
FFEM
Fonds Français pour l'Environnement Mondial
France - Seychelles
REHABILITATING ISLAND ECOSYSTEMS
Eradication of invasive exotic species and reintroduction of threatened endemic species.





What is the FGEF?

The FGEF (French Global Environment Facility; in French *Fonds Français pour l'Environnement Mondial or FFEM*) is a bilateral fund which was set up in 1994 by the French government following the Rio Summit. It aims to promote the protection of the global environment in developing countries.

The FGEF subsidises sustainable development projects in the following areas to help preserve the main factors of global environmental balance :

- **Biodiversity**
- **Climate change**
- **International waters**
- **Land degradation**
- **Persistent organic pollutants (POP)**
- **The ozone layer (Montreal protocol)**


FGEF activities in the field of biodiversity protection

Increasing human impact on the natural environment is causing the unprecedented widespread extinction of living species. The consequences of this large-scale erosion on the natural equilibrium that all human societies depend upon are considerable. In a bid to halt this loss of biodiversity (defined as encompassing all the genetic resources, species and ecosystems of the earth), the FGEF supports projects which address the orientations of the Convention on Biological Diversity (an international treaty adopted during the Rio Earth Summit in 1992).

These projects concern:

- biodiversity conservation: ecosystems, species, and genetic resources particularly under threat;
- sustainable management of natural resources;
- the promotion of biodiversity as a lever for social and economic development.

With two priority objectives:

- to involve the local population in biodiversity conservation activities;
- to mainsteam biodiversity protection into a process of development through a sustainable approach to natural resources use.

The FGEF intervenes in ecosystems where the biodiversity is particularly rich, under threat or includes rare or endemic species: it intervenes wherever the loss of biodiversity presents a global issue beyond the country or area concerned. These projects must involve local populations and enable them to develop resources and espouse the protection of their environment as well as directly benefit from the advantages linked to the use of natural resources.

The Seychelles: an exceptional natural environment...

The Western Indian Ocean has been identified as a global biodiversity 'hotspot' by several international organisations for nature conservation (Conservation International, WWF, IUCN). Due to their unique natural history, the insular ecosystems have evolved separately from the major evolutionary trends and genetic combinations which have taken place on the continents and, therefore, host numerous species found only in this part of the world (high levels of endemism).

The Seychelles comprises 115 main islands of different types and origins:

- **41 isolated granitic islands of continental origin which are like a living laboratory of evolution having different unique and often threatened ecosystems, as well as numerous endemic terrestrial species at risk of extinction.**

- **74 coralline islands formed on a volcanic basement, mostly uninhabited and characterised by high levels of marine biodiversity. These islands are also breeding sites or stop over points for many different species (birds, marine mammals, sea turtles) and some are home to endemic terrestrial life forms (invertebrates, plants, reptiles, birds, bats) threatened with extinction.**

Rocky landscape with invasive plants on the North Island

Main threats to the Seychelles environment

Exploitation of marine resources: increasing exploitation of marine resources leads to overexploitation of species and/or fragile stocks with low levels of renewal. In the Seychelles, this poses a threat to both pelagic and coastal resources.

Global climate disturbances: in the Seychelles, climate change due to increased levels of greenhouse gasses has already had devastating ecological effects, with three consecutive bleaching events in 1998, 2002 and 2003 leading to almost 90% depletion in coral reef coverage in 1998 and over 90% coral death for certain species in 2003. This depletion of habitat may indirectly lead to reduced levels of capture for artisanal fisheries.

The Island Ecosystems Rehabilitation project aims to specifically address two types of threat at a worldwide level:

Natural habitat destruction: endemic land species are or were naturally present on the largest granitic islands, of which the three main ones (Mahé, Paslin, La Digue) provide housing for 95% of the Seychellois people. Although almost 50% of Seychelles territory is under legal protection, these large islands and their inhabitants are under increasing pressure from economic development (tourism and polluting activities), urbanisation and exploitation of natural resources.

Invasive species: these are plants or animals which have been deliberately or accidentally introduced into a region outside their native range and whose development leads to the scarcity and/or extinction of native species and damages local biodiversity. Biological invasion is now recognised as the second cause, after habitat destruction, for the decline in biodiversity. Island ecosystems are particularly sensitive to invasive species due to their isolation and high levels of endemism. Introduced species compete with native ones which have mostly evolved in the absence of predatory or competitive species.

