

# Auswirkungen des Klimawandels in Indonesien auf Mensch und Umwelt mit Bezug zu Südostasienstaaten

Seminar: Klimawandel, Klimawirkungen und Antworten  
in Entwicklungsländern

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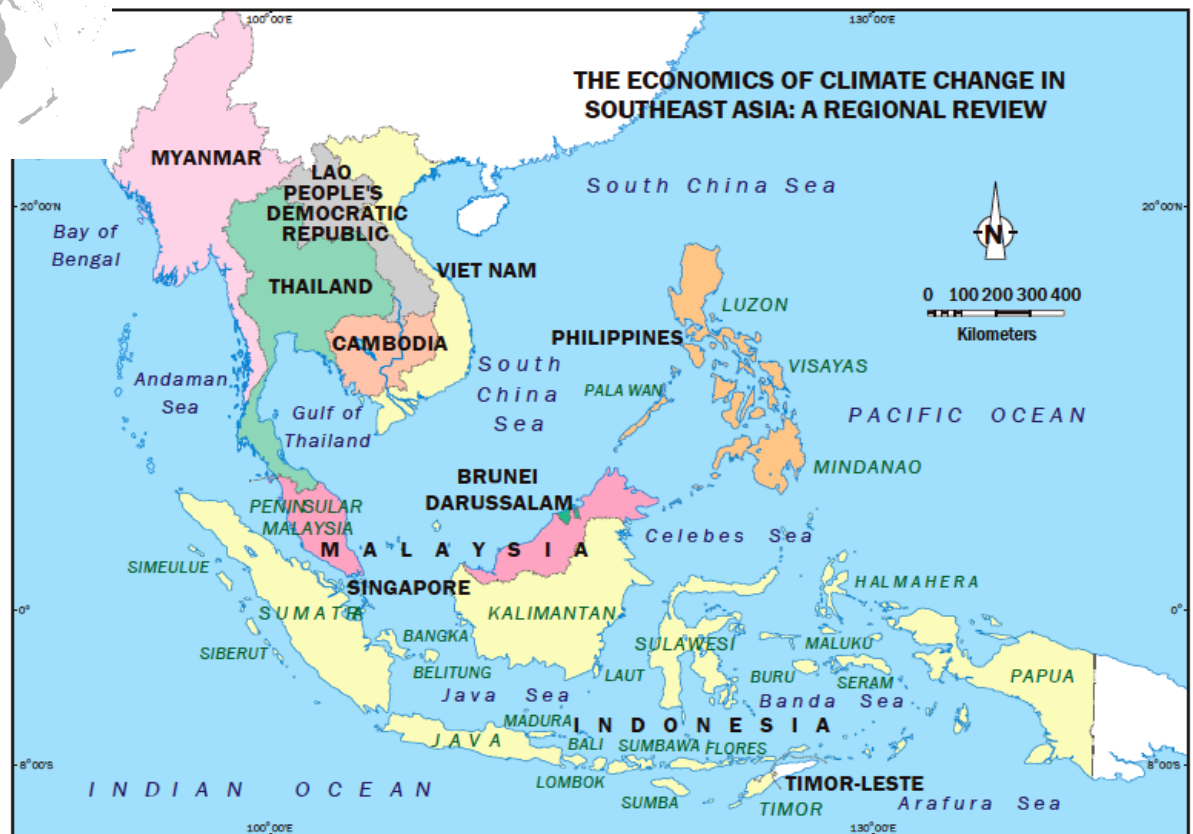
# Gliederung

- Einleitung
- Veränderung der Klimaelemente
- Veränderung in Landwirtschaft und Forstwirtschaft
- Gesundheit
- Politische Aktionen gegen den Klimawandel
- Zusammenfassung

# Einleitung



Quelle:  
<http://de.wikipedia.org/wiki/Datei:LocationSoutheastAsia.PNG>



Quelle: Asian Development Bank (2009): The Economics of Climate Change in Southeast Asia: A Regional Review. Mandaluyong City,3 Philippines. p.10

# Indonesien



Quelle: <http://web.worldbank.org/WBSITE/EXTERNAL/COUNTRIES/EASTASIA/PACIFICEXT/EXTTEAPHALFYEARLYUPD/ATE/0,,menuPK:550232~pagePK:64168427~piPK:64168435~theSitePK:550226,00.html>

Fläche: 1,912,988 sq. km.

Hauptstadt: Jakarta

Unabhängigkeit: 1945 von NL



<http://de.wikipedia.org/w/index.php?title=Datei:Indonesien.png&filetimestamp=20090113123237>

	2000	2005	2007	2008
<b>World view</b>				
Population, total (millions)	206,27	220,56	225,63	228,25
Population growth (annual %)	1,3	1,4	1,2	1,2
Surface area (sq. km) (thousands)	1.904,0	1.904,0	1.904,0	1.904,0
Poverty headcount ratio at national poverty line (% of population)	..	..	..	..
GNI, Atlas method (current US\$) (billions)	122,45	276,76	371,70	458,16
GNI per capita, Atlas method (current US\$)	590	1.250	1.650	2.010
<b>Environment</b>				
Forest area (sq. km) (thousands)	978,5	885,0	..	..
Agricultural land (% of land area)	24,7	26,4	..	..
<b>Economy</b>				
GDP (current US\$) (billions)	165,02	285,87	431,93	514,39
GDP growth (annual %)	4,9	5,7	6,3	6,1

Source: [http://ddp-ext.worldbank.org/ext/ddpreports/ViewSharedReport?&CF=&REPORT\\_ID=9147&REQUEST\\_TYPE=VIEWADVANCED&DIMENSIONS=105](http://ddp-ext.worldbank.org/ext/ddpreports/ViewSharedReport?&CF=&REPORT_ID=9147&REQUEST_TYPE=VIEWADVANCED&DIMENSIONS=105)

