Ecological Mangrove Restoration
Workshop Series

Proceedings Report

February 5-9 & 12-15, 2007

A Letter From MAP's Director

Dear Friends,

We at Mangrove Action Project (MAP) are pleased to bring the Ecological Mangrove Rehabiltiation (EMR) method to Sri Lanka through this pair of exciting workshops. MAP is actively promoting use of the six-step EMR method as an effective, long-term solution to degraded mangrove forests worldwide. Thank you to IUCN and Diakonie Emergency Aid for their kind financial support of these workshops.

MAP is currently building regional mangrove restoration teams to continue training mangrove restoration practitioners in the precepts of EMR leading into on-the-ground mangrove rehabiltiation projects in Asia, Africa and the Americas.

Recent studies reveal that one hectare of mangroves sequesters 3.2 tonnes of carbon per annum. Yet, our planet is losing 225,000 hectares of mangroves yearly. The EMR method has the potential to restore our mangrove forests' capacity to function as a large-scale carbon sink, mediating the prolonged effects of global warming.

Conserving and restoring mangroves is a win-win solution for protecting life on this planet. We at MAP urge you to join us in this important effort!

Sincerely,
Alfredo Quarto
Executive
Director
MAP

WORKSHOP #1 - TANGGALLE

Held at the National Aquactic Resources Research & Development Agency (NARA) center with a beautiful view of Rekawa Lagoon, this first workshop brought together mangrove restoration practitioners from Sri Lanka and abroad for a five-day technical training on the "Ecological Mangrove Restoration" method pioneered by Robin Lewis. Robin, armed with 710 powerpoint slides, led us through the six steps of successful mangrove restoration with emphasis on case studies. Several other guest speakers delivered presentations from Sri Lanka, India and Indonesia. Participants spent a full day in the field, looking at restoration attempts in-situ and practicing survey techniques for determining mangrove zonation in a reference forest. Included in this report are: a discussion of key concepts of the workshop , plans for follow-up, the formation of a Sri Lankan network for mangrove rehabilitation, and a summary table of participant workshop evaluations

WORKSHOP #2 - AMPARA

This second workshop primarily involved fisherfolk leaders from local fisheries societies located along the Eastern coast of the island. These leaders are involved in mangrove restoration activities and desired training in additional techniques for mangrove restoration. The group was also interested in developing integrated mangrove awareness and conservation programs, emphasizing the development of sustainable livelihood alternatives and non-timber forest product uses of mangroves as well as environmental education. The workshop was participatory in nature; involving participants in small-group work, interactive discussions, and field trips where participants gained hands-on field experience. The workshop utilized sections of MAP's action research-problem solving curriculum "Do Your Own Mangrove Action Project," which is being translated and printed for participants along with other MAP resources, such as the EMR Handbook, and a mangrove cookbook. Toward the end of the workshop, three small groups prepared action plans for disseminating the information they learned back in their own communities, an activity that will be supported by Sewalanka Foundation.

MANGROVE ACTION PROJECT MAP

SEWALANKA FOUNDATION

BACKGROUND

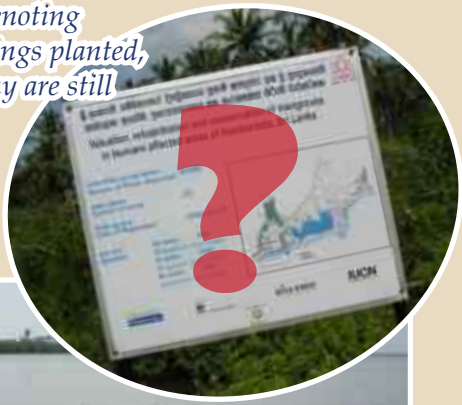
Since the December 2004 tsunami, there has been a mounting call for re-establishing protective greenbelts along coastlines. Although the jury is still out on the extent to which mangroves mediate tsunami damage, mangrove forests are proven effective barriers against tropical storms and strong wave action. How effective depends on a number of factors, such as, the density, width, height, and complexity of the mangrove forest, as well as the bathymetry of the coastline and other oceanographic factors. What is more clearly understood is that mangroves provide many benefits to coastal populations in terms of economic goods and ecological services, such as, fisheries production, medicinal use, wastewater treatment, provision of building materials, bird and mammal habitat, eco-tourism value, etc. Mangrove forests are valuable ecosystems which are currently extremely undervalued and they require long-term protection and conservation.

Much of the post-tsunami effort to restore coastal greenbelts involved simple planting of mangrove seedlings and propagules. Already, there have been numerous failures due to planting of inappropriate species, in inappropriate locations, but in general failure occurs due to a lack of understanding of the restoration site itself. What was its history? What mangroves grew there? Where did they grow? What were their hydrological requirements? How deep was the substrate in which they grew? What were the fresh water inputs to the area? Where did exchange of tidal and sea water take place? Contrary to popular belief mangroves require some freshwater to grow well, and they are submerged only around 33% of the time. Planting mangroves along an exposed coastline, in too deep water without fresh water input is a recipe for failure.

Much money was spent after the tsunami in developing mangrove seedling nurseries while little money or time was put into determining the site-specific needs of mangroves at each restoration location. The resulting failure of many restoration projects is discouraging to all parties involved, not least the local communities which need positive encouragement to restore and protect mangroves, rather than discouragement over project failure. We need a more holistic approach to mangrove restoration, based on ecological mangrove principles, which involves local stakeholders in planning, implementation and monitoring, working with (not against) nature by encouraging natural regeneration and planting mangroves only for very specified reasons where natural propagules are not available.

Mangrove Action Project together with Sewalanka Foundation facilitated two workshops entitled, "Community Based Ecological Mangrove Restoration Training" in order to address the above issues. These hands-on workshops were designed so that local mangrove restoration practitioners, local NGOs and community members could actively participate in learning the basic principles of ecological mangrove restoration (EMR) techniques. MAP firmly believes only such a long-term, holistic approach to mangrove restoration will effectively (in terms of cost as well as ecological success) rehabilitate mangrove forests to the point where humans and mangroves can benefit from one another's care and provender.

Post tsunami damage in Panama Lagoon



Signboard denoting 22,000 seedlings planted, but how many are still alive?

Planted too deep and grazed upon by cattle.

Numerous seedlings were planted here, but this damaged Sonneratia caseolaris forest was already successfully regenerating on its own. If it ain't broke, don't fix it!

No shortage of nursery raised seedlings in Sri Lanka. How will they fare when planted?

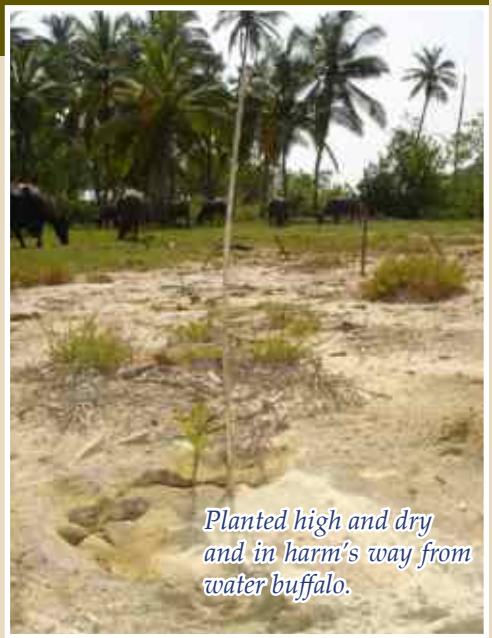
Current Mangrove Restoration Efforts in Sri Lanka

Over the course of the two workshops, we visited half a dozen restoration sites in Southern and Eastern lagoons. In every case, seedlings raised in nurseries (predominantly Rhizophora spp.) were planted regardless of their habitat requirements. Lagoon ecosystems tend to have very narrow margins in which mangroves survive, depending upon their tolerance for inundation, which is related to the depth of the substrate, the natural breaching of the lagoon and the amount of freshwater entering the lagoon throughout the various seasons. In most cases, we found mangroves planted at a substrate depth out of the natural range for mangroves in that area. This was tested by measuring substrate depth in a nearby healthy mangrove forest (named a reference or analogue forest).