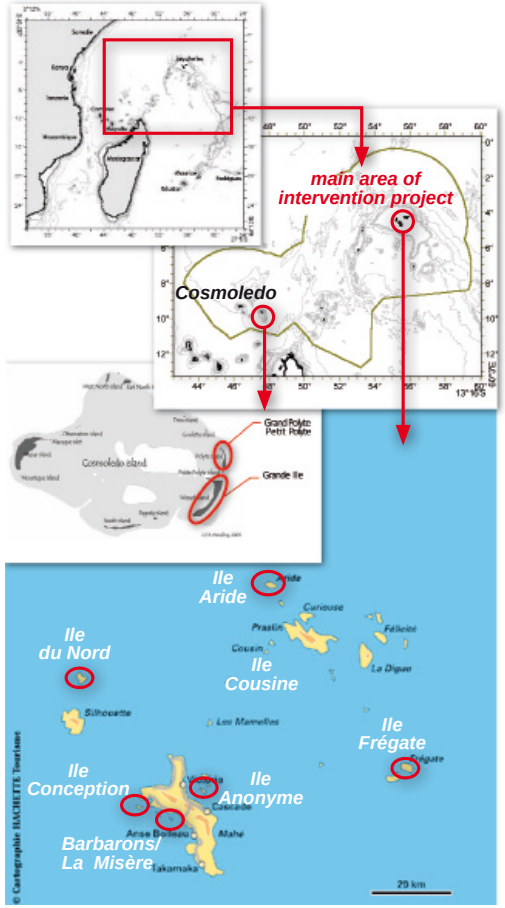
In Seychelles, the main invasive vertebrates are: Black Rat, Brown Rat, Barn Owl and Common Myna. Because of these threats, the Seychelles have a long list of animal and plant species or sub-species in danger of extinction. Small islands without introduced predators now represent the only hope of survival for these severely threatened endemic species, but unfortunately, before the project started, there were only 7 granitic islands of over 10 ha without introduced predators.

Restoring islands to save species

The project aims to rehabilitate those islands essential to the conservation of the Seychelles' indigenous biodiversity. Two specific sets of actions were conducted between 2005 and 2009 by an NGO, the Island Conservation Society (ICS), and its local partners with €460,000 of funding from the FGEF:
1. removal of introduced predatory species, monitoring of invasive plants and reintroduction of rare species often threatened with extinction ;
2. reinforcement of local capacities for studying fauna and flora, rehabilitation operations and sustainable management of outstanding island sites through the development of ecotourism activities.

The granitic islands concerned by the project are Ile du Nord (North Island, 201 ha), Aride (73 ha), Conception (69 ha) and Anonyme (10 ha), the coralline islands concerned are Grande Ile (Wizard) (142 ha), Grand Polyte and Petit Polyte (21 ha) in the Cosmoledo Atoll. Some activities have also been carried out on Mahé, Praslin, Frégate, Cousine and on the Farquhar Atoll.

The project was backed in its application for FGEF funding by the French Ministry of Foreign and European Affairs (MAEE), a member institution of the FGEF, and supported by the French Embassy.



Main partners and their role in the project:

- **ICS (Island Conservation Society)**, is an NGO created and registered in 2001 which promotes the conservation and restoration of outer islands, it manages Aride Island Nature Reserve and it was the implementing agency for the project.
- **North Island Ltd is a private company who owns North Island (Ile du Nord)** since 1997 and manages a small hotel complex comprising 11 luxury villas; they were involved in the restoration of vegetation and the introduction of threatened species.
- **The Ministry of Environment, Natural Resources and Transports (MENRT)** is responsible for implementing environmental policies in the Seychelles; they were involved in several restoration projects and helped with the scientific monitoring of species.
- **Islands Development Company (IDC)**, a parastatal structure created in 1980 and responsible for the development and management of the outer islands; they participated in co-funding of eradication operations and were involved in logistics (aircrafts, boats, helicopters).

