


Quick Assessment and Nationwide Screening (QANS) of Peat and Lowland Resources and Action Planning for the Implementation of a National Lowland Strategy

PVW3A10002
Agentschap NL 6201068 QANS Lowland Development

BAPPENAS & Ditjen Sumber Daya Air, PU
Government of Indonesia
&
Partners for Water Programme
The Netherlands

Policy note on mangroves & tambak development in Indonesia
Final draft

Report on QANS Activity 2.6
28 February 2013

This Policy Note has been prepared as part of the *Quick Assessment and Nationwide Screening of Peat and Lowland Resources and Action Planning for the Implementation of a National Lowland Strategy* (QANS project) for the Indonesian Ministry of Public Works (PU) and Bappenas, funded by the Netherlands Partners for Water Programme (PfW), Agentschap NL 6201068 QANS Lowland Development (PVW3A10002). With QANS, PfW aims to support the Government of Indonesia in its efforts to achieve sustainable development of the lowlands, while at the same time promoting Dutch expertise and know-how in the water sector. QANS is implemented by a consortium consisting of Euroconsult Mott MacDonald (EMM) from the Netherlands in the lead, in association with DHV B.V. (the Netherlands/Jakarta), WUR/ Wageningen University and Research Centre (the Netherlands), Deltares (the Netherlands/Jakarta) and PT. INDEC Internusa (Bandung).

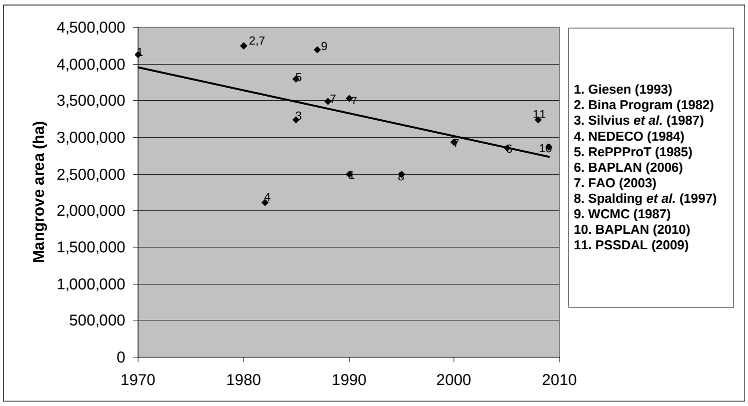
This Policy Note on *Mangroves and tambak development in Indonesia* was prepared by Wim Giesen (Euroconsult Mott MacDonald; wim.giesen@mottmac.nl), Ingrid Gevers (Centre for Development Innovation, Wageningen UR; Ingrid.Gevers@wur.nl) and Mohammad Ilman (tambak consultant; muh.ilman@gmail.com). This paper can be cited as:

Giesen, W., GJM. Gevers and M. Ilman (2013) - Policy note on mangroves & tambak development in Indonesia. Quick Assessment and Nationwide Screening (QANS) of Peat and Lowland Resources and Action Planning for the Implementation of a National Lowland Strategy - PVW3A10002. Agentschap NL 6201068 QANS Lowland Development. Euroconsult Mott MacDonald, Deltares, Wageningen UR and partners, for Ministry of Public Works and Bappenas, Government of Indonesia and Partners for Water (Netherlands).

