

**Community-based ecological coastal rehabilitation using an
Ecosystem approach**

WIOSAP FULL PROPOSAL



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COMMUNITY-BASED ECOLOGICAL COASTAL REHABILITATION USING AN ECOSYSTEM APPROACH

EXECUTIVE SUMMARY

The project is centred on the use of natural solutions known as Ecosystem-based approaches, by local NGOs and communities, to rehabilitate the degraded coastal ecosystems at Pasquière on Praslin Island, Seychelles. The aim is to prevent the loss of wetlands by enhancing vegetation cover on degraded foothills upstream of the wetlands, remove invasive plant species encroaching the wetlands and replant with appropriate native species, to reduce soil erosion from the land into the marine park as well as enhancing the overall biodiversity and functioning of the ecosystems. The project will train at least 10 participants in rehabilitation techniques and monitoring who will then be skilled enough to rehabilitate and maintain 2 ha of wetlands and 2 ha of degraded foothills during and beyond the project lifespan. The project aims to demonstrate ecosystem rehabilitation using a landscape-level, ecosystem-based approach through community engagement that can be replicated elsewhere.

I. BACKGROUND AND JUSTIFICATION

Geographical, Socio-economic context

The Seychelles is an archipelago consisting of 115 islands (42 granitic and 73 coralline islands) in the Western Indian Ocean. It is a small island developing state of over 94 000 inhabitants. The Seychelles have a tropical climate with two main seasons the rainy northwest season with an average 2000 mm of rain per year, and the dry southeast monsoon. The main pillars of the economy are tourism and fishery.

The project will take place on one of the main island, Praslin at Pasquière, Anse Possession. The site is located between two Key Biodiversity Areas: from the top of the hills is the La Plaine Hollandaise upland wetland (a rare ecosystem not yet protected under the Protected Area law) and downstream is the Curieuse Marine Park. The entire site has biodiversity and eco-tourism interests. The site will encompass the Pasquière, Davidson and the Casimir rivers, the fragmented freshwater marshes and mangrove forests, and the lagoon in the marine park.

The problems being addressed

The problems being addressed are the loss of wetlands in addition to soil erosion on degraded hills leading to sedimentation of critical wetlands downstream and the encroachment of these wetlands by invasive alien plant species, which reduces the ability of these wetlands to provide important ecosystem services. Praslin Island suffered numerous forest fires. In the absence of rehabilitation, these burnt forests are subjected to severe degradation and red sediment-laden water is a common sight during rainfall events. Sediments are deposited into the wetlands or directly into the sea where they have other impacts such as reducing the water storage capacity, deposition of sediments into raised land, which facilitates IAS encroachment, silt deposition onto seagrasses and coral reefs that stresses these habitat-types. To date 40% of Praslin is degraded and 90% of lowland wetlands in the Seychelles have been lost, making lowland wetlands the most threatened and critical habitats.

The project addresses the degradation of critical coastal habitats at Pasquière adjacent to and within the Curieuse Marine National Park. A ridge to reef, landscape level approach is taken to address the impacts of soil erosion and associated stressors (IAS encroachment) onto important ecosystems. There is a need to rehabilitate the degraded foothills using anti-erosion measures to reduce erosion, bioengineering techniques and replanting to stabilise the slopes, removal of IAS plants and replacement with appropriate wetland/coastal species, profiling of channels to enhance hydrological flows and a general improvement of the wetland to enhance its biodiversity and

sustainable use e.g. eco-tourism. The rehabilitation and management of degraded but critical coastal habitats will be done by working together with communities, organisations and local government to encourage and ensure local community participation in rehabilitation efforts during and beyond the project.

The project will provide training to interested participants and will equip participants with the skills needed to contribute to the implementation of activities during and beyond the project lifespan. The project will valorise and demonstrate the use of landscape-level, EbA approaches to ecological coastal rehabilitation, to guide replication in other areas.

Identification of the need of the project

Since 2010 TRASS became concerned on the impact of soil erosion from degraded forests onto downstream ecosystems. A project funded by the Mangrove For the Future (MFF) was implemented by TRASS, which adopted a landscape-level approach to understand some of the issues related to impacts of soil erosion and sediment deposition in the wetlands and the Curieuse Marine Park in the Baie of Pasquière. The project was entitled “Ridge to Reef - Where does all the soil go? Raising awareness and engaging community to participate in measuring soil erosion at Anse Possession, Praslin – Seychelles. ” The study indicated the presence of more sediments (higher turbidity) and a higher Aluminium level (from eroded laterite soil) particularly after heavy rainfall. The study established the need for coastal monitoring as a tool for monitoring soil erosion downstream through different ecozones. During the implementation of the GEF funded Ecosystem-based Adaptation through South-South cooperation (EbA-South, 2014-2019) it was recognised that invasive alien plant species were posing a serious threat to the functioning and biodiversity of the Pasquière wetlands. The EbA-South project established IAS management as an effective tool to control IAS encroaching the wetland. Trials done during TRASS rehabilitation programmes, on species performance on burnt degraded land, revealed a selection of species that are adapted to and grows well in harsh conditions and hence are excellent candidates for rehabilitation of degraded lands. These plant species are being used in TRASS widescale rehabilitation activities, and will also be used during the proposed project. Hence, the need to reduce soil erosion, re-establish vegetation cover and stabilise foothills, manage IAS in wetlands were identified as important steps to enhance the functioning and health of ecosystems using a ridge-to reef, EbA approach. TRASS, being the only environmental NGO in the Seychelles focussing entirely on the rehabilitation of degraded ecosystems, is thus committed to the rehabilitation and conservation of the ecosystems at Pasquière, Praslin.

