Ecological Mangrove Rehabilitation Regional Seminar

South Sulawesi

July 18 - 22, 2011

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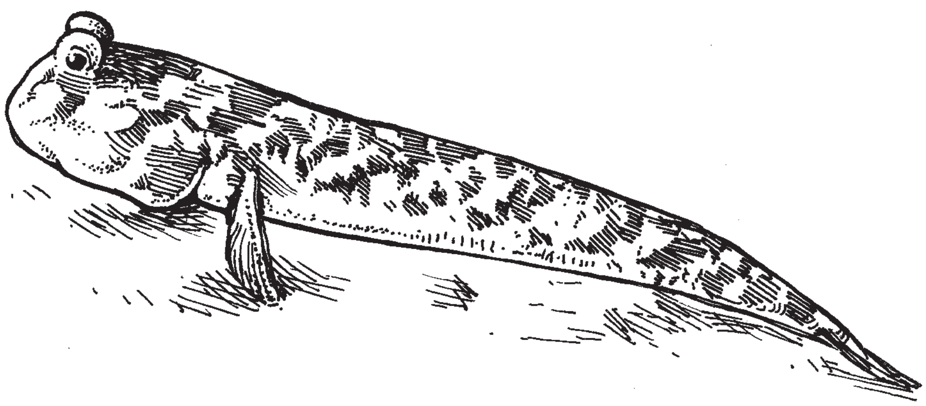
- Ben Brown, September 2011, Makassar.



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Ecological Mangrove Rehabilitation Seminar
South Sulawesi

Facilitation: Mangrove Action Project – Indonesia (MAP-Indonesia)

1.0 Background

1.1 Mangroves and Resilience

Whole mangrove ecosystems have a high degree of resilience. Ecosystem resilience is the capacity of an ecosystem to tolerate disturbance without collapsing into a different state that is controlled by a different set of processes. A resilient ecosystem can withstand shocks and rebuild itself when necessary. Resilience in socioeconomic systems have the added capacity of humans to anticipate and plan for the future. Humans are part of the natural world. We depend on ecological systems for our survival and we continuously impact the ecosystems in which we live from the local to global scale. Resilience is a property of these linked social-economic-ecological systems (SEE).

Resilience as applied to integrated systems of people and mangroves, has three defining characteristics:

- The amount of change the system can undergo and still retain the same controls on function and structure;
- The degree to which the entire mangrove ecosystem is capable of self-organization/self-renewal
- The ability to build and increase the capacity for learning and adaptation – Management based on a continuous cycle of field trials and reflection is known as adaptive management and is discussed in the final section of this report under considerations.

Catastrophic Shifts In Ecosystems

The amount of resilience a system possesses relates to the magnitude of disturbance required to fundamentally disrupt the system causing a dramatic shift to another state of the system, controlled by a different set of processes. Reduced resilience increases the vulnerability of a system to smaller disturbances that it could previously cope with. Even in the absence of disturbance, gradually changing conditions, e.g., sedimentation, sea-level rise, habitat fragmentation, etc., can surpass threshold levels, triggering an abrupt system response. When resilience is lost or significantly decreased, a system is at high risk of shifting into a qualitatively different state. The new state of the system may be undesirable, as in the case of a mature mangrove forest that becomes a pock-marked terrain full of *Acrostichum* fern or an abandoned shrimp pond complex. Restoring a system to it's previous state *can* be complex, expensive, and sometimes even impossible.

How Is Resilience Lost In Mangrove Systems?

The resilience of a mangrove forest as a complex social-ecological systems depends largely on underlying, slowly changing variables; such as climate, land use, water balance, human values and policies. Resilience can be degraded by a large variety of factors including:

- loss of biodiversity
- disturbance to natural hydrology
- toxic pollution
- inflexible, closed institutions
- perverse subsidies that encourage unsustainable use of resources
- a focus on production and increased efficiencies of a specific part of the mangrove system

How Is Resilience Enhanced?
Mangrove forests are inherently resilient, but just as their capacity to cope with disturbance can be degraded, so can it be enhanced. One key to resilience in social-ecological systems is diversity. Biodiversity plays a crucial role by providing functional redundancy. This means that more than one species can fill an important ecological role when other species may be absent or unable to fulfill such a role. As an example from Tanakeke Island in South Sulawesi; different mangrove species occur at various substrate heights or levels of tidal inundation. Communities on Tanakeke Island have a strong preference for Rhizophora mangroves, due to their value as fuel-wood, ability to make high quality charcoal, and as perceived superior habitat for mangrove crabs, the most economically valuable species in near-shore ecosystems. Communities have deforested nearly all other mangrove species, while replanting only two species of Rhizophora. This has resulted in a decrease in the resilience of the system. A slow-moving variable, such as sea-level rise, can one day throw the entire system into a shock, by potentially affecting a tidal inundation period that is too long for species of Rhizophora to withstand. A resilient forest, would have enough different types of mangroves, including those able to withstand greater periods of inundations (*Avicennia marina, Sonneratia alba*, etc.) to avoid total loss of mangrove in such an event. In addition, a resilient system would allow for mangroves to migrate inland (to the extent possible in an island system with little higher ground). One way to achieve this would be the current valuation of an upper mangrove system, which over time could be replaced by inland migrating species including *Rhizophora*. Valuing ecological diversity (biodiversity, micro-habitats, ecotones, etc) is one way to improve resilience.

Likewise in socioeconomic systems, diversity and redundancy are important. More than one government agency tasked with community outreach for mangrove habitat protection, allows for greater opportunity for iterative dialogue with fisherfolk who are constantly interacting with the resource. In this instance we can look at mainland Takalar. A region of abandoned shrimp ponds exists around Laekang Bay in the village of Puntondo. Current jurisdiction over this area is in the District Government office (Kantor Bupati). The Fisheries department is interested in the area, for potential rehabilitation of ponds. The Forestry department works in the area, but currently plants mangroves in inappropriate habitats, such as high wave energy coastlines. Coordination between these three government offices could result in a win-win-win situation where fisheries values and mangroves were enhanced, benefitting local communities which are constituents of the Bupati. Instead, lacking coordination and a common vision, failed mangrove plantings and abandonment of ponds comprise an impoverished reality.

1.2 Ecological Mangrove Rehabilitation
Rehabilitation of existing and former mangrove forest areas is more important nowadays that ever before. Healthy mangrove ecosystems offset some of the effects of collapsing fisheries, climate change and sea level rise, increasing storm events and water pollution. Whole mangrove ecosystems, however, are becoming increasingly disturbed, fragmented and rare, due primarily to lack of perceived by governments, investors and to some extent coastal communities. Mangrove systems provide open access goods and services, and are therefore targets for conversion and privatization; evident in the large-scale expansion of shrimp aquaculture, charcoal production and conversion to oil palm plantations in recent decades.

Worldwide, over 150,000 hectare of mangroves are lost each year. This necessitates practitioners to be both effective and efficient in rehabilitation activities. Actual planting of mangroves is rarely needed as mangroves annually produce hundreds or thousands of seeds or seedlings per tree, which under the proper hydrologic conditions can re-colonize former mangrove areas, returned to normal hydrology, very rapidly.

Over the years, there have been many different attempts to restore mangrove trees. Some of these efforts have been gargantuan, involving several thousand hectares of coastal lands. Other efforts have been small in comparison, with perhaps less than an hectare of mangroves restored. Yet, in these efforts, both large and small, the lessons learned in this important process are vital in re-establishing otherwise rapidly vanishing mangrove forests. Without taking those necessary steps now to restore mangroves, our planet's coastal regions will be seriously impacted by erosion, declining fisheries, vanishing wildlife, and displaced coastal peoples.

There are many different techniques and methods utilized in planting mangroves. Because some of these have resulted in identifiable successes or failures, we wish to present herein a summary description of particular case studies which are representative of some of the recommended methods for rehabilitating mangroves. It should be borne in mind from the start, however, that mangrove forests cannot in general be rehabilitated cheaply or rapidly. What we describe here is rehabilitation of a limited variety of mangrove trees and plants, but a restoration of an entire forest ecosystem is a very difficult task. In Southeast Asia, for instance, there may exist some 40 or more mangrove plant varieties, of which an ambitious restoration program might handle only half a dozen varieties, or so. What we describe, therefore, is a simpler and manageable process of partially rehabilitating a mangrove forest, while hoping that in time the great diversity of the original forest will again return.

