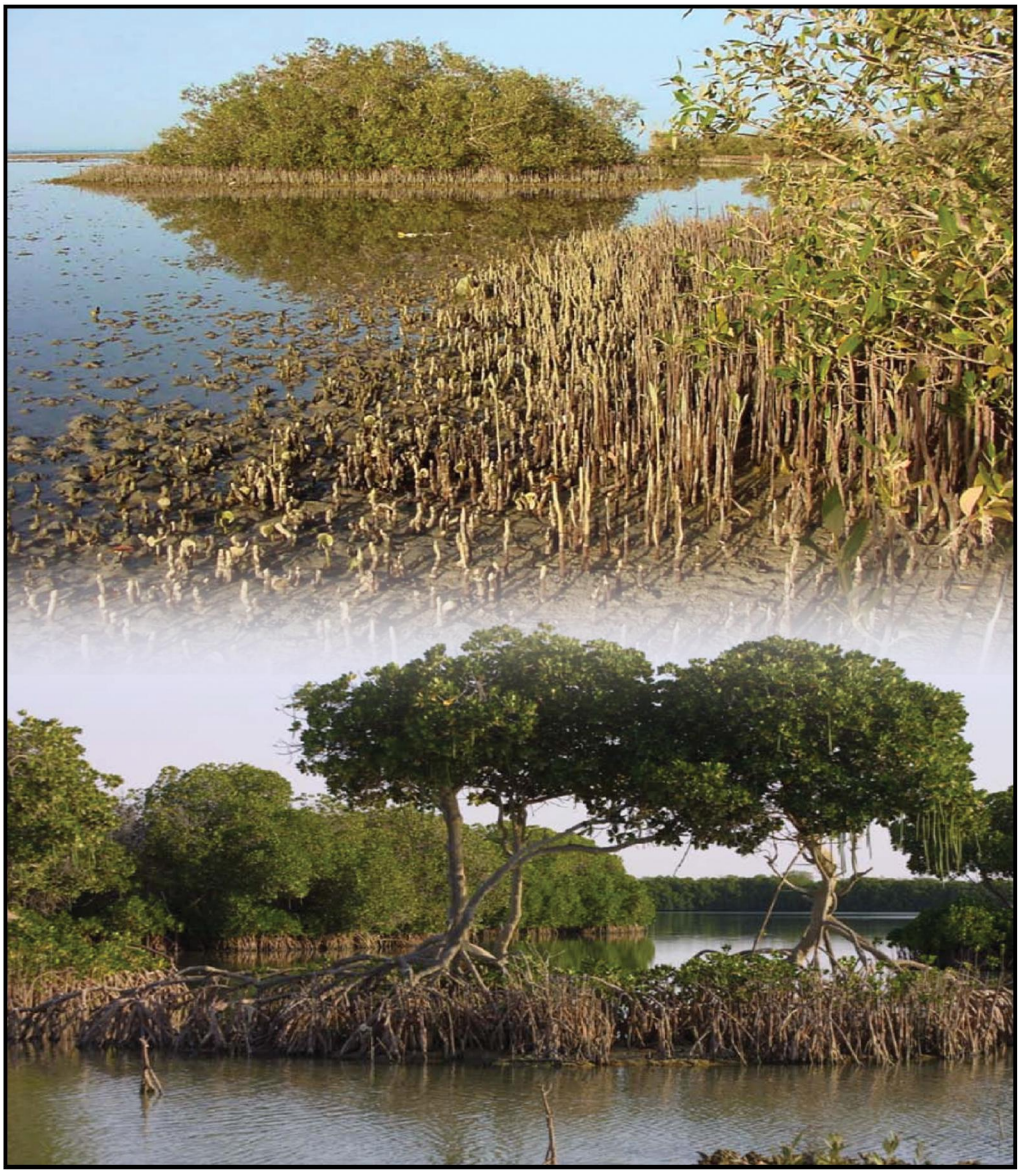
Assessment and Management of Mangrove Forest in Egypt for Sustainable Utilization and Development



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ITTO

وزارة الدولة لشئون البيئة
جهاز شئون البيئة
Ministry of State for Environmental Affairs
Egyptian Environmental Affairs Agency

محميات مصر
PARKS EGYPT

Project Identification

a) Title: Assessment and Management of Mangrove Forest in Egypt for Sustainable Utilization and Development.

b) Serial Number: PD 63/01 Rev. 2 (F).

c) Executing Agency: Ministry of Agriculture and Land Reclamation (MALR), Under Secretariat for Afforestation and Environment (UAE), Ministry of State of Environmental Affairs (MSEA) and Egyptian Environmental Affairs Agency (EEAA)

d) Host Government: Egypt.

e) Starting Date: 6, June 2003.

f) Planned Duration: 24 months Actual Duration: 36 months

g) Actual Project costs: US $ 439,745 ITTO contribution US$ 301,570

PART I: Executive Summary

1-Background Information About the Project

This project, Assessment and Management of Mangrove forests in Egypt for Sustainable Utilization and Development, arised from the recognition of the urgent need to secure the fast disappearing mangrove areas on the Red Sea coast of Egypt. Whilst these areas are of limited extent, they have importance internationally as part of the global mangrove resource and also locally as a source of livelihood for the surrounding population. Loss of the resource would cause environmental damage along the coast and loss of livelihoods for the currently dependent population. In addition, there would be a wider loss to the international community from a unique, isolated population of mangroves.

Although the Government of Egypt was aware of the importance of this resource, and the serious losses that will be incurred if actions were not taken, it recognized that it did not have the required expertise and resources available nationally to begin the process reversing degradation and moving towards sustainable management. It therefore, seeked assistance from the international community to halt damage and begin restoration actions.

Little has been done with the Egyptian mangrove population. In part, this is because of limited national resources but also because of lack of information on both the constituents of the ecosystem and how to manage them sustainably. Overlying these issues is the dependency of the adjacent community on the resource for their livelihood. It is neither possible, nor acceptable, to simply prohibit use. The adjacent population is in reality part of the ecosystem and their needs must be incorporated fully into any recovery and sustainable management plans.

The main objectives of the projects were to frame, promote and implement policies and actions that ensure the conservation and sustainable utilization of the natural forest ecosystems of Egypt and to complement these with planted trees that enhance environmental and service values.

The development objective is "contribute to improved sustainable development of the mangrove forest areas of Egypt and the surrounding populations".

The specific objective is "secure the Egyptian Red Sea mangrove population and ensure its conservation and sustainable management.

There are four outputs that were designed to encompass four limited sets of tasks: collection of information; research, plan development and collaborative management. The outputs are:

Output 1: collect, analyze and document baseline biological, silvicultural, environmental and socioeconomic information;

Output 2: design and implementation of a silvicultural research programme;

Output 3: preparation of a comprehensive suite of initial Management plans for the whole mangrove area and undertake pilot rehabilitation;

Output 4: development of a small-scale harvest and utilization of mangrove resources through collaboration approaches.

This project started from what is effectively a zero base. Therefore, it was very much a process project and the later activities were informed and dependent on the initial ones. The strategy followed a series of steps. First the resource and its socio-economic environment were assessed. The baseline information obtained were used to define the project starting point from which progress were assessed. Then, a strategic management plan was developed, based on information assessed, activities undertaken and monitored, and stakeholder needs. Later, a series of operational plans were produced collaboratively with local people. During this process, opportunities for income generation were assessed and the necessary skills base created.

The project team hired consultants of different disciplines (e.g. biologists, environmentalists, socio-economists, etc) from various universities and research institutions in Egypt to review the current information on mangroves based on the available published literature as well as from various sources within the country. Consultants were requested also to pay field visits to mangrove sites along the Red Sea coast and Gulf of Aqaba to collect samples of soil, water, mangroves, fauna to be analyzed at the laboratories and results be presented in technical reports to help in mangrove assessment and management. They were also requested to participate in various workshops involving key stakeholders, and provide, when necessary, training to staff available at selected sites of mangroves, mostly Nabq, Hurghada, Safaga, Quseir, Wadi El-Gemal and Shalateen.

Meanwhile, field staff from National Parks of Egypt and Ministry of Agriculture and Land Reclamation were assigned to implement the project on the ground in close collaboration with the Governorates of the Red Sea and South Sinai as well as local communities living in the adjacent of mangroves.

The project's planned duration was 24 months, and the planned overall costs were US $ 437, 865. ITT contribution was US $ 299,690 and the rest was the Government of Egypt contribution. Although the project agreement was signed on 2/11/2002 and the starting date was September 2003, there was a delay in implementation due to change in cabinet and responsible coordinator. Therefore, the project was extended till end of December 2006.

2-Project Achievements

This project has undertaken a detailed study of the biological, silvicultural, environmental and socio-economic – value leading to the preparation and implementation of plans for sustainable management and conservation of the mangrove area. An important component of the project was the collaborative management of mangrove forest resource with adjacent communities as a primary plank of the strategy, with development of sustainable cottage industry based on the resource.

Characterization of the environmental conditions affecting the distribution of mangrove *Avicennia marina* (and to a minor extent *Rhizophora mucronata*) along the Egyptian Red Sea coast and islands have shown that the Egyptian Red sea belong to the category of "Warn Coastal Deserts". The annual mean temperature varies between 22.4°c at Suez in the north and 25.8°c at Ras Benas in the south. Rainfall decreases in the same direction till Qoseir (from 16.3 to 32mm/yr), but increases southwards to 17.3 mm/yr at Ras Benas. There are many oceanographic factors that control the mangroves including water temperature, tides, salinity, currents and dissolved oxygen.

Data available on mangroves include site geomorphology, biotic community characteristics of important stands, topography and zonation, physical characters, population characters including demography, phenology, intensity of respiratory roots, standing crop-phytomass, survival and mortality of seedlings, branches and twigs.

Biotic communities of mangroves included a diverse flora and fauna. A total of 36 algal species were recorded. Insect fauna included 40 species,

and crustaceans exceed 80 species dominated by brachyuran crabs followed by anomurans (hermit crab) and caridea.

Mangroves act as nursery habitats for juveniles of commercially important fish species. A total of 21 fish species were recorded, 12 from Gulf of Aqaba and 18 species from the Red Sea mangroves.

Soil collected from different sites during the life time of the project revealed the possibility of the rehabilitation of the deteriorated mangroves. The growth performance of *R. mucronata* was significantly higher in pure stands than in association with *A. marina. R. mucronata* growing in pure population grew twice taller, had more main and lateral branches and attained nearly 4 times the total number of leaves compared with its performance in mixed population with *A. marina*. However, *A. marina* trees growing in association with *R. mucronata* were taller than plants growing in pure communities *R. mucronata* stands have the lowest salinity, silt, pH and Na, but highest of sand and Ca Co3. *A. marina* had the highest values of silt, clay, pH, K and Na. *R. mucrorata* contained higher ash. content (28.2%) than *A. marina* (18.8%). The higher values were associated Cl, Mg, Ca, and Na.

The current level of impacts on mangroves at Nabq is moderate. The highest direct economic values is from recreational activities, followed by artisanal fishing. Levels of use are relatively low.

Before the project, there were almost no information on the socio-economic of the Red Sea mangroves. A socio-economic consultant was hired to: (1) provide information on the economic benefits and operating practices of key activities that may be employed in the identification of an economically management strategy for the mangrove resource; (2) train EEAA rangers to survey techniques, data collection and analysis, and ultimately on the economic appraisal on natural resource use. His full report was included in the progress report # 5. The following is a brief account on the main results.

The objective of the mangrove assessment was to review the social, cultural, economic and political conditions of individuals, groups communities and organization. The main topics embodied in the socioeconomic assessment were resource use patterns, stakeholder characteristics, gender issue, stakeholder perceptions; organization and resource governance; traditional knowledge; community services and facilities; market attributes for extractive use; market attributes for non-extractive use, non-market and non-use values.

Key livelihood values of mangroves in Egypt include: fishing, livestock raising (mainly camels and goats), tourism, use of timber (for cooking, light structure, animal feed, use of firewood for tourism), employment at the national parks (as community guards and to provide food to tourists at restaurants), erosion and flood protection, attractive landscape, and refuge for many wildlife species.

Fishermen earn monthly income of about L.E. 250. They fish using nets from boats up to 1.5 km from the shore at Nabq. The best fishing season is between April and May. Tour operators organize visits to Nabq and Al-Qalaan mangroves where visitors enjoy the landscape and obtain fish food.

Socioeconomic characteristics in mangrove areas based on a survey conducted in five villages are: population, beudouins (education level, employment status, marital status, origins of bedouins, their possession) bedouin perception to mangroves, conservation, degree of importance to mangroves, threats to mangroves and remedies to threats, mangrove use patterns, and gender issues.

The estimated population of the five villages (during 2005) was 437 representing 95 households. The average family size is 4.6. There are two schools, one primary and the other is preparatory, at each of Hamata and Abu-Ghosoon. There is one medical clinic at Abu-Ghosoon, and other one at Hamata. At Marsa Alam, about 60 km north of Hamata, there is a small hospital and postal office. Electricity is provided to Bedouins by hotels in Wadi El-Gemal. Approximately 50% of the population are under 20 years old. About 45% of the population is composed from women.

The majority of Bedouins (about 60%) have primary level of education. Fishing is the dominant job opportunity for the majority of Bedouins (70% at Al-Qulaan, 35% at Hamata, 67% at Nofaa). A small percentage (8%) of labour force are governmental employees.

Bedouin men undertake fishing activities out at sea whilst the women collect shellfish along reef flats. Bedouin men look after camels whereas the women herd goats. The main traditional activities undertaken by bedouins are livestock raising, minor seasonal agriculture, horticulture and fishing. However, bedouins are increasingly getting involved in tourism, through acting as tourist guide; dive masters and assistants, cooking traditional bedouin meals, camel riding and making souvenirs for tourists.

Approximately 40% of bedouins are married. Most of Bedouins came from the Red Sea and a smaller percentage (13%) from the upper Egypt. Most of them have radio, TV, Gas oven and refrigerators.
Majority of bedouins (87%) are aware of the importance of mangroves and the need for conservation. However, only one third of Bedouins realize the threats to mangroves. The main uses of mangroves are camel feeding (45%) fuel wood (29%), charcoal (13% and goat feeding (13%). Most women are involved in livestock browsing (38%) and in fuel wood (29%).

