Mangrove trends, threats & opportunities

VTB Studiedag 'Mangroves: Living on the edge'

Burgers Zoo, Arnhem, 15 September 2017

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Outline of presentation

1. Introduction to mangroves
2. World-wide status & trends
3. Threats to mangroves
4. Opportunities for sustainable management

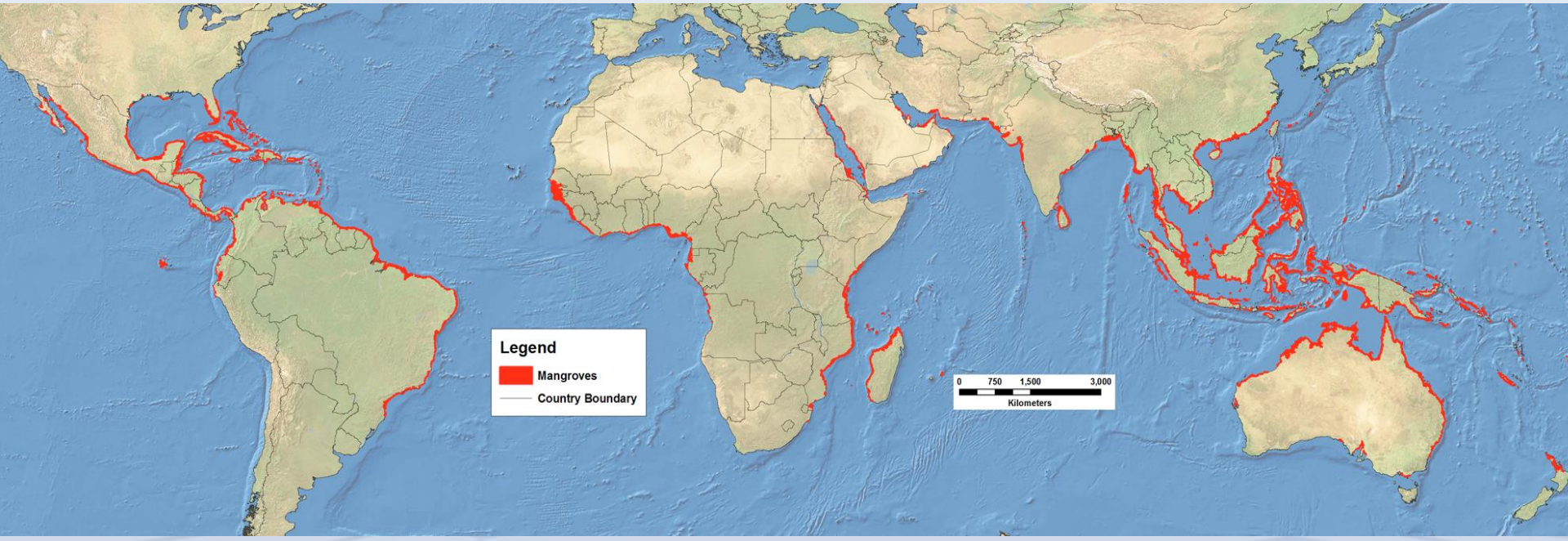
Introduction to mangroves

What are mangroves?

- Trees or shrubs found in intertidal (saline) environments in tropics & subtropics
- Dwarf shrubs or trees up to 30(-40) m tall
- ‘Mangrove’ used describe individual plants or assemblages of plants (including herbs, climbers, etc...)
- Zonation: exposed, central, rear mangroves




Introduction to mangroves



Source: UNEP (2013)

Introduction to mangroves

Ecological niche

- occupy interface of land and sea
- tolerant of saline conditions & low oxygen levels (of ‘soil’)
- common adaptations include aerial roots, viviparous embryos, water dispersal of propagules, salt-tolerance (or disposal)
- distinction: exclusive (‘true mangrove’) & non-exclusive (‘associate’) species
- exclusive: 70+ species world-wide (60-84)
- richest mangroves are in SE Asia: 52 exclusive, >220 associate species




Introduction to mangroves

Mangrove uses

- highly productive (almost 50% more than tropical lowland forests)
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- improve coastal water quality by retention, removal & cycling nutrients, pollutants & particulate matter from land-based sources