In other cases, mangroves were planted at too high an elevation, perhaps where the tsunami deposited sand and sediments. In many instances we witnessed mangroves planted in cattle and water buffalo stomping grounds, another cause for alarm.

Signboards around the restoration sites touted 10,000 - 80,000 seedlings planted, but there was little evidence of survivorship, much less of maintenance and monitoring. Witnessing these failed projects first- hand provided participants with ample motivation to change their own strategies based on principles of Ecological Mangrove Restoration.

The outflow to the sea has been blocked by this permanent road. Planted seedlings, if they survive, could choke out this important waterway.



Planted high and dry and in harm's way from water buffalo.

WORKSHOP #1

WELCOME & INTRODUCTIONS

After an opening oil lamp lighting ceremony, Jim Enright provided a brief introduction to MAP and mangroves in the post-tsunami context. Noting that although the jury is out on whether mangroves play a damage control role in times of tsunami, there are numerous environmental goods and services provided by mangroves which are reason enough to conserve and restore these precious ecosystems.

MAP's focus is on conserving natural mangrove forests using various approaches, including advocacy, environmental education, sustainable utilization of mangroves, community-based mangrove management and lastly restoration. This workshop; however, will focus almost entirely on *mangrove restoration*, as there have been numerous examples of pre- and post-tsunami failures in mangrove rehab.

MAP promotes a six-step method to successful mangrove restoration called "Ecological Mangrove Restoration (EMR), the key points of which are to....

1. Understand autecology (individual species ecology) and the ecology of the mangrove community;
2. Understand normal hydrology;
3. Assess modifications to hydrology or added stress;
4. Select the restoration site based on technical, political, social and economic considerations;
5. Restore or create normal hydrology, or remove or reduce stress; and
6. Plant mangroves only as needed!

Understanding these six steps will be the main focus of this first workshop. Through field trips and a series of powerpoint presentations by Robin Lewis, participants will be expected to understand that one cannot expect to meet mangrove restoration goals by planting mangroves alone without application of the EMR principles.

Mangrove restoration will also be looked at in the specific context of Sri Lanka, and we will have presentations from local mangrove experts, as well as mangrove restoration practitioners, to help us better understand Sri Lanka's particular situation. MAP has also brought experts from India and Indonesia who have been involved in mangrove research and implementation of the EMR method.

GUEST SPEAKERS

Ruhuna University, Sri Lanka

PhD. Jayatissa of Sri Lanka gave two presentations. The first on the mangroves of Sri Lanka and the second an assessment of tsunami impacts on mangroves in Sri Lanka. The audience learned about the distribution of various mangrove species in Sri Lanka including rare and endemic species. Dr. Jayatissa noted that no one really knew for sure how many hectares of mangroves exist in Sri Lanka, with estimates ranging between 4000-12,000 hectares. Dr Jayatissa also took a closer look at the lagoon ecosystems of the island. Rekawa lagoon, where the workshop was located was discussed in light of a road project which altered the hydrology of the lagoon to the point of fisheries collapse in the 1990s. Examples like these highlighted the delicate nature of Sri Lanka's lagoons and the need for better science to enable managers to make appropriate management decisions.

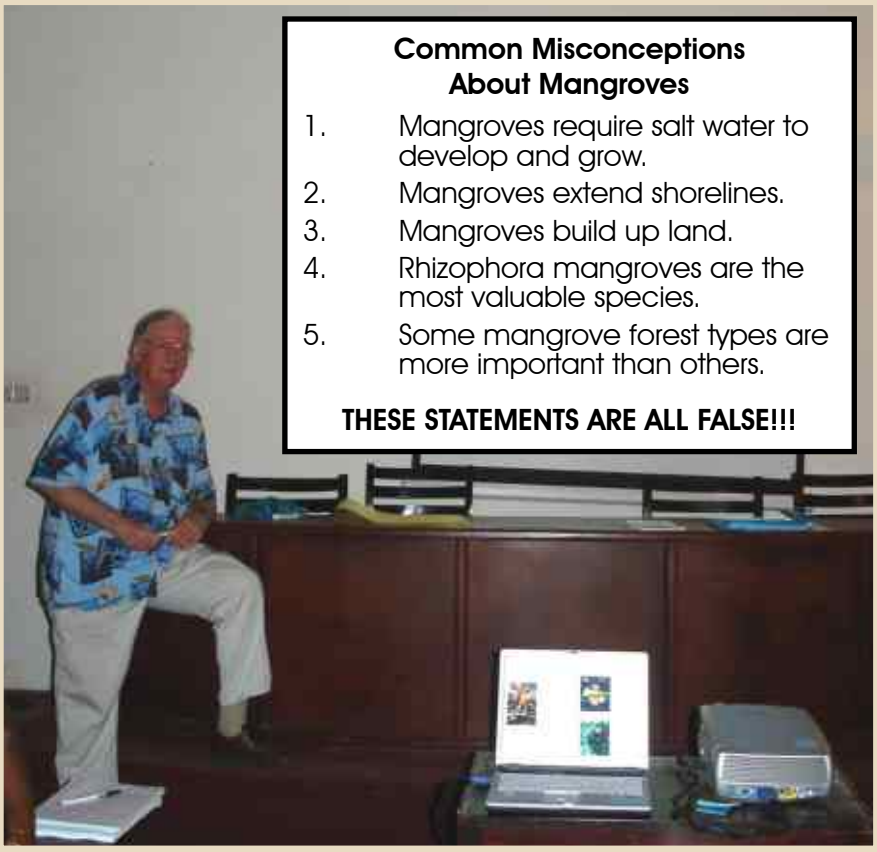
IUCN

Vimukthi Weeratunga, Biodiversity Coordinator of IUCN gave a presentation on community participation in restoration of Panama Lagoon and an important migratory bird habitat in Yala National Park which were both damaged by the tsunami. Their community work focused on fisheries societies and the connection between community and the mangroves in terms of economic value as well as appreciating biodiversity.

TCP

On day three, the Turtle Conservation Project gave a presentation on a pair of mangrove restoration projects in Rekawa and Puttalam Lagoons. Plantings in nearby Rekawa Lagoon admittedly failed, but TCP claims success in Puttalam Lagoon where a silvoforestry system has been worked out with local fisherfolk involving harvest of Rhizophora mucronata. Workshop participants, by this time well equiped with new skills and knowledge of EMR barraged TCP with questions and criticism. It was a sign that the status quo of mangrove restoration in Sri Lanka was about to change!

KEY POINTS OF ECOLOGICAL MANGROVE RESTORATION



Roy R. "Robin" Lewis III, Certified Professional Wetland Scientist, President, Lewis Environmental Services, Inc., Tampa, Florida, USA, has more than three decades of experience in marine wetland research, publishing more than 70 scientific papers on mangrove and seagrass restoration, and has worked in eleven foreign countries on mangrove restoration projects, including Nigeria, Vietnam, Hong Kong, Thailand, Cuba, Mexico, and Costa Rica.