Silviculture activities included three types of implementation tactics: (A)direct re-transplantation of seedlings from the wild and from nurseries into selected areas (7); (B) initiating new system by implementing the same activity in selecting sites void of mangrove plants but have potentialities for action (3 sites); (C) rehabilitation of example of degraded mangroves stands applying additional needed measures. The EEAA rangers, technical staff of the Ministry of Agriculture and Land Reclamation and local communities have earned basic needs to apply mangrove transplantation and rehabilitation procedures. Scheduling monitoring of the established locations assures evaluating the changes in the concerned locations and reveals indicators for future plans.

By end of December a total of 125 500 m² (31.3 Acre) were added as mangrove expansion transplanted area. Further 7.5 Acres were triggered for self regeneration "Wadi Ariar". About 30 000 *Avicennia* seedlings were transplanted from the established nurseries and from the wild. Successful introduction of *Rhizophora* propagules were made at Hamata and Quseir.

Recent information obtained by remote sensing has shown that mangrove areas have reached 700 ha by end of 2006 compared to 525 ha in 2002. There were also considerable difference in areas compared with 2002. For instance Abu Monqar mangrove had an area of 276 ha compared to 333 ha in 1975. Surprisingly, Hamata mangroves that were 295 ha in 1975, became 1119 ha in 2006 (due to the discovery of new sites in recent years). On the other hand, the mangrove area of Ghargarna, using Quick Bird, is only 265 ha.

During the lifetime of the project many meetings and 4 major workshops were held at the Gulf of Aqaba (Nabq) and the Red Sea (mostly Hurgada, Safaga, Wadi El-Gemal and Shalatin). These meetings and workshops were attended by staff of the national parks, representatives of the Ministry of Agriculture and Land Reclamation, consultants of the ITTO

project, local communities, local authorities and investors. Topics discussed and approved included more involvement of local communities in the project, implementation of new economic activities (mostly related to fisheries, tourism and apiculture), sustainability of the project after its completion, research and studies conducted by consultants and rangers of the national parks, affrostation activities, threats facing mangroves and remedies to reduce threats, public awareness activities, government and local community commitment after completion of the ITTO project.

Resources of the ITTO project were used to help development of local communities. These included hiring many locals in the different activities of the project (mostly in the affrostation work), working at the national parks and Ministry of Agriculture as community guards, introducing apiculture and training locals in producing honey, involving locals in fisheries and touristic activities (by purchasing a boat and a vehicle to be used to improve their livelihood and reducing pressures on mangroves. Thus, local communities felt the ownership of the project.

The National Action Plan for the conservation of mangroves in Egypt include the following components: Integrated coastal zone Management, education and awareness, marine protected areas, ecologically sustainable mangrove utilization and affrostation, impacts of shipping and marine pollution, research, monitoring and economic valuation. (details in Annex 1).

The current situation prevailing after the project completion, as compared to the pre-project situation is as follows: (1) accurate information on the current mangrove area is 700 ha compared to 525 ha in 2002. (2) a detailed study is available on the biological, silvicultural, environmental and socio-economical value. (3) local communities have been involved in mangrove conservation and sustainable use of their resources. (4) there are currently a multi-disciplinary team on the ground that have been trained, equipped, and able to implement research, studies and laws. (5) strategic management plan is being implemented by the staff of the national parks in collaboration with other governmental agencies, local authorities and local communities. (6) activities were either improved or initiated and being implemented (e.g. affrostation, apiculture, fisheries and tourism). Thus, government and local communities committed to improve sustainable development of mangrove areas is continuing after the project completion.

3-Target Beneficiaries Involvement

Members of senior staff of the Ministry of Environment and Ministry of Agriculture and Land Reclamation, University Professors with well experience in the mangroves and environment, representatives of the Governorates of the Red Sea and South Sinai, local authorities, rangers of the National Parks (Nature Conservation Sector of the Egyptian Environmental Affairs Agency), and technical staff of the Ministry of Agriculture and Land Reclamation working at the Red Sea Governorate and representatives of local communities (bedouins, fish traders and tourism, and relevant organizations (e.g. other governmental agencies, and NGOs).

4-Lessons Learned:

Lessons learned from the project implementation are divided into two groups; developmental and operational lessons. (see details in the main text).

A-Developmental lessons

Aspects of the project design which most contributed to its success in achieving the development objectives are the following:

- Job creation is emphasized in dealing with local population to ensure their acceptance of change.
- Law enforcement is not sufficient – coordination between stakeholders is critical
- Support of the political leadership is important
- Early avoidance of conflicts
- Adaptive management and flexibility
- Mangroves are resources for education, training and scientific research
- Mangroves preserve indigenous knowledge and culture

Changes in intersectoral links which affected the project's success:

- A key stakeholder (Nature Conservation Sector) be identified to be the ultimate legal authority for the project implementation and conservation of mangrove resources.
- Partnerships are the key for sustainable management.

Additional arrangement that could improve cooperation between the relevant parties interested in the project:

- No additional arrangements / actions were needed.

Factors which most likely affect project sustainability after completion:

- Joint coordination between the different governmental agencies, stakeholders and local communities was critical.
- Mangrove areas are among the most effective conservation tool
- Economic benefit is a must

B-Operational lessons

Project organization and management:

- Selecting the appropriate staff is crucial.

Project documentation:

- Be in electronic form.

Monitoring and evaluation: quality of project planning:

- Priority areas for mangrove conservation and rehabilitation.

Definition of the role and responsibilities of the institutions involved in the project implementation:

- A single legal authority be identified to cooperate and coordinate all activities.
- The National Committee for Coastal Zone Management should involve mangrove management in their activities.

Actions to be taken to avoid variation between planned and actual implementation:

- Risk assessment review for planned and actual actions / costs be regularly reviewed.

External factors that influenced the project implementation and that could / or not have been foreseen:

- Implementation of mangroves in the Integrated Coastal Zone Management.

PART III: Recommendations

It is recommended that the Government review, adopt and implement the activities contained in the proposed national action plan for the conservation of mangroves in Egypt in order to ensure the rehabilitation, conservation and sustainable utilization of mangroves. Recommendations of future projects should ensure only one legal authority in charge of mangrove management. However, the roles and responsibilities of different authorities need to be clarified and better collaboration among them are ensured. Any activity should be developed and implemented within the framework of the Integrated Coastal Zone Management Plan (ICZMP). Environmental impacts assessment should be continued for all projects likely to affect mangrove communities, with specific attention given to likely alteration a tidal flows, hydrological inputs and water quality characteristics. Adequate buffer zone (500 – 100) should be established between mangroves and new development.

The potential recreation and non-use value of Egypt's mangrove is likely to increase over time. Therefore, it is essential to conduct a carefully designed and targetted public awareness and education campaign to inform local communities, the general public and visitors with respect to what mangroves are and why they are so important.

Introducing apiculture has proven to be a very successful trial. It is recommended to continue this trial, however, all the economic viability and all potential impacts must be thoroughly assessed.

Based on the successful rehabilitation programme conducted during the project implementation, it is recommended that the proposed strategy should focus on the existing areas, species and local seed sources. More pilot nurseries be established by local communities and / or private individuals for sale to NCS, and possibly, forthcoming ITTO projects. However, seed sources should not be mixed until the genetic make up of individual stands has been determined.

Future projects should be linked to local job opportunities. During the design phase of future projects, it was important to understand the need and the interest of various stakeholders. Selecting the appropriate staff is crucial at the ground level. Risk assessment and risk mitigation strategy for specific planned activities and estimated cost should be reviewed during the design and implementation phase of future projects. Priority areas for mangrove conservation and rehabilitation should also be identified at an early stage of designing future projects. It is also

important that implementation of future projects should be reviewed regularly and ensure decentralization management be enforced, and empowerment be given to local authorities and communities. This will facilitate law enforcement and coordination among stakeholders who will benefit from the economics of mangroves. Finally, top-level support and commitment is important to ensure the sustainability of future projects.

PART II: Main Text

Project content and context

This project, Assessment and Management of Mangrove forests in Egypt for Sustainable Utilization and Development, arised from the recognition of the urgent need to secure the fast disappearing mangrove areas on the Red Sea coast of Egypt. Whilst these areas are of limited extent, they have importance internationally as part of the global mangrove resource and also locally as a source of livelihood for the surrounding population. Loss of the resource would cause environmental damage along the coast and loss of livelihoods for the currently dependent population. In addition, there would be a wider loss to the international community from a unique, isolated population of mangroves.

Although the Government of Egypt was aware of the importance of this resource, and the serious losses that will be incurred if actions were not taken, it recognized that it did not have the required expertise and resources available nationally to begin the process reversing degradation and moving towards sustainable management. It therefore, seeked assistance from the international community to halt damage and begin restoration actions.

Egypt is predominantly a desert country and an important of timber and timber products, including those from the tropical forests. Along its Red Sea coast and islands it does however, and important resource in an area of mangrove forest. Although small, this area contains significant biodiversity and is also and important source of income for the surrounding population. By virtue of their isolation, Egypt's mangroves are highly valuable internationally, as the unique genetic material they contain is part of a threatened global resource.

There are other isolated populations in the Middle East region and those, too, are both threatened and of importance. The problems being faced by Egypt are just one facet of a wider problem and the findings from this project will have value beyond national boarders.

The total area of mangroves, at the beginning of the project, was estimated at 465 ha, distributed in many isolated sites at Halayeb, Shelateen, Hamata, Quseir, Nabq, Hurghada and Safaga. There has been considerable disturbance over the years to the mangrove areas, in part from the development of infrastructure for roads and habitations but also from the largely uncontrolled harvesting of minor products. The resource at the beginning of the project was both fragmented and degraded and its potential future productive capacity is extremely limited without remedial action. At the same time, the potential service value of preventing coastal erosion is also largely undermind.

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The main objectives of the projects were to frame, promote and implement policies and actions that ensure the conservation and sustainable utilization of the natural forest ecosystems of Egypt and to complement these with planted trees that enhance environmental and service values.

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The specific objective is "secure the Egyptian Red Sea mangrove population and ensure its conservation and sustainable management.

There are four outputs that were designed to encompass four limited sets of tasks: collection of information; research, plan development and collaborative management. The outputs are:

Output 1: collect, analyze and document baseline biological, silvicultural, environmental and socioeconomic information;

Output 2: design and implementation of a silvicultural research programme;

Output 3: preparation of a comprehensive suite of initial Management plans for the whole mangrove area and undertake pilot rehabilitation;

Output 4: development of a small-scale harvest and utilization of mangrove resources through collaboration approaches.

Project design, organization and implementation

This project started from what is effectively a zero base. Therefore, it was very much a process project and the later activities were informed and dependent on the initial ones. The strategy followed a series of steps. First the resource and its socio-economic environment were assessed. The baseline information obtained were used to define the project starting point from which progress were assessed. Then, a strategic management plan was developed, based on information assessed, activities undertaken and monitored, and stakeholder needs. Later, a series of operational plans were produced collaboratively with local people. During this process, opportunities for income generation were assessed and the necessary skills base created.

The first step of the project implementation was the formation of the steering committee by the Ministerial Decree # 21 of the Minister of Environment. It included members of senior staff of the Ministry of Environment and Ministry of Agriculture and Land Reclamation, University Professors with well experience in the mangroves and environment, representatives of the Governorates of the Red Sea and South Sinai, local authorities, NGOs, rangers of the National Parks (Nature Conservation Sector of the Egyptian Environmental Affairs Agency), and technical staff of the Ministry of Agriculture and Land Reclamation working at the Red Sea Governorate.

The Steering Committee met twice every year during the period of the project, and the first decision was the appointment of the project manager (Professor Mohamed Zahran).

Aims of the project were discussed and approved, including:

1. Contribute to improve sustainable development of mangrove forests of Egypt along the Red Sea coast and Gulf of Aqaba.

2. Link the sustainable management, conservation and development of mangrove ecosystems in Egypt with improving livelihood of the surrounding population.

3. Encouraging the adjacent divllars of the mangrove ecosystem to engage with the changed management system and will also provide opportunities for skills transfer.

It was decided not to recruit international consultants, and rely on the national consultants who were identified and their Terms of References were prepared. Organization of the project management was approved by the steering committee, based on top-down approach. Management structure of the project was as follows: Project Director (CEO of EEAA), Project Coordinator (Director, NCS), Project Manager, Steering Committee, National Consultants, Technicians, field staff and local communities with NGOs.

Logical framework analysis for the project implementation was prepared and approved to be implemented on a yearly basis. It outlines project development objectives, specific objective, expected outputs and activities, indicators, means of verification (Table I).