**Table 2.1. Selected Economic and Social Indicators**

Indicator	Indonesia	Philippines	Singapore	Thailand	Viet Nam	Southeast Asia	Developing Asia	World
GDP growth, 1990–2007 (annual average, %)	4.9	3.8	6.8	5.2	7.5	5.5	7.0	2.9
GDP per capita, 2007 (constant 2000 US\$)	1,033.6	1,216.2	28,964.2	2,712.7	617.0	4,020.3	3,802.5	5,964.3
Share of agriculture in GDP, 2005 (%)	12.0	14.2	0.1	10.7	20.1	11.0 <sup>a</sup>	22.4	1.1
Poverty incidence								
1990 headcount ratio (%)								
\$1.25-a-day poverty line	54.3	29.7	-	9.4	34.2	39.1	-	-
\$2.00-a-day poverty line	84.6	54.9	-	30.5	65.3	66.0	-	-
2005 headcount ratio (%)								
\$1.25-a-day poverty line	21.4	22.6	-	0.4	22.8	18.8	27.1	25.2
\$2.00-a-day poverty line	53.8	45.0	-	11.5	50.5	44.6	54.0	69.4
Total population, 2007 (million)	225.6	87.9	4.6	63.8	85.1	563.1	3,519.7	6,612.0
Population growth, 1990–2007 (annual average, %)	1.4	2.1	2.5	1.0	1.5	1.0	1.5	1.4
Population density, 2007 (people per square km)	124.5	294.8	6,659.8	124.9	274.6	781.5	901.6	51.0
Urban population growth, 2000–2005 (annual average, %)	4.0	3.5	1.5	1.5	3.1	3.5	2.6	2.1
Share of population within 100 km of coast, 2005 (%)	-	-	-	-	-	80.2	34.3	38.0
Employment in agriculture, 2004 (% of total employment)	43.3	37.1	0.3	42.3	57.9	43.3 <sup>b</sup>	36.8	-

Note: a This excludes Brunei Darussalam and Myanmar.

b This excludes Brunei Darussalam, Cambodia, Lao PDR, and Myanmar.

- = data not available, Developing Asia = ADB Developing Member Countries.

Sources: World Bank's World Development Indicators online database, World Bank's PovcalNet Database (2008).

# Veränderung der Klimaelemente

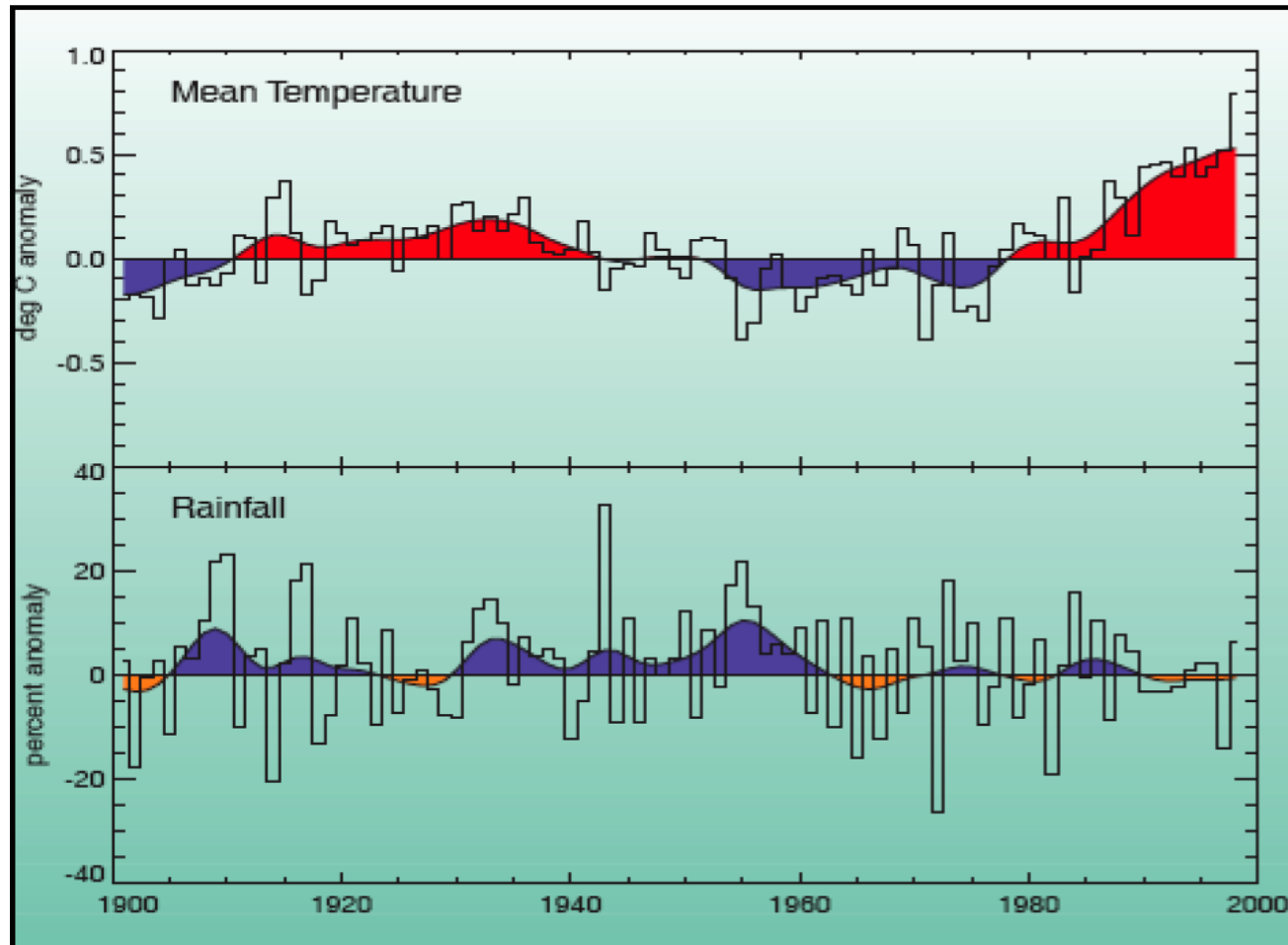


Figure 1. Changes in annual mean temperature, 1901-1998 (top), and annual rainfall, 1901-1998 (bottom), across Indonesia. Adapted from Hulme and Sheard (1999), Figure 1.

**Table 3.1. Observed Temperature Changes in Southeast Asia**

	Temperature Change (°C)	Source
Indonesia	Increase of 1.04-1.40°C per century	Rataq (2007)
Philippines	Increase of 1.4°C per century	IPCC (2007)
Singapore	Increasing by about 0.3°C per decade as observed between 1987-2007	Ho (2008)
Thailand	Increase of 1.04-1.80°C per century	Jesdapipat (2008)
Viet Nam	Increase of 1.0°C per century	Cuong (2008)

Source: Compiled by ADB study team.

**Table 3.2. Projected Change in Mean Surface Air Temperature for Southeast Asia under A1FI and B1 (with respect to baseline period of 1961-1990), °C**

Season	2010-2039		2040-2069		2070-2099	
	A1FI	B1	A1FI	B1	A1FI	B1
December to February	0.86	0.72	2.25	1.32	3.92	2.02
March to May	0.92	0.80	2.32	1.34	3.83	2.04
June to August	0.83	0.74	2.13	1.30	3.61	1.87
September to November	0.85	0.75	1.32	1.32	3.72	1.90
Mean	0.87	0.75	2.01	1.32	3.77	1.96

Source: IPCC (2007).