This was Robin's first visit to Sri Lanka (affectionately renamed Sierra Lanka). Robin's mission was to pass on skills and knowledge of successful mangrove restoration techniques to active mangrove restoration practitioners working in Sri Lanka. The following six step approach has been developed to be applicable all over the world.

Six (6) Steps To Successful Mangrove Restoration

1. Understand both the autecology (individual species ecology) and community ecology of mangrove species at the site, paying particular attention to patterns of reproduction, propagule distribution, and successful seedling establishment;

2. Understand the normal hydrologic patterns that control the distribution and successful establishment and growth of targeted mangrove species;

3. Assess modifications of the previous mangrove environment that currently prevent natural secondary succession;

4. Select an appropriate mangrove restoration site through application of Steps 1-3, above, that is both technically likely to succeed in rehabilitating a healthy mangrove ecosystem, and also takes into consideration resolution of land ownership/use issues necessary for ensuring long-term access to and conservation of sites;

5. Design restoration programs at appropriate sites selected in Step 4, above, to initially restore the appropriate hydrology and take advantage of natural volunteer recruitment of mangrove propagules for plant establishment;

6. Utilize actual planting of propagules, collected seedlings, or cultivated seedlings only after determining through Steps 1-5, above, that natural recruitment will not provide the quantity of successfully established seedlings, rate of stabilization, or rate of growth of saplings established as quantitative goals for the restoration project.

KEY POINTS OF ECOLOGICAL MANGROVE RESTORATION

Most mangrove restoration projects fail completely, or rarely achieve their stated restoration goals. What is the problem?

The answer to the question is that the technology to restore mangroves is well developed, and can be 100% successful, however the correct application of this technology is an infrequent occurrence.

So let's see how we can make mangrove forest restoration work, each and every time it is attempted, and do it in a cost-effective way

The three photos to the right depict a time sequence over 78 months from the completion of hydrologic restoration at a mangrove restoration site at West Lake, Florida, USA. At this site, no active planting was undertaken but all three Florida mangrove species became established. This work can be accomplished by excavation or backfilling of an area where substrate height has been altered to achieve the same general slope and the elevations relative to a benchmark at the reference site. Getting the slope and substrate height right will ensure that the hydrology of your site is correct.

In Sri Lanka, aside from directly damaging trees, the 2004 tsunami altered elevations and the general slope of mangrove forests by adding sediment and sand in some places and washing them away from others. Before attempting restoration, it is essential to understand the elevations and general slope of a reference mangrove forest in the same area. After rehabilitating the substrate you may wait for natural re-vegetation to occur (if there are enough mangrove seeds and propagules around(, otherwise the site can be planted.

Another key point to understand is that the lagoons of Sri Lanka, unlike most mangroves world-wide are not tidally dominated all the time, but there is a typical annual cycle of flooding and drying related to rainfall and groundwater inputs, coupled with the presence or absence of mangroves at certain elevations. These are the critical pieces of information needed for every lagoon on the island which will likely be different for each lagoon.

HAVING A FIELD DAY

Robin Lewis discusses mangrove species composition in this analogue forest (reference forest). An analogue forest is a healthy, natural nearby mangrove forest which acts as a living example for mangrove restoration practitioners. Performing several transect surveys and compiling data on which species grow at what substrate depth along the transect provides practitioners with an excellent template on which to pattern their restoration plans. (left)

A full-day field trip around Rekawa Lagoon was on the docket for Day 3 in order to assess mangrove restoration efforts and perform transects in a reference forest. Four field sites were investigated. It was noted that most mangrove restoration efforts in Rekawa appeared unsuccessful, ignored principles of autecology, hydrology and analogue forestry and were not being maintained or monitored. By the end of the field trip, the group had a firm understanding of several key principles of EMR. This will provide participants with a solid foundation for mangrove restoration planning in the near future.

Taking salinity measurements inside the reference forest for later comparison with the open lagoon. (above)

The majority of restoration efforts in Sri Lanka's lagoons entailed planting Rhizophora apiculata or R. mucronata beyond the edge of the natural forest boundary. The natural boundary in most cases provides a clear sign that mangroves will not survive further out into the lagoon, perhaps due to overlong periods of inundation. (above left). In some cases, planted seedlings are surviving and growing beyond the apparent natural edge of the mangrove. This is the exception however rather than the rule. (above right)

The group took their own transect measurements to understand the natural zonation in a reference forest. (bottom left). These transects were drawn onto mural paper back at the NARA center and shared with the group. Six to nine species of mangroves appeared along the transects running perpendicular from the terrestrial edge out into the lagoon. Robin suggested setting up a datum on shore in order to be able to chart the surface water height throughout the year and better understand the hydrological requirements of Rekawa's mangroves.

MANGROVE ACTION PROJECT

PhD. Oswin Stanley hails from Tamil Nadu in India but is based in Gujarat where she directs the Eco-Balance Consultancy. Oswin has been involved in two previous EMR workshops and was invited to co-facilitate this round of workshops in Sri Lanka. Dr. Stanley presented on Lagoon Ecology, based upon her 9 years of experience in Muthupet Lagoon where she prepared her doctoral thesis. This presentation took a detailed look at mangrove flora and fauna in a lagoon ecosystem as well as bio-physical parameters of lagoon ecology, including hydrology. This presentation provided participants with a solid overview of lagoon ecology useful in better understanding these dynamic and easily impacted ecosystems in Sri Lanka.

Ben Brown of MAP Indonesia gave two presentations on mangrove restoration projects in Sulawesi and Sumatera. The projects depicted the integrated nature of mangrove conservation and management and underlined the importance of involving local community in all processes. The Sumatera work saw the active restoration of over 100 hectares of mangroves and the conservation of a total of 583 hectares. From setting the legal framework for community co-management, to technical mangrove restoration planning and implementation, to development of sustainable livelihood alternatives, MAP's work in Indonesia is concerned with long-term ownership and involvement of communities in mangrove protection.

NGO's WORKING IN SRI LANKA

Sewalanka

IUCN performed a socio-economic and biological survey. Species for nursery were selected based on local species availability (akin to looking at an analogue forest in terms of composition only). Local fishery societies volunteered for mangrove rehab (except for a paid nursery manager), in exchange for a community facility. Worked in two sites: Panama Lagoon and Thirukovil. Nurseries are already constructed or under construction in both sites. Lots of stakeholder involvement and interaction between community groups. Interested in new activities such as livelihood development, community-based aquaculture and development of non-timber forest products from mangroves.

Saviya Development Foundation

Working in Madhu Ganga River which resembles a lagoon. 770 ha of mangrove area. Bruguiera gymnorrhiza, B sexangula, R. apiculata and R. mucronata are grown in the nursery and planted. No monitoring yet. There is an awareness program for children. During a 2001 wetland biodiversity program with IUCN discovered Lumnitzera littorea which is thought not to exist elsewhere on Sri Lanka. Only 10 trees exist with a high level of insect infestation and no natural establishment.

EMACE

Work on Bolgoda Lake. Their project focused on pollution control involves networking with CBOs and NGOs. Global Nature Fund and European Aid support a program on awareness (stakeholder facilitation), research (sawdust survey for composting, sale to cement factory), as well as solid waste and waste oil management It came up during Q&A to contact IDEA and ENERGIA which have Sri Lankan programs and may be able to assist with solutions to utilization of sawdust for livelihoods and pollution control.

