

Adaptation to recurrence forest fires and their risks under the influence of climate change and climate variability

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Outline:

- Background
 - Forest Fires in Indonesia and the causes
 - Role of climate
- Climate scenarios for Indonesia
- Adaptation to climate change
 - Elements needed
 - Approach of TroFCCA
- Conclusions



Background:

Forest Fires in Indonesia

Records

- Forest fires are **not new**
- **Written records**
 - First record in the 17th Century
 - Major fire events: 1982-83, 1987, 1991, 1994, 1997-98 and 2002
 - The most severe event: 1997-98
 - Area affected: **11.7 M Ha**
 - Type of land cover: lowland peat / swamp forest, timber plantations, agricultural land
 - CO₂ released to atmosphere = **700 million metric tonnes**
 - Estimated lost: **US\$ 9.1 billion**



Background:

Forest Fires in Indonesia

Causes:

- Forest fires in Indonesia are usually human induced
 - Direct - setting up fires
method of land clearing.
 - Indirect - human activities that favour the occurrences and potentially increase the risk of fires
logging, road development, resettlement, etc.



Background:

Forest Fires in Indonesia

Why forest fires are important?

- Forest fires cause significant **negative impacts** on the **environment** and **socio-economics**.

Mean economic lost of the 1997-1998 drought and fires

Sector	Mean estimated economic losses (US\$ in million)
Agriculture	
<i>Farm crops</i>	2,431
<i>Plantation crops</i>	319
Forestry	
<i>Timber from natural forest (logged & unlogged)</i>	1,813
<i>Lost of growth in natural forest</i>	355
<i>Timber from plantations</i>	91
<i>Non timber forest products</i>	631
<i>Flood protection</i>	413
<i>Erosion and siltation</i>	1,354
<i>Carbon sink</i>	1,446
Health	148
Building and property	1
Transportation	33
Tourism	111
Fire fighting costs	12
Total	9,158

Source: Applegate et al. (2002)



Background:

Forest Fires in Indonesia

Why forest fires are important?

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- Forest fires are local, national, regional and international relevance.



Background:

Forest Fires in Indonesia

- Forest fires cause significant negative impacts on the environment and socio-economics.
- Forest fires are local, national, regional and international relevance.
- Forest fires are **associated with climate conditions**, and therefore are relevant to climate change (and climate variability).

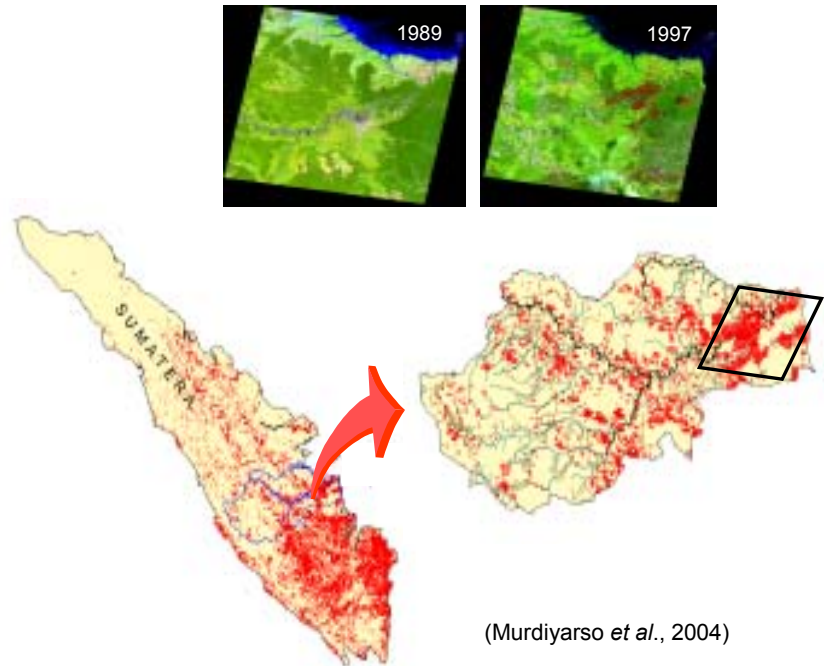
Linking climate conditions and forest fires

- Weather and climate conditions have a correlation with the number of hot spots and the extent of forest fires

Dry climate, lower humidity, and higher surface temperature is a favourable condition that enhances the intensity and extent of fires.

