UNIVERSITI PUTRA MALAYSIA

AGRICULTURE • INNOVATION • LIFE

STATUS AND TRENDS OF MANGROVES IN SOUTHEAST ASIA

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OUTLINE OF PRESENTATION

- Brief introduction
- Status and trend of mangroves by country in Southeast Asia (before 2000)
- Status and trend of mangroves in Southeast Asia (after 2000)
- Challenges

INTRODUCTION

- Approximately 75% of world's mangroves are found in just 15 countries, and only 6.9% are protected under the existing protected areas network
- Southeast Asia has the greatest diversity of mangrove species in the world, and mangrove forests provide multiple ecosystem services upon which millions of people depend

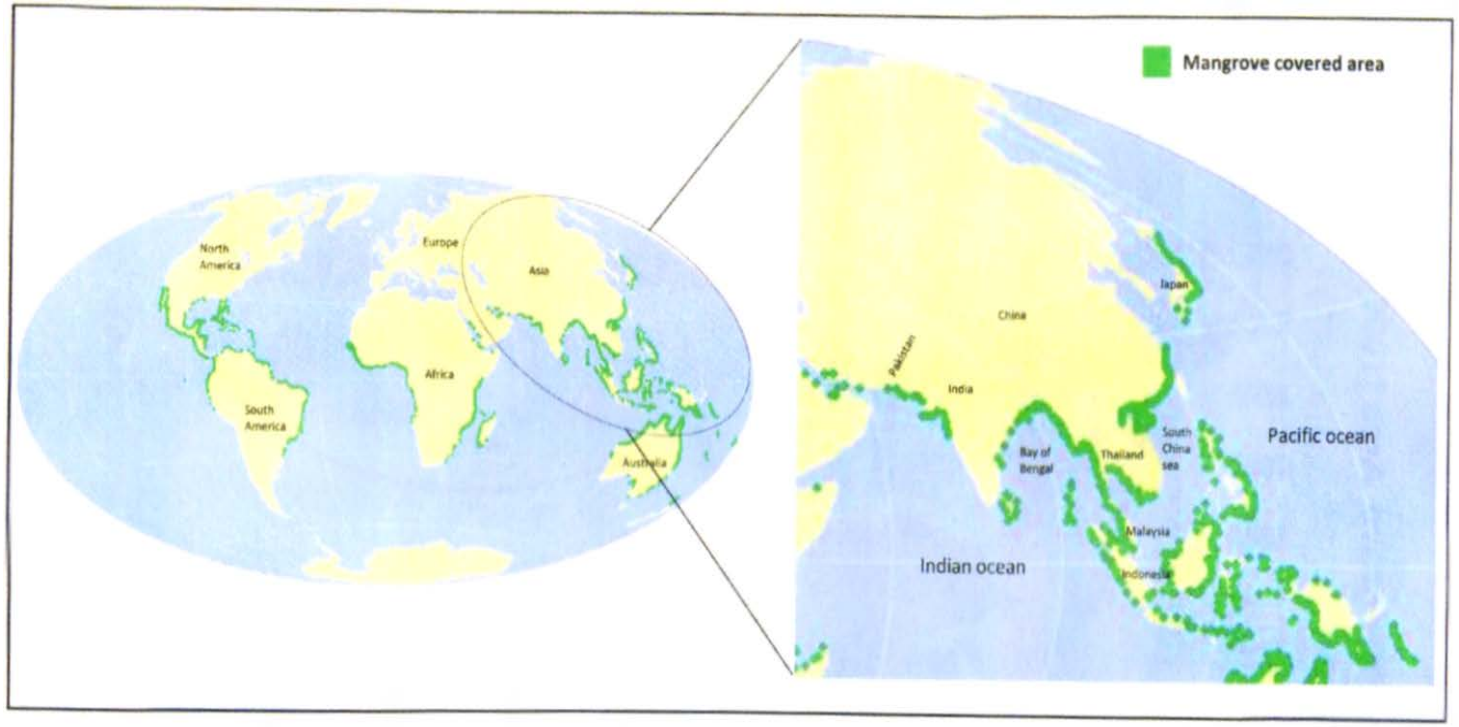
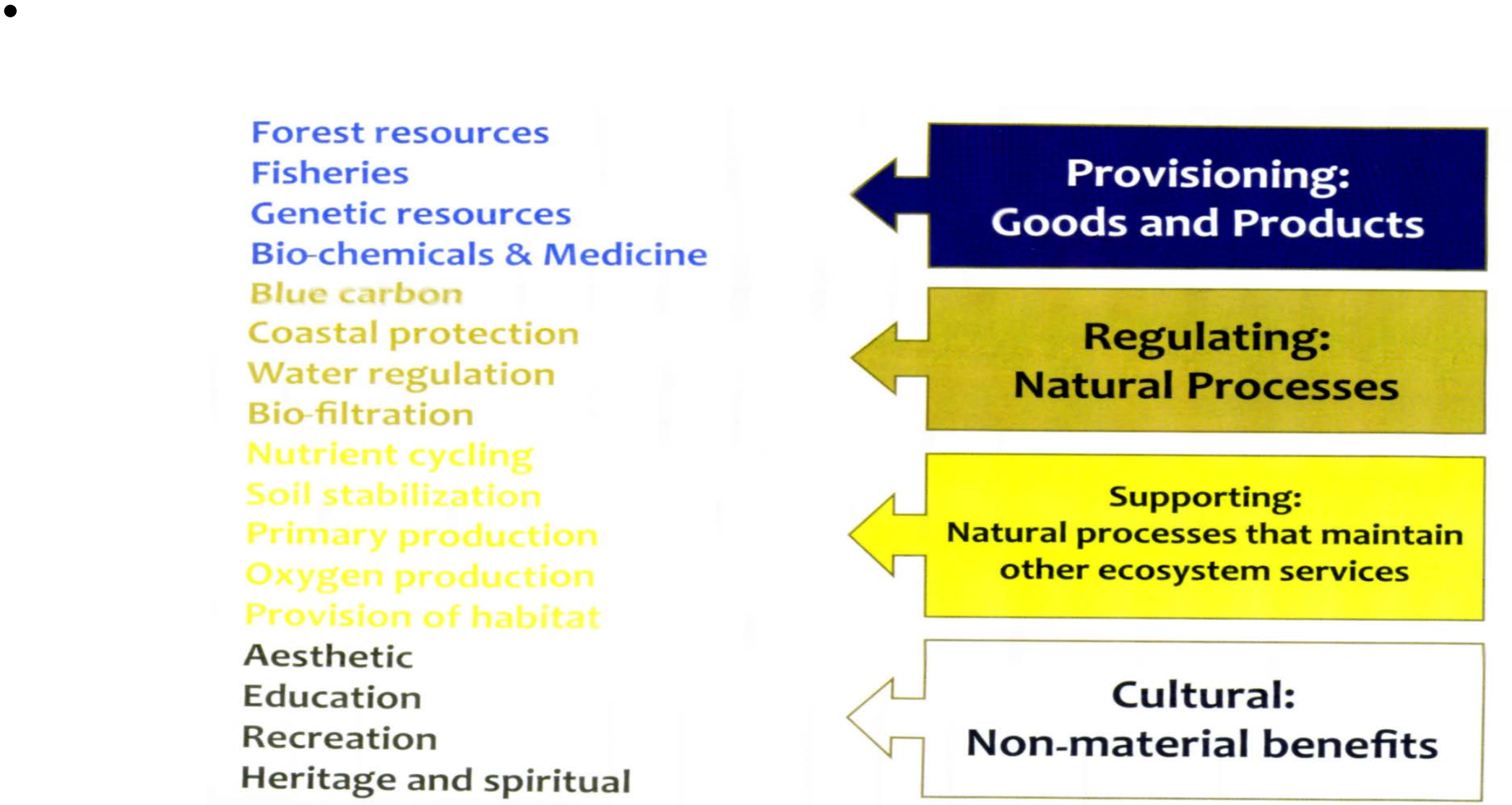


Fig. 1 Global distribution of mangrove forests. Distributions of mangroves in Asian countries are shown in inset. (Source: Giri et. al 2011)


Forest resources
Fisheries
Genetic resources
Bio-chemicals & Medicine
Blue carbon
Coastal protection
Water regulation
Bio-filtration
Nutrient cycling
Soil stabilization
Primary production
Oxygen production
Provision of habitat
Aesthetic
Education
Recreation
Heritage and spiritual
Provisioning:
Goods and Products
Regulating:
Natural Processes
Supporting:
Natural processes that maintain
other ecosystem services
Cultural:
Non-material benefits