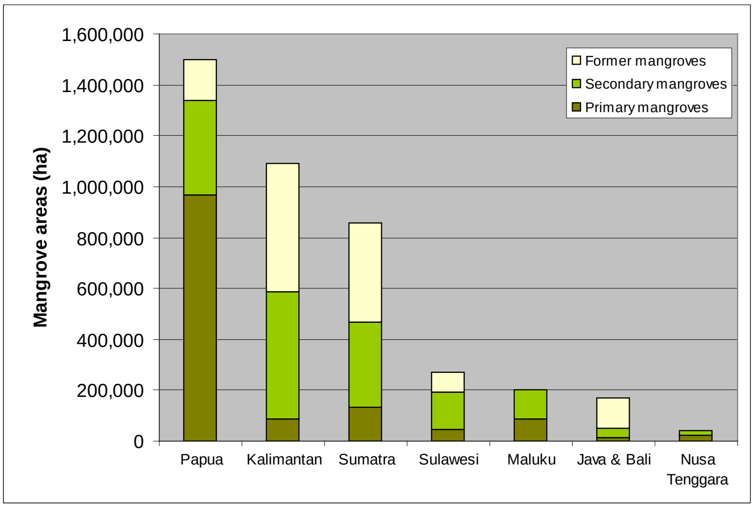
1. History of mangrove development

1.1 **Mangrove areas.** Indonesia has the largest mangrove area in the world. However, over the past 4 decades this area has declined from over 4 million hectares (Mha) to 2.7 Mha (2010). These latest figures are from the Indonesian Forestry Department's mapping section, Baplan.

Much higher figures are often quoted, but these are either outdated or are not based on detailed studies.

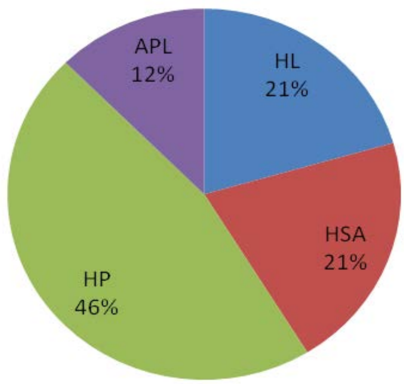


1.2 **Mangroves per island (-group).** Most mangroves can be found in Papua, with 1,335 (Mha), followed by Kalimantan (0.587Mha), Sumatra (0.469Mha), Maluku (0.201Mha), Sulawesi (0.191 Mha), Java & Bali (0.050Mha) and Nusa Tenggara (0.039Mha). 47% of mangroves are primary while 53% are secondary growth, which in the latter case means that they have been cleared and/or felled and are (in the process of) recovering. The % primary mangrove varies from 15% on Kalimantan to 28% on Java & Bali & 73% on Papua.

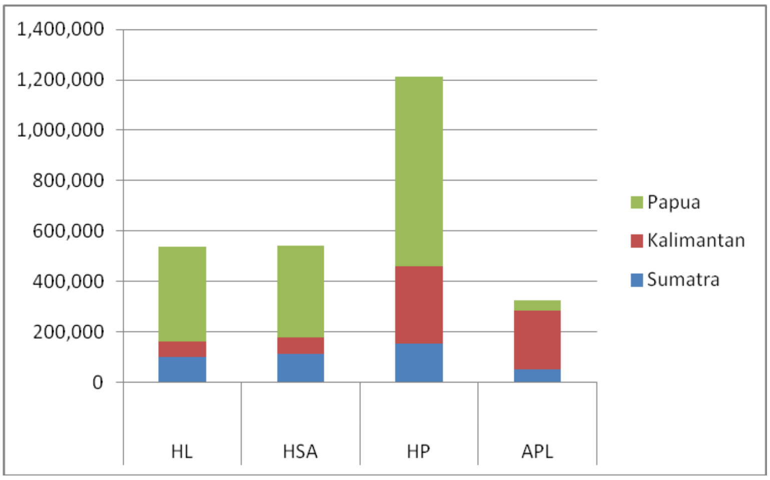


2. Mangrove legal status

2.1 **Forestry status.** Most (88%) of Indonesia's mangroves are legally managed by the Ministry of Forestry, while only 12% have a non-forestry (APL) status. Almost half (46%) of all mangroves have a production forest (HP) status, which can be either normal production (HPB), limited production (HPT) or for conversion (HPK). The remaining 42% are protected, either as a reserve for biodiversity protection (HSA, 21%), or as a coastal protection forest (HL). Mangroves are often claimed by the Ministry of Marine Affairs & Fisheries (KKP) in programs for fishpond development (see 5).

