

Technical Report - Rapid Survey on Potential of Ecological Mangrove Rehabilitation

Executive Summary

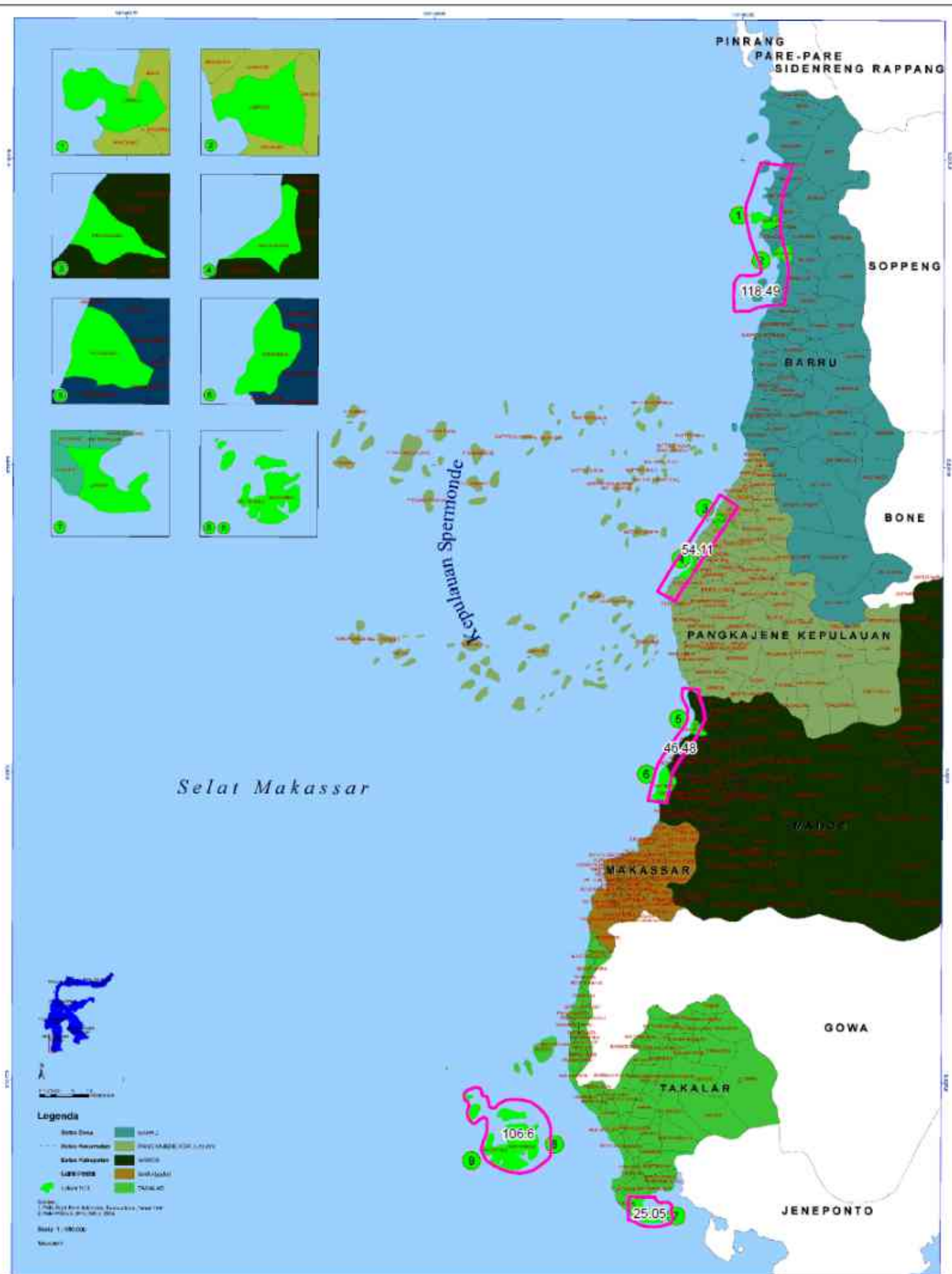
400 hectares of mangrove habitat is slated to be rehabilitated using the Ecological Mangrove Rehabilitation (EMR) method, as a major part of the Restoring Coastal Livelihoods program. 45 hectares have already been hydrologically rehabilitated in Lantang Peo village, Tanakeke Island, with another 120 ha planned for 2011-2012 (year two of RCL) in the villages of Tompohtana and Rewatayya/Kalukuang, with mid-course corrections being performed in Lantang Peo. Thus, 165 ha of mangrove rehab will take place on Tanakeke Island over the first 2 years of RCL, keeping the project on track quantitatively. This report takes a rapid look at the potential for EMR to be undertaken in other areas of the RCL project, in order to spread the benefit of EMR to other regions. There is also the added consideration of developing one or more higher-profile or accessible EMR sites for future advocacy purposes.