Indonesia experiences climate variability:

- seasonal*
- inter-annual*
- inter-seasonal*



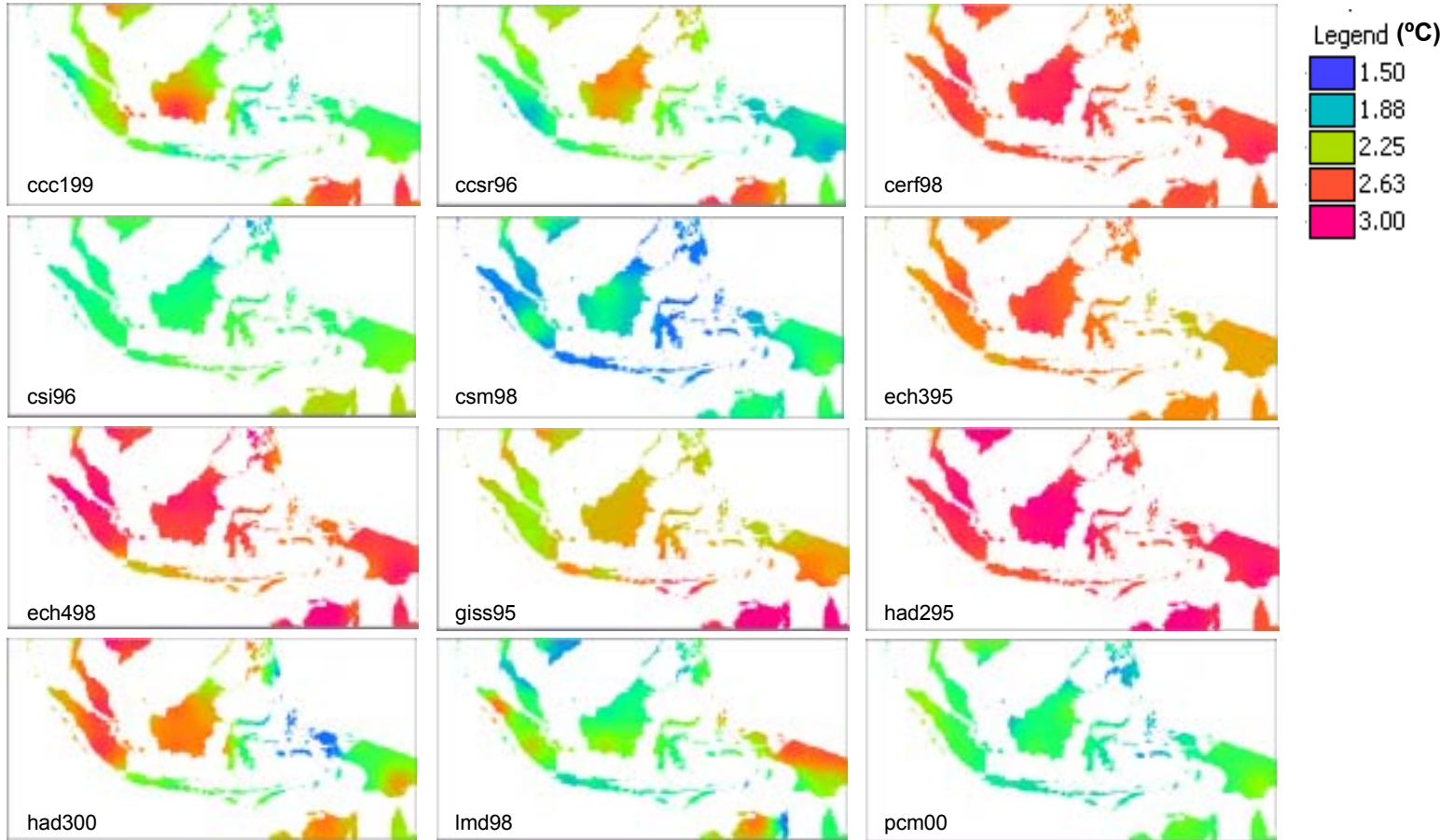
A combination of ENSO and IDM, such as those in 1992/1993 and 1997/1998, have caused severe droughts that correlates with the increased number of hotspots of forest fires over Indonesia.