Coral bleaching --> ca. 90-95% der Korallen betroffen

Biodiversität

Quelle: Asian Development Bank (2009): The Economics of Climate Change in Southeast Asia: A Regional Review. Mandaluyong City, Philippines. p.25, 26



**Table 3.3. Observed Change in Precipitation in Southeast Asia**

	Change in Precipitation	Reference
Indonesia	Decrease in annual rainfall during recent decades in some areas	Aldrian (2007)
Philippines	Increase in annual rainfall and in the number of rainy days	Anglo (2006)
Singapore	Decrease in annual rainfall in the past 3 decades	Ho (2008)
Thailand	Decreasing annual rainfall for the last 5 decades	Jesdapipat (2008)
Viet Nam	Decrease in monthly rainfall in July-August and increase in September to November	Cuong (2008)

Source: Compiled by ADB study team.

Quelle: Asian Development Bank (2009): The Economics of Climate Change in Southeast Asia: A Regional Review. Mandaluyong City, Philippines. p.28

**Table 3.4. Projected Change in Precipitation for Southeast Asia under A1FI and B1 (with respect to baseline period 1961–1990), %**

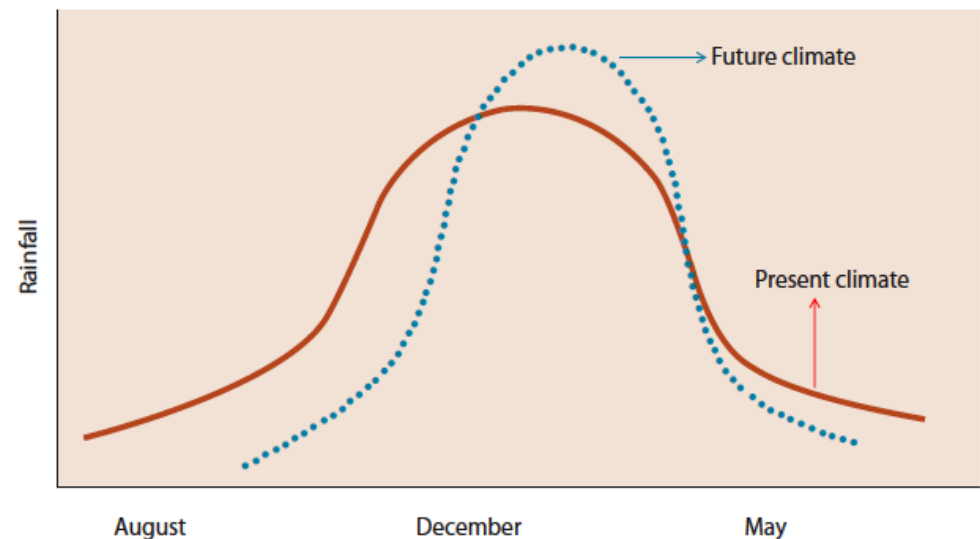
Season	2010–2039		2040–2069		2070–2099	
	A1FI	B1	A1FI	B1	A1FI	B1
December–February	-1	1	2	4	6	4
March–May	0	0	3	3	12	5
June–August	-1	0	0	1	7	1
September–November	-2	0	-1	1	7	2
Mean	-1.00	0.25	1.00	2.25	8.00	3.00

Source: IPCC (2007).

Quelle: Asian Development Bank (2009): The Economics of Climate Change in Southeast Asia: A Regional Review. Mandaluyong City, Philippines. p.29

der Regenzeit wird feuchter und die Trockenzeit trockener  
 Indonesien:  
 intensivere Niederschläge  
 bei 2% bis 3% mehr Niederschlag pro Jahr  
 kürzere Regenzeit (weniger Regentage im Jahr)  
 deutliche Erhöhung der Gefahr von Überschwemmungen

Figure 4: Likely future rainfall pattern in Java and Bali



Source: Based on Naylor et al., 2007

# Extrem events

Zunahme in den letzten Jahrzehnten

Hitzewellen, eine Erhöhung der Zahl der heißen Tage und warmen Nächten und einem Rückgang der Zahl der kalten Tage und kühle Nächte seit 1950

deutlichen Anstieg der Zahl der Starkniederschläge in der Region zwischen 1900 und 2005

Zahl von tropischen Wirbelstürmen

massiven Überschwemmungen und Erdbeben in vielen Teilen der Region --> viele Schäden an Eigentum, Vermögen und an Menschen

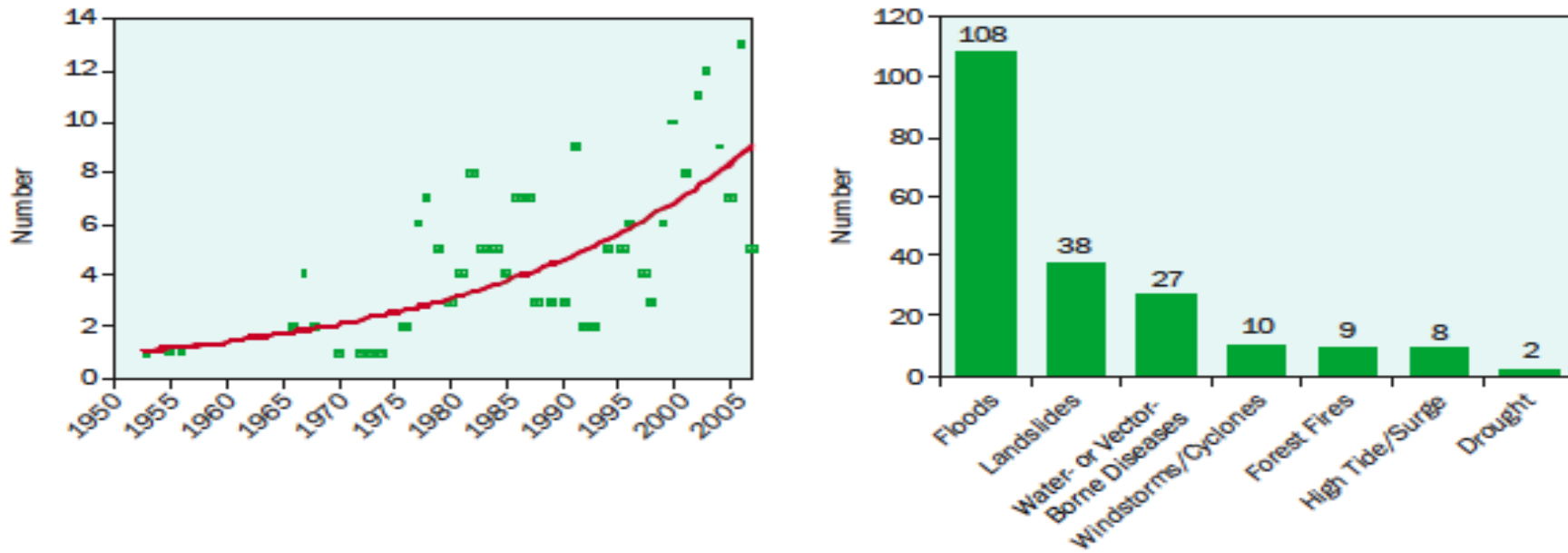
Dürren



Jakarta floods (Mercy Corps digital library)

<http://www.mercycorps.org/files/file1198714955.pdf>

**Figure 3.4. Occurrence of Climate-Related Hazards by Type in Indonesia (1950–2005)**



Source: Boer and Perdinan (2008).

