see p. 16 and Kapisen 20, p 24), partly as a result of the new leaflet which has been distributed widely within the local tourism industry.

So a good opportunity arose when we linked up with the Natural History Museum's Children's Club leaders, and during the August school holiday we arranged for club members (and some of their mothers) to visit the Tea Tavern glacis Nature Trail. The enthusiastic group came armed with paper and pencils and clipboards, determined to learn more about plants and animals found at the site. They wrote information on a worksheet we provided, noting all the interesting species they saw, often adding little drawings to help them remember. We hope that a few of them may have been inspired to become biologists and perhaps the Seychellois researchers of the future?



New! PCA Facebook page

One of our younger members, Mariette Dine, has at last pushed our older members into accepting that a PCA Facebook page is a necessity! The page is in its infancy and Mariette is coordinating the effort, with input from other members. We hope this will allow PCA to reach out to more people, encourage them to see plants as more than just 'green things' in our environment – and hopefully engage them in active native plant conservation. Either look up Plant Conservation Action group on a search engine to find the new Facebook page or try this link: <https://www.facebook.com/pcagroup2018> .

Anniversary for regional environmental calendar

For the last few years, PCA members have contributed photos and information to a calendar produced for countries of the Western Indian Ocean. This year it celebrates its 30th anniversary. It started off in 1988 as a small but informative calendar for Roman Catholics in La Réunion. At a time when other easily-available calendars were printed on card and had only dates on them, this calendar contained church patron saint's dates and information about all the local churches and chapels, and included an almanac of church events on the island. But it also contained national event dates and school terms/holidays, and provided an outlet for sensitisation campaigns, mainly those related to health, community and environment, e.g. blood donation, women's rights, or dealing with waste. By reflecting the needs of society, having a positive approach to social harmony, and with brightly coloured photos on the cover, the calendar appealed to people of all faiths.



As with many projects which start small, the calendar evolved over the years, gaining more of a regional focus. Mauritius, Rodrigues, and Seychelles were included, and as environmental concerns such as pesticide-use, pollution and climate change became more pressing in all the countries of the region, so too the calendar came to focus on environmental issues.

In recent years Jean-Yves Carré, the priest responsible for the calendar's production, began to focus on endemic species, under ever greater threat from human impacts in the island nations. Since 2012, themes have included birds, coral reefs, orchids, butterflies, fungi, palms, snails, and for 2019, the focus will be on ferns. PCA members have contributed to almost all of these themes, particularly of course for those on endemic plants and fungi. The number of regional scientists who voluntarily give their time, expertise and photos has increased. Jean-Yves says the informative and attractive calendars are a tribute to their passion and determination in trying to conserve all these unique plants and animals of the Western Indian Ocean Islands. We look forward to seeing the new fern calendar for 2019, for which PCA member, Bruno Senterre, has provided many photos and much information about Seychelles' special fern species. Later in the year it may be possible to purchase a copy from the Herbarium.



Progress in glacia vegetation restoration

Adaption to changing circumstances is common in our lives, perhaps more so on small islands, and the last few months have seen a recent example of necessary adaptation at the Tea Tavern glacia restoration site, near Morne Blanc (Kapisen 18, p17-18; 19, p21; 20, p16-19). During a period of restructuring in the Seychelles National Parks Authority (SNPA), PCA's role in the maintenance of the site, along with that of the local community group, is proving crucial for the sustainability of the restoration.

PCA's activities have included cutting off the flowering heads of invasive lemongrass (Sitronel) to reduce the further spread of the species through seed formation. Although this plant helps to hold the soil and reduce erosion in the barer areas of the site, it forms tussocks that spread outwards, sometimes overshadowing native seedlings. It is therefore necessary to keep it under control. But interestingly, in some places endemic pitcher plants (Lalyann potao) are now appearing from under the lemongrass and climbing over the top of it, which makes grass-control more problematic! Hopefully lemongrass will in the future be replaced by the large native sedge species (*Lophoschoenus hornei*) that was in flower (see picture).



Native sedge (left) + lemongrass (right) (PCA).