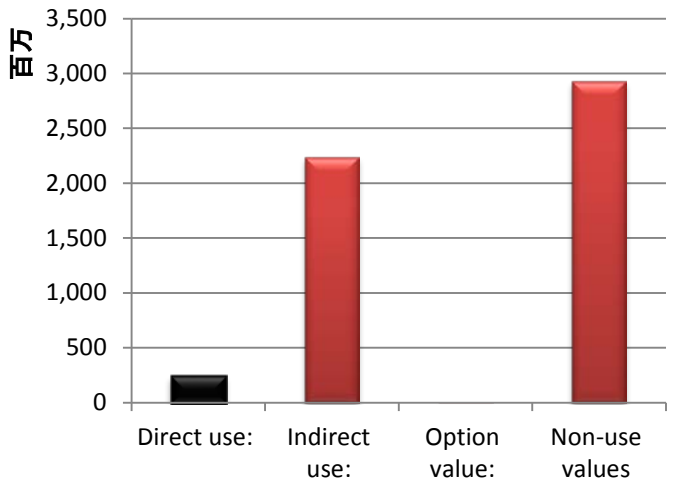
Carbon Storage by Mangroves

- They also store substantially higher densities of carbon, as compared to most other ecosystems globally, thus playing an important role in soaking up carbon dioxide emissions and mitigating climate change

- Mangrove forest sequesters as much as 50 times the amount of carbon in their soil per hectare as inland forest(Pidgeon, 2009)

Economic values of mangroves in Peninsular Malaysia
(GEF/UNDP/IMO, 1999)

4% - direct use value (market)
96% - indirect, option, non-use values (non-market)



Use values	Gross value (RM)
Use values	**2,475,741,981**
Direct use:	**233,721,896 (USD 58 million)**
Charcoal and poles	91,365,205
Fish & prawn	16,266,907
Mud crabs	13,476,857
Tourism	112,612,927
Indirect use:	**2,238,036,135**
Nursery role	1,094,871,841
Carbon sequestration	480,729,717
Protection from erosion	662,434,577
Option value:	**3,983,950**
Biodiversity value	3,983,950
Non-use values	**2,932,185,680**
Existence value	2,932,185,680
Use and Non-use values	**5,407,927,661**

COUNTRIES WITH MANGROVES IN SOUTHEAST ASIA

- <u>Mainland SEA</u>

Vietnam

Cambodia

Thailand

Myanmar

Peninsular Malaysia

- <u>Maritime SEA</u>

Indonesia

Philippines

East Malaysia

Brunei

Singapore

East Timor

Status and trend of mangroves by country in Southeast Asia (before 2000)

INDONESIA

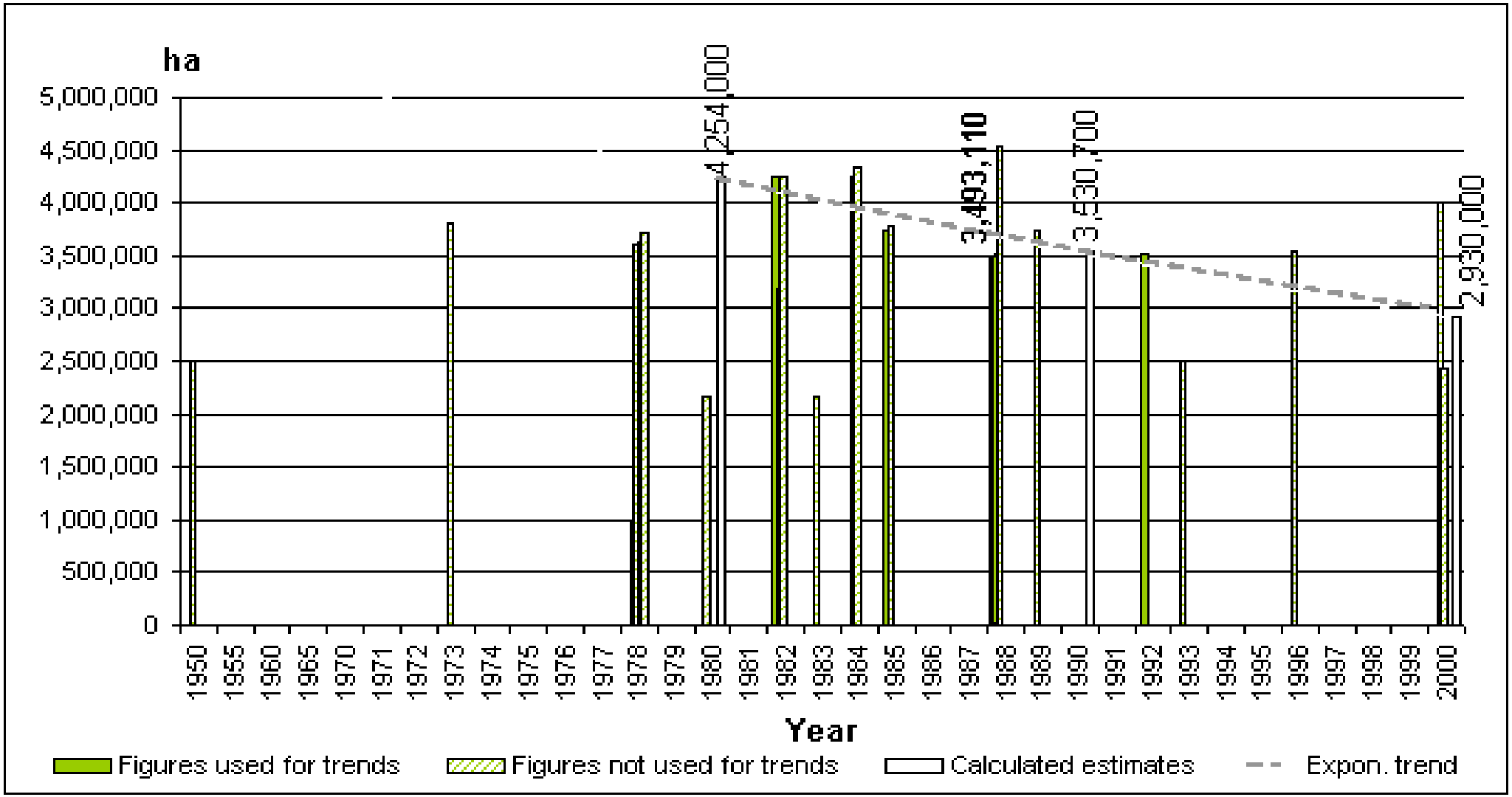


Figure 1. Trends in mangrove area extent over time

(Source: FAO, 2003)

Indonesia

- Shrimp farming evidently is the cause of approximately 25 per cent loss of mangroves in Indonesia

- Conversion to agricultural, mainly paddy land, over-exploitation by coastal communities, commercial logging and lack of effort on regeneration of degraded and over-exploited mangrove areas have been identified the reasons for 75 per cent of the mangrove loss

- Transmigration programme that facilitated human migration from over-populated Java to Kalimantan and Papua also had made an impact on tidal wetland extent (including mangroves) as they have been reclaimed for human settlements and urban expansion to accommodate the migrants

(Giesen *et al*., 2006)

CAMBODIA

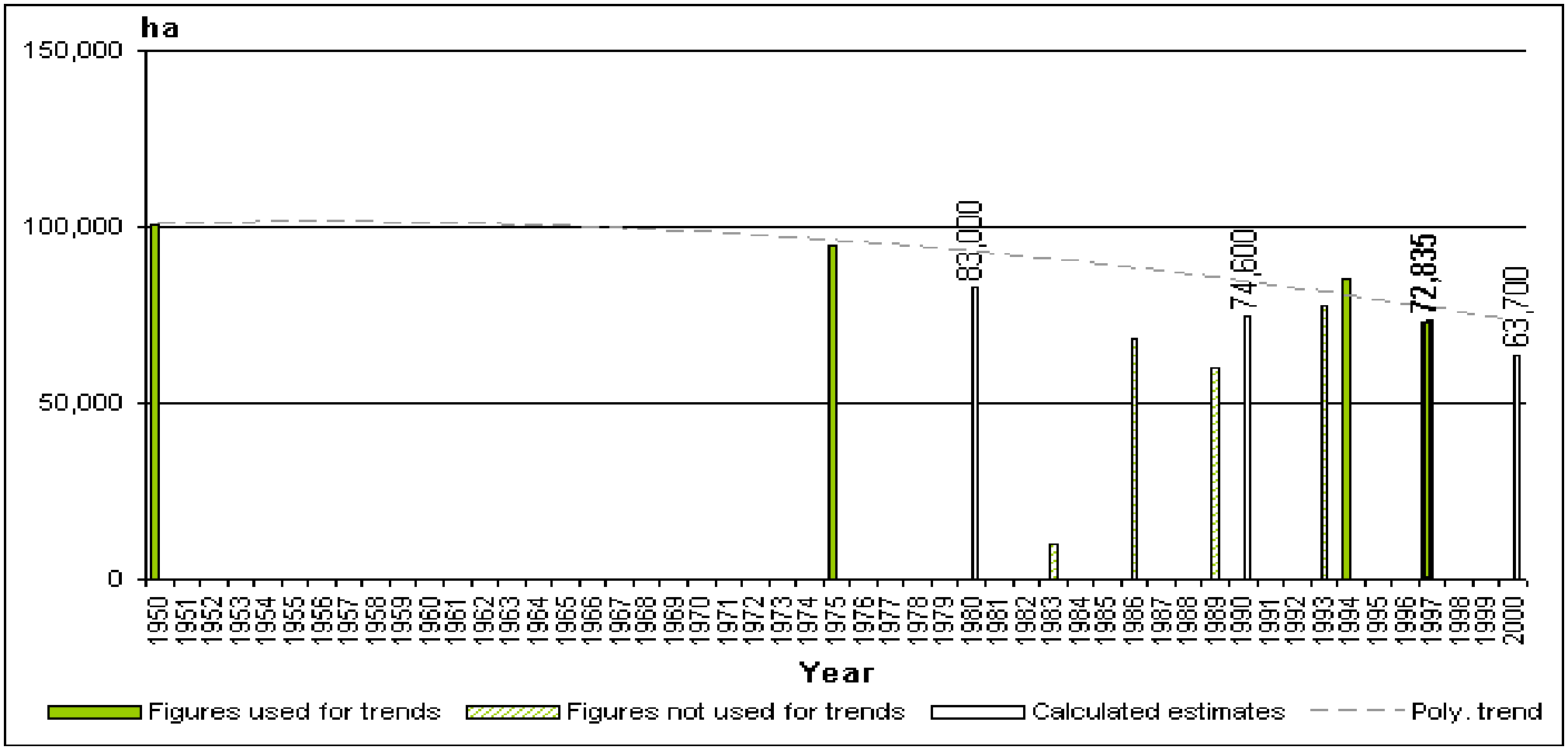


Figure 1. Trends in mangrove area extent over time
(Source: FAO, 2003)