Logical Framework Matrix, Outputs, Indicators and Assumptions

	Narrative summary of Project element	Objectively verifiable indicators	Means of verification	Important risks and assumptions
I	***Development objective:*** Contribute to improved sustainable development of the mangrove forests and surrounding populations	Quality of life in target population	Health, social and economic statistics for target populations	Local population is amenable to planned changes
II	***Specific objective:*** Secure the Egyptian Red Sea mangrove population and ensure its conservation and sustainable management	Illegal activities reduced and Mangroves are sustainably used.	Formal regular monitoring reports. Sequential records	Legal and institutional support given
1	**Output 1:** Collect, analyze and document baseline biological, silvicultural, environmental and socio-economic information. This has been presented in the progress reports No. 4 & 5	Appropriate and accurate baseline data collected and preparation of mangrove information reports.	Survey and progress reports Final technical reports of project consultants.	Co-operation from local stakeholders
	Activities and input 1:			
1.1	Specify baseline studies and support data collection. This has been presented in the progress report No. 2 & 3 combined in one report	Further biological, environmental and socio-economic studies prepared	Final technical and scientific reports	Institutional support and transportation to sites provided
1.2	Collect and analyze Biological baseline data at selected sites. This has been presented in the progress report No. 5.	Field surveys accomplished and data collected.	Survey and progress reports. Final consultancy reports	
1.2.1	survey of pathogenic and beneficial microflora	Pathogenic and beneficial microflora identified	Survey and progress reports	Seasonal variations in phenological events
1.2.2	Identify Insects, nematodes, crustaceous, fishes,…etc	Species lists prepared for mangrove fauna	Technical reports, Final project report	
1.2.3	Genetic characteristics	Identification of genetic characteristics	Survey and progress reports	Genetic analysis resources available
1.3	Conduct Environmental Baseline surveys. This has been presented in the progress report No. 5.	Field surveys accomplished and data collected. Species lists prepared	Survey and progress reports. Final consultancy reports	
1.3.1	Collect, analyse and document geomorphological data (sedimentation, tides ,	Identification of geomorphological	Technical reports. Final	Seasonal variations in

	Narrative summary of Project element	Objectively verifiable indicators	Means of verification	Important risks and assumptions
	groundwater, climatic features,…etc)	parameters	consultancy reports.	edaphic conditions
1.3.2	Identify sediment and water characteristics (physical and chemical)	Provide physical and chemical characteristics of mangrove sediment	Data provided in final consultancy report	
1.3.3	Estimation of mangrove biomass	Mangrove biomass estimated	Final project report	Non destructive research methods incorporated
1.4	Conduct Socioeconomics survey. This has been presented in the progress report No. 5	Field surveys accomplished and data collected. Species lists prepared	Survey and progress reports. Final consultancy report.	Co-operation from local stakeholders
1.4.1	Review the existing information	Literature review of available information	Project progress report	
1.4.2	Conduct preliminary field visit followed by survey on mangrove socio-economics	Identify uses and benefits of Mangrove trees and	Survey and progress report. Final consultancy technical report.	
1.4.4	Stakeholder analysis and review of user patterns	Estimate threats to mangroves and human impacts	Survey and progress reports. Final consultancy reports	Institutional support given. Co-operation from local stakeholders
1.4.5	Data analysis and Propose measures for sustainable use and management options for conservation	Estimate Economic value for Mangrove. Measures for sustainable use provided	Final consultancy technical report	
2.	**Output 2:** Design and implementation of a silvicultural research programme	Silviculture research programme prepared. Implementation on schedule	Field and laboratories technical reports. Inventory and stakeholder analysis	Filling gaps on Mangrove knowledge
	Activities and inputs 2:			
2.1	**Silviculture activities**			
2.1.1	Collection of seeds, from the natural stands of mangrove forests for the germination experiments	Adequate number of seedlings collected and plots are prepared	Project progress reports Nos. 4 & 5	
2.1.2	Follow up Safaga, Nabq, Hamata and Shalateen experiments and recording phenological aspects.	Growth and survival rates identified	Project progress reports. Nos. 4 & 5	

	Narrative summary of Project element	Objectively verifiable indicators	Means of verification	Important risks and assumptions
2.1.3	Follow up the germination experiments in the four nurseries	Nurseries are established and prepared for plantation experiments	Nurseries established. Project progress reports Nos. 4 & 5.	
2.1.4	Undertake plantation experiments in the four nurseries during June 2005 – December 2006.	Plantation of mangroves and germination experiments undertaken	Plantation undertaken at nurseries. Project progress reports.	
2.1.5	Undertake plantation of the mangrove seedlings in the permanent lands	Plantation of 25 – 50 hectars of mangroves forests in the Red Sea and Gulf of Aqaba Coast of Egypt.	Selection of the sites for rehabilitation and plantation of the mangrove plants	Expected risks as: 1. Harmful insects. 2. Fugal pathogen. 3. Uprooting the young seedlings. It is assumed that successful propagation of mangrove forcers in the target area.
2.2.	**Research programme activities**			
2.2.1	Preparation of guidelines for handling of seedlings and other propagules	Provide site propagation of mangrove seedlings guidelines	Project progress reports. Final consultancy technical report	
2.2.2	Preparation of propagation site layout and operational work plan	Operational work plan including propagation site layout prepared	Progress reports. Final project report	
3.	**Output 3:** Preparation of strategic and operational management plans & beginning of pilot rehabilitation programme	Preparation of strategic and operational plans for conservation and development of mangroves in Egypt. Rehabilitation of 25 ha. As a pilot demonstration	Principal investigator compiles data and prepares the plan. Approval of plan by steering committee	Involvement of local communities in related income generating activities
	Activities and inputs 3			
3.1.	Review and analyse the status of mangroves, legislative and conservation aspects	Identify threats and impacts to mangroves together with gaps in	Project progress reports. Final project report	

	Narrative summary of Project element	Objectively verifiable indicators	Means of verification	Important risks and assumptions
		legislation and/or management for conservation		
3.2	Prepare strategic action plan for the conservation of mangroves in Egypt	Strategic action plan for mangrove conservation prepared	Strategic action plan	
3.3	Prepare propagation and transplantation scheme for rehabilitation of degraded mangrove sites in Egypt	Identification of degraded sites and preparation of transplantation scheme	Final project report	Successful propagation in nurseries
3.4	Initiate pilot rehabilitation and transplantation programmed	Transplantation of degraded mangrove areas at selected sites	Pilot rehabilitation of selected mangrove sites.	
3.5	Encourage community participation and involvement and raising public awareness towards mangrove conservation	Involve stakeholders in preparation of the strategic action plan. Enhance public participation and raising of public awareness		Local population is amenable to planned changes
4.	**Output 4:** Development of small-scale sustainable harvest and utilization of mangrove recourse thought collaborative approaches	Mangrove derived disposable income increased, variation reduced and long term income as**ed	Regular monitoring reports on annual basis with significations improvement in key measures.	Added value can replace reduced consumption Relevant new Skills can be transferred
4.1	Beekeeping and integrated aquaculture	Provide technical, financial assistance, and training to locals	Purchase equipment, conduct training	The concept is accepted by locals, and revenues generated Impact of bees on local species assessed
4.2	Community based ecotourism	Technical, financial assistance provided; training to locals	Purchase a boat for locals, and provide information on fisheries, and tourist sites	Locals are not used to deal with tourists in the south, pilot project my not be accepted by the local authorities due to security restriction
4.3	Community based mangrove reforestation	Locals establish nurseries; training to locals provided	Seedlings are sold to government agencies	Limited available financial resources

Operation yearly programme was implemented through specific activities conducted in the field. Monitoring of the implementation of the project's activities was executed through sites (field experiment for the silviculture and rehabilitation of the mangrove forests, collection environmental, biological and socio-economic data. Quarterly technical reports were prepared by the consultants and progress reports by the project manager and approved by the project coordinator. Direct communication between all concerned groups were facilitated by the project coordinator.

Because mangroves exist in very extensive sites (28) over the very long coast and islands and the limited time frame of the project, it was decided to focus activities (e.g. rehabilitation, local workshops and training programs) on specific sites at Nabq, Safaga, Wadi El-Gemal and Shalateen

The project team hired consultants of different disciplines (e.g. biologists, environmentalists, socio-economists, etc) from various universities and research institutions in Egypt to review the current information on mangroves based on the available published literature as well as from various sources within the country. Consultants were requested also to pay field visits to mangrove sites along the Red Sea coast and Gulf of Aqaba to collect samples of soil, water, mangroves, fauna to be analyzed at the laboratories and results be presented in technical reports to help in mangrove assessment and management. They were also requested to participate in various workshops involving key stakeholders, and provide, when necessary, training to staff available at selected sites of mangroves, mostly Nabq, Hurghada, Safaga, Quseir, Wadi El-Gemal and Shalateen. Meanwhile, field staff from National Parks of Egypt and Ministry of Agriculture and Land Reclamation were assigned to implement the project on the ground in close collaboration with the Governorates of the Red Sea and South Sinai as well as local communities living in the adjacent of mangroves.

Conducted Activities

Silviculture of mangrove plants

Silivculture activities were supervised by Professor M. Abdel Razik (consultant) assisted by the agricultural experts and the rangers of the protected areas and the local communities. The main activities conducted were establishment and maintenance of four nurseries at Nabq, Safaga, Quseir and Shatateen, germination of mangrove seeds, and siliviculturing of mangrove seedlings.

Rehabilitation of mangrove forests

This activity was also supervised by professor M. Abdel Razik and assisted by the agricultural and national park staff and local communities. It was implemented in the delta of Wadi Ariar within the border of Wadi El-Gemal protectorate.

Environmental studies

This activity was supervised by Professor K. Shaltout who collected available literature and carried out field visits to most mangrove sites and collected soil samples to be analyzed at his laboratory. Rangers of the protectorates also collected environmental data, demarked all mangrove sites, and implemented laws 102 for protectorates and Law 4 for environmental protection.

Biological studies

These were carried out by several consultants and rangers of the protected areas. These included description of the sites, structure, associated fauna and flora, identification of harmful fungi and algae and insects. Major impacts on mangroves were identified and assessed by all the project team.

Socio-economic studies

These were carried out by Professor E. El-Hawary and assisted by the rangers of the protectorates. The main target of this study was to make use of the mangrove forests and their biota for the welfare of the Egyptians living in the Red Sea and South Sinai coastal areas.

Media and Public Awareness

These activities were supervised by Dr. S. Khalifa (Agriculture expert) where he organized youth camps for university students, presented lectures, participated in clean-up campaign in mangrove areas, trained students to collect mangrove seeds, published several articles in newspapers. In addition, he conducted several workshops attended by ladies living in the villages and cities of the Red Sea Governorate.

New job opportunities

These activities were supervised by Dr. Sayed Khalifa and assisted by technicians of the Ministry of Agriculture and Land Reclamation, and rangers of the protectorates. These activities included introduction of apiculture for honey production as new source of revenues for local communities, involvement of local communities in siliviculture and rehabilitation of mangroves.

Improve the existing approved activities of local communities

These activities were supervised by the rangers of the protectorates, through different approaches. These included improving handcrafts, reducing camel grazing on mangroves, involvement in fisheries and touristic activities.

Project Achievements

A total of 7 progress reports were prepared and submitted to ITTO. This is the final report summarising the main achievements of the project, target beneficiers involvement, lessons learnt and recommendations for future work. The main text of this final report will record all relevant information to be used as institutional memory. Meanwhile, detailed information are available in the 7 progress reports and will be also available on the internet of the EEAA.

This project has undertaken a detailed study of the biological, silvicultural, environmental and socio-economic – value leading to the preparation and implementation of plans for sustainable management and conservation of the mangrove area. An important component of the project was the collaborative management of mangrove forest resource with adjacent communities as a primary plank of the strategy, with development of sustainable cottage industry based on the resource.

Egypt has coastline of over 3000 km long distributed along the Mediterranean, the Red Sea, the Gulfs of Aqaba and Suez. Mangrove forests occur along the Gulf of Aqaba, Ras Mohammed and the coastline and many islands of the Red Sea proper. They occupy about 525 ha in 28 sites: 5 sites along the Gulf of Aqaba and Ras Mohammed in the Sinai Peninsula and 23 sites along the Red Sea proper from Hurghada southwards. The mangrove forests of Egypt are species poor (only two species). *Avicennisa marina* and *Rhizophora mucronota*. The former

species is the most wide spread whereas the latter one occurs in few localities in the Red Sea coast south of Latitude 25°N.

Before the project, the following information were collected. The mangrove stands that grow in Nabq, Gulf of Aqaba represent the most northern limit for the mangrove distribution in the Red Sea and Indian Ocean. Monospecific stands of *Avicennia marina* grow on a hard fossil coral base at most locations. They occur along the coastal fringe situated on the seaward margin of Wadi Kid and Wadi Addawy, where underwater freshwater seepage into the mangrove habitat. The vegetational structure of the mangrove stands, is typically dominated by smaller shrub-like trees, although in some locations, dense areas of taller mangroves, are also present. These mangroves are subject to extreme environmental conditions (surviving close to their physiological limits with highly fluctuating values of salinity, temperature and ground water supply). However, they provide for a large number of faunal assemblages of marine organisms including a high species diversity of fish crustaceans, molluscs and echinoderms. In addition they provide space for many terrestrial organisms and avifauna that visit these mangrove stands for reproduction, food and shelter. They are also surrounded by a very rich habitats including coral reefs and seagrasses.

Characterization of the environmental conditions affecting the distribution of mangrove *Avicennia marina* (and to a minor extent *Rhizophora mucronata*) along the Egyptian Red Sea coast and islands have shown that the Egyptian Red sea belong to the category of "Warn Coastal Deserts". The annual mean temperature varies between 22.4°c at Suez in the north and 25.8°c at Ras Benas in the south. Rainfall decreases in the same direction till Qoseir (from 16.3 to 32mm/yr), but increases southwards to 17.3 mm/yr at Ras Benas. There are many oceanographic factors that control the mangroves including water temperature, tides, salinity, currents and dissolved oxygen.

Data available on mangroves include site geomorphology, biotic community characteristics of important stands, topography and zonation, physical characters, population characters including demography, phenology, intensity of respiratory roots, standing crop-phytomass, survival and mortality of seedlings, branches and twigs.

Biotic communities of mangroves included a diverse flora and fauna. A total of 36 algal species were recorded. Insect fauna included 40 species, and crustaceans exceed 80 species dominated by brachyuran crabs followed by anomurans (hermit crab) and caridea.

Dotilla sulcata, Macrophthalamus depressus and *Uca inversa* were the most frequent species. *Balanus amphitrite* was frequent in the roots of mangrove trees. All nematodes collected were free living species (4800 larvae (200g of soil). However, mangrove trees were infected by pathogenic fungi belonging to *Curularia sp*, *Alternaria alternate*, *Cladosporium herbarium* and *Ulocladium atrum.* Other pathogenic fungi found in old leaves of *Avicennia marina* included *Phellinus pachyphloeus* and *P.rimosus*. *Rhizophora mucronata* mangrove leaves were also infected by pathogenic fungi *Glomus mosseae.* Microbal spores were also found in mangrove soil including *Acalospora laevis* and *Gigaspora margarita.*

Mangroves act as nursery habitats for juveniles of commercially important fish species. A total of 21 fish species were recorded, 12 from Gulf of Aqaba and 18 species from the Red Sea mangroves.