Climate Scenarios over Indonesia based on GCMs

- Generally warmer – higher evapotranspiration rates

Change in average annual temperature 2080, Emission A2ASF, various models
(MAGICC/SCENGEN)

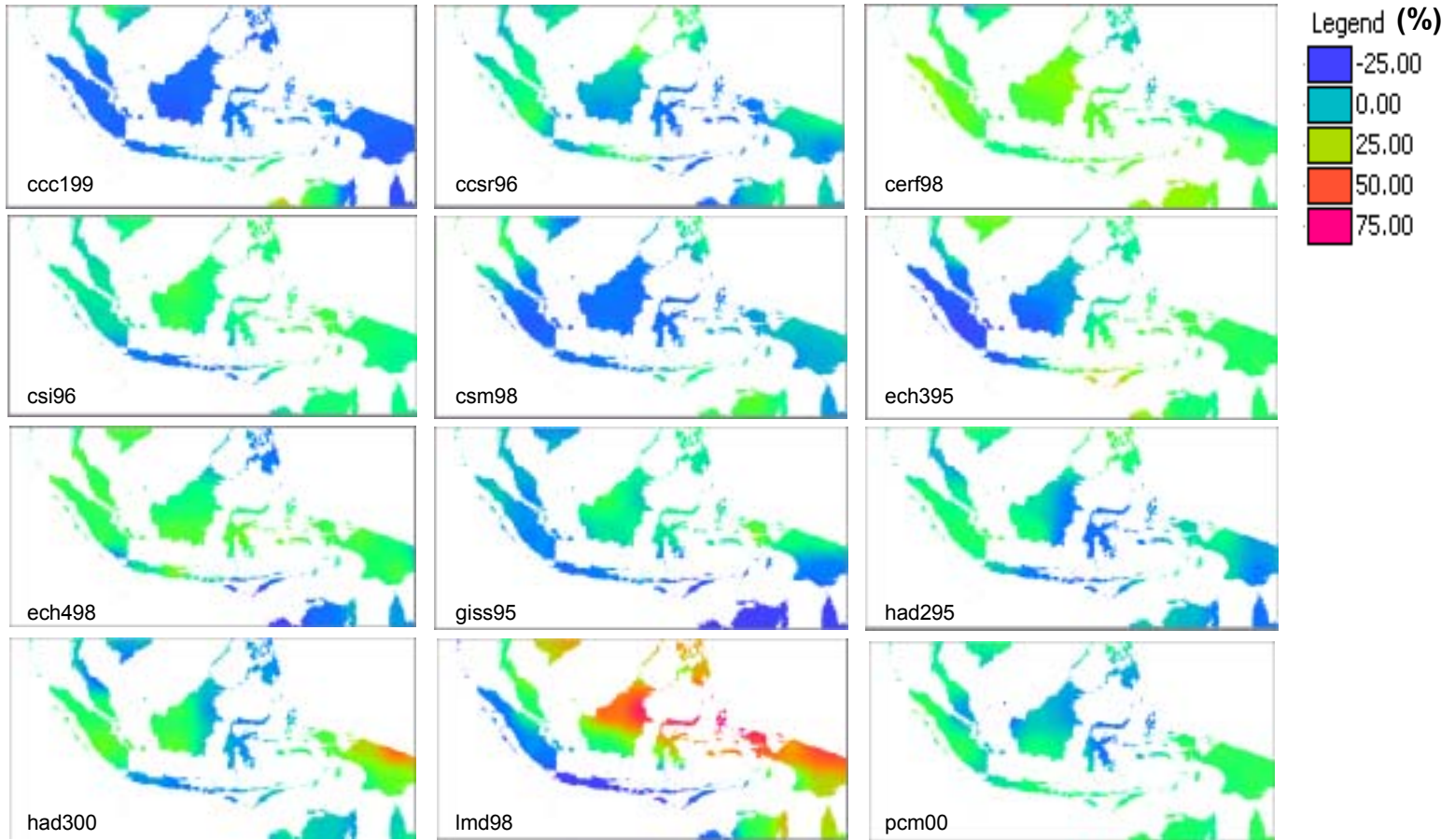




Climate Scenarios over Indonesia based on GCMs

- Generally warmer – higher evapotranspiration rates
- Some GCMs indicate a **wetter**, some indicate a **drier**, and some shows a **mix condition**.