Nature trail steps upgraded (U Bristol).

Also, a start has been made on managing the invasive shrub, *Cocoplum* (Prindefrans), by pulling up seedlings (some of which are quite large) and also older plants which now have limited root systems after previous herbicide treatment (Kapisen 18, p18). Other *Cocoplum* plants, however, did not respond sufficiently to this herbicide treatment and still have significant root systems. Even the strongest in our team were unable to dislodge the roots, so these plants were cut back in places where they compete with native species. So far, this has mostly taken place on the top of the ridge, where the land is flatter and there is little soil erosion.

One rewarding aspect of the earlier maintenance by the local community group is their own realisation of how effective and important their work has been over the past couple of years. They must have pulled up thousands of small and larger *Bwa zonn* seedlings, thus removing the majority of the 'seed bank' in the soil. Now, they see that there are seedlings only in places which they did not visit before.

Additions to the site relate to the short nature trail, which has been again upgraded and also now has its own information leaflet. This has been distributed within the tourism industry to attract visitors to the restoration area. An information board about the pitcher plant has been erected, with a unique pictorial depiction of this iconic species. No language is used in the interpretation, so that all nationalities can understand the basic trapping mechanism and biology of the plant. Another board has been placed at the start of the restored area to recognise the important role of the local community in the maintenance of the site.



Pitcher plant information board in place (C Morel).



Community members with their board + PCA members (PCA).

Update on the invasive *Acacia concinna* control project

The thorny woody creeper, *Acacia concinna* (called Rons in Creole) has proved a difficult invasive plant to tackle. Not only does the plant creep and climb and have numerous sharp prickles but the root system also becomes quite extensive due to roots developing where branches touch the ground. So it is a blessing that the species has a limited distribution on Mahé. Following the establishment of the pre-trial site in 2017 (Kapisen 20, p25), a survey was carried out to provide maps of the distribution of *Acacia concinna*. The presence of the species - together with information on its dominance and a list of other plant species found at the sites - was recorded.

There have been several challenges and set-backs to this project in 2018 but progress has been made at four main sites in the south of the island using contracted labour teams and trials with several different herbicide treatments. The contracted workers were trained during the visit of a South African expert, Arne Witt, and trial plots set up, during which a study was carried out to find out how long it took teams of workers to clear and treat each plot using different methods. Plants were initially cleared to a height of about 1 metre, followed by further cutting down to ground level and herbicide applied to the cut stumps. Actual removal of the rootstock was done when possible. Monitoring of the plots will continue.



One site prior to clearing (I Charlette).



The same site during clearing (I Charlette).

As it had been proposed that rehabilitation should follow clearance, a nursery for native plants was set up in the grounds of the University of Seychelles in south Mahé, where the majority of invaded sites are found. However, it now seems that rehabilitation will not always be necessary, being dependent on plans the landowner has for the further use of the land.



A boulder area cleared of *A. concinna* (I Charlette).



Nursery site at UniSey (I Charlette).

It has been thought that *Acacia concinna* does not produce viable seeds in Seychelles, but this has not been scientifically determined. The results of germination trials to test seed viability are still awaited.

RESTORATION WORD SEARCH

All the words that are in CAPITALS and UNDERLINED in the paragraph about restoration below the grid, can be found in this grid (up or down, forwards or backwards, diagonally). Once you have found all the words, 10 squares have not been used. From the letters in these 10 squares, make the missing word in the last sentence in the paragraph below.

C	O	M	P	E	T	E	D	C	E	S	E
U	R	A	I	S	E	E	A	V	P	F	P
T	R	E	E	U	E	R	O	A	F	L	N
E	S	L	S	S	E	L	C	O	E	A	S
D	E	N	E	T	A	E	R	H	T	F	M
I	I	M	E	A	O	T	E	I	N	R	A
C	C	R	O	I	V	R	V	Y	A	E	I
I	E	E	R	N	L	E	A	C	L	E	N
B	P	M	E	A	I	A	G	T	P	N	T
R	S	O	T	B	G	T	H	R	I	O	A
E	E	V	A	L	H	L	O	A	O	O	I
H	L	E	W	E	T	E	R	R	S	W	N