Obviously, the way to retain the great biodiversity of the mangrove ecosystem is to protect and conserve those intact mangrove ecosystems that still exist. The mangrove forests that have been lost account for over half of our planet's original mangrove forest cover. In 1995 roughly 16 million hectares remained from a former area of 32 million hectares. The remaining mangroves are still in great peril, and vanishing fast under development pressures from shrimp aquaculture, charcoal, and timber industries, agriculture expansion, population pressures, coastal pollution, and tourism developments. Rehabilitating mangroves is only a partial solution. Protecting those precious remaining mangrove ecosystems must become an imperative for all nations, before too much is lost, and our efforts to restore are in vain.

The following is meant to provide only a rudimentary understanding of some proven techniques and advice from a few experts on restoring mangroves in their areas. However, for a fuller understanding and a more certain approach to restoration, the reader should research more thoroughly this subject, and consult more directly with those who are experienced experts in hands-on restoration techniques (see list at the end of this report). The techniques outlined herein are only a basic guide, and should be tailored to each unique situation and coastal region where restoration is being attempted.

A Simple Guide To Restoring Mangroves.

There are basically four approaches, which are used in mangrove rehabilitation programs:

1. Hydrologic rehabilitation with no planting
2. Hydrologic rehabilitation with planting
3. Planting without consideration for hydrology
4. Removal of stress in the form of overgrazing, or intense wood cutting to allow either natural regeneration, or planting. Planting for future harvests of wood (silviculture) is a common practice, but ecological impacts of too much wood removal at one time need to be carefully examined.

Method 1 has proven very successful (Lewis 1990a; Brockmeyer *et al*., 1997; Turner and Lewis, 1997), but does take some time for mangrove seeds to colonize sites with restored hydrology. It is the most cost effective of the first three methods.

Method 2 has also proved effective, and can provide visible recovery very quickly (Lewis *et al*., 2000), but planting costs can double the overall cost of a project and may limit the biodiversity of the site due to competition from planted mangroves (usually only one or two species) with volunteer species (5-15 species).

Method 3 is perhaps the most common method tried, and almost always has significant problems in achieving success. It is not easy to create a garden of mangroves where none existed before. Mangroves have very restricted tolerance for inundation, salinity and flooding, and where the water fluctuations are not suitable, such as natural mudflats, mangroves typically do not grow, and are almost impossible to successfully plant and grow into trees. A few may survive for a few years, but nearly always they eventually disappear. Despite these failures, often after millions of dollars have been spent (see Lewis, 1999 and Erftemeijer and Lewis, 2000 for examples), planting continues without consideration of the hydrologic site conditions.

We caution that existing site conditions need to be carefully assessed before any thought of planting is considered. Why does the site not now have mangroves? Is there documentation that they existed in the past?

What happened? Was hydrology altered due to creation of bunds, dikes, roads, aquaculture ponds, agriculture or drainage canals? Is excessive sedimentation taking place? If overharvesting removed mangroves, then planting may make sense. Perhaps there is a lack of seed sources (propagule limitation). Providing seeds to an area by simply harvesting them and broadcasting them on a rising spring tide in the area may be enough to begin reestablishment. Actual planting by hand of the larger propagules of *Rhizophora* and related species is popular, and may be a good community activity. It may also decrease community interest in future mangrove conservation, if planting activities fail. Don't plant too close together (2 – 8 meter spacing is fine) and don't be surprised if Mother Nature plants mangroves better than you do! Large expensive nurseries to grow mangroves are rarely essential, cost a lot of money, and take valuable resources away from real mangrove restoration efforts.

The various ways in which to rehabilitate mangroves can often confuse practitioners, especially those coming into mangrove rehabilitation without prior experience in either habitat restoration or mangrove ecology. The six-step Ecological Mangrove Rehabilitation Method was designed in order to provide a consistent process for mangrove rehabilitation projects, to increase the likelihood of success.

6 Steps to Successful Ecological Mangrove Rehabilitation (EMR):

Work together with local communities, NGOs and government to:

1. Understand both the individual species and community ecology of the naturally occurring mangrove species at the site, paying particular attention to patterns of reproduction, distribution, and successful seedling establishment;
2. Understand the normal hydrology that controls the distribution and successful establishment and growth of targeted mangrove species;
3. Assess the modifications of the mangrove environment that occurred and that currently prevent natural secondary succession;
4. Select appropriate restoration areas through application of Steps 1-3, above, that are both likely to succeed in rehabilitating a forest ecosystem and are cost effective. Consider the available labor to carry out the projects, including adequate monitoring of their progress toward meeting quantitative goals established prior to restoration. This step includes resolving land ownership/use issues necessary for ensuring long-term access to and conservation of the site;
5. Design the restoration program at appropriate sites selected in Step 4, above, to restore the appropriate hydrology and utilize natural volunteer mangrove recruitment for natural plant establishment;
6. Utilize actual planting of propagules or 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 as required for project success.

1.3 Ecological Mangrove Rehabilitation (EMR) Seminars and Workshops

As a means of disseminating and training practitioners in the methods of EMR, seminars and workshops are held for practitioners at various levels, government & academia as well as community. EMR workshops were first held by the creator of the EMR method, Robin Lewis, in Florida, USA. Community EMR workshops in Asia have been held in Indonesia, Sri Lanka, Cambodia, India and now Malaysia. Community EMR workshops adhere to an action-research/problem-solving method. The typical flow of an EMR workshop, follows the six-step EMR method. In community EMR workshops, participants are engaged in mural drawing, field visits, powerpoint presentations and group discussions are the main activities undertaken during a training. In regional seminars, such as this training in South Sulawesi, the focus is on technical powerpoint presentations, but also presentations from local government, academic and community practitioners as well as field visits.

After understanding the local situation, both past and present, the group then learns how other coastal communities have taken action in similar situations, both within their own region as well as internationally. The group is also presented with global resources to assist them in future action planning and implementation (methods, tools, techniques, networks).

1.4 South Sulawesi's Mangroves - Past and Present

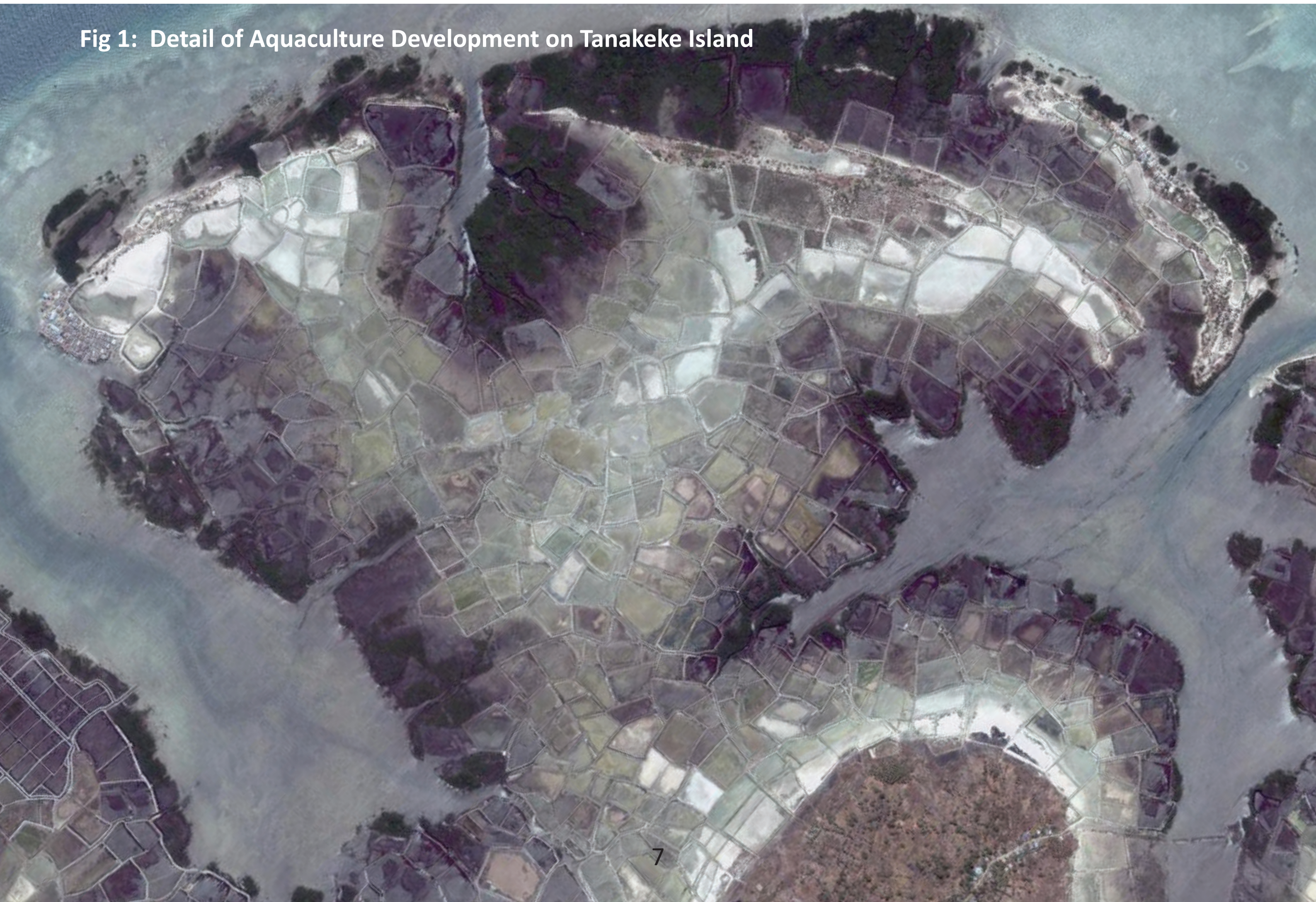
There have been estimates that 210,000 hectares of mangroves existed in South Sulawesi historically, which had decreased by at least 60% in the mid-1990's due to aquaculture expansion. (Prof. Mahatma, Konsortium Mitra Bahari, personal communication). On the island of Tanakeke alone, an original 1700 ha of mangroves has been reduced to 500ha in the 1990's due to shrimp pond construction (see fig 2). Nearly all of those ponds are currently disused, begging the necessity for rehabilitation.