Soil collected from different sites during the life time of the project revealed the possibility of the rehabilitation of the deteriorated mangroves. The growth performance of *R. mucronata* was significantly higher in pure stands than in association with *A. marina. R. mucronata* growing in pure population grew twice taller, had more main and lateral branches and attained nearly 4 times the total number of leaves compared with its performance in mixed population with *A. marina*. However, *A. marina* trees growing in association with *R. mucronata* were taller than plants growing in pure communities *R. mucronata* stands have the lowest salinity, silt, pH and Na, but highest of sand and Ca Co3. *A. marina* had the highest values of silt, clay, pH, K and Na. *R. mucrorata* contained higher ash. content (28.2%) than *A. marina* (18.8%). The higher values were associated Cl, Mg, Ca, and Na.

During the project, a multi disciplinary field survey of the Nabq mangroves was conducted by the National Park staff of the Gulf of Aqaba protectorates during 2005 – 2006. The survey was to assess the present status of mangroves, and the organisms they support and the level of impacts to mangrove ecosystem. In addition, permanent monitoring stations were established for the long term research of the primary productivity of mangrove vegetation. The survey included description and location of five mangrove stands (Ghargana, Abu Zabad, Rowaisseia and Monquatta); mangrove structure in term of tree height, basal area density of trees and aerial roots; reproductive functioning and productivity of mangrove trees (e.g. leaf litterfall production rate, phenological trends); macro fauna, soil analysis, oceanographic

measurements, salinity, temperature, current speed and direction); coral reef habitats and fishes; and human impacts on mangroves.

Results of the survey have shown that the mangrove structure at Nabq are less well developed than those reported to grow under favourable conditions, but comparable to those found at higher latitude (e.g. Red Sea, Arabia Gulf South West of Australia).

Leaf litterfall production ranged between 0.23 (January and 1.24 (April) g.m. $^{-2}$ day. These were notably lower than values obtained for the same species in Florida (2.4 g.m^{-2} .day), and even in the Red Sea from Saudi Arabia (1.21 – 1.79 g.m.$^{-2}$day).

Tree height ranged between 2.3 and 2.8 m. and was not significant in all mangrove stands at Ghargana, Rowaisseia, Monquatta and Abu-Zabad. Trees grow in the middle and lower intertidal zones forming dense growths with better developed crowns and attain greater height when compared to those growing in the upper intertidal zone where tidal flushing is minimal and soil salinity levels increase dramatically.

The mean Basal Area in all stands was 0.948m^2 (0.1) ha^{-1}, with highest value (1.756) at Monquatta and lowest (0.535) between Abu Zabad and Rowaisseia. The highest mangrove density was recorded in Rowaissei (313 stem. 0.1 ha^{-1}) and the lowest at Ghargana (120 stem 0.1ha^{-1}).

Soil analysis revealed that organic matter content followed a pattern characterized by increased organic matter in the mid stand zones and continued seaward, but low in low cover and new growth areas.

This indicate that organic matter and silt deposition take place locally within the dense mangrove stands due to reduction of soil transportation system which limit the spreading of these elements to the nearby areas.

The diversity of macro-invertebrate fauna (27 genera of crustacea, molluscs and echinoderms) is lower than those reported previously from the Gulf of Aqaba (33 genera). The highest was in Abu Zabad (81.4%) followed by El-Rowaisseia (77.7%), Monquatta (51.8%), and the lowest at El-Ghargana (40.7%).

Total coral cover in the fringing reefs adjacent to mangrove vegetation ranged between 18 and 68.5%, with and average of 38%. This percentage cover is similar to the range values recorded before in the same region. Fish abundance ranged from 78 to 562 with an average of 301 fish.500m^2.

The current level of impacts on mangroves at Nabq is moderate. The highest direct economic values is from recreational activities, followed by artisanal fishing. Levels of use are relatively low.

Before the project, there were almost no information on the socio-economic of the Red Sea mangroves. A socio-economic consultant was hired to: (1) provide information on the economic benefits and operating practices of key activities that may be employed in the identification of an economically management strategy for the mangrove resource; (2) train EEAA rangers to survey techniques, data collection and analysis, and ultimately on the economic appraisal on natural resource use. His full report was included in the progress report # 5. The following is a brief account on the main results.

The objective of the mangrove assessment was to review the social, cultural, economic and political conditions of individuals, groups communities and organization. The main topics embodied in the socioeconomic assessment were resource use patterns, stakeholder characteristics, gender issue, stakeholder perceptions; organization and resource governance; traditional knowledge; community services and facilities; market attributes for extractive use; market attributes for non-extractive use, non-market and non-use values.

The goals of conducting the socio-economic assessment of mangroves in Egypt were (1)management, (2) research, (3) development, (4) monitoring, and (5) policy. As for management the assessment investigated the potential impacts of mangrove strategies to protect and conserve mangroves while research intends to increase knowledge about the social and economic conditions of mangroves stakeholders and to show how the conditions of stakeholders are directly linked to human activities. As for development, the assessment aims to identify socio-economic issues that need to be addressed during development activities to improve the conditions of mangrove management, and at the same time it will help establish a baseline for assessing socio-economic changes over time in communities linked with mangroves. As for policy, the assessment will provide socio-economic information and make recommendations to guide decision makers.

Mangrove stakeholders included: bedouins, fish traders and tourism, and relevant organizations (e.g. governmental agencies, universities and NGOs).

Field visits were made to Hamatta area, Ras Mohammed and Nabq. Consultations were made with stakeholders to ensure their concerns and priorities, co-operation, increase their sense of ownership and committment, provide access to local knowledge, resources and assistance, and to increase public and political support for management of mangroves.

Data collection were based on three methods (1) observation, (2) semi structured survey, and (3) Questionnaire.

Key livelihood values of mangroves in Egypt include: fishing, livestock raising (mainly camels and goats), tourism, use of timber (for cooking, light structure, animal feed, use of firewood for tourism), employment at the national parks (as community guards and to provide food to tourists at restaurants), erosion and flood protection, attractive landscape, and refuge for many wildlife species.

Fishermen earn monthly income of about L.E. 250. They fish using nets from boats up to 1.5 km from the shore at Nabq. The best fishing season is between April and May. Tour operators organize visits to Nabq and Al-Qalaan mangroves where visitors enjoy the landscape and obtain fish food.

Socioeconomic characteristics in mangrove areas based on a survey conducted in five villages are: population, boudouins (education level, employment status, marital status, origins of bedouins, their possession) bedouin perception to mangroves, conservation, degree of importance to mangroves, threats to mangroves and remedies to threats, mangrove use patterns, and gender issues.

The estimated population of the five villages (during 2005) was 437 representing 95 households. The average family size is 4.6. There are two schools, one primary and the other is preparatory, at each of Hamata and Abu-Ghosoon. There is one medical clinic at Abu-Ghosoon, and other one at Hamata. At Marsa Alam, about 60 km north of Hamata, there is a small hospital and postal office. Electricity is provided to Bedouins by hotels in Wadi El-Gemal. Approximately 50% of the population are under 20 years old. About 45% of the population is composed from women.

The majority of Bedouins (about 60%) have primary level of education. Fishing is the dominant job opportunity for the majority of Bedouins

(70% at Al-Qulaan, 35% at Hamata, 67% at Nofaa). A small percentage (8%) of labour force are governmental employees.

Bedouin men undertake fishing activities out at sea whilst the women collect shellfish along reef flats. Bedouin men look after camels whereas the women herd goats. The main traditional activities undertaken by bedouins are livestock raising, minor seasonal agriculture, horticulture and fishing. However, bedouins are increasingly getting involved in tourism, through acting as tourist guide; dive masters and assistants, cooking traditional bedouin meals, camel riding and making souvenirs for tourists.

Approximately 40% of bedouins are married. Most of Bedouins came from the Red Sea and a smaller percentage (13%) from the upper Egypt. Most of them have radio, TV, Gas oven and refrigerators.
Majority of bedouins (87%) are aware of the importance of mangroves and the need for conservation. However, only one third of Bedouins realize the threats to mangroves. The main uses of mangroves are camel feeding (45%) fuel wood (29%), charcoal (13% and goat feeding (13%). Most women are involved in livestock browsing (38%) and in fuel wood (29%).

Values of mangrove goods and services, based on the assessment include:
Direct use (fuel wood, animal grazing, traditional medicines, pharmaceutical and genetic resources, apiculture, fisheries, aquaculture, recreation and ecotourism, landscape, education and scientific research, wildlife resources and house construction)
Indirect use (support to off-site fisheries, biodiversity support, shore protection, sediment regulation and accretion, storm protection, nutrient retention, water quality maintenance, micro-climate stabilization, groundwater recharge and discharge, flood and flow control, shoreline stabilization / erosion control, and sediment retention. Non-use values have not yet assessed, but it is suggested that public awareness material (e.g. selling books, CD, posters, post-cards on mangroves, setting up a charity or fund for mangrove conservation) could be enhanced in the future.

Socioeconomic studies of mangroves continued during 2006 and were conducted by staff of Nabq and Wadi El-Gemal National Parks. Data collected included number of individuals, age groups, sex marital status, education: status, housing and economic activities (e.g. fishing, herding, handcrafts, wood collection, work at the national parks and tourism), and new economic initiatives (e.g. tourism, apiculture) by the project. Their

full report is included in the progress report #7, which has shown the National Parks staff have acquired the necessary skills for conducting socio-economic studies and can initiate new activities for the well-fare of local communities. In addition, their results were in full agreement with those of the consultant.

Silviculture activities included three types of implementation tactics: (A)direct re-transplantation of seedlings from the wild and from nurseries into selected areas (7); (B) initiating new system by implementing the same activity in selecting sites void of mangrove plants but have potentialities for action (3 sites); (C) rehabilitation of example of degraded mangroves stands applying additional needed measures. The EEAA rangers, technical staff of the Ministry of Agriculture and Land Reclamation and local communities have earned basic needs to apply mangrove transplantation and rehabilitation procedures. Scheduling monitoring of the established locations assures evaluating the changes in the concerned locations and reveals indicators for future plans.

By end of December a total of 125 500 m^2 (31.3 Acre) were added as mangrove expansion transplanted area. Further 7.5 Acres were triggered for self regeneration "Wadi Ariar". About 30 000 *Avicennia* seedlings were transplanted from the established nurseries and from the wild. Successful introduction of *Rhizophora* propagules were made at Hamata and Quseir.

Recent information obtained by remote sensing has shown that mangrove areas have reached 700 ha by end of 2006 compared to 525 ha in 2002. There were also considerable difference in areas compared with 2002. For instance Abu Monqar mangrove had an area of 276 ha compared to 333 ha in 1975. Surprisingly, Hamata mangroves that were 295 ha in 1975, became 1119 ha in 2006 (due to the discovery of new sites in recent years). On the other hand, the mangrove area of Ghargarna, using Quick Bird, is only 265 ha.

Thus the current mangrove areas in Egypt has increased considerably mainly because of the conservation measures taken by the staff of the National Parks, and the affrostation activities that took place during the lifetime of the ITTO Project.

During the lifetime of the project many meetings and 4 major workshops were held at the Gulf of Aqaba (Nabq) and the Red Sea (mostly Hurgada, Safaga, Wadi El-Gemal and Shalatin). These meetings and workshops were attended by staff of the national parks, representatives of the

Ministry of Agriculture and Land Reclamation, consultants of the ITTO project, local communities, local authorities and investors. Topics discussed and approved included more involvement of local communities in the project, implementation of new economic activities (mostly related to fisheries, tourism and apiculture), sustainability of the project after its completion, research and studies conducted by consultants and rangers of the national parks, affrostation activities, threats facing mangroves and remedies to reduce threats, public awareness activities, government and local community commitment after completion of the ITTO project.

Resources of the ITTO project were used to help development of local communities. These included hiring many locals in the different activities of the project (mostly in the affrostation work), working at the national parks and Ministry of Agriculture as community guards, introducing apiculture and training locals in producing honey, involving locals in fisheries and touristic activities (by purchasing a boat and a vehicle to be used to improve their livelihood and reducing pressures on mangroves. Thus, local communities felt the ownership of the project.

Rangers of the National Parks, staff of the Ministry of Agriculture and Land Reclamation were involved in conducting research and studies on mangroves, including baseline information, rehabilitation programmes, environmental, biological and socio-economic studies, demarcation of mangroves, implementation of Law 4 for environmental production and Law 102 for protectorates, contribute to the preparation of and implementation of the strategic plan. Thus, all their activities have contributed significantly achieving the development objective of the project (contribute to improved sustainable development of the mangrove forest area of Egypt and the surrounding populations).

The National Action Plan for the conservation of mangroves in Egypt include the following components: Integrated coastal zone Management, education and awareness, marine protected areas, ecologically sustainable mangrove utilization and affrostation, impacts of shipping and marine pollution, research, monitoring and economic valuation. (details in Annex 1).

Synthesis of the Analysis

The current situation prevailing after the project completion, as compared to the pre-project situation is as follows: (1) accurate information on the current mangrove area is 700 ha compared to 525 ha in 2002. (2) a detailed study is available on the biological, silvicultural, environmental

and socio-economical value. (3) local communities have been involved in mangrove conservation and sustainable use of their resources. (4) there are currently a multi-disciplinary team on the ground that have been trained, equipped, and able to implement research, studies and laws. (5) strategic management plan is being implemented by the staff of the national parks in collaboration with other governmental agencies, local authorities and local communities. (6) activities were either improved or initiated and being implemented (e.g. affrostation, apiculture, fisheries and tourism). Thus, government and local communities committed to improve sustainable development of mangrove areas is continuing after the project completion.