Change in average annual precipitation 2080, Emission A2ASF, various models
(MAGICC/SCENGEN)





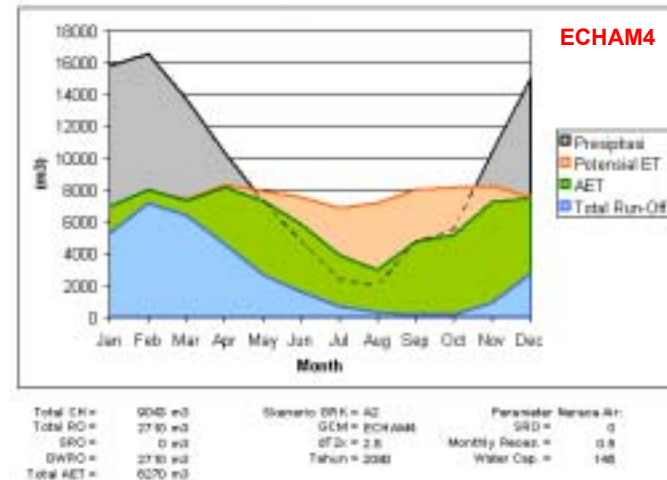
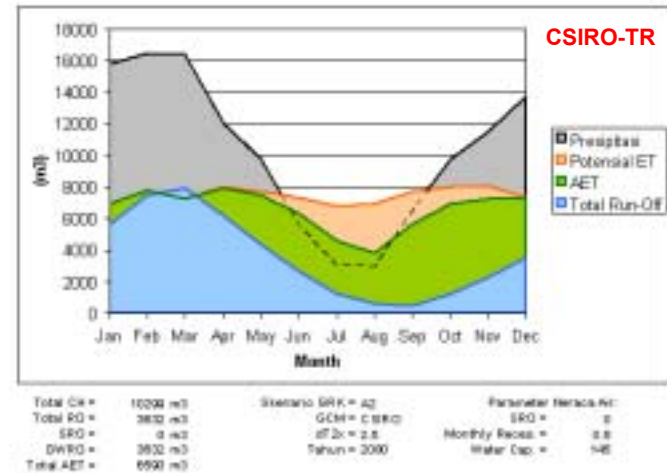
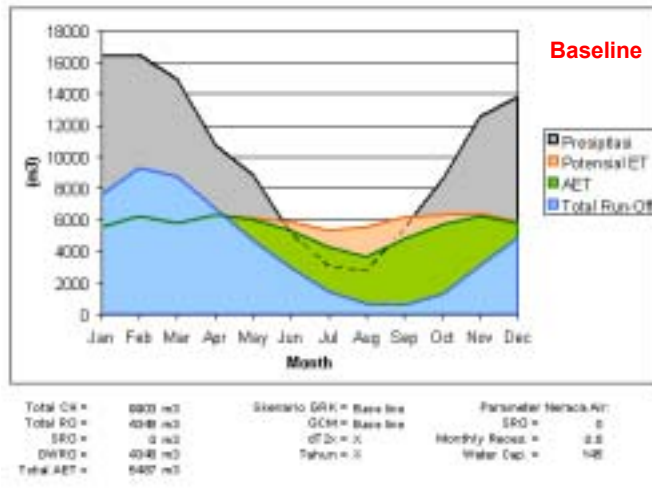
Climate Scenarios over Indonesia based on GCMs

- Generally warmer – higher evapotranspiration rates
- Some GCMs indicate a wetter, some indicate a drier, and some shows a mix condition.
- More rainfall, but with higher temperature may increase dryness (water deficit)



