Climate change: Risk, Vulnerability, Adaptation and Resilient Livelihood

Panomsak Promburom

Center for Agricultural Resource System Research

Faculty of Agriculture, Chiang Mai University

34th International Vegetable Training Course: "Vegetables: From Seed to Table and Beyond"

14 September to 4 December 2015

AVRDC Research and Training Station Kasetsart University, Kamphaengsaen Campus, Nakhon Pathom, Thailand

Topics

- Livelihood
- Introduction to climate change
  - Understanding climate change
  - Terminology
  - Multiple dimensions of climate change
  - Future climate scenario
  - Climate change and context specificity
- Understanding climate change, risk and vulnerability
- Risk and vulnerability to climate change analysis
- Adaptation to climate change for resilient livelihood

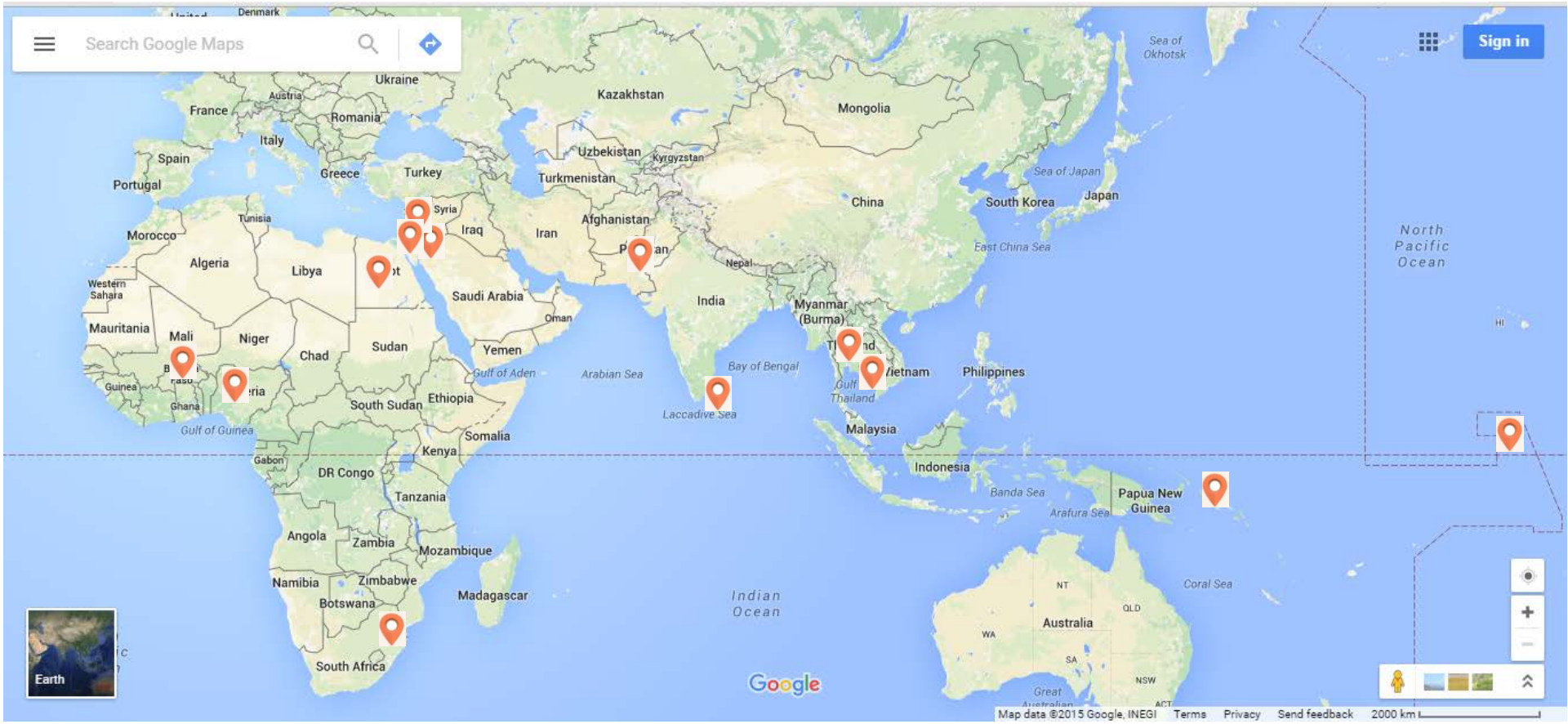
Livelihood

"a set of activities, involving securing the basic necessities of life (water, food,…) and the capacity to acquire above necessities working either individually or as a group by using endowments for meeting the requirements of the self and his/her household on a sustainable basis with dignity"

Oxford University Press, 2010

"a livelihood system is comprising the capabilities, assets (both material & social resources) and activities required for a means of living"

(Chambers and Conway, 1991)

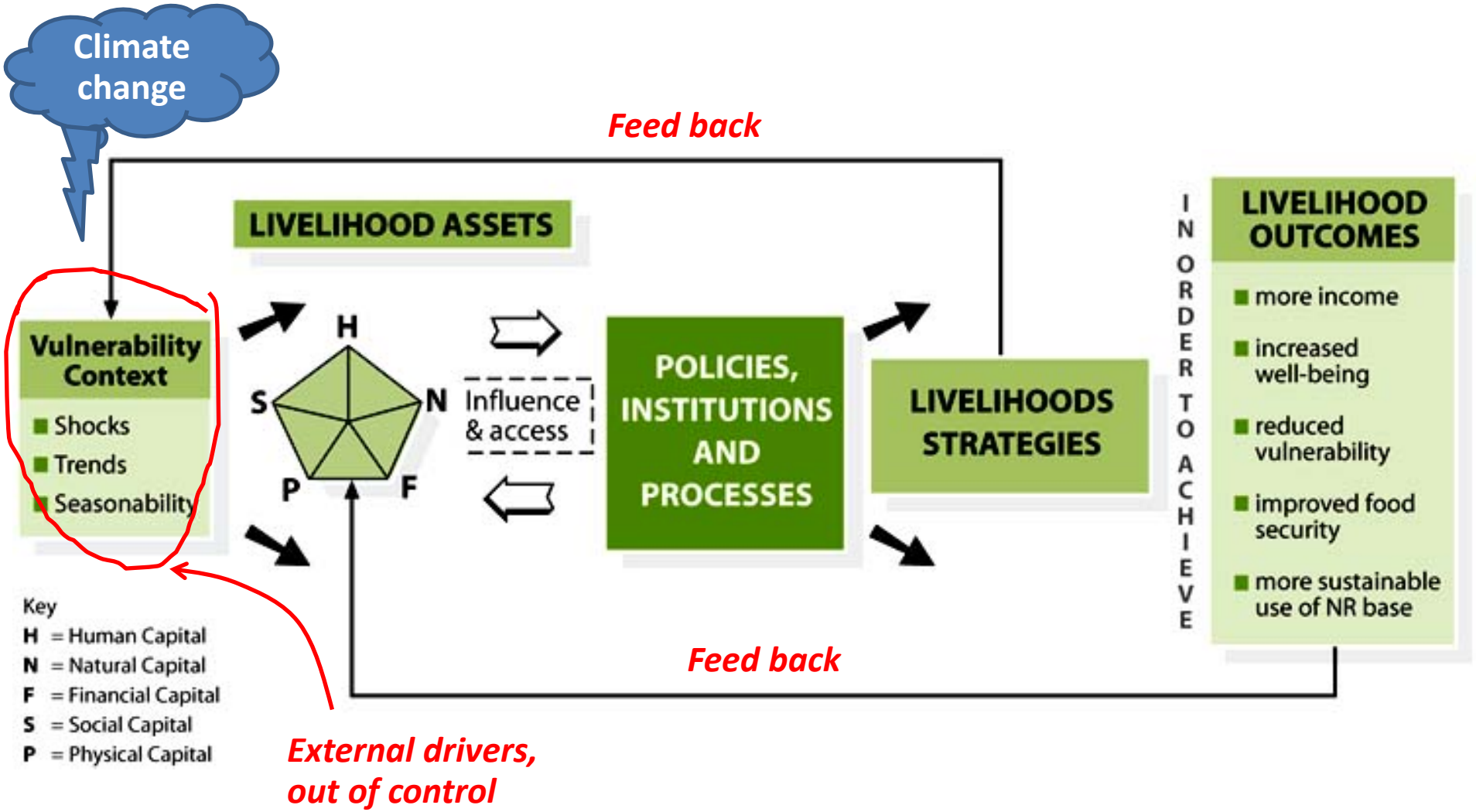

Search Google Maps
Sign in
Ukraine
Kazakhstan
Mongolia
France
Austria
Romania
Italy
Spain
Portugal
Greece
Turkey
Uzbekistan
Kyrgyzstan
Turkmenistan
Syria
Iraq
Iran
Afghanistan
China
South Korea
Japan
Sea of Japan
East China Sea
Sea of Okhotsk
North Pacific Ocean
Tunisia
Morocco
Algeria
Libya
Western Sahara
Saudi Arabia
Nepal
India
Myanmar (Burma)
Philippines
Vietnam
Thailand
Gulf of Thailand
Bay of Bengal
Arabian Sea
Laccadive Sea
Oman
Yemen
Gulf of Aden
Mauritania
Mali
Niger
Chad
Sudan
Guinea
Ghana
Gulf of Guinea
South Sudan
Ethiopia
Somalia
Kenya
Gabon
DR Congo
Tanzania
Angola
Zambia
Mozambique
Namibia
Zimbabwe
Botswana
Madagascar
South Africa
Indian Ocean
Malaysia
Indonesia
Banda Sea
Arafura Sea
Papua New Guinea
Coral Sea
Australia
NT
QLD
WA
SA
NSW
Great
Earth
Google
Map data ©2015 Google, INEGI
Terms
Privacy
Send feedback
2000 km

Exercise:

- Draw a picture representing a common rural (community/village) livelihood context of your country. *[10 minutes]*