Based on the above, it can be said that the specific objective and output have been mostly realized. Table (2)

Progress in implementation of the activities:

Groups	Activities	Estimated percentage of implementation	Estimated completion date
1.	1.1. Specify baseline data	100%	Completed
	1.2. Biological basline data	90%	
	1.3. Silviculture baseline data	90%	
	1.4. Environment baseline data	90%	
	1.5. Socioeconomic baseline data	100%	Completed
2.	2.1. Prep. Res. Programme	100%	Completed
	2.2. Permanent sample plots (PSPs)	90%	
	2.3. Experiment	100%	Completed
3.	3.1. Mapping and inventory	100%	Completed
	3.2. Stakeholder analysis	100%	Completed
	3.3. Prep. Stratigic Mang. Plan.	100%	
	3.4. Prep. Oper. Plans	100%	Completed
	3.5. Pilot Rehabilitation	90%	

4.	4.1. Development and evaluation of operations	[redacted]	90%	
	4.2. Skills analyses and training	[redacted]	90%	
	4.3. Support to cottage industries	[redacted]	100%	Completed
	4.4. Grants for loss of income alternatives	[redacted]	100%	Completed

It is impossible to state that all the required data for the assessment and management of mangrove forests in Egypt for sustainable utilization and development were obtained. First, mangroves exist over a very long coastline and many islands in a scattered way. Financial, human resources and time available to study all the 28 sites were beyond the resources of the project. Therefore, the best way was to focus on specific sites whereas much information were collected. Meanwhile, frequent visits were made to other sites where information were collected and be compared with data from specific sites. Second, there were specific scientific problems and obstacles that we faced during the implementation of the project. These included limited success of seed germination at Nabq Nursery during 2005. Fortunately, when the experiment was repeated during 2006, successful results were obtained. In addition, poor production of fruits from mangroves of Ras Mohammed and Nabq was evident during the time frame of the project. Therefore, a decision was taken to transfer seeds from other sites along the Red Sea coast. Furthermore, young seedlings of *Avicennia marina* were attacked by filamentous algae. Therefore, efforts were made and were successful to remove them with assistance of local communities. Third, the project suffered from the lack of some expertise especially those related to birds and micro-organisms as well as associated fauna of mangroves. We have very small number of taxonomists in Egypt in these fields. However, we were fortunate to identify a very good expert on birds who is currently reviewing and surveying all bird fauna of mangroves, as means of sustainability of the project. His cost are currently being covered from the resources available from Nature Conservation Sector. Fourth, available resources to complete the management plan and genetic studies were very limited. However, we were very fortunate to make use of the expertise of one of the senior staff of the national parks (Dr. Nasser Galal) to complete the management plan (Annex 1) and he is currently in charge of implementing it. Studies on genetic resources still need further resources and time to understand the significance of the mangroves along the Red Sea coast and islands. A proposal has been made to conduct the

genetic resources studies, and a search is being made to find financial resource to implement this proposal.

Schedule of the project has been delayed for sometime due to the change of the cabinet Minister of Environment and the responsible Coordinator. Therefore, the project was extended till end of December 2006.

Actual expenditure of the project was much below planned expenditure. To be able to assess the 28 sites of mangroves and to implement affrostation activities will require resources much more than the available resources of the project. Therefore, we have to rely on other resources not only to implement various activities but also to ensure the sustainability of the project. These included hiring extra staff for both National Parks and Ministry of Agriculture and Land Reclamation. Meanwhile, the budget of the NCS has been increased during 2007 to cover extra expenses for mangrove restoration, protection and conservation.

The potential for replication and for scaling-up of the project is very significant, based on the successful results obtained, the presence of a multidisciplinary team from various governmental institutions, NGOs, local authorities and local community. In addition, there exist now a dynamic long-term framework for actions in the form of the management plan that is being implemented.

Lessons Learned:

Lessons learned from the project implementation are divided into two groups; developmental and operational lessons.

A-Developmental lessons

Aspects of the project design which most contributed to its success in achieving the development objectives are the following:

Job creation is emphasized in dealing with local population to ensure their acceptance of change.

During the project design phase, it was assumed that local population will be amenable to planned changes. This assumption was found to be correct. However linking the project activities to job opportunities and training have been proven to be the main factors in the acceptance of the local populations to the project implementation. It is, therefore,

suggested that future projects of this nature should be linked to job opportunities, and this aspect is emphasized in dealing with local population.

Law enforcement is not sufficient – coordination between stakeholders is critical

During the design phase of the project, it was assumed that illegal actors can be diverted without alternative damage. This has been proven to be correct assumption based on reducing illegal activities, presence of the national park staff regularly in the mangrove sites to enforce legislation and carry out works related to demarcation of mangrove boundaries. Meanwhile, coordination with local authorities and investors (mainly fisheries and touristic activities) was critical to ensure improved sustainable development of the mangrove forests.

Support of the political leadership is important

Because mangrove areas are a planning and conservation tool largely with a long-term strategic vision and objectives, gaining the understanding and support of the top political leadership is very important. This has been the case in Egypt for the most part. Such top-level support and commitment is a great advantage for mangrove area development and sustainable maintenance.

Partnerships are the key for sustainable management

Broad based support for the mangrove area is critical. The participation of local communities, local authorities, universities and research institutions, NGOs and private sector has given an important momentum for mangrove area development, particularly affrostation activities. Communicating the needs of the community and management objectives to local community creates good support, goodwill and support for the mangrove areas. Local community and biodiversity resources can co exist and, with proper management, are mutually beneficial and sustainable. However, a delicate balance must be struck with the various stakeholders. While it is important to consult with and involve key stakeholders, care must be given to take into consideration conflicts of interests and not reduce management authority.

Mangrove areas are among the most effective conservation tool

Mangrove areas are tangible entities with legal status and well-defined, defensible boundaries. The law 102 has been relatively effective to implement since it spells out the types of activities not allowed in mangrove areas and specifies the responsible authority for enforcement giving them the executive powers for the management of mangrove areas.

Economic benefit is a must

In the light of more pressing social, economic and environmental problems, biodiversity conservation had often received law priority and has been perceived as a luxury the country can ill afford. Recent studies have shown tangible economic benefits and with direct benefits to the local people (fisheries, tourism).

Early avoidance of conflicts

It was found that current and planned land use and economic activities in and around mangrove areas should be considered and addressed. Some activities have been found to present serious threats that can undermine the proper management of mangrove areas or, on the other hand, could represent a unique opportunity and an asset for sustainable conservation efforts.

Adaptive management and flexibility

It is recognized while management plans are important tools, they should not be an end in themselves, but seek to facilitate and guide the decision making process for mangrove areas and managers. Plans should likewise be dynamic and revised on a regular basis. The planning process should be flexible exercise identifying the management priorities and framework and refined through implementation. An adaptive management approach is the best approach to respond to the problems and opportunities as they arise (e.g. new alternative economic activities that may arise form the use of genetic resources of mangroves, expected climate change impacts on mangroves).

Mangroves are resources for education, training and scientific research

Interpretive programmes for visitors are encouraging appreciation of nature and generating support for conservation efforts. Mangroves offer many opportunities for training, help to build needed national capacities for mangrove management and promote international cooperation through the exchange of information and experience.

Mangroves preserve indigenous knowledge and culture

Mangrove areas help communities living in or near them to maintain their traditional lifestyle, while offering them a means to improve their standard of living. There are many different local communities living in remote locations in and around mangroves. They tend to be among the poorest and most marginal people in Egypt. These communities, however, have rich and colourful cultures. Relying on natural resources for their way of life, they have extensive knowledge about habitats, species and land forms found in their environment. Modernization and development are bringing changes, causing these communities to loose their traditional knowledge and practices, which could lead to unsustainable use of mangrove resources and a vicious circle of resource abuse and further poverty. The project has involved these people in their activities, in order to benefit from their knowledge, gain their cooperation, and provided them with new income opportunities.

Changes in intersectoral links which affected the project's success

These have been achieved through initial evaluation to understand the various needs and interests of stakeholders. This was followed by regular re-evaluation to ensure the delicate balance between stakeholders is maintained. However, it was critical to the success of the project reducing the overlapping of the many institutions that are involved in activities related to or affecting the mangrove ecosystem. The roles and responsibilities of the different organizations need to be clarified and better collaboration among them are ensured. A key stakeholder (Nature Conservation Sector) be identified to be the ultimate legal authority (according to Law 102) for the project implementation and conservation of mangrove resources.

Additional arrangement that could improve cooperation between the relevant parties interested in the project

It was assumed that workshops, meetings, training are sufficient communicating mechanisms for the project implementation. This has proven to be sufficient, hence no additional arrangements / actions were needed.

Factors which most likely affect project sustainability after completion

Joint coordination between the different governmental agencies, stakeholders and local communities was critical. It was agreed that more

staff were needed to implement many activities in mangrove sites. Extra staff were recruited for both national parks and Ministry of Agriculture and Land Reclamation. More financial resources were allocated for mangrove activities (more affrostation sites were added after completion of the project leading to the increase of more than 50 Acres of mangroves planted at many sites). Public awareness is another important factor to ensure mangrove conservation. Meanwhile, law enforcement, partnerships with stakeholders and the key for sustainable management of mangroves.

B-Operational lessons

Project organization and management

There were quite considerable differences due to the fact that project organization and management were designed mostly a the central level and less attention was given at the ground level, leading to presence of unappropriate staff. Therefore, the lesson is selecting the appropriate staff is crucial. Mangrove management is as good as the staff running it. A manager who has good management and leadership capabilities is vital to support and provide direction to his staff. Mangrove area staff has to be able to act independently, make decisions as the need arises and follow through in an effective and systematic manner in implementing management objectives. Hiring the right staff and providing training is essential. Furthermore, job security and career development, will reward those with outstanding performance.

Project documentation be in electronic form.

Staff of the national parks and the Ministry of Agriculture and Land Reclamation reported on their activities regularly. Consultants reported on a quarterly basis, and the project manager every 6 month. Based on the 7 progress reports, and this final report, the existing project documentation is satisfactory. However, in order to make a wider dissemination and distribution of results and make use of information on mangroves for future projects, it is recommended that all project documentation should be in electronic form, and be available at the internet for every one use.

Monitoring and evaluation: Quality of project planning

On examining this issue, it was found that planning for the project implementation was a very ambitious process. It was impossible to study

and manage all mangrove sites. Therefore, priority mangrove areas were divided into 3 categories as clusters. Cluster 1, forests requiring total protection ("no take zone as in Nabq); cluster 2 forests permitted regulated utilization as in Wadi El-Gemal; cluster 3 degraded forests in need of rehabilitation as in Wadi Ariar. Thus the main lesson is priority areas for mangrove conservation and rehabilitation.

Definition of the role and responsibilities of the institutions involved in the project implementation

Many institutions are involved in the activities related to or affecting the mangrove ecosystems. Their role and responsibilities need to be clarified and better collaboration among them ensured. However, a single legal authority be identified to cooperate and coordinate all activities. In addition, the National Committee for Coastal Zone Management should involve mangrove management in their activities.

Actions to be taken to avoid variation between planned and actual implementation

During the course of the project implementation, it was found that many planned activities and estimated costs were beyond the time and resources available form the project. For example genetic resource studies required highly specialized staff and laboratories, hence actual costs were much higher than the available resources. The same is true for preparation of the management plan which required many meetings, several workshops with stakeholders, and actual preparation of the plan. Fortunately, this has been achieved by a volunteer expert from the national parks. Therefore, it is recommended that risk assessment review for planned and actual actions / costs be regularly reviewed: and risk mitigation strategy should be prepared at the project design stage.

External factors that influenced the project implementation and that could / or not have been foreseen

During the course of the project implementation, several factors have influenced the project positively or negatively. For example, the perception of the value of mangroves from all aspects ecologically, economically, varied greatly among different stakeholders. Some thought mangroves should be removed for development activities. Others were able to see not only the value of mangroves, but also their potential value (eco-tourism, apiculture). Hence, public awareness campaign was critical. In addition, many mangrove sites were heavily polluted with oil

either coming from ships or from rigs in the Gulf of Suez. Furthermore, some academic staff that were hired as consultants had good knowledge, based on the available literature, but have very limited field experience. Based on the above the best lesson is implementation of mangroves in the Integrated Coastal Zone Management.

PART III Conclusion and Recommendations

Egypt is currently undergoing an economic transformation and witnessing a growth rate unprecedented in its long history, which is rapidly altering the economic, social, as well as, physical and natural resources of mangroves. This current trend poses a critical and mounting risks to invaluable natural heritage resources of mangroves. Thus, there is an urgent need to initiate more actions to mitigate negative impacts of development (mostly tourism and pollution) and maximize benefits to society from natural resources maintained in the mangrove areas.

More financial and technical support still needed to move ahead with management of all mangrove sites and fulfill their role and achieve their conservation objectives. One of the top priorities is the consolidation of the management of mangroves and to ensure their sustainable use. Community improvement projects such as providing health care provide local communities with tangible benefits, linking conservation and the enhancement of their way of life. Another top priority is sustainable self-financing of mangrove areas. The concept of revenue generation has been on the table for some time, and a system for self-financing of mangroves are being debated extensively at the moment. There is also a need to develop an ecotourism strategy for mangroves, and generate more awareness and support to mangroves. There is an increasing need for qualified manpower, particularly at the middle and senior management levels. More affrostation activities should be implemented in the future to increase the mangrove areas, and benefit form their resources. Finally, there is a need to standardize the reporting, monitoring and management methodologies applied throughout all mangrove areas in Egypt.

It is recommended that the Government review, adopt and implement the activities contained in the proposed national action plan for the conservation of mangroves in Egypt in order to ensure the rehabilitation, conservation and sustainable utilization of mangroves. Recommendations of future projects should ensure only one legal authority in charge of mangrove management. However, the roles and responsibilities of different authorities need to be clarified and better collaboration among them are ensured. Any activity should be developed

and implemented within the framework of the Integrated Coastal Zone Management Plan (ICZMP). Environmental impacts assessment should be continued for all projects likely to affect mangrove communities, with specific attention given to likely alteration a tidal flows, hydrological inputs and water quality characteristics. Adequate buffer zone (500 – 100) should be established between mangroves and new development.

The potential recreation and non-use value of Egypt's mangrove is likely to increase over time. Therefore, it is essential to conduct a carefully designed and targetted public awareness and education campaign to inform local communities, the general public and visitors with respect to what mangroves are and why they are so important.

Introducing apiculture has proven to be a very successful trial. It is recommended to continue this trial, however, all the economic viability and all potential impacts must be thoroughly assessed.

Based on the successful rehabilitation programme conducted during the project implementation, it is recommended that the proposed strategy should focus on the existing areas, species and local seed sources. More pilot nurseries be established by local communities and / or private individuals for sale to NCS, and possibly, forthcoming ITTO projects. However, seed sources should not be mixed until the genetic make up of individual stands has been determined.