Many NATIVE PLANT SPECIES in Seychelles are THREATENED by introduced ALIEN plants which have spread rapidly. These invasive species COMPETE with native plants for WATER, SPACE and LIGHT. RESTORATION is a process of helping invaded areas to recover. First we REMOVE the alien TREES and shrubs. They are CUT and we TREAT the stumps with HERBICIDE to stop them growing. The natives are now FREE to GROW. We also RAISE native SEEDlings and plant them. With RAIN the seedlings ROOT well. But we cannot LEAVE the site - it still needs HELP. We must MAINTAIN the area to ensure that the restoration is SUSTAINABLE. We MONITOR the site to check how it is doing. Restoration takes a lot of CARE and EFFORT and LOVE for our special _ _ _ _ _ plants.

Answer on Page 26

Seychelles Herbarium News

Charles Morel and Tarah Padayachy, Herbarium staff, charles6422@gmail.com

Finally, the Seychelles Herbarium has moved to a new location with more space and a separate room for the plant specimens. It is now situated at Mont Fleuri, near the hospital - Bel Etang Building, Room 2A, Ground Floor (see photo). PCA is now using the herbarium office for its regular group meetings.



Entrance to Seychelles National herbarium.



Barcode on a herbarium specimen.



Charles scanning a barcode, Dr Bytebier looking on.

The Herbarium received a visit from Dr Benny Bytebier, from the Bews Herbarium in South Africa, who trained the two staff members, Charles Morel and Tarah Padayachy, on the use of the Brahms software system for managing herbarium collections.

The Bews Herbarium also donated customized specimen barcodes for the Seychelles plant specimen collection. Barcodes provide a quick and efficient way of locating a plant specimen in the herbarium database - each specimen is provided with a series of letters and numbers that is also converted into a digital striped pattern that can be scanned by an electronic barcode reader (similar to the barcodes that you see on product labels in a supermarket). A unique barcode is given to each specimen and placed on the herbarium sheet along with the label containing identification and collection details.



Tarah using the donated stereo-microscope.

As a result of the barcode donation, the ability of staff to carry out important digitisation and imaging of herbarium specimens has been greatly enhanced. To date, the digital database now includes ca. 4,500 herbarium specimens which have been given specific bar codes and have been imaged. This includes the majority of specimens currently held at the Herbarium, including ferns as well as flowering plants and some other plants such as bryophytes and lichens.

The Herbarium team also participated in the 3rd and last meeting of the Herbarium Network Project for the Western Indian Ocean (WIO) region, funded by the Indian Ocean Commission (COI). It was held in Mauritius, with participation of herbarium staff from South and East Africa and the Indian Ocean island states.

During the network meeting, the herbarium curators received training on the use of the stereo-microscope which has been donated to each herbarium through project funding, along with a camera. The WIO regional orchid guide was also finalised and a strategy was developed for the continuation of the network when the COI-biodiversity project closes.



Participants in the WIO Herbarium Network meeting (Tarah 2nd from left; Charles on the far right).

All photos: Seychelles Herbarium

Spider bonanza!

Palm spiders are scary to some people, especially overseas visitors not used to seeing such large species, but they are really harmless. They spin extensive (but beautiful!) orb webs which the unwary forest-walker may bump into, thus getting sticky golden threads on their clothes. Palm spiders also form multiple webs hanging between trees and houses or telephone and electricity cables along roadsides, with smaller spiders making webs attached to the larger ones.

A couple of years ago, local people noticed that these once-ubiquitous palm spiders disappeared. There were even newspaper articles questioning where they had gone. It seemed to be correlated with the insecticide fogging which was carried out over the inhabited areas of the main islands to control the “hairy caterpillar” outbreak (*Euproctis sp.* which caused severe itching and painful rashes: Kapsen 18, p16). In fact many insect species were affected and perhaps this is one reason why the spiders disappeared - their prey was no longer available!