- Briefly explain the livelihood context. *[3 minutes]*

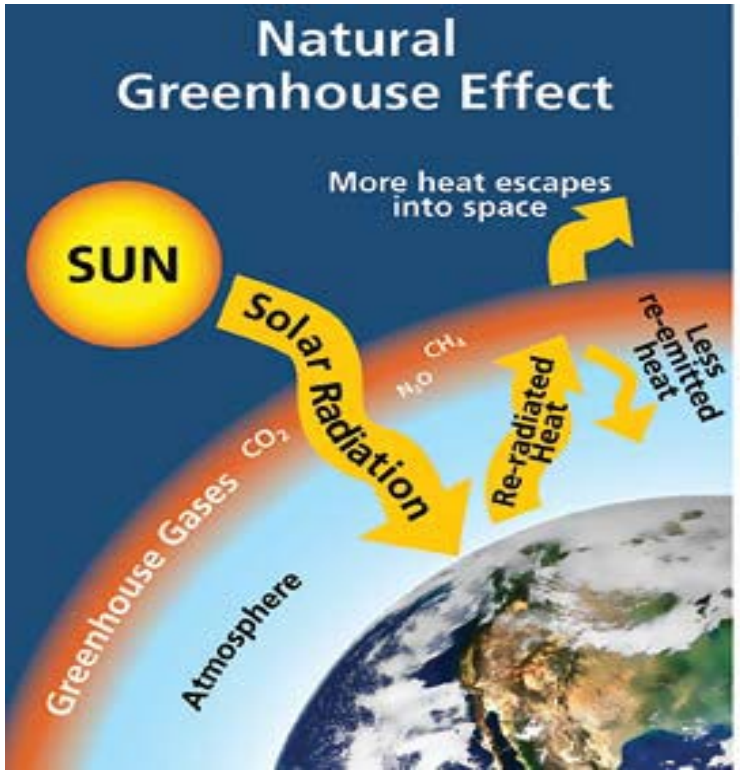
Sustainable livelihood framework (SLF)

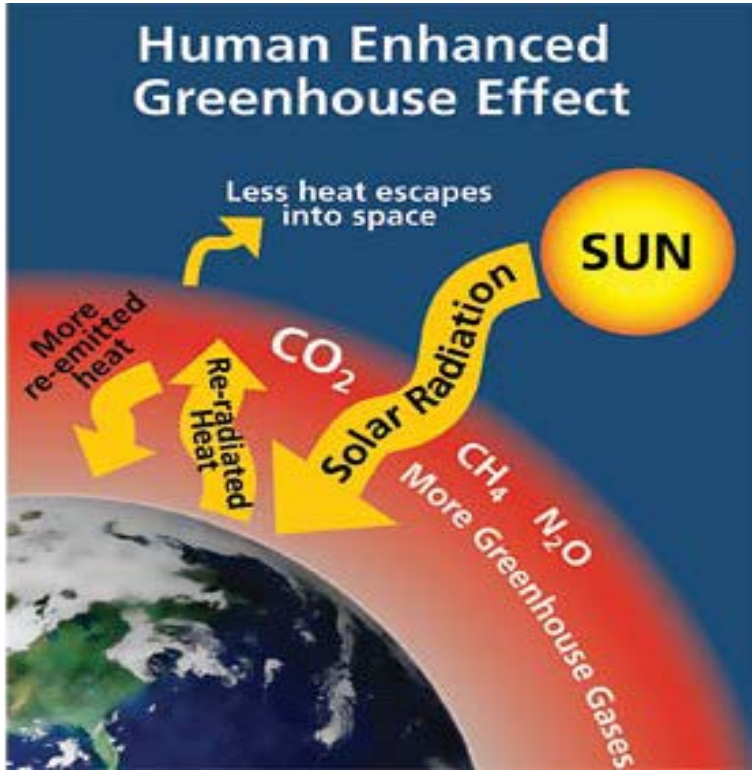


Source: DFID 1999

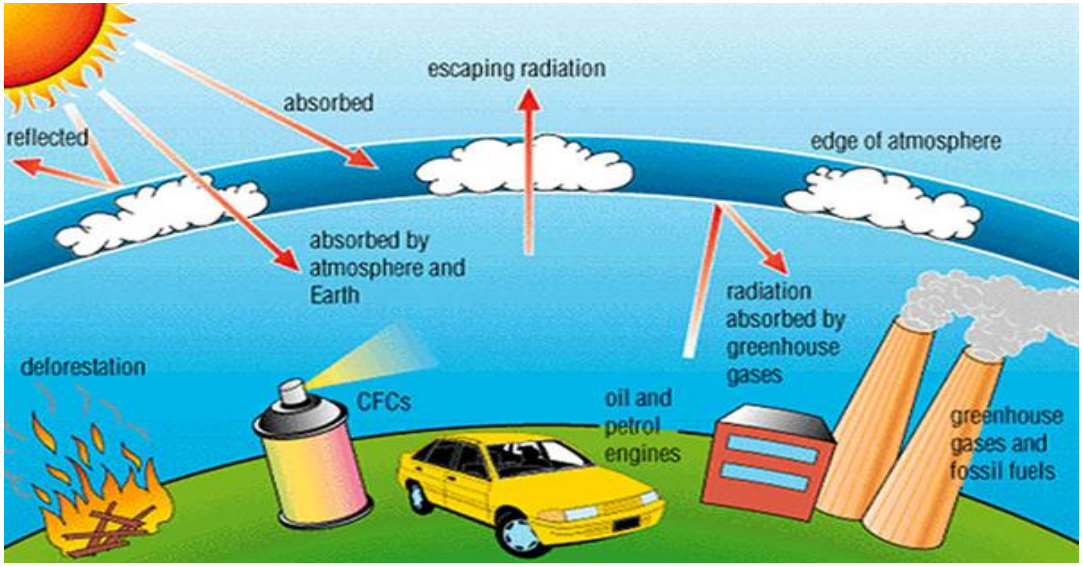
Introduction to climate change

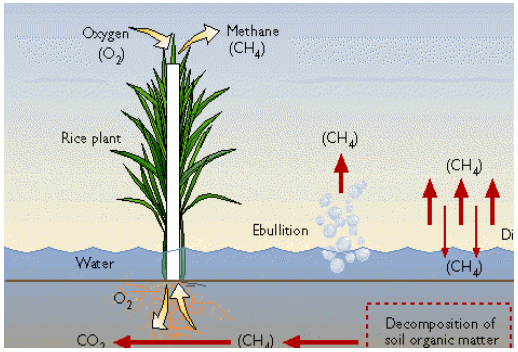
Climate change → change in climate pattern caused by green house gas effect that heat up the earth surface and atmosphere.



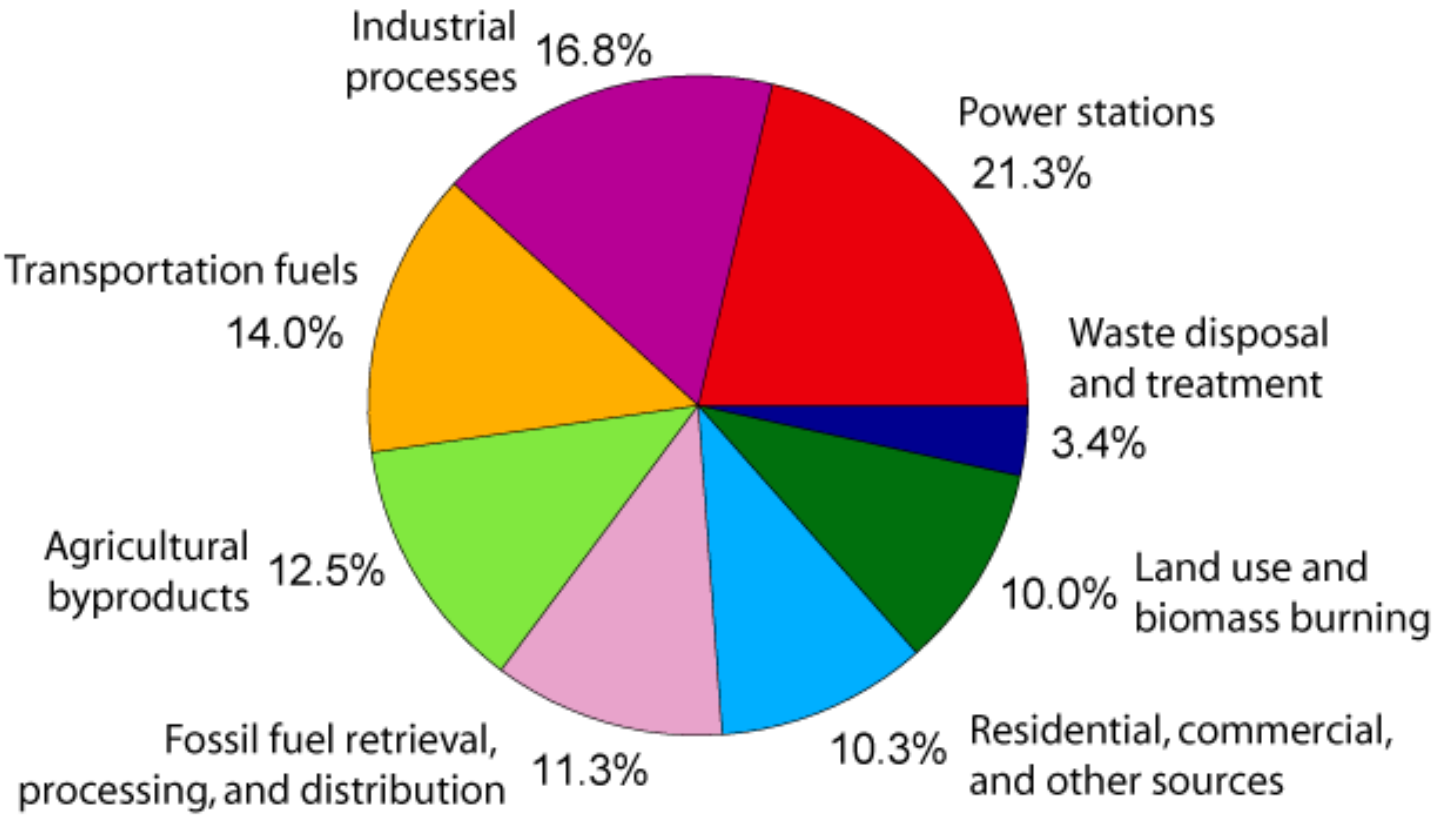


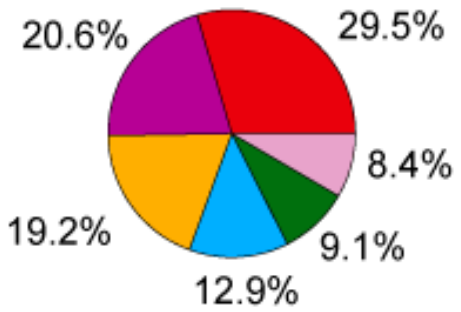
Emission of green house gases



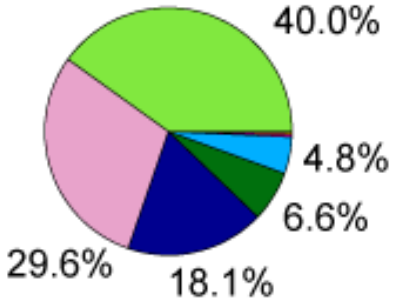


Annual Greenhouse Gas Emissions by Sector

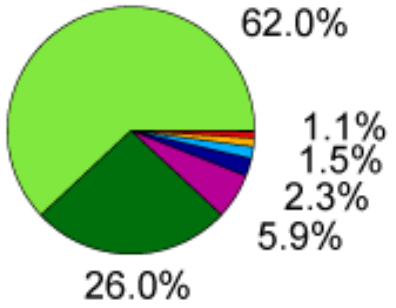




Carbon Dioxide
(72% of total)