The findings from the rapid survey indicate the following;

- Continued EMR totalling between 300 - 400 hectares on Tanakeke Island alone is feasible, and would guarantee the completion of RCL targets. It is also economically feasible to complete 400 hectares on Tanakeke, and still undertake EMR in the other Districts.
- On mainland Takalar, there exists a pair of potential sites in Puntondo village. These sites should be prioritized for EMR, due to their higher profile - associated with the PPLH environmental education center. Land tenure issues, and collaboration between stakeholders are the keys to securing these sites. From an ecological/hydrological perspective, these sites have a high likelihood of successful EMR.
- Maros and Pangkep districts offer no significant potential for EMR. RCL project sites in this district maintain a viable greenbelt of *Avicennia* spp., but are not interested in rehabilitating parts of the aquaculture complex (built in historically converted mangrove areas), which are the only ecologically/hydrologically viable habitat for mangrove rehabilitation. There is no need to enhance (with plantings) areas where land is accreting (sedimentation) in front of the existing *Avicennia* greenbelt, as these areas are currently being colonized naturally by the *Avicennia* themselves.¹ The proximity to Makassar, the relative high price of land, the cultural longevity of aquaculture (although currently experiencing low economic productivity) and male dominance in decision-making are all factors which make it difficult to consider rehabilitation options in this area. However, were an RCL EMR assessment team to re-visit this region, and find significant community interest in rehabilitating under-used or disused aquaculture ponds, it would be prudent to develop one or more sites for potential multiplier effects.
- Barro District offers some, albeit small, potential for EMR. The village of Lampoko has both abandoned shrimp ponds physically viable for EMR, as well as degraded forest areas along the bay that could be enhanced. The village of Lawallu also exhibits abandoned shrimp ponds which would make good EMR sites. Coordination with community and land tenure discussion should ensure.
- Various stakeholders have suggested three areas in South Sulawesi, which do not occur in EMR districts, where EMR has strong potential. These are located in Wajo, Luwu District and Jeneponto Districts. Discussions about these three potential sites for EMR spread are discussed in this report.

¹ Note: programs such as Green PNPM are attempting to plant these accreting areas, as well as tidal mudflats which exist farther out to sea with *Rhizophora* seedlings, and are meeting with difficulty and failure - which is currently being researched in a separate report by MAP-Indonesia.

RCL Project Locations



Takalar Sites Investigated



Tanakeke Island

Mainland Takalar
Laekang Village Area

Takalar Mainland

Five potential sites have been investigated on Takalar mainland. These sites have been prioritized below and provided with a discussion.

1) Empang Besar - Puntondo

As you approach the PPLH environmental education center from the village of Puntondo - you come point just before entering the village where the road bisects Laekang Bay to the right (East) from an area of abandoned aquaculture ponds to the left (West). This area of ponds measures approximately **7 hectares**, and was historically mangrove habitat. Closer to shore, a variety of back mangrove species exist (predominantly *Lumnitzera racemosa*), many growing on salt-tolerant grass which is likely serving the double function of physically protecting small mangrove seedlings from waves/currents, as well as preparing the substrate for seedling establishment (biochemically), by converting anoxic substratum to a more organic, oxidized substrate. As one heads north in this mini "bay," the substrate height decreases, giving way to habitat appropriate to mid-front mangrove species including *Avicennia* spp, *Sonneratia* spp, *Brugueira gymnorhiza*, *Rhizophora apiculata*, *R. stylosa* and *R. mucronata*. These seedlings are in abundance along the Western edge of the area, where, due to dike wall degradation and wind, natural seedlings have taken root and are growing well. This site would have grown back to a greater extent, except that it is somewhat propagule limited, do to the general lack of adult mangrove trees in greater Laekang Bay. From a physical standpoint, continued strategic breaching, rethinking a connection to the sea to the East, and human-assisted mangrove propagule dispersal should fully revegetate all appropriate mangrove habitats in the abandoned pond complex.

From a sociopolitical standpoint, there is still a fair amount of organizing and advocacy work that needs to be addressed. Around half of the shrimp pond complex was re-claimed by the Bupati's office, as local community members who had been managing the ponds had no official utilization or ownership documents. It is said that the Bupati had ceded these lands to friends but this needs to be further investigated. A special strategy to win over the Bupati's office may involve a trip to successful EMR on Tanakeke as well as additional political/academic influence.

The other half of the complex is "owned" by a pair of remote owners, from around the area of Cikoang. These owners need to be approached as well. It would be prudent to involve local community groups (Pasir Putih, Bunga Desa) as well as PPLH to assist with settling land tenure issues. District government offices, such as fisheries department staff who have participated in EMR trainings, can be considered as well.

Empang Besar - Puntondo



Potential rehab boundary (approx 15 ha)

2) Artificial Lagoon - PPLH Puntondo

This area, behind PPLH, should be considered for enhancement (fisheries and mangrove enhancement) as well as the development of a demonstration silvo-fishery model.

In the historical past, this area exhibited a fringing mangrove typical to Laekang Bay. It was heavily logged by Japanese during WWII, and had never recovered. Core samples in the bay reveal a plentiful layer of mangrove peat, 15-25 cm below the surface sediment. Extensive aquaculture ponds were developed in the area, and an area of high land formed due to dredged sediment, and wind-blown material. This has grown over with beach forest species, as well as an abundance of *L. racemosa*. The entire area functions currently much like an artificial lagoon. In terms of ownership, PPLH owns 2/3 of the lagoon area, while a community member from Puntondo owns the final third.