2080, emission A2ASF

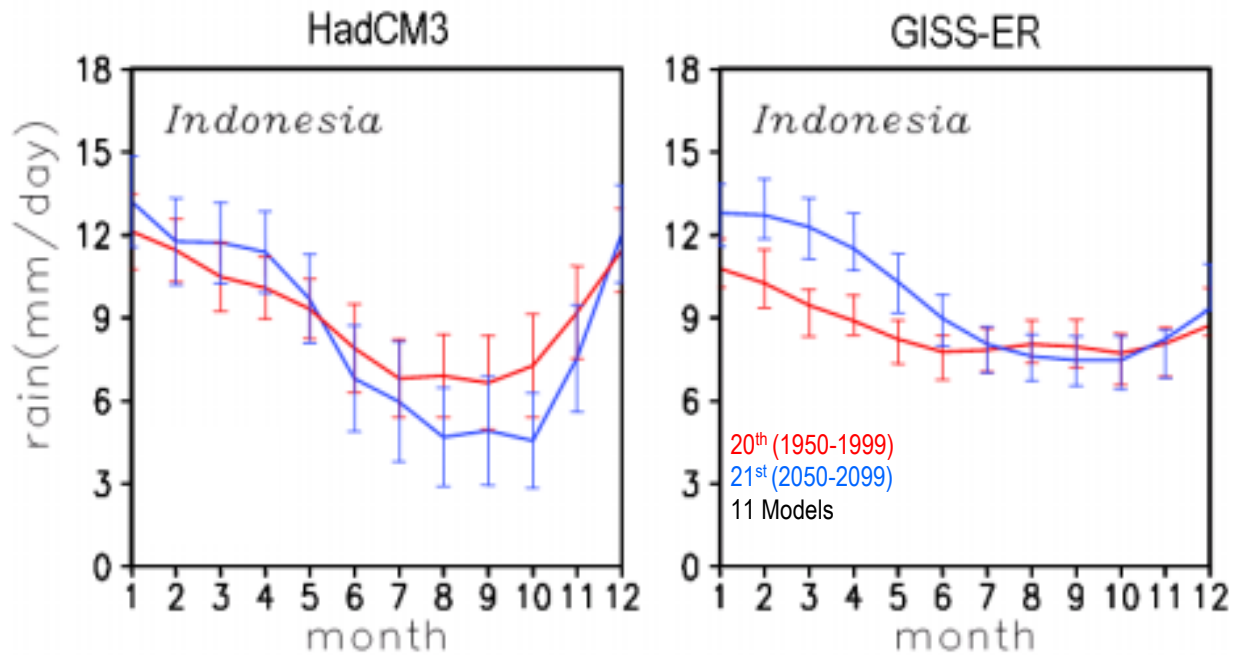
Impact of climate change on water balance of Java





Climate Scenarios over Indonesia based on GCMs

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- Some GCMs indicate a wetter, some indicate a drier, and some shows a mix condition.
- More rainfall, but with higher temperature may increase dryness (water deficit)
- Some GCMs show **enhanced seasonal variability**.



(Source: Wenhong Li, 2006)



Climate Scenarios over Indonesia based on GCMs

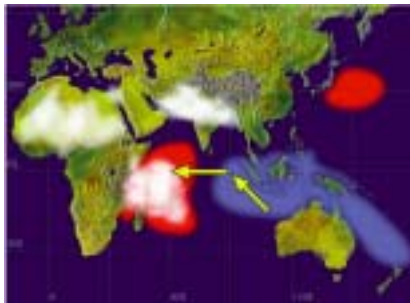
- Generally warmer – higher evapotranspiration rates
- Some GCMs indicate a wetter, some indicate a drier, and some shows a mix condition.
- More rainfall, but with higher temperature may increase dryness (water deficit)
- Some GCMs show enhanced seasonal variability.
- There is a tendency of increasing frequency and intensity of **extreme climate events**.

Future climate variability

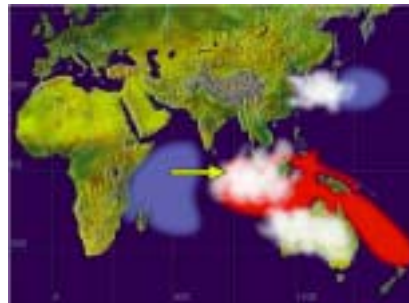
Trends in El Nino frequency/intensity have No consensus:

- some models no change
- some models increase frequency and /or intensity
- **no models show a decrease**

