



SEYCHELLES PLANT CONSERVATION RESEARCH AGENDA

2008 – 2015

Ministry of Environment, Natural Resources and Transport (MENRT) and
Plant Conservation Action group (PCA)

Victoria, Seychelles 2007




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Foreword

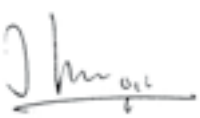
Knowledge has always been key to any society's development. Real progress has always required good information and well researched data as a basis for sound judgement and decision. Much early scientific research in Seychelles was related to agriculture, due in part to its importance in the economic development of our country. Plants were selected and trialled in order that the best husbandry practices could be adopted to optimise yields and combat pests and diseases, while more recently the emphasis has been on improved agricultural techniques. Although agricultural research was designed to solve farmer's problems and was initiated by local needs, there was little research on native plants and conservation concerns until the 1960s when 'green' issues began to emerge.

As the level of development in the Seychelles continues to increase, environmental issues become ever more complex and it is of paramount importance that our judgement is guided by good scientific research. It has therefore been necessary to profoundly analyse conservation needs, identify priorities for research programmes and develop strategies for this research. As is the case for many developing countries, Seychelles has relied to a great extent on foreign institutions for research assistance because there are not yet enough local research institutions. However, as the number of young Seychellois graduates increases, so do the opportunities for forging strategic partnerships to conduct the necessary studies. A research strategy can help to identify the synergies that will benefit both Seychelles and overseas institutions.

The Seychelles Plant Conservation Research Agenda clearly steers plant research into a more structured and comprehensive system, which if correctly implemented will lead Seychelles to greater achievements. It was born out of a consultative process which included many of the main stakeholders, both foreign and local, and is another example of a successful partnership between the Environment Department and a non-governmental organisation, in this particular case the Plant Conservation Action group. It is firmly based on the needs of Seychelles and will ensure that the limited resources available for research are utilised to find sound solutions to the problems which are challenging local environmentalists and protected area managers.

With such an instrument it is hoped that research in plant biology and ecology will find its rightful place alongside research in animal biology and ecology. It will enable us to implement various articles of the Convention on Biological Diversity, the UNFCCC, UNCCD and other multilateral environment agreements. It will provide us with a better understanding of the reasons behind the decline of some endemic species, the aggressive takeover of certain invasive species and plant population dynamics.

As we develop and fewer areas are left untouched by the activity of man, a well developed and prioritised research agenda will hopefully guide our path in tackling the pertinent and emerging issues that haunt us. I take this opportunity to thank all those who found time and energy to work on this excellent initiative and I urge everyone to take advantage of it. I sincerely hope that it will lead us to a better understanding of our rich floral heritage.



Joel Morgan, Minister for Environment,
Natural Resources and Transport

Preface

The Seychelles Plant Conservation Research Agenda was prepared at an international workshop held in Victoria from June 26 to June 29, 2007. The workshop was hosted by the Terrestrial and Ecological Research Centre (TERC) (ex Botanic Garden Section) of the Seychelles Ministry of Environment, Natural Resources and Transport (MENRT) and the Plant Conservation Action group (PCA), and organised by Denis Matatiken (TERC, MENRT), Frauke Fleischer-Dogley (PCA), Christopher Kaiser (Institute of Terrestrial Ecosystems, ETH Zurich), and Christoph Kueffer (Institute of Integrative Biology, ETH Zurich). The workshop participants are listed in Annex 3.

The organisers wish to acknowledge the financial/technical support of the following organisations; The Department of Environment, Seychelles Marketing Board, Air Seychelles, Aki Graphics, Cable and Wireless, PCA, and IBZ and ITES ETH Zurich.

The Seychelles Plant Conservation Research Agenda was edited by Christoph Kueffer (IBZ, ETH Zurich), Katy Beaver (PCA), and Christopher Kaiser (ITES, ETH Zurich) and approved by members of the PCA and the workshop participants. Layout and illustrations have been provided by Eva Schumacher. The Research Agenda represents a response to the Seychelles National Strategy for Plant Conservation for 2005 - 2010 (NSPC) published in 2005.

Introduction

From June 26 to June 29 2007, the Seychelles Ministry of Environment, Natural Resources and Transport (MENRT), specifically the Terrestrial and Ecological Research Centre (TERC) (ex Botanic Garden Section), together with the Plant Conservation Action group (PCA) and several institutes from the Federal Institute of Technology (ETH) Zurich, Switzerland organised a plant conservation research workshop in Victoria entitled "Synergies between Plant Conservation and Ecological Research".

The workshop's aims were to review past and present plant conservation and research activities and to identify future priorities and synergies between conservation and research. Ultimately, the objective was to develop a research agenda for plant research in Seychelles, which is listed as Subtarget 3a in the Seychelles National Strategy for Plant Conservation for 2005–2010 (NSPC).

The workshop participants provided a broad range of expertise to plant conservation in the Seychelles. Representatives from several ministries of the Seychelles government, different NGOs and the private sector, mainly the tourism industry, represented the local plant conservation community (see workshop participants in Annex 3). International scientists with research experiences from other oceanic islands, such as Mauritius, La Réunion, Rodrigues, Azores, Pacific islands, Hawaii, New Caledonia, were also present. The research areas covered during the three-day workshop included ecology of invasive species, conservation genetics and plant-pollinator interactions. Presentations from seven local and eleven international experts were scheduled, along with group discussions on the following topics: taxonomy; *ex-situ* plant propagation; education, awareness, and capacity building; *in-situ* conservation of rare species; plant-environment interactions (particularly soils); and biotic interactions (particularly plant-animal interactions) (see workshop programme in Annex 2).

Significant points arising from workshop discussions

The basis for rational conservation actions is a good knowledge of the current situation and its dynamics. It was therefore concluded that the compilation, documentation and interpretation of data on the current status of the endemic flora and its habitats is a foremost priority. Existing data has to be made more easily accessible to researchers and gaps in the knowledge of the flora need to be filled. Changes in population sizes and habitat characteristics need monitoring. Clearly, an understanding of plant reproductive processes, such as pollination and seed dispersal, are very important in determining the health of populations and habitats, yet only limited knowledge on this exists. Furthermore it was highlighted that the impact of climate change, mainly expressed in more frequent and extreme weather events, needs to be monitored, especially in mountain mist forests and inselbergs – two habitats that are of paramount importance for Seychelles' plant biodiversity.

Ex-situ conservation, the conservation of threatened species outside their habitats, has progressed in Seychelles, especially through the work of the Biodiversity Centre at Barbarons with the support of Eden Project in Cornwall (UK). However, besides the Biodiversity Centre, many others in Seychelles and in the Western Indian Ocean region have gained relevant experiences in *ex-situ* plant propagation, and this expertise needs to be linked. *Ex-situ*

conservation should be more focused on complementing *in-situ* conservation, and questions such as where self-sustaining populations can be re-established in the field, have to be answered. For this, the genetic diversity of the very rare species has to be better understood to ensure that *ex-situ* populations conserve genetic variability. Such research is expensive, so it was proposed that a protocol is established to map out the level of genetic research required for every critically endangered species separately, based mainly on the significant threat factors of a species.