GREEN Movement

Work in Kogala Lagoon after an oil tanker wrecked on the reef outside of the lagoon and spilled oil into the lagoon damaging mangrove flora and fauna. A boom was built at the mouth of the lagoon to control oil pollution. Now there is an effort to rehabilitate mangroves destroyed by the spill.

Rainforest Rescue International

Began working in coastal area after tsunami. Programs include well cleaning (8000+), provision of 250,000 seedlings for agriculture, coastal home garden and ecosystem program with livelihoods and ecosystem restoration components and creation of a mangrove nursery (30,000 seedlings of mixed species). Related to EMR, RRI will embark upon upper watershed erosion control for preservation of tidal prism. RRI also offered a training on analogue forestry for all takers.

ICEI

Planting has been undertaken in two lagoons (Pottuvil and Thirukovil) with fisheries societies. Nurseries have been constructed and plants reared based on species listed during a biodiversity study. FAO will be funding a Batticoloa-based professor to conduct a survey on zonation but not yet hydrology. There is a serious issue in Eastern lagoons of conflict between rice farmers and fisherfolk. This needs resolution before ecological mangrove restoration can be undertaken.

NETWORK BUILDING

At the end of the first workshop, a discussion was held upon the lawn to discuss the importance of staying in touch with one another through a Sri Lankan mangrove restoration network. (Right)

Francis of Sewalanka (slffisheries@gmail.com) will coordinate the start-up of a Sri Lankan mangrove network until May, after which Gayani will take over much of the responsibility. It is suggested that a yearly network manager should be elected, but it is really the workshop participants and other mangrove supporters who will make this network live and breath. The process must be collaborative and voluntary in order to succeed.

Below are some of the major points of the discussion on networking.

1. People stated they wished to have the opportunity to visit other organizations sites to see what work they were doing and learn form their techniques. Are any organizations willing to select a day and make an open invitation for members of the group to visit them some time in March or April?

2. Participants all agreed to submit a short info sheet on their work. Previous projects, current work, project aims and goals, methodologies, and current stage of implementation should be included. These will be compiled by Gayani at Sewalanka (mangproject@gmail.com) – who will collate them and redistribute the completed document.

3. People wanted to have a contact list. This is to consist of all the best people to contact within each government department, organization, and NGO for different mangrove project related matters. This includes gaining government permission for projects, finding out what work different organizations and departments are currently involved in and anything else that people in the group think is important.

4. A second list of contacts for resource people was suggested. This list would consist of people with specific skills to offer in areas related to mangrove restoration. Examples include knowledge of EMR techniques, GIS mapping skills, hydrological engineering skills, species identification and biodiversity knowledge and other such areas.

Also organizations should make known the resource people that they have available for use by other members of the group. Short term use of resource people (1 – 2 days) would be expected to be free but long term sub-contracts/secondments could be negotiated between the groups.

Resource people would also be encouraged to come together to help with joint trainings of CBOs, this will be something that the group will aim to focus on in the future. Proceeds from the field guide (discussed in point 5) could be used to support community awareness sessions given by the group to rural Sri Lankan communities?

5. Creation of a Sri Lankan mangrove field guide was suggested. What format should this be in? Will it be published? Where will the profits go? How will we collect the data? Who will collate the information and author actual book? These are all questions that need to be discussed over a list-serve.

6. The group agreed to circulate restoration plans before implementation, which will allow for feedback from the rest of the group, helping us to identify potential issues and provide solutions or alternate methods for achieving the project goals. Robin, Ben and Jim of MAP are also willing to review and comment upon restoration plans.

PLUS - MINUS - CHANGE

☺	☹	Δ
MAP coordination	Food was too unvaried	Go beyond EMR
Teachings/information	Too much lecture, sometimes boring	Planned actions as outcome
Time management between sessions	Need Sri Lankan trainers, Sri Lankan graduates that know about our mangroves (ex. Dr Jayatissa)	Similar trainings to administrators and policy makers
Composition of participants	More techniques for involving community in planning and implementation of restoration activities	Awareness program and materials on hydrology for wide dispersal
Excellent teachings by Lewis and Power Point's	Printed material of Robin's slides	Need more group activities and fun activities
Notebook with Power Point slides	No negatives, the workshop was done well	More discussions
Beach Resort	Not sufficient to local experience, need to apply your experiences to Sri Lankan situation	More field visits. Spend one night in the mangrove forest
Food	Not info time spent on local species/autecology	No need to change
Transport	More individual design exercises in the field	Include a local mangrove expert for the entire workshop
Excellent knowledge base on mangroves, ecosystem, biodiversity and restoration	Chance to practice restoration planning	Small exercises as team building activities
Field trips for understanding Sri Lankan situation		More short interactive sessions of about 10 minutes that allow us to apply what we have been taught and reaffirm that knowledge possibly including some home work.
Hand-outs/additional information		Some sessions early on where people are helped to find their voice so they will ask more questions later on.
Security		
The activities were free		
Network building exercise		
Future references		
Organization of workshop/material		
Manuals		
Learned about selecting best species for restoration based on locally occurring zonation in reference forest		
Good mix of theory and experience		

RESPONSES ON THOUGHT QUESTIONS

Question #1: Of the new skills, knowledge, information that you gained from this workshop, what are most important to you?

Question #2 What do you commit to doing with this new information when you get back to your communities?

Learning about the reference forest was a new concept for me. Always need to study a nearby analogue forest, its structure, species composition and history in order to make a good prescription for restoration.

Community participation is key to a successful restoration project.

Mostly we had planned to replant mangroves just using relatively easy [to gather and stick in the ground] *Rhizophora* spp. BUT, from this workshop we came to know that this is not the ideal situation and *Rhizophora* is not the universal species to be cultivated in all sites. So now we are ready to change our restoration plan to include:

- correct hydrological survey
- use of a reference forest
- hydrological restoration over just planting activities.

Awareness program for local community is essential emphasizing economic and social benefits of mangroves.

I would like to learn more on how to do hydrologic and topographic surveys with little money and a low amount of experience.

Interviewing villagers to understand the history of the mangroves and species composition is a very good idea

Most of my projects are under a year in length and not very successful. I have decided projects need to be longer, longer planning processes and long term monitoring are essential.

Most important aspects of EMR? Everything!!! From Step 1 to Step 2, I was previously clueless.

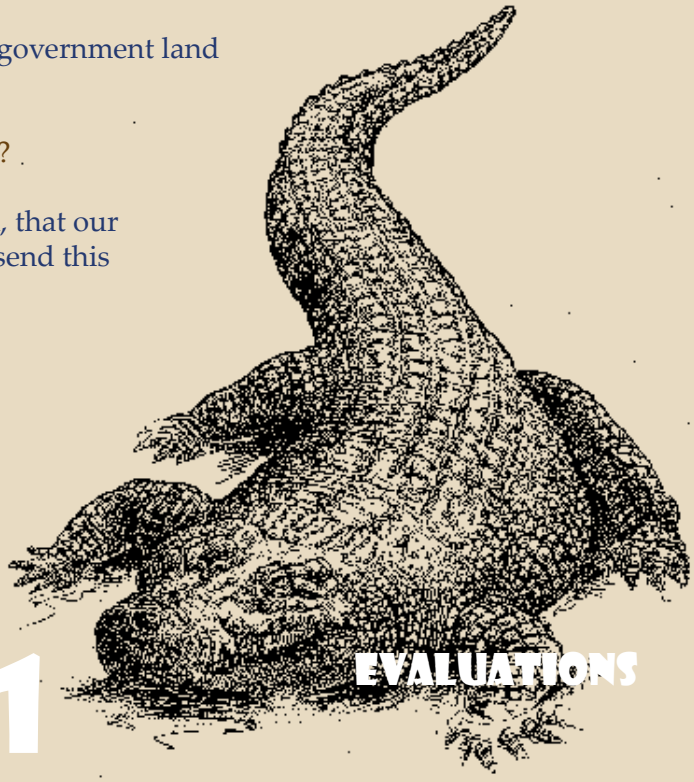
I still need to learn how to carry out surveys of physical, chemical and biological parameters of a proposed site, the scientific steps to be taken to approach such work.