CAMBODIA

- For fuelwood, charcoal and shrimp farming (mainly in Koh Kong Province) represent the most important causes of mangrove losses since 1978, when the Department of Fisheries of the Ministry of Agriculture, Forestry and Fisheries took the management of the mangrove forests
- Before this 1978, during the Khmer Rouge regime all conservation and forestry activities ceased, and although conservation has become important since then, there are no proposals for the protection or active management of mangrove areas
- Mangroves were first mapped for management purposes by the Department of Fisheries after the Khmer Rouge Regime at the same time that the Fisheries Law was adopted, which also protect mangroves as nursery area, and prohibited cutting of trees
- In some areas, mangroves have been cleared for salt production.
- Rural communities still rely on mangroves for their livelihood and economy; timber is still extracted for firewood and charcoal for domestic consumption and shrimps are produced even if in smaller quantities than in the past
- Some mangrove forests in protected areas (Ream National Park, Batum Sakor National Park and Peam Krasoap Wildlife Sanctuary)

BRUNEI

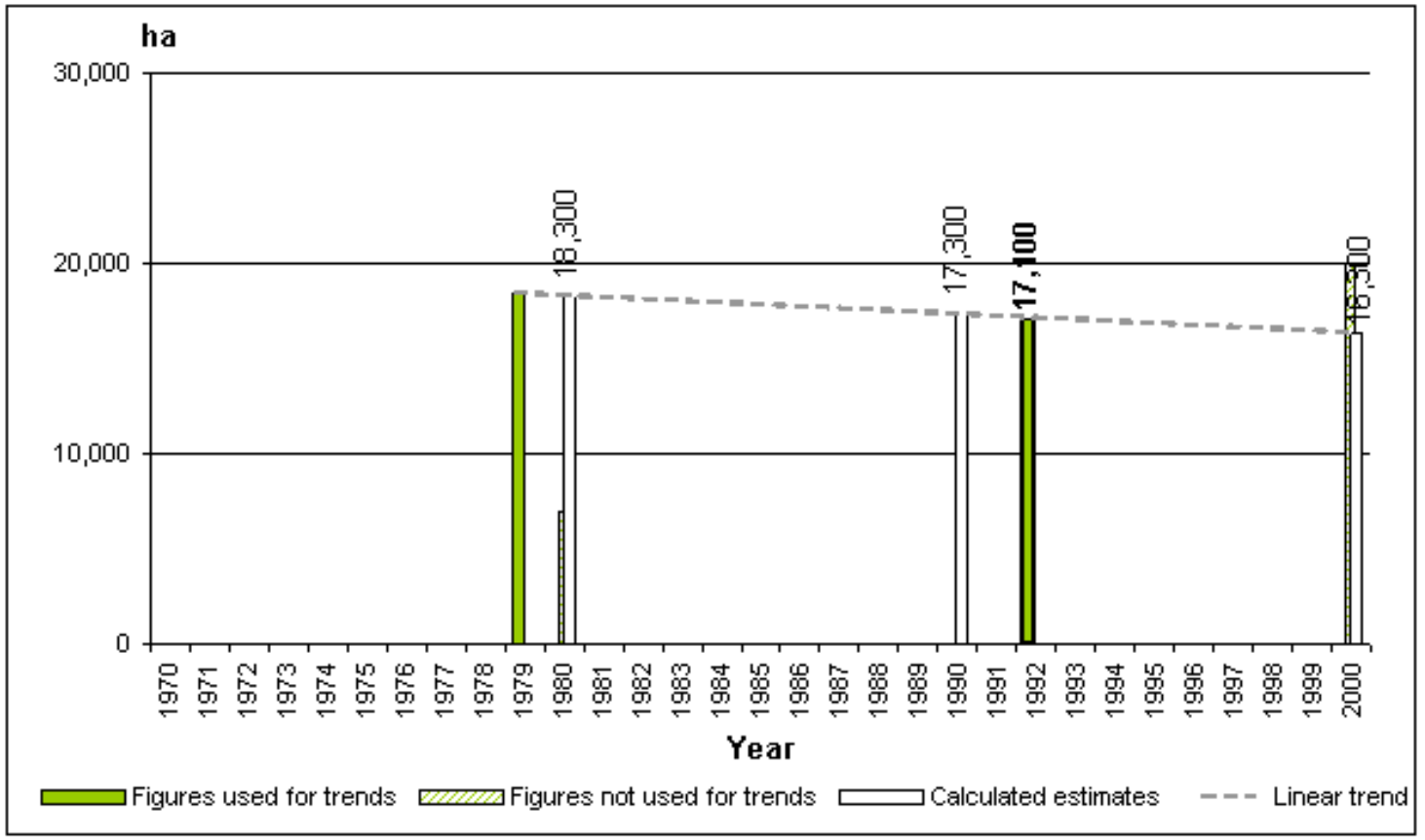


Figure 1. Trends in mangrove area extent over time

(Source: FAO, 2003)

BRUNEI

- In the past, the mangrove forests of Brunei were a major source of wood for the charcoal industry, firewood for local use and for export and manufacture of dye used in the tanning industry(Lim and Sharifuddin 1975)

- Mangrove forests continued to be exploited for charcoal and poles for filling in the construction work but later declined because of the increasing use of natural gas (Stewart 1986).

- Some mangrove areas are being developed as residential sites , aquaculture shrimp sites in Brunei-Muara District and 154 ha resettlement project and ecotourism

- Now, the mangrove forests in Brunei are among the best preserved in the region, rich with different types of flora and fauna