There are three inlets for sea water into the resultant pond area (see map). The inlet closest to PPLH is restricted by a weir door. Flood tide-micro-delta formation is evident inside this opening, and the area requires maintenance (removal of sediment) and potentially a small amount of widening (too much widening would reduce the tidal prism and likely increase micro-delta formation).



Potential rehab boundary (approx 2 ha)

Artificial Lagoon - PPLH Puntondo (continued)

The second opening exists midway through the artificial lagoon. It is a small opening, filling and draining slowly. It has recently been further restricted by workers from PPLH, who have created an undersized culvert to allow its passage through a newly built fence. The inside of the pond complex, at this point, has recently been fortified with a dike wall, further restricting flow in and out of the lagoon, and reducing habitat connectivity. The outflow to this final pond occurs in the community members area. This opening is also restricted by a weir door.

Poor operation of the weir doors, can result in death of most of the mangroves within the lagoon by flooding. There are already recent signs of stress of the mangroves. The mangroves are also at great risk during a storm event, which could cause flooding from land or from sea. Inadequate drainage in the pond could lead to rapid mortality of mangroves inside the area.

It is in the best interest of PPLH and the private community owner, to make hydrological amendments to the entire area, to ensure improved water exchange, habitat connectivity, and mangrove survivorship. This can be achieved while still promoting silvofisheries value in the final third of the pond (owned by the community member).

Pond Complex - Laekang Village



Low to no potential



Historical extensive pond (circa 1600's)

3) Pond Complex - Laekang Village

There is little potential here for rehabilitation, as the ponds are currently operated by the community at Laekang Village. What is of major interest here, is evidence of a very old, historical pond, which is likely one of the models for all milkfish/prawn aquaculture world-wide. A final meander of the Laekang River, has been historically sectioned off, to retain water and serve as a traditional form of aquaculture, which has persisted to this day. This pond may be many hundreds of years old, and could provide a good example of sustainable silvofisheries.

Cikoang - Takalar Mainland



Current low potential as ponds appear operational.
Ground-truthing of current status recommended.