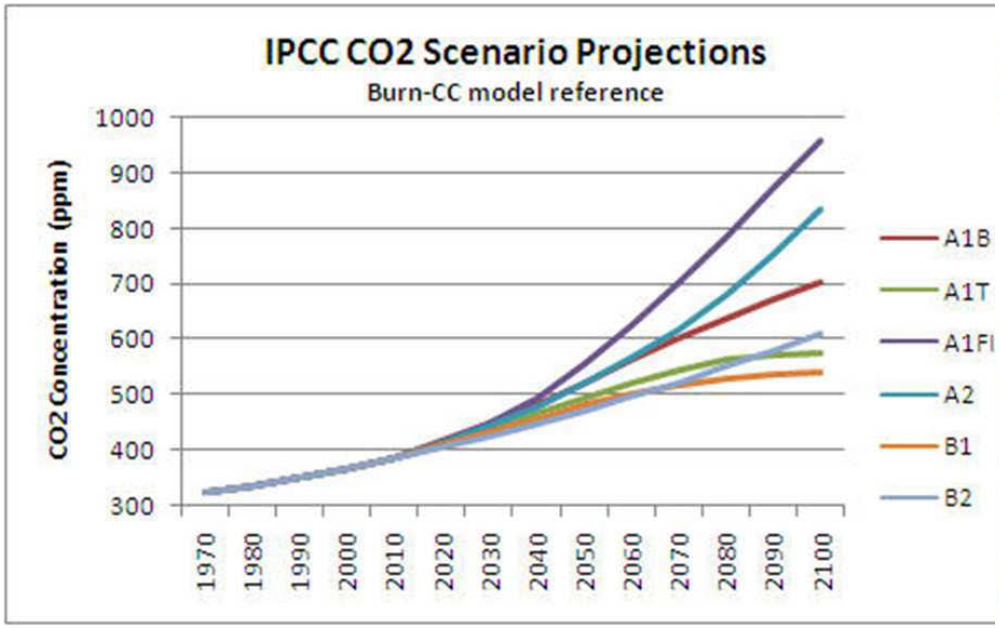


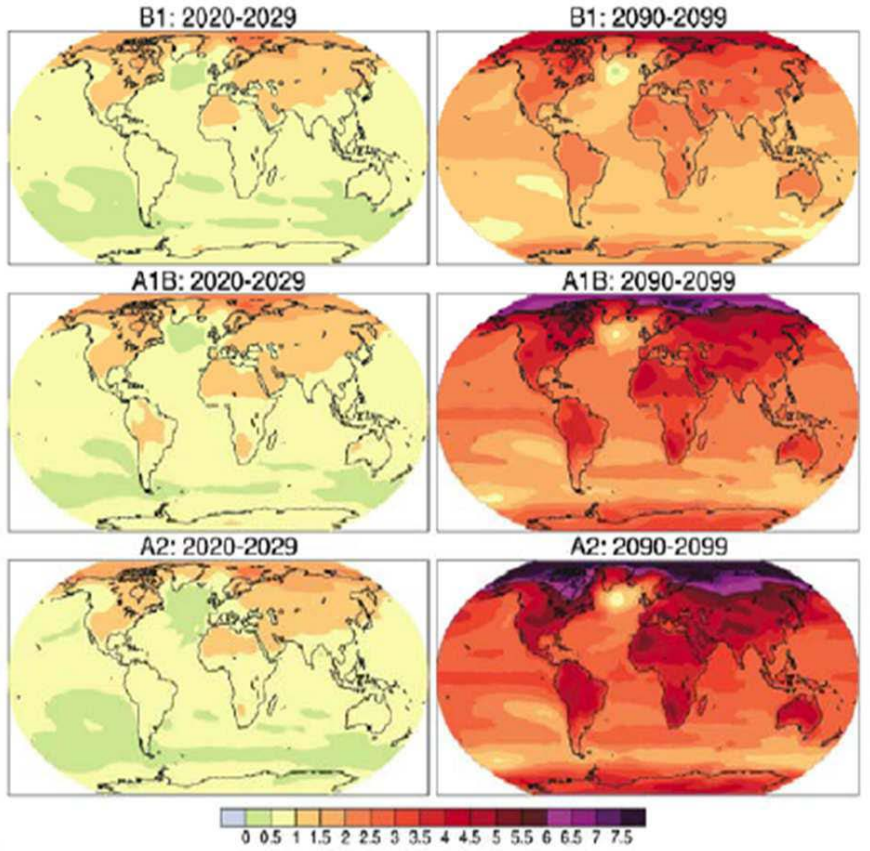
Methane
(18% of total)

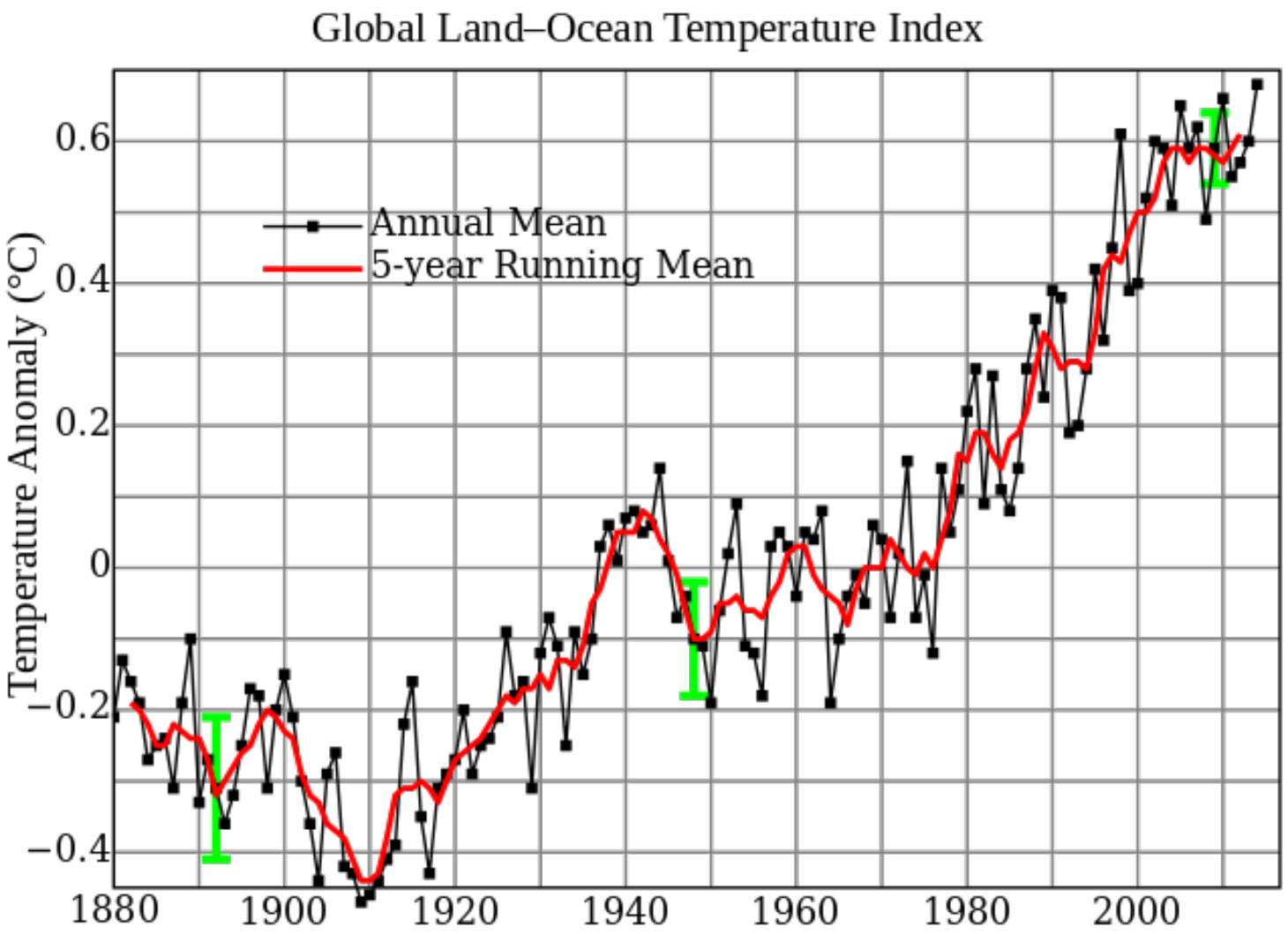


Nitrous Oxide
(9% of total)

As atmospheric GHGs continue to rise, the greenhouse effect will become more severe and global temperature will eventually increase

