



*for a living planet*®

# Climate Change in Indonesia

---

## Implications for Humans and Nature

**Michael Case<sup>1</sup>, Fitriani Ardiansyah<sup>2</sup>, Emily Spector<sup>3</sup>**

<sup>1</sup>Research Scientist, WWF-International Climate Change Programme

<sup>2</sup>Program Director - Climate & Energy WWF-Indonesia

<sup>3</sup>Brandeis University

WWF Press Conference, Manhattan Hotel, Jakarta

November 28, 2007





# Overall Reports

## Climate change in Indonesia - Implications for humans and nature

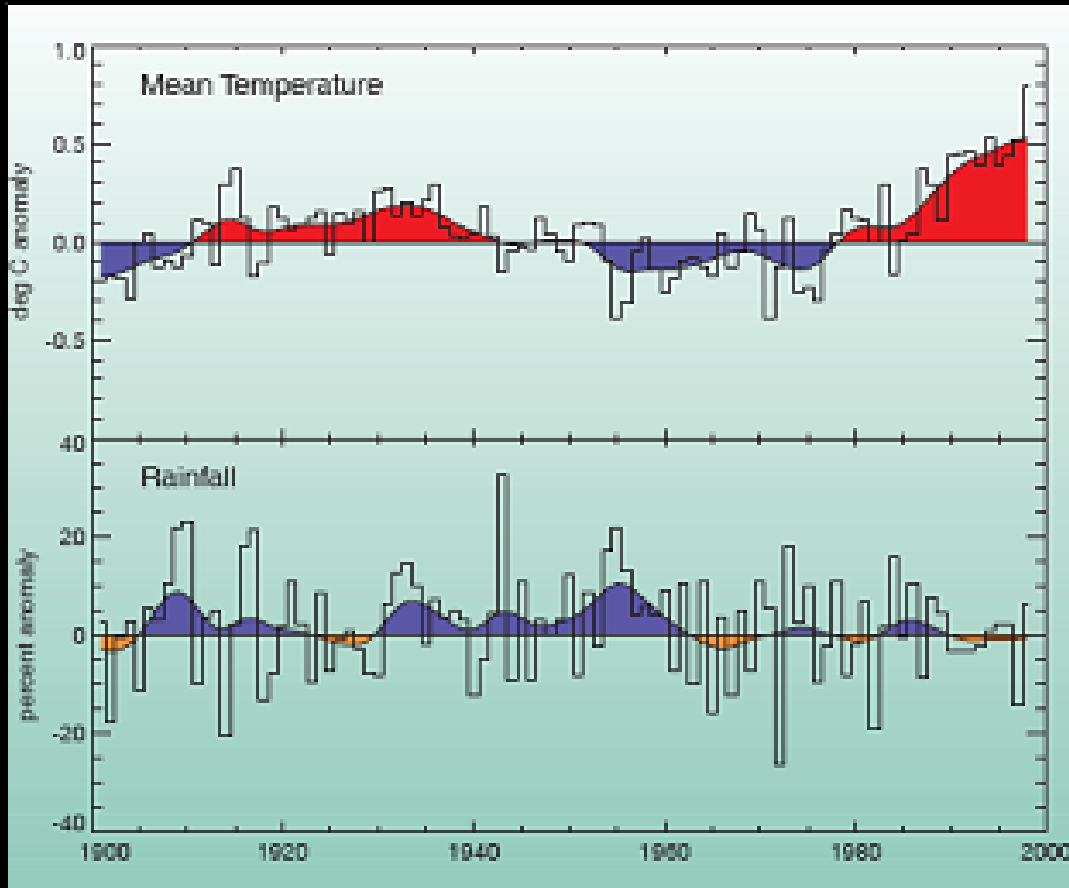
### Annexes:

- Climate Change Impacts on the Management of Citarum Watershed
- Mainstreaming Climate Program into Small Island Development
- Climate Change Impacts on Orangutan Habitat
  - Forest and Land Fires





# Observed climate change



Hulme and Sheard (1999), and Boer and Faqih (2004)

- Temperature increased by 0.3°C
- Annual precipitation decreased by 2-3%
  - Changes in precipitation patterns (decline in the south, increase in the north)
  - Seasonality precipitation changes (wet season rainfall increased in the south; dry season rainfall in the north decreased)