Has the workshop changed your plans? Definitely! Now I realize the importance of maps, photography, and complete scientific studies as well as data collected from the surrounding communities. Gotta start all over in planning our project to take a more scientific approach. THANKS! A LOT OF PEOPLE LEARNT A LOT!!

We should unite our efforts to take back shrimp ponds on government land and rehabilitate one for a demonstration.

How does aquaculture pond effluent affect the mangroves?

When we were kids, we didn't get this kind of information, that our mangroves are valuable and need protecting. We need to send this message to the next generation.



WORKSHOP #2

The second workshop began with an overview of Ecological Mangrove Rehabiliation by Robin Lewis. First Robin enlightened us to the truth behind some key misunderstandings of mangroves. This led into a comparison between mangrove planting projects and ecological mangrove restoration and an overview of the Five (5) Step Method developed by Mr. Lewis. After Robin's introduction to key concepts, the group loaded into a bus to prepare for a field trip to Panama Bay.

The participants split up into three groups to explore Panama Lagoon by boat and by foot, looking with new eyes at mangroves destroyed by the tsunami, planted seedlings and reference forests for the area (forests still intact). The concepts of autecology and hydrology, first mentioned in Robin's presentation were brought to life in the field.

The participants were also asked to gather information in order to draw a mural of the present-day condition of the lagoon.

PANAMA LAGOON

Remote sensing images are hard to come by in Sri Lanka due to military control as well as slow internet connections (making access to programs such as Google Earth difficult)

Workshop participants got around this issue by climbing a dune in Panama Lagoon for a better vantage point from which to draw their mural of the present-day condition of the lagoon. (*left*)

The local group from Panama takes a look at a mangrove area damaged by the tsunami and replanted with *Rhizophora mucronata* seedlings. (*below left*) They compared this site to a nearby forest still in tact which they felt would serve as a good reference forest. (*below right*) This forest showed a typical zonation pattern of *Excoecaria agallocha, Lumnitzera racemosa, Avicennia marina* and *Rhizophora mucronata* (from terrestrial to lagoon edge). The group commented on how this differed from the planting regime of *Rhizophora mucronata* only.

Here the groups were asked to complete their mural drawings of the present-day condition of Panama Lagoon. They presented their drawings to the group for verification.

Next the group was challenged to create mural drawings of the lagoon 30-40 years ago. Since access to old aerial photos is impossible, they had to think of a way to get information from two generations ago.

The group came up with ten specific interview questions that they could pose to community elders from Panama Lagoon such as:

1) What types of mangroves grew in the lagoon in the past and where?

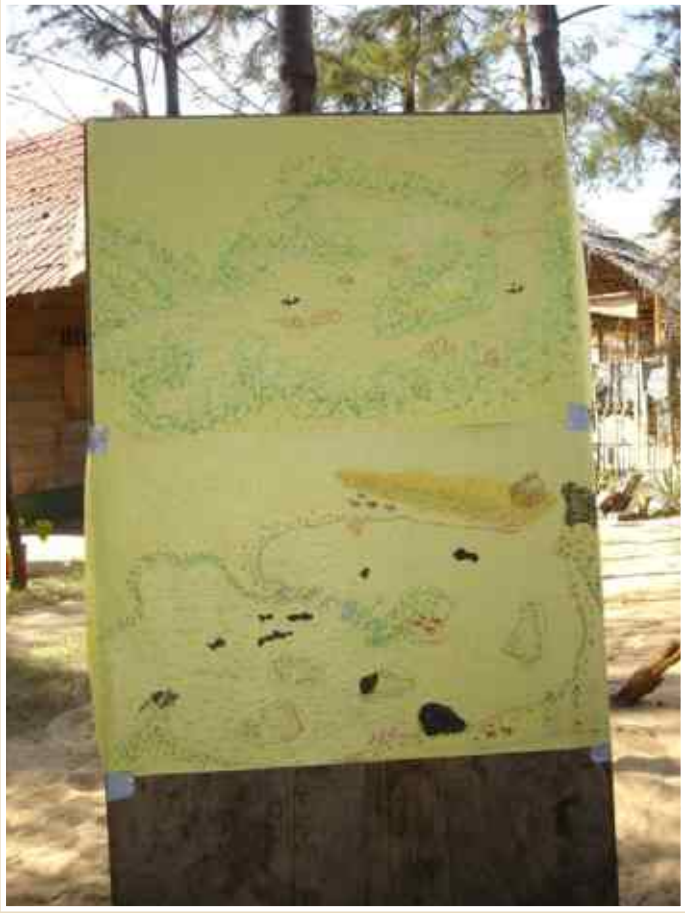
2) How did people fish in the past, what kind of equipment did they use?

3) Did cattle and buffalo use the lagoon for grazing in the past?

Then the group went to work on their past mural drawings. (*below left*) These were interpreted by a workshop facilitator in front of the group, who circled notable changes over time. These drawings were used to help the group visualize how mangrove habitat has degraded over time and what other effects these have had on community, such as decrease in fisheries. We can't go back to the past, but by understanding the past and present, we can visualize changes we need to make to ensure a bright future for the lagoon.

The day closed with a review, but also some time to check into the further learning desires of the group. Participants wanted more information on hydrology, autecology and sustainable utilization of mangroves. This was built-into the program for Days 3-4.

The day began with participants pairing up with a "friend that they haven't met yet" and learning about each other.



We started out in Pottuvil Lagoon, learning a little from the local community about their eco-tourism program focused on guided nature tours of the lagoon. Certainly a positive economic incentive to protect the lagoon.

Today was the day for the participants to sharpen their field skills in autecology and hydrology by performing transect studies of the lagoon in both a reference forest, as well as a section replanted by the forestry department, a representative of which was present for Days 3 & 4 of the workshop.

Taking measurements in the reference forest. Seven species of mangroves existed along the transect, at a maximum water depth of 40 cm. Several species of aquatic grasses notably served as nurseries for young mangroves (and crocodiles as well). Each species was examined and remarks on its fruiting and means of dispersal were noted.

The transect in the government planted plot required a boat for travel to the deepest seedlings, which were struggling to grow in 70-85 cm of water. The shallowest planting depth here was 40 cm, whereas in the natural forest 40 cm was the deep water limit for mangroves. None of the mangrove species growing toward the terrestrial edge such as Avicennia, Bruguiera, *or* Exoecaria *were planted.*

Back at Aragumbay, the groups drew out their transects on mural paper, quickly revealing the failure of the planting by the forestry department. It was concluded that planted seedlings were being submerged for too long a period, resulting in stunted growth and mortality. The participants broke into small groups to make recommendations to the forestry department on how they could go about planning for successful restoration of the area. The plan included: 1) involving local community in planning and implementation; 2) making hydrological measurements in 2-3 reference areas; 3) imitating mangrove zonation from reference areas in future plantings. The representative from the forestry department present at the workshop suggested the group formulize the plan and bring it to the head of the department.