Finally it was emphasised that a thorough understanding of the uniqueness of the Seychelles flora is missing, which would greatly strengthen the cause of plant conservation in Seychelles. The age, isolation and granitic nature of Seychelles must have shaped the endemic flora in many ways. Prof Peter Edwards (ETH Zurich), for instance, illustrated in his presentation the many ways in which the Seychelles flora is adapted to regeneration in a granite-dominated environment - from boulders to inselbergs - with shallow and nutrient-deficient soils.

The workshop participants discussed how to fill knowledge gaps and how to disseminate research results to the relevant actors. To enhance the research and management capacity in Seychelles, visiting scientists need to be in communication with local researchers from the inception phase of research projects. It was suggested that it should become compulsory for every visiting scientist to contribute to training courses or long-term research and monitoring programmes.

The general conclusion at the workshop was that Seychelles has achieved much in plant conservation. It is reassuring that, after many years of very successful conservation of the Seychelles avian fauna, the country is strengthening its capacity to also conserve the native flora. To further implement this agenda however, it will be necessary to strengthen and widen the network with universities and research institutions. Priority will be given to research projects which are financially self-supporting and fully collaborative with Seychelles. The Seychelles will also strive to access and engage finance internationally, regionally and locally, for example available through the UNDP-GEF Mainstreaming Biodiversity Project and the Sustainable Land Management Project.

Summary of the Agenda Objectives

The agenda is divided into ten objectives. Each objective includes background information, a rationale and recommendations on how to proceed with the actions.

The **first** objective addresses the lack of information on the taxonomy and threat status of most plant taxa with the exception of woody dicotyledons. The **second** objective discusses the status of and future needs for *ex-situ* conservation. The **third** objective is about how to prioritise species and habitats for conservation action. The **fourth** objective stresses the need to better understand the relation between native plants and the abiotic environment in Seychelles. Objectives **five** (invasive species) and **six** (climate change) discuss research needed to deal with major existing and emerging threats. Objectives **seven** and **eight** target *in-situ* conservation of threatened plants, including reintroduction of plants from *ex-situ*, conservation biology of threatened plants, and conservation and restoration of ecological interactions through *in-situ* conservation and habitat rehabilitation. Finally, objectives **nine** and **ten** address capacity building, education and awareness building.

Research Agenda

Objective 1 Documenting the plant diversity of Seychelles

Background
The National Strategy for Plant Conservation (NSPC) has identified the incomplete documentation of the plant diversity of Seychelles and its threat status as a major weakness of plant conservation in Seychelles (see NSPC Target 1). The research agenda reiterates this emphasis (Actions 2, 3) and adds further needs (Actions 1, 4, 5). In particular, documentations still exist mainly for the dicotyledons, and almost nothing is known about the genetic diversity of the flora. There have been several attempts at establishing local and international databases on aspects of the plant diversity of the Seychelles, but these databases are not maintained, are not easily accessible and/or are not interlinked.

Action 1 *Establish a Clearing House Mechanism (CHM) for existing databases on the plant and crop diversity of the Seychelles.*

Rationale There are databases on *in-situ* plant distribution (red data list project, IBZ ETH, TERC, PCA), national and international *ex-situ* collections and propagation techniques (Darwin Initiative Project of Eden Project [Cornwall, UK] and TERC), crop diversity (Barbarons Biodiversity Centre, FAO), and medicinal plants (SBS, PHARMEL).

Recommendation A lead organisation has to be appointed as CHM, e.g. Victoria Botanical Garden or Biodiversity Centre of TERC. Researchers should continuously provide data to ensure the regular update of databases. An expanded database could include a digital herbarium. As a first step, a compilation of all contact persons for each database is needed. The first steps can be implemented through a short term project or work attachment by a master student.

Action 2 *Preparation of monographs on ferns, mosses, lichens, fungi, algae and liverworts.*

Rationale Currently there are species list available for ferns, fern-relatives, bryophytes (mosses and liverworts) and lichens. None are definitive and apart from ferns, are probably incomplete or are in the process of being extended. There is no complete list of algae

(including marine species) and very little has been published on the fungi, which therefore represent an important knowledge gap.

Recommendation A completion of monographs on ferns, mosses, lichens, and liverworts is expected in 2008 through Justin Gerlach. Explore the possibility to retrieve the work on ferns already done by Francis Friedmann, via the French Embassy.

Action 3 *Preparation of a flora of the monocotyledons of the Seychelles.*

Rationale There is no up to date monocotyledon flora. Through the Biodiversity Assessment, recent literature has been compiled (Justin Gerlach). See also NSPC Target 1.

Recommendation Explore the possibility to retrieve work already done on monocotyledons by Francis Friedmann, via the French Embassy. The flora should include up to date information on taxonomy (i.e. should make use of revised taxonomy through genetic tools, among others).

Action 4 *Revise the flora of the dicotyledons of the Seychelles.*

Rationale The flora of Francis Friedmann already exists; however with new techniques some updating is needed.

Recommendations Revise the dicotyledon flora based on recent taxonomic work. Collaboration with international experts for the different taxonomic families is required, together with compilation of local knowledge. Updates should be published in preference to a new flora.

Action 5 *Conduct research and identify genetic diversity of Seychelles plants.*

Rationale Considerable uncertainty remains about the genetic diversity of the Seychelles' plant species. Such baseline knowledge on genetic diversity is essential for *ex-situ* and *in-situ* species recovery and population augmentation (see also Objectives 2 and 7).

Recommendation Encourage plant researchers to include a component investigating genetic diversity. The research must be in line with the provisions of the Access and Benefit Sharing Act. Determine the actual number or crucial statistics of the plant taxa and different plant groups found on the Seychelles islands. Evaluate the current Seychelles endemic and native plant list and seek knowledge from experts in those particular plant groups to state if the plants in the lists are truly endemic.

Objective 2 Improve *ex-situ* conservation for Seychelles plants

Background

It is essential that effective and easy to use *ex-situ* protocols are developed within the Seychelles to directly support the requirements of maintaining the species or plant populations as evolutionary lineages *ex-situ,* and potentially *in-situ* as components of functioning wild habitats. *Ex-situ* conservation can have different objectives, and it is important that these are clarified for the Seychelles as a first priority. The second priority is to ensure a detailed knowledge on the propagation and horticultural management of all endemic plants and their remaining genetic diversity. Thirdly, some *ex-situ* raised plants may be re-introduced to the wild, which needs experimental testing.

Action 1 *To determine the effective use and implementation of ex-situ conservation tools and facilities in the Seychelles in order to raise funds, awareness and to support the conservation of species and habitats in-situ.*

Rationale *Ex-situ* conservation can have several objectives. These include: reproduction of rare plants to maintain genetic diversity in living collections and for *in-situ* conservation and habitat rehabilitation; preservation of plant material for later reproduction; building staff capacity and skills for the conservation of Seychelles threatened plants; display and educational material; plants grown specifically for research. Currently the role of *ex-situ* conservation to support species and habitat conservation on the Seychelles Islands has not been fully determined. Just recently *ex-situ* community gardens have been developed through certain schools in the Seychelles. This has great potential with regards to raising conservation awareness and encouraging more people from the community to value nature. In addition, the current wealth of environmental knowledge on the Seychelles islands provides an ideal opportunity to present environmental messaging about the islands to the tourists that visit the them. The sustainable *ex-situ* production of medicinal plants is an issue that was raised in the NSPC (NSPC Target 8).