South Sulawesi, however, unlike most regions of Indonesia which have undergone intensive aquaculture development during the blue revolution of the 1980's and 90's, has an entrenched history in brackish water aquaculture. Original ponds, perhaps 400 years old, are still evidenced in the Takalar district, and both Bugis and Makassarese societies ascribe at least some of their modern cultural identity to fish farming. Therefore, although returns may be nominal, and expenses for inputs ever-increasing, ponds on mainland South Sulawesi are constantly reinforced and managed, switching over the years between more and less intensive methods of rearing milkfish, Panaeid prawns, secondary fish species and occasionally Gracilaria seaweed.

Resultantly, cultural memory of a fully-functioning, specious mangrove forest has waned. In most communities minds, mangroves of one or two species, planted on the edge of aquaculture ponds and channels can be named a forest. There is little to no memory of most species, or their uses, although there were likely more than 28 species of true mangrove trees present in the Province historically. It is little wonder that mangrove restoration efforts involve merely planting of one or two species of Rhizophora trees, when the nearest functioning full species reference forests take place only in the Northeast corner of the province, in the district of Luwu Utara. All other mangrove systems have been converted or compromised.

In part, this Ecological Mangrove Rehabilitation seminar was arranged in South Sulawesi, to gather a broad array of people who still care about mangroves, to stimulate the memory of what once was, and what yet may be - a fully functioning mangrove forest amidst the ponds of short term economic gains and minimal returns to coastal communities.

Fig 1: Detail of Aquaculture Development on Tanakeke Island



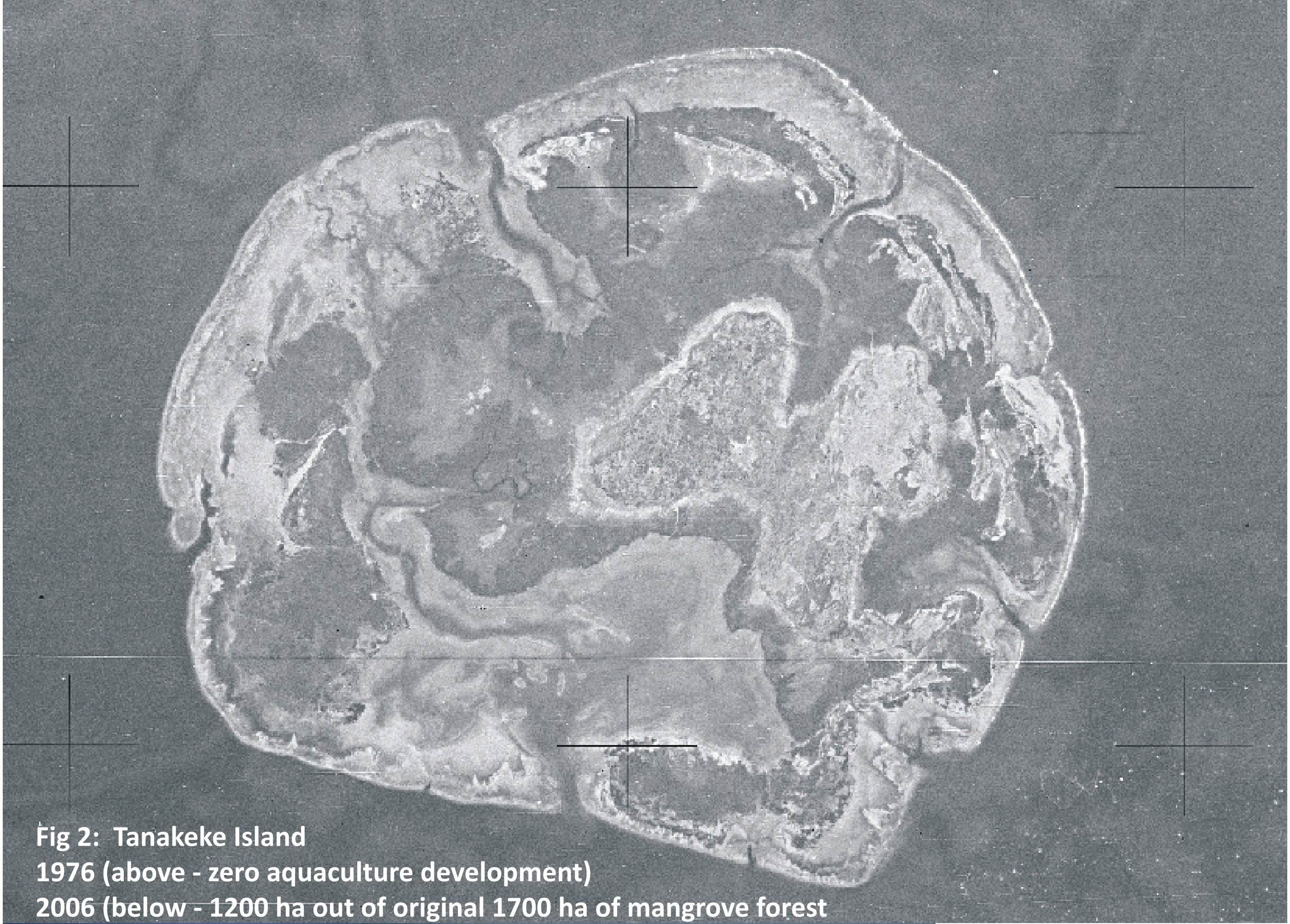
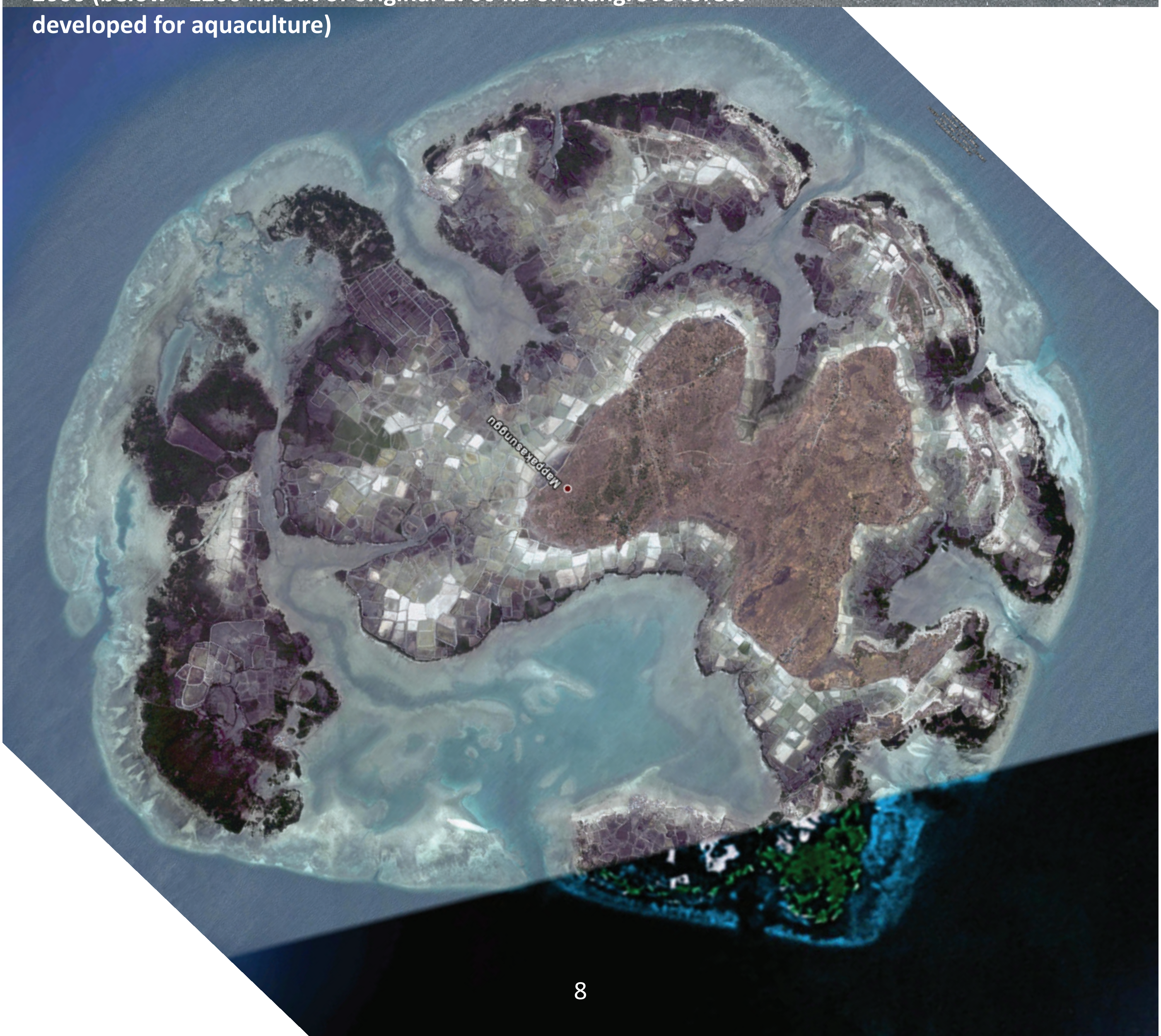