# Projected climate change

- Warming 0.2 to 0.3°C per decade
- Increase in annual precipitation across islands, except in the south (projected to decline by 15%)
- Change in the seasonality of precipitation; parts of Sumatra and Borneo may become 10-30% wetter by 2080's (Dec-Feb); Jakarta projected to be 5- 15% drier (Jun-Aug)
- 30-day delay in the annual monsoon, 10% increase in rainfall later in the crop year (April-June), and up to 75% decrease in rainfall later in the dry season (July–September)

Hulme and Sheard (1999), Boer and Faqih (2004), Naylor et al. (2007)





# Impacts : water & food availability

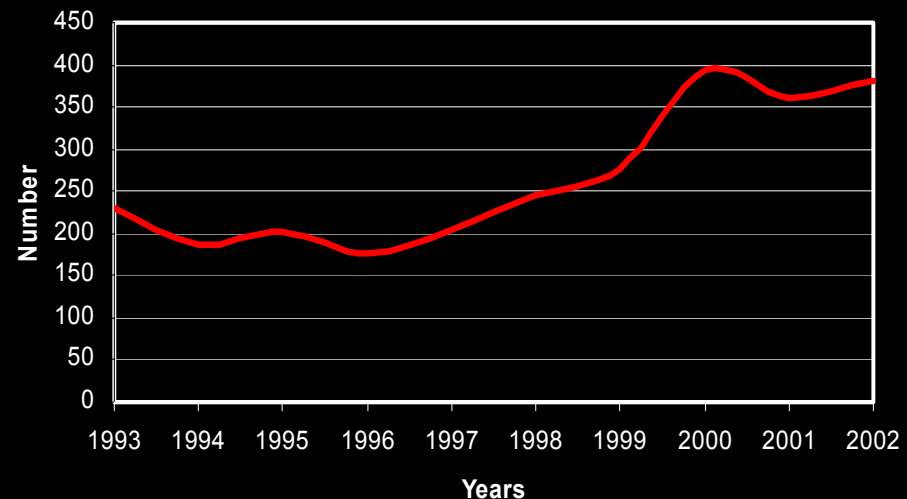
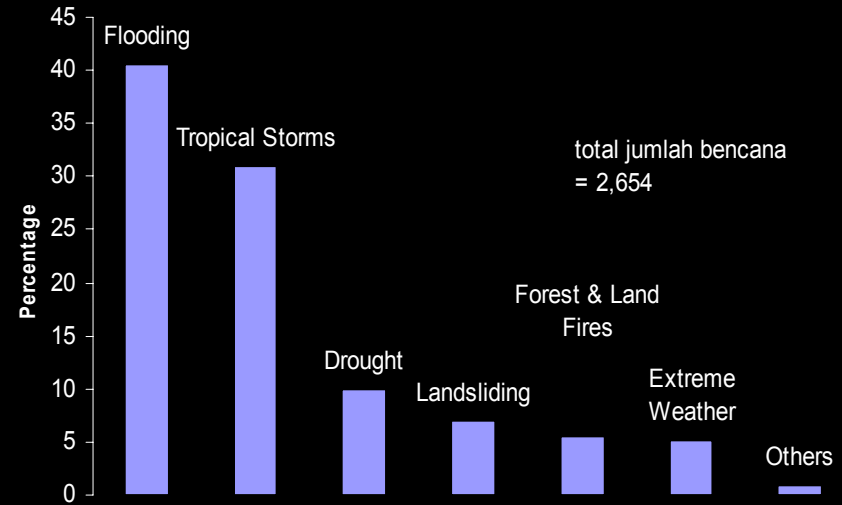
Decreased rainfall during critical times →

- high drought risk,
- uncertain water availability,
- uncertain ability to produce agricultural goods,
- economic instability,
- more undernourished people,
- hindering progress against poverty and food insecurity (Wang et al., 2006)

Increased rainfall in wet times →  
high flood risk,

- e.g. the Jakarta flood on 2 February 2007 inundated 70,000 houses, displaced 420,440 people, killed 69 people, losses of Rp 4.1 trillion (US\$ 450 million) (WHO, 2007, Bappenas, 2007)