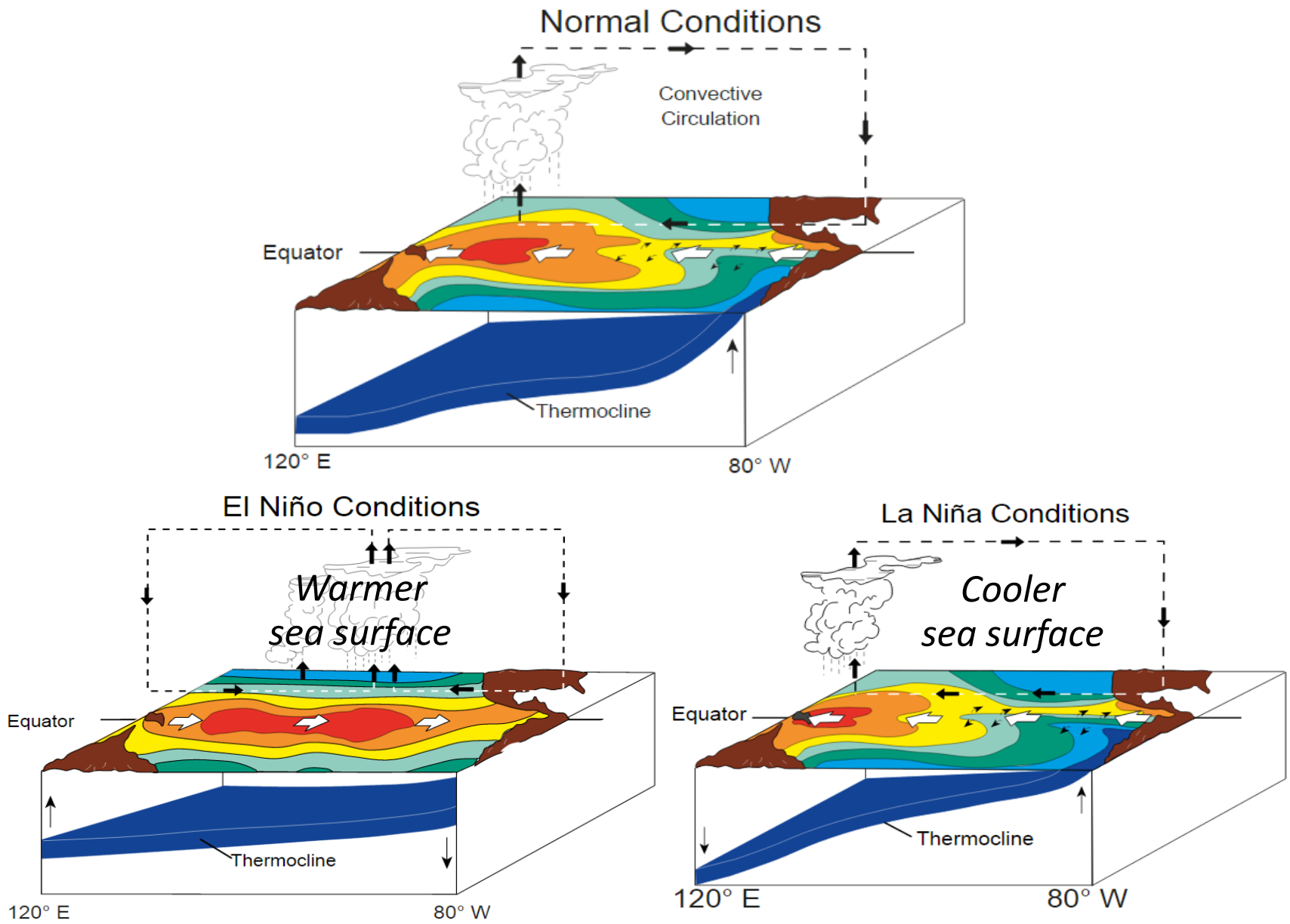


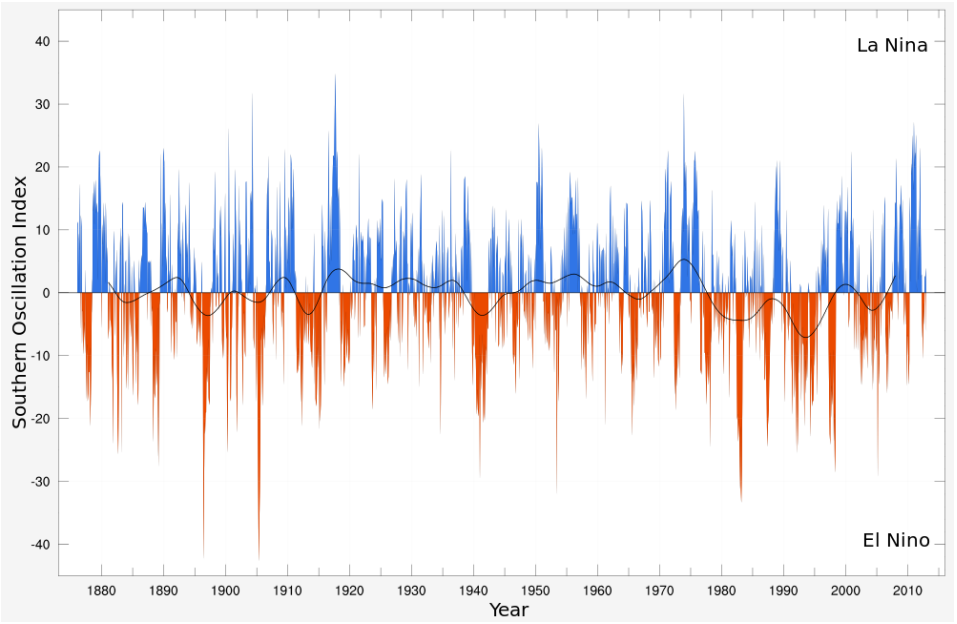




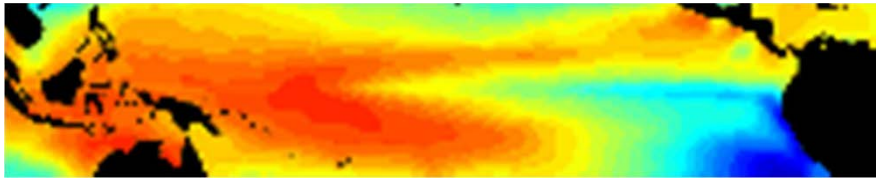
https://commons.wikimedia.org/wiki/File:Global_Temperature_Anomaly.svg

Influence of sea surface on weather and climate pattern

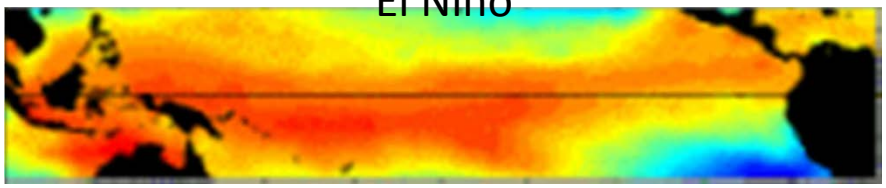




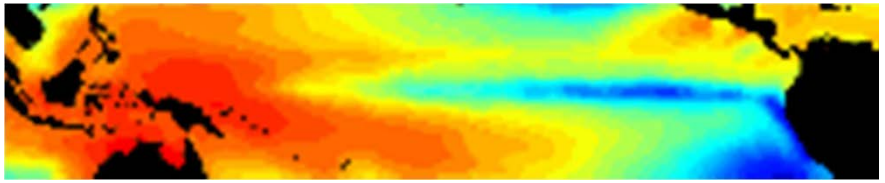
Normal



El Niño



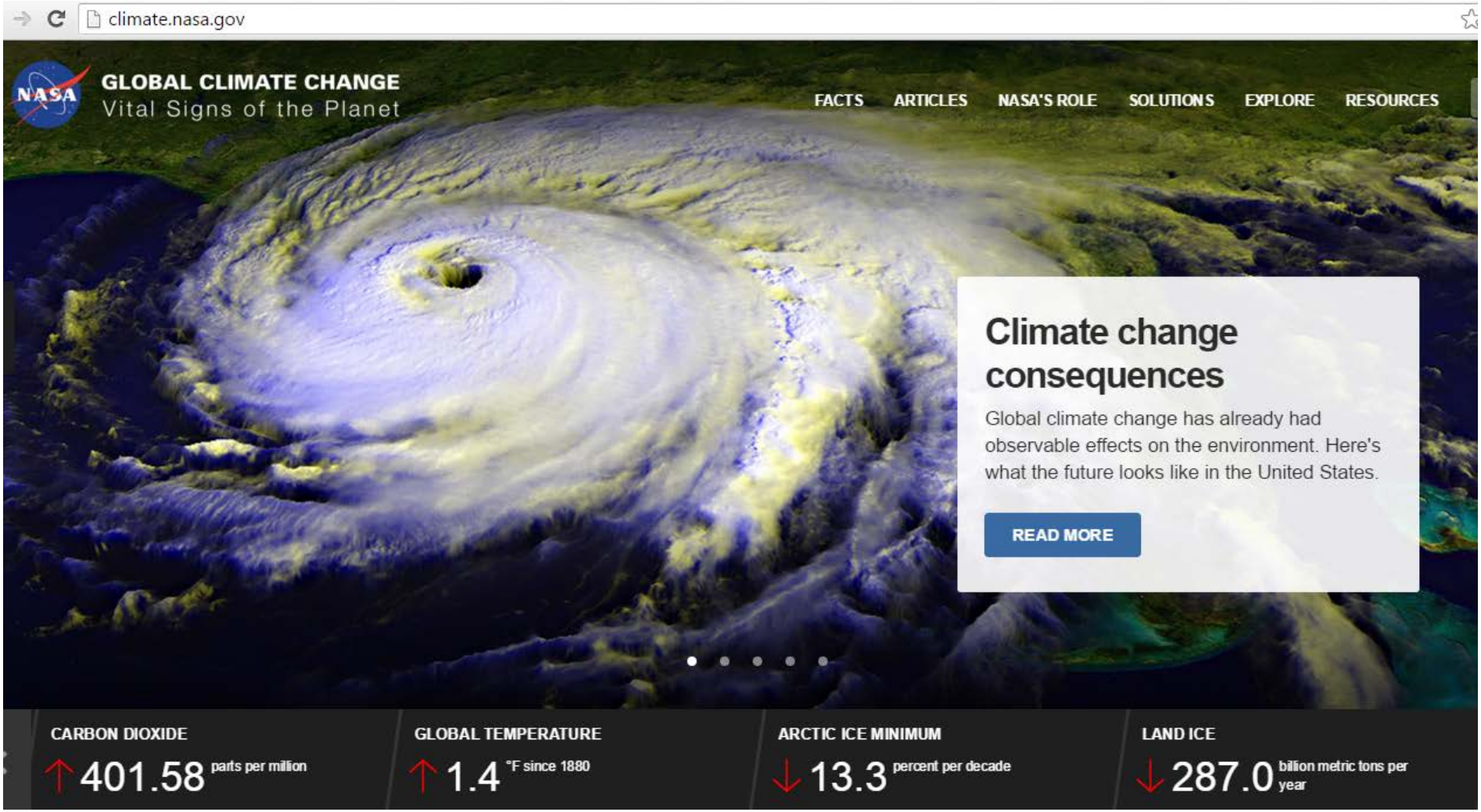
La Niña



The extreme oscillation causes extreme weather events (flood, drought), especially in the pacific rim countries that depend upon agriculture & fishing.