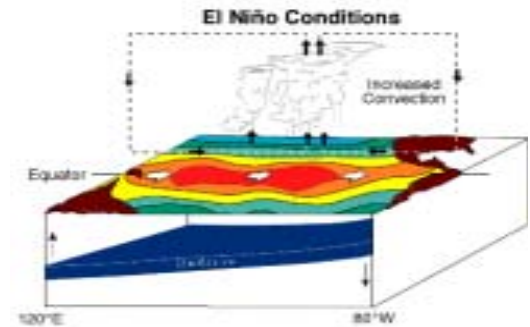
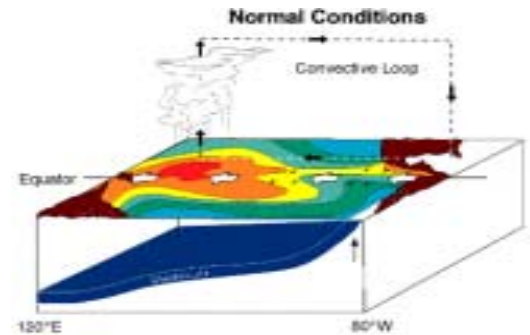
Source: Canadell *et al.* (2006)



+ve DME (warmer SST)



-ve DME (colder SST)



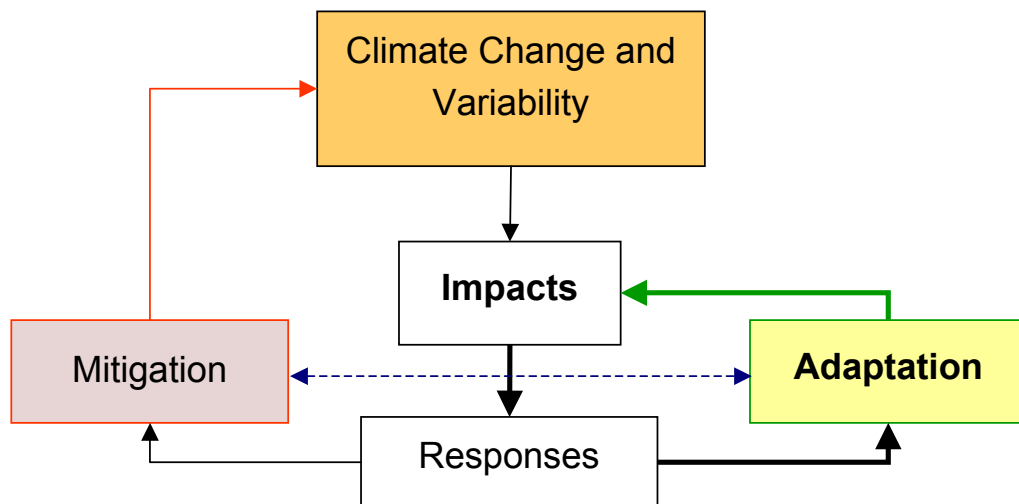
Source: NOAA

Future recurrence forest fires in Indonesia

- Forests more vulnerable to fire in the dry season, and more severe when El Niño and positive Indian-Ocean Dipole Mode occur.
- Fire events are likely to continue.



Adaptation to Climate Change



Vulnerability: the degree to which a system is susceptible to or unable to cope with adverse effects of climate change/variability and extreme events

Adaptation: adjustment of social and natural systems to respond to the impacts of climate change and variability (IPCC, 2001)

Why adaptation strategies?

- Better planning that includes climate change threats and opportunities for **sustainable development** (e.g. water resources management, agriculture, energy/hydropower)
- **Mitigation** of potential climate related **hazards** (e.g. flood, drought, forest fire, landslides)



Developing Adaptation Strategies

Elements needed

- Adaptation strategies should be developed on the basis of **assessed vulnerabilities** (applying **top down** or **bottom up approaches**) and the identification of **adaptive capacity**.
- The process should bring **local institutions** and **incorporate indigenous knowledge**.
- Adaptation is best addressed through **mainstreaming** within the framework of **sustainable development**
 - Mainstreaming adaptation is an effort to promote a **sectorial issue to become a communal issue** for all development sectors which requires a **synergy** and concentration on **identified priorities** while pursuing resource optimization.