Stronger, more frequent El Niño →  
more drying & flooding

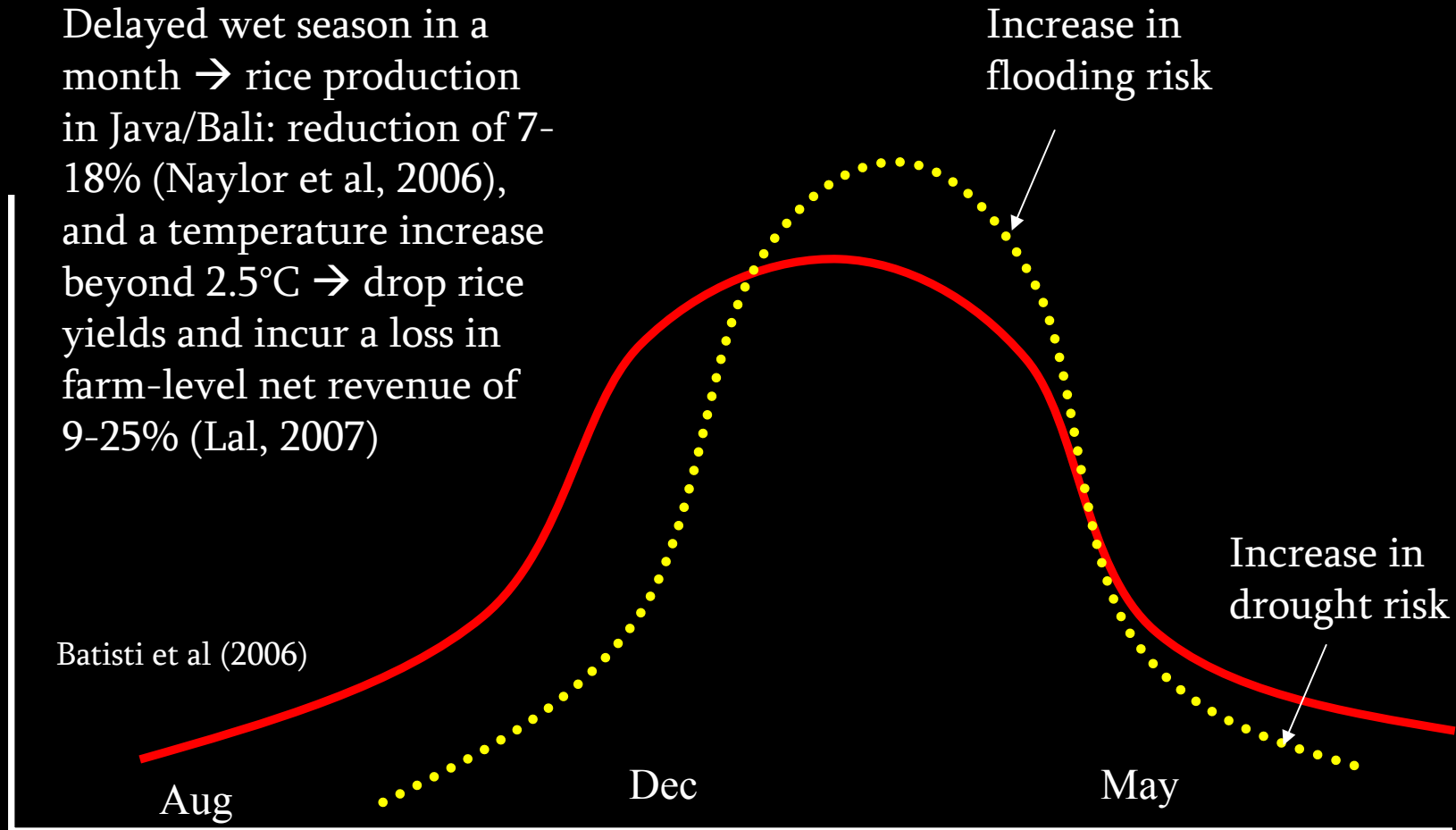




# Impacts: water & food availability

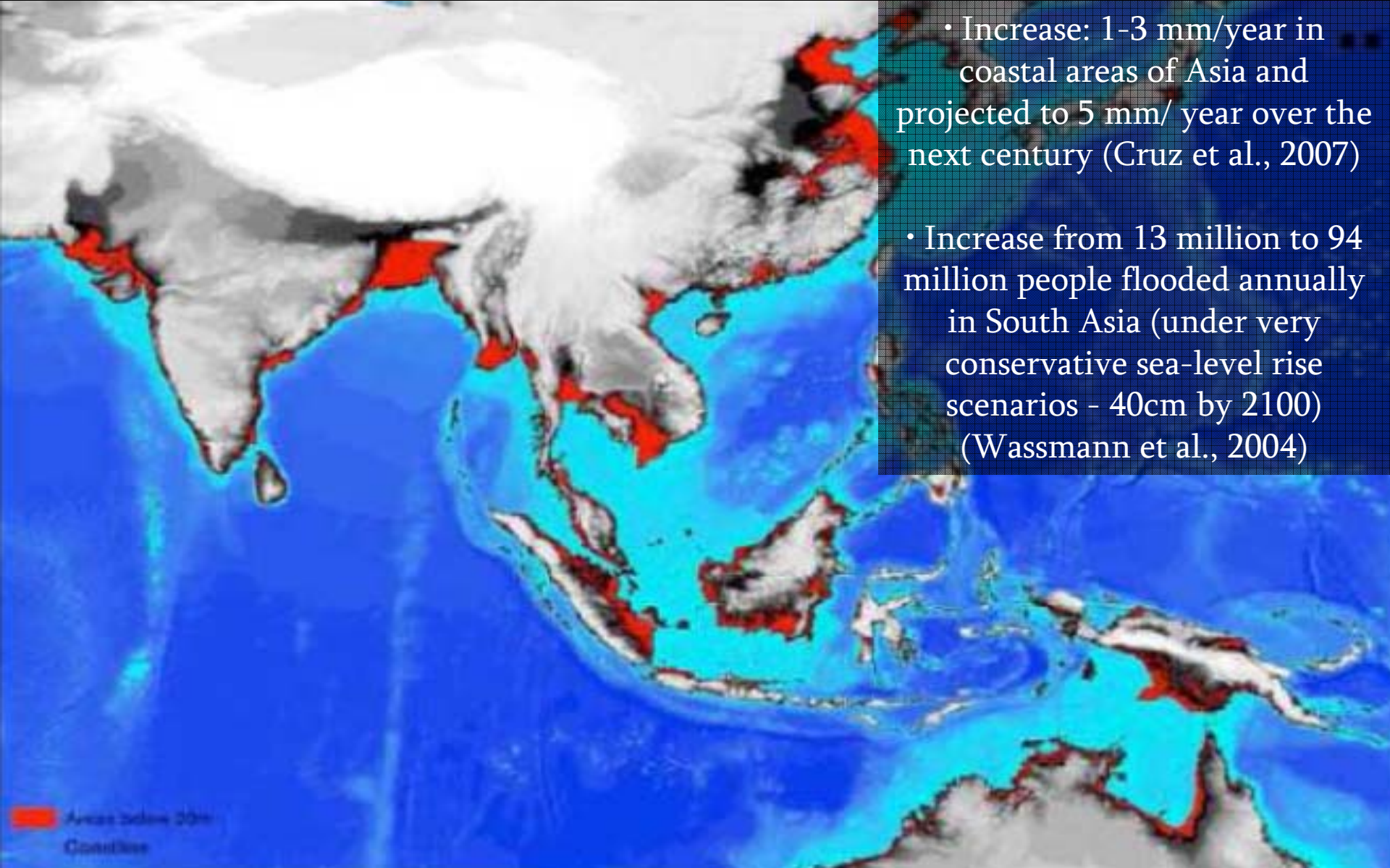
Delayed wet season in a month  $\rightarrow$  rice production in Java/Bali: reduction of 7-18% (Naylor et al, 2006), and a temperature increase beyond 2.5°C  $\rightarrow$  drop rice yields and incur a loss in farm-level net revenue of 9-25% (Lal, 2007)