SPECIAL TOPIC - SIGNS OF STRESS

When mangroves are submerged in water for too long a period of time they need to be creative in finding enough air for their roots (as a way of dealing with hydrogen sulfide in anoxic soils). One way they solve this problem is by the use of lenticles - pores which protrude from the bark and are able to "breathe" in the air above the waterlogged soil and ventilate the roots, creating a barrier to toxic hydrogen sulfide in the soil.

In cases where mangroves are stressed from extreme periods of inundation, these lenticles become larger; through a process called *hypertrophy*.

In most of the the lagoons we looked at, the size of the lenticles increased dramatically the farther we moved out into the lagoon. Paying attention to lenticles on living trees may give clues as to the waterside limit for mangrove growth.

During the morning of the final day, participants had a chance to pursue topics of interest. A small session on monitoring took place followed by a discussion on non-timber forest products and other sustainable uses of mangroves including environmental services they provide. Sewalanka remarked that they would follow up on this discussion by facilitating the continued exploration and development of sustainable utilization of mangroves.

Next came a review which covered the major topics of the entire training. The group, already clever to start with, had absorbed a great deal of NEW information during the four-day training; information which they would have to pass on to their communities in order to make the deepest impact in terms of mangrove restoration and conservation into the future. Again, participants broke up into small groups with the task of creating a plan for dissemination of new skills and knowledge amongst their communities. They were asked to address; "WHO they would have to present information to...WHAT information was to be presented....and HOW to best present new skills, knowledge and ideas....?"

Upon reconvening, the groups presented their plans for dissemination. One group prepared a draft brochure and poster to present their ideas. The others presented their action plans orally. Summaries of the plans are below:

ACTION PLANS

WHO?

School students
Community fisheries societies
Other community groups
(Women's societies, farmer groups, sports teams, youth groups)
Environmental conservation groups
Forestry/Fish and Wildlife department
Government officials

WHAT?

What mangroves are
What are different types of mangroves?
Fauna in mangroves
Direct uses of mangroves (goods)
Info on indirect value of mangroves (services)
Causes of mangrove destruction
How do we conserve mangroves?
How to get involved?
Whom to contact for more details?
Mention sponsors!

HOW?

Workshops like this
Direct field visits, study tours
Short documentaries & Films
Brochures, Posters, Notice board
Powerpoint presentations & video
Ayuvedic medicines television show
Outreach Assistance from Government
Half-hour program for MTV starring Ben, Oswin, Jim and Frank
Cultural infusion (traditional dances) to present mangrove information
Lectures to government and school students
Action planning and implementation
Seminar to public service department
Support environmental studies
Drawing competition
Curriculum

PLUS - MINUS - CHANGE EVALUATION

☺	☹	Δ
On time, good logistics	No schedule for first day programme	First day programme should be included and formatted
Much new information	Not shown the industrial side regarding mangrove	More practical training
Games/activities during programme	Mosquitoes in rooms	Some allowance
Multimedia presentations	Tamil translation not good	Tamil translator
Field Trip	More toilets	Participation from government officers responsible for mangrove restoration and management is needed.
Good participants	Room facilities	Relevant translated materials
Teaching methods	Some participant behavior is not good	Certificate
Food & accommodation (hotel staff behavior - Thanks Ranga!)		We are very interest to get more knowledge from MAP
Explanation of analogue forest		
Transport arrangements		
Training materials		
Knowledge about mangrove restoration, planting and nursery management.		

SUMMARY OF THE WORKSHOPS

MAP is very pleased with the outcomes of the pair of workshops held in Sri Lanka and this has everything to do with the eagerness to learn and the high level of commitment, skills and knowledge of the participants going into the workshop. Coming to understand the methods of Ecological Mangrove Restoration served to open the eyes, hearts and minds of the participants to think critically about previous and current mangrove restoration practices in Sri Lanka and to rethink their own mangrove restoration plans in the near future. The participants need to be thanked for their hard work and pateince during the time-consuming but important process of translation between the Singhala, Tamil and English languages. Sewalaka Foundation must also be commended, not only for bringing us all together under one "canopy," but also for their pledged commitment to facilitating the continuation of Ecological Mangrove Restoration through information sharing, action planning and mangrove restoration activities. Mangrove Action Project is also eager to assist Sri Lankan practitioners in the effort to improve mangrove restoration practices, through better planning, better science and an increase in community involvement. We would like to express our heart-felt thanks to the many people and organizations who made this workshop series possible. For the mangroves!

National Ecological Mangrove Restoration - Technical Training Workshop Programme
5-9 February 2007 - NARA Center, Tangalle, Sri Lanka

Day 1 - Monday, Feb. 5 - Introduction to Ecological Mangrove Restoration	
8:30-10:30	Opening Ceremony • Oil lamp lighting ceremony • Welcome from Sewalanka, Ampara District Director • Introduction of EMR training, Francis Binney, Sewalanka • Background to EMR training, Jim Enright, MAP • Mangroves in Sri Lanka by Dr. L.P. Jayatissa, Ruhuna University
10.45-12.30	• Community participation in mangrove restoration in Panama lagoon & Yala National Park by Vimukthi Weeratunga, Biodiversity Coordinator, IUCN Sri Lanka • Assessment of Tsunami Impacts on Mangroves in Sri Lanka by Dr. L.P. Jayatissa, Ruhuna University • Q & A and discussion
13:30-14:00	• Group Introduction > mangrove species activity • Workshop expectations recorded on cards
13.30-17.00	• Ecological Mangrove Restoration Training – Robin Lewis
Day 2 - Tuesday, Feb. 6 - EMR Training	
8.30-9.00	• "The lagoon ecology and lagoon mangroves of India" by Dr. Oswin Deiva Stanley
9.00-10.30	• Ecological Mangrove Restoration Training – Robin Lewis • Turtle Conservation Project presentation on mangrove planting
10.45-12.30	• Ecological Mangrove Restoration Training – Robin Lewis
13:30-14:00	• Brief Case Study – EMR in Tiwoho, N. Sumatra, Indonesia – Ben Brown
14.00-16.30	• Ecological Mangrove Restoration Training – Robin Lewis
16.30-17.00	• Presentation on overview of the field site visit
Day 3 - Wednesday, Feb. 7 - Restoration Site Visits	
8.00-12:30	• Mangrove field site visit & transect at TCP site, Rekawa Lagoon
14:00-16:00	• Mangrove field site visit & transects near NARA Centre, Rekawa Lagoon • Follow-up of field exercise > mapping zonation transects > discussion
16.00-17.00	• Mangrove field site visit to Green Coast Project site near our hotel at Rekawa
Day 4 - Thursday, Feb. 8 - EMR Training	
8.30-9.30	• Case study "Rehabilitation Mangrove in Sumatra, Post Tsunami " by Ben Brown • Discussion on community participation in planning-implementation
9:30-17.00	• Ecological Mangrove Restoration Training – Robin Lewis
Day 5 - Friday. Feb. 9 - Networking Building and the Future of EMR in Sri Lanka	
8.30-10.30	• Presentations by GREEN Movement, SDF, EMACE, Sewalanka, RRI, ICEI
10.45-12.30	• Monitoring Mangrove Projects – Robin Lewis • Network Building - Sri Lanka Mangrove Network
13.30-14.30	• Mangrove Restoration of Shrimp Ponds – Robin Lewis
14.45-16.30	• Wrap up & Workshop Evaluation • Closing Ceremony