Quelle: Asian Development Bank (2009): The Economics of Climate Change in Southeast Asia: A Regional Review. Mandaluyong City, Philippines. p.31

in der Regel im Zusammenhang mit ENSO

In den letzten Jahren El Nino-Ereignissen häufiger aufgetreten (mit Zunahme der Temperatur)

Klima-Gefahren sind in den letzten 5 Jahrzehnten häufiger aufgetreten

häufige Gefahren ist Überschwemmungen, Erdbeben und Krankheiten



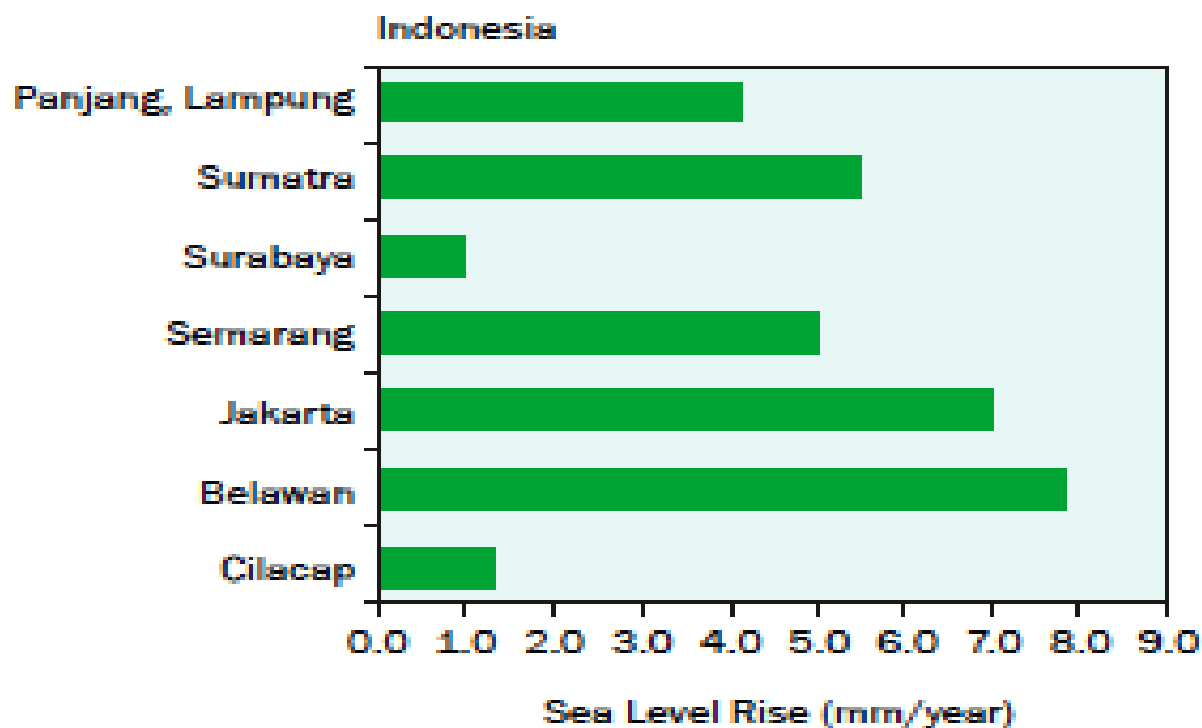
<http://news.bbc.co.uk/2/hi/asia-pacific/6610973.stm>

## Sea level in Southeast Asia

**Table 3.6. Observed Change in Sea Level in Southeast Asia**

	Change in Sea Level	Source
Indonesia	Increased by 1-8 mm/yr depending on location	SME (2007)
Philippines	Increasing in major coastal cities with Manila exhibiting the highest increase	Yanagi and Akaki (1994), Perez (1999), Hulme and Sheard (1999)
Singapore	No observable trends toward higher mean sea level so far	Ho (2008)
Thailand	Trending higher in recent years	Jesdapipat (2008)
Viet Nam	Increasing by 2-3 mm/yr	Cuong (2008)

Source: Compiled by ADB study team.



**Table 3.7. Projected Global Average Surface Warming and Sea Level Rise in 2100**

Case	Temperature Change (°C) (in 2090–2099 relative to 1980–1999) <sup>a</sup>		Sea Level Rise (meter) (in 2090–2099 relative to 1980–1999)
	Best Estimate	Likely Range	Model-based Range Excluding Future Rapid Dynamic Changes in Ice Flow
At constant year 2000 GHG concentration <sup>b</sup>	0.6	0.3–0.9	–
B1 scenario	1.8	1.1–2.9	0.18–0.38
A1T scenario	2.4	1.4–3.8	0.20–0.45
B2 scenario	2.4	1.4–3.8	0.20–0.43
A1B scenario	2.8	1.7–4.4	0.21–0.48
A2 scenario	3.4	2.0–5.4	0.23–0.51
A1FI scenario	4.0	2.4–6.4	0.26–0.59

– = not available.

Note: <sup>a</sup> These estimates are assessed from a hierarchy of models that encompass a simple climate model, several Earth Models of Intermediate Complexity, and a large number of Atmosphere-Ocean Global Circulation Models (AOGCMs).

<sup>b</sup> Year 2000 constant composition is derived from AOGCMs only.

Source: IPCC (2007).