  - NPP mangroves: 14.7 MgC ha^{-1} yr^{-1} (range 4-26.7) (Komiyama et al. 2008)
  - NPP lowland rainforests: 10 MgC ha^{-1} yr^{-1} (7.3-12.8) (Malhi 2012)

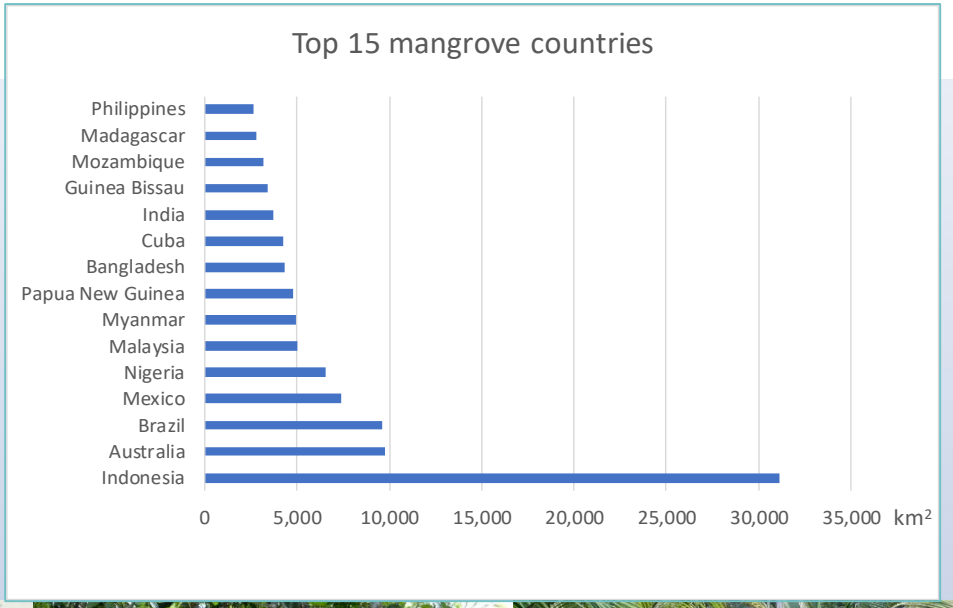



World-wide status & trends

Area & distribution

- world-wide ±138,000 km² (2000), in 124 (sub-)tropical countries
- >75% in just 15 countries
- Indonesia: about 25% of global total
- Belize: 74,684 ha or 0.57%

(Giri et al. 2011)

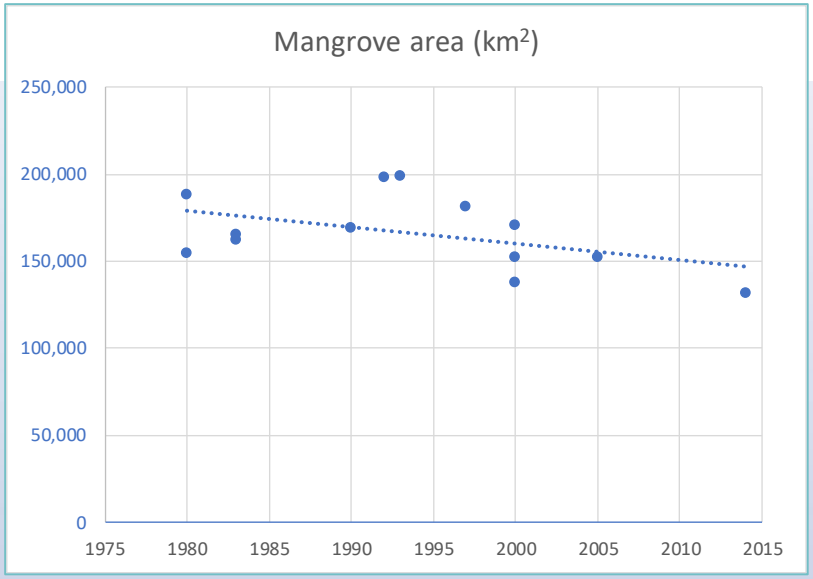


World-wide status & trends

Changes in area

- 1980-2000: decline by almost one third

  (FAO 2007: 26%; Giri et al. 2011: 35%)
- Since 2000: continued decline (albeit slowing down in most areas)