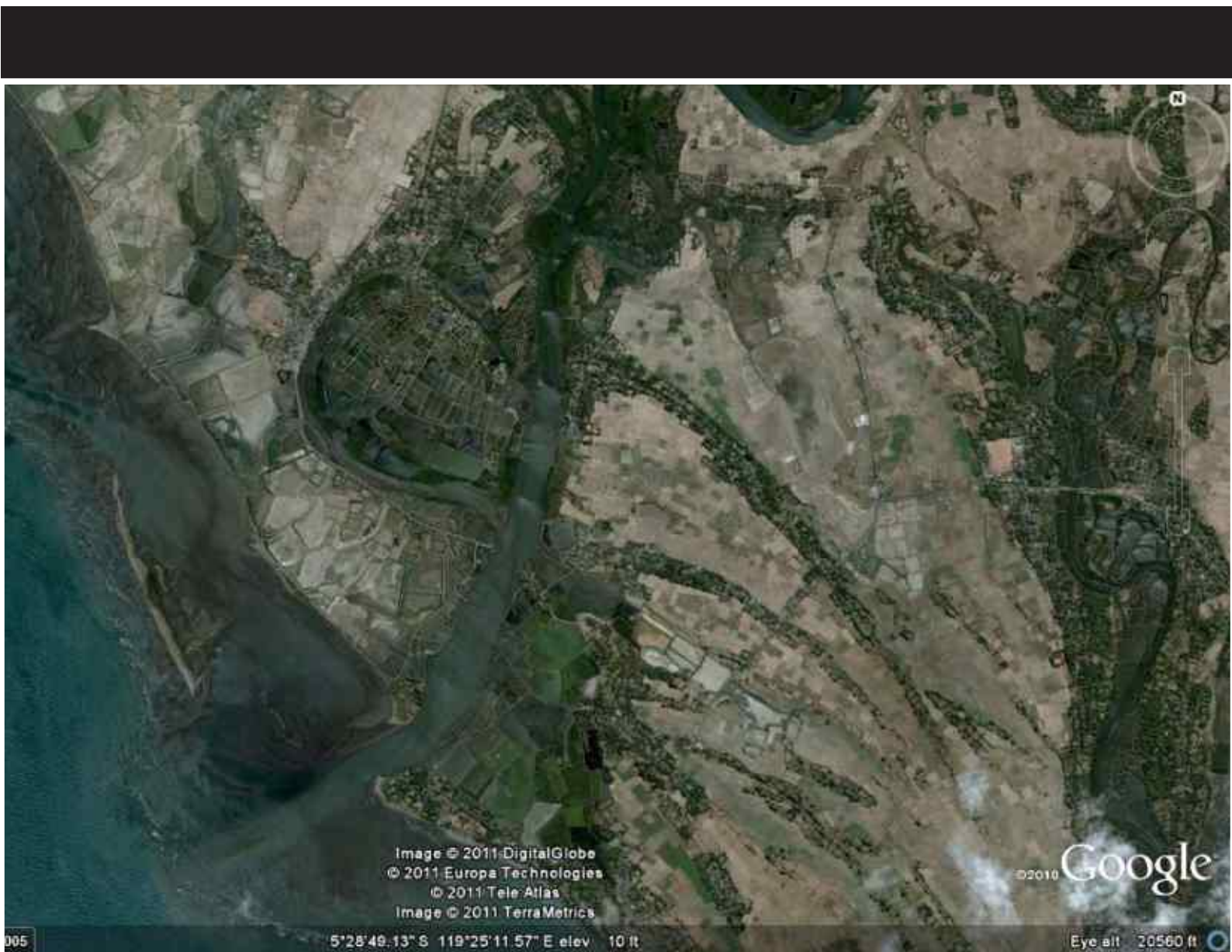
4) Cikoang

The mangrove on Cikoang exist on a major river, and there is abundant natural mangrove habitat that has been severely degraded, both due to aquaculture expansion, salt production and over-logging. Much of the riverine mangrove habitat in this region could be rehabilitated, with community buy-in. Cikoang is currently outside of the RCL working region. One reason to strongly consider this area, is its potential for production of *Acanthus ilicifolius*, a mangrove herb which is being promoted by RCL for production of herbal tea and other health products.

It is also suggested to re-investigate pond status and ownership, sending in a rapid mapping team for the exercise (should not be overly participatory, in order not to raise expectations of local community - best guised as research).

5) Takalar Lama

This area by the dock where boats depart for Tanakeke Island was historically a large riverine mangrove system. It was severely degraded, due to aquaculture development, yet there is a lot of evidence of pond abandonment and natural re-vegetation within many abandoned ponds. There is also evidence of mangrove planting by communities in the river, which shows their interest in bringing mangroves back to life in this area. This area is also home to once abundant stands of *Nypa fruticans*, another source of mangrove products that RCL is interested in developing. Trialing utilization of the *Nypa* sap, and improved management of the stand, may lead to more opportunities for mangrove rehabilitation, including *Nypa* rehabilitation. Once EMR is completed on Tanakeke Island, villagers involved in EMR should be contracted to develop awareness of mangrove rehab in Takalar Lama (where many have extended families) and also map the pond complex. This activity can also take place as part of *Nypa* palm field school.



Ground-truthing of current status recommended.

Possible potential for *Nypa fruticans* utilization and improved management, as an entry point into habitat rehabilitation.



Significant evidence of pond abandonment, and natural revegetation - circa 2005. More recent status check needed.

Significant potential for *Nypa fruitcans* utilization and improved management, as an entry point into habitat rehabilitation.



Maros and Pangkep Districts

Areas surveyed in these two districts include Nisombalia and Pajukukkang villages in Maros and Pitusunggu and Bontomanai villages in Pangkep. These areas are written about together due to their similar nature.

In general, these areas occur at major or minor river estuaries along the Western coast of mainland South Sulawesi. Historically, they would have featured a range of mangrove habitat types, predominantly alluvial river delta and riverine. There would be anywhere from 12-24 species of true mangroves in this area, providing significant ecosystem services, not least of all fisheries production.