Relevance to national strategies, WIOSAP and relevant global commitments

WIO-SAP: the project is relevant to Component A: Sustainable management of critical habitats. Outcome A1: Appropriate tools and methodologies are used to manage critical coastal and marine habitats in order to enhance their resilience and long-term sustainability, and Outputs

‘A.1.2: Management plans developed and adopted for at least four key critical coastal and marine habitats, thus mitigating habitat loss and climate change impacts’; and most importantly

‘A.1.3: At least three key degraded critical coastal habitats restored and resilience increased’.

On the national level, the project is directly relevant to the Seychelles Wetland Policy and Action Plan 2018-2022. The mission is ‘The conservation and sustainable use of wetlands as a fundamental contribution to Seychelles’ Sustainable Development’. The policy states that grass roots, non-governmental and private sector agencies should be encouraged to participate in and lead actions in this plan. The project meets the objectives under the Seychelles Sustainable Development Strategy 2012-2020 (SSDS) which is a tool to adhere to the Convention on Biological Diversity (CBD), United Nations Framework for Climate Change (UNFCCC) and the

United Nation Convention to Combat Desertification (UNCCD). The SSDS emphasises the need for the country to become a knowledge-based society and to manage its natural resources in a sustainable manner. SSDS clearly states that endemic and rare species will continue to be threatened by natural and human related hazards such as environmental degradation from development, the spread of alien invasive species, land use change and effects of climate change. The strategy supports the rehabilitation of key degraded habitats through the use of the ecosystem approach. The Seychelles National Climate Change Strategy support the role and involvement of NGO's, CBO's and other organizations, including efforts to build capacity in those institutions to manage our environment. It is thus envisaged that this project will be instrumental in building the capacity of TRASS and other participating bodies.

This proposal is also in line with the Seychelles Plant Conservation agenda 2007- 2015 and the National Biodiversity Strategy and Action Plan (NBSAP). Additionally, this proposal makes reference to the Water Policy, which advocates for appropriate measures to rehabilitate, sustainably manage and protect catchment forests. It further states that forests should be rehabilitated by native species and managed sustainably to deliver multiple benefits for communities. Through close collaboration with the recently established EbA Watershed Praslin Committee, it is expected that more attention is given to the matter and that both groups support each other to highlight the importance of forest rehabilitation and water catchment issues.

In view of the fact that the sites included in this project is partially located in the Marine National Park, the project draws parallel to the specific objectives of the Protected Areas Policy which encourages the provision for the restoration of degraded habitats and ecosystems of historical important biodiversity areas The project is also in line with the Seychelles MFF Country Strategy and Action Plan in terms of 'Improving the Knowledge Base for Coastal Planning, Policy and Management; Providing Decision Support for "Reef to Ridge" Approaches to Land and Resource Management; Promoting Adaptive Coastal Management Programmes that include ongoing Ecological and Socio-economic Assessment and Monitoring.

Programmes/activities complementing the project

The project is complemented by the following "Enhancing Capacity, Knowledge and Technology Support to Build Climate Resilience of Vulnerable Developing Countries". The aim is to address the vulnerabilities of local communities to climate change by using ecosystem-based approaches to adapt to climate change through on-the-ground interventions. Another project, the Ecosystem-based adaptation to climate change in Seychelles (EBA project) funded by the Adaptation fund will also complement the project through the sharing and exchanges of rehabilitation techniques. One component of the project is being implemented on Praslin and consists in rehabilitating degraded watersheds to restore ecosystem services such as healthy water catchment properties.

II. PARTNERSHIPS

Partner	Mandate	Role	Resources provided
Gaea Conservation Network Seychelles (Gaea Seychelles)	Promotes civic engagement and collective actions for environmental conservation	Assist TRASS with the implementation of all project activities	Guidance & support in baseline inventories, plans, training and reporting.
Chinese Academy of sciences (CAS)	Academic institution, research and Development centre	Provide scientific guidance for long-term monitoring	Technical Advisor guidance

University of Seychelles (UniSey) & University Centre for Environmental Education (UCEE)	Institution of higher education in Seychelles	Support student participation in long-term monitoring and research	Students and lecturer participation. Support with materials and equipment.
Ecosystem Based Adaptation (EBA) Watershed Praslin Committee (PWC)	Manage the watersheds of Praslin through community engagement	Contribute to the workforce	Volunteer labour force
BS Excavation (BSE)	Construction company with over 30 years of experience	Wetland rehabilitation aspect of the project	Expert advice, guidance and support related to wetland re-profiling.

The Ministry of Environment, Energy and Climate Change will provide facilitation support.

III. OBJECTIVES

A. Overall objective

The overall objective is: Rehabilitation of fragmented wetlands and associated foothills as a tool to reduce the impacts from land-based stresses onto critical habitats downstream. The project aims to rehabilitate fragmented wetlands to improve their functions e.g. enhanced absorption and filtration of sediments coming from the badly eroded degraded hills thus protecting the seagrass beds and coral reef in the Curieuse marine park. The management of land-based stresses (reduction of soil erosion through replanting and stabilisation of degraded banks and hill slopes, improving the capacity of wetlands to settle and filter sediments etc) will enhance the health of the wetlands, lagoon and coral reefs of the MPA. The rehabilitation also aims to increase the resilience of these habitats to impact of climate change and IAS encroachment.

Immediate objectives

1. Prepare Rehabilitation and Management plans for the marsh, mangrove, degraded shrubland and barren hill above the wetlands, based on scientific data.
2. Rehabilitate and manage the wetlands and foothills at Pasquière (based on the above plans) to enhance ecosystem and enable development of sustainable activities e.g. ecotourism, education and research
3. Enhance understanding on the importance of ecological rehabilitation
4. Train and enhance restoration skills and knowledge amongst local communities and participating organisations

The outcomes will be to rehabilitate degraded wetlands and associated foothill to improve species biodiversity and habitat quality; train and enhance rehabilitation skills and knowledge amongst local communities and participating organisations; improve public awareness on the importance of wetlands, their rehabilitation and management; influence procedures and policies regarding habitat rehabilitation using landscape-level and ecosystem-based approaches.