Fig 2: Tanakeke Island
1976 (above - zero aquaculture development)
2006 (below - 1200 ha out of original 1700 ha of mangrove forest developed for aquaculture)



2.0 EMR Workshop Proceedings

This Ecological Mangrove Rehabilitation workshop was attended by representatives of government agencies. Academia, NGO's and some community fisherfolk. A complete list of participants is presented in the appendix. The format of the workshop was semi-formal - with abundant powerpoint presentation, and two field visits. Stress was placed on value-sharing, open communication and participation.

2.1 Overview, Welcome, Ice-Breaker and Introduction to EMR

Discussion of Agenda and *Expectations of the Workshop*– Opportunity to learn about, question and fine tune the agenda together. Participants were asked to write down their hopes and expectations for the workshop. These were referred to by organizers/facilitators throughout the workshop, to make sure that content was appropriate to participant needs.

2.2 Six Critical Steps Necessary To Achieve Successful Mangrove Rehabilitation:

PowerPoint Presentation – Robin Lewis

Key topics presented in a four part PowerPoint presentation throughout the event. Information on each of the six steps of EMR were provided as an overview, as well as in detail. Case studies from around the world as well as Indonesia were discussed, with a focus on mangrove rehabilitation successes and failures. A few common misconceptions about mangroves a and mangrove restoration were discussed, in the form of a true/false test. Robin also made participants aware of www.mangroverestoration.com - where 7o scientific papers are available for free download. Likewise - the four part slide show was made available to participants.

Contents and the questions and answers generated during the powerpoint slide show will not be recapitulated in great detail in this report. Instead, we provide bullet points of topics covered below, as well as Robin Lewis' summary of what transpired, as well as recommendations will be provided in section 3.

Key of topics covered during powerpoint presentation

- Understanding community ecology and autecology (ecology of individual mangrove species)
- Understanding hydrology - or the exchange of water in and out of the mangrove system
- Wetland systems other than mangroves have been studied - in terms of hydrology for about 50 years, we are still catching up with needed research in mangroves.
- In terms of difficulty of restoration, wetland systems are ranked from least to most difficult as follows
  estuarine marshes,
  coastal marshes,
  mangrove forests,
  freshwater marshes,
  freshwater forest,
  groundwater/ seepage slope wetlands,
  seagrass meadows (for more info see www.seagrassrestorationnow.com)
- Most mangrove restoration projects fail completely, or rarely achieve their stated restoration goals (field 1999; lewis 1999,2000). What is the problem, and what tools can help us avoid the common mistakes ? Mangrove restoration - globally - has around a 90% failure rate - meaning only 10% success
- 150,000 ha of mangrove a year are destroyed worldwide - we need to be efficient and effective to keep up with this rate of destruction - and we need to prioritize conservation of existing mangrove systems.
- Understanding natural hydrology - takes looking at a nearby reference forest - and recreating conditions in the mangrove rehab area - especially important are substrate micro-elevation, which will in part dictate two key hydrological factors 1) tidal inundation period and 2) tidal inundation frequency
- Recreating this natural hydrology is the key to success. Then, if mother trees are nearby, natural revegetation will take place. If not, you can introduce propagules by dispersal on high tides or direct planting.
- Sometimes you can to secure the recreated substrate height in the short term by planting salt water tolerant grass, which will grow fast and reduce erosion. Eventually, mangrove seedlings will be recruited into the area and come to dominate.

2.3.1 Case study - Use of marine tolerant grass

Top Left to Bottom Right
Time Zero - Regraded area (1985)
Time Zero - Planted with salt-tolerant grass (1985)
Time Zero + one year (1986)
Time Zero + 11 years ((1996)

In Puntondo - Takalar, we have our own salt tolerant grass species, which are also functioning to hold sediment levels, and prepare soil (bio-geo-chemically). There is evidence in this picture of capture of *Lumnitzera racemosa* seedlings.

Top Right

Occasionally - heavy equipment such as a bulldozer will be needed for re-grades and the creation of tidal creeks for the appropriate exchange of water (inundation and drainage).

Time Series

Top Left - 1990

This area had been filled with dredgings from the shipping canal, which killed native mangroves. This photo - although full of green forest, shows Casuarina pine, a non-native species of Florida

Middle Left - 1995 (Time Zero)

Lewis Environmental Services was commission to design and implement EMR. Here we see a time-zero photo, after regrading of the area, and excavation of tidal creeks has taken place.

Bottom Left - 2003 (Time Zero + 8 yrs)

Due to the success of functioning tidal creeks, mangrove propagules came into the area naturally, and became established. No planting was undertaken in this project, which met its success criteria for mangrove coverage.

2.3.3 Case study - Tiwoho Village, North Sulawesi

Far Left - 1993

25 hectares of shrimp ponds were abandoned. By 2002, several hectares had naturally been restored, as shrimp pond dike walls degraded over time. But the back section of the pond complex remained barren, due to poor exchange of tidal waters.

Middle left - 2004

MAP worked with Yayasan KELOLA and PhD Rignolda Djamaluddin to design and implement hydrological restoration by strategic breaching of remnant dike walls, as well as filling of unnatural aquaculture canals.

Bottom left - Time Zero

Some presence of planted and natural mangroves, primarily Ceriops tagal, at densities of under 100 trees per hectare.

Bottom Right - Time Zero + 6 years

Presence of 17 species of mangroves, with trees up to 10 meters tall - a mix of natural recruits and planted material.

2.4 Participant Presentations

Powerpoint and verbal presentations were given by several participants representing academia, fisherfolk community members, local and provincial governments and regional and international NGO's. The content of these presentations will not be discussed thoroughly in this report, however, we will provide highlights from some of the groups who presented.

Rehanna (Tanakeke Island - Fisherfolk): Rehanna presented on community involvement, with a focus on women's involvement, in Ecological Mangrove Rehabilitation in Lantang Peo village, Tanakeke Island. She spoke of men's and women's roles in planning and implementation of 46 hectares of mangrove rehabilitation. She also spoke of community involvement (women, men and students) in field schools studying silviculture and use of non-timber forest products, which will help determine future management of Tanakeke Island's mangroves.