Quelle: Asian Development Bank (209): The Economics of Climate Change in Southeast Asia: A Regional Review. Mandaluyong City, Philippines. p.34

Meeresspiegelanstieg: 40 cm in SA in 2100

# Auswirkungen des Meeresspiegelanstiegs

Eindringen von Salzwasser und Bodenversalzung in landwirtschaftlichen Gebieten -> Rückgang der Produktion und erhebliche Verlust der Anbauflächen

Überschwemmung und Landsenkungen in küstennahen Städten und Gemeinden → Verluste für den Tourismus und Aquakultur

Indonesien: Grundwasservorkommen in einigen Ballungsgebieten nahe der Küste von Jakarta (seit 1960), Surabaya, Semarang sind durch das Eindringen von Salzwasser betroffen

Eindringen von Salzwasser in die flachen und tiefen Grundwasserleitern von Jakarta hat das Binnenland bis zu 10-15 km von der Küste erreicht

Verlust von kleinen Inseln

# ENSO Ereignisse in Indonesien

- Verstärkte Wasserknappheit in Gebieten, die bereits unter Wasserstress leiden
- es sind besonders die Fluss und Stauseen vor allem während der Trockenzeit von Juni bis September betroffen
- Verknappung von Trinkwasser
- Verringerung der Stromerzeugung aus Wasserkraft



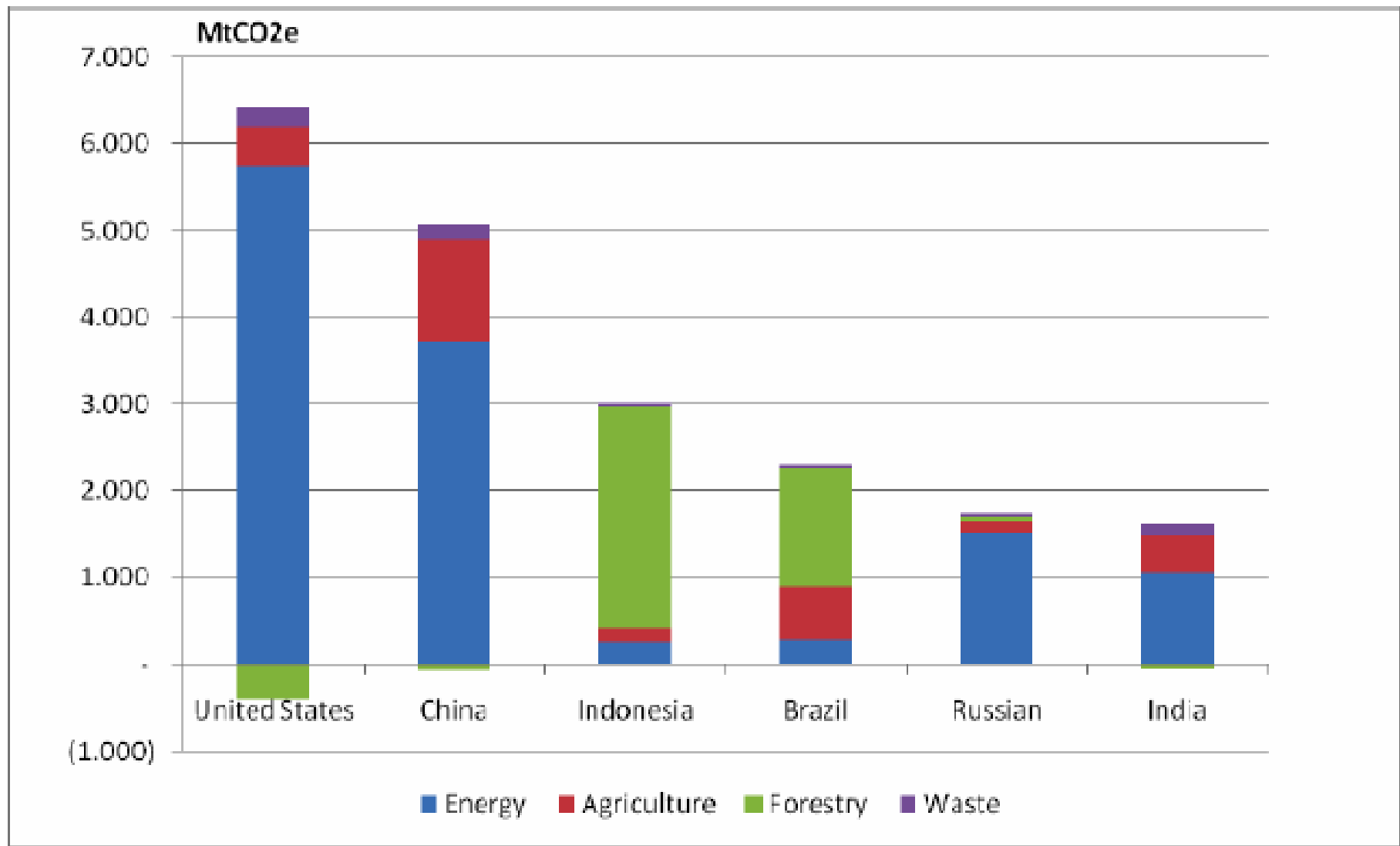
# La Nina

- Events häufiger geworden
- Schwere und intensive Niederschläge -> übermäßiger Abfluss hat bereits empfindliche Ökosysteme erreicht
- massive Überschwemmungen, Erdbeben, schwere Erosion der Ufer und Sedimentation
- umfangreiche Verluste der Lebensgrundlage, menschenwürdiges Leben und Eigentum
- Indonesien: 2003-2005 durch Überschwemmungen von La Nina --> Schäden an Infrastruktur von etwa \$ 205 Mio.

# Veränderung in Landwirtschaft und Forstwirtschaft



<http://www.global-greenhouse-warming.com/climate-change-in-Indonesia.html>



Quelle: Agus P. Sari, Martha Maulidya, Ria N. Butarbutar, Rizka E. Sari, Wisnu Rusmanto. (2007): Executive Summary: Indonesia and Climate Change Working Paper<sub>19</sub> on Current Status and Policies

**Table 2.5. Primary Forest in Southeast Asia (1990-2005)**

Country	Primary Forest ('000 ha)			As % of Total Forest Area			Annual Change (ha per year)	
	1990	2000	2005	1990	2000	2005	1990-2000	2000-2005
Brunei Darussalam	313	288	278	100.0	100.0	100.0	-2,500	-2,000
Cambodia	766	456	322	5.9	4.0	3.1	-31,000	-26,800
Indonesia	70,419	55,941	48,702	60.4	57.2	55.0	-1,447,800	-1,447,800
Lao PDR	1,490	1,490	1,490	8.6	9.0	9.2	0	0
Malaysia	3,820	3,820	3,820	17.1	17.7	18.3	0	0
Myanmar	-	-	-	-	-	-	-	-
Philippines	829	829	829	7.8	10.4	11.6	0	0
Singapore	2	2	2	100.0	100.0	100.0	0	0
Thailand	6,451	6,451	6,451	40.4	43.5	44.4	0	0
Viet Nam	384	187	85	4.1	1.6	0.7	-19,700	-20,400
Total	84,474	69,464	61,979	-	-	-	-	-

- = data not available.