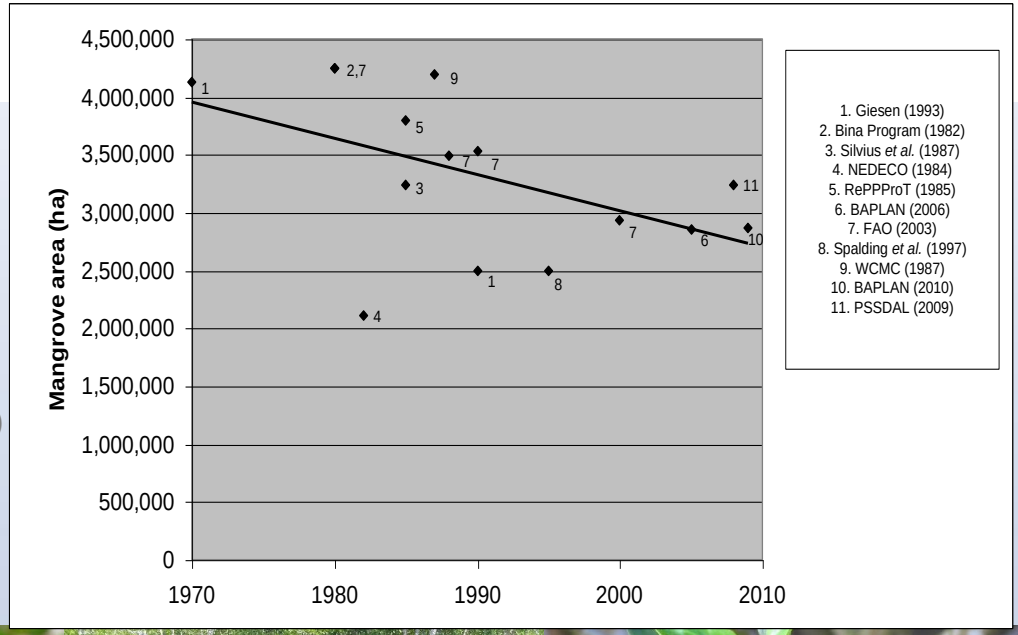


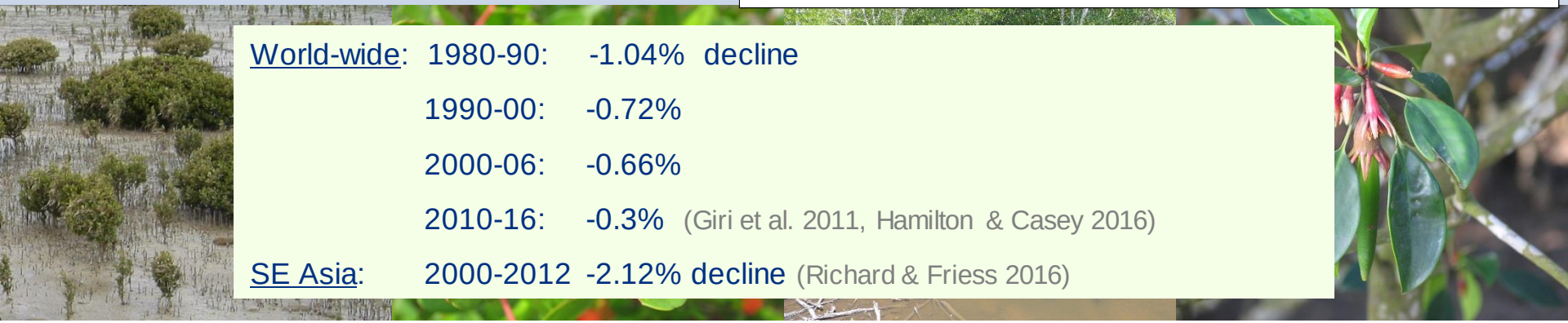



World-wide status & trends

Regional differences

- Declines highest in Asia, lowest in Oceania
- Indonesia follows this trend: 33% decline from 1970-2010 (Giesen et al. 2013)
- Belize: 4% decline 1980-2010





World-wide: 1980-90: -1.04% decline

1990-00: -0.72%

2000-06: -0.66%

2010-16: -0.3% (Giri et al. 2011, Hamilton & Casey 2016)