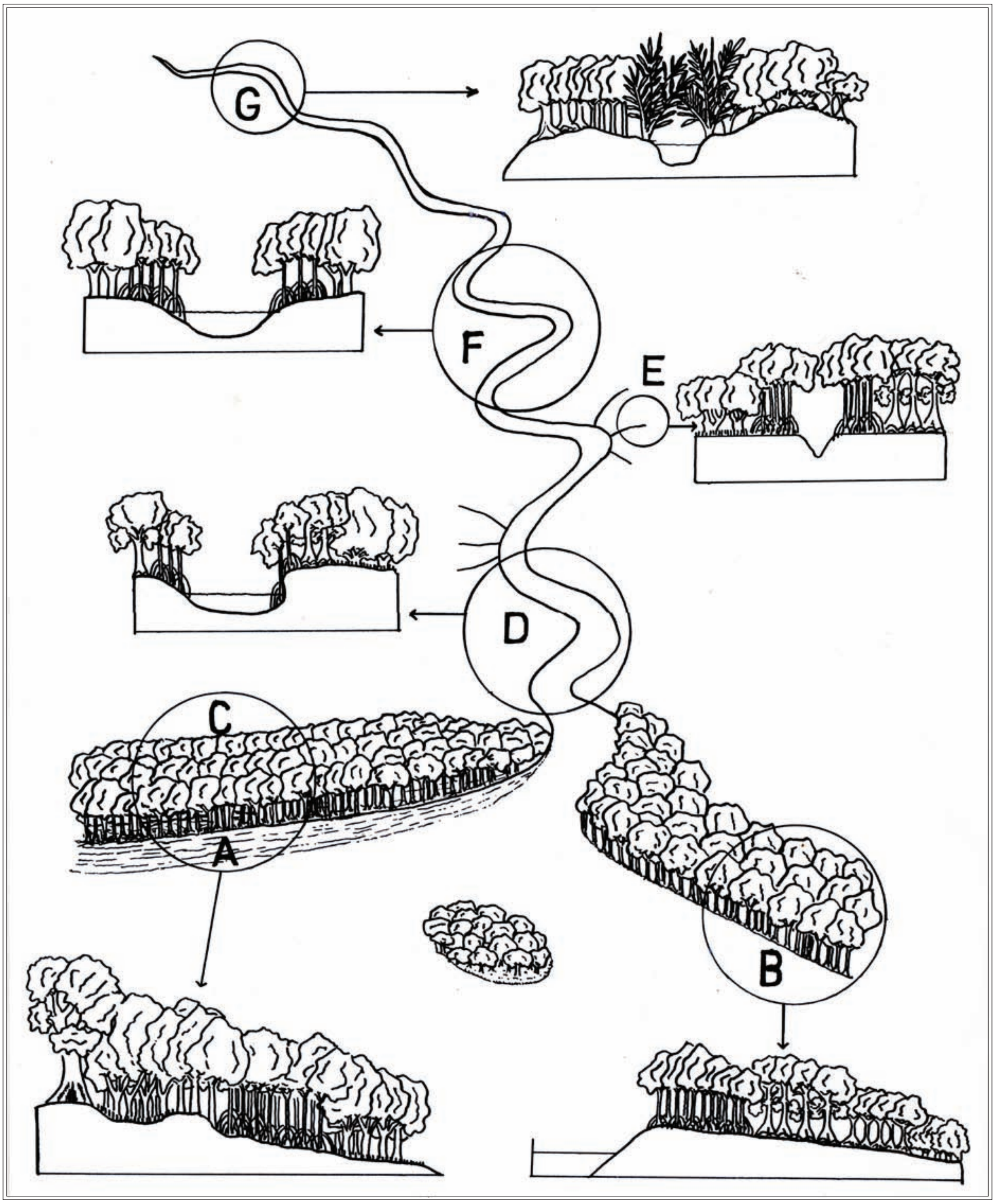
Jovelyn T Cleofe and Gemma J. Gades (CERD - Philippines): Mangroves in Philippines have been offered adequate central government protection since 1995, yet were already in a highly degraded state. The story was told of the role of a woman's group in the Southern Philippines, in restoring and managing local mangrove resources. Mangrove restoration is affected by planting, and has met with success and failure, but what is unequivocally successful is the high level of participation of women in management initiatives.

Frederika Bawole (Village Head, Tabulo Selatan, Gorontalop): Ibu Frederika spoke of her role in organizing communities in her village to undertake mangrove planting, in 48 hectares which was deforested by the Provincial Fisheries department for the development of an aquaculture facility. She spoke of strong community support and involvement of women in the program, but lack of technical expertise in affecting mangrove rehabilitation. Some of the areas they have planted have suffered high mortality, and Frederika hoped for continued learning and sharing, to help solve this issue.

PhD Jim Davie (Emerald Planet): Jim presented on the importance of understanding coastal geomorphology dynamics in Indonesia as a basis for EMR. Jim cited examples from Sumatera, Java and Australia in his talk, with historical observations spanning over a century. Jiim also brought up the interesting challenge and special opportunity presented in rehabilitating disused shrimp ponds, which are abundant across Indonesia, and his excitement for learning more about EMR as a potential solution to large-scale, cost effective restoration.

*PhD Marzuki Ukkas (*Univ Hasanuddin*)* – An impromptu presentation on changes over time in Tanakeke Island, from personal observation and study. This talk discussed the development of 1200ha of aquaculture ponds out of an original 1700ha of mangroves, the social reasons and implications for this conversion and subsequent abandonment of ponds. Professor Marzuki discussed opportunity for EMR in other parts of South Sulawesi, including the Siwa sub-district of Wajo.

Drs Sri Endang (South Sulawesi Forestry Department): Ibu Sri Endang, is the head of Production Forests in South Sulawesi, for the Forest Department. She broke from her traditional role, speaking of whole watershed management, with a focus on a lower - to upper watershed paradigm, where lower watershed users would provide payment for environmental services to upper watershed communities, who are often more impoverished, and lack access to resources and funds for upper watershed protection. Ibu Endang also highlighted the importance of whole watershed thinking, citing examples of landslides affects and erosion on lower watershed sedimentation patterns, as well as fresh water delivery for coastal uses such as rice farming and aquaculture.



Time ran out for an in-depth discussion of the above figure from PhD Jim Davie's presentation. The Figure depicts Structural differences among mangrove communities found in a range of intertidal habitats on tropical coastlines and estuaries. Below is commentary on the figure as discussed in the Integrated Mangrove Conservation Management Plan for Jambi Nature Research (Davie, 1995)

A and C - represent advancing coastlines dominated by marine processes. Cheniers (sand ridges) may or may not occur.
B - is a retreating coastline on an open coast or at the mouth of an estuary.
D - represents a typical estuary cross-section in the meandrine segment/ Here salinities are still high to moderate, as tidally generated currents dominate. The accreting bank on the left of the profile is associated with a point bar./ This situation is balanced by the steep, and often undercut eroding bank opposite.
E - is typical of the shallow streams which drain into the estuary on the meanders. Conditions are similar on both sides of the stream.
F - is still within the meandrine segment, however, the influence of freshwater is greater. This is shown by the terracing and formation of flood levees.
G- occurs in the upstream segment where the estuary has straightened and stronger freshwater flow effects a similar topography on both banks. Mangroves are confined to narrow terraces formed during periods of freshwater flood.
Appearance of these habitat types depends on the hydrodynamic conditions of individual streams. Where different types occur in an individual landscape, they should be identified, and managed so that connectivity between types is valued. Resource extraction should not take place at the cost of breaking the connection between habitat types.

2.5.1 Field Trip to Tanakeke Island

Middle Left - The main lessons of this trip were recognizing natural cues of rehabilitation, as well as the importance of strong tidal flows to allow for long-term functional drainage.

On the left we see an area barren of seedlings. Although abundant mother trees appear near by, there is inadequate movement of water into the area. Dike walls were only recently breached in this site. The small drainage creek pictured forming here, is of inadequate size to functionally drain and flood this pond.

Bottom Left - Here we see how micro-elevation determines natural mangrove seedlings establishment. Areas which are too low in terms or relative substrate height are barren, while substrate slightly higher (5-15 cm higher) have well established mangroves. These higher areas, still have remnant root systems from previous mangrove trees, while the lower areas are devoid of roots, and were unable to hold sediment, which has been redistributed in the pond complex or out to sea.

2.5.1 Field Trip to Tanakeke Island (cont'd)

Top Left
Standing around the perimeter of a 10m x 10m planting trial quadrat. A control is still empty - showing lack of recruitment of propagules 6 months after hydrological restoration. This is a concern. A third plot will be constructed, and planted with salt tolerant grass to understand the affects of propagule catching and preparation of sediment.

Middle Left
Inadequate breaching. It is not dug down to substrate level, and small Rhizophora are growing in the outlet (near Robin's feet) which may cause clogging. It was recommended to deepen the breach, and remove the Rhizophopra seedlings established at the mouth.