IV: PROJECT IMPLEMENTATION AND MANAGEMENT PLAN

A. Expected project results and indicators

- Production of four Rehabilitation and Management plans for the marsh, mangrove, degraded shrubland and barren hill above the wetlands
- Production of a coastal rehabilitation protocol for the Seychelles context
- One long-term rehabilitation monitoring site established
- 2 ha of degraded fragmented wetland rehabilitated
- 2 ha of degraded foothills (immediately above wetlands) rehabilitated

- At least 0.5 ha of wetland area cleared of IAS
- Production of min. 2000 seedlings for replanting of degraded areas
- At least 0.5 ha of IAS-free area replanted
- At least 200 m of riparian and wetland banks plus channel rehabilitated and stabilised
- At least 10 participants trained in habitat rehabilitation techniques (forest, wetland, coastal) and monitoring
- At least 2 hands-on learning activities with communities
- Production of 1 set of educational and promotional materials (co-financing)
- Production of 1 set of training materials (co-financing)
- 1 TV documentary on the implementation of the project and lessons learnt (co-financing)
- Minimum 2 popular articles on project results published in the local media
- 1 peer-reviewed publication on ecological coastal rehabilitation prepared for publication

B. Project activities and workplan

See annexes for the workplan (Annex 1) and logical framework (Annex 2).

Component A. Output A.1.2: Management plans developed and adopted for four key critical coastal and marine habitats, thus mitigating habitat loss and climate change impacts

Outcome 1: Production of Rehabilitation and Management plans for the marsh, mangrove, degraded shrubland and barren hill above the wetlands, based on scientific data.

Output 1.1. Data on the baseline environmental conditions is collected to inform the development of the rehabilitation and management plans for 4 habitats – marsh, mangrove, degraded shrubland and barren hill above the wetlands.

Activities

A.1.1.1. Purchase inventory equipment (dip nets, pH/conductivity meter, waders, camera....)

A.1.1.2. Establish the baseline biological conditions through standardised biodiversity inventory of the wetlands (wetland biodiversity inventory) and foothills (hill biodiversity inventory) noting species, abundance, diversity & richness, indicator species, rare and common species, invasive alien species, threats....

A.1.1.3. Establish the geomorphological conditions of wetlands: mapping and characterisation of the wetlands (wetland-types, extent, area, topography)

A.1.1.4. Establish the hydrological conditions of wetlands: river flow, discharge, tidal & non-tidal flow/patterns)

A.1.1.5. Establish the physico-chemical conditions of the wetlands and foothills: water and soil quality tests, basis soil properties (pH, conductivity, salinity, turbidity, colour, nitrate, phosphate)

A.1.1.6. Establish the degradation conditions: identify the stressors, human impacts, modifications that occurred e.g. road construction, restrictions to tidal exchange, invasion by IAS, soil erosion.

A.1.1.7. Undertake a socio-economic mapping of Pasquière

A.1.1.8. Produce a report on the baseline conditions of the four habitats.

Output 1.2. Rehabilitation and management plans prepared for the marsh, mangrove, degraded shrubland and barren hill above the wetlands.

Activities

A 1.2.1. Analyse data/report from Output 1.1 and formulate rehabilitation actions for each of the four habitats

A 1.2.2. Prepare draft rehabilitation and management plans for each of the four habitats

A 1.2.3. Discuss the draft rehabilitation and management plans with stakeholders

A1.2.4. Produce final rehabilitation and management plans for implementation in phase 2 (i.e. Output A.1.3).

Component A. Output A.1.3: Key degraded critical coastal habitats restored and resilience increased.

Outcome 2: Rehabilitation and improved management of wetlands and foothills to enhance ecosystem and enable future development of sustainable activities e.g. ecotourism, education and research

Output 2.1. Min. 2000 seedlings propagated

Activities

A.2.1.1. Purchase materials for seedling production (polybags etc)

A.2.1.2. Collect humus and topsoil for preparation of planting medium

A.2.1.3. Prepare planting medium (sieving etc) and fill polybags

A.2.1.4. Collect plant materials (seeds, fruits, seedlings, cuttings)

A.2.1.5. Pot plant materials

A.2.1.6. Maintain seedlings in nursery (watering, weeding, replace dead seedlings etc)

Output 2.2. Two hectares of wetland rehabilitated

Activities

A.2.2.1. Purchase tools, equipment and materials for rehabilitation

A.2.2.2. Remove IAS and undesirable indigenous plant species from the wetland

A.2.2.3. Transport seedlings and replant IAS-cleared areas with appropriate species

A.2.2.4. Periodic maintenance of IAS-cleared areas

A.2.2.5. Improve hydrological flow through widening and deepening channels to remove excess sediment deposition

A.2.2.6. Periodic maintenance of channels

A.2.2.7. Stabilise wetland banks by installing anti-erosion mats, coconut rolls etc

A.2.2.8. Replant the wetland banks with native species

Output 2.3. Two hectares of degraded foothill above the wetland rehabilitated

Activities

A.2.3.1. Purchase bio-engineering materials for rehabilitation

A.2.3.2. Stabilise bare hill slopes using bioengineering products

A.2.3.3. Transport seedlings and replant bare hill slopes with native plants

A.2.3.4. Prepare degraded shrubland for replanting (strip clearing)