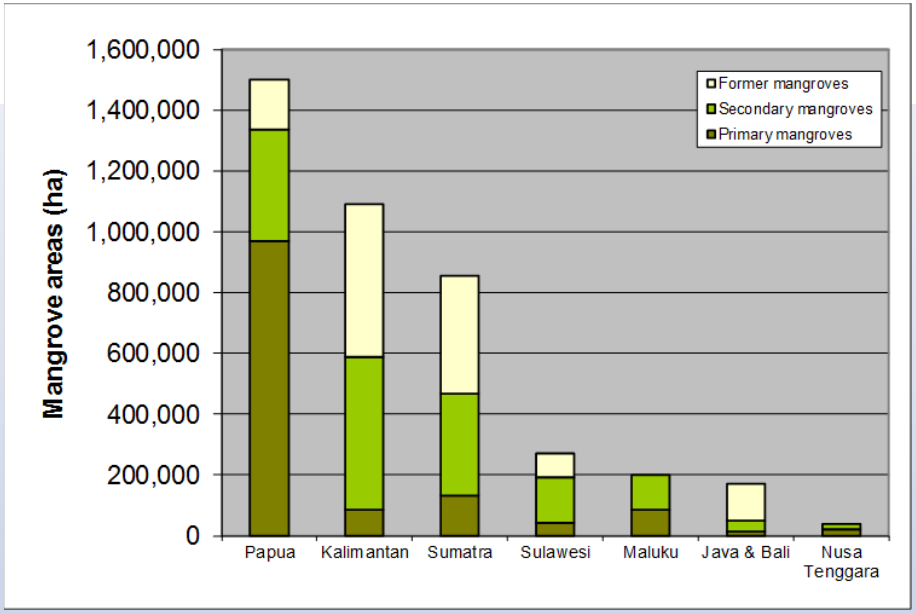
SE Asia: 2000-2012 -2.12% decline (Richard & Friess 2016)

World-wide status & trends

In-country differences: Indonesia

- >90% loss in South Sulawesi, West & East Java
- <10% loss in Papua

(Giesen et al. 2013)



World-wide status & trends

Impact on biodiversity

	Family	Species	IUCN	Distribution
	Acanthaceae	*Avicennia bicolor*	VU	Eastern Tropical Pacific from Mexico to Colombia.
	Acanthaceae	*Avicennia integra*	VU	Endemic to northern Australia, found in only 15 locations.
	Acanthaceae	*Avicennia rumphiana*	VU	Indonesia; Malaysia; Papua New Guinea; Philippines
	Bignoniaceae	*Tabebuia palustris*	VU	Pacific coast of Costa Rica, Panama, and Colombia
	Fabaeae			Colombia and northern
	Lythraceae			ndia, Indonesia, Malaysia,
	Malvaceae	*Camptostemon philippensis*	EN	Patchily distributed in Indonesia (Borneo and Sulawesi), and the Philippines.
	Malvaceae	*Heritiera fomes*	EN	India, Bangladesh, (Irrawaddy) Myanmar, Thailand, and northern Malaysia
	Malvaceae	*Heritiera globosa*	EN	This species is endemic to Borneo (West Kalimantan, Indonesia).
	Rhizophoraceae	*Bruguiera hainesii*	CR	Very limited patchy distribution: Indonesia, Malaysia, Thailand, Myanmar, Philippines, Papua New Guinea & Singapore.

Note: these are exclusive mangrove trees only & does <u>not</u> include associate species (including trees, but also climbers, epiphytes, etc…)

Source: Polidoro et al. (2010)

Threats to mangroves

Multiple threats

- Logging
- Conversion
- Violent storms
- Pollution
- Lack of freshwater input
- Smothering by sediments
- Disease







Threats to mangroves

Impacts of climate change

- Sea level rise: loss of area (>30%?), landward migration
- Air temperature increase (2-4°C in next 100 years): latitudinal expansion
- Increase / more intense storms: damage & loss
- Precipitation changes: increases/decreases
- Species composition changes (due to different responses)

(Finlayson 2016)