Community Based Ecological Mangrove - Restoration Training Programme
12-15 February 2007 - Aragumbay, Ampara, Sri Lanka

Day 1 - Monday, Feb. 12 - Introduction to Ecological Mangrove Restoration	
8:30-9:30	• Overview, Welcome and Introduction by Dr. Weerikoon, Sewalanka • Greeting by Mr. Jim Enright, MAP-Asia Coordinator • Greeting by Mr. Gunarajasingam Nagaraja, District Director, Batticaloa
9:45-12:30	• "Six Critical Steps Necessary To Achieve Successful Mangrove Restoration" a Powerpoint presentation by Robin Lewis • Q&A and discussion
13:30-17:00	• Field Trip to Mangroves to Panama Lagoon 1) Mangrove Ecology Walk; 2) Hydrology in the Mangroves 3) Assessment of barriers to mangrove growth; 4) Criteria based selection of appropriate mangrove restoration sites; (criteria; ecological and economically feasible, cognizant of land ownership/use issues) • Mural drawing of present day condition of lagoon
Day 2 Tuesday, Feb. 13 - Problem Identification through Mural Drawing	
8:30-10:30	• Ice Breaker: Getting to know each other through paired introductions • Why rehabilitate? (brainstorm) > identification of goods & services of mangroves • Conservation or Rehabilitation? What are your restoration goals? • Expectations of the workshop (small group)
10:45-12:30	• Mangrove field site visit & activities "Do Your Own Mangrove Action Project" • Presentation of murals of present condition of Panama lagoon by participants • Developing interview questions for to determine past condition of lagoon
13:30-15:30	• Mural drawing of past condition of lagoon (30 - 40 years ago) • Presentations & discussion of murals, issue identification, looking for solutions
15:45-17:00	• Problem solving strategies > example: managing livestock for mangrove conservation • Case study of Gujarat livestock problem 7 possible solutions; by Dr. Oswin
20:00	• Video - Green Belt Reports
Day 3 - Wednesday, Feb. 14 - Ecological Mangrove Restoration Training	
8:30-12:30	• Field Trip to Pottuvil Lagoon • Presentation on community based eco-tourism project at Pottuvil Lagoon • Transect activity in reference forest and Forest Department planting site
13:30-15:00	• Presentations of transect studies and group discussion
15:15-17:00	• Restoration planning for Pottuvil and Rekawa lagoons and presentations
20:00	• Powerpoint presentations at Ranga's • "Collaborative mangrove management, case studies from Sumatra" (Ben Brown) • "Mangrove plantation projects in India" (Dr. Oswin Deiva)
Day 4 - Thursday, Feb. 15 - Future Thinking	
8:30-10:00	• What do we want to learn / discuss on this final day? • Why monitor? • What is monitoring?
9:45-12:30	• How to monitor? Community based monitoring & use of remote sensing images • Setting up monitoring transects and performing calculations • Future networking & cooperation with Sewalanka • Workshop evaluation (Plus, Minus, Change) • Thank-you's and closing remarks

WORKSHOP #1 - PARTICIPANT CONTACT LIST

Roy R.Robin Lewis
Certified Environmental Professional
Professional Wetland Scientist
Certified Senior Ecologist
President - Lewis Environmental Services
Salt Springs, Florida, USA
PO Box 5430, Salt Springs, FL 32134-7880
Phone (888) 889-9684 or (352) 54-4842
Fax (813) 231-0983 or (352) 546-5224
Email: LESRRL3@AOL.COM
www.lewisenv.com
www.mangroverstoration.com
www.seagrass.biz

Jim Enright
MAP Asia Coordinator
Mangrove Action Project (MAP)
Yaotak Building B-206
31 Vienkapang Road
Amphur Muang, Trang 92000
THAILAND
Tel: ++ 66-75-226-258
E-mail: mapasia@loxinfo.co.th
Skype: jim.enright
www.mangroveactionproject.org

Benjamin M.Brown
Director – MAP Indonesia
PSAP - University of Gadjah Mada
Bulaksumar B-13
Yogyakarta-DIY
Indonesia 55281
Tel /Fax +62 274 901054/ 557845
Mobile: 08156813031
Email: seagrassroots@gmail.com
www.mangroveactionproject.org

Dr.Oswin D. Stanley
Eco-Balance Consultancy
6B, Umiya Park Society, Subhanpura, Vadodara-390 007, Gujarat, India
Email: dr_oswin@ecobalance.org
www.eco-balance.org

J.A.Saminda Lakmal (NAQDA Officer)
No: 49/1/E
Amunugoda- Imbulgoda
Mobile 0773680905

Ms.P.V.A.C.Lakmali
Sewalanka Foundation
432/A, Colombo road,
Boralesgamuwa
Emails: islander.organic@gmail.com
agriculture@sewalanka.org
Tel 0112545362-6
Fax 0112545166
Mobile 0773730273

L.D.B.Suriyagoda
Department of Crop Science
Faculty of Agriculture
University of Peradeniya
Peradeniya
Tel 0812388239
Email laiths@pdn.ac.lk

Gayani Wickramaracchchi,
Sewalanka Foundation
432/A, Colombo road, Boralesgamuwa
Tel 0112545362-6
Fax 0112545166

Email: Mangproject@gmail.com
192/10, Dawatagahawatte, Kesbewa
Mobile 0773321618

H.M.Priyantha Herath
173,Watuwatta
Dummalasuriya
Mobile 0714011897
Email: watuwatta@yahoo.com

Upul Jayathulaka
Sewalanka Foundation
432/A, Colombo road, Boralesgamuwa
Mobile 0776301632
Emails: upulkjm@yahoo.com
ujayathilaka@gmail.com

A.W. Amila Chanaka
Green Movemant of Sri Lanka
No.09, 1st lane,
Wanatha Road,
Gangodawila,
Nugegoda
Tel 0112817156 / 0114305274
Mobile 0779523600
Emails: Boiga_Amila@yahoo.com
bondu@greensl.net

J.M.D.A Dhanuka
General Secretary
YMCA Pamunugama
Office Suruwala Rd
Settappaduwa,,Panunugama No: 257
Kepungoda, Pamunugama
Email: bethani@bellmail.lk
Tel 0602319556
Mobile 0714259106

VGS Kumari
Kospelawattha
Horagoda, Teljjawila
Tel 0414925232
Mobile 0776532423
Email: Skvgamage@yahoo.com

M.P. Kumara
Nikaketiya
Ritigahayaya
Katuwana
Kumarampp@yahoo.com
Mobile 0716035682

Sajeewa Wathsala
Negenhiru Foundation
No 4/11
Patabendimulla, Ambalangoda
Tel/fax 0912256621
Email nagenhiru@sltnet.lk

K. Gamini Liyanage
Saviya Development Foundation
24/A Wewalwala Road , Galle
Tel 0912245781 (office)
0912264396 (Residence)

K.W. Zachin Amaraween
NARA
RRC Rekawa
Netolpitiya, Tangalle
Tel 0472242221

WORKSHOP #1 - PARTICIPANT CONTACT LIST

Saman S.Muthumala
Central Environment Authority
District Office/District Secretariat Complex
Hambanthota
Tel 0472222377
Residence – "Sisira"
Pollattara, Nakulgamuwa
Tel 0412255065
Email: dhbcea@sltnet.lk
www.cea.lk