Bottom left
Crossing through deeper water in an adequately sized channel. It was recommended to rip one more channel of this size through the middle of the restoration area.

2.5.2 - Field Trip to Nisombalia Village, Maros

Maros represents a different challenge for mangrove rehabilitation in South Sulawesi. Most ponds in this region are currently operated, although productivity of shrimp and fish is low. Abdul Gafar, of the Provincial Agriculture Department, presented on Fish Farmer Field School as a method to both transform aquaculture practices by promoting ecological values. It is felt that over time, fish farmer field school participants will begin to experiment with increasing vegetation in their ponds, as well as development of more functional mangrove shelterbelts, to provide water filtration, primary production, and natural pest buffers to their ponds.

Top Left: Looking at rice fields which have failed the past year, in part due to salinization caused by lack of mangroves as an ecological buffer between land and sea.

Top Right: Measuring turbidity as part of fish farmer field school - a step toward improved ecological pond management.

Middle Left: Fish production is low, but ponds are still actively managed. The question is, is there an opportunity for EMR in a situation like this, which is common throughout Maros, Pangkep and Barru.

Bottom Left: If communities can be convinced to give up some pond areas for ecological restoration, there is evidence that the process will work. Here, a tidal creek which flows between the ponds, is growing well with numerous species of mangroves. As long as the substrate height and flows are adequate, mangroves will re-colonize this area.

2.6 On Monitoring

Towards the end of Robin's slide presentation - a special section on monitoring was presented. This section holds special significance, in light of the failure of the majority of mangrove restoration efforts in Indonesia and worldwide, and the need to build in adequate monitoring to future projects and programs. A summary of the discussion on monitoring follows.

Activities	Remarks
Monitor mangrove species that develop	Check correctness of original provenance of propagules and seed
Monitor growth as a function of time	Parameters include the density, percent cover and species composition of both planted and volunteer mangroves over time.
Monitor growth characteristics	Include determination of stem structure, node production, phenology, fruiting and resistance to pests
Record level of failure of saplings	Provide a scientific explanation of failure
Record fauna	Fish monitoring is expensive but can be very helpful to validate economic value of mangrove rehab. Of other fauna, crabs and benthic macroinvertbrates can be considered.
Adjust density of seedlings and saplings to an optimum level	Degree of thinning, replanting or natural regeneration should be noted. Growth should be monitored
Estimate cost of restoration project	The estimation of costs should include all the undertakings including site preparation, propagule collection, nursery establishment, field transplantation, etc.
Monitoring Schedule	Baseline, 3, 6, 9 and 12 months, Year 2, Year 3......as long as possible after year three.
Monitor characteristics of the rehabilitated mangrove ecosystem	This involves detailed measurement of fauna, flora and physical environment of the new mangrove ecosystem and comparison with similar undisturbed mangrove ecosystems.

MAP-Indonesia has prepared a monitoring methodology for both baseline data collection and regular monitoring, available upon request.

2.7 Emerging Restoration Principles

- Get the hydrology right first!
- Do not build a nursery, grow mangroves and just plant some area currently devoid of mangroves (like a convenient mud flat). There is a reason why mangroves are not already there or were not there in the recent past or have disappeared recently. Find out why.
- Once you find out why, see if you can correct the conditions that currently prevent natural colonization of the selected mangrove restoration site. If you cannot correct those conditions, pick another site.
- Use a reference mangrove site for examining normal hydrology for mangroves in your particular area. Either install tide gauges and measure the tidal hydrology of a reference mangrove forest or use the surveyed elevation of a reference mangrove forest floor as a surrogate for hydrology, and establish those same range of elevations at your restoration site or restore the same hydrology to an impounded mangrove by breaching the dikes in the right places. The "right places" are usually the mouths of historic tidal creeks. These are often visible in vertical (preferred) or oblique aerial photographs.
- Remember that mangrove forests do not have flat floors. There are subtle topographic changes that control tidal flooding depth, duration and frequency. Understand the normal topography of your reference forest before attempting to restore another area.

2.8 Summary - Advantages and disadvantages of natural regeneration

Advantages:
+ Cheaper to establish,
+ Less subsidy is needed in terms of labour and machinery,
+ Less soil disturbance,
+ Saplings establish more vigorously,
+ Origin of seed sources usually known.
+ Nature will plant the mangroves species in the correct tidal zones. Only those mangroves in the correct zone will survive through competition.

Disadvantages:
– Replacement may not be of the same species removed,
– Absence of mother trees may result in low/or no propagules supply,
– Genetically improved stock not easily introduced,
– Excessive wave action may cause poor establishment,
– Predation of propagules by macro benthos (e.g. crabs, snails etc),
– Less control over spacing, initial stocking and composition of seedlings.

3.0 Considerations and Recommendations

3.1 Robin Lewis Summary of Seminar, Site Specific Recommendations and General Recommendations

Robin Lewis not only acted as main presenter in the EMR workshop, but participated in site assessments in Takalar, Maros and Pangkep districts, in order to provide technical recommendations for follow-up EMR activities in the RCL project. His findings report is presented in its entirety as section 3.1.

On 18-22 July 11 the "Regional Seminar on Ecological Mangrove Rehabilitation (EMR)" was held in Makassar, South Sulawesi, Indonesia. Sponsors of the workshop include Mangrove Action Project – Indonesia, Oxfam and the Canadian International Development Agency. Mr. R. Lewis under special invitation during the period of 13-22 July 11, provided mangrove restoration expertise. Approximately 30 participants attended the workshop. This report summarizes the field visits, discussions and recommendations as described by Mr. R. Lewis.

Prior to the workshop, four (4) potential mangrove restoration sites were inspected with Mr. Ben Brown of MAP-Indonesia. These included: 1. Pajukukang – North Maros (PNM); 2. Nisombalia – North Maros (NNM); 3. Puntondo Fish Ponds (PFP); and 4. Puntondo Lagoon (PL). NNM was inspected a second time with the class on 21 JUL 11, and a fifth site Lantang Peo – Tanekeke Island (LPTI) was inspected with the class on 19 JUL 11

3.1.1. Topics of the Regional Seminar

The regional seminar consisted of R. Lewis giving lectures on topics related to mangrove forest ecology, management and restoration based upon his 40 years of work in the field, illustrations of key issues in mangrove hydrology along with international case studies, and a discussion of the six-step EMR methodology (Figure 1). Other participants also gave presentations on their mangrove management and restoration projects. The emphasis was developing a rational Indonesian specific EMR program directed towards the restoration of abandoned or disused tambaks (aquaculture ponds). The EMR approach to tambak restoration was contrasted with the current predominant approach to mangrove forest restoration in Indonesia which largely consists of direct planting of either propagules or nursery grown seedlings of mostly a single species of mangrove (Rhizophora stylosa – "bakau"). Plantings usually occur on unvegetated mudflats in front of existing mangroves, along beach fronts, or along narrow fringes of mangroves bordering tambaks constructed in former mangroves and other wetlands. This methodology has been repeatedly documented to rarely establish

. functional mangrove forests (Stevenson et al. 1999; Lewis 2005; Samson and Rollon 2008) with most of the plantings not surviving.

The recommended alternative approach (shown in Figure 2) is the design and implementation of a “strategic breaching” approach to abandoned or disused tambaks, which limits the amount of excavation necessary while maximizing the hydrologic reconnections with an optimum tidal prism to keep the limited excavated openings functioning over time. This approach is generally being applied at the LPTI restoration site.

Participants in the Regional Seminar agreed that while the EMR methodology, as applied to disused tambaks in Indonesia, offers a much greater chance of successful and more ecologically sound mangrove rehabilitation, their remains ownership issues and government reluctance to admit that mudflat planting does not routinely work. These issues are a limiting factor for implementing the EMR approach to mangrove rehabilitation. Recommendations to overcome these limitations are made in section 3.

3.1.2. Recommendations for EMR at the Potential EMR Sites Inspected During the Regional Seminar.

Site 1. Pajukukang – North Maros

This site consists of a number of polyculture ponds (black tiger shrimp/milkfish) mixed with a large number of rice agriculture ponds planted with freshwater rice species. In general, productivity of all of the ponds appears low and our local contact person indicated that the poor crop productivity may be due to limited freshwater drainage from the uplands. Similarly, cost and management of food supply and appropriate water exchange were identified as issues for the polyculture ponds. A recent pond management field school has been completed and efforts to prepare a local source of organic mulch that can replace the use of expensive fertilizers is underway. If these efforts yield productive results, and either enough freshwater can be found to support rice culture, or saline rice strains can be introduced that will thrive without a lot of freshwater, the plight of the local farmers would improve. Only a thin strip of mangroves along the outer coast currently exists to protect the community from storms, and their attempts to expand this with mudflat plantings has not been successful. With local farmers support, unproductive ponds could easily be converted to mangroves behind this narrow strip using the EMR approach and productive tidal creeks could be constructed within these ponds to improve local inshore fisheries. A single pond restoration project might prove worthwhile to demonstrate EMR to the local community.