Recommendations

1. Set up a working group with representatives from botanical gardens, forestry, agriculture, hotels, the tourist industry, ethno-botanical cultural groups, key representatives from the community, commercial horticulture and the landscape sector to determine the role of *ex-situ* conservation tools and facilities for the Botanical Garden, Barbarons Biodiversity Centre and the Seychelles islands.
2. Explore nationally the sustainable use of wild plant species for traditional use and to raise monies and awareness for conservation in the Seychelles islands.

Action 2 *Compile existing national knowledge on the propagation, cultivation and establishment in gardens and in the wild of Seychelles plants and crop diversity.*

Rationale Already good works have been undertaken through the collaborative Eden Project and MENRT Darwin Initiative project on the propagation and establishment of 50% of the Seychelles endemic plants. However, this work has highlighted that more detailed propagation and cultivation knowledge on the native threatened Seychelles plants and the underutilised crops of the Seychelles is required. The findings from this work should be well documented and made available to conservation practitioners (perhaps in the form of a booklet or a database, see Objective 1, Action 1). In addition, propagation of native species for habitat rehabilitation and to prevent over-harvesting of wild plants in Seychelles might be undertaken at the Biodiversity Centre and/or in addition outsourced to utilise the skillbase and techniques of commercial nurseries, universities or international forestry organisations.

Recommendations

Set up a national network of horticulturalists (people from Botanic Gardens, Forestry, Agriculture, private hotels, commercial nurseries, schools and private persons who have experience with the propagation of endemic and native plants) interested in *ex-situ* plant propagation of the native flora of the Seychelles and document these findings. Better understand the impacts of over-harvesting.

1. Document who holds *ex-situ* material within the Seychelles and where this material is held (ideally obtain provenance information where possible). Thereby the cultural context of native plant propagation has to be considered. Issues such as traditional knowledge, gender, social groups may be relevant.
2. Envisage networking native plant propagation and *ex-situ* plant conservation experts regionally (especially within the Western Indian Ocean region).

Action 3 *Validate and document ex-situ asexual and sexual propagation techniques and horticultural knowledge on Seychelles native plants, with a particular emphasis on the threatened and endemic species.*

Rationale Much knowledge on the propagation techniques of Seychelles plants is available but in the form of experience and knowledge of growers and individuals spread throughout the Seychelles islands and a few detailed propagation studies. Unfortunately this valuable knowledge is neither fully documented nor in many cases validated through detailed scientific propagation trials. It is important that guidelines, knowledge and expertise are compiled, documented and published to support current and future conservation practitioners. Currently knowledge on seed storage behaviour in the Seychelles is unknown and seed banking could potentially be a valuable conservation tool.

Recommendations

1. Prepare, document and publish detailed protocols that have been validated (in-depth or scientific trials) on the asexual and sexual propagation techniques for endemic and threatened plant species.
2. Undertake detailed scientific trials on the effective propagation of Seychelles endemic, threatened and, in the long term, other native plant species.

3. List the more difficult to propagate species in the Seychelles islands and obtain the advice and skills of commercial growers, botanical gardens or universities to find solutions for these difficult taxa.
4. Investigate the seed storage behaviour of Seychelles endemic and threatened native plant species in order to determine if seed banking should be developed as part of the *ex-situ-in-situ* Seychelles conservation strategy. Preliminary estimates based on general patterns of seed storage behaviour indicate that a majority of Seychelles native plants have seeds with orthodox or intermediate seed storage behaviour, i.e. they are suitable for storage (Alvin Yoshinaga, University of Hawaii, pers. com.).

Action 4 *Develop effective and easy to use ex-situ protocols for the majority of Critically Endangered plant species of the Seychelles. These protocols should work towards conserving their plant populations as evolutionary lineages and potential components of functioning wild habitats.*

Rationale Financial, human and time resources are limited within the Seychelles and therefore effective and efficient *ex-situ* protocols are essential to maximise conservation outputs. The IUCN guidelines state that *ex-situ* management should be utilised for Critically Endangered or Extinct-in-the-wild species to ensure recovery of the wild populations.

Recommendations

1. Ensure that at least a small number of each known population of all endemic and threatened plant species is held *ex-situ*. Determine which endemic and threatened plants require in-depth *ex-situ* conservation measures (not all will require this and these should be continually monitored and managed *in-situ*).
2. Undertake two to three case studies that include the processes of *ex-situ* protocols to planting *in-situ* (species recovery). It is suggested that species where already significant information is available, such as *Medusagyne oppositifolia, Impatiens gordonii* or *Lodoicea maldivica*, are utilised as the first case-studies. (See also Objective 7)
3. Collate, make available and utilise the current best practice protocols that are internationally available to support this process (e.g. IUCN, CPC, Australian Network for Plant Conservation guidelines).
4. Integrate the *in-situ* studies with the *ex-situ* work, considering, among others, horticultural practices, genetics, ecotypes, habitat, phenology, reproduction biology, and threats and management *in-situ*. It is important that horticulturalists, *ex-situ* conservation practitioners, geneticists, ecologists and restoration ecologists work together to share their knowledge and techniques.
5. Ensure that quarantine procedures are fully integrated with the planning of the reintroduction in the field.
6. Most species recoveries fail because there has not been effective experimental monitoring after the re-introduction process. To maintain best practice and learn from experiences it is important to ensure good experimental design throughout the recovery process. This will provide objective indicators that can help to analyse if the recovery has been a success or a failure, according to defined goals (e.g. habitat rehabilitation vs. rare species conservation) and priorities.

Objective 3 Prioritisation of species and habitats for conservation action

Background
Viable populations of all native species, and particularly those endemic to the Seychelles islands, should be conserved. Habitats can be valuable because they harbour rare species, are very rich in plant biodiversity, or are special in themselves as habitats (composed possibly mainly of common species, e.g. mangrove forests). Also, habitat quality for reintroduction of *ex-situ* propagated species needs to be considered.

Action 1 *Produce red data lists of non-woody plants following IUCN criteria.*

Rationale A red data list has been prepared for endemic woody plants, but native and non-woody plants are not covered. The preparation of red data lists for all native flowering plants has been identified as a priority by the NSPC (Subtarget 2b).

Recommendation Through the red data list project for endemic woody plants, a working approach has been developed and tested that can be followed for the other taxa.

Action 2 *Develop locally appropriate methods to monitor endangered species and habitats.*

Rationale To date there is no database that allows for detection of early changes, threats and opportunities confronting rare plants or threatened habitats. This action has been identified as a priority in the NSPC (Subtarget 2d).

Recommendation The purpose of the monitoring has to be linked to other objectives and projects and must be clearly defined (especially to distinguish between short, medium and long term monitoring). The potential contribution of each research project for monitoring should be identified at the beginning of a project. Efforts must be made to analyse data sets collected regularly. New approaches, such as remote sensing, may be tested.

Action 3 *Identify and publish Important Plant Areas.*

Rationale Considerable data on areas of particular value for plant conservation is available, but this data has never been synthesised in a standardised way, and it needs to be checked and updated. This action has been identified as a priority in the NSPC (Subtarget 1d).

Recommendation Define criteria for Important Plant Areas specific to the particularities of the Seychelles. These criteria should be based on the methodology for identifying Important Plant Areas prepared by Plantlife International, which considers three types of values for sites: a) sites that harbour rare species, b) sites particularly rich in plant biodiversity, c) sites that represent a special and/or rare vegetation type. The available data (vegetation / red data / biodiversity assessments of Annette Carlström, IBZ ETH, NPTS, TERC) should be used, and if necessary checked and updated.