MALAYSIA

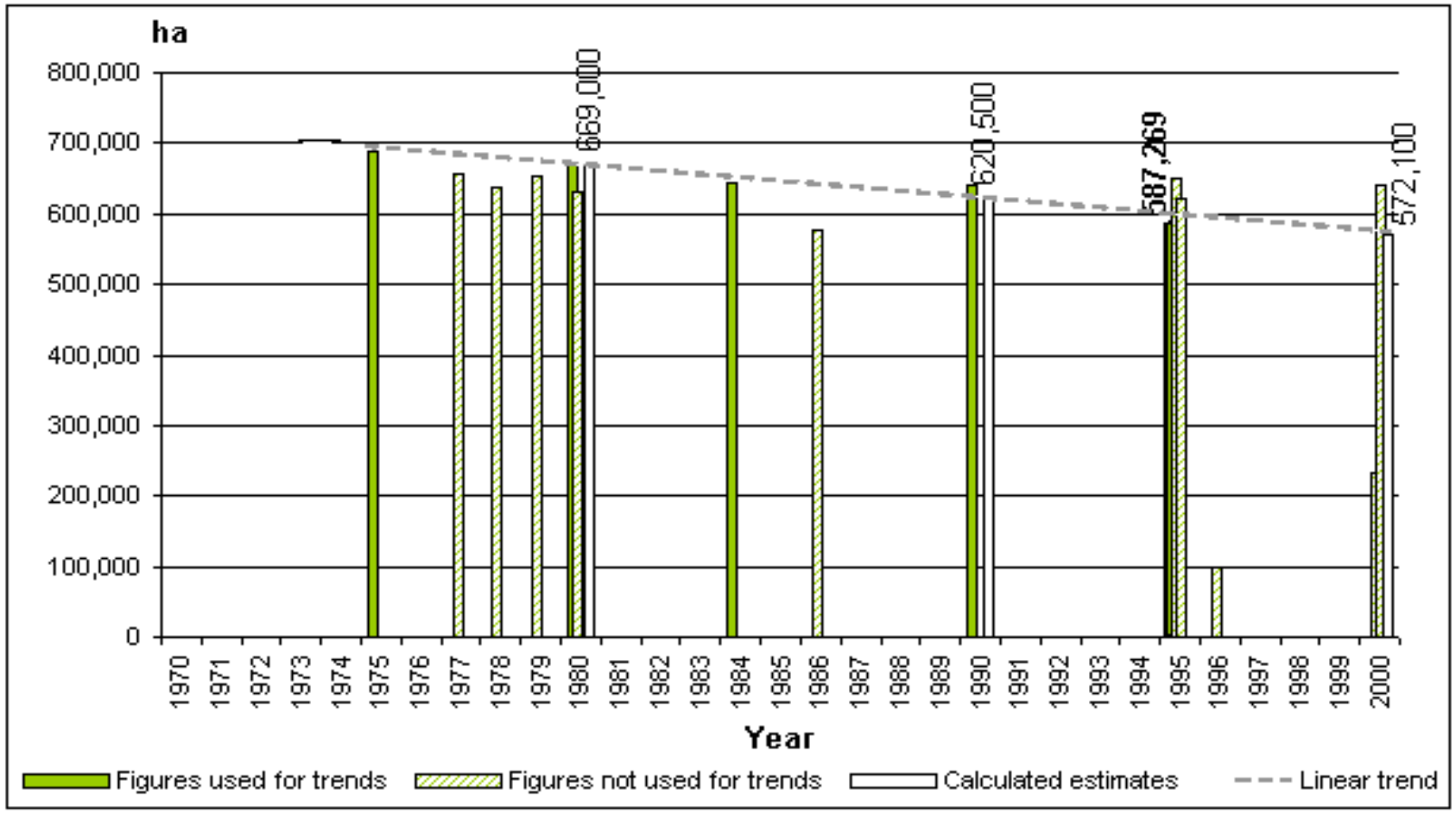


Figure 1. Trends in mangrove area extent over time (MALAYSIA)

Source: FAO (2003)

Drivers of mangrove change in Malaysia

Agriculture

- Cultivation of oil palm in Malaysia has been the most profitable of all the agricultural crops and a vast amount of lands, including those of inland mangroves. In terms of productivity and economic benefits oil palm plantations are many times more economical than mangrove forests
- In the next decade it is perceived that much of the mangrove forests in Sarawak will be converted to oil palm plantations too as the state tries to eradicate poverty among the rural communities and empower them as settlers depending on the plantation
- **Aquaculture**

  Fish and prawn cultures have been proven to he economically more profitable, especially for overseas markets. The major sites for fish cultures are especially in the Langkawi, Matang and Kuala Selangor mangroves
- **Urban development**

  Currently, there is large scale urban development in the south of Peninsular Malaysia affecting the mangroves

Aquaculture

Urban development for Iskandar Malaysia

- formerly known as Iskandar Development Region and South Johor Economic Region is the main southern development corridor in Johor, Malaysia
- The Iskandar Malaysia was established on 8 November 2006.

Ecotourism Industry

- Ecotourism sector in Malaysia has shown rapid growth and has tremendous potential to be further developed including mangrove tourism

- Some 8 million foreign tourists visited Malaysia generating RM13.4 billion in foreign exchange earnings and is one of the fastest growing industries which has made a great contribution to the overall national economy

MYANMAR

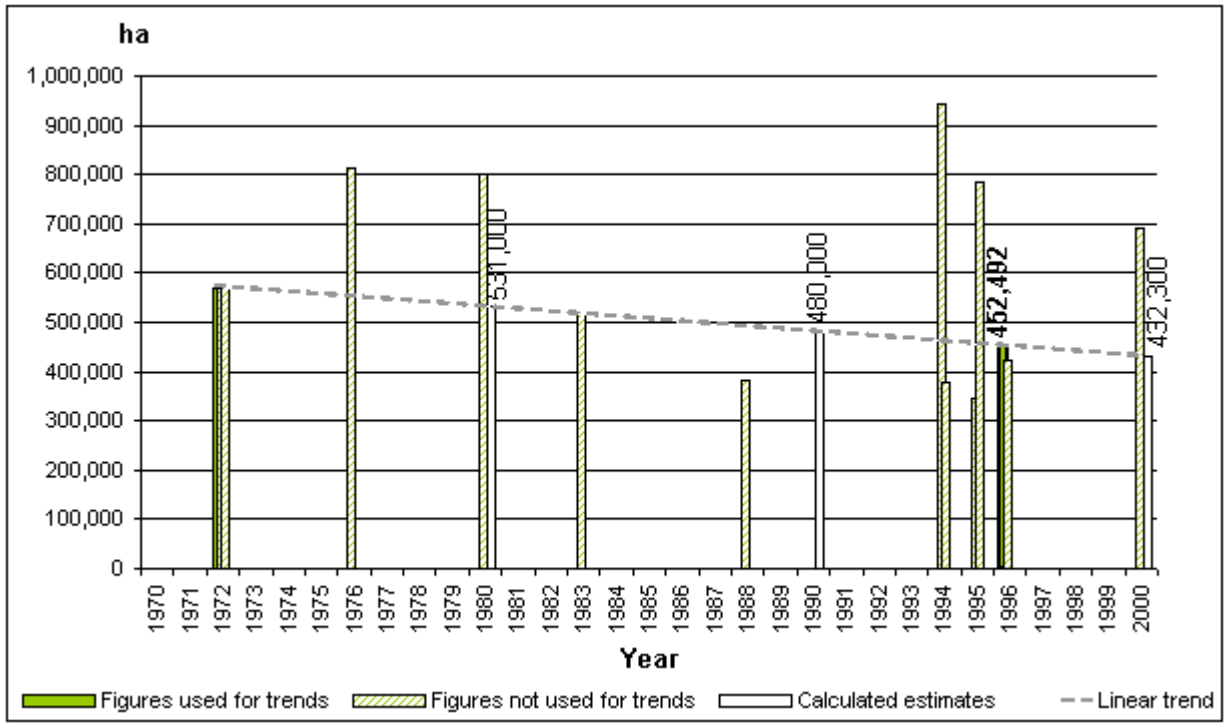


Figure 1. Trends in mangrove area extent over time

(Source: FAO, 2003)

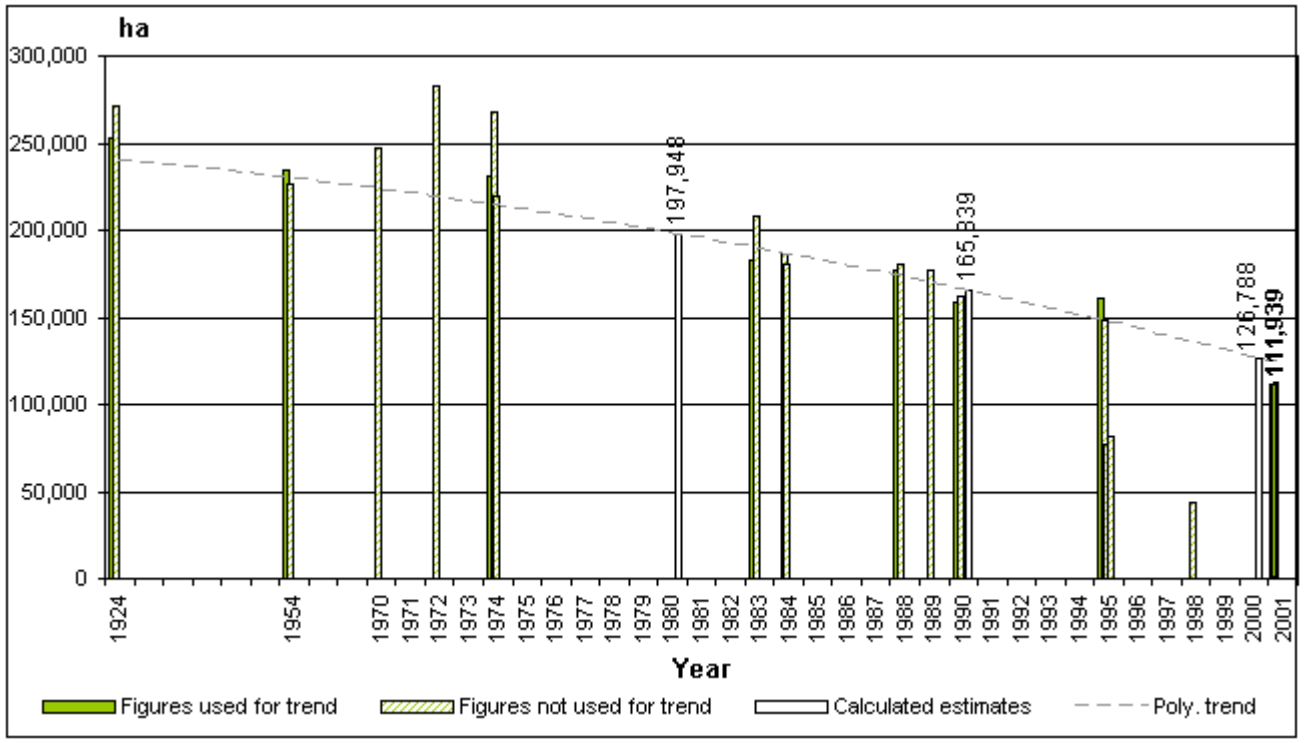


Figure 2. Area changes over time, the Ayeyarwady Delta mangroves, Myanmar

(Source: FAO, 2003)