Site 2. Nisombalia – North Maros

This site consists of a number of well managed polyculture ponds mixed with rice culture ponds, some of which are showing salinity stress where they are located at lower topographic elevations. All the ponds appear to have been in place for many years and no major changes are recommended except perhaps conversion of one or two of the stressed rice ponds to EMR restoration sites if the local community is willing to participate. Should the conditions change in the future with sea level rise and more saltwater inundation, more consideration could be given to EMR rehabilitation.

Site 3. Puntondo Fish Ponds

This approx. 7ha area is targeted for EMR rehab at this time, pending settlement of land tenure issues in both government owned and privately owned sections. Our inspection showed some tidal exchange where dikes have been breached and several ponds are now connected to the tides. Various species of mangroves are naturally establishing themselves inside the pond complex, with satisfactory density and growth where dike wall breaching is significant. Some improvement to these connections was discussed in the field. Portions of the site are also showing early succession from halophytic grasses to mangroves. The ultimate connection to the sea under the adjacent road looks somewhat problematic and needs to be checked for clearance and any obvious restrictions to tidal flows on spring tides. A detailed map of the site and characterization of the breaches needs to be completed and phased restoration, management, and monitoring plans prepared and implemented.

Site 4. Puntondo Lagoon

This area, located behind the environmental education center, has undergone significant modification and is currently being further impounded by the closure to two of the three natural openings to the sea that allowed for tidal exchange. The third opening facilitated through a seawall has sand accumulating within the lagoon. The flood tide delta appears to be the only free tidal opening at this time, and it too is closing. Complete blockage of all tidal exchange can be expected to occur within 6-12 months. When this happens, the stressed lagoon will be subject to complete die-off of all mangroves if a storm tide, passing cyclone or typhoon introduces enough water into the lagoon, which would drown the mangroves since the natural exits are blocked. This is a common cause of mangrove deaths worldwide.

It is understood that the lagoon has divided ownership with competing interests and goals. Some of the owners want natural conditions, some want a functioning tambaks. Not all of these interests can be accommodated without significant stress to the lagoon ecosystem. If all the owners can come together with a science-based management plan, the lagoon has a chance of surviving. Without that, the lagoon in its semi-natural state is doomed.

Site 5. Lantang Peo – Tanekeke Island

The villagers of Lantang Peo are working with MAP Indonesia on a 45 ha rehabilitation project that has returned some tidal flows to disused tambaks adjacent to the village. The oldest of these ponds has had some natural tidal flows for about 10 years and the youngest, approximately a year's worth. Thus the site lends itself to a chronosere study, where specific ponds of different ages can be studied as a substitute for watching and monitoring a few ponds from the time of restoration (i.e., Time Zero) until complete restoration at perhaps Time Zero plus 30-40 years. An additional 255 ha of rehabilitation is planned to convert a significant portion of the 1200 ha of ponds on the island back to a functional mangrove ecosystem.

It is understood that while about 210 breaches have been made in the dikes, only a dozen or so may be truly functional in the long term. Many breaches observed have sand accumulations and/or planted or volunteer mangroves that are now blocking flows and will increase that blocking force over time. For this reason, a good GIS map locating the 20 or so significant breaches needs to be made, with characterization as to width and depth. These breaches should be watched on a spring tide (high and low) to determine where water flows are going, where restrictions exist, and where improvements and future maintenance of breaches may be needed.

A single significant channel with good flows was observed near the village, and this may be the major opening to the system that needs to be maintained with all the other channels connected to it. Only a more detailed examination of the issue will answer this question. The maximum tidal prism for the entire area should be the rehab design goal, and a total area restoration, management and maintenance plan should be prepared in conjunction with the villagers who will ultimately manage the mangroves and harvest the wood products and fish and invertebrates derived from a well maintained ecosystem.

Some monitoring has begun and some plantings of Rhizophora stylosa (bakau) have taken place. While the interest on the part of the villagers is to plant and establish bakau cover over all the ponds, this is not a good design for future maintenance of natural tidal flows and maximum fish and invertebrate use. A naturally diverse mangrove community with good representation of all the native mangrove species of the area should be the goal, along with the need for minimal maintenance of the tidal channels. A predominantly bakau plant community with few natural channels will eventually close in on itself and significantly reduce the fish and invertebrate use (and potential harvest) of the restored plant community over time.

Figure x. Alternative approaches to mangrove forest rehabilitation as presented at the Regional Seminar.

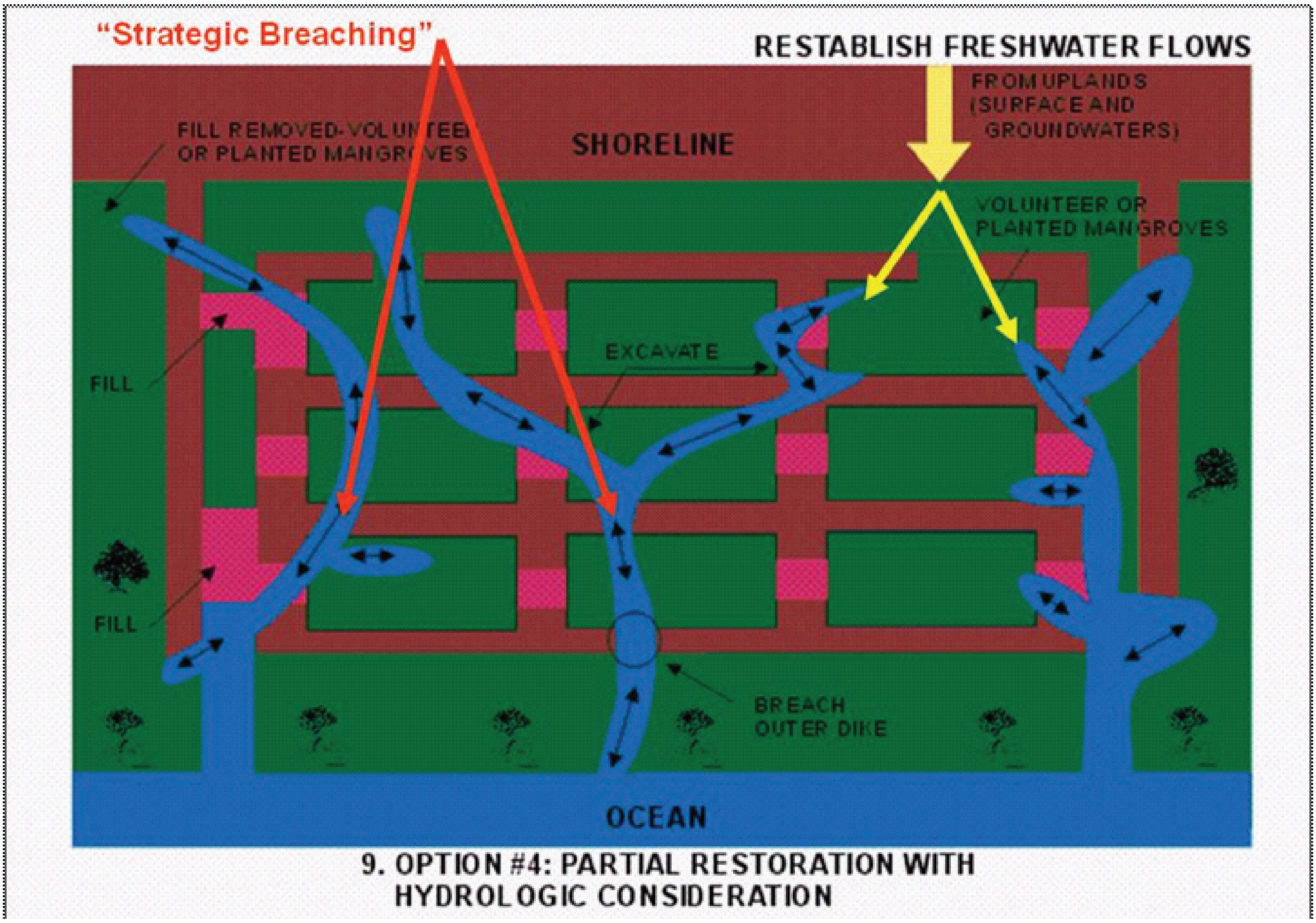


Figure x. The strategic breaching model for disused tambaks restoration back to mangroves as presented at the Regional Seminar.