Objective 4 Understanding plant-environment relations

Background

Plants maintain ecosystem functioning and are the basis for many ecosystem services. In Seychelles, relevant ecosystem services include for instance erosion control, provision of fresh water from water catchments, or landscape aesthetics for tourism. A thorough understanding of the relations between plants and the environment is therefore the basis for a sustainable ecosystem management that maintains both the native biodiversity and the ecosystem services that Seychelles depends on.

Action 1 *Understanding the controlling abiotic factors of plant distributions on a landscape scale.*

- *Action 1a* *Link native and alien plant distribution to information about geology, soil, microclimate and topography.*
- *Action 1b* *Characterise the dynamic nature of different habitat types (fire, soil movement, water movement).*
- *Action 1c* *Prepare a habitat classification system and map for the Seychelles.*

Rationale Because of the long and intense disturbance history of the Seychelles over the past 250 years (invasions, habitat degradation, etc.) the current distribution of the plants in Seychelles does not necessarily reflect the adaptation of particular plants to particular abiotic conditions. The reconstruction of the plant-environment relations is therefore challenging. A better understanding of the adaptations of the native flora to abiotic conditions helps to ensure that all critical habitat types (see Objective 3, Action 3) are represented, and may be used as a basis for defining goals for habitat rehabilitation projects. A detailed habitat classification will also serve as a baseline for monitoring (e.g. considering global change).

Recommendation Because of the problem mentioned above – that the current vegetation distribution does not reflect pre-human habitat types – the reconstruction of plant-environment interactions and habitat types has to build on experimental work and functional traits of plants as well as on a classification of habitats based on abiotic factors such as soil types, distribution of boulders and rocks, topography (geomorphology), or microclimate. For scaling up, remote sensing techniques should be used. This Action requires a major scientific investigation on the scale of several PhDs.

Action 2 *Understanding plant-soil interactions.*

Action 2a *Characterise the current natural soil conditions (N, P, K, Mg; chemical form in which available in soils), compare with historical values, and understand micro-environmental variations and nutrient dynamics.*

Action 2b *Study the adaptations of native species to soil conditions (e.g. mycorrhizal associations) and particularly of rare plant species, to support ex-situ conservation.*

Action 2c *Derive conclusions for habitat rehabilitation strategies that consider plant-soil relations in Seychelles.*

Rationale Because of the extremely nutrient-poor and ancient soils in the granitic Seychelles, soil-plant interactions are particularly relevant for the ecology of the Seychelles flora. There are no equivalents anywhere else in the world, and it can be expected that plant-soil relations are rather unique in Seychelles. It can be expected that plant-soil relations vary greatly on the landscape scale in Seychelles (e.g. coralline v. granitic islands, coastal, seabird-influenced v. inland habitats, distribution of granite boulders, rugged topography, legacy of human disturbances). Soil conditions and nutrient dynamics may have been considerably different in the past. For instance, nutrient transport by animals such as seabirds or tortoises, impacts on nutrient dynamics by native plant species, or the role of boulder fields may have changed after human settlement. Soil-plant relationships are a critical factor for both *in situ* plant conservation and habitat rehabilitation.

Recommendation This action involves experimental research on the scale of several PhDs. In particular, mycorrhiza (especially endomycorrhiza) of endemic plants need to be studied. Existing data and knowledge from agriculturalists and past research projects can be used (e.g. PhD Christoph Kueffer, IBZ ETH; *ex-situ* conservation trials performed through Darwin Initiative Eden Project).

Objective 5 Support of invasive species management and biosecurity measures

Background

Invasive species, including pests and diseases, plants and animals, are a major threat to the plant biodiversity on oceanic islands by directly affecting rare plants (e.g. pests, seed predation, competition) or indirectly changing habitat conditions (e.g. soil fertility, forest and disturbance dynamics, soil disturbances by animals). Preventive measures, i.e. the prevention of the transport of new alien species to a new area, are considered to be the most effective option against invasive species. Long-term management of established populations needs to be considered in the context of habitat rehabilitation (see Objectives 7 and 8).

Action 1 *Research for the support of the management of invasive species.*

Rationale Invasive plant species are a major concern for nature conservation in Seychelles. Three types of invasive species research are needed:

i. Research that helps to predict potential future invasions (especially characteristics of potentially new invasive plant species). This may build on a regional comparative approach, and may particularly consider plant-soil relations.

ii. Research on impacts on ecosystem processes (e.g. on nutrient cycling, forest dynamics, fire).

iii. Management-related research that supports efficient and cost-effective control and follow-up management (such as plant health operating protocols, procedures to prevent new invasions, and habitat rehabilitation).

Recommendation Descriptive and experimental work should be performed to study the biology of particular (potentially) invasive plant species, including reproductive characteristics, reproductive biology, competition with native species for biotic and abiotic resources, seed bank, and mechanisms that explain the impacts on ecosystem processes.

Action 2 *Research for the support of biosecurity measures.*

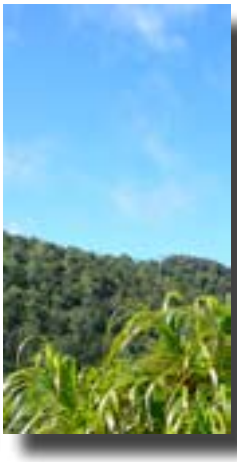
Action 2a *Prepare a list of pest and disease species on the Seychelles islands.*

Action 2b *Survey the effects of pests and diseases on native species in-situ.*

Action 2c *Prepare a plant health operating protocol for the nursery, botanical gardens and for Seychelles, including specific areas and islands if required.*

Rationale Preventive measures, i.e. the prevention of the transport of new alien species to a new area, are considered to be the most effective option against invasive species.

Recommendation The UNDP-GEF "Mainstreaming Prevention and Control Measures for Invasive Alien Species into Trade, Transport and Travel across the Production Landscape" Project ("Biosecurity Project" in short) has recently been approved and will start implementation in 2008. This Project aims at addressing the threats posed to Seychelles' biodiversity through the introduction of Invasive Alien Species (IAS) and will improve local capacity for national and international research on IAS. The GEF project will also analyse which transport pathways (e.g. tourists, commercial trade, shipping, air freight) are the most relevant ones for the different taxa (pathway risk assessment) and look at measures to halt the inter-island spread of IAS. Actions should be based on models from other island states such as New Zealand, Galapagos, Hawaii or other organisations such as Eden Project (Cornwall, UK).



Objective 6 Identify the impact of climate change on habitats and plant species

Background

Climate change is considered one of the major future threats to biodiversity, and island ecosystems are thought to be particularly vulnerable to the impacts of climate change. In particular, coastal vegetation (including mangroves) and montane ecosystems will have no retreat habitats after increase of the sea level (viz. cloud layer). To date almost nothing is known about the possible impacts of climate change on the plant biodiversity of the Seychelles. At least among plant conservationists, also relatively little is known about the likely future local climate change in Seychelles.

Action 1 *Compile and review meteorological data, including regional climate scenarios, for the Seychelles and investigate implications for plant conservation, e.g. extreme weather events.*

Rationale Protocols already exist internationally for downscaling climate change predictions to local scales, but little is known for the Seychelles. In particular, the implications for plant conservation have not been considered.