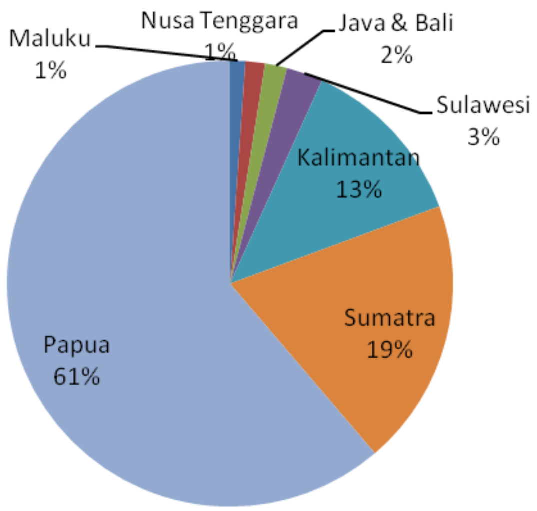


2.2 **Forestry status per island (-group).** About 90% of mangroves are located in Papua, Kalimantan and Sumatra. Forest status categories are not equally divided across the three islands (see figure). Production forest (HP) is distributed equally (pro rata) across the three islands, but Kalimantan has a very high percentage of non-forest mangroves (34%), while almost half (48%) of Papua's mangrove are protected, either for coastal protection (HL) or as a reserve (HSA).



3. Mangrove protection & biodiversity

3.1 **Mangrove reserves.** About 617,000 ha of mangroves were included in Indonesia's Protected Area Systems (HSA) in 2000, declining to 577,000 ha in 2010. This is a 6.4% loss, which compares to an overall 7.4% loss of mangroves nation-wide over the same period. Most (61%) HSA mangroves occur in Papua, while a further 32% occur in Sumatra and Kalimantan. HSA mangroves are particularly under-represented in Kalimantan, which has 20% of all mangroves but only 13% of mangrove reserves, in terms of area.



3.2 **Threatened mangrove species.** Indonesia has the most biodiverse mangroves in the world, with 219 higher plant species, including 49 'true mangrove' plant species (found only in the mangrove habitat) and 170 mangrove associate species. Kalimantan has the highest number of true mangrove plant species (39), while Java has the highest number of associate species (166), including a large number of herbaceous weeds. 28 species are threatened, including 12 true mangrove species and 14 Southeast Asian endemics (see list).

Threatened mangrove species in Indonesia					
Southeast Asian Endemics			*True Mangrove species*		
	Family	**Species**		**Family**	**Species**
1	Ericaceae	*Rhododendron brookeanum*	1	Acanthaceae	*Acanthus volubilis*
2	Euphorbiaceae	*Blumeodendron tokbrae*	2	Arecaceae	*Phoenix paludosa*
3	Euphorbiaceae	*Blumeodendron tokbrae*	3	Malvaceae	*Brownlowia tersa*
4	Euphorbiaceae	*Croton heterocarpus*	4	Malvaceae	*Campnostemon philippensis*
5	Flacourtiaceae	*Scolopia macrophylla*	5	Malvaceae	*Heritiera globosa*
6	Leguminosae	*Dalbergia menoeides*	6	Lythraceae	*Sonneratia ovata*
7	Loranthaceae	*Amyema anisomeres*	7	Myrsinaceae	*Aegiceras floridum*
8	Malvaceae	*Campnostemon philippensis*	8	Rhizophoraceae	*Bruguiera exaristata*
9	Malvaceae	*Heritiera globosa*	9	Rhizophoraceae	*Bruguiera hainesii*
10	Melastomataceae	*Ochthocharis bornensis*	10	Rhizophoraceae	*Ceriops decandra*
11	Myrsinaceae	*Aegiceras floridum*	11	Rhizophoraceae	*Kandelia candel*
12	Orchidaceae	*Oberonia laeta*	12	Rubiaceae	*Scyphiphora hydrophyllacea*
13	Orchidaceae	*Oberonia rhizophoreti*			
14	Rubiaceae	*Ixora timorensis*			