Ayeyarwady Delta mangroves

- The mangroves in this area have suffered an alarming decline overtime: over 140,000 ha of mangroves have disappeared between 1924 and 2001, ca. 56 % of the original extent
- The major cause of this rapid decline is conversion of mangrove areas into rice fields in line with government policies to promote self-sufficiency in food production
- Also, the overexploitation to produce fuelwood
- Rehabilitation of mangroves and the establishment of community mangrove forests have been initiated

THE PHILIPPINES

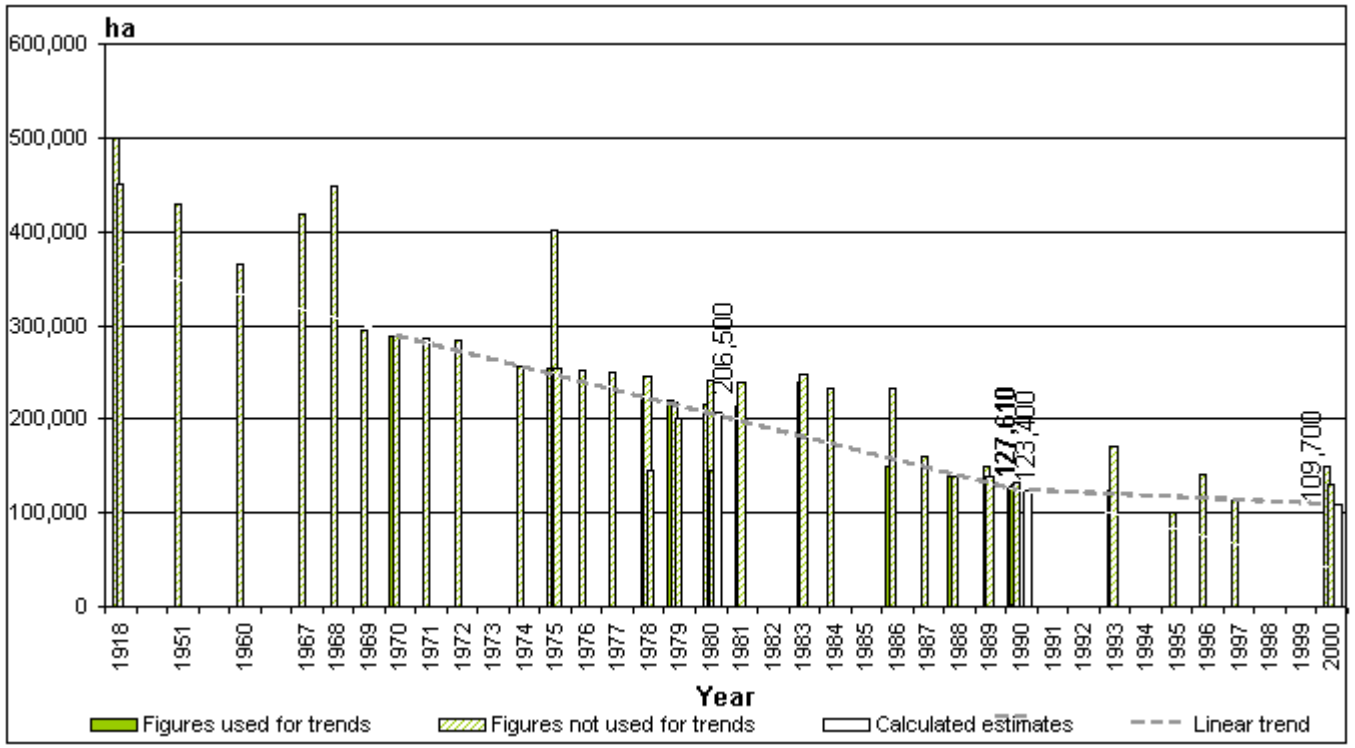


Figure 1. Trends in mangrove area extent over time

(Source: FAO, 2003)

The Philippines

- Used to be covered by 400,000-500,000 ha of mangroves in 1920 but it declined to around 120,000 ha in 1994, decline may be attributed to overexploitation by coastal dwellers, and conversion to agriculture, salt ponds, industry and settlements
- Aquaculture development for production of shrimp, fish, and other aquatic resources, is known to be the leading cause of mangrove loss in the country. For instance, between 1968 and 1983, 237,000 ha of mangroves were lost for pond construction. This was almost half of the total national mangrove area (Fernandez 1978)
- Shrimp aquaculture operates extensively normally for three to ten years after which the production decreases, and then abandonment occurs. Once the operation is halted, aquaculture operators find another new location containing a healthy mangrove ecosystem and again deplete the resources
- If this trend continues, mangrove areas in the country will be in serious threat. Although greater conservation and rehabilitation efforts have been in place, it is expected that the mangrove ecosystem in the country will continue to face degradation (Fortes 2004)

- Conversion to Agriculture
  - especially rice paddies and palm oil plantations to sustain the growing need for food not as significant as conversion to aquaculture

- ca. 19% (49,363 ha) of the Philippines' total mangrove area is located within existing protected area networks (International Union for Conservation of Nature (IUCN) protected areas categories, I-VI), with the greatest area of protected mangroves located in Palawan

SINGAPORE

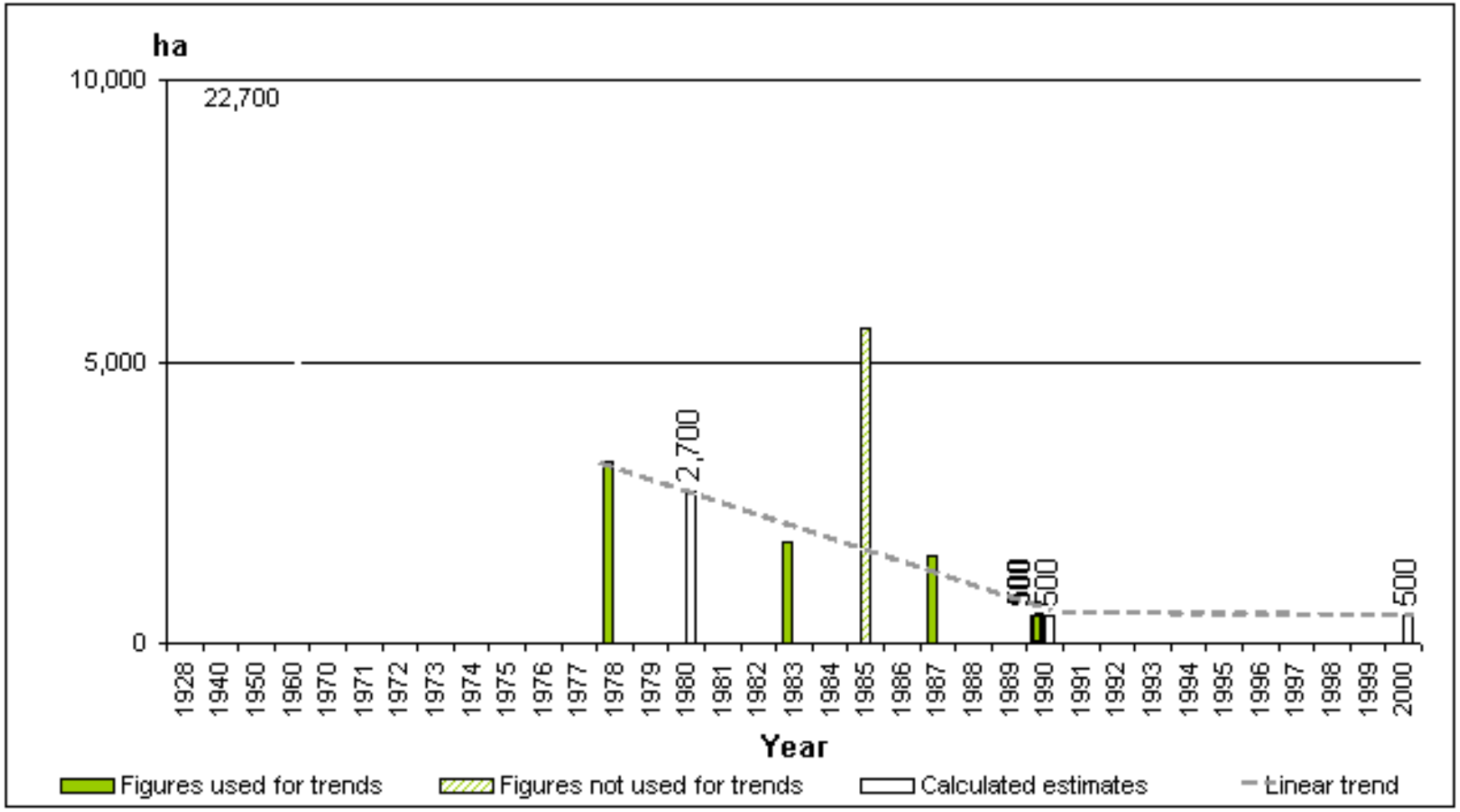


Figure 1. Trends in mangrove area extent over time
(Source: FAO, 2003)

SINGAPORE

- Mangrove loss in mid-1970s was attributed to exploitation (timber, firewood and charcoal production) and clearing for various development demands eg.housing, industry, refuse disposal, barraging of estuaries to increase freshwater supply (Chua 1975)
- By 1980, the mangrove forest was reduced to few patches of exposed habitats on the mainland and comparatively undisturbed ones among the offshore islands
- The sharp decline of Singapore's mangrove habitat area from 7500 to 491 ha is attributed to coastal development mangrove

- Now, Singapore mangroves increased to 734.9 ha, ca. 1% of total area in Singapore due to expanding land area through coastal reclamation and at the same time reforestation efforts and the natural regeneration of mangroves in long abandoned prawn ponds may have contributed to the increased area (Chou, 2016)
- The present mangrove patches are fragmented and limited in area but still support a high diversity of 35 'true' mangrove plant species (Yang et al. 2011) with 15 locally listed as "vulnerable" and five as "critically endangered" (Davison et al. 2008)

FUTURE THREAT

- One of the most crucial threat is sea level rise because of the interacting balance between saline inundation and freshwater runoff
- The worst case scenario is a 1m sea level rise by 2100. Based on digital elevation models, a 1m sea level rise will inundate 25% of Singapore's mangroves and a slow elevation rate will cause the habitat to collapse.