An El Niño associated with warm and very wet weather months in April–October along the coasts of northern Peru and Ecuador, causing major flooding.

La Niña causes a drop in sea surface temperatures over Southeast Asia and heavy rains over Malaysia, the Philippines, and Indonesia.


climate.nasa.gov
GLOBAL CLIMATE CHANGE
Vital Signs of the Planet
FACTS
ARTICLES
NASA'S ROLE
SOLUTIONS
EXPLORE
RESOURCES
Climate change consequences
Global climate change has already had observable effects on the environment. Here's what the future looks like in the United States.
READ MORE
CARBON DIOXIDE
↑ 401.58 parts per million
GLOBAL TEMPERATURE
↑ 1.4 °F since 1880
ARCTIC ICE MINIMUM
↓ 13.3 percent per decade
LAND ICE
↓ 287.0 billion metric tons per year

"Any change in climate over time, whether due to natural or as a result of human activity".

IPCC, 2009.

"Climate change has already impacted on innumerable communities, exposing them to increasing hazards and making them more vulnerable; and we can expect this to become more marked and for some communities catastrophic, in coming years".

Robert Chambers, 2009.

What would be the issues/concerns that relevant to climate change?

- Think about your hometown, community, and livelihood context.
- Think about climate change (from your point of view)
- Then express what kind of issues/concerns pop up in your mind.

Climate change: Effects

- Global temperature increase
- Glaciers shrink, lost of sea ice, Sea level rice
- Sea level rise
- More intense rainfall, more flood, more frequent storms
- Longer hot period, more drought & heat wave
- Change in agro-ecosystem, plant and animal niches shift
- Water availability decrease
- Crop production decrease/increase slightly
- Migrations and consequences
- Emerging diseases
- ……

Table 1 Summary of climate change impacts in Africa by 2009

Factor affected	Low-warming scenario	Mid-warming scenario	High-warming scenario
CO_2 atmospheric levels in parts per million (ppm)	600 ppm	850 ppm	1 550 ppm
Global temperature increase	1,8° C	2,8° C	4,0° C
Global sea level rise	0,18–0,38 m	0,21–0,48 m	0,26–0,59 m
Water	20–30% decrease in water availability in vulnerable areas	■ Precipitation in sub-tropical areas falls by up to 20% ■ Annual mean rainfall increases by 7% in East Africa ■ Precipitation decrease of 20% along Mediterranean coast	30–50% decline in water availability in Southern Africa
Agriculture and food	5–10% decline in African crop yields	550 million additional people at risk of hunger	Decrease of 15–35% in agricultural yields across continent
Extreme events	Up to 10 million more people affected by coastal flooding globally	■ Coastal flooding affects between 11 and 170 million additional people per year globally ■ 10–20% increase in cyclone activity in the southern Indian Ocean	■ 420 million people exposed to flooding globally ■ Tens of millions displaced by extreme weather events and climate processes

Source Adapted from Oli Brown et al (eds), ***Climate change and security in Africa***, Nordic African Ministers of Foreign Affairs Forum, 2009, http://www.iisd.org/pdf/2009/climate_change_security_africa.pdf (accessed August 2010)

SOUTHEAST ASIA START REGIONAL CENTER

Climate change: terminology

"Climate" is weather conditions in a particular place or region which is characterized over period of time, i.e. 30-year period

Climate ≠ Weather ≠ Extreme weather event

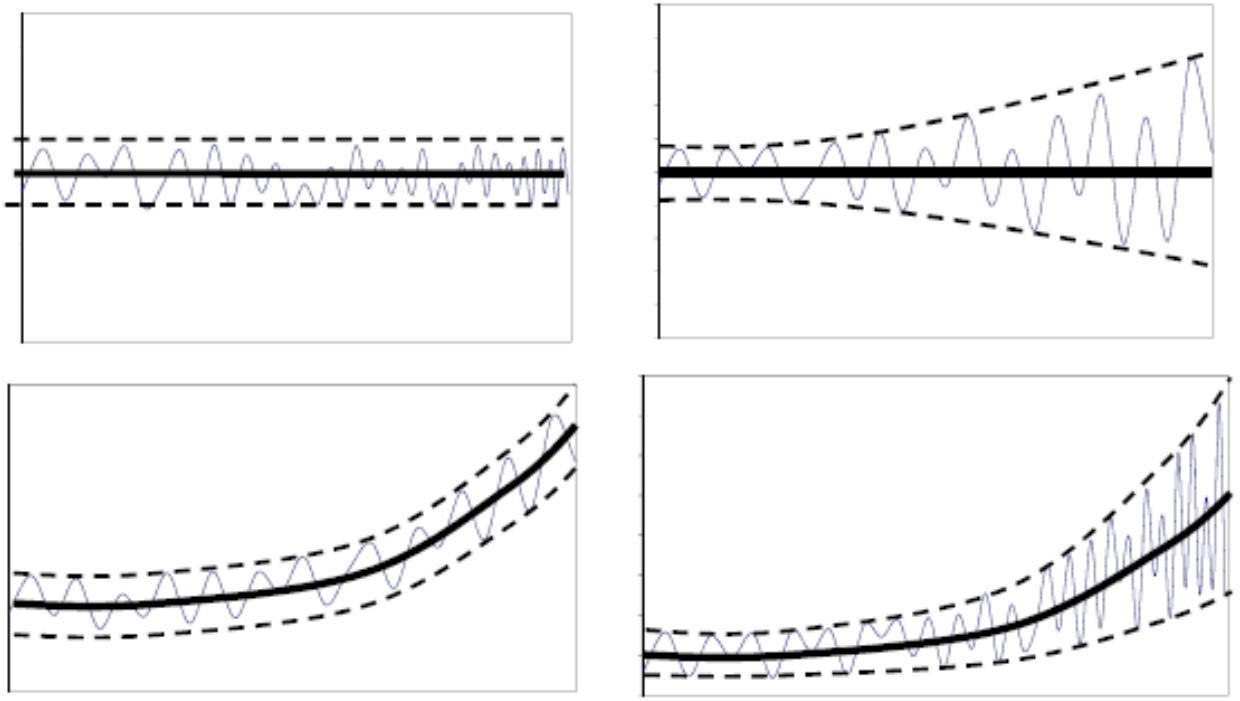
Climate change ≠ Climate variability

Climate threat ≠ Climate impact ≠ Climate risk ≠ Vulnerability

Be careful ! In many cases, these terms have been used in mixed and confusing meaning – often out of the context

SOUTHEAST ASIA START REGIONAL CENTER

- Over emphasize on the temperature increasing – global mean temperature
- There are many ways to look at "change"



Climate changes

Change by mean over long period

- Global mean temp. change
- Decrease or increase in total annual rainfall

Variability

- out-season rain, early/late rain
- long dry spell

Extreme event

- more frequent cyclone
- heavy rainfall (high intensity)

Consequences

- Flood
- Drought
- Temperature increases
- sea level rising
- Cyclone, storm

Adverse effects/impact

- Crop damage
- low crop yield, crop failure
- pest/disease outbreak
- disasters

SOUTHEAST ASIA START REGIONAL CENTER

Multiple dimensions of climate change

- Climate change is not uniform across space and time – do NOT overlook multiple dimensions of climate change:
  - Magnitude – change in range of weather pattern
  - Frequency – change in return cycle of extreme weather event
  - Distribution of change over space and time
    - Geographical – e.g. area of hot area / distribution of weather parameters over geographical area
    - Temporal – e.g. length of season, onset – end of season, distribution of weather parameters over time

Different areas / systems / sectors have different concern on future climate change