Examples of key vulnerabilities, indicators and method to measurement and monitoring

Aspect	Causes of vulnerability	Indicators of vulnerability	Methods to measure/monitor	Proposed adaptation strategy/ improving resilience
Bio-physics	<ul style="list-style-type: none"> - Prolonged drought (high temperature, less rain) - "Open" forest/logging - Drainage of peatswamp - Coal seams 	<ul style="list-style-type: none"> - Change in climatic parameters and their trends - Observed impacts - Presence of coal seams 	<ul style="list-style-type: none"> - Climate model - Interpretation of data/information - Remote sensing technology - Survey 	<ul style="list-style-type: none"> - Protected natural forest - Water level management
Socio-economics & Institutions	<ul style="list-style-type: none"> - Uncontrolled burning practices - Poverty - Weak institutional capacity - High dependency on natural resources 	<ul style="list-style-type: none"> - Take national and local standard of poverty line into consideration - Number of people dependent directly on natural resources - Access to government services 	<ul style="list-style-type: none"> - Survey 	<ul style="list-style-type: none"> - Plantation management with fire break - Options for alternative income /livelihood



Institutions directly involved in forest fire mitigation and suppression

- **International**

- United Nations Institutions e.g. FAO
- Global Environment Facility
- International NGOs e.g. WWF & Wetlands International
- The Global Fire Monitoring Center (GFMC).

- **Regional**

- ASEAN (by establishing Haze related initiatives)

- **Government of Indonesia (by releasing relevant regulations)**

- Bureau of Mitigation National Coordinating Agency for Disaster Mitigation (led by the Vice President)
- Directorates at Ministry of Environment (MoE)
- Directorates at Ministry of Forestry (MoF)
- Directorates at Ministry of Agriculture (MoA)

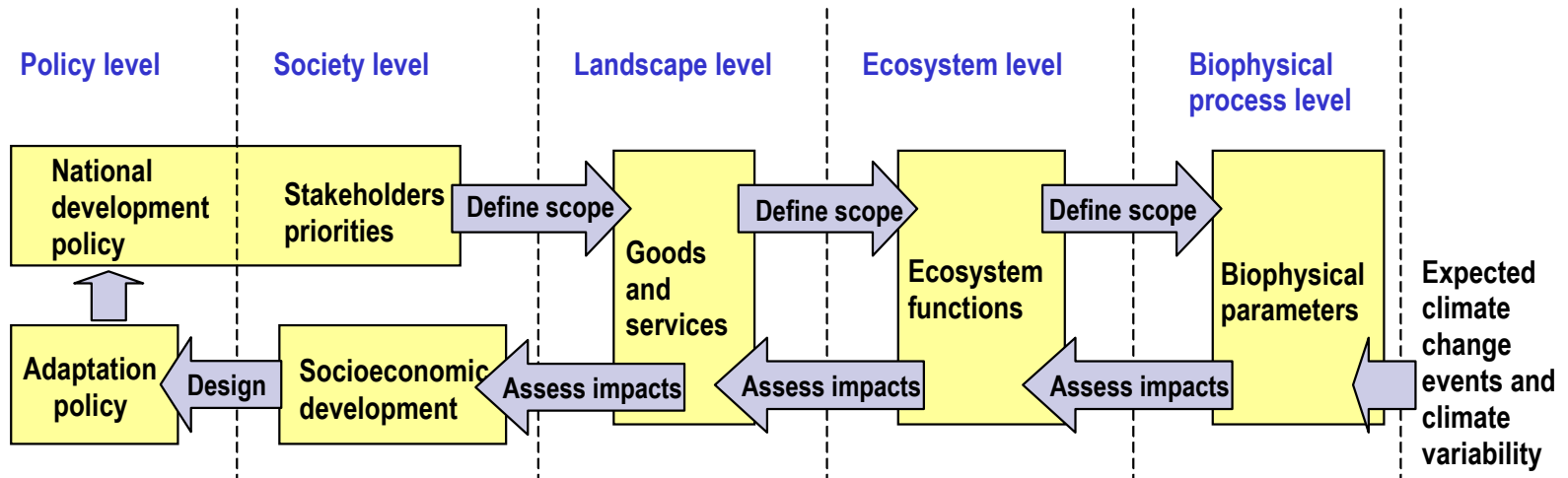
Continuation...(institutions involved directly in forest fires mitigation and suppression)

■ **Local (provincial) governments**

- **On monitoring:**
 - Provincial Government Agencies for Impact Assessment Control (Bapedalda)
 - Bio-physic and Meteorological Agency (BMG)
 - National Space Agency (LAPAN)
- **On prevention:**
 - Provincial Government Education Agencies
 - Provincial Government Agriculture Agencies
 - Provincial Government Forestry Agencies
- **On suppression:**
 - Provincial Government Agriculture Agencies
 - Provincial Government Forestry Agencies
 - Private sectors
 - NGOs.
- **On recovery:**
 - Estate crops divisions, Provincial Government Agriculture Agencies
 - Provincial Government Forestry Agencies (Dinas Kehutanan)
 - Private Sectors
 - NGOs
- **On law enforcement:**
 - Local Police agencies
 - Ministry of Justice
 - NGOs

These institutions mainly counteract direct causes of forest fires. How about the indirect causes? (e.g. poverty, logging, land cover conversion, etc.)