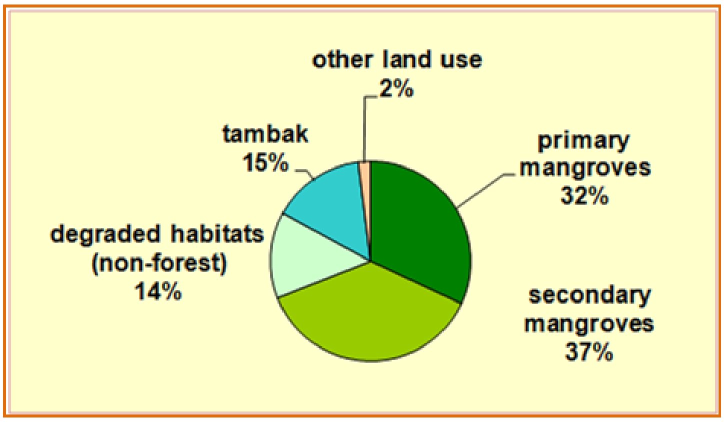
4. Mangrove green-belts

4.1 **Coastal protection.** Mangroves are important for protection of coastlines, as they can reduce storm surge water levels and reducing surface waves. They can potentially play a role in coastal defence, either alone or together with other measures such as early warning systems and sea walls. 1 km of mangrove can reduce storm surges by up to 50cm and wind induced waves by up to 75%. According to Bappenas studies, climate change is expected to lead to more frequent and violent storms, along with a sea level rise of about 65cm this century. Hints of increased erosion are already evident in some coastal areas (e.g. parts of West Kalimantan), even in well-vegetated areas, and are perhaps early signs of the effects of climate change.

4.2 **Coastal green-belt**. Indonesia had green-belt regulations (e.g. Joint Ministerial Decrees, No. KB 550/246/ KPTS/4/1984 and No. 082/KPTS II/1984; Presidential Decree (Kepres) No. 32, 1990), but following decentralisation legislation in 2004, green-belt legislation became a matter of interpretation at provincial level. As a result, green-belts are no longer enforced at provincial or district level, and development of coastal zones occurs unbridled. Law No. 27 of 2008 on Management of Coasts and Small Islands could potentially have filled the void, but detailed regulations that should have been issued at a lower level of legislation remain absent. In absence of provincial green-belt policies and legislation, Kepres 32/1990 seems the most appropriate; this stipulates that the coastal mangrove belt is minimally to be 130 metres times the average tidal range (in metres).

5. Mangrove conversion

5.1 **Land use changes**. Indonesian mangroves have declined in area by about one third since 1980, which means that about 1.33 Mha of mangrove have been converted to other land use/land cover. Conversion to brackish-water fish-ponds (tambak) is as the main cause of decline, but this accounts for only half of the conversion, as by 2010 tambak totalled 636,000 ha in 2010. WACLIMAD assessments of mangrove conversion from 2000-2006 indicates that most of the remainder ends up as degraded, unproductive habitat, with only small percentages (2-3%) becoming rice paddies, coconut groves and so on.