W.G .Lasantha Kumara
NARA
R.R.C Rekawa
Tangalle
0472242221
Residence "Weeragiri"
Welipitiya, Middeniya
0475686313

Nethmi Dissanayake
EMACE Sri Lanka
No; 15, Mihiri place
Asiri Uyana
Katubedda
Moratuwa
Office Tel 06021645754 / 0112612837
Mobile 0777677982
Email: nethu.raindrops@gmail.com

Charith Senanayake
Rainforest Rescue International
37C Wackanagoda Rd
Galle
Tel 0912232585
Mobile 0773200007
Email: contact@earthrestoration.org

R.M.Harshani De Silva
EMACE Sri Lanka
No; 15, Mihiri place
Asiri Uyana, Katubedda, Moratuwa
Office Tel 06021645754 / 0112612837
Email globetrotterh@gmail.com 59/33, School lane
Nawala
Tel 0112866839
Mobile 0777623991

Silvia Guerzoni ICEI
Pothuwil, Ampara
Office 0632248081
Mobile 07791466072

Jason Ruszczyk
Sewalanka Foundation
432/A, Colombo road, Bo-ralesgamuwa
Tel 0112545362-6
Fax 0112545166

P.A.K Chandrani
Divisional Forest Office
Hambanthota
Tel 0472220371 (office)
0472241700 (residence)
Mobile 0776657605
Email: cha.forest@yahoo.com

Residence "Sithumini"
Maragahahena, Kadurupokuna Rd
Tangalle

Francis Binney
Fisheries Consultant
Sewalanka Foundation
432/A, Colombo road, Borales-gamuwa
Tel 0112545362-6
Fax 0112545166
Email: slffisheriers@gmail.com

WORKSHOP #2 - PARTICIPANT CONTACT LIST

T. Selvarasa
Vinayajapuram -03

T Lavankkumar
Sanyan G.S Road
Thambiluvil – II

A.L Hidayathullah
8c G.S.Gaffoor Lane
Ampara Road
Sammanthurai

P. Somasiri
Panama North
Panama

J.S.D.M Wijewardana
Panama North
Panama

H.Abesiri
Panama Central
Panama

W.M.A.P Amarasinghe
No 212/1
Panama South
Panama

S. Saliden
Central Road
Pasarachchani
Pothuvil

Y. Yokenthira
Pillayarkovil Road
Thampaddai -01
Tel: 0779901312

M.N.M.Mazeem
Kaariyappar Road
Matuthamunai

A. Junaideen (B.Sc)
Central Road
Pothuvil
Tel: 0602630641
Mobile 0779783284

JMNN Bandara
Samanpaya
Ammbalampotha
Maratuwegama
Buttala

G.W.D Suranga
EMACE
PO Box 96
Moratuwa. 10400
Tel: 2612837
Mobile 0776321913

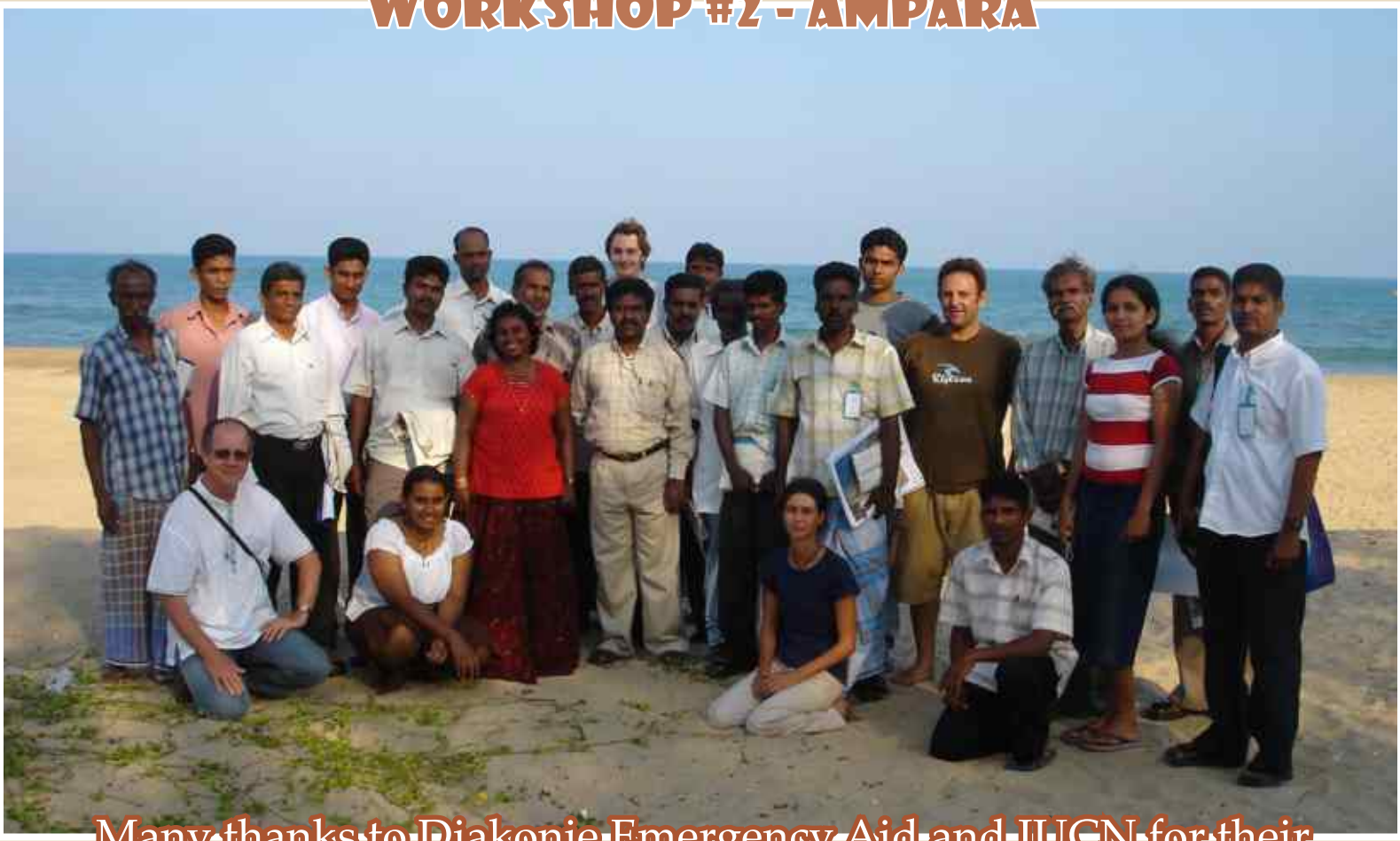
T. Gopalrajah
(Administration officer)
No.185
Sewalanka Foundation
Kalady, Batticaloa
Office 0652224778
Mobile 0773452699,
0779580897

S.Thanesh Kumar
Sewalanka Foundation
Batticaloa
Tel: 0773452693
Thane04shan@yahoo.com

Note: Trainers and participants who attended both workshops are listed in Workshop #1

WORKSHOP #1 - TANGALLE

WORKSHOP #2 - AMPARA



Many thanks to Diakonie Emergency Aid and IUCN for their kind support of these two workshops. Nandri ! Astuti !