Recommendation As a first step, the status of knowledge on future local climate change should be assessed in collaboration with the Meteorological Office of Seychelles. As a second step, in an exploratory expert study, possible impacts of these changes on the plant biodiversity should be compiled and prioritised.

Action 2 *Research on the particular threats to cloud forests, and especially monitoring of the microclimate in cloud forests (e.g. 2 meteorological stations, one at the lower margin (c. 600-700 m asl.), and one at Morne Seychellois summit).*

Rationale Cloud forests are among the most vulnerable habitats to climate change.

Recommendation A low cost automatic meteorological system is relatively cheap, and funding may be relatively easily obtained. It is important to consider the purpose of the monitoring and plan the data analysis before the setup of the meteorological station(s).

Action 3 *Monitor changes to the coastal vegetation and its ecosystem services in response to climate change.*

Rationale Climate change has a variety of impacts on coastal vegetation, most obviously directly through sea level rise, but also less obvious effects such as increasing salt level in the groundwater. Interactions with coastal development are also relevant.

Recommendation Establish a monitoring protocol, and harmonise with existing monitoring programmes, e.g. PUC may be monitoring coastal vegetation on La Digue; Wetland Unit of MENRT; Mangroves for Future Initiative; and ReCoMaP (funding option). Monitor the extent and health of vegetation (e.g. loss due to housing development, erosion).

Action 4 *Monitor and understand the risk of increased drought and fire frequency on the Inselberg vegetation.*

Rationale Climate change may lead to increased risk of drought and fire, particularly on Praslin. Although fires may, even in the future, be relatively infrequent on Mahé, they can still have a major effect, especially considering the vulnerable small populations of rare species in areas particularly vulnerable to these risks (Inselbergs, ridges).

Recommendation Establish a monitoring protocol and harmonise with existing monitoring programmes on Praslin, in particular. Characterise susceptible areas, finalise the mapping of threat areas and investigate the link between human settlements and fire occurrence. Post-fire colonisation and succession is little understood and requires further research. Investigate the role of bracken ferns, alien invasive species and erosion on fire.

Objective 7 *In-situ* conservation of threatened plant species

Background

A fundamental requirement for the conservation of plant diversity is the *in-situ* conservation of species' natural habitats and the maintenance and recovery of viable populations of species. *In-situ* plant conservation comprises several approaches, such as habitat rehabilitation, re-introduction of critically endangered plants from nurseries and augmentation of isolated or small populations with plant individuals from genetically more diverse populations. Given limited resources in the Seychelles, research into *in-situ* conservation prioritises critically endangered plant species, flagship species characteristic of the Seychelles, and species of commercial interest. However, it is of paramount importance to investigate the effects of *in-situ* conservation on entire ecosystems, i.e. to include the ecological and demographic factors, which have an immediate significance for population habitat viability. For example, fragmentation may disrupt critical life-history stages such as pollination and germination, and human-induced changes to disturbance regimes may alter community dynamics by, e.g., the introduction of alien invasive species which in turn affects plant-pollinator and plant-seed disperser interactions. *In-situ* conservation can only account for such processes if they are investigated on a community level (see Objective 8). As already described in Objectives 1 and 2, sound knowledge of the taxonomy of the Seychelles' flora and extensive research on *ex-situ* techniques which facilitate the propagation of plants in nurseries, are pre-requisites for successful *in-situ* conservation.

Action 1 *Develop methodology for selection and apply it to a priority list of species.*

Rationale Research on model species for *in-situ* conservation; criteria for suitable model species are not available.

Recommendations First, choose a suitable model species for *in-situ* conservation, e.g. note which species are probably threatened because of genetic factors. Work on those species where major problems are identified and concentrate on the major threats of the species. But also identify easily conserved species for developing best practice *in-situ* conservation techniques.

Action 2 *Develop an action plan following a hierarchical approach for species identified in Action 1.*

Rationale A hierarchical approach should be applied because species experience different threat factors with varying levels of intensity. This approach facilitates the efficient use of resources and expertise in the Seychelles and results in general output applicable to other species and habitats.

Recommendation Follow this phased approach to identify threat factors of the model species:

Phase 1 *Population status and long term viability (this should be done as part of the red data list assessment***)**

- 1.a Population size and distribution
- 1.b Population age structure
- 1.c Baseline information for future monitoring
- 1.d Taxonomic uncertainties and within-species morphological diversity

Phase 2 *Reproductive ecology as a necessary basis for evaluating population viability*

- 2.a Breeding systems
- 2.b Pollination biology and dispersal mechanisms
- 2.c Seed, seed bank and seedling viability
- 2.d Local adaptation and performance.

Phase 3 *Quantify genetic constraints to recruitment*

- 3.a Genetic diversity within and between populations
- 3.b Gene flow
- 3.c Inbreeding, outbreeding and genetic fitness
- 3.d Local adaptation using provenance trials.

Phase 4 *Species recovery and population augmentation*

- 4.a Guidelines for establishing ex-situ stock which secures genetic diversity present in wild populations
- 4.b Avoid “genetic contamination” of wild stock.

Action 3 *Carry out in-situ conservation according to outcomes of Actions 1 and 2.*

Rationale Long-term species viability and ecosystem functioning must be ensured by *in-situ* conservation activities

Recommendation Use species and habitats identified in Actions 1 and 2 to conduct habitat restoration schemes, re-introduction procedures and augmentation projects of wild plant populations. Make information available on the best methodologies for the conservation of habitats.

See also Annex 4: Priority target list for model endemic species for *in-situ* conservation programmes

Objective 8 Understanding biotic interactions on a community level

Background
Plant-plant and plant-animal interactions are essential processes in biological communities. Habitat destruction, fragmentation and degradation by invasive alien plant and animal species (IAS) often result in changes of, for example, plant-pollinator/seed disperser composition which can cause reduced efficiency of pollination and seed dispersal services. Interactions among natives and introduced mutualists, e.g. seed dispersal of IAS, may facilitate the spread of IAS and the threats they pose to endemic plant communities. Other important plant-plant and plant-animal interactions include plant diseases and herbivores. Little is known about such interactions in the Seychelles and their role in habitat rehabilitation projects.

Action 1 *Investigate changes in the structure of plant-animal interactions as a result of changing plant community structure.*

Rationale Biotic interactions are crucial for habitat rehabilitation projects. On highly disturbed islands, IAS may perform roles formerly played by native species.

Recommendation Establish observational and experimental studies. Use an adaptive management approach in habitat rehabilitation projects. Document and monitor plant-plant and plant-animal interactions during habitat rehabilitation projects.

Action 2 *Actively maintain and restore biotic interactions, either within habitat restoration schemes or individually.*

Rationale Viable populations cannot be maintained if essential mutualistic interactions are not present.

Recommendation Use an adaptive management approach in habitat rehabilitation projects, taking account of suitable measures for mutualists, e.g. heterogenic habitat and soil structure to provide nesting places for insect pollinators, supplement wild honey bee populations with managed bees, and account for resource availability (nectar and pollen) provided by native plant species. Restoration could also address plant-plant interaction, root competition, light competition, allelopathic chemicals and others. Document and monitor plant-plant and plant-animal interactions during restoration projects.