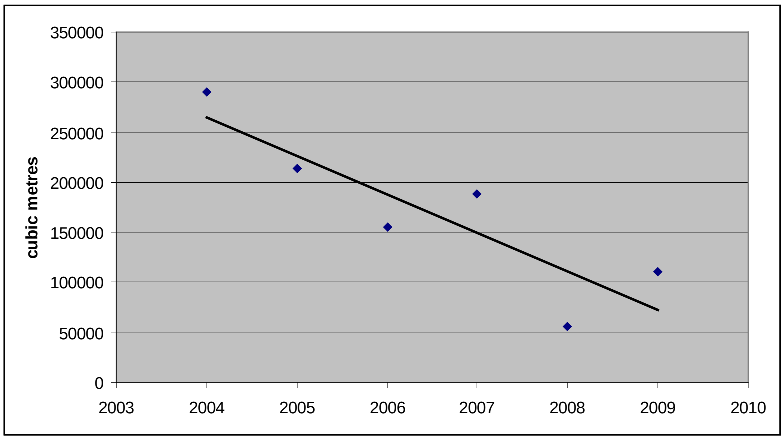


Mangrove conversion in Indonesia by 2010

5.2 **Carbon emissions.** It has emerged that mangroves are among the most carbon rich forest ecosystems in the world. Mangrove deforestation generates emissions of 0.02–0.12 Gt (billion tons) of carbon per year—as much as around 10% of emissions from deforestation globally, although mangroves accounting for just 0.7% of tropical forest area. Similar to peat swamp forests, much of the carbon stored in mangroves occurs in sediments, and over time this is far greater than aboveground carbon. Indo-Pacific mangroves store about 1,000 tons of carbon/ha, of which about 160 tons/ha is in aboveground biomass. The rest stored underground, of which about 40% in the topmost 30 cm. Based on land use changes from 2000-2006, is has been calculated that mangrove loss and conversion in Indonesia results in an annual emission of about 70 Mt of carbon per year, which compares to 760 Mt for forestry and LU changes, 500 Mt for peat land fires, 350 Mt for peat decomposition and 2,051 Mt overall for Indonesia. As a ballpark figure, mangrove conversion contributes about 3.4% of all carbon emissions in Indonesia.

6 Mangrove forestry use

6.1 **Mangrove concessions**. In 2009, 324,000 ha of mangrove were under concession, down from 455,000 ha in 1980 and 877,000 ha in 1985. Of the total area of mangrove under logging concessions, 282,768 ha (87%) is located in Papua, while 35,341 ha (11.2%) is located in Kalimantan and only 5,670 ha (1.7%) in Sumatra. In all, there are 23 forest concession companies (HPH) active in Papua, 13 in Kalimantan and only one in Sumatra. Production of logs (see figure) has steadily declined in the last decade, but figures on the other key mangrove products such as chips (for boards and pulp) and charcoal (for export) are unavailable.

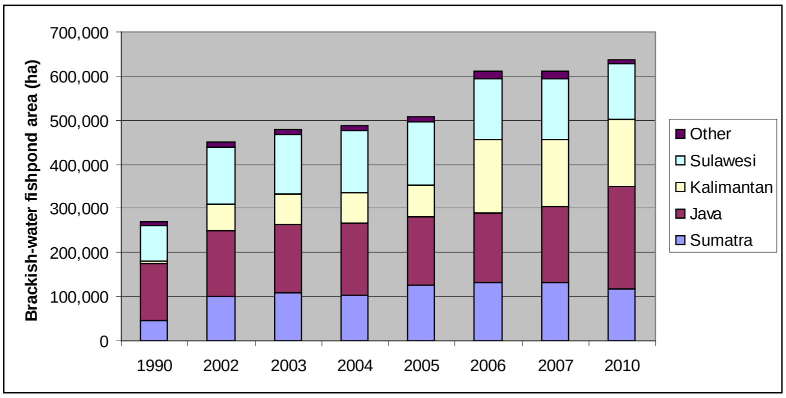


Mangrove log production in Indonesia

6.2 **Secondary degraded habitat.** Unsustainable forestry practices may have contributed to degradation, as clear-felled areas may be colonised by fast-growing mangrove herbaceous species such as *Acanthus ilicifolius, Acrostichum aureum* and *Derris trifoliata* (see photograph) than can prevent natural regeneration by out-competing tree species. Such degraded areas can remain locked in a stable condition for many year.

7. Tambak development to date

7.1 **Development of tambak area**. The total area of tambak (brackish-water fishponds) has increased from 145,000 ha in 1960, to 268,742 ha in 1990 and 636,000 ha in 2010. Provinces with the largest tambak areas are East Kalimantan (137,000 ha), South Sulawesi (97,000 ha), East Java (85,000 ha), Central Java (75,000), West Java (71,000 ha) and South Sumatra (41,000 ha) (KKP, 2010). Since 2000, expansion of tambak has been particularly rapid in Kalimantan, where during 2002-2010 the area increased 2.5 times.