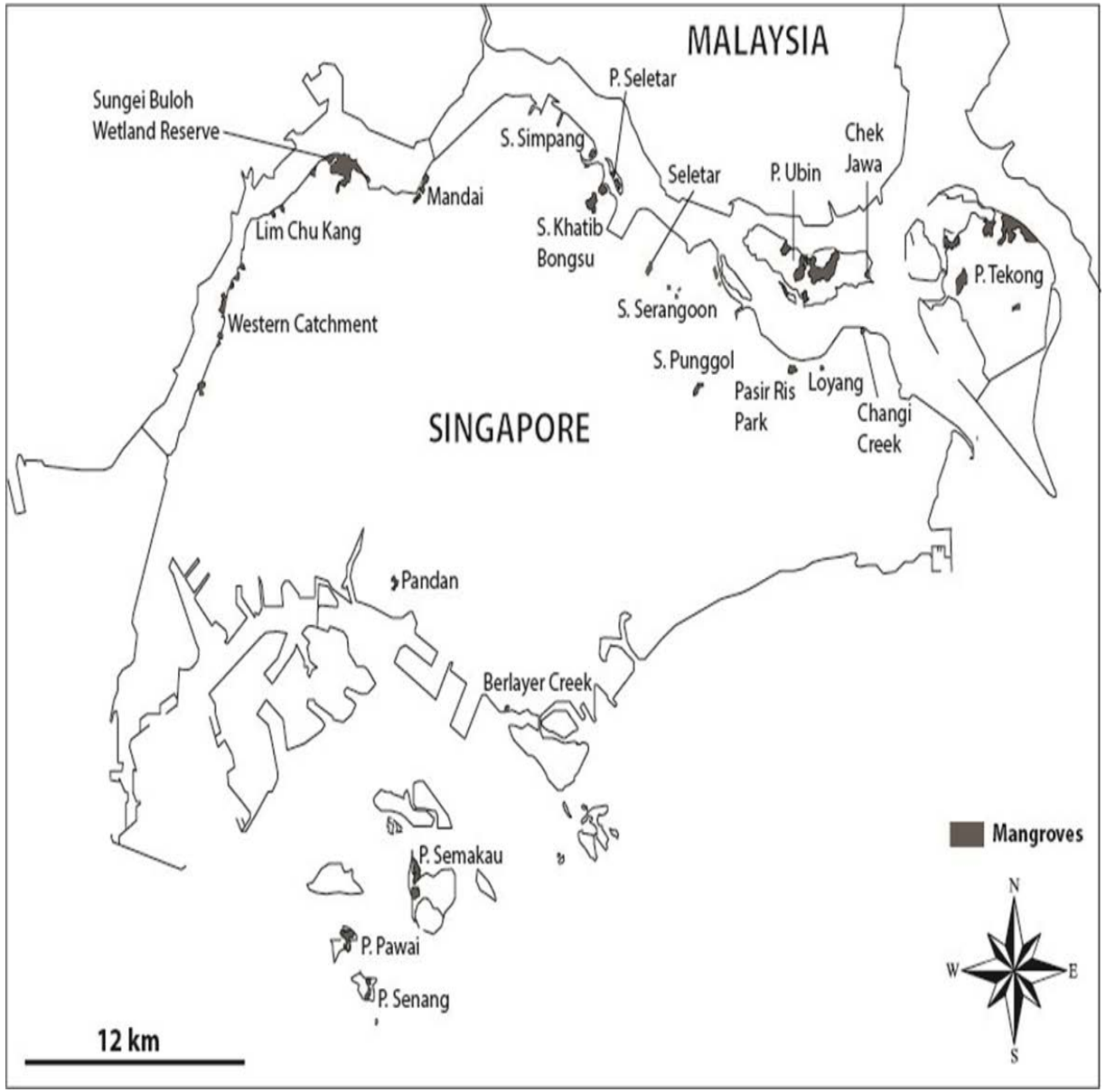


Figure 1. Location of mangrove habitats in Singapore
Source: Chou (2016)

THAILAND

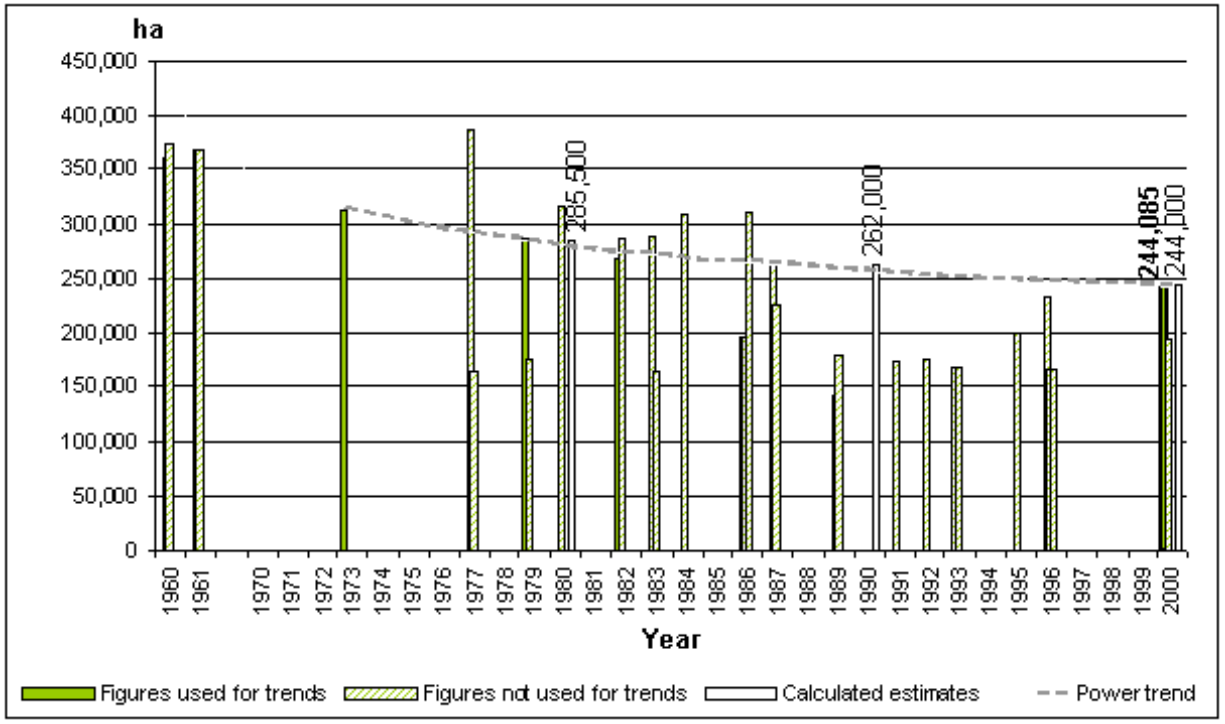


Figure 1. Trends in mangrove area extent over time
(Source: FAO, 2003)

Thailand

- ca. 50 per cent of mangrove areas in Thailand were converted to other land uses before 1991

- 33-65% of mangrove loss due to clearing for shrimp pond between 1996- 2000 ; other causes include coastal zone development, urban expansion, agriculture, resettlement, construction of harbours and ports & establishment of salt ponds

- Due to re-plantation of mangroves in abandoned shrimp ponds by the Royal Forest Department, the total mangrove extent in Thailand has shown an increase during the past decade

  Giesen *et al.* (2006)