Source: Global Forest Resource Assessment (FAO 2005).

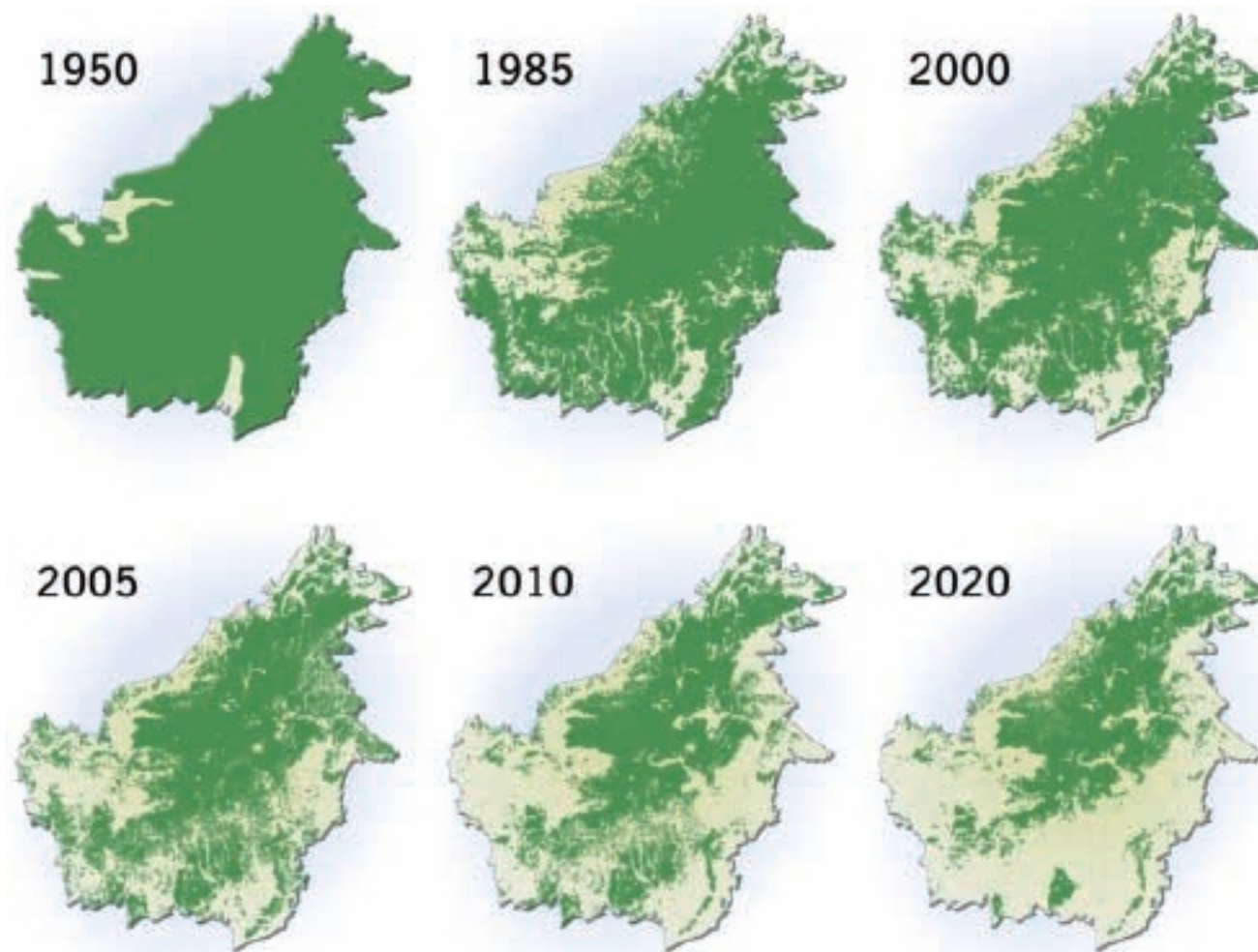
Quelle: Asian Development Bank (2009): The Economics of Climate Change in Southeast Asia: A Regional Review. Mandaluyong City, Philippines. p.18

**Figure 7.2. Decrease of Forest Cover in Indonesia 2000-2005: Forest Cover Change Areas**



*Reported by Mr. Hermawan Indrabudi, Min Forestry's Center for Forest Inventory and Mapping.  
 National Workshop on Forestry and Climate Change in Indonesia. Jakarta, Aug 27-28, 2007. GTZ & GOI.*

Quelle: <http://web.worldbank.org/WBSITE/EXTERNAL/COUNTRIES/EASTASIAPACIFICEXT/INDONESIAEXTN/0,,contentMDK:22393673~pagePK:1497618~piPK:217854~theSitePK:226309,00.html>



**Figure 3. Extent of deforestation in Borneo 1950-2005, and projection towards 2020 (UNEP/GRID-Arendal, 2007)**

# Waldwirtschaft

- Temp-Anstieg: → Anstieg von Waldbränden
  - → Anstieg von Schädlingen und Krankheiten
- Variabilität des NS: → Anstieg von Waldbränden, Schädlingen und Krankheiten durch Dürren
  - → Anstieg von invasiven Pflanzenarten
- Meeresspiegelanstieg: → Verlust von Mangrovenwäldern