Future projects should be linked to local job opportunities. During the design phase of future projects, it was important to understand the need and the interest of various stakeholders. Selecting the appropriate staff is crucial at the ground level. Risk assessment and risk mitigation strategy for specific planned activities and estimated cost should be reviewed during the design and implementation phase of future projects. Priority areas for mangrove conservation and rehabilitation should also be identified at an early stage of designing future projects. It is also important that implementation of future projects should be reviewed regularly and ensure decentralization management be enforced, and empowerment be given to local authorities and communities. This will facilitate law enforcement and coordination among stakeholders who will benefit from the economics of mangroves. Finally, top-level support and commitment is important to ensure the sustainability of future projects.

Comparison between the soil characters of the mangrove sites (*Avicennia marina*) at Nabq and Ras Mohamed in South Sinai.

Soil variable		Nabq (Marsa Abu Zabad)		Ras Mohamed
		Upper-tide	Mid-tide	
Sand	%	79.4 ± 0.0	88.4 ± 0.0	98.4 ± 0.0
Silt	%	10.6 ± 0.0	11.6 ± 0.0	1.6 ± 0.0
Clay	%	10.0 ± 0.0	0.0 ± 0.0	0.0 ± 0.0
E.C. (mS cm^{-1})		21.3 ± 0.9	4.6 ± 0.1	2.3 ± 0.1
pH		8.4 ± 0.1	8.4 ± 0.1	8.9 ± 0.1
O.M.	%	0.5 ± 0.1	0.4 ± 0.1	0.4 ± 0.1
Ca CO_3	%	12.8 ± 0.3	17.3 ± 0.2	23.6 ± 0.4

Comparison between the soil characters before and after the elimination of the surface soil of the mangrove site (*Avicennia marina*) at the mouth of Wadi Gimal.

Soil character		Before elimination	After elimination	Relative change (%)
Sand	%	81.4 ± 0.0	99.4 ± 0.0	22.1
Silt	%	7.6 ± 0.0	0.6 ± 0.0	- 92.1
Clay	%	11.0 ± 0.0	0.0 ± 0.0	- 100.0
EC (mS cm^{-1})		13.4 ± 0.7	2.1 ± 0.2	5.8
pH		8.6 ± 0.1	9.1 ± 0.1	- 84.3
O.M.	%	0.4 ± 0.1	0.2 ± 0.1	- 50.0
Ca CO_3	%	13.0 ± 0.9	7.0 ± 0.9	- 46.2

Comparison of growth performance (mean ± SE per individual) of *Rhizophora mucronata* growing in pure population and mixed with *Avicennia marina* at low, medium and high tides. *: $P \leq 0.05$, **: $P \leq 0.01$ according to F-test.

Growth character		Pure				Mixed				F-value
		Low	medium	High	F-value	low	medium	High	F-value	
Height	cm ind.$^{-1}$	281.0 ± 15.2	297.0 ± 36.0	250.7 ± 30.7	0.74	10.7 ± 10.7	29.2 ± 16.6	234.0 ± 96.9	3.78*	3.62*
Length		187.7 ± 31.2	210.0 ± 8.0	162.7 ± 14.2	0.96	5.3 ± 5.3	15.3 ± 10.2	159.0 ± 73.5	3.26	3.05*
Width		168.3 ± 15.9	179.5 ± 8.5	148.3 ± 15.3	1.04	6.7 ± 6.7	13.2 ± 9.1	161.0 ± 57.3	5.56*	4.42*
Size index		212.3 ± 19.6	229.0 ± 12.0	187.0 ± 17.6	1.27	2.0 ± 2.0	19.3 ± 11.9	185.0 ± 73.5	4.26*	3.86*
Trunk circumference		27.6 ± 3.3	24.0 ± 1.0	19.7 ± 1.9	0.73	0.3 ± 0.3	2..6 ± 1.5	15.4 ± 6.5	3.09	4.12*
No. of main branches		19.3 ± 0.9	21.0 ± 3.0	17.0 ± 1.5	1.38	1.3 ± 1.3	0.3 ± 0.2	6.0 ± 2.3	5.14*	27.52**
No. of lateral branches		46.3 ± 8.7	56.5 ± 27.5	41.7 ± 8.8	0.28	13.0 ± 1.3	8.4 ± 4.5	19.4 ± 6.9	1.92	5.9**
Leaf area (cm^2)		320.3 ± 24.2	345.5 ±109.5	290.0 ± 50.0	0.23	13.0 ± 13.0	46.0 ± 39.0	125.3 ± 57.1	1.17	5.49**
Leaf number		19.9 ± 5.2	17.4 ± 2.0	16.2 ± 3.3	0.23	7.0 ± 7.0	9.2 ± 4.9	13.2 ± 4.9	0.28	0.59
No. of aerial roots		296.0 ± 0.0	287.0 ± 0.0	422.0 ± 0.0	0.00	6.0 ± 6.0	232.7 ± 116.3	235.1 ± 85.3	0.82	0.19
No. of seedlings		159.0 ± 0.0	311.0 ± 0.0	386.0 ± 0.0	0.00	1.7 ±1.7	172.3 ± 86.2	39.4 ± 17.3	1.49	2.86*

Comparison between the soil variables (mean ± SE) of the stands supporting *Rhizophora mucronata* and *Avicennia marina* under pure and mixed populations. *: $P \leq 0.05$, **: $P \leq 0.01$ according to F-test.

Character		*Rhizophora mucronata*	*Avicennia marina*	*R. mucronata & A. marina*	F-value	
					R. m.	*A. m.*
Gravel	%	0.7 ± 0.1	2.6 ± 1.2	2.4 ± 0.4	12.4**	1.17
Sand	%	79.1 ± 1.9	75.4 ± 2.7	75.4 ± 27.3	171.86**	206.88**
Silt	%	3.2 ± 0.3	3.4 ± 0.8	3.4 ± 0.8	5.00*	7.44*
Clay	%	17.1 ± 1.7	18.8 ± 2.5	18.8 ± 2.5	11.76**	10.48**
Organic carbon	%	1.6 ± 0.1	1.7 ± 0.1	1.7 ± 0.1	62.28**	14.86**
pH		6.7 ± 0.0	7.2 ± 0.1	7.2 ± 0.1	542.73**	660.20**
EC (mS cm^{-1})		136.7 ± 9.3	162.8 ± 23.6	162.8 ± 23.6	11.83**	5.19*
Ca CO_3 (meq l^{-1})		26.7 ± 0.4	17.5 ± 3.5	17.5 ± 3.5	16.87**	7.24*
Cations						
Na	meq l^{-1}	327.8 ± 9.2	546.2 ± 91.9	546.2 ± 91.9	10.34**	1.91
K	meq l^{-1}	36.3 ±7.0	90.8 ± 26.0	90.8 ± 26.0	4.10*	5.31*
Ca	meq l^{-1}	23.7 ± 1.4	30.8 ± 6.2	30.8 ± 6.2	6.71*	7.14*
Mg	meq l^{-1}	52.0 ± 3.8	58.8 ± 12.1	58.8 ± 12.9	6.32*	5.71*
Anions						
Cl		294.0 ± 12.0	518.6 ± 105.5	518.6 ± 105.5	7.22*	4.63*
SO_4		0.9 ± 0.0	1.0 ± 0.0	1.0 ± 0.0	1372.19**	96.11**

List of Mollusca recorded in surveyed transects in Nabq mangroves. (+) represent mean present and (-) represent mean absent.

Taxonomic rank	TG - 1	TG - 2	TA - 1	TA - 2	TRA - 1	TRA - 2	TR - 1	TR - 2	TM - 1	TM - 2
Phylum: **Mollusca**										
Order: **Gastropoda**										
Family: **Neritidae**										
Nerita sp.	+	+	+	+	+	+	+	+	+	+
Family: **Littorinidae**										
Littorina scabra	+	-	+	+	+	+	+	+	+	+
Family: **Trochidae**										
Trochus sp.	-	-	-	-	-	+	-	-	+	-
Tectus sp	-	-	-	+	-	-	-	-	-	-
Family: **Planaxidae**										
Planaxis sp	-	-	+	+	-	-	+	+	+	-
Family: **Strombidae**										
Strombus sp	+	+	+	+	-	+	-	+	+	-
Family: **Bursidae**										
Bursa sp	-	-	-	+	-	-	-	-	-	-
Family: **Buccinidae**										
Engina sp.	-	-	+	-	-	-	-	-	-	-
Family: **Nassariidae**										
Nassarius sp.	-	-	-	+	-	-	+	+	-	-
Family: **Fasciolariidae**										
Fusus sp	-	-	-	+	-	-	-	+	-	-
Family: **Conidae**										
Conus sp	-	-	+	+	-	+	+	+	-	-
Family: **Cerithidae**										
Cerithidea spp.	+	-	+	+	-	-	+	+	+	+
Family: **Ricinulidae**										
Ricinula undata	-	-	-	-	-	-	+	-	-	-
Order: **Bivalvia**										
Family: **Arcidae**										
Barbatia sp	-	-	-	-	-	-	-	+	-	-
Family: **Mytilidae**										
Modiolus sp.	+	-	+	+	-	+	+	+	+	+
Family: **Ostreidae**										
Dendrostrea folium	+	-	+	-	-	-	+	+	+	+
Family: **Psammobidae**										
Asaphis sp	-	-	-	-	-	-	+	+	-	-

List of pathogenic fungi isolated from infected leaves of *Avicennia* collected from different localities of Red sea

Locality	**Pathogenic fungi**
Wadi El-Gemal	*Alternaria alternate* *Cladosporium herbarum* *Curvularia sp* *Pestalotiopsis* sp (Brown spot)
Safaga	*Alternaria alternate* *Cladosporium herbarum* *Alternaria alternate*
Sharm	*Ulocladium atrum* *Alternaria alternate*