Several other organisations contributed to the project either through their expertise or funding:

- **Contribution of expertise:** MNHN (National Natural History Museum, Paris ; UMR 7204), PCA (Plant Conservation Action Group), NPTS (Nature Protection Trust of Seychelles) (local NGOs), ETH (Geobotanical Institute, Zurich University), NZCCM (New Zealand Center for Conservation Medicine), SOPTOM (Center for the Observation and Protection of Tortoises and their Habitats, France).
- **Involvement of local private partners in logistic support, project actions or contributions in kind:** Cable & Wireless (telecommunications), Helicopter Seychelles, Zilair, Air France and Air Seychelles (airlines), Banyan Tree Resort and Lemuria Hotel (luxury hotels), Indian Ocean Explorer (cruise ships), Anonyme Island, Fregate Island Private (private islands), Management of President's Affairs, United Arab Emirates (ownership or management of sites), Animal Control Products (Pestoff, NZ).
- **Funding:** Environment Trust Fund (Seychelles), *Conservation des Espèces et des Populations Animales* – Conservation of Animal Species and Populations (CEPA, France), Miguel Torres Foundation (wines from Catalonia-Spain), Star Seychelles, Chicago Zoological Society (USA), Le Havre Rotary Club, private donors (Jo Albert, Karyn Bordat).

Five components with highly encouraging results

Component 1: Eradication of introduced predatory species and development of protection measures.

The objective of component 1 was to eradicate introduced predatory species (rats, cats, Barn Owls and Common Mynas) on granitic and coralline islands using methods adapted to each context, and to develop measures of protection to prevent natural or accidental re-infestation.

Almost all the eradications of invasive species eradication have been completed. Rats have been removed from 5 islands (North Island, Conception, Grande Ile and Grand Polyte in Cosmoledo, and Anonyme) over a total area of 455 ha, Barn Owls have been removed from 2 islands and the Common Mynas have been controlled on one island although they have not yet been completely eradicated. No significant environmental effects of the products used for rat control (anticoagulants) were observed during the project (there was some doubt as to their potential toxicity for non-targeted species). Preventive measures against new invasion by these species have been implemented.

The most notable accomplishment of this component is the substantial increase (almost over 50%) in the total rat-free area of the Seychelles granitic archipelago. These newly rat-free islands are being progressively recolonised by marine birds (White-tailed Tropicbirds or Wedge-tailed Shearwaters on North Island or Conception) and some endemic invertebrates that were thought to have disappeared (snails, Giant Millepede) have since reappeared. These islands will thus be able to further participate in conserving the unique biodiversity of Seychelles in the future, especially since further reintroductions of threatened species can now be considered.

The project also showed that it is possible to eradicate rats from rather large tropical islands with relatively mountainous landscapes or very isolated from any logistic base.

Eradication of rats on North Island using a helicopter equipped with a spreader bucket. An expert and a pilot from New Zealand helped to train a local team (ICS/Helicopter Seychelles) which went on to complete further eradication operations autonomously.




Evolution of restored vegetation
1 : October 2006
2 : February 2008

1- Introduction of 25 White-eyes from Conception to North Island in 2007.

2 - Photo of a leaf insect introduced onto Conception in 2010.

3 - Reintroduction of 20 Seychelles Black Mud Terrapins to North Island (Aride in 2010).

Component 2: Vegetation rehabilitation on different islands depending on requirements linked to each context/management plan.

The objective of component 2 was to eliminate or control invasive plants on several granitic and coralline islands in order to restore habitats and encourage the establishment of endemic/indigenous species and help save certain plants from extinction. Vegetation restoration happened mainly on 2 granitic islands (North Island and Conception) and planting of endemic species was carried out according to revised objectives (15,000 plants). Vegetation management plans were written or updated for 3 islands.

The actions carried out in component 2 are innovative because of their scale (45 ha, mainly on North Island) and can serve as an example, especially regarding the need to take into account the considerable maintenance work after replanting. In view of this, the vegetation management plan represents an essential operational tool.

Component 3: (Re)introduction of several rare or threatened endemic species of invertebrates, reptiles and birds,

The objectives of component 3 were:

- to reintroduce a minimum of 6 endemic species (3 birds, 2 insects and 2 tortoises on various islands for a total of 9 reintroductions);
- to carry out complementary research on species earmarked for reintroduction;
- to carry out scientific monitoring of transferred populations and main groups of vertebrates and invertebrates before, during and after operations (with development of a long-term monitoring protocol).