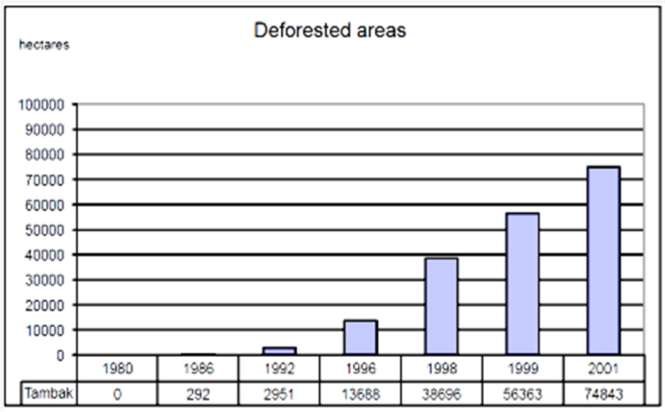
Source: KKP GIS database 2010.

7.2 **Challenges faced**

Despite the rapid growth of the industry, there have been setbacks in the production due to diseases and the increased concern about the environmental sustainability and social impacts of shrimp farming. Shrimp farms are often developed in mangrove areas leading to a loss in biodiversity, and pollution from ponds is flushed into the surrounding ecosystem by tides. Conversion of mangroves has also increased the rate of coastal erosion by removing the protective green belt (see images, right). The technical knowledge base of the majority of the shrimp farmers is low and most farms have a shortage of input supplies such as shrimp fry, good quality shrimp feed, regular supply of electricity and limited infrastructure development. The lack of accurate information and knowledge available to the farmers consequently results in inappropriate farming techniques, disease and production losses

In bottom image, disappeared mangroves are outlined in red, and tambak in yellow.

7.3 **Conversion & productivity.** Widespread mangrove conversion for tambak aquaculture was seen as a way to increase shrimp production. However, experience in many parts of Indonesia has often proven the opposite. A good example is the Mahakam delta in East Kalimantan. In 1996 a total of 13,688 ha mangroves converted to tambak produced about 6,000 ton of shrimp. Driven by increased shrimp prices in the late 1990s, mangroves were continuously cleared and developed into tambak. By 2001 the total tambak area in the Mahakam Delta quintupled to 74,843 ha. However, the shrimp production over the same 5 year period only doubled to around 11,000 ton. This highlights that the constant conversion of mangrove to tambak has had an adverse effect on the shrimp productivity decreasing from 400 kg/ha/year to less than 150 kg/ha/year over a 5 year period.



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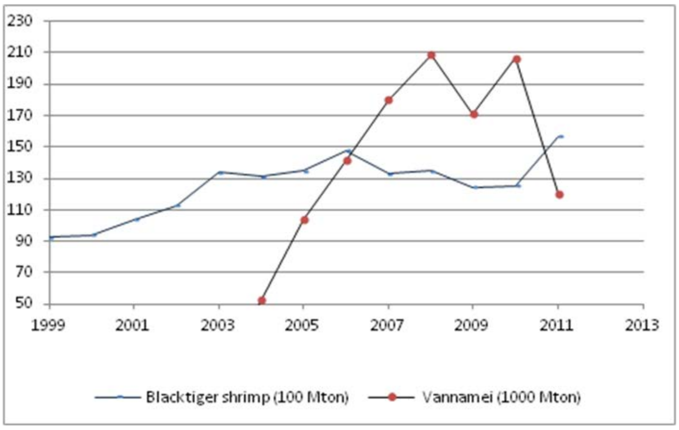
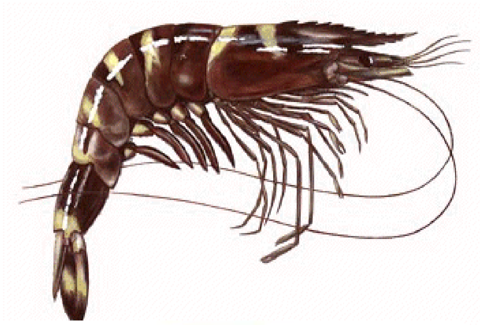
7.4 **A case of two shrimp species.** The Indonesian shrimp industry very much relies on two major species: *Penaeus monodon* or Black tiger shrimp and *Litopenaeus vannamei* or Pacific Whiteleg (Vanname) shrimp. Vannamei was introduced to commercial farms in East Java in 2003 in an attempt to maintain production levels after continuous harvest failure due to disease of Black Tiger shrimp starting in the mid-nineties. Initially, Vannamei shrimp was found to be much easier to culture as the species appeared relatively resistant to viruses attacking Black Tiger shrimp. Between 2004-2008 the national production of Vannamei increased from 53,000 ton to 209,000 ton, far exceeding production levels of the Black Tiger shrimp that varied between 90,000-150,000 ton. The impact of introduced Vannamei on the ecosystems has never been studied in Indonesia, which is worrying as in recent years Vannamei has also become susceptible to viral infections such as Myo and White Spot. Government plans to increase Vannamei production should therefore always include a risk assessment and bear in mind that escaped shrimp (an alien species) could affect the wild shrimp populations. Wild shrimp provide an important livelihood in areas with high quality native shrimp brood stock such as Aceh, and in traditional tambak areas along the east coast of South Sulawesi, East Kalimantan, West Kalimantan and along Sumatra's east coast.