A.2.3.5. Transport seedlings and replant degraded shrubland with natives

A.2.3.6. Maintain rehabilitated areas

Outcome 3: Enhanced understanding on the importance of ecological coastal rehabilitation

Output 3.1. One long-term monitoring site, for measuring the success of the rehabilitation, established and monitored

Activities

A.3.3.1. Set up long-term monitoring site

A.3.3.2. Purchase monitoring equipment & materials

A.3.3.3. Undertake soil loss (erosion) monitoring

A.3.3.4. Undertake plant monitoring

A.3.3.5. Prepare a scientific publication and a popular article on the results

Outcome 4: Train and enhance restoration skills and knowledge amongst local communities and participating organisation

Output 4.1. At least 10 participants trained in habitat rehabilitation techniques and monitoring
Activities

A.4.4.1. Undertake three field-training sessions/workshops on rehabilitation techniques and monitoring. (Training materials will be co-funded)

A.4.1.2. Implement minimum 2 hands-on learning activities with communities.

B. Project Beneficiaries

During the course of the project planning, TRASS received active inputs from various individuals and organisations notably Ministry of Environment, National Park, Sustainability for Seychelles, Wildlife Club of Seychelles, University Centre for Environmental Education, MFF Programme Manager, Gaea Seychelles, Private contractors from the community (BS Excavation) and community members. The project in itself is as a result of local communities noticing changes to the Pasquière coastal habitats and hence these communities will also benefit from the project. The main beneficiaries will be the 10 participants trained in ecological rehabilitation, the Pasquière community, users of the marine park, UniSey students and other participating organisations and communities.

During the project planning, TRASS received interest from Gaea Seychelles, University Centre for Environmental Education (UCEE), Praslin Watershed committee, BS Excavation to be involved as partners into the project. Gaea Seychelles will co-manage the project with TRASS, assist with the baseline inventories, monitoring/evaluation and all training and awareness components. UniSey and UCEE will assist mainly with the educational and awareness aspects. The EbA Watershed Praslin Committee will provide volunteer labour for the physical works. BS Excavation will provide support for wetland works. Students from UniSey would be involved in the monitoring sessions and basic studies as part of their university degree, as well as staff from the Ministry of Environment, National Park and other interested bodies. TRASS is also trying to bring on board Raffles Hotel, which is adjacent to the project site. Policy and decision makers will also benefit from understanding the consequences of habitat degradation and the need for rehabilitation, conservation and management of critical habitats.

It is important to stress that this project focuses on ‘gender equity’ as the issues treated equally concern both men and women, and young or old alike. To note that in the Seychelles woman are normally more active in project design and implementation. Efforts will be made to engage more males into the project.

C. Implementing agency management of projects

TRASS has 10 years of experience in ecosystem rehabilitation and is the leading NGO in engaging communities in environmental work. TRASS will be responsible for the planning and implementation of the project. TRASS will also be responsible for plant production (it has the largest plant nursery on Praslin), planting and supervision of work. Gaea Seychelles will assist with the implementation of all project activities, provide, expert guidance and contribution to the design and implementation of the project; baseline inventories, mapping, monitoring, rehabilitation techniques, training and awareness, and reporting. I will also assist with financial management. The EbA Watershed Praslin Committee will contribute to the workforce providing volunteer labour force including participation of the Fire Rescue Team (Fire) in physical work. UCEE and the Wildlife Club of Seychelles will assist with training, education and awareness aspects of the project as well as the provision of support with educational materials and equipment. UniSey will facilitate student participation. The CAS will provide scientific and technical

guidance. The BS Excavation with its experience in wetland reprofiling work will provide expert advice, guidance and support related to wetland reprofiling. The Ministry of Environment, Energy and Climate Change will provide facilitation support.

V. METHODOLOGY

1. Establish the baseline environmental conditions

Inventory method: Biodiversity inventory data will be collected using the ‘Rapid Inventory method’. The method consists in exploring within a given habitat type (e.g. a marsh) and recording the species observed. Each inventory will be done in a specific habitat and a geo-referenced point taken using a GPS. Species abundance is estimated by collecting semi-quantitative data through the 5-levels system ‘ROFCA’ (i.e. R=Rare, O=Occasional, F=Frequent, C=Common, A=Abundant). All vascular plants and animals encountered will be recorded. Other parameters will also be recorded: hydrological, physico-chemical, geomorphological, threats and disturbance. **Aquatic/wetland inventory:** Benthic and aquatic animals will be sampled using dipping nets and visual observations. Dipping net samples will be taken in several areas of the rivers and marshes. The species captured will be identified and released safely back into their environment. In the event that an electro-fishing equipment is used for sampling, then a quantitative assessment of the aquatic population will be done.

Water and soil quality: Water and soil samples will be collected for each specific habitat to be analysed either by the Seychelles Bureau of Standard (SBS) or the Seychelles Agricultural Agency (SAA). A sterilised water bottle will be used to collect each water sample. Soil samples will be collected using a soil auger. 5 sub-samples will be taken at 30 cm depth and mixed in a bucket, from which a 500 g sample will be transferred into a plastic bag for analysis in the lab.

Vegetation and Wetland mapping: Explorations will be done to identify and map the different vegetation-types and wetland-types within the project area. A GPS will be used to record waypoints for each vegetation/wetland-type. Vegetation and wetland-type classes will be distinguished based on the universally accepted classification system of The Nature Conservancy – UNESCO and the ‘Cowardin classification system’ respectively.

2. Rehabilitate and manage the wetlands and foothills at Pasquière

2.1. Rehabilitation sites

Six zones are proposed (see map below). The rehabilitation will be guided by a coastal rehabilitation and management protocol which will be produced based on the local ‘Protocol for Implementation of Ecosystem-based Adaptation Interventions in Coastal Wetlands of the Seychelles’ (Henriette, 2019) and other international EbA and rehabilitation guidelines.