The introduction of endemic species involved prior veterinarian health screening and concerned 2 species (the Seychelles White-eye and the Seychelles Black Mud Terrapin) on North Island, as well as the White-eye on Cousine to support another project. Three complementary reintroductions are planned for 2010 on Conception and Frégate (Seychelles Leaf-insect, Phylliidae), and Aride (Seychelles Black Mud Terrapin). Scientific monitoring has revealed interesting variations in numbers after the eradication of rats for indigenous bird, reptile or insect species, which regained or even exceeded their initial levels. Various species and sub-species of insects previously unknown to science have also been described.

The (re)introduction objective required preliminary targets to be met with the eradication of predators (these were met in August 2007 on Conception and Cosmoledo) and the restoration of ecosystems (reintroduction of trees necessary for the habitat of species).
Following the mid-term evaluation report, the redefined objective of 5 to 6 species reintroductions should be reached in 2010. Moreover, scientific monitoring of transferred species and the ecosystem will continue.

1

3

4

1-2 : Documents promoting ecotourism on Aride and rehabilitation of infrastructures for wardening and scientific monitoring on Conception.
3-4-5 : Training sessions undertaken as part of the project

Component 4: Setting up or improving wardening and tourism activities in the rehabilitated islands

The objectives of component 4 were: to create or adapt infrastructures for accommodating wardens or scientific staff, welcome members of the public, set up an efficient island wardening system in order to control boats and access to the islands, and propose a specific legal status to prevent reinvasion by rats.

2

Wardening and training activities were carried out simultaneously to the rehabilitation or construction of structures on two islands (Aride and Conception); and over 70 participants and from 25 different organisations (where Mauritius and Réunion were also represented) took part in a final workshop on the rehabilitation of island ecosystems, which should lead to a technical publication.
Progress concerning the legal status of rehabilitated islands in Seychelles is crucial in order to ensure the success of rehabilitation activities in the long-term.

Component 5: Reinforce local capacity and valorisation of project outputs

The objectives of this component were: to reinforce local capacity in fields related to the study of flora and fauna and rehabilitation operations (3 students including two doing Masters and 2 PhD theses as well as several technical staff), to encourage experience sharing of the project outputs at local and international level, and to raise levels of public awareness (press, radio, TV).

5

The objectives concerning reinforcement of local capacity have been fully reached with 35 participants in training sessions (opened to all islands and organisations in the country) and 2 PhD students defending their thesis in 2010. With regards to the project added-value and lessons shared, over thirty popular articles and several television reports have led to raised public awareness in Seychelles, which should now be reinforced at the international level.

The publication of one single scientific article during the time of the project will be offset by publications planned for 2010 and 2011 (3 in press and others under preparation).

Main contributions and innovations from the project


Conception Island

An important contribution to the scientific debate

The project's main contribution is the possibility of **eradicating rats** (especially the Black Rat, *R. rattus*) from large (201 ha), relatively mountainous (180m a.s.l.) tropical islands (with plenty of food supply) isolated from logistic bases (1200km). By using a more intensive control trapping wherever possible these islands were able to be declared rat-free after one year instead of two.
Actions of vegetation restoration (component 2) are quite innovative due to their scale (45 ha), and the drafting and **implementation of vegetation management plans** represents a useful operational tool that should be promoted in future compilation of experiences.

S**cientific monitoring of all animal and plant populations** (e.g. birds, reptiles, invertebrates and plants on North Island) during ecosystem restoration work (eradication of animals, vegetation management and reintroduction), was systematically documented, thus constituting a considerable and unique bank of information in the Seychelles and the region. The project initiated a **platform for discussion** through a workshop bringing together islands and organisations working towards the restoration of ecosystems in the Seychelles.

An innovative model of partnerships between public, private and NGO sectors

Private partners (e.g. North Island) funded the majority of eradication and habitat restoration costs, but they were guided on aspects concerning management, protocol, scientific monitoring and promotion by the NGOs (ICS, PCA, NPTS). **This project brought together more private partners than originally planned thanks to its reputation and exemplary nature.** ICS also implemented highly specialised technical operations such as rat eradications and species reintroductions. Government departments participated in logistic aspects for remote islands (IDC) or in certain technical aspects such as plant propagation and planting, or species transfers (MERNT). Each actor involved in the project contributed its own skill/area of expertise and benefited in exchange from those of the other participants.
This collaborative venture between public-private sectors has been upheld beyond the project's duration: PCA has signed an agreement with North Island to continue to provide guidance in the follow up of the Vegetation Management Plan activities. Another example is that of ICS which is continuing the protection of the White-eye through rat control on property owned by the President of the United Arab Emirates.