TIMOR-LESTE

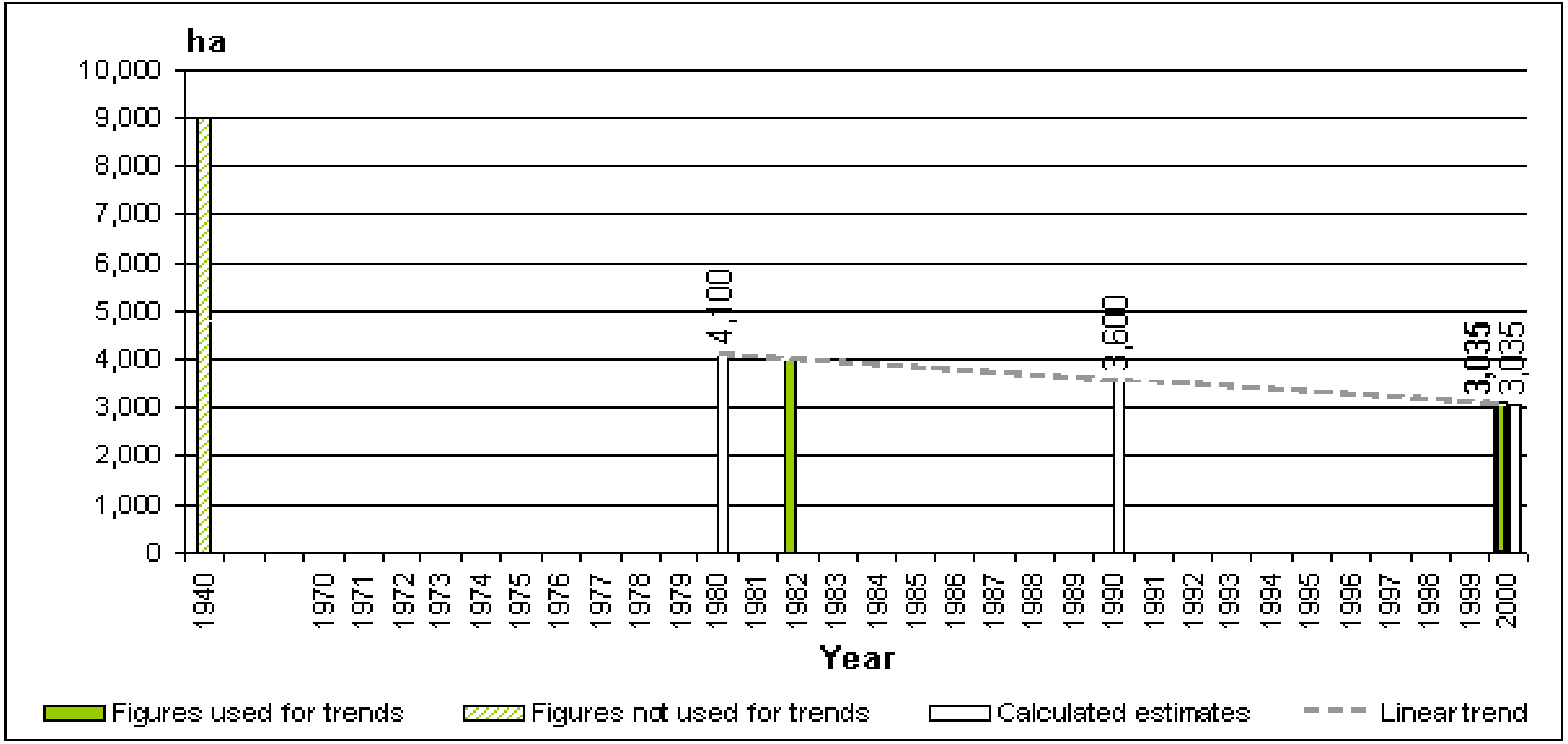


Figure 1. Trends in mangrove area extent over time
(Source: FAO, 2003)

Table 1 Estimates of mangrove coverage (hectares) in Timor-Leste

Area (ha)	Year	Reference
9,000	1940	MacKinnon et al. 1982
4,000	1982	MacKinnon et al. 1982
3,035	2000	Wilkie et al. 2003
1,802	2000	FAO 2007
899 (north coast)	2009	Boggs et al. 2009
1,300	2013	This study

Timor-Leste

- ca. 1300 ha of mangrove forests with total of 19 true mangrove species
- Despite their small size and fragmented distributed, these mangroves are heavily exploited as a source of food, and wood for housing and fuel
- Timor-Leste mangroves face a very uncertain future in light of their small, fragmented distribution, heavy human encroachment, and forecasted rise in sea level
- Compared to the mangroves of other Southeast Asian nations, the Timorese mangroves remain little studied; require urgent management and conservation
- The most likely negative impact to Timor-Leste's mangroves is climate change predicted increase in sea-level

(Alongi *et al*., 2009, Record, 2013)

VIETNAM

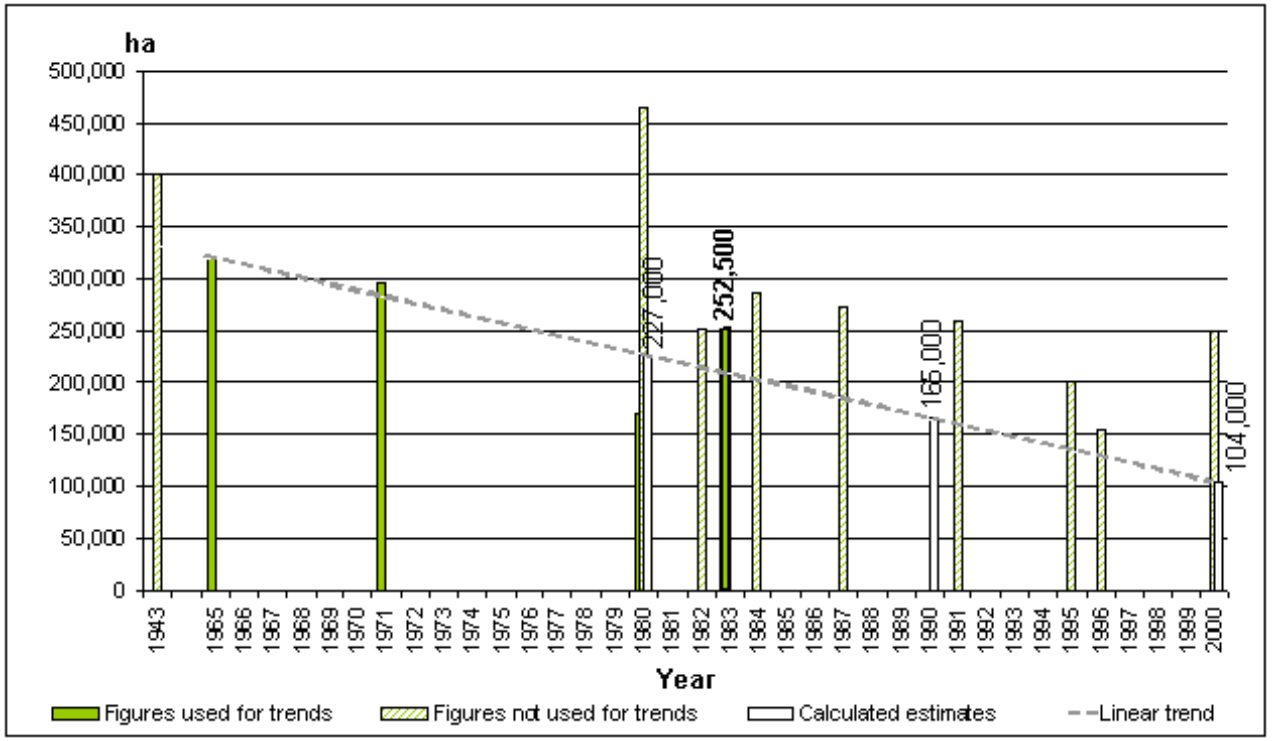


Figure 1. Trends in mangrove area extent over time

(Source: FAO, 2003)

Vietnam

- The extensive mangrove areas (400,000 ha) along the sheltered coasts of Vietnam have been destroyed during the war

- In later years mangroves were felled for shrimp and fish aquaculture

- Mangrove re-plantation programmes had successfully re-vegetated 96,876 ha of the 155, 290 ha of degraded and destroyed mangrove areas by 1999

- UNESCO Biosphere Reserve dominated by mangroves and many rare species; the forest's area is 75,740 ha

Status and trend of mangroves in Southeast Asia (after 2000)

Table 1. **Mangrove area and loss statistics for Southeast Asian countries between 2000 and 2012**

Country	Total mangrove in 2000, ha	Mangrove deforestation, ha	Mangrove habitat area lost, ha	Percentage mangrove loss 2000–2012, %
Indonesia	2,788,683	60,906	48,025	1.72
Myanmar	502,466	27,957	27,770	5.53
Malaysia	557,805	18,836	15,809	2.83
Thailand	245,179	3,504	3,344	1.36
Philippines	257,575	1,423	1,296	0.50
Cambodia	47,563	1,218	1,086	2.28
Vietnam	215,154	531	528	0.25
Brunei	11,054	48	41	0.37
Timor-Leste	1,066	2	2	0.19
Singapore	583	0	0	0
Southeast Asia	4,626,545	114,424	97,901	2.12

Countries are ordered by total mangrove lost. Mangrove habitat lost takes into account mangrove regrowth in deforested areas during the period.