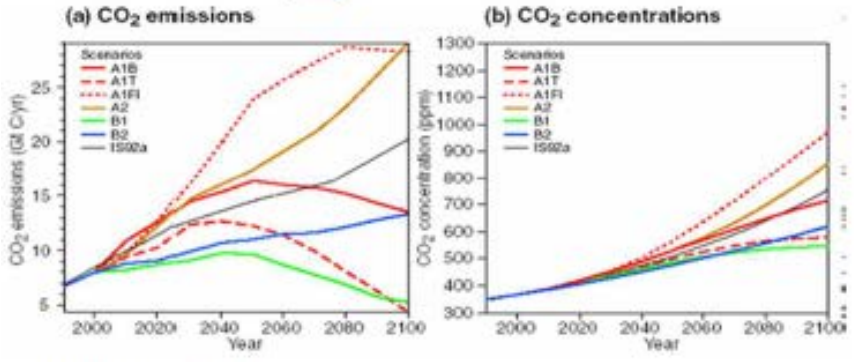
SOUTHEAST ASIA START REGIONAL CENTER

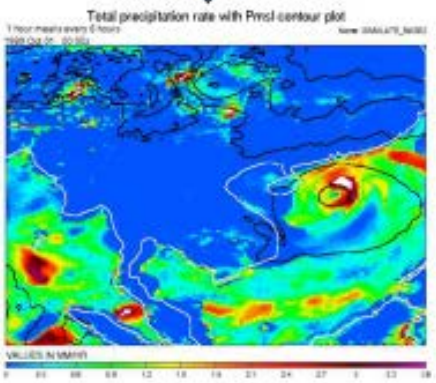
Future climate scenario

Climate model - simulation

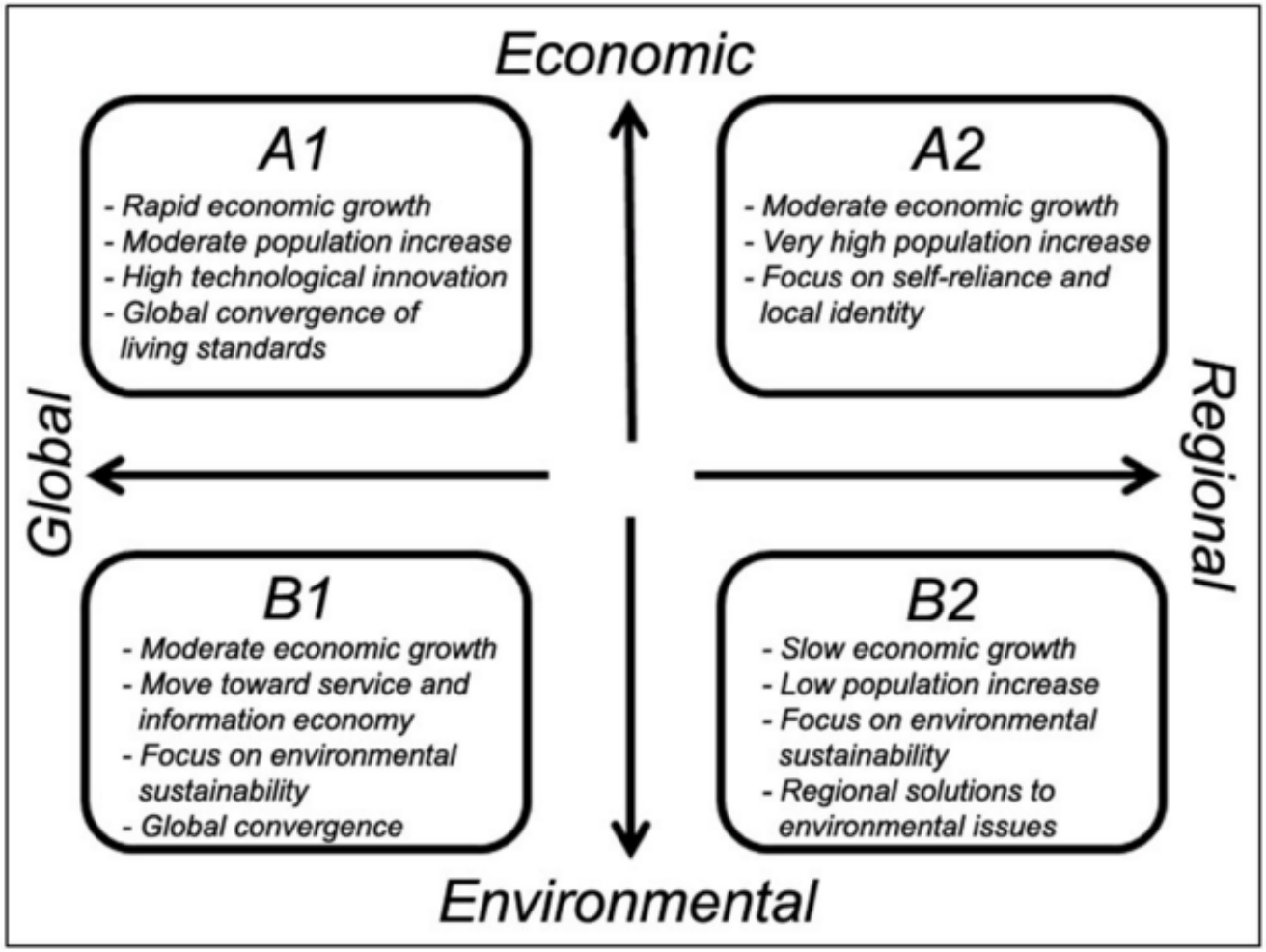
Future GHG Scenario

Future climate Scenario





IPCC SRES *(Special Report on Emission Scenarios)*



IPCC SRES storylines are oriented along two axes: 1) ecomomic vs. environmental priorities, and 2)global vs. regional development. The four scenarios each describe divergent, yet plausible futures.

What should/could we do?

Mitigation → reduce green house gas emission

- Increase carbon stock
- Reduce fuel energy use

Adaptation → Adjust livelihood assets, strategies, policy institutional arrangement & processes

- ..

Climate change and context specificity (risk profile)

"What is the threat/pressure?

When?

How much/What magnitude/How frequent?

Where?

What kind of impact?

Impact to whom?

Why?

……."

Understanding climate change risk and vulnerability

Exposure

"Climate change has already impacted on innumerable communities, exposing them to increasing hazards and making them more vulnerable; and we can expect this to become more marked and for some communities catastrophic, in coming years".

- Primarily a function of geography.
- e.g. Coastal communities will have higher exposure to sea level rise and cyclones while communities in semi-arid areas may be most exposed to drought.

Sensitivity

"Sensitivity is the degree to which the community is affected by climatic stresses".

- A community dependent on rainfed agriculture is much more sensitive than one where the main livelihood strategy is labor in a mining facility.
- A fruit orchard farm in flood-prone area is less sensitive to flash flood than the vegetable-based farm.
- A poor farmer is very sensitive to one single crop failure than those farmers who are richer.

Climate pressure & Exposure

Low sensitive

Low/no risk

Sensitive

High risk

Coping capacity & Vulnerability

Rich, access to good health care

Not vulnerable

High risk

sensitive

High risk

Poor

Vulnerable

Coping capacity & Vulnerability

sensitive

High risk

High risk

Rich

Poor

Coping capacity

Not Vulnerable

support

Vulnerable

Not Vulnerable

Impact / Risk

- Adverse effects of climate change.
- Potential or likelihood or trend to face with the adverse effects at the present or in the future.

Impact (Risk) = Exposure x Sensitivity

Flood along river side

Lower S I

Higher S I

Facing the same E

Adaptation (to climate change)

"Adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities."

Adaptive Capacity

"The ability of a system to adjust to climate change (including climate variability and extremes) to moderate potential damages, to take advantage of opportunities, or to cope with the consequences."

Human	Knowledge of climate risks, conservation agriculture skills, good health to enable labour
Social	Women's savings and loans groups, farmer-based organizations
Physical	Irrigation infrastructure, seed and grain storage facilities
Natural	Reliable water source, productive land
Financial	Micro-insurance, diversified income sources

Vulnerability

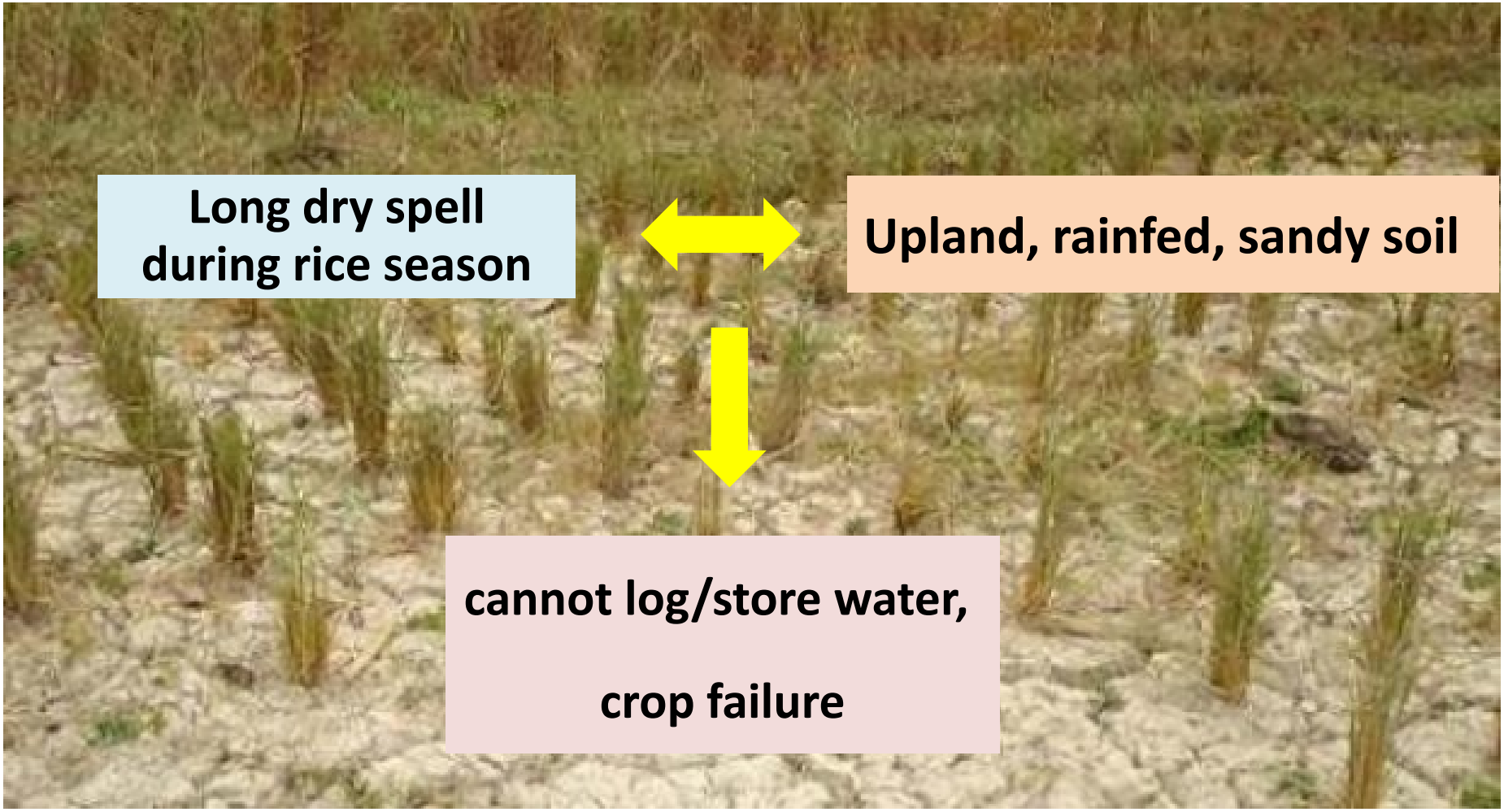
"The degree to which a system is susceptible to, or unable to cope with, adverse effects/impact of climate change, including climate variability and extremes. Vulnerability is a function of the character, magnitude, and rate of climate variation to which a system is exposed, its sensitivity, and its adaptive capacity."