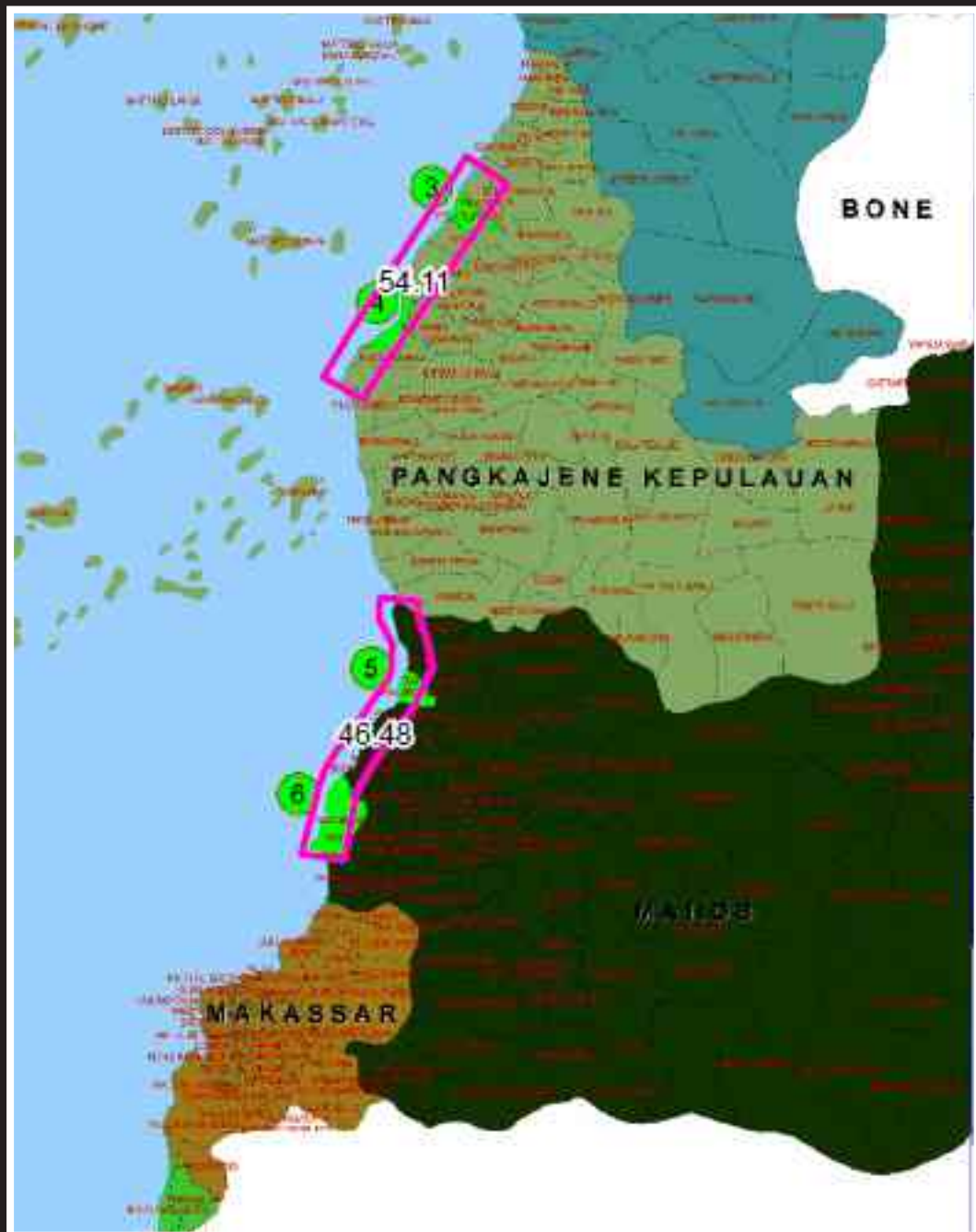
Aquaculture ponds, in this region have developed early on, in between the 1950s and 1980's, which is earlier than most regions in Indonesia. The ponds originally were run as extensive to semi-intensive systems, with intensification taking place in the 1980's as Indonesia strived to push shrimp export earnings. Disease caused these systems to return to semi-intensive production today, largely of milkfish, with polycultures of mixed low-value fish, prawns, and sometimes gracilaria seaweed. Most pond managers today complain of low yields, and the requirement for ever-increasing quantities of increasingly expensive urea to achieve those low-yields. Although the ponds are relatively under-productive, pond management continues, with resultant milkfish finding markets in Makassar, as well as Java.

There is some abandonment of ponds in this region, but there is also evidence of pond expansion where possible, sometimes facilitated by mangrove planting. Mangroves are planted, where possible, adjacent to existing mangroves along canals, rivers and beach front, and if they take hold, the previous mangrove coverage is cut and developed into ponds. This works to restrict flows in rivers and canals, and is seen as water management issue by some community members.

There is also frequent evidence of mangrove planting, in fluvial mudflats, at the seaward edge of existing mangrove greenbelts. This specific topic is being explored further in a current research effort by MAP-Indonesia. In short, *Rhizophora* spp. seedlings are being planted in these tidal mudflats, in greenbelts 15-50 meters wide. There is oftentimes evidence of sedimentation (accretion) in these mudflats, and colonization of *Avicennia marina* up to 15m away from their mother trees. The *Rhizophora* plantings are being done in direct competition to the natural seaward expansion of *Avicennia* in these cases. Mangroves are also being planted in eroding environments, but mostly meeting with total failure (100% mortality). In the instance of Nisombalia village, this action has been attempted 3 times, and is currently scheduled for a fourth planting as part of the Green PNPM program.

Thus, we see that communities and government programs desire to have mangroves, at least in theory, but will not take appropriate action to rehabilitate entire mangrove systems. Mangroves are only being considered for planting as a greenbelt to shelter aquaculture production areas. There is currently little to no opportunity to rehabilitate the aquaculture areas back into mangroves, as community and political will are set against this.

Maros and Pangkep Sites Investigated





Examples of Aquaculture Development

Desa Nisombalia, Maros (above)

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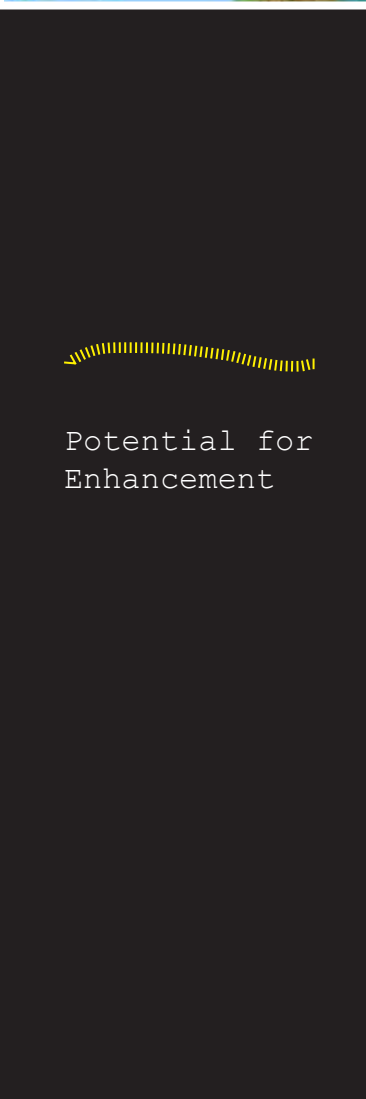
Desa Bontomanai, Pangkep (below)