Source: Richards and Friess (2016)

AQUACULTURE

els (*Perna viridis*) were the dominant cultured species in Kota Marudu
e the disease outbreak in 2009

main driver of mangrove deforestation in Southeast Asia between 2000-2012

Sea-bass (*Lates calcarifer*) cultured in cages

Oyster (*Ostrea* spp.) culture

Table 2. Percentage of the total deforested mangrove (2000–2012) converted to different land uses

Country	Aquaculture	Rice	Oil palm	Mangrove forest	Urban	Other category
Indonesia	48.6	0.1	15.7	22.6	1.9	11.2
Myanmar	1.6	87.6	1.1	0.5	1.6	7.6
Malaysia	14.7	0.1	38.2	17.6	12.8	16.7
Thailand	10.8	5.6	40.0	5.1	14.4	24.1
Philippines	36.7	0.9	11.1	7.3	2.7	41.3
Cambodia	27.7	1.5	8.9	9.8	4.6	47.6
Vietnam	21.0	10.4	0.5	0.6	62.5	4.9
Brunei	29.2	0	27.7	12.5	15.9	14.8
Timor-Leste	0	26.1	0	0	0	73.9*
Singapore	0	0	0	0	0	0
Total	29.9	21.7	16.3	15.4	4.2	12.3

Countries are ordered by total mangrove lost. Percentages might not sum to 100 owing to rounding.
*The small amount of mangrove deforestation in Timor-Leste is due mainly to shoreline erosion.

- Since the 1960s and 1970s, conversion of mangrove forests to aquaculture ponds was encouraged by the governments of Thailand, Indonesia, Vietnam, and the Philippines to enhance food security and improve livelihood; they are now some of the largest aquaculture producers in the world

- Policies that encouraged expansion rather than intensification have now been reversed; intensive production now accounts for the majority of production in Thailand

- Mangrove conversion to aquaculture now occurs mainly in Kalimantan and Sulawesi; Indonesia's aquaculture production increased three-fold by 2012 and highest in Southeast Asia due to government encouraging growth of industry for improving livelihood, generating foreign currency, and providing protein

- Further mangrove conversion to aquaculture in Indonesia may be expected in the future

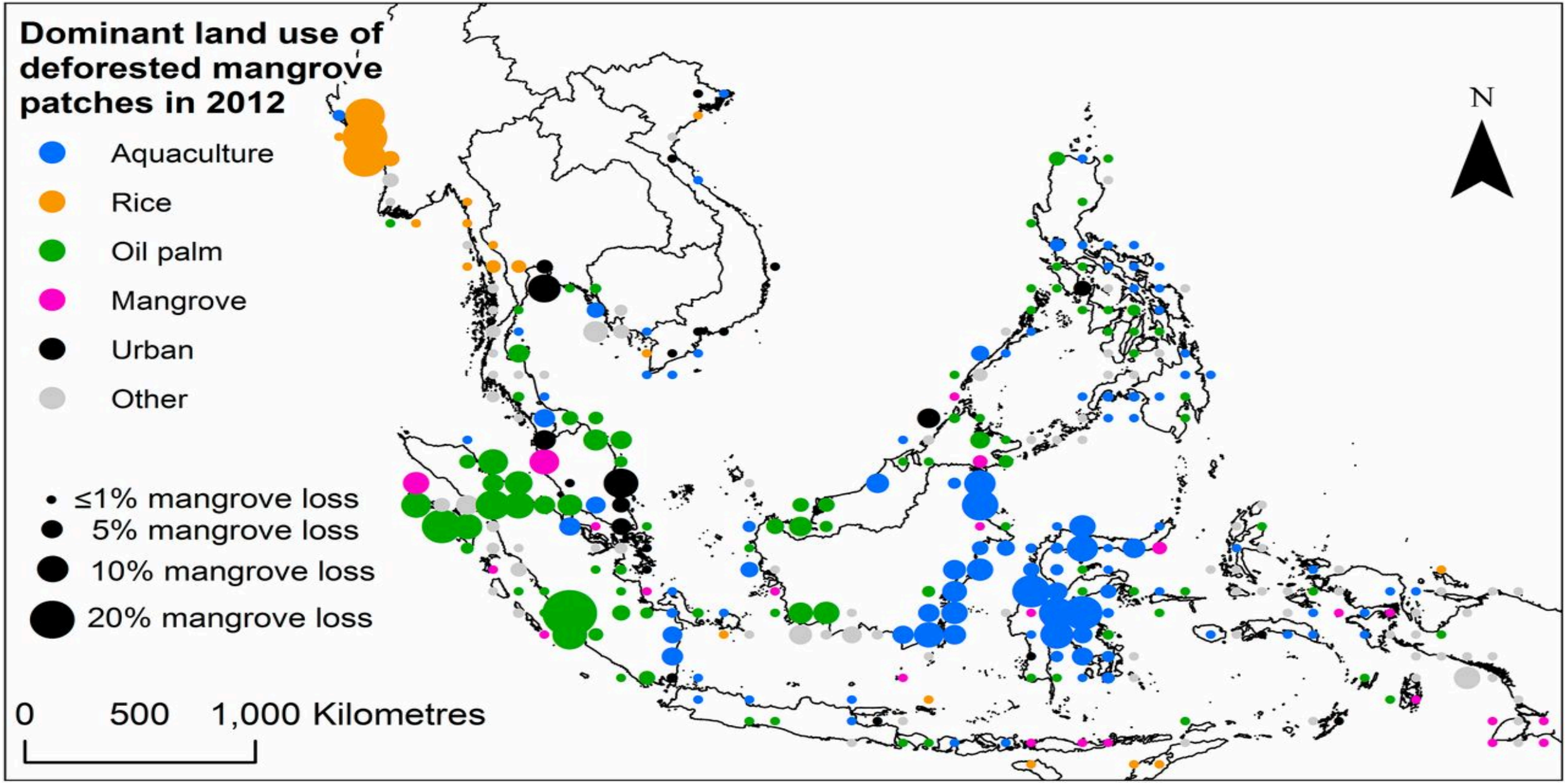


Figure 1. Mangrove deforestation between 2000 and 2012

Source: Richards and Friess (2016)

Rice

- the expansion of rice agriculture in Myanmar is responsible for driving the fastest rate of mangrove deforestation in Southeast Asia, moving away from the hotspot of rice cultivation in the Ayeyarwady Delta
- the government of Myanmar aimed to increase rice production through engineering assistance and village-level expansion targets to enhance national food security
- The Myanmar government provides few environmental safeguards for mangrove forests; for example, the current protected area network is poorly enforced and covers little mangrove forest
- as a result of the lack of environmental safeguards and continuing economic transformation in Myanmar, the mangrove conversion to rice will continue to displace large areas of mangrove in the future.

Malaysia: Oil Palm

- In Malaysia, the industry provides direct employment for about 570,000 people; the industry also offers a long-term and stable source of income for its smallholders
- Palm oil is Malaysia's largest agriculture commodity and has recently become Malaysia's second largest income earner from exports
- The Malaysian Government aims to increase the annual export earnings from palm oil by RM21.9 billion to RM69.3 billion by 2020
- It is difficult to see how this target can be achieved without having to open up new lands for oil palm cultivation **including the mangroves (forest is state matters)**

INDONESIA: OIL PALM

- Palm oil production in Indonesia is expected to continue to increase by almost 30% by 2019 owing to increasing global demand for foodstuffs and national targets to ensure energy security

- In May 2015, Indonesian President Joko Widodo announced the development of 1.5 million ha of new terrestrial agricultural land in Papua within the next 3 years as part of the Merauke Integrated Food and Energy Estate to increase food and energy security and stimulate economic growth in Papua

- Although there was a low deforestation rate in the mangrove-rich Indonesian province of Papua before this, oil palm cultivation could be the potential driver of mangrove loss since previously also planted in mangroves besides terrestrial forest and peat swamps in Sumatra and Borneo

Table 1. Change in mangrove area and ecosystem service value in Southeast Asia by country 2000–2050

Source: Brander *et al.* (2012)

Country	Mangrove area in 2000 (ha; 000's)	Change in mangrove area 2000–2050 (ha; 000's)	Total value change (US$/ annum; millions)
Brunei	16	−1	−4
Cambodia	54	−4	−2
Indonesia	4329	−1656	−1728
Malaysia	699	−220	−279
Myanmar	338	−80	−50
Philippines	102	−6	−11
Thailand	250	−25	−36
Vietnam	254	−90	−48
Total	6042	−2082	−2158

CHALLENGES

- There is increased awareness of the value of mangrove ecosystems, which has led in turn to the preparation of new legislation, better protection and management and in some countries to an expansion of mangrove areas through active planting or natural regeneration
- Mangrove loss in Southeast Asia still remains substantial. This not only results in negative impacts on the mangrove diversity, but also undermines the ecosystem services that mangrove forests provide, such as carbon storage.
- Despite its importance, mangroves in Southeast Asia are still exposed to many threats especially from adverse economic activites upstream and the mangrove ecosystem itself, which often lead to the decline of its quality. There still remains the issue of how to address mangrove health
- The motivating factors and target commodity differs by country, and were influenced by tne respective national economic policies. For instance, in Myanmar, rice production is considered critical for national food security, while palm oil production in Indonesia, Malaysia

Issue of conservation of mangrove forest

Commitment from governments

Examples: Malaysia, Singapore

- All the decisions made with regard to the implementation of forest management, conservation and development activities in the state are carried out at the state level by the respective State Authorities.

- Under National Forestry Act, 1984 (Amended 1993), Director of the State Forestry Department is responsible to the State Government for the preparation and implementation of the State forest management plan, reforestation and other programmes relating to amenity forests.

When there is a will, there is a way!

Thank You