rainfall





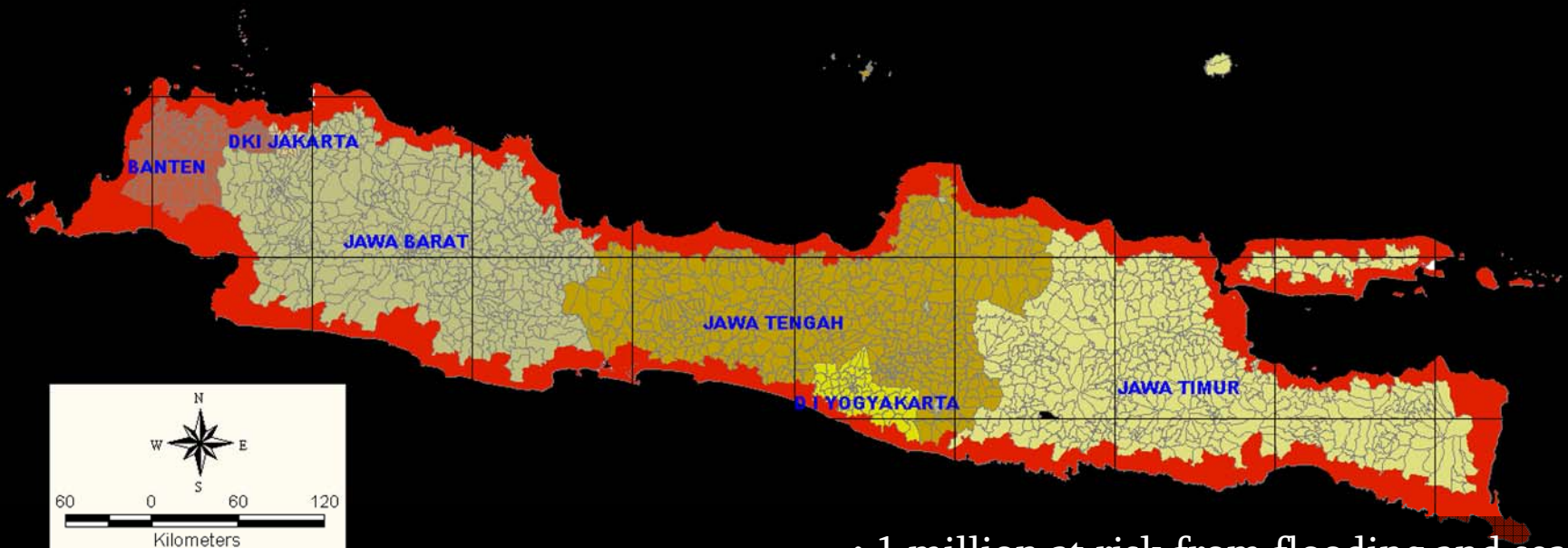
# Impacts: sea level rise



- Increase: 1-3 mm/year in coastal areas of Asia and projected to 5 mm/ year over the next century (Cruz et al., 2007)
- Increase from 13 million to 94 million people flooded annually in South Asia (under very conservative sea-level rise scenarios - 40cm by 2100) (Wassmann et al., 2004)



# Impacts: sea level rise



- 1 million at risk from flooding and sea-water intrusion due to sea-level rise and declining dry-season precipitation, negatively impacting the aquaculture industry (e.g., fish and prawn industries) and infrastructure along the coasts of South and South-East Asia, (Cruz et al., 2007)