Black Tiger shrimp production ranges between 90-150,000 metric tons/annum, while Vannamei increased from 50-210,000 tons from 2004-2008, but dropped to 110.000 tons in 2011.



8. Improved tambak development

8.1 **Tambak policies & regulations.** There is a need for clear government policy on coastal zone and environmental regulations, and measures to create a 'climate' conducive for sustainable tambak development. Tambak development and planning will benefit from a landscape or ecosystem approach that requires the combined action of scientific bodies, policy makers and famers. Capacity is needed to design and facilitate dialogues and planning processes from interdisciplinary perspectives, to achieve improved management of coastal zones. Tambak development can be made more sustainable through better regulatory and planning processes at provincial and national levels. Empowerment of farmers by enhancing their capacity and enforcement of regulations can play a significant role in enhancing the overall sustainable development of tambak farming.

8.2 **Tambak management.** Key considerations are the siting of shrimp farms and monitoring their development. Tambak should be developed in areas with suitable soil quality, a nearby source of good quality water with optimum salinity, and minimal tidal ranges of 1.5m to allow adequate flushing. Also, adequate provisions for protective mangrove green-belts should be made, both along the coast and along rivers. A balance between mangroves and tambak should be maintained, and a ratio of 4:1 (mangrove:tambak) is often cited, but may be adapted to local circumstances. Farms should be easily accessible and key infrastructure available. Better management practices are required to control disease in shrimp farms, including provision of healthy seed supply, good feed with the use of prophylactic agents (including probiotics), good water quality (including regular flushing), and lower stocking densities

9. Future of mangroves & tambak

9.1 **Mitigating impacts on the environment.** To mitigate impacts on the environment, brackish-water aquaculture needs to be compatible with other users, maintain buffer zones and an acceptable balance between mangroves and shrimp pond area, utilize improved pond design, and improve residence time of water and capacity to assimilate effluents of the water body. The use of mangroves for filtering shrimp pond effluents offers an attractive tool for reducing the impact in regions where mangrove wetlands exist.

9.2 **Balance between mangroves and tambak.** Brackish-water aquaculture (and especially shrimp farming) needs to strike a balance with other land uses and maintain mangroves for biodiversity, coastal protection and maintenance of coastal fisheries. Mangroves are important for tambak health and production, not only by protecting against coastal erosion, but also providing fish- and shrimp fry, using mangroves as filters for treating ponds effluents, and using them as buffers so that diseases are less likely to spread between ponds.

9.3 **Certification process & Good Aquaculture Practices.** Various initiatives are underway in Indonesia for certifying shrimp production, to reduce impacts on the environment and improve access to certain lucrative markets. However, there is a debate about the costs for certification, as small producers can often not afford this. The various standards required by different countries make compliance difficult and costly, hence the way forward may be "Good Aquaculture Practices" as this will improve management systems for compliance with certification standards.