This public-private-NGO partnership model has served and will continue to serve as an example in future rehabilitation actions on public and private islands in the Seychelles.

Reinforcement of local capacity

The development of local capacity in terms of eradications and setting up scientific monitoring of restored ecosystems (birds, reptiles, invertebrates, plants) will enable similar interventions to be carried out on new sites. Young scientists trained as part of their degree will be able to intervene in the fields of research and teaching.


Training course on invertebrates

Lessons learned and prospects

Estimated financial cost of eradication and reintroduction operations.


North Island

Eradication of rats on a granitic island	**350 to 500€/ha depending on size and number of islands**
Eradication of rats on a remote coralline island	1000€/ha
Construction of a rat-proof room (for rats and other invasive species)	**5000€ for an area of 9m2**
Rat control on forested land	60 to 100€ /ha/year
Removal of introduced plants: - full grown coconut palms (200/ha) with regeneration: - diverse exotic plants with replanting and manual maintenance:	**Between 550 and 835 €/ha (without planting or maintenance) Up to 14 700 euros/ha (sloping land).**
Drafting of vegetation management plan	5000 € per site
Introduction and scientific monitoring of a rare species (eg : White eye)	**28 000€**
Training course for 10 people over 8 days	8 100 €

The costs for rat eradication and control operations under this project are relatively close to those of other operations in the same field, after comparison with costs outlined in a review by Beaver & Mougal in the Seychelles *(Review of IAS -Invasive Alien Species- control and eradication programmes in Seychelles, 2009, UNDP &MENRT)*.

However, these figures must be treated with caution before being applied to other world regions. The local context must be taken into account from both a geographical (remoteness of these islands) and socio-economic (labour costs, helicopter costs, close relationships between stakeholders, shared costs of the technical team between several operations) perspective.

Extending the project on a regional scale

Beyond the continuation of the project's activities by the various partners, a regional project is currently being developed and should be focusing on innovative actions of ecosystem rehabilitation, especially in the Seychelles, Mauritius and Rodrigues Islands, Réunion and the "Iles Eparses", with a practical training programme leading to degrees for the protection, restoration and management of the environment for all the countries of the Indian Ocean Commission (IOC).

Prioritizing the 'ecosystem' approach for future projects

Main lessons learned

In future operations, it would be preferable to adopt an 'ecosystem' approach rather than the 'species' approach used in this project. Indeed, regarding the eradication of several species in the ecosystem, certain specialists recommend an integrated approach thus avoiding the negative effects that the eradication of one species independently of another would create. Furthermore, the prerequisite to the introduction of native fauna (birds, insects, reptiles etc.) is the availability of a suitable ecosystem, which in certain cases requires restoring of vegetation or other environment features (digging ponds for example).

In the future, three steps should be carried out during the project:

- Consider the project's (long term) objective as a whole (take into account the different species, their habitat, the environmental characteristics)
- Study the initial ecosystem in order to establish the conditions necessary to reach the project's objective
- Establish the corresponding action plan

With indigenous vegetation, five endemic species of landbirds and a million nesting seabirds from ten different species, the Aride Island Nature Reserve is a model of rehabilitation. Aride is the only place in the world where Wright's Gardenia grows naturally, and one of the rare islands where the Seychelles Magpie Robin still exists.

Aride Island Nature Reserve

Rehabilitating Island Ecosystems

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Island Conservation Society / Fondation pour la Conservation des Iles (Seychelles) : ***www.islandconservationsociety.com***
Aride Island Nature Reserve : ***http://arideisland.net***
North Island (Seychelles) Pty Ltd : ***www.north-island.com***
Plant Conservation Action Group : ***http://seychelles-conservation.org***
Ministry of Environment, Natural Resources and Transport: ***www.env.gov.sc***
Fonds Français pour l'Environnement Mondial / French Global Environment Facility : ***www.ffem.fr***

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Grande Ile and Grand Polyte (Cosmoledo Atoll)

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