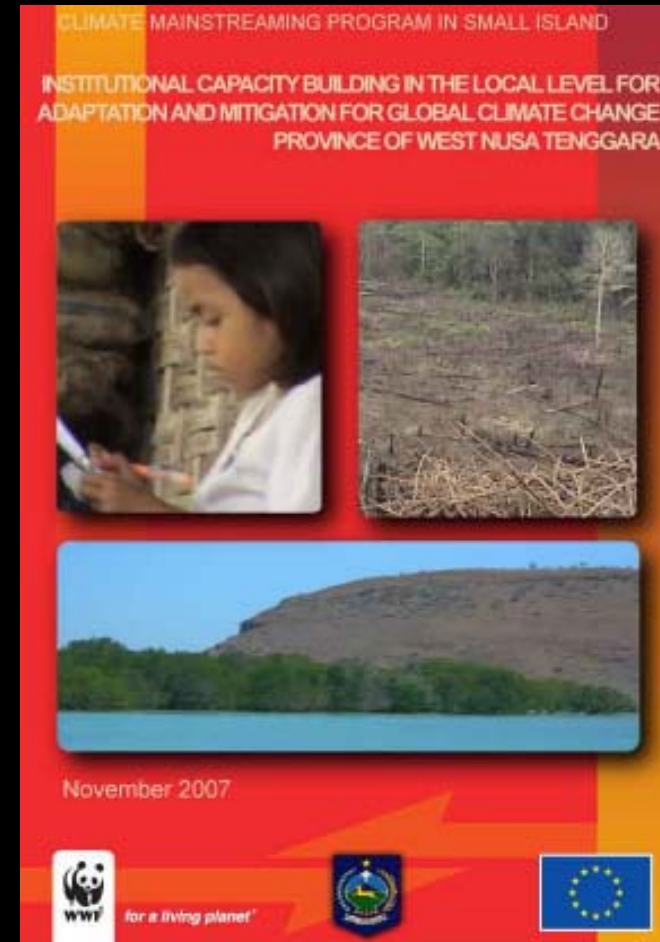




# Impacts: sea level rise

Annex: Mainstreaming Climate Program into Small Island Development  
(Syafuddin, Hakim, Muhammad, Anggraini, 2007, WWF-Indonesia)

- Small island is pressured both by the nature (water rise, extreme weathers) and human induced (inefficient usage of water, improper land use) → crisis of food, water shortage and eventually increase poverty.
- Integration of climate into development program needed esp. focusing on governance, assistance and capacity building.
- There is a willingness from the governor level to address the issues in a comprehensive way.





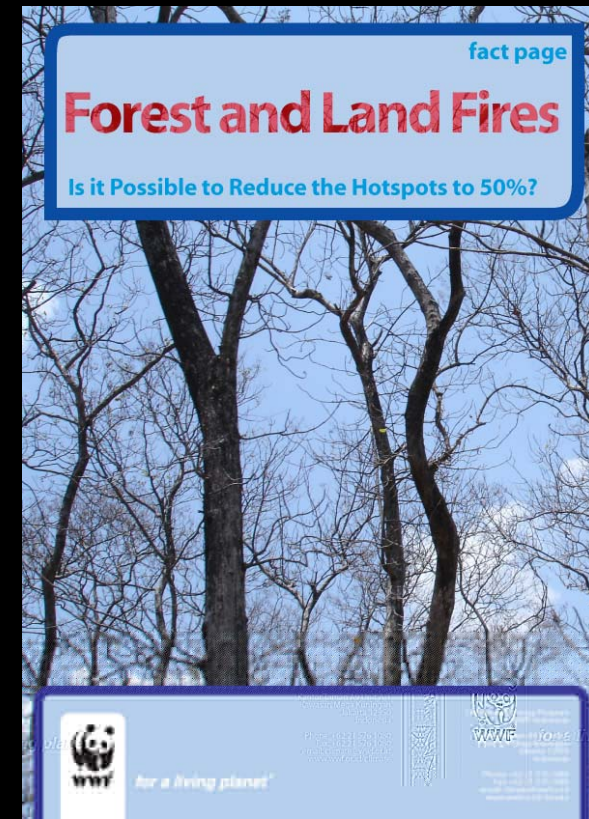
# Impacts: biodiversity & ecosystem services

- 50% of Asia's total biodiversity is at risk (Cruz et al., 2007)
- Defragmentation of forests, forest and land fires, reduction of food impacting wildlife habitat (Applegate et al., 2002)
- Changes in species distribution, reproduction timings, and phenology of plants (Cruz et al., 2005)

## Annex: Climate Change and Forest and Land Fires

(Hariri and Ardiansyah, 2007, WWF-Indonesia)

- Intensity of fires increasing; burnt area shifted to lands outside forests.
- Rapid increase in land conversion triggering more fires





# Impacts: biodiversity & ecosystem services

## Annex: **Climate Change Impact on Orangutan Habitat**

(Suhud and Saleh, 2007, WWF-Indonesia)

- Warming temperatures and changes in precipitation and seasonality → negative impacts on orangutans by affecting the phenology of fruit trees. Climate modeling done for the Central Kalimantan region projects that precipitation will increase by 70% by year 2025 (Suhud and Saleh, 2007).
- During 1997, 12% of the core forest cover in the Sebangau-Katingan (Central Kalimantan) catchment area was burned (Morrogh-Bernard et. al., 2003) and in the last ten years periods (1997-2006), based on the hot spot data, Central Kalimantan province is top on the list as the areas with the highest fire intensity and largest fire size in all of Indonesia (Suhud and Saleh, 2007).