Objective 9 Capacity building

Background
In principle there are three major aims for capacity building: compilation of data, maintenance of data and the training of as wide a range of people as possible, e.g. for long-term research, advocacy work and training of other people. The broader context of capacity building, i.e. especially funding and network building, is addressed in the NSPC (see NSPC Objective 5).

Action 1 *Find ways to effectively raise monies through applying for grants, through commercial development, through the Botanical Garden and the Biodiversity Centre and by working in collaboration with other partners, in order to obtain the resources, training and development that would put into effect the recommendations highlighted throughout this document.*

Rationale Undertaking and completing the work within the Seychelles Plant Conservation Research Agenda will not be effectively realised without the necessary financial and human resources.

Recommendation Set-up a multidisciplinary project group to focus on obtaining funds to support the Research Agenda.

Action 2 *Find ways to effectively promote the Seychelles Research Agenda requirements amongst the world's scientific experts so that the Seychellois can successfully manage approaches from researchers to usefully answer specific questions on their conservation challenges.*

Rationale The Research Agenda implies the development of a strategy which can engage the commitment of people within Seychelles, as well as scientific researchers globally.

Recommendation Set up a project group to focus on how to advertise and disseminate this research strategy to scientists globally.

Action 3 *Produce an inventory of existing monitoring and GIS data.*

Rationale Management of long-term monitoring data is essential if we want to effectively use the data to make informed decisions. A certain amount of monitoring work

is already in progress but is scattered among various departments and agencies, making it difficult to keep track of progress. GIS is becoming an increasingly important tool in plant conservation work as it provides a visual image of past, present and future changes in species or habitat distribution.

Recommendations Plant conservationists should be trained in database and GIS use and management, collaborate with trained information technology (IT) personnel and make maximum use of new technologies. Establish a protocol for collaboration and the sharing of data between different departments and agencies involved in monitoring programmes.

Action 4 *Build capacity for analysing and publishing data from long-term monitoring.*

Rationale Training in statistical analysis and experimental design, involving local and/or international students and technicians, should help in better utilisation of available data. It may be possible to set up programmes where automated data analysis becomes part of the monitoring. Simple analysis techniques could also be used in developing public awareness, although care must be taken to ensure that the data is not misinterpreted.

Recommendation Organise training programmes in various methods of data analysis, dissemination of findings and communication strategies.

Action 5 *Encourage the involvement of visiting scientists in capacity building.*

Rationale In view of the small pool of expertise locally, it is important that opportunities for capacity building are included in the work of visiting scientists.

Recommendation It should become compulsory that every collaborative research project involving visiting scientists contains a capacity building component which enables participants to gain award-bearing certification. The component could include statistics, experimental design or taxonomy, etc. depending on the expertise of the visiting scientist. A useful model is the PABITRA transect in the Pacific.

Action 6 *Produce identification guides for lower and flowering plants of the Seychelles.*

Rationale Although guides to flowering plants do exist, they are not easily accessible and user-friendly for local environmentalists. General knowledge of Seychelles' ferns and non-vascular plants is still very incomplete. Providing basic identification guides would increase people's awareness and interest in these lesser known groups.

Recommendation Firstly, a basic identification guide for ferns and fern-relatives should be produced; then a guide providing information and illustrations of basic groups of bryophytes, lichens, algae, fungi, etc, which would help people (especially local environmentalists) to get interested in these lesser known plants. A useful addition would be a guidebook on the flowering plants of the Outer Islands.

Action 7 *Training and employing plant conservationists and para-taxonomists.*

Rationale There are many local para-botanists who have developed their knowledge through their own field experiences and research. The Ministry already employs a number of plant conservationists who have potential and are interested to develop their knowledge further. This is true also for employees of local environmental NGOs. It is important to continue to provide incentives to such employees.

Recommendation Provide training programmes or courses similar to the plant conservation training course run in 2007 under the auspices of FFEM (Rehabilitation of Island Ecosystems project) on an annual basis. It is the responsibility of the employer to follow up each participant in the training to ensure that the acquired knowledge and experience is put into practice. Employers should provide pathways to utilise the acquired knowledge so that they can contribute to this research strategy.

Objective 10 Education and awareness building

Background

Although Seychellois are generally aware of the importance of the environment, plants are often taken for granted and undervalued. Increasing awareness of the need for plant conservation and sustainable use is already an important feature of the NSPC (Targets 9, 10 and 11). However, although much has been accomplished, better ways have to be found for integrating plants into the formal education system, promoting plant conservation, increasing the appreciation of Seychelles' plant biodiversity amongst visitors to the country and the general community, and providing opportunities for local action.

Action 1 *Integrate plant conservation and sustainable living into the new school curriculum.*

Rationale The forthcoming revision of the national curriculum for schools provides an excellent opportunity to better integrate environmental education into the school curriculum and teacher training programmes, making them more practical and issue-based.

Recommendation Advocate for the better integration of environmental education and sustainable living in the national curriculum and in the teacher training programmes of the NIE. Make use of local and international expertise in the process.

Action 2 *Research best-practice for connecting schools and the community.*

Rationale It is important to know what may constitute best practice in the context of Seychelles, especially with regard to developing synergies between schools and the community.

Recommendation Involve teachers in action research projects which will encourage schools to act as hubs for disseminating environmental awareness, and that will encourage links between schools and the community. Existing parent/teacher associations may be a starting point.

Action 3 *Develop the Biodiversity Centre as a community involvement centre.*

Rationale The National Biodiversity Centre is a learning centre where people can gather, get involved and learn more about the native plants, their properties and their traditional and medicinal uses. It can be used as a venue where members of the community can meet and get involved in conservation work through a series of educational programmes to educate school children and other visitors about the importance and conservation of plant biodiversity. It should be used as a teaching ground and also as an area where older citizens can share their experiences.

Recommendation Good educational programmes for the community should be established, with various elements such as story telling, food, music, sketches, etc. serving to pass the message across to visitors. (Eden Project could provide assistance)

Action 4 *Address private gardens to enhance awareness of native plant diversity.*

Rationale Seychellois love their gardens and often invest a lot of time and effort in maintaining their beauty. This represents an opportunity to increase Seychellois' appreciation of the diversity and attractiveness of native plants. There already exists a national annual competition for the most attractive gardens.

Recommendation Initially a category could be introduced within the current national competition, assessing the presence and variety of native species in a garden. Horticulturists and the Biodiversity Centre should be encouraged to sell easily propagated native species and provide guidance on their requirements and care.

Action 5 *Investigate the most effective method(s) of informal education and awareness-raising for use within the Seychelles.*

Rationale Environmental education and awareness building strategies are often implemented without taking consideration of the focal group or target society and therefore are not targeted effectively. A cost-benefit analysis is also beneficial.

Recommendation This action will form part of a larger study being undertaken by Caroline Howe (Imperial College London) on the role of education within environmental conservation and sustainable development. Included in the study is the production of guidance notes on creating and developing existing environmental education programmes within the Seychelles in order to develop a long term commitment to awareness building programmes. There will also be information sharing with similar educational projects carried out on other island states.

Action 6 *Present success stories in plant conservation in the media.*

Rationale Plant conservation and research are active in the Seychelles but the findings are often not communicated to the general public. The PCA newsletter *Kapisen* provides an insight but is restricted by its limited distribution.