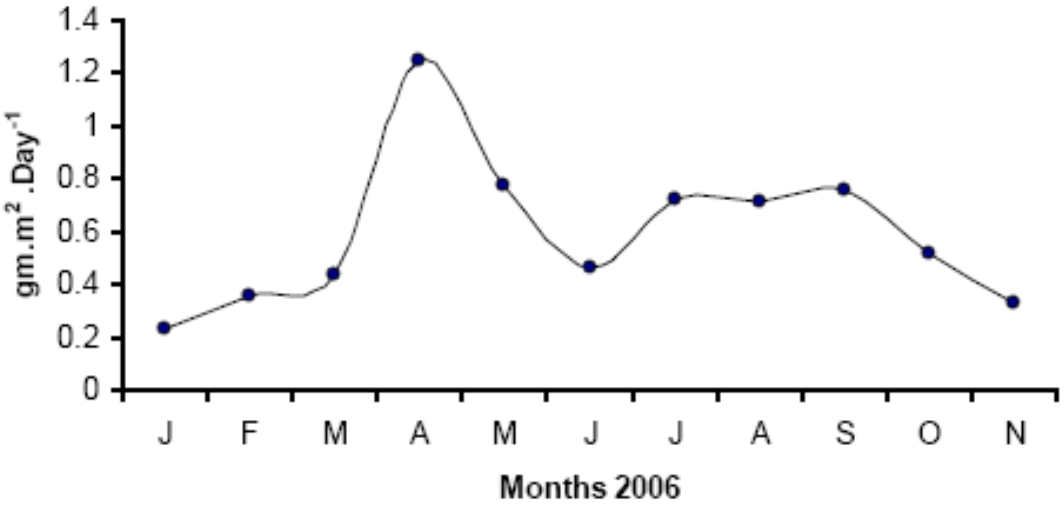


Figure: Shows the mean dry weight of litterfall traps

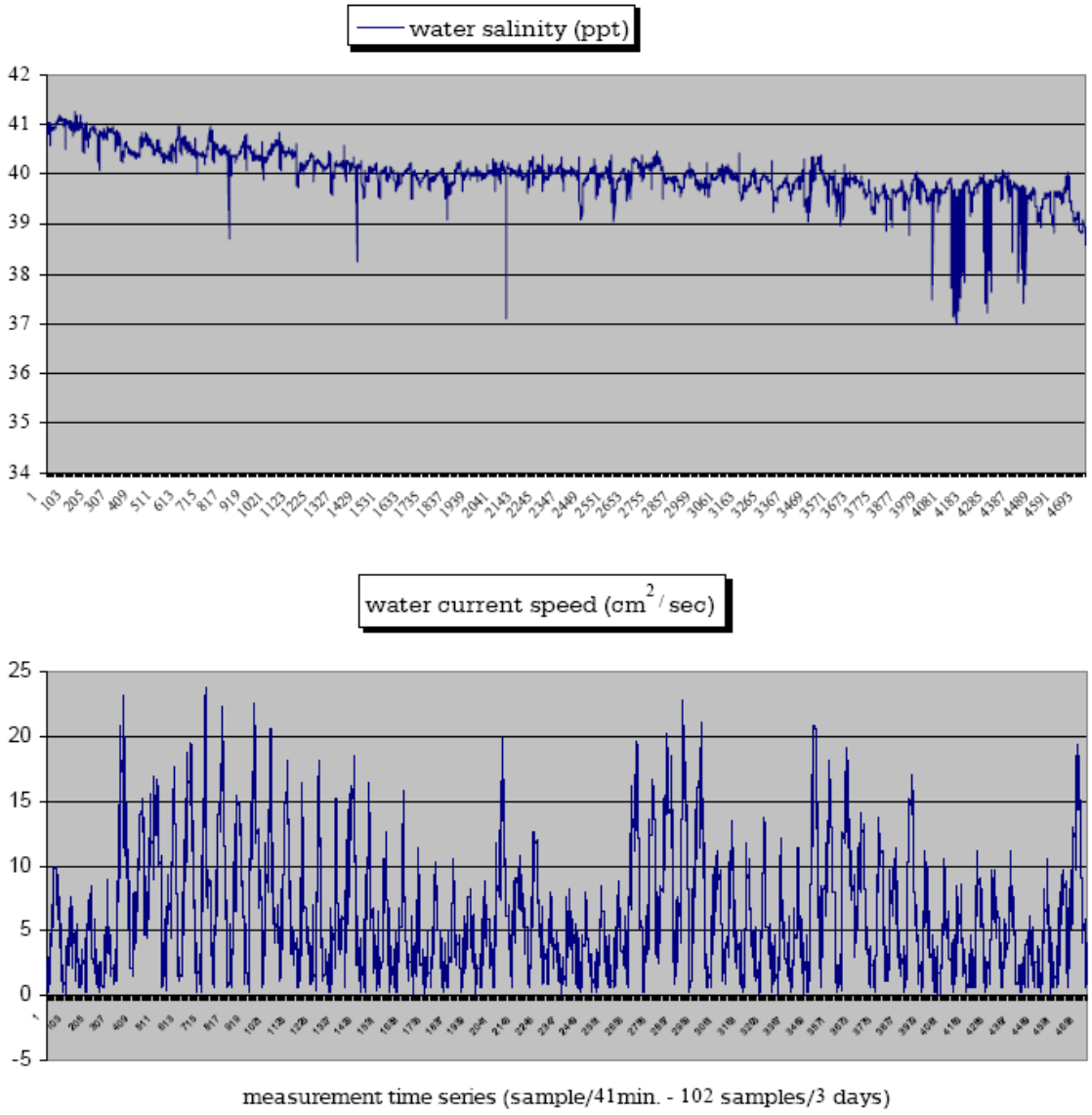
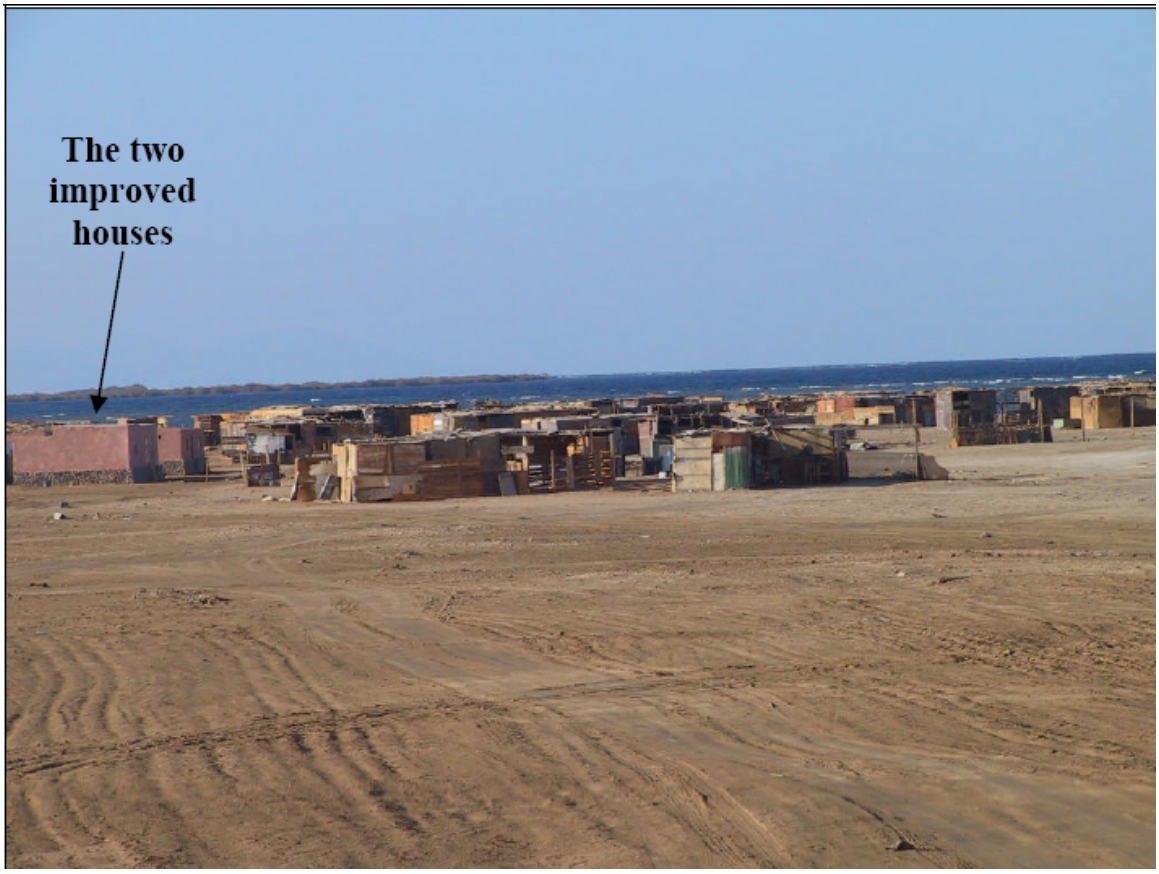
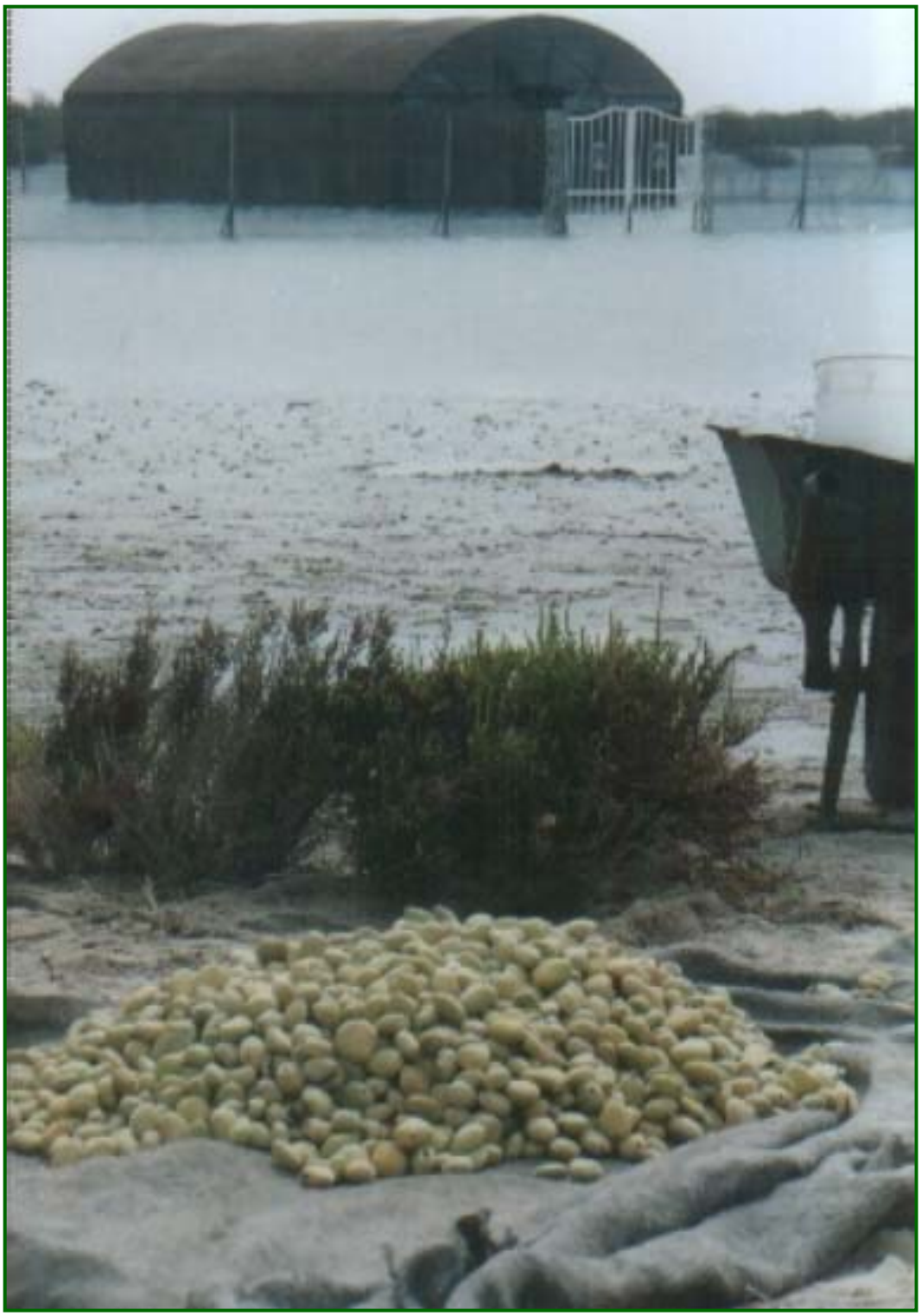


Figure: Temporal variations in water salinity, temperature and current speed

The shrimp farm production



The Bedouin housing at El Ghargan




وزارة الدولة لشئون البيئة
قطاع حماية الطبيعة
ITTO
وزارة الزراعة
الإدارة المركزية للتشجير والبيئة
ورشة عمل لتوعية السكان المحليين عن الأهمية والاستخدام
الأمثل للمانجروف
محافظة البحر الأحمر - حماطة ٢٠٠٦/١٠/٣١ م
Mangrove Conservation and Sustainable use
Community Awareness Workshop
RED SEA GOV.


شکلات انتاج
مایو ۲۰۰۶

أ. د. مصطفي فودة	المنسق الوطني للمشروع
أ. د. محمود عبد القوي زهران	المدير التنفيذي للمشروع

السادة المستشارون :

أ. د. محمد عبد الرازق	أستاذ بعلوم الاسكندرية
أ. د. كمال شلتوت	أستاذ بعلوم طنطا
أ. د. مجدي توفيق	أستاذ بعلوم عين شمس
أ. د. عماد الهواري	أستاذ بزراعة القاهرة
أ. د. سيد خليفة	أستاذ بمركز بحوث الصحراء ومستشار الادارة المركزية للتشجير بوزارة الزراعة
م / محمد أحمد مصطفي	رئيس الادارة المركزية للتشجير بوزارة الزراعة

الملخص التنفيذي

خلفية عن المشروع

تم تنفيذ هذا المشروع بغرض التنمية المستدامة لأشجار المانجروف على امتداد ساحل البحـر الأحمر. بالرغم من أن المساحة الكلية لأشجار المانجروف تعتبر صغيرة نـسبياً، إلا أن لهـا أهمية عالميه لكونها إحدى الثروات العالمية، ، وأيضاً نظراً لأهميتها المحلية كمصدر لمعيشة السكان المحليين قاطنين تلك المناطق .هذا بالإضافة إلى كون توزيع أشجار المانجروف فـى مصر يمثل أقصى توزيع جغرافى لها شمالا.

من هذا المنظور فقد اهتمت الحكومة المصرية بأهمية أشجار المانجروف وما تتعرض له من مخاطر، لذلك فقد طلبت المساعدة من منظمة ITTO للحد من المخاطر التى تتعرض لها بيئة أشجار المانجروف ، وضمان الاستخدام المستدام لها.

هدف المشروع إلى وضع وتنفيذ إطار لتحسين وتشجيع السياسات والأنـشطة التـى تـضمن الصون والإستخدام المستديم للنظم لأشجار المانجروف بغرض تحسين بيئتها وضمان إستدامة الخدمات التى تقدمها للسكان المحليين . وعليه فالهدف التنموى للمشروع هو المـساهمة فـى تحسين التنمية المستدامه ووضع المستوى المعيشى للسكان المحليين ، وذلك من خلال حمايـة وصون بيئة أشجار المانجروف.

تم تصميم المشروع لتحقيق الأربع مخرجات التالية:-

١- تجميع ، تحليل وتوثيق الممعلومات البيولوجيه والبيئية لبيئة أشجار المـانجروف شـاملة الأهمية الإجتماعية – الإقتصادية.
٢- تصميم وتنفيذ برنامج بحثى لإستزراع أشجار المانجروف.
٣- إعداد وتنفيذ خطة إدارة لصون أشجار المانجروف، وتنفيذ مشروع إستزراع إرشادى.
٤- تنمية موارد أشجار المانجروف من خلال تنفيذ بعض المشروعات الـصغيرة الخاصـة بالحصاد والإستخدام المستدام لأشجار المانجروف وتم تنفيذ المشروع بواسطة مجموعـة من الخبراء والمستشارين فى عدة مجالات بيولوجية وبيئية واجتماعية واقتصادية .

قام بتنفيذ الأنشطة المتفق عليها باحثى البيئة بمحميات البحر الأحمر وخليج العقبة، والعـاملين بوزارة الزراعة وإستصلاح الأراضى بمحافظة البحر الأحمر والخبراء، هذا بالإضـافة إلـى إشراك السلطات المحلية، السكان المحليين وجميع المنتفقين من بيئة أشجار المانجروف وأيضاً المستثمرين.

إنجازات المشروع

- إعداد دراسة تفصيلية عن الموارد البيولوجيه، البيئية، الإستزراع، والأهمية الإجتماعيـة والإقتصادية لأشجار المانجروف.
- الإستفادة من الدراسة فى إعداد وتنفيذ خطة إدارة للصون والإستخدام المـستدام لأشـجار المانجروف.
- يعتبر من أهم إنجازات المشروع اشراك السكان المحليين فى الكثير من الأنشطة.
- تم التعرف على الخواص البيئية التى تؤثر على انتشار وتوزيـع أشـجار المـانجروف (نوعى أفاسـينا مارينـا وريزوفـورا ماكروناتـا) شـملت هـذه الخـواص العوامـل الجيومورفولوجية، البيولوجية (أهم المناطق، طوبغرافيا المكان) والطبيعيـة (خـصائص التربة) وخواص الأشجار من حيث الطول، الكثافة، فترات ازدهار الثمار والبذور.
- تم التعرف على ٣٦ نوع من الطحالب، ٤٠ نوع من الحشرات، وأكثر من ٨٠ نوع مـن القشريات، و ٢١ نوع من الأسماك.
- تم الاستفادة من خواص التربة وأيضاً الاختلافات فى معدل نمو أشجار المانجروف فـى المناطق المختلفة فى عمليات إنشاء المشاتل والاستزراع.
- الأخطار التى تتعرض لها بيئة أشجار المانجروف تتمثل فـي الأنـشطة الترفيهيـة ذات الصلة بالسياحة، الرعى والصيد الجائر ، التحطيب من أجل الوقـود، التلـوث بأشـكاله المختلفة ، والكثير من الأنشطة البشرية والتنموية وخاصة الأنشطة السياحية.
- تم تنفيذ الكثير من البرامج التدريبية والتعليمية والوعى البيئى وذلك من خلال عقد العديد من ورش العمل وإصدار المطبوعات ذات الصلة.
- الدراسة الإجتماعية – الإقتصادية التى تمت شملت : نمط استخدام أشجار المـانجروف، خصائص المجتمعات المحلية، العائدات، مداركهم بشأن أهمية أشجار المانجروف، التعليم، الوضع الإجتماعى، الخدمات التى تقدمه السلطات المحلية، والمعـارف التقليديـة بـشأن أشجار المانجروف.
- تم تقييم أهم الأنشطة شاملة أعمال الصيد، الرعى،السياحة ، استخدام الأشجار ، الوظائف التى تقدمها السلطات المحلية للسكان، المناظر الطبيعية واستخدام الحياة البرية قاطنة بيئية أشجار المانجروف.
- بلغ متوسط الدخل الشهرى للعاملين بالصيد ٢٥٠ جنيه مصرى، وتتركز معظـم أعمـال الصيد خلال فترة الربيع. كما يستفيد بعض السكان المحليين من أعمال السياحة وخاصـة فى مناطق نبق (خليج العقبة) والقلعان (محمية وادى الجمال بالبحر الأحمر) .