However, this year there has been a resurgence of the palm spider, at least in areas where they were able to cling on to life, so this is hopefully a sign of recovery of insect life also. But perhaps it also shows that human needs do tend to be given priority over nature, especially given Seychelles’ high dependence on tourism. Such short-term thinking is regrettable, given human dependence on the rest of the living world.



Female Palm spider in web (L Chong-Seng).



Palm spider group webs in 2018 (K Beaver).



The webs are not visible against the sky but the spiders are! Notice the tiny male and one spider which has just moulted (K Beaver).

PCA Field trip - lots to see and learn

Andre Dufrenne, PCA member
andre.dufrene@yahoo.com

Explorations of a new area are always exciting, and August's PCA field trip was no exception for all who joined it, especially our new members. Our main focus was to explore the area around Basen Diri, situated in the District of Takamaka in the south of Mahé Island. Basen Diri is a miniscule wetland in a glaciais/boulder field - and it has a few rice plants growing in it! Wetland rice has not been grown in Seychelles for around two centuries, so when and how did these few plants get there?



Basen diri - a pond in a rock... (A Dufrenne).



...with a few rice plants (A Dufrenne).

Along the trail we observed different plant species: endemic and indigenous (i.e. native) and alien species – the number of natives increasing as we went higher up into the more rocky sections of the trail. Some members took the walk quite slowly as they were sharing knowledge about all the species they saw. Other members took the trail as a speedy challenge, and then had a nice discussion break while waiting for the others to catch up.



At the start (K Beaver).



Enjoying a rest on the extensive glaciais (A Dufrenne).

The forest here was amazing to observe. For example there were many Bwa sagay (*Diospyros boiviniana*) – one of the endemic plants species of Seychelles which had lots of seedlings growing under the mother tree. Further up, we continued to explore and noted some indigenous Tropic bird orchids - Orkid payanke in Creole (*Angraecum eburneum*), which is the national flower of Seychelles but not common in the wild. There were no flowers as it normally flowers during the wet season. Reasons for its increasing rarity include disappearance of habitat and the fact that people collect orchids and try to grow them at home - however, it is extremely difficult to grow and almost all the plants taken from the wild just die.



Bwa sagay seedlings (A Dufrenne).



Payanke orchid (A Dufrenne).

I also managed to observe two species of fern relatives - *Psilotum complanatum* and *P. nudum*. *Psilotum complanatum* is the rarer of the two and is normally epiphytic. The other species, *Psilotum nudum*, is known as Pti sed in Creole, or whisk fern, and is normally terrestrial but the two species are sometimes difficult to distinguish.



Psilotum complanatum with sporangia (spore capsules) (A Dufrenne).



Psilotum nudum (A Dufrenne).

By the time we returned to the start, the sun was beating down fiercely but we went home satisfied and with some unforgettable memories.



Drawing by Zoë Chong-Seng

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

Facebook: <https://www.facebook.com/pgagroup2018>

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



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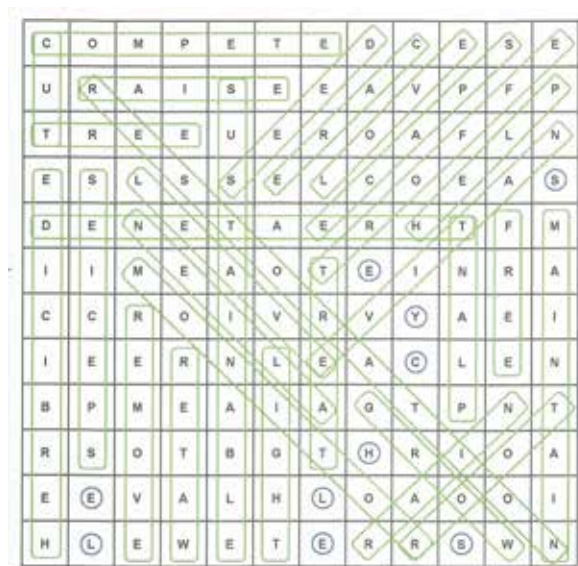
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Answers to the Word Search on page 18:



Extra word: SEYCHELLES