# Landwirtschaft in Indonesien

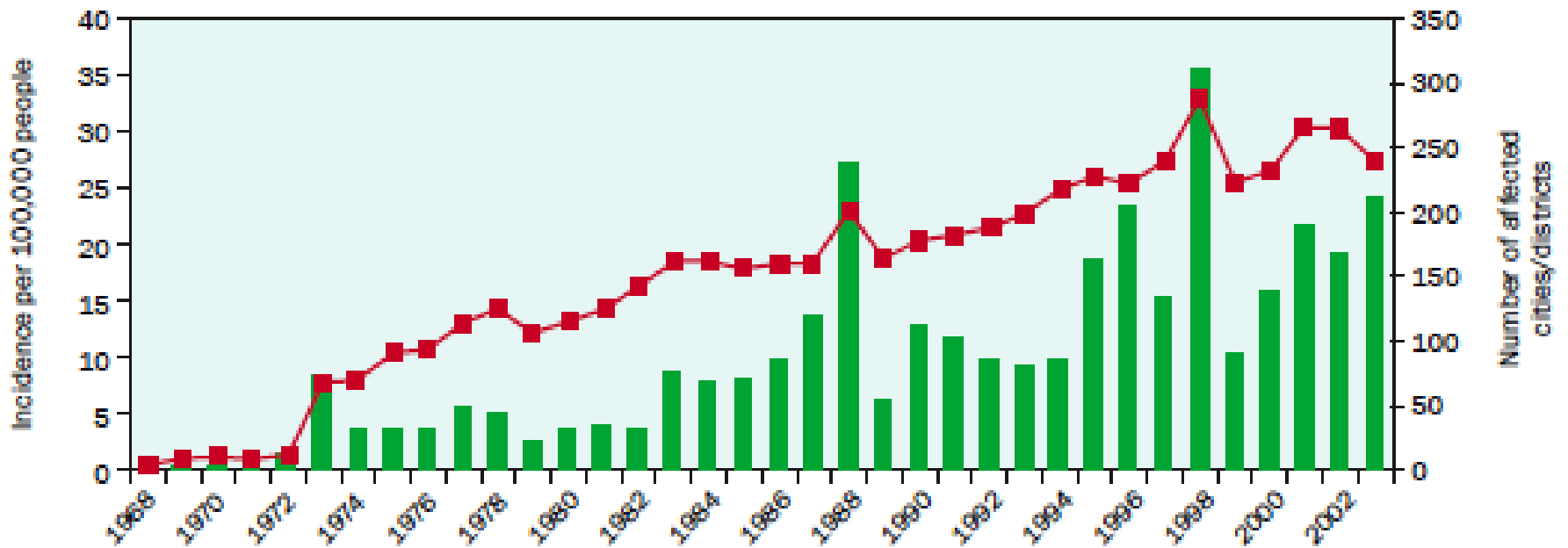
- bedeutenden Wirtschaftssektor
- Temp-Anstieg: → Rückgang des Ertrags durch Hitzestress
  - → Anstieg von toten Tieren im Viehbestand durch Hitzestress
  - → Zunahme von Schädlingen und Krankheiten
- Variabilität des NS: → Zunahme von Dürren, Überschwemmungen und Trop.Stürmen → Schäden der Ernte
  - → Veränderung des NS-Mustern: beeinflusst das vorhandene Erntemuster, Wachstum der Pflanzen, Aussaatzeit
  - -->Anstieg des Abflusses und Bodenerosion → Verringerung der Bodenfruchtbarkeit → geringerer Ertrag
- Meeresspiegelanstieg: → Versalzung von Ackerland
- Extremereignisse, El-Nino, La Nina
- Zukunft der Landwirtschaft





# Gesundheit

**Figure 3.11. Incidence of Dengue (histogram) and Affected Cities and Districts (line) in Indonesia**



Note: 1973, 1988, and 1998 are La Niña years.

Source: Depkes RI in [www.tempointeraktif.com](http://www.tempointeraktif.com)

Quelle: Asian Development Bank (2009): The Economics of Climate Change in Southeast Asia: A Regional Review. Mandaluyong City, Philippines. p.54

späten 1990er Jahren El Nino und La Nina → Ausbrüchen von Malaria, Dengue-Fieber und Pest

Extreme Temperaturen: Hitzetod, erhöher Ozon → Lungengewebe beschädigt, USW.

# Politische Aktionen gegen den Klimawandel

**Table 9.1. Government Agencies and Climate Change Key Plans**

Country	Focal Point	Key Plans/Strategy
Indonesia	Ministry of Environment, Climate Change Division	National Climate Change Action Plan 2007
Philippines	Presidential Task Force on Climate Change	Philippines Energy Plan 2004–2014
Singapore	Ministry of Environment and Water Resources	National Climate Change Strategy 2006, part of Singapore Green Plan 2012
Thailand	Ministry of Natural Resources and Environment, Office of Natural Resources and Environmental Policy and Planning	National Strategic Plan on Climate Change 2008–2012
Viet Nam	Ministry of Natural Resources and Environment, Department of Meteorology, Hydrology and Climate Change	National Target Program in Response to Climate Change

Sources: Boer and Dewi (2008), Cuong (2008), Ho (2008), Jesdapipat (2008), Perez (2008).

Quelle: Asian Development Bank (2009): The Economics of Climate Change in Southeast Asia: A Regional Review. Mandaluyong City, Philippines. p.188

Nationaler Aktionsplan für den Klimawandel:

Fordert stärkere Integration zwischen Schadensbegrenzung und Anpassung

Sorgt dafür, dass nationale Entwicklungsziele durch eine bessere Koordinierung zwischen den zuständigen Stellen (Energie-, Transport-, Forst- und Landwirtschaft) hergestellt wird

**Table 9.2. Sectoral Policies, Programs, and Measures Relevant to Mitigation and Adaptation in Indonesia**

Sector	Policies, Programs, and Measures
Climate change	<ul style="list-style-type: none"> <li>• Act No. 23/1997 Environmental Management</li> <li>• Act No. 6/1994 Ratification of UNFCCC</li> <li>• Act No. 17/2004 Ratification of the Kyoto Protocol</li> <li>• Decree No. 206/2005 Afforestation and Reforestation (A/R) CDM projects</li> <li>• Decree No. 14/2004 Afforestation and Reforestation (A/R) CDM projects</li> </ul>
Energy	<ul style="list-style-type: none"> <li>• National Energy Law/Presidential Decree No. 5/2006 (Perpes)</li> <li>• National Energy Conservation Plan 2002 (RIKEN)</li> <li>• MEMR Decree No. 2/2004 (Green Energy Policy)</li> <li>• MEMR Decree No. 1122/2002</li> <li>• MEMR Decree No. 02/2006</li> <li>• Presidential Instruction No. 10/2005</li> <li>• Ministerial Regulation No. 031/2005</li> </ul>
Transportation	<ul style="list-style-type: none"> <li>• The Blue Sky Programme</li> <li>• Indonesia Area Traffic Control System</li> <li>• Ministry of Energy and Mineral Resources Decree No. 1585/K/32/MPE (1999) on Criteria for Marketing of Gasoline and Diesel in Indonesia</li> <li>• Act No. 14 on Traffic and Land Transportation</li> <li>• Government Regulation No. 44 regarding vehicles and vehicle operation</li> <li>• Minister of Environment Decree No. Kep-35/MENLH/10/1993 on Emission Limit for Gas Waste of Motor Vehicles</li> <li>• Governor of DKI Jakarta Decree No. 1041 on Motor Vehicle Emission Standards for DKI Jakarta</li> <li>• President Instruction No. 1/2006 on biofuels</li> <li>• President Instruction No. 10/2006 on biofuels</li> </ul>
Forestry	<ul style="list-style-type: none"> <li>• Reduced Emissions from Deforestation and Degradation in Indonesia</li> <li>• Regulation PP6/2006 on Forest Management and Utilization</li> <li>• Ministerial Decree SK. 159/Menhut-II/2004 related to the restoration of degraded ecosystem in production forest areas</li> <li>• Presidential Instruction Inpres 4/2005 on illegal logging</li> <li>• Presidential Decree Keppres 32/1990 prohibiting development on peat &gt;3m deep</li> <li>• Presidential Instruction Inpres 2/2007 on rehabilitation of the ex-Mega Rice Project in Central Kalimantan</li> <li>• Ministerial Decree KepmenEkuin 14/2001 on Integrated Water Resources</li> <li>• Regulation PP 4/2001 on Forbidding the Use of Fire</li> <li>• Ministerial Decree KepMenHut 260/1995 Guidelines for Fire Control/ Prevention</li> </ul>
Agricultural	<ul style="list-style-type: none"> <li>• Climate Field Schools</li> <li>• National Climate Information System for Agriculture Development</li> </ul>
Water and coastal	<ul style="list-style-type: none"> <li>• Law 27/2007 on Coastal Zone and Small Island Management Conduct</li> <li>• Coral Reef Rehabilitation and Management Programme</li> <li>• Coral Triangle Initiative</li> </ul>