**Dampak Perubahan Iklim Terhadap Habitat Orangutan**

November 2007

WWF for a living planet<sup>®</sup> European Union Dajen PHKA



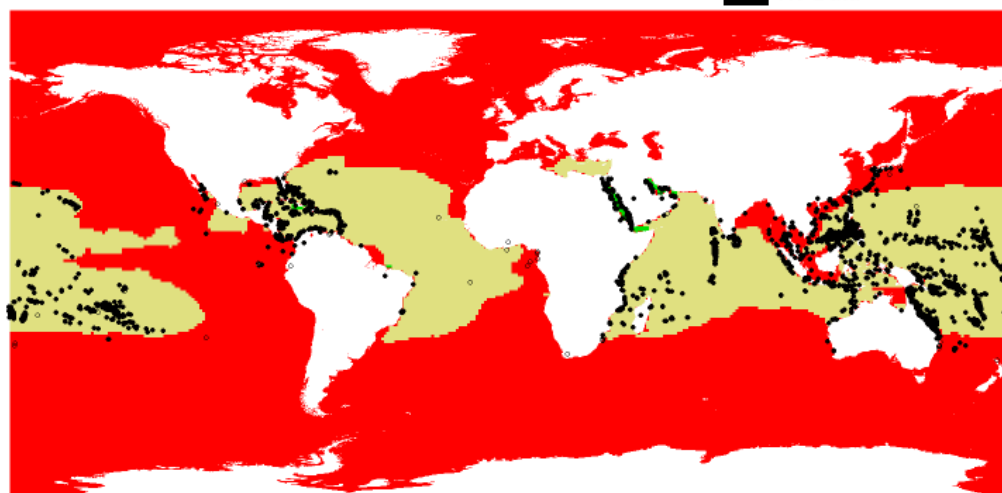
# Impacts: biodiversity & ecosystem services

- 8% loss of coral reefs in Asia (next 30 years) (Wilkinson, 2004); significant declines in fish larvae abundance (Cruz et al., 2007; Loukos et al., 2003); massive coral bleaching, changes in ocean circulation & salinity impacting Indonesia's marine turtle populations (WWF, 2007a)



Predicted Future (~2065) Surface Ocean Aragonite Saturation State

References: 5, 7



ReefBbase.shp

- Coral Reef
  - Reef Community
- Country.shp

Saturation State Future

- > 4.0 Optimal
- 3.5 - 4 Adequate
- 3 - 3.5 Marginal
- < 3.0 Extremely Low
- No Data



# Impacts: human health

- More frequent and severe heat waves, floods, extreme weather events, and prolonged droughts leading to increased injury, illness, and death
- Increased vector-borne infections (e.g., malaria and dengue (PEACE, 2007)), an expansion of water-borne diseases, such as diarrhea (Checkley et al., 2000, McMichael et al., 2003), an increase in infectious diseases, poor nutrition due to food production disruption, ill-health due to social dislocation and migration, and increased respiratory effects from worsening air pollution and burning
- More phytoplankton blooms, providing habitats for survival and spread of infectious bacterial diseases, such as, cholera (Pascual et al., 2002)





# Vulnerability & adaptation

## Vulnerability:

- Water availability and food production (flooding, drought, etc.)
- Coastal livelihood due to sea-level rise, coral bleaching, reduction of fish availability, etc.

The following can enhance social capital and reduce the vulnerability to climate change:

- Increase education and technical skills; Increase income levels
- Improve public food distribution; Improve disaster preparedness and management and health care systems; More integrated agro-ecosystems
- Increased water storage, water efficiency and re-prioritizing current water use
  - Investment in drought-tolerant and salt-tolerant crops
    - Crop diversification
    - Better early El Niño warning systems
  - Sustainable management of coastal zones
    - Conservation of mangroves
- Reducing deforestation and protection of forests





*for a living planet*®

**www.  
wwf.or  
.id/**

Kantor Taman A9/Unit A1  
Jl. Mega Kuningan, Jakarta 12950  
INDONESIA

(Ph):+62-21-5761070, (Fax):+62-21-5761080

[www.wwf.or.id](http://www.wwf.or.id) and [www.panda.org](http://www.panda.org)

Email:

Fitrian Ardiansyah at [fardiansyah@wwf.or.id](mailto:fardiansyah@wwf.or.id)