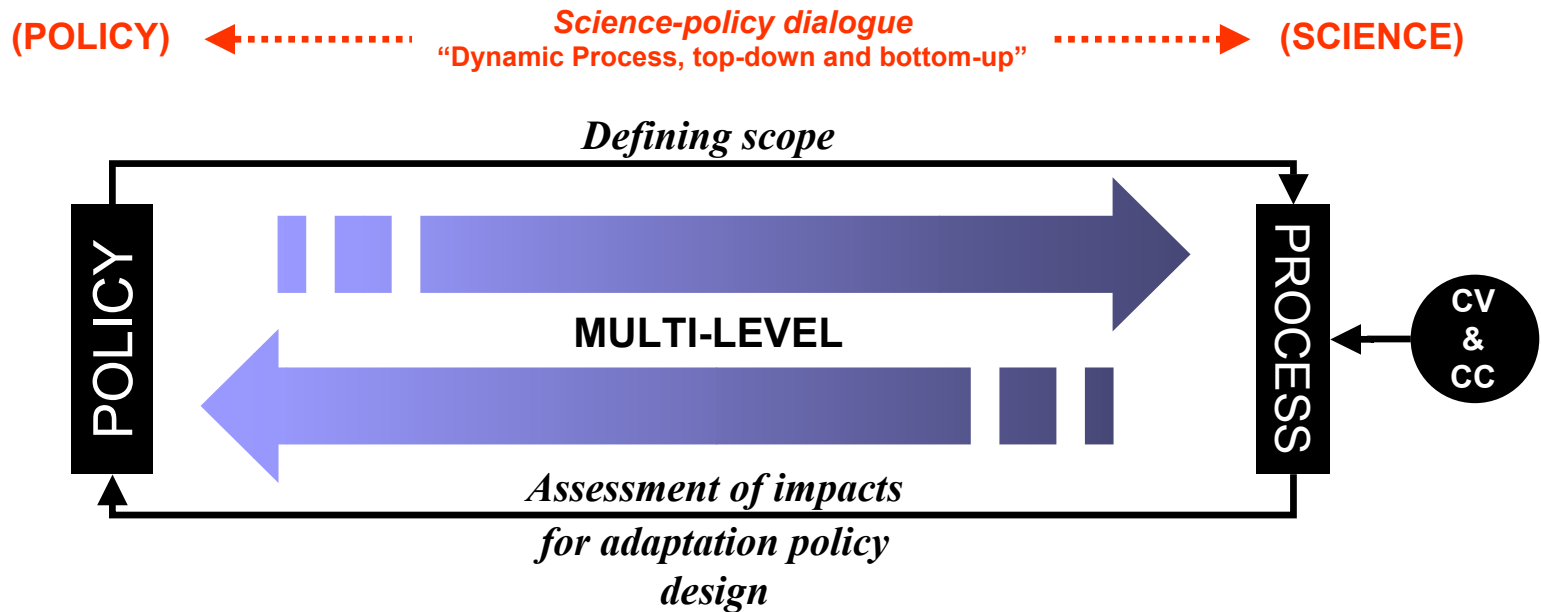
TroFCCA's general methodology



Taking into account all stakeholders priorities/needs together with holistic aspects of environmental goods and services of forests into socio-economic developments
"MAINSTREAMING"

TroFCCA's general methodology

IN SHORT





Conclusions

- Forest fires are likely to reoccur in the future (more intensively and frequently);
- Multi-level approach; comprehensive vulnerability assessments for identifying adaptation strategy; dynamic process with top-down and bottom-up approaches through science-policy dialogues (like TroFFCA's approach), should be used for identifying and streamlining adaptation strategies to the adverse effect of climate change and climate variability.



Thank you