Zone 1: IAS infested area

Zone 1 (0.5 ha) is an area where invasive species and undesirable native species have infested and is encroaching onto the wetland. These species will be removed from the site.

Zone 2: Channel profiling

The channel that connects the fragmented wetlands is filled with vegetation and silt, which impedes hydrological flow. The channel will be reprofiled using a small excavator. The banks will be stabilised using bio-engineering materials and replanted seedlings.

Zone 3: Encroached waterbody

Zone 3 (1-2 ha) is an area where dense ferns and sedges and IAS plants have filled the waterbody. This impedes water flow but also diminished the surface area available for wildlife e.g. the

endemic Golden panchax and waterbirds. The dense vegetation will be removed by using a small excavator and through physical removal using machetes.

Zone 4: Wetland bank

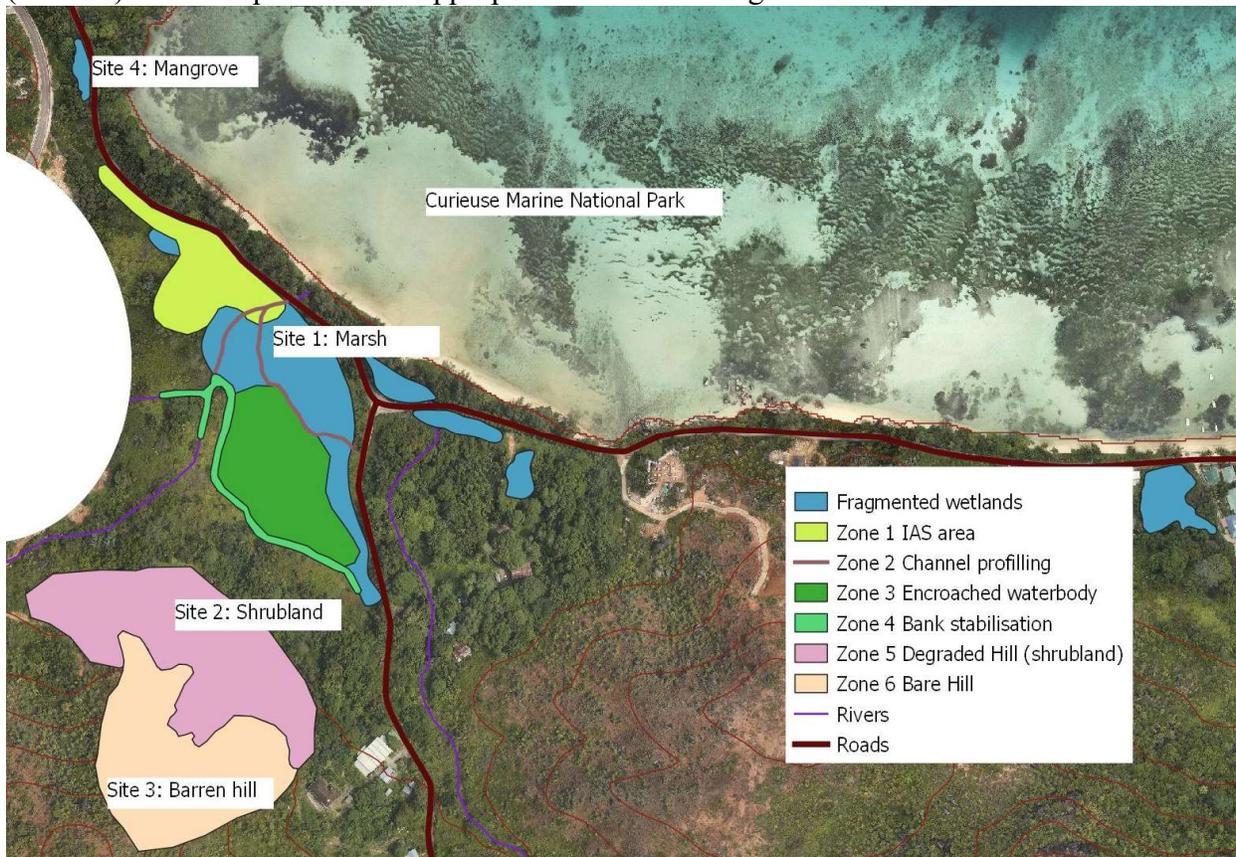
Zone 4 refers to ca. 200 m riparian and wetland banks where IAS will be removed, before the bank is stabilised using bioengineering techniques coupled with replanting of native plants.

Zone 5: Degraded shrubland

Zone 5 is the foot of the hill where the shrubland is degraded. Approximately 1 ha will be rehabilitated using the ‘strip clearing’ method and replanted with appropriate native species. This is a proven method that is currently being implemented on projects sites on Praslin

Zone 6: Degraded bare hillslopes

Zone 6 is uphill of Zone 5. It consists of an open area with bare laterite soil and very sparse vegetation. The exposed soil is eroded and carried by runoff downslope into the wetlands. The site (ca. 1 ha) will be replanted with appropriate native seedlings.



2.2. General rehabilitation guidelines

The following rehabilitation measures will be applied to the 6 rehabilitation sites proposed.

2.2.1. Management of Invasive Plant Species invading and encroaching onto the wetlands

The management of Invasive Plant Species invading and encroaching onto the wetlands will be done using proven methods following Rocamora and Henriette, (2015) and experiences from several rehabilitation projects in the Seychelles such as the EbA project (Adaptation Fund) and the EbA-South project (UNEP). The management of invasive species will be done as follows:

Ring barking - for trees more than 8 cm in diameter: Using a machete strip away a portion of the bark and the cambium (30 cm wide) all around the trunk at a height of 1 m above the ground.

