

# Vulnerability and Adaptation to Climate Change: Water and Food Security in Indonesia



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## Adaptation is necessary

- IPCC suggests immediate cut of greenhouse gas emissions by 60 - 80 percent to stabilize concentration.
- Kyoto Protocol requires "only" 5 percent reduction of Annex I country emissions from 1990 levels by 2008 - 2012.
- Average temperature will increase by 1.5 to 4.8 °C in the next century.



## Indonesia will be affected

- Consist of more than 17,000 islands – the largest number of islands in one country.
- More than 81,000 km of coastlines – second longest coastlines after Canada.
- Most of the people's livelihoods depend on climate-dependent sectors such as agriculture.
- Water and food security is at stake.



## Climate Scenarios

- Increased of temperature between 1.6 - 3.0 °C by CCCM and UKMO and between 2.0 and 4.2 by GISS and GDFL.
- CCCM predicts less rainfall, whereas UKMO predicts more.
- Most probably, less rainy-days per year, but more intensity per rainy-day, resulting in more rainfall per year.
- Current rainfall data from rain stations in 33 watersheds – 10 in Java island, 7 percent of landmass, but home for 65 percent population.



## Water

- Availability has already been a concern
- Projection of increased water demands: assuming 6 - 6.5 percent economic growth rate per year, 10 percent growth of industry, 3.5 percent of agriculture – yielded an estimate of 4.15 percent per year increase of water demand.



## Changes in water availability

### *Water Demand-Supply Ratio*

<i>Watershed</i>	<i>1 x CO2</i>	<i>2 x CO2</i>
Brantas	1.12	0.92
Citarum	0.97	0.99
Bengawan Solo	0.89	0.94
Jratun-Seluna	0.80	0.83
Progo-Opak	0.68	0.68
Pakelan Sampeyan	0.66	0.70
Cisadane-Ciliwung	0.47	0.53
Serayu	0.39	0.38
Citanduy	0.33	0.32
Ciliman-Ciujung	0.30	0.32



## Adaptation

- Emphasized in Java.
- Efficient use of water.
- Water pollution to be minimized.
- Watershed management, including better and more-integrated watershed planning and well-enforced regulations.
- Mitigation of droughts and floods.
- Better-managed use of groundwater.



## Agriculture

- Already underdeveloped.
- Loss of arable lands due to conversion to settlement and industrial use.
- Cases in Pusakanegara (West Java) and Mojosari (East Java).



## Changes in agricultural yields

	<i>Pusakanegara</i>	<i>Mojosari</i>
Annual rainfall (mm)	423 – 1681 (21 – 83 percent)	265 – 1130 (15 – 63 percent)
Increase of min. temperature (°C)	2.3 – 3.9 (10 – 17 percent)	2.3 – 3.9 (10 – 17 percent)
Increase of max. temperature (°C)	2.0 – 3.9 (9.5 – 12.5 percent)	2.3 – 3.9 (7 – 12 percent)
Solar radiation (MJm <sup>-2</sup> )	0.3 – 0.7 (2.2 – 3.5 percent)	0.2 – 0.6 (1.3 – 3.3 percent)
Rice yield (tons/ha)	5,578 (normal year) 2,637 (El Niño year) decrease about 0.5 percent per year.	6,925 (normal year) 2,939 (El Niño year) decrease of more than 1 percent per year.

## Adaptation

- Use of more resilient variety of rice.
- Changes in planting schedule.
- Efficient use of water and flood control.
- Improved overall agriculture techniques.
- (Diversification of staple food)



## Forest

- Third largest after Brazil and Congo, 142 forest areas (75 percent of landmass).
- Rapid deforestation



## Forest

- Changes in the types of forests:
  - Sumatera, from subtropical wet forest to warm temperate wet forest, from subtropical rain forest to subtropical dry forest.
  - Kalimantan, from subtropical wet forest to subtropical moist forest.
  - Sulawesi, from subtropical moist forest to tropical wet forest.
  - Java, from tropical moist forest to subtropical rainforest, and from tropical wet forest to either tropical dry forest or subtropical rain forest.



## Adaptation

- Only few adaptation measures can be undertaken.
- Rehabilitation, reforestation, afforestation, conservation of existing forest.
- Livelihood changes are necessary to survive.