- بلغت الكثافة العددية لـ 5 قرى ٤٣٧ فرد ومتوسط أفراد العائلـة ٤,٦ فـرد ويتواجـد المدارس الإبتدائية والإعدادية ، ومستوصف ومستشفى على بعد ٦٠كم من مرسى علـم. تقدم الكهرباء للسكان المحليين بدون مقابل.
- بتحليل الفئات العمرية، إتضح أن ٥٠% من السكان أقل من ٢٠ عام ، وتبلغ نسبة الإناث ٤٥%. الكثير من السكان حصل على التعليم الإبتدائى ، وتعتبر حرفة الصيد أهم الحرف حيث بلغت ٧٠% فى منطقة القلعان، ٣٥% فى حماطة، ٦٧ فى نوفا.كما تعمل نسبة قليلة (٨%) فى الوظائف الحكومية.
- يقوم الذكور بعمليات الصيد، بينما تقوم الإناث بتجميع الحيوانات البحرية قاطنـة بيئيـة أشجار المانجروف. يهتم الذكور بالجمال والإناث بالماعز. القليل جداً يعملون فى الزراعة . هناك زيادة ملحوظة خلال الأعوام القليلة الماضية بأعمال السياحة.
- ٤٠% من البدو متزوجون ، معظمهم من البحر الأحمر والقلة من صعيد مصر (١٣%) ومعظم عائلات البدو لديهم راديو ، تليفزيون ، بوتاجاز ، وثلاجة .
- معظم البدو لديهم إدراك كامل بأهمية أشجار المانجروف التى تعتبر أهم موارد معيشتهم حيث تستخدم فى أعمال الرعى (٤٥%) ، تقطيع الأشجار من أجل الوقود (٢٩%) وإعداد الفحم (١٣%) ، وتغذية الحيوانات الأخرى (١٣ %)

- تركزت استراتيجية استزراع أشجار المانجروف فى الـ ٣ محاور الأتية :

١. استزراع مباشر للبادرات البرية أو من المشاتل فى العديد من المناطق .
٢. تنفيذ عمليات استزراع فى مناطق تخلو من أشجار المانجروف ولكن احتمال الاسـتزراع عال نتيجة دراسة خواص التربة
٣. إعادة تأهيل بعض مناطق المانجروف التى تدهورت بفعل الأنشطة البشرية .

- بنهاية المشروع تم استزراع ١٢٥٥٠٠ متر مربع (٣١,٣ فدان) ، منها ٧,٥ فدان فى منطقة وادى أريار ، مستخدمين أكثر من ٣٠٠ ألف بادرة من المشاتل تم إنشاؤها فـى سفاجا ، القصير ، شلاتين ونبق . كما تم نجاح استزراع أشجار المانجروف من نـوع ريزو فوراً فى كل من حماطة والقصير .

- بتحليل صور الأقمار الصناعية التى تم الحصول عليها بنهايـة المـشروع ومقارنتهـا بالسنوات الماضية اتضح أن المساحة الكلية لأشجار المانجروف وصلت إلى أكثر مـن ٧٠٠ هكتار مقارنة ب ٥٢٥ هكتار عام ٢٠٠٢ .

- تم عقد العديد من الاجتماعات وورش العمل فى كل من نبق ، شرم الشيخ ، الغردقـة ، سفاجا ، وادى الجمال وشلاتين ، حضرها العـاملين بالمحميـات ووزارة الزراعـة ، السلطات المحلية ، السكان المحليين الخبراء والمستشارين ، خبراء منظمة " ITTO " وبعض المستثمرين .

- شملت الموضوعات التى تم مناقشتها والموافقة عليها المزيد مـن مـشاركة المجتمـع المحلى ، تنفيذ أنشطة اقتصادية جديدة ذات العلاقة بالصيد ، الـسياحة ، الاسـتزراع ، استدامة المشروع بعد انتهاءه ، استكمال البحوث والدراسات ، مواجهة الأخطار التـى تتعرض لها بيئة أشجار المانجروف ، برامج التوعية ، دور الحكومة والمجتمع المحلى بعد انتهاء المشروع .

- تم استخدام موارد المشروع فى مساعدة تنمية المجتمع المحلى شاملة العمالة فى عمليات الاستزراع ، التدريب ، إنشاء خلايا عسل النحل البرى ، وشراكة المجتمع المحلى فـى جميع أنشطة المزارع .

- تم إعداد خطة إدارة صون أشجار المانجروف والتى شملت تكامل أنشطة إدارة المناطق الساحلية ، التعليم ، الوعى البيئى ، إنشاء المزيد من المحميات البحرية ، الاسـتزراع ، التعامل مع المشاكل البيئية (التلوث البحرى) ، البحوث ، والمتابعة والتقييم الاقتصادى لأشجار المانجروف .

الوضع الراهن مقارنة ببداية المشروع

- توفير قدر كبير من المعلومات بشأن بيئة أشجار المانجروف .
- زيادة المساحة الكلية لأشجار المانجوف .
- توفير دراسة تفصيلية عن الوضع الاجتمـاعى والاقتـصادى وشـراكة المجتمـع المحلى.
- تواجد فريق متعدد التخصصات لديهم الأجهزة والمعدات اللازمة لتنفيذ برامج التقييم والمتابعة والاستزراع .
- إعداد خطة إدارة صون أشجار المانجروف .
- تحسين المستوى المعيشى للسكان المحليين .
- التزام الحكومة والسلطات المحلية والسكان المحليين بالحفاظ علـى بيئـة أشـجار المانجروف .

الدروس المستفادة :

أ. الدروس التنموية

- خلق فرص عمل جديدة للسكان المحليين وضمان تقبلهم للتغيرات الجديدة .
- تنفيذ القانون ليس كافياً ، ولكن يجب التنسيق مع جميع المنتفعين .
- دعم القيادة السياسية هام جداً .
- التجنب المبكر للنزاعات .
- الإدارة التلائمية والمرنة
- أشجار المانجروف مصدر للتعليم والتدريب والبحث العلمى .
- صون أشجار المانجروف يحافظ على المعارف التقليدية .
- ضرورة التعرف على أهم المنتفعين ذات الصلة القانونية لتنفيذ المـشروع بنجـاح (قطاع حماية الطبيعة).
- الشراكة مفتاح للإدارة المستديمة .
- حماية أشجار المانجروف من أهم الاداوات الفعالة لصون التنوع البيولوجى .
- أهم عوامل نجاح المشروع التنسيق بين جميع المنتفعين وضمان إشراكهم فى جميع الأنشطة .
- أشجار المانجروف ذات عائد اقتصادى هام .
- استدامة أنشطة المشروع بعد انتهاؤه التزام من جميع المنتفعين .

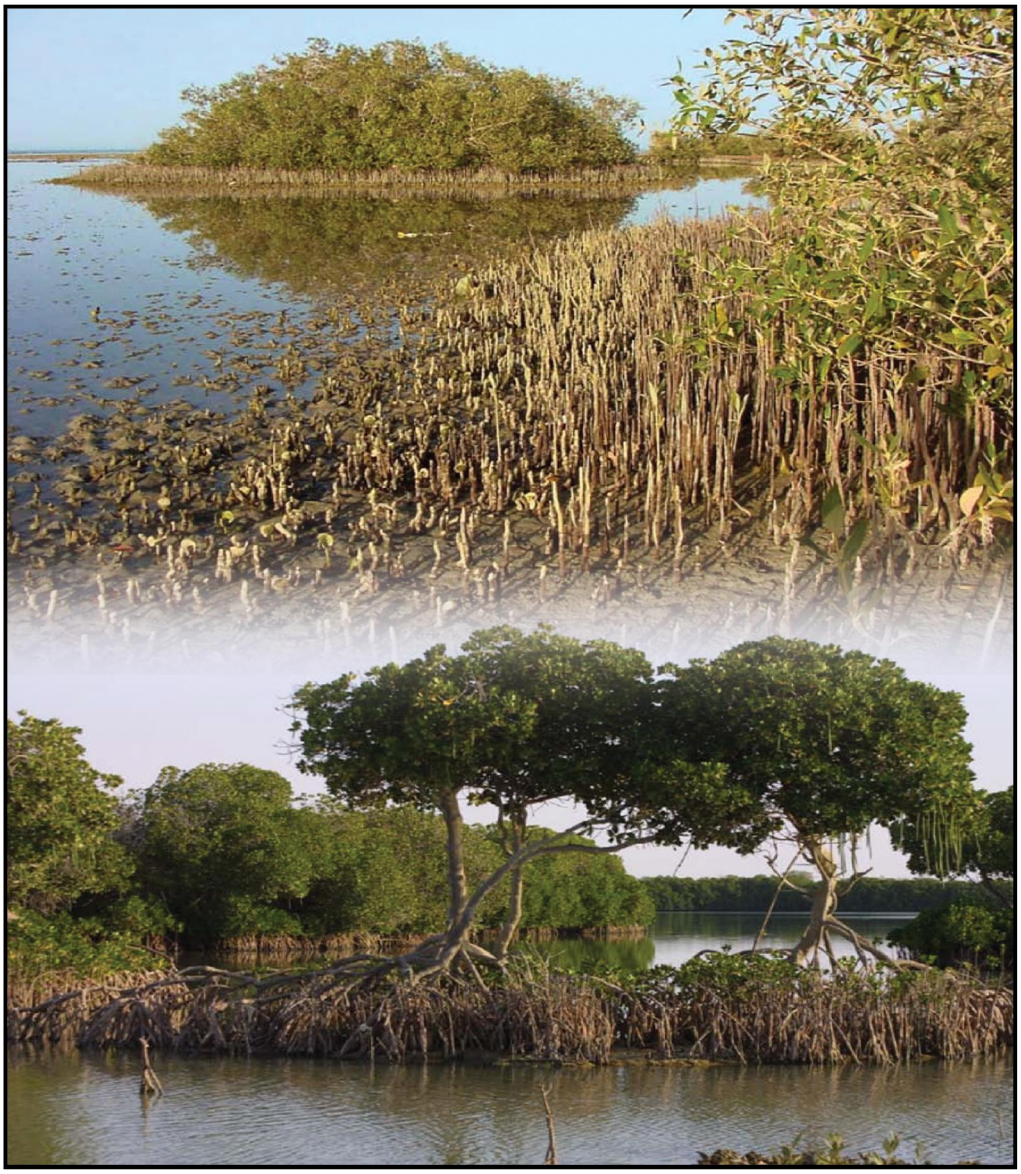
ب. الدروس التشغيلية :

- التنظيم الجيد لإدارة المشروع هو الاختيار الجيد لفريق العمل .
- ضرورة توثيق أنشطة المشروع بالطرق الحديثة (الرقمية) .
- المتابعة والتقييم دليل على جودة تخطيط المشروع .
- ضرورة تنفيذ أولويات العمل وفق فترة زمنية محددة .
- ضرورة تحديد دور ومسئولية الأجهزة المشتركة فى تنفيذ المشروع .
- لتفادى الاذدواجية ، يجب تحديد جهة قانونية تقوم بأعمال التنسيق والتعـاون مـع الجميع .
- ضرورة إشراك اللجنة الوطنية لإدارة المناطق الساحلية .
- تقييم المخاطر للأنشطة المخطط لها والأنشطة الفعلية التى تـم تنفيـذها بـصورة دورية، شاملة التكلفة والعائد .

التوصيات :

- مراجعة الحكومة المصرية والموافقة على تنفيذ خطة إدارة صون أشجار المانجروف بعد انتهاء المشروع .
- إقتراح أنشطة جديدة مستجدة ذات الصلة بالاستخدام المستدام لأشجار المانجروف ، والتوسع فى أنشطة خلايا النحل البرى فى بيئة أشجار المانجروف .
- إدراج خطة الإدارة فى أنشطة اللجنة الوطنية لإدارة المناطق الساحلية .
- التأكد على تنفيذ دراسات تقييم الأثر البيئى لجميع المشروعات التى تنفذ بالقرب من بيئة أشجار المانجروف .
- إنشاء مناطق عازلة (٥٠٠ – ١٠٠٠ متر) بين أشجار المانجروف وأى أنشطة تنموية .
- استكمال الدراسات الاجتماعية – الاقتصادية لأشجار المانجروف .
- استمرار برامج الاتصال والتعليم والوعى البيئى .
- استزراع المزيد من أشجار المانجروف كأحد أنشطة التأقلم مع التغيرات المناخية.
- المشروعات المستقبلية يجب ربطها بخلق فرص العمل والاستثمار والفكر غير التقليدى فى إدارة موارد بيئة أشجار المانجروف وإشراك السكان المحليين فى معظم أنشطة خطة الإدارة .
- تطبيق اللامركزية فى تنفيذ الأنشطة وتنفيذ القانون والشراكة مع المجتمع المحلى ودعم القيادة السياسية .

مشروع تقييم وإدارة أشجار المانجروف فى مصر:
الإستخدام المستدام والتنمية



ابريل ٢٠٠٩

ITTO

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جهاز شئون البيئة
Ministry of State for Environmental Affairs
Egyptian Environmental Affairs Agency

محميات مصر
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