Tree felling: Use a chainsaw to cut down trees as close to the ground as feasible.

Diminishing the seed bank and Hand-pulling: Continued removal of invasive species can diminish the seed bank enough to encourage native regeneration. These techniques will be used mainly in the post-IAS removal and post-planting maintenance. Follow-up maintenance by regular removal of surviving invasive plants and any new seedlings is essential for success.

Integrated management and ecosystem approach: Another way to efficiently and cost effectively manage broadleaf invasive species, is to create small gaps through the felling of a few of the invasive species trees (as above) and then planting the gaps with native plants. The newly planted areas may act as sources of native seeds, which may increase the proportion of native biodiversity in the invasive-dominated habitat.

2.2.2. Replanting degraded slopes above wetlands

Local experiences from TRASS rehabilitation programmes and other international experiences e.g. from China will be used for the replanting of degraded slopes. The following steps are proposed for the replanting of native seedlings.

- Each planted seedling to be geo-referenced
- Seedlings planted at least at 3 m intervals, but shrubs and herbs can be planted at 1 m interval.
- The total number of planted plants of each species to be counted
- Soil loosening technique - Dug hole to 30-50 cm deep and wide, and loosen the soil.
- Use of 250g of charcoal per plant to provide long-term nutrients (optional)
- Use of 1 kg of humus or compost per plant (optional) to provide short-medium term nutrients
- Charcoal and humus mixed with the soil prior to planting
- Dried leaves used as mulch around the seedlings (whenever dried leaves available)

2.2.3. Stabilising wetland banks and adjacent hill slopes to reduce erosion

Techniques for erosion control and slope stabilisation are inspired from Aquaterra and the Adaptation Fund EbA project. Erosion control mats or blankets made of natural products such, as coconut coir will be used on steep slopes as anti-erosion measures. It is a biodegradable geotextile product. Once installed, coconut mats increase soil stabilisation, decrease the effects of erosion, trap soil, leaf litter and nutrients, and allow vegetation to effectively take root.

Coconut fibre log is another product used for bank stabilisation and support. The logs are installed in rows to provide support against flowing surface water and hence hamper hillside erosion. The coconut products also provide the ideal microclimate for rapid growth and establishment of new vegetation. Seedlings will then be planted into the coconut mats and logs for further stabilisation purposes but also as part of the rehabilitation of the biodiversity and for creation of new micro-habitats.



Coconut coir mats in bank stabilisation, slope protection & silt check to trap sediment in channels

2.3. Plant propagation for hills and wetlands

2.3.1. Species selection

All species used in the rehabilitation programme will be endemic and indigenous species including the ones trialed and proven to be suitable for rehabilitation of degraded lands.

2.3.2. Nursery stocks and management

A minimum of 1,000 seedlings per hectare is recommended for the sites. Hence, a minimum of 2000 seedlings will be propagated for replanting.

2.4. Enhance understanding on the importance of ecological rehabilitation

Long-term monitoring site: The project site will be established as the long-term research and monitoring site. The following monitoring and research will be undertaken:

2.4.1. Quantification of soil loss (erosion) before, during and after rehabilitation.

The aim will be to quantify, compare and demonstrate soil loss with and without rehabilitation measures and hence there will be a reference bare plot on non-rehabilitated areas versus plots on rehabilitated areas. Baseline data on erosion rates on degraded vs rehabilitated sites are lacking at the moment and this long-term experiment aims at filling this existing knowledge gap, whilst at the same time demonstrating the essential principle of reducing erosion by better vegetative cover and advocating the need for rehabilitation using EbA approaches on degraded hills typical of Praslin Island.

2.4.2. Plant survivorship and growth on rehabilitated sites. Survival rate and growth for each plant species will be measured over time. The number of plants alive and their height up to longest leaf will be measured every 2-3months during the project and every 6 months thereafter. Data from all plantings will be compiled into the TRASS database.

VI. SUSTAINABILITY AND REPLICABILITY

TRASS has the mandate to restore degraded land and has since its creation in 2009 implemented over a dozen projects with active community participation through donor funding. TRASS will continue to seek further donor funding to sustain the project. The involvement of the communities since TRASS creation has ensured continuous implementation of activities even in the absence of donor funds. These activities were and are being sustained through frequent voluntary works (as often as once a week in some cases). TRASS reputation and success with engaging communities in its programmes has led to its success and this will surely continue to ensure the sustainability of the project in the long-term. Moreover, the availability of personels trained during this project, and with the adoption of the sites by the local community will ensure that the sites are sustained. This project will be supported by the upcoming Ridge to Reef project funded by GEF, which foresees the implementation of similar actions in the project area (expected to begin in 2020).

VII. PROJECT MONITORING AND EVALUATION

The project monitoring and evaluation will be done by TRASS and Gaea Seychelles (Annex 2). Progress reports as required under the project will be prepared and sent to the WIO-SAP project unit. The project workplan and logical framework will be used to monitor the advancement of the project activities and if need be make the necessary adjustments. The workplan will be further elaborated into an action tracker, which will track planned activities and deadlines.