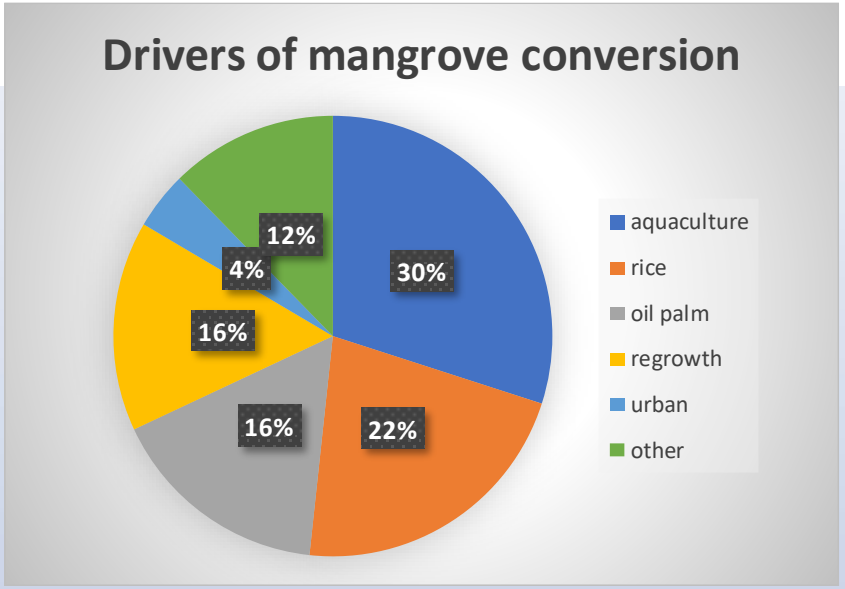



Threats to mangroves

Drivers of change Southeast Asia

2/3's of loss = due to conversion to aquaculture ponds, rice fields & oil palm plantation

Richards & Friess (2016) - Rates and drivers of mangrove deforestation in Southeast Asia, 2000–2012. PNAS vol. 113 (2): 344-349

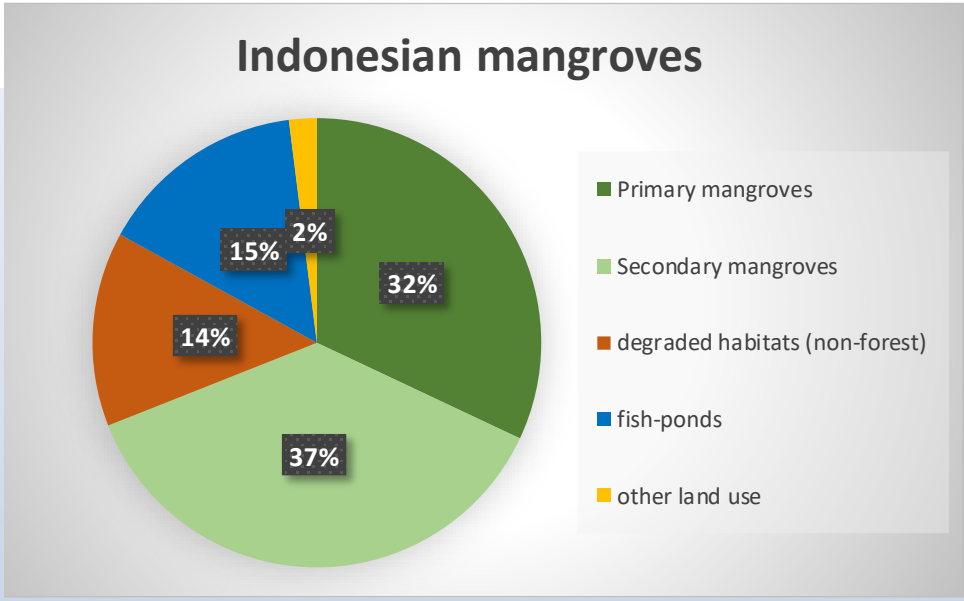


Threats to mangroves

Assessment of Indonesian mangroves (2013)

- original area: 4 Mha
- declined to 2.7 Mha by 2010
- fishponds *(tambak)* = 636,000 ha
- rest = mainly degraded (non-forest) habitat

(Giesen et al. 2013)



Opportunities

- Responsible aquaculture & certification (presentation Roel Bosma)
- 2004 *tsunami* & climate change: need for coastal protection (presentation Pieter van Eijk on mangrove recovery)
- CC & carbon emissions: blue carbon (presentation Boone Kauffman)
- Fisheries, NTFPs, ecotourism & other benefits (presentation Daniel Knoop on local economic benefits)

Thank you for your attention

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