Recommendation Use newspapers (e.g. the weekly environment page of 'Nation'), radio and television to disseminate information on plant conservation activities. Involve local plant conservationists in the production of media material. Collaborate with other environmental programmes to cover the importance of plants to people, e.g. as food, shelter, clothing, in the culture, etc.

Action 7 *Use participatory methods to mitigate stakeholder conflicts.*

Rationale Stakeholder conflicts often arise during the development and/or management of protected areas and species. Examples from the past are: the development of the Fond Ferdinand site; the development of the Vallée de Mai Management Plan; the Coco de Mer Management Decree; a management system for La Réserve.

Recommendation Participatory methods for stakeholder conflict resolution should be developed, based on, for example, the "Model Forests" method.

ANNEX 1 Abbreviations

CHM	Clearing House Mechanism
CPC	Centre for Plant Conservation (www.centerforplantconservation.org)
FAO	Food and Agriculture Organization of the United Nations
FFEM	Fonds Français de l'Environnement Mondial
IBZ ETH	Institute of Integrative Biology (former Geobotanical Institute), Swiss Federal Institute of Technology (ETH) Zurich, Switzerland
IUCN	World Conservation Union
ITES ETH	Institute of Terrestrial Ecosystems, Swiss Federal Institute of Technology (ETH) Zurich, Switzerland
MENRT	Seychelles Ministry of Environment, Natural Resources and Transport
NIE	Seychelles National Institute of Education
NSPC	Seychelles National Strategy for Plant Conservation 2005-2010.
PABITRA	Pacific-Asia Biodiversity Transect Network (http://www.botany.hawaii.edu/pabitra/)
PCA	Plant Conservation Action group
PHARMEL	Banque de données de Médecine traditionnelle et Pharmacopée (http://www.ulb.ac.be/sciences/bota/pharmel.htm)
ReCoMaP	Regional Programme for the Sustainable Management of the Coastal Zones of the Indian Ocean Countries
SBS	Seychelles Bureau of Standards
TERC	Terrestrial and Ecological Research Centre *(ex* Botanic Gardens Section) of Seychelles Ministry of Environment, Natural Resources and Transport
UNDP-GEF	United Nations Development Fund - Global Environment Facility

ANNEX 2 Workshop programme

Day 1 – June 26

9.00 – 9.30	*Welcome – Denis Matatiken*
	Introduction – Christoph Kueffer
9.30 – 11.40	*Session 1 Plant Conservation in Seychelles – Status*
9.30 – 9.50	**Seychelles' National Strategy for Plant Conservation -** Didier Dogley
9.50 – 10.10	**Seychelles Red Data List Project –** James Mougal, Michael Huber, Sascha Ismael and Karl Fleischmann
10.10 –10.40	*Coffee Break*
10.40 – 11.00	**Status of the ferns of Seychelles –** Justin Gerlach
11.00 – 11.20	**Traits of invasive species in the Seychelles –** Eva Schumacher, Christoph Kueffer, Karl Fleischmann, Hansjörg Dietz and Peter Edwards
11.20 – 11.40	**The uniqueness of the Seychelles flora and its scientific importance** – Peter Edwards
11.40 – 12.40	*Session 2 Plant Conservation on oceanic islands – International experiences*
11.40 – 12.00	**Confronting the synergism between alien plants and alien animals in island ecosystem conservation and restoration** – James Juvik
12.00 – 12.20	**Plant conservation in an island paradise** – Jean-Claude Seviathan
12.20 – 12.40	**Restoration ecology in a mid-altitude forest ecosystem invaded by *Hedychium gardnerianum* on La Réunion island: an experimental approach testing the impact of different potential control methods** – Luc Gigord
12.40 – 13.00	**A global conservation strategy at the Réunion island scale: the national botanical garden approach** – Stephane Baret
13.00 – 13.40	*Lunch*
13.40 – 12.30	*Session 3 Plant Conservation Research and Management: Local experiences and international perspectives*
13.40 – 14.00	**Towards sustainable management of *Lodoicea maldivica*** – Frauke Fleischer-Dogley
14.00 – 14.20	***Cinnamomum verum* forests – Potentials for habitat rehabilitation?** – Christoph Kueffer, Eva Schumacher, Karl Fleischmann, Hansjörg Dietz and Peter Edwards
14.20 – 14.40	**Reflections on 6 years of vegetation rehabilitation on North Island** – Linda Vanherck and Greg Wepener
14.40 –15.00	**The role of *ex-situ* protocols in species recovery for the Seychelles using *Impatiens gordonii* as a case study'**– Alistair Griffiths
15.00 – 17.00	Final discussion: Challenges and opportunities of plant conservation in Seychelles (compared to other oceanic islands)

Day 2 – June 27

8.00 – 12.40	*Session 3* *Plant Conservation Research and Management: Local experiences and international perspectives*
8.00 – 8.10	*Introduction: Christopher Kaiser*
8.10 – 8.30	**The slow demise of a miniature forest** – Katy Beaver
8.50 – 9.10	**Conservation of the critically endangered Bwa mediz (*Medusaygne oppositifolia*)** (preliminary title) – Denis Matatiken
9.10 – 9.30	**Ecological genetics and conservation of a highly threatened island flora: lessons from New Caledonian** –Chris Kettle
9.30 – 9.50	**Invaders of pollination systems: an example from Mauritius and implications for the Seychelles** – Christopher Kaiser
9.50 – 10.20	*Coffee Break*
10.20 – 10.30	Introduction: **Preparing a plant research agenda for the Seychelles –** Christoph Kueffer *-> What are the gaps in plant conservation research in Seychelles?* *-> What are the priority research needs in the next five years?*
10. 30 – 12.45	*Three parallel group discussions:* *Taxonomy* "Establishing a widely accessible and comprehensive information resource on the Seychelles plant diversity with a focus on dicotyledons, monocotyledons and ferns" Ex-situ *plant propagation* "Ex situ conservation of threatened plant taxa" *Education, awareness & capacity building* "Research studies to determine the use and effectiveness of education materials on plants produced for schools, and to determine the effectiveness of public awareness programmes on attitudes to conservation issues"
12.45 – 13.45	*Lunch*
13.45 – 14.45	*Continued group discussions*
14.45 – 15.00	*Coffee break*
15.00 – 17.00	Final discussion (chair: Jaboury Ghazoul)

Day 3 – June 28

8.00 – 18.00 **Research agenda: In-situ conservation and ecosystem management**

8.00 – 9.00 Prioritisation and monitoring of species and habitats

9.00 – 12.30 *Three parallel group discussions*

A. *Species-related studies / in situ conservation of rare species*:
"Genetics, population biology, threat factors"

B. *Ecosystem research*
"Ecosystem research considers the conservation of plant biodiversity, ecosystem functioning and sustainable use of natural resources from an integrative perspective and in the light of global change, e.g. invasive species, pests and diseases, and climate change"

B.I: *Plant-environment interactions (particularly soils)*

B.II: *Biotic interactions (plant-plant / plant-animal interactions, e.g. pollination, herbivory, seed dispersal)*

12.30 – 13.30 *Lunch*

13.30 – 16.30 **Synthesis:** *– chair: Frauke Fleischer-Dogley & Peter Edwards*

Ecosystem rehabilitation techniques and strategies – from scientific to practical knowledge
"Ecosystem rehabilitation techniques and strategies are specific to different habitat types (small islands, mid-altitude forests, cloud forests) and integrate the sustainable use of ecosystem products (e.g. forestry, tourism, local use of wild plant products)"