VIII: BUDGET

Description	Quantity	Unit Cost (US\$)	Total Cost (US\$)	WIOSAP Support	Co-financing (In-kind)	Remarks
Project Coordinator	24	1,080	25,920	25,920		
Project Manager	24	300	0	0	7,200	In-kind SeyCCAT project staff to assist
Project Financial Manager	24	200	4,800	4,800		
Project Auditor	1	800	800	800		
Consultants (Technical Advisors)	14	300	4,200	4,200		
Inventory & monitoring equipment. Office equipment			7,000	7,000		
Rehabilitation tools & equipment			5,000	5,000		
Purchase & shipping of bioengineering materials						
Coconut logs/sausage (3 m per unit)	200	22	4,480	4,480		
Coconut blanket (5m per unit)	200	10	2,016	2,016		200 m riparian
Anti-erosive mats	200	5	1,098	1,098		200 m hill
Shipping cost + local transportation cost	1	5,109	5,109	5,109		
Internet & telephone	24	219	5,255	5,255	500	In-kind Gaea Consultant
Fuel	24	250	6,000	6,000		
Stationary			1,000	1,000		
Office					14,015	In-kind TRASS
Nursery facility					8,759	In-kind TRASS
Bank charges	24	30	720	720		
Consultants for Baseline surveys (2 field + 1 mapper)	30	650	19,500	19,500		
Contractors for rehabilitaion work: IAS clearing, channel profiling, planting etc	20	300	6,000	6,000		
Training/Workshops			3,000	3,000	7,000	In-kind SeyCCAT
Production & printing of restoration materials, training manuals, documentary			0	0	15,000	In-kind SeyCCAT
Production of promotional & educational materials			0	0	5,000	In-kind SeyCCAT
Nursery plant production	8	876	7,007	7,007		
Local travel (Mahe-Praslin)	52	50	2,600	2,600		
Local travel (within Praslin)	72	52	3,744	3,744		
Accommodation on Praslin	20	219	4,380	4,380		
TOTAL			119,629	119,629	57,474	

BUDGET JUSTIFICATION

	Category	Justification
1	Personnel	1 Project Coordinator for the duration of the project to coordinate all activities and staff. 1 Project Manager to manage all project aspects under the supervision of the coordinator. 1 or 2 Technical Advisors on rehabilitation techniques, data management and analysis. 1 Financial Manager to manage the finances under the project.
2	Equipment	Inventory & monitoring Equipment (camera, gps, dip nets, trays, binoculars, pH/conductivity meter (water quality test), waders/boots, microscope, specimen tubes etc). Office equipment (laptop, printer)
		Rehabilitation tools, equipment & protective clothing (machetes, pruning spear, chainsaw, hoes etc)
		Purchase & shipping of bioengineering materials (e.g. Coconut logs, anti-erosion mats) needed for stabilisation of banks (min. 200 m) & slopes & where IAS plants have been removed to control reinvasion. Shipping cost + local transportation cost of the materials
3	Operating costs	Internet & telephone at TRASS office and of staff. Stationary for use in the project
		Fuel for use in the TRASS truck to transport staff and volunteers to activities, for logistics, purchasing etc
4	Contract Services	Consultants for Baseline surveys. 2 field consultants to collect data and 1 mapper. This includes data collection, analysis and production of a report.
		Contractors for rehabilitation work: IAS clearing, channel profiling, plant transportation by foot, planting, plant maintenance, weeding
		One Workshop at the start of the project to engage community members. Minimum 3 on-the-field training sessions
		Production & printing of restoration materials, training manuals and project documentary. Postings on website and Facebook.
		Production of promotional & educational materials for use during field awareness activities, schools, national events and exhibitions.
		Production of min. 2000 plants in the nursery (humus and soil, collection, sieving and mixing, collection of seeds, cuttings, seedlings, filling of min. 2000 pots and potting, watering and maintenance
5	Travel	Boat or airfares for Project staff from Mahe to supervise or participate in project activities. Local travel (within Praslin). Accommodation on Praslin for project staff coming from Mahe or for Praslin staff going to Mahe for training, meetings etc

ANNEX 1: WORKPLAN

Task	Lead	Year 1												Year 2											
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12
		O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S
Overall objective: Rehabilitation of fragmented wetlands and associated foothills as a tool to reduce the impacts from land-based stresses onto critical habitats downstream																									
Component A. Output A.1.2: Management plans developed and adopted for key critical coastal and marine habitats, thus mitigating habitat loss and climate change impacts																									
Outcome 1: Production of Rehabilitation and Management plans for the marsh, mangrove, degraded shrubland and barren hill above the wetlands, based on scientific data.																									
Output 1.1: Data on the baseline environmental conditions of the marsh, mangrove, degraded shrubland and barren hill above the wetlands, are collected to inform the development of the rehabilitation and management plans																									
A.1.1.1. Purchase of inventory equipment	TRASS	X	X																						
A.1.1.2. Biodiversity inventories	Gaea, UniSey		X	X																					
A.1.1.3. Geomorphological conditions	Gaea, UniSey		X	X																					
A.1.1.4. Hydrological characteristics	Gaea, UniSey		X	X																					
A.1.1.5. Physico-chemical conditions	Gaea, UniSey		X	X																					
A.1.1.6. Degradation conditions	Gaea, UniSey		X	X																					
A.1.1.7. Socio-economic mapping	TRASS		X	X																					
A.1.1.8. Produce a report	Gaea				X																				
Output.1.2: Rehabilitation and management plans for coastal areas prepared																									
A.1.2.1 Analyse data/report from Output 1.1 & formulate rehabilitation actions	Gaea TRASS				X																				
A.1.2.2. Prepare rehabilitation and management plans	Gaea TRASS					X																			
A.1.2.3. Discuss rehabilitation & management plans with stakeholders	Gaea TRASS					X																			