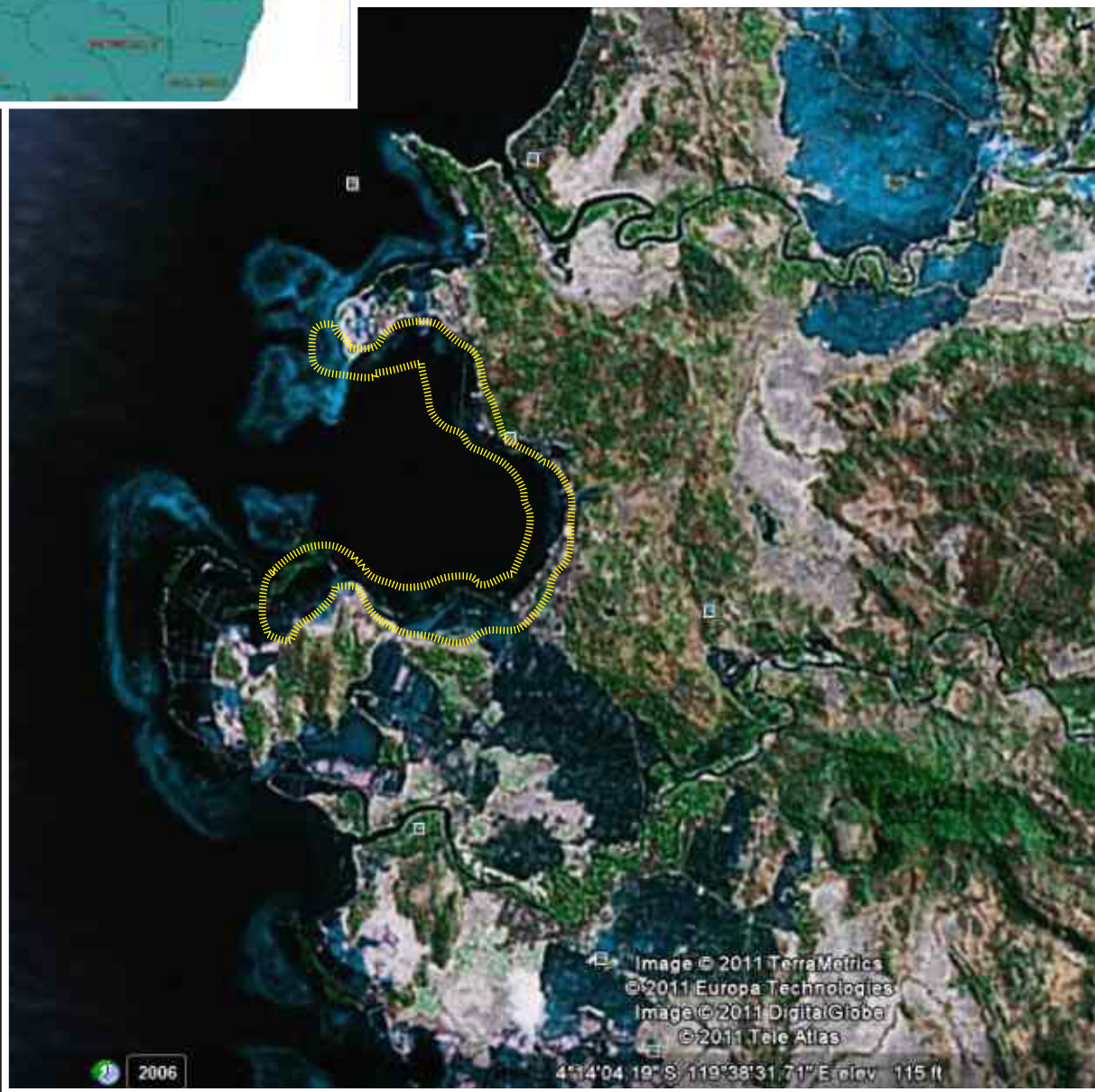


Barru Sites Investigated

Lawallu Village



Potential for
Enhancement



Barru District

Need to re-survey

Two RCL partner villages were surveyed over a period of 2 rapid visits, with additional information provided during various assessments including resilience assessment, vegetation assessment and agro-ecosystem analysis from coastal field school.

The village of Lawallu, is set on a small bay which receives significant fresh water inflow from the nearby uplands. Various species of mangroves still exist in the bay and adjacent shoreline, perhaps the most floristically diverse micro-habitat out of all RCL project sites. Some of the mangroves in the region have been converted to aquaculture ponds, including those at the nearby government fish hatchery and aquaculture demonstration site, however much of the mangrove forest has escaped conversion. Degradation of the resource through timber harvesting - for fuelwood continues apace. There would need to be a significant social movement to protect mangroves in this bay, and if so, there are opportunities for enhancement - both through promotion of natural revegetation as well as planting.

Lampoko offers less opportunity for demonstration of enhancement, due to less overall mangrove habitat.

Although the following three sites lie outside of the RCL focus region, they are located in South Sulawesi, and present opportunity for scaling-up of impact, and as such, remain in line with RCL foundation documents.