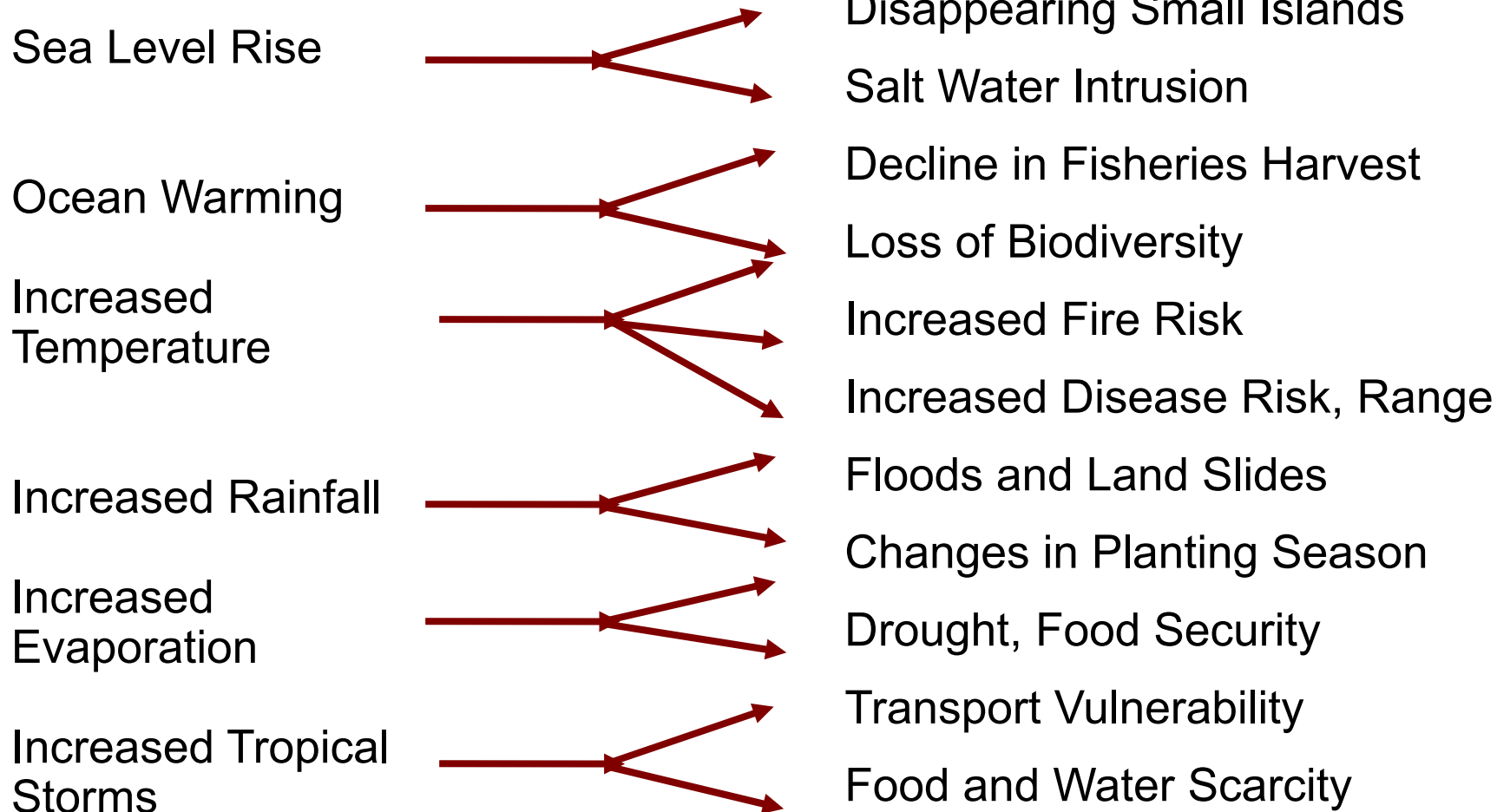
CDM = Clean Development Mechanism; MEMR = Ministry of Energy and Mineral Resources.

Source: Boer and Dewi (2008).

# Zusammenfassung

## Climate Change Effects

## Impacts on Indonesia



**Vielen Dank für die Aufmerksamkeit!**

# Literaturnachweis

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[http://web.worldbank.org/WBSITE/EXTERNAL/COUNTRIES/EASTASIAPACIFICEXT/INDONESIA\\_EXTN/0,,contentMDK:22393673~pagePK:1497618~piPK:217854~theSitePK:226309,00.html](http://web.worldbank.org/WBSITE/EXTERNAL/COUNTRIES/EASTASIAPACIFICEXT/INDONESIA_EXTN/0,,contentMDK:22393673~pagePK:1497618~piPK:217854~theSitePK:226309,00.html)

[http://siteresources.worldbank.org/INTINDONESIA/Resources/Environment/ClimateChange\\_Full\\_EN.pdf](http://siteresources.worldbank.org/INTINDONESIA/Resources/Environment/ClimateChange_Full_EN.pdf)



# Movies

- [http://english.ntdtv.com/ntdtv\\_en/ns\\_asia/2009-11-28/887981814120.html](http://english.ntdtv.com/ntdtv_en/ns_asia/2009-11-28/887981814120.html)  
→ Deforestation in Indonesia
- <http://www.youtube.com/watch?v=44S5sYWpwHE> → Coral Bleaching,  
less fish
- <http://www.youtube.com/watch?v=KSNcFyOSS3c> → Flooding