ANNEX 2: LOGICAL FRAMEWORK

Project title: Community-based ecological coastal rehabilitation using an Ecosystem approach				
Project overall objective: Rehabilitation of fragmented wetlands and associated foothills as a tool to reduce the impacts from land-based stresses onto critical habitats downstream				
Project Results		Outputs	Activities	Costs US\$
Component A. Output A.1.2: Management plans developed and adopted for key critical coastal and marine habitats, thus mitigating habitat loss and climate change impacts	Outcome 1: Production of Rehabilitation and Management plans for the marsh, mangrove, degraded shrubland and barren hill above the wetlands, based on scientific data.	O.1.1 Data on the baseline environmental conditions of the marsh, mangrove, degraded shrubland and barren hill above the wetlands, are collected to inform the development of the rehabilitation and management plans	A.1.1.1 Purchase of inventory equipment A.1.1.2 Inventory of the Biodiversity A.1.1.3 Survey Geomorphological conditions A.1.1.4 Survey Hydrological conditions A.1.1.5 Survey Physico-chemical conditions A.1.1.6 Survey the Degradation conditions A.1.1.7 Undertake a Socio-economic mapping A.1.1.8 Produce a report	30,000
		O.1.2 Rehabilitation and management plans for coastal areas prepared	A.1.2.1 Analyse data/report from Output 1.1 and formulate rehabilitation actions A.1.2.2 Prepare rehabilitation & management plans A.1.2.3. Discuss the draft rehabilitation and management plans with stakeholders A.1.2.4 Produce final rehabilitation and management plans for implementation in phase 2	20,000
Output A.1.2. TOTAL				50,000
Component A. Output A.1.3: Key degraded critical coastal habitats restored and resilience increased	Outcome 2: Rehabilitation and improved management of wetlands and foothills to enhance ecosystem and enable future development of	O.2.1 Min. 2000 seedlings propagated	A.2.1.1 Purchase materials for seedling production A.2.1.2 Collect humus and topsoil A.2.1.3 Prepare planting medium & fill polybags A.2.1.4 Collect plant materials A.2.1.5 Pot plant materials A.2.1.6 Maintain seedlings in nursery	7,007

	sustainable activities e.g. ecotourism, education and research	O.2.2. Two hectares of wetlands rehabilitated	A.2.2.1 Purchase tools, equipment and materials A.2.2.2 Remove IAS plants from the wetland A.2.2.3 Transport & replant IAS-cleared areas A.2.2.4 Maintain IAS-cleared areas A.2.2.5 Re-profile channels A.2.2.6 Periodically maintain channels A.2.2.7 Stabilise banks using bioengineering products A.2.2.8 Replant banks with native seedlings	26,254
		O.2.3. Two hectares of degraded foothill above the wetland rehabilitated	A.2.3.1 Purchase materials for rehabilitation A.2.3.2 Stabilise bare hill slopes using bioengineering products A.2.3.3 Transport & replant bare hill slopes A.2.3.4 Prepare degraded shrubland for replanting A.2.3.5 Transport & replant degraded shrubland A.2.3.6 Maintain rehabilitated areas	22,082
	Outcome 3: Enhanced understanding on the importance of ecological rehabilitation	O.3.1. One long-term monitoring site established and monitored	A 3.1.1. Set up long-term monitoring site A 3.1.2. Purchase monitoring equipment & materials A 3.1.3 Undertake soil loss (erosion) monitoring A 3.1.4 Undertake plant monitoring A 3.1.5 Prepare a scientific publication and a popular article on the results	8,313
	Outcome 4: Train and enhance restoration skills and knowledge amongst local communities and participating organisations	O.4.1 At least 10 participants trained in habitat rehabilitation techniques and monitoring	A 4.1.1 Undertake 3 field training sessions/workshops on rehabilitation techniques and monitoring A.4.1.2 Min. 2 hands-on learning activities A.4.1.3 Min. 2 popular articles in the local media	5,972
Output A.1.3. TOTAL				69,629
GRAND TOTAL				119,629

ANNEX 3: PROJECT MONITORING PLAN

Project Title: Community-based ecological coastal rehabilitation using an Ecosystem-based approach			
Project overall objective: Rehabilitation of fragmented wetlands and associated foothills as a tool to reduce the impacts from land-based stresses onto critical habitats downstream.			
Project Results	Indicator	Target/baseline	Method of verification
Outcome 1. Rehabilitation and Management plans for 4 habitats produced	No. of baseline surveys	Target: 4 surveys Baseline: 0	Database. GPS points. Report on baseline condition. Photo gallery.
	No. Rehabilitation and Management plans	Target: 4 plans Baseline: 0	Rehabilitation and Management plans
Outcome 2. Rehabilitation and improved management of wetlands and foothills	No. seedlings propagated	Target: Min. 2000 seedlings Baseline: 0	Database. Photo gallery.
	No. hectares of wetland rehabilitated	Target: 2 ha wetland Baselines: 0	Database. GPS points. Maps. Reports. Photo gallery.
	No. length channel desilted	Target: 200 bank channel desilted Baselines: 0	Database. GPS points. Maps. Reports. Photo gallery.
	No. Length wetland bank stabilised	Target: 200 bank stabilised Baselines: 0	Database. GPS points. Maps. Reports. Photo gallery.
	No. hectares of hills rehabilitated	Target: 2 ha foothills Baselines: 0	Database. GPS points. Maps. Reports. Photo gallery.
	No. plants replanted	Target: Min. 2000 seedlings pl Baselines: 0	Database. GPS points. Maps. Reports. Photo gallery.
Outcome 3: Enhanced understanding on the importance of ecological rehabilitation	No. of monitoring sites No. monitoring sessions	Target: 1 monitoring site + 8 monitoring sessions Baseline: 0	Database. GPS points. Photo gallery. Reports. Articles.
Outcome 4: Train and enhance restoration skills and knowledge amongst local communities and participating organisations	No. Training/workshop No. personel trained	Target: 3 trainings 10 persons trained Baselines: 0	Participants list. Certificate of participation. Report. Photo gallery.