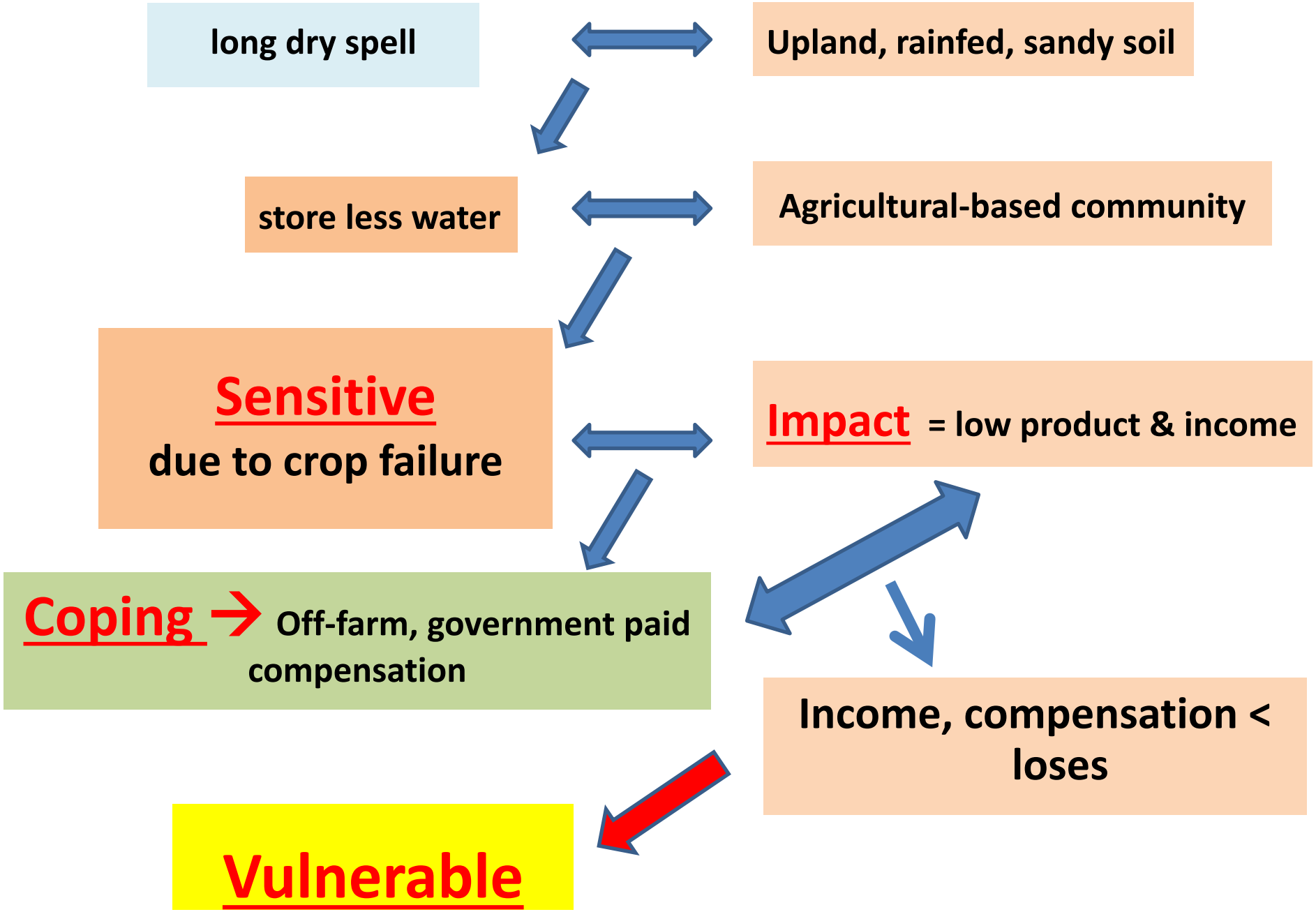
"Vulnerability is a function of the character, magnitude, and rate of climate variation to which a system is exposed, its sensitivity, and its adaptive capacity."

(IPCC, 2007)

$$\text{Vulnerability} = \frac{\text{Impact or Risk}}{\text{Coping or adaptation capacity}}$$

Exposure


Long dry spell during rice season
Upland, rainfed, sandy soil
cannot log/store water,
crop failure


long dry spell
Upland, rainfed, sandy soil
store less water
Agricultural-based community
Sensitive
due to crop failure
Impact = low product & income
Coping → Off-farm, government paid compensation
Income, compensation < loses
Vulnerable

Adaptation to cope with future (drought) risk

long dry spell

- Upland, rainfed, sandy soil
- Agricultural-based community

Vulnerable in the past

- Develop water storage in farm
- Change to other crops e.g. sugarcane, cassava

Reduce sensitivity, risk and vulnerability to drought, long dry spell

Vulnerability =

Impact or Risk

Coping / adaptation capacity

Coping & Adaptation

Coping

- Short-term and immediate
- Oriented towards survival
- Not continuous
- Motivated by crisis, reactive
- Often degrades resource base
- Prompted by a lack of alternatives

Adaptation

- Oriented towards longer term livelihoods security
- A continuous process
- Results are sustained
- Uses resources efficiently and sustainably
- Involves planning
- Combines old and new strategies and knowledge
- Focused on finding alternatives

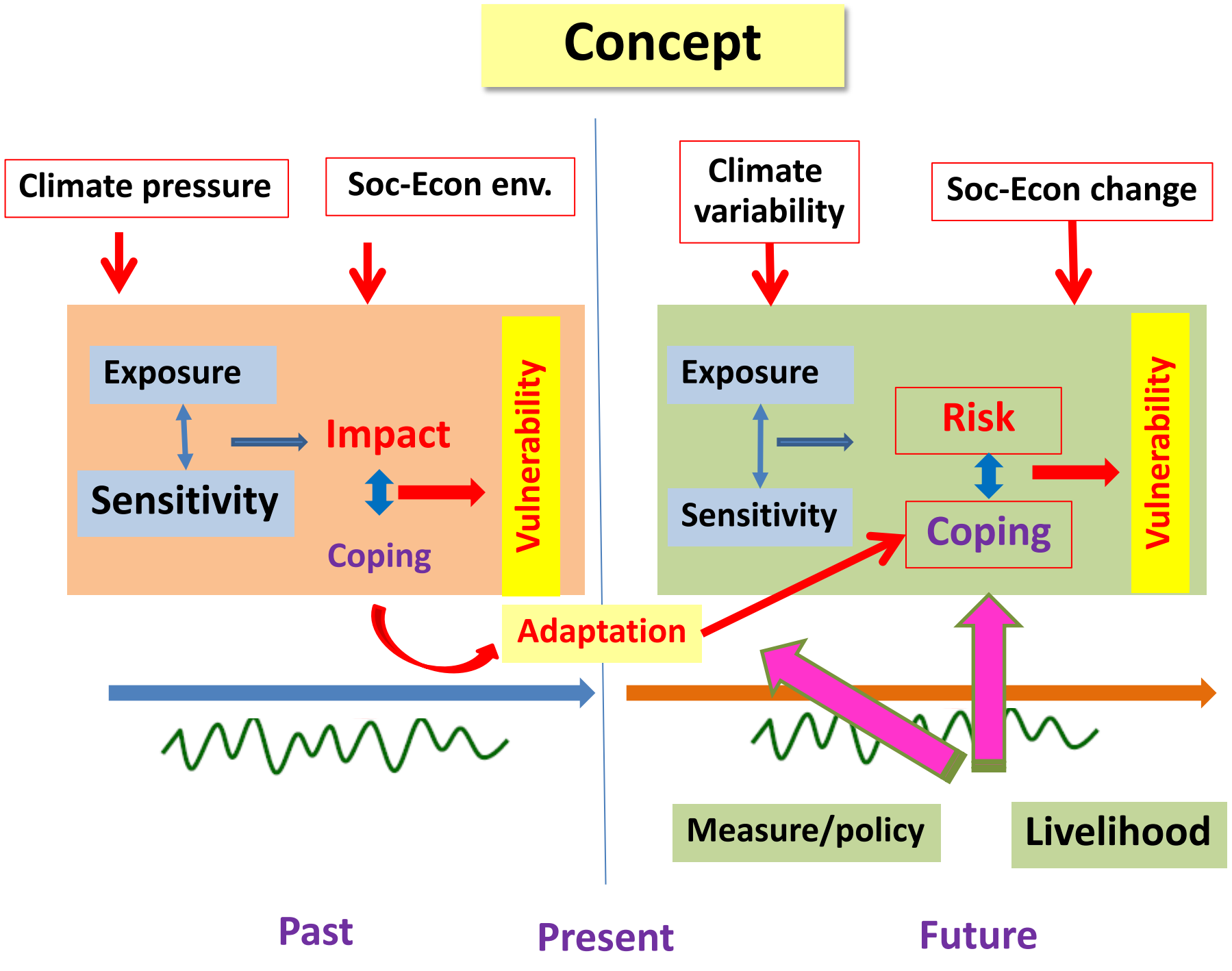
Enabling (enhance) coping & adaptive capacity

Social & Policy | Human | Natural Resources | Economic | Infrastructure & Services

- Information availability and accessibility
- Good forecasting and warning system
- Human capital (health, education, knowledge)
- Social capital (social network, fostering system, kinship)
- Infrastructure (irrigation, road, reservoir, health service)
- Natural resources (forest, land, water, biodiversity)
- Economic capital (sources of income, funds, micro credit)
- Inter-sectoral efforts integration
- Policy and measure (crop failure insurance, disaster fund)

Exercise:

- Organize working group (4 groups)
- Select a agricultural-based livelihood system.
- Explore the system context and risk profile.
- Investigate : threat/pressure, exposure, impact/risk, coping capacity and vulnerability to climate change.


Concept
Climate pressure
Soc-Econ env.
Climate variability
Soc-Econ change
Exposure
Sensitivity
Impact
Coping
Vulnerability
Exposure
Sensitivity
Risk
Coping
Vulnerability
Adaptation
Measure/policy
Livelihood
Past
Present
Future

Community-based Risk & Vulnerability Assessment

Sustainable livelihood

A livelihood is sustainable which can cope with and recover from stress and shocks, maintain or enhance its capabilities and assets, and provide sustainable livelihood opportunities for the next generation"

(Chamber and Conway, 1991)

‘A livelihood is sustainable when it can cope with and recover from stress and shocks and maintain or enhance its capabilities and assets both now and in the future’.

(Carney, 1998)

‘The capacity of a system to experience shocks while retaining essentially the same function, structure, feedbacks, and therefore identity’.

(Walker et al.,2006)

Resilience

‘The capacity of a system to absorb disturbance and reorganize while undergoing change’

(The Resilience Alliance, 2012)

‘The capacity of a system, community or society potentially exposed to hazards to adapt by resisting or changing in order to reach and maintain an acceptable level of functioning and structure’.