Siwa Region, Pitumpanua and Keera Sub-District, Wajo District, North Bone Bay

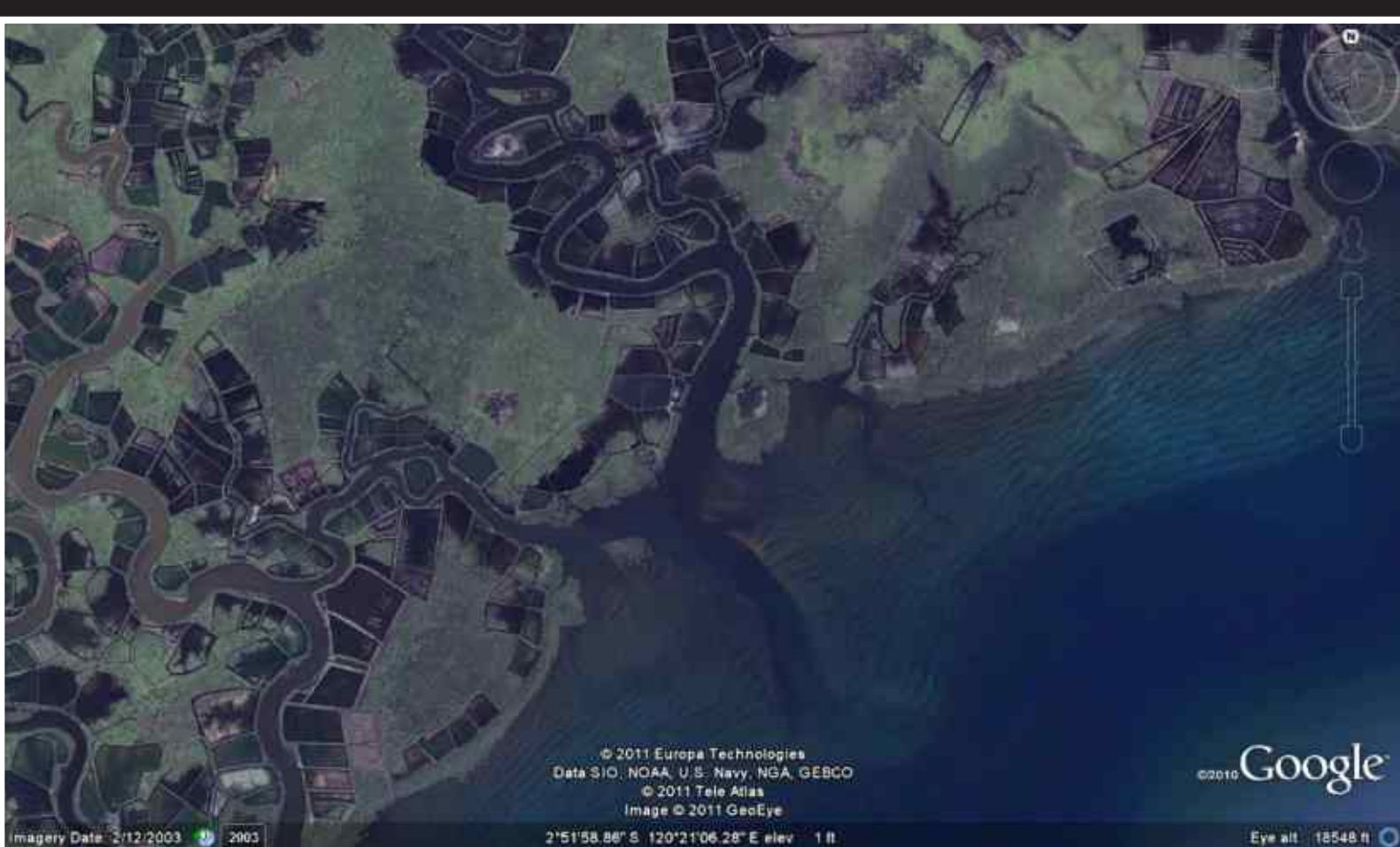
This site was suggested by Professor Marzuki Ukkas, of the University of Hasanudin Faculty of Fisheries and Marine Sciences, after his attendance of the RCL EMR Seminar, and subsequent understanding of the potential of rehabilitating disused shrimp ponds. The region is approximately 250 km north of Makassar, on the way to Palopo and Luwu District. The Siwa region consists of Siwa, Tokke-tokke, Bengteng, Laukku, Paojepe, Kaluku and Keera.

This region was identified as well, during initial assessment in year one, as having great potential for scaling up. The aquaculture ponds in this region are under-productive, and experiencing a large degree of abandonment. Ground-truthing is recommended.



Luwu and Luwu Utara Districts, North Bone Bay

North of Palopo, at the Northeastern most edge of the province, lies the region of Luwu. This region exhibits the largest region of in-tact mangroves in the province, but is also home to vast areas of aquaculture ponds. A trend analysis is needed to reveal the rate of expansion of aquaculture, or, indeed, if expansion has curtailed. The interesting opportunity that this region presents, is South Sulawesi's only in-tact contiguous mangrove ecosystem, which can provide a reference for ecosystem good and services that could be expected in other regions, if EMR is successful on a medium to large scale >500 contiguous hectares. Geographically isolated from major market areas, this region has a very rural population, richer in resources than many parts of South Sulawesi, but lacking in diversity of market opportunities. A survey team visiting Wajo, could continue onto Luwu for more ground-truthing. It would also be interesting to analyze developments two decades after a major mangrove restoration and conservation initiative in the region, undertaken by ADB.