3.1.3. General Recommendations for EMR Practitioners in Indonesia

A. The failure of the mudflat and beachfront plantings of primarily bakau to survive over time, or if partially successful, provide minimal ecological functions, needs to be documented if possible. The cost per successful hectare of mangrove establishment also needs to be calculated and reported. Use of a similar unsuccessful technique (Riley Encasement Method) in Florida (Johnson and Herren, 2008) was shown to ultimately cost nearly USD$1.5 million per successful hectare where it was shown to partially work. This kind of information has been used to move government agencies towards more ecologically sound and cost effective methods of mangrove restoration in Florida.

B. The success of EMR and "strategic breaching" to establish more ecologically sound and cost effective mangrove rehabilitation sites needs to be similarly documented. The ongoing work at Tanekeke Island is particularly important in this regard.

C. An easily accessible and viewable EMR restoration site needs to be established on the mainland, perhaps close to Makassar. Even if small, the availability of such a site for viewing by larger numbers of government officials, academics and students is important in educating everyone about the value of the EMR approach.

D. A short Indonesian written publication with good drawings that describe the difference between mudflat/ beachfront plantings should be distributed. EMR should be prepared to educate everyone about the issues.

E. Further local workshops should be funded and conducted to provide EMR training to all those who desire to learn how it works and how to undertake this type of restoration.

3.1.4. Literature Cited

All of these publications can be downloaded for free from the website www.mangroverestoration.com

Johnson, LK, and LW Herren. 2008. Reestablishment of fringing mangrove habitat in the Indian River Lagoon. Report to the St. Johns River Water Management District. 161 pages.

Lewis, RR. 2005. Ecological engineering for successful management and restoration of mangrove forests. Ecological Engineering 24(4 SI)403-418.

Samson, MS, and RN Rollon. 2008. Growth performance of planted red mangroves in the Philippines: revisiting forest management strategies. Ambio 37(4):234-240.

Stevenson, NJ, RR Lewis, and PR Burbridge. 1999. Disused shrimp ponds and mangrove rehabilitation. Pages 277-297 in "An International Perspective on Wetland Rehabilitation", WJ Streever, (Ed.). Kluwer Academic Publishers, The Netherlands 338 pages.

3.2 Participants Recommendations

At the end of the workshop, all participants were asked to brainstorm on general recommendations for the promotion of EMR in Indonesia, considering both opportunities and obstacles.

1. Melihat besar dan luasnya kerusakan hutan mangrove dan dampaknya terhadap wilayah pesisir dan kehidupan masyarakat, maka dirasakan pentingnya aksi untuk mengurangi laju kerusakan hutan mangrove dan mengupayakan pemulihannya secara terpadu.
2. EMR adalah pendekatan yang harus di terapkan untuk merehabiitasi hutan mangrove dan perlu dilanjutkan dengan pengelolaan pesisir secara terpadu.
3. EMR perlu direkomendasikan menjadi metodologi rehabilitasi untuk mengurangi tingkat kegagalan rehabilitasi mangrove.

4. Proses pemulihan hutan mangrove dengan pendekatan EMR perlu disosialisasikan ke media massa, advertorial dan perguruan tinggi dan pihak-pihak lainnya, dan diimplementasikan secara lebih luas, tidak hanya terbatas d beberapa lokasi tertentu saja.
5. Keberhasilan rehabilitasi hutan mangrove memerlukan sinergi / kerjasama dengan stakeholders lainnya. Kemitraan antar para pihak (masyarakat, pemerintah, perguruan tinggi, LSM, swasta) sangat di butuhkan untuk menyukseskan kegiatan rehabilitasi mangrove.
6. Diperlukan peningkatan secara berkelanjutan kapasitas sumber daya manusia di bidang pengelolaan lingkungan hdup dan penataan ruang pesisir.
7. Perlu di lakukan upaya penyadaran masyarakat dan pengawasan secara konsisten untuk menghentikan pembukaan hutan mangrove menjadi lahan tambak.
8. Di dalam melakukan rehabilitasi mangrove, pendekatan ekonomi harus diintegrasikan ke dalam pendekatan ekologi. Pendekatan ekonomi harus menciptakan lapangan kerja bagi masyarakat setempat di mana hasil-hasil dari kegiatan ekonomi tersebut perlu dikerjasamakan dengan program-program pemerintah dan swasta agar produknya dapat diterima pasar (marketable).
9. Proses pelibatan perempuan dan kajian antroplogi social harus di lakukan dalam kaitannya dengan proses EMR secara holistic.
10. Model-model pendekatan Sekolah Lapang dapat diterapkan untuk membangun kesadaran masyarakat dan memberdayakan masyarakat di dalam mengelola sumber dayannya secara lestari.
11. Tambak-tambak yang tidak lagi dikelola perlu direhabilitasi kembali menjadi hutan mangrove diupayakan semaksimal mungkin secara alami.
12. Perlu di dorong upaya mengalihkan pemanfaatan suberdaya mangrove dalam bentuk produk ekstraktif yang bernilai ekonomis.
13. Perlunya dibangun kesepakatan dengan masyarakat local dengan menghargai kearifan local didalam mengelola hutan mangrove dan didokumentasikan sebagai kebijakan formal.
14. Kegiatan pelatihan rehabilitasi mangrove harus dilanjutkan secara kontinyu.
15. Perlu melibatkan pemerintah-pemerintah daerah didalam sosialisasi dan implementasi EMR secara lebih luas.
16. Perlunya mendorong upaya penegakan hukum secara konsisten guna mendukung pengelolaan hutan mangrove secara berkelanjutan.

4.0 Participant Evaluation

Method: Participants used the "plus-minus-change" method (described below) to evaluate the effectiveness of the "Ecological Mangrove Rehabilitation Workshop" and reflection to describe the processes and material covered in the EMR workshop. These two simple evaluation processes have proven effective when working with multi-stakeholder groups.

1. "Plus-Minus-Change"
   On the blackboard or a large piece of paper, create three columns and label them "plus," "minus," and "change." On the y-axis, participants were asked to write down the following headings; "Content," "Facilities," "Field Trip," "Gender," and "Other."

2. Reflection
   Participants were also asked to list "Opportunities," and "Obstacles" to EMR in Indonesia, which to some extent has been addressed in formulating recommendations from part

4.1 Summary of Results from "Plus-Minus-Change"

Category	Plus (+)	Minus (-)	Change (Δ)
Content	Mangrove Forest Management Ecological Mangrove Rehabilitation Historical Implications For Coastal Erosion Case Studies Recommendations Geomorphology Understanding of hydrology clear Economic issues covered well Social and women's involvement issues covered well	Watershed discussion Presenters spoke to much of results and not process Need audiovisual materials Too much theory - need some practice Too many technical terms Too short	Need to express links to coral reefs and biodiversity More representative from BLH Province and District Field Trip to North Sulawesi More interactive sessions More take home practical material More time More social science focus
Facilities	Good food Good facilities	Not enough transportation money Too much MSG in the food	Government standard for transportation is 110,000rp/day
Field Trip	Both good and informative Good to see small island and mainland differences	Lack of dialogue with local villagers	
Gender	Many vocal and expressive women sharing their views The majority of women participated heavily	One male participant still very inappropriate even in a clearly gender themed workshop	
Other	Interactive Discussions	Participants late Cell phone use in workshop One good moderator that knows mangrove issues would have been helpful	Translation was sometimes wrong Longer workshop needed

4.2 Results from Reflection

Opportunities	Obstacles
Lots of available land which needs EMR Local communities increasingly engaged in NRM Community interest high People understanding and prioritizing - biodiversity - ecological restoration - ecosystem approach - women's involvement Some government agencies also forward thinking EMR is an inexpensive, viable solution There needs to be an alternative, successful approach to what has been a big failure - mangrove restoration	Competing land-uses Unclear Land Tenure People will still clear-cut timber, not from local communities but transients Government programs working in the opposite direction of EMR - thinking in terms of short term economic growth rather than long term solutions (habitat rehabilitation) Lack of holistic government awareness of mangrove rehab and conservation, communities ahead of government in terms of holistic thinking (written by government officer) Many interested only in increasing mangrove growth out to see - to extend aquaculture zone. Because EMR needs time to prove results, some stakeholders will lose patience.

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