16.30 – 17.00 *Coffee Break*

17.00 – 18.00 *Final discussion*

Day 4 – June 29

8.00 – 18.00 ***Field Excursion***

ANNEX 3 Workshop participants

Adrien Ouvier	L'institut de techniques de l'ingenieur en aménagement paysages et de l'espace
Alistair Griffiths	Eden Project, Cornwall, UK
Andy Roucou	Red Cross Seychelles
Basil Esther	Ministry of Environment, Natural Resources and Transport, Seychelles (Forestry)
Caroline Howe	Imperial College London, UK
Christoph Kueffer	Institute of Integrative Biology, ETH Zurich, Switzerland
Christopher Kaiser	Institute of Terrestrial Ecosystems, ETH Zurich, Switzerland
Denis Matatiken	Ministry of Environment, Natural Resources and Transport, Seychelles (TERC)
Didier Dogley	Ministry of Environment, Natural Resources and Transport, Seychelles (Environment)
Eva Schumacher	Institute of Integrative Biology, ETH Zurich, Switzerland
Frauke Dogley	Seychelles Islands Foundation
Greg Wepener	North Island, Seychelles
Hansel Simara	Ministry of Environment, Natural Resources and Transport, Seychelles (Forestry)
Jaboury Ghazoul	Institute of Terrestrial Ecosystems, ETH Zurich, Switzerland
James Juvik	University of Hawai'i at Hilo, Hawaii, USA
James Mougal	Ministry of Environment, Natural Resources and Transport, Seychelles (TERC)
Jan Rijpma	Agriculture and Environment consultant (UNDP-GEF)
Jean Claude Seviathian	Mauritian Wildlife Foundation
Jeanette Larue	Ministry of Education, Seychelles
Jonathan Mercier	L'institut de techniques de l'ingenieur en aménagement paysages et de l'espace
Justin Gerlach	Nature Protection Trust of Seychelles
Karl Fleischmann	Institute of Integrative Biology, ETH Zurich, Switzerland
Katy Beaver	Plant Conservation Action group, Seychelles
Lena Desaubin	Ministry of Environment, Natural Resources and Transport, Seychelles (Communication)
Linda Vanherck	North Island, Seychelles
Lindsay Chong Seng	Seychelles Islands Foundation
Luc Gigord	University of Lausanne, Switzerland
Marc Jean-Baptiste	Ministry of Environment, Natural Resources and Transport, Seychelles (Praslin Office)
Marie Therese Purvis	Ministry of Education, Seychelles
Mermedah Moustache	Ministry of Environment, Natural Resources and Transport, Seychelles (PGR)
Michel Vely	Ministry of Environment, Natural Resources and Transport, Seychelles (Environment)
Michel Vielle	President's Office (Dept. of Risk and Disaster Management)
Peter Edwards	Institute of Integrative Biology, ETH Zurich, Switzerland
Ron Gerlach	Nature Protection Trust of Seychelles
Selby Remie	Ministry of Environment, Natural Resources and Transport, Seychelles (Conservation)
Stephane Baret	Conservatoire Botanique National de Mascarin
Terence Valentin	Ministry of Environment, Natural Resources and Transport, Seychelles (Forestry)
Walter Mangroo	Ministry of Environment, Natural Resources and Transport, Seychelles (TERC)
Willy Andre	Plant Conservation Action group, Seychelles

ANNEX 4 Priority target list for model endemic species for *in-situ* conservation programmes (see Objective 7)

This list has been developed as a starting point for discussion, with the following considerations in mind:

a) Threat status (e.g. CR, VU);

b) Flagship species (note that Coco-de-Mer has been omitted because of its unusual nature, but could be included);

c) Species that could be used as models for in situ conservation (e.g. growing in one habitat type, ease of propagation, much already known about the species).

***AC** Threat status as assessed by Annette Carlström (1996)

***RDL** Threat status as assessed in the Red Data List submission to IUCN (by Sascha Ismail and Michael Huber) (2006) - N.B. This only covered woody species.

NT = Near Threatened; VU = Vulnerable; EN = Endangered;

CR = Critically Endangered.

IAS Invasive Alien Species

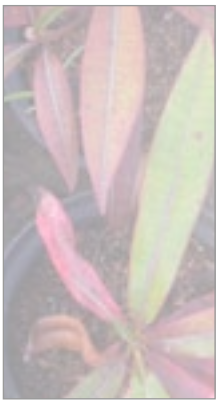
\# Species included because they could be studied and rehabilitated in the same habitat and locations, and could serve as useful examples.

Species	Category (AC)*	Category (RDL)*	Comments
Critically endangered species			
Campnosperma seychellarum	VU	CR	1 island; populations small and scattered; genetically vulnerable; dispersal problems; little regeneration; competition from IAS; propagation fairly easy?
Drypetes riseleyi	EN	CR	3 islands but only 8 sites; small populations; genetically vulnerable; no regeneration; threat from IAS; propagation fairly easy
Grissolea thomassetti	VU	CR	2 islands but only healthy populations on 1; other population genetically vulnerable; habitat heavily invaded; by IAS
Medusagyne oppositifolia	CR	CR	Flagship species; 1 island; 4 scattered small populations; little regeneration in only 1 site; genetically vulnerable; quite a lot known about it already; propagation difficult

Rothmannia annae	EN	CR	Flagship species; 1 island; 1 decreasing population; quite a lot known about it already; propagation fairly easy; already used in rehab
Impatiens gordonii	CR	-	Flagship herbaceous species; 2 islands; 2 populations; genetically vulnerable; propagation fairly easy; quite a lot known about it already
Vateriopsis seychellarum	CR	CR	Flagship (evolution) species; 1 island; isolated small populations; little good regeneration; poor habitat quality; quite a bit known about it already; requires mycorrhiza for good growth
Near threatened and vulnerable species			
Allophylus sechellarum	VU	VU	3 (6) islands; decline in habitat quality due to development and aliens; propagation fairly easy (may interbreed with *A. pervillei*
# Diospyros seychellarum	VU	NT/VU	4 islands; competition from IAS especially in woodlands; propagation difficult? Easily monitored
# Excoecaria benthamiana	NT	VU	Severely fragmented populations; genetically vulnerable; propagation fairly easy
Ixora pudica	NT	VU	2 islands; restricted distribution; habitat degraded by IAS; not enough known about reproduction etc.
# Mimusops sechellarum	VU	NT/VU	Small groups of stunted trees at edge of habitat limit; fragmented; poor regeneration; propagation fairly easy but high rat predation; already used in rehab
Pandanus hornei	VU	VU	4 islands; fragmented populations; no distant dispersal; genetically vulnerable; habitat invaded by IAS; propagation fairly easy
Syzygium wrighti	NT	VU	5 islands; mainly in small groups; maybe at edge of ideal habitat; threat from IAS; disease problem? propagation fairly easy

Another species that could be usefully considered at the same time as the other 3 marked *#* in the table is *Soulamea terminaloides* (VU).

Certain species could be chosen for *in-situ* conservation on individual islands - e.g. *Timonius sechellensis* on Praslin, *Carissa edulis* var. *sechellensis* on Silhouette, *Trilepisium (gynandrum) madagascariense* on Silhouette.





Ministry of Environment Seychelles

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