This area in Luwu depicts around 50% conversion of mangroves into aquaculture ponds, juxtaposed to over 90% which exists in Maros and Pangkep Districts. Opportunity to halt conversion, and even reverse it by rehabilitation through programs such as fish farmer field school and Ecological Mangrove Rehabilitation are quite relevant for this region.



This area in Luwu depicts a mangrove area which has undergone near complete conversion.

This adjacent mangrove forest is still in a natural state, as of yet undeveloped for aquaculture.

To cease encroachment - programs such as fish farmer field school (and other field school types) coupled with EMR are suggested.

Jeneponto District

This District neighbors Takalar, an RCL Project target district. Three inquiries from the District level of government (Fisheries Dept, Forestry Dept and Planning Dept) have been made to MAP-Indonesia about the potential for EMR in Jeneponto. The government has planned, and continues to plan for mangrove planting, but are curious about the method of EMR, as past plantings have met with failure. One woman from the Forestry Dept is especially keen to trial EMR in Jeneponto, and has asked for MAP's assistance in a) site assessment and b) training.

This natural spread of EMR from Takalar District, to neighboring, non-target RCL districts should be encouraged. It is recommended that a team of community and government from Takalar, accompanied by RCL project team members explore opportunity in Jeneponto.

Biophysically, much of the Jeneponto coast is inappropriate for mangrove growth, as the majority is a high energy coast, featuring sandy and rocky beach communities. However, a major bay (Teluk Malasoro) exist in Jeneponto which was historically mangroved (read from 1954 US Army Corps of Engineers map) and there is also incidence of abandoned aquaculture ponds in previous mangrove habitat. Advice on where, and perhaps more importantly, where not to attempt mangrove rehabilitation is a service that the RCL project team should consider providing.



Jeneponto - Malasoro Bay

Most mangrove coverage in this bay is missing, due both to historical logging (circa World War II), as well as aquaculture development (above). Local stakeholders, and government (BAPPEDA, Fisheries Dept, Forestry Dept) have all expressed interest to MAP Indonesia in trialing ecological mangrove rehabilitation.

Detail of a river flowing into the bay shows slightly more original mangrove coverage than neighboring Laekang Bay. This means more propagules for natural revegetation of rehabilitated sites.



Conclusions

In a region where so much of the cause of mangrove degradation and destruction was caused by aquaculture development, it makes sense that the greatest opportunity for mangrove rehabilitation would take place in abandoned or disused aquaculture ponds. From a technical standpoint, EMR provides a feasible, low-cost, and highly successful means of rehabilitating these ponds into functioning mangrove ecosystems.

In some cases, full community support, as well as support from government agencies, exists, which enables mangrove rehabilitation to take place. This is the case on Tanakeke Island, where aquaculture failed largely due to higher operational costs and lower marketing opportunities, as well as the relative success of seaweed farming.

In other instances, communities, governments and international programs still have high hopes for the continuance of aquaculture. Such is the case in Maros and Pangkep districts, where several government agencies provide seed stock, international agencies and projects such as ACIAR, NACA, HIVOS/NOVIB are currently involved in "sustainable" aquaculture extension. Regardless of whether or not aquaculture provides a viable, sustainable future for a broad swath of South Sulawesi communities, its perceived value is still higher than the value that communities and local stakeholders place on a functioning mangrove ecosystem in the same spatial setting. Stop-gap solutions where mangroves and aquaculture coexist - such as development of greenbelts, and silvofisheries systems (mangroves in and on the fringes of ponds), still receive attention, whereas rehabilitation or restoration of the system is never considered.

In light of current circumstances and perceptions, it seems prudent to choose the simplest battles, Ecological Mangrove Rehabilitation, on Tanakeke Island and to a lesser extent mainland Takalar, where local communities are strongly supportive and stakeholders complicate. An attempt to make EMR visible, in Takalar near to the entrance of PPLH-Puntundo would seem imperative. It is also advisable to ground-truth Takalar Lama - to quantify pond abandonment, instance of natural revegetation of ponds, and quantify *Nypa fruticans* stands.

Gaining a foothold for mangrove rehabilitation in Barru, vis-a-vis enhancement is a viable and suggested option. Likewise is the undertaking of a more focused survey of the level of aquaculture pond use/disuse and owner preferences in Maros and Pangkep Districts.

An opportunity for awareness building on mangrove value exists in Maros, Pangkep and Barru, in the form of developing an industry for use of *Avicennia marina* propagules. This is being pursued in partnership with Big Tree Farms, and will provide short-term economic value for this valuable greenbelt. Increased perceived value of non-*Rhizophora* mangrove species can be built upon to try and gain support for front-to-back mangrove rehabilitation, as economic and ecological shelterbelts.

Assessing the potentials of non-RCL districts is not a major priority, but should only be considered if time and other resources permit.

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