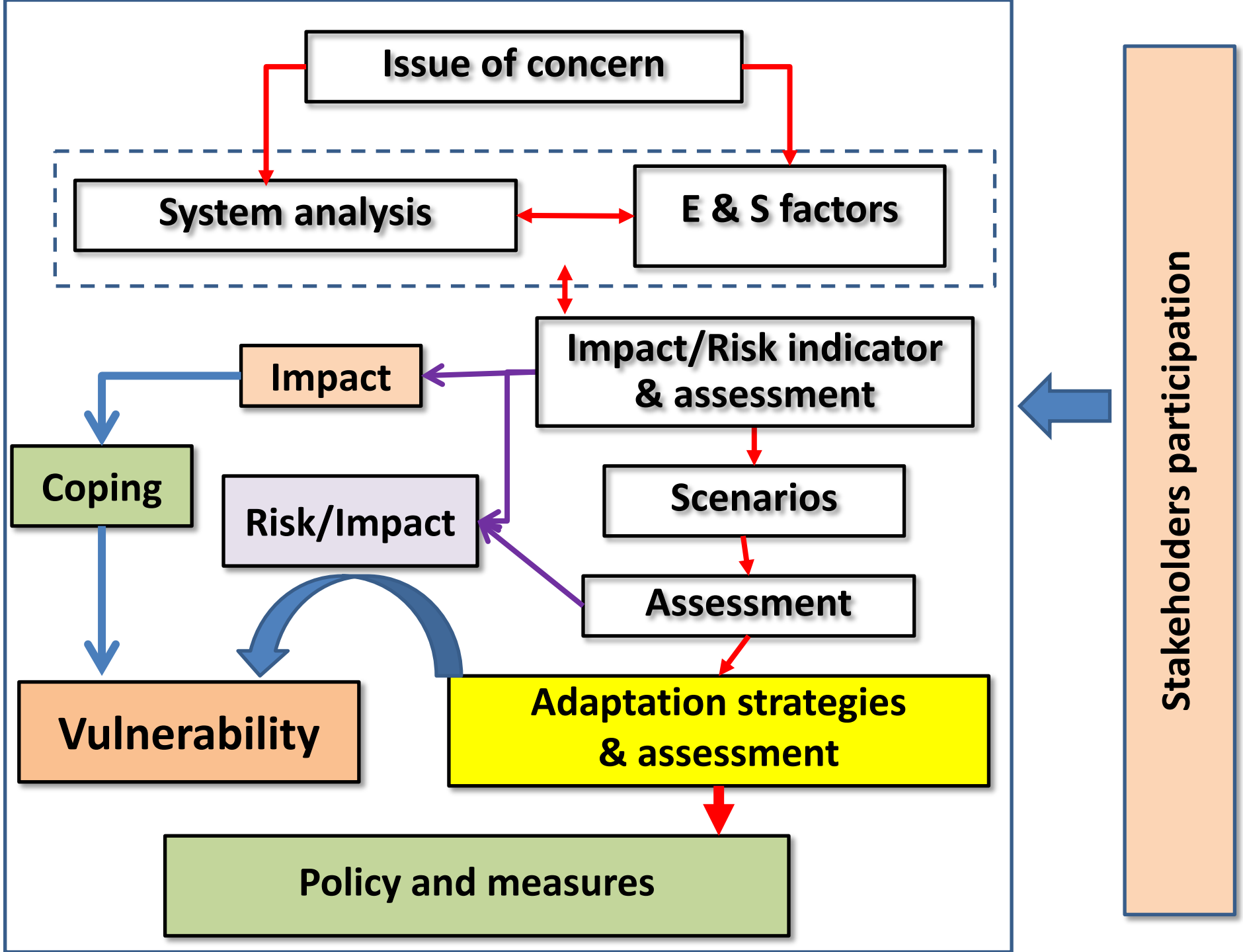
(United Nations International Strategy for Disaster Reduction, 2005)

‘The ability of a social or ecological system to absorb disturbances while retaining the same basic structure and ways of functioning, the capacity for self-organization, and the capacity to adapt to stress and change’.

(IPCC, 2007)

Resilience

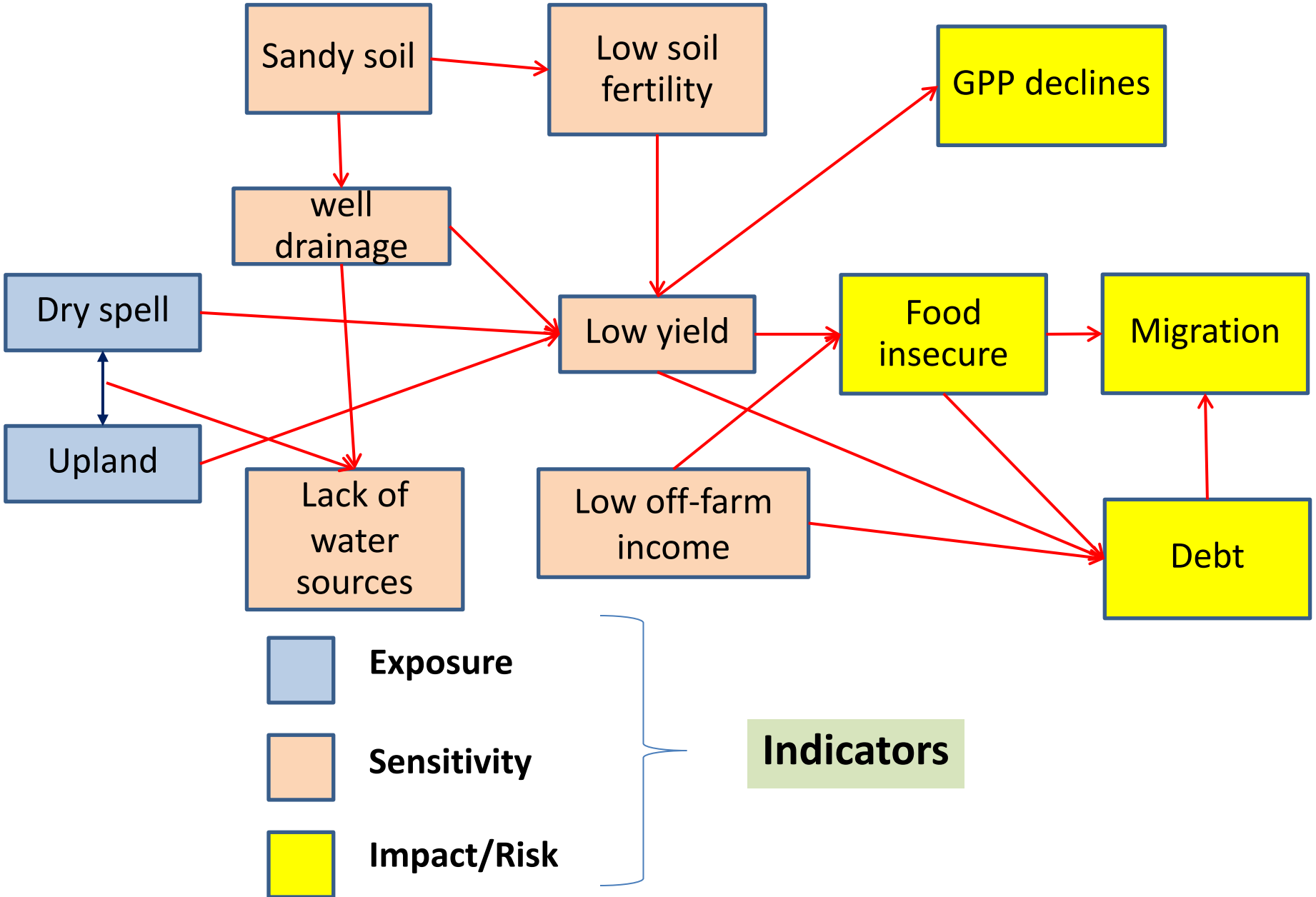
- Focus on ‘systems’ of a social or ecological nature, with no evident attention to the individual or the household.
- Resilience is thus seen to be a collective property – of the community rather than the individual.


Issue of concern
System analysis
E & S factors
Impact/Risk indicator & assessment
Impact
Coping
Risk/Impact
Scenarios
Assessment
Vulnerability
Adaptation strategies & assessment
Policy and measures
Stakeholders participation

System analysis & Issue of concern

- System approach, things are interconnected.
- Who? Doing what? where? when? how? how much/often? that relevant to the issue.
- What are the key climate factors and/or pressures? How have these been changing?
- How have other factors been related /involving to the changes?
- How have things (system) responded to the changes?
- Who have been adversely affected, how?
- How to explain, measure and assess these effects/impact? What would be the appropriate indicators?

System contextualization



Factors and indicators: examples

Factors	Indicators
Climate threats/pressures	
Temperature increase	• Average monthly temperature • Number of 'hot day'
Flood	• amount of rainfall / 24 hours. • Flood area • Flood depth and duration
Drought	• yield, total product • production loss or damaged
Rise of sea level	• Change of sea level compare to the reference level

Factors and indicators: examples

Factors	Indicators
Exposure (to flood)	
Geographical location and characteristics	• Distance to the stream/river • Elevation
Exposure (to sea level rise)	
Geographical location and characteristics	• Distance to the sea shore • elevation

Factors and indicators: examples

Factors	Indicators
Exposure (to flood)	
Geographical location and characteristics	• Distance to the stream/river • Elevation
Exposure (to sea level rise)	
Geographical location and characteristics	• Distance to the sea shore • elevation
Exposure (to drought)	
Geographical location and characteristics	• Irrigated/rainfed • lowland/highland

Factors and indicators: examples

Factors	Indicators
Sensitivity (to flood)	
Cropping system	• crop type • crop diversity
Housing	• permanent? • house style (high story or not)
Household capital	• Economic status (rich, poor)
Sensitivity (to drought)	
Cropping system	• crop type • crop diversity
Household capital	• Economic status (rich, poor)

Factors and indicators: examples

Factors	Indicators
Impact/risk (to flood)	
Agricultural product	• yield or quantity of product • yield lost • quality of product
Housing	• damage cost
Health	• cases of sickness relevant to the flood
Impact/risk (to drought)	
Agricultural product	• yield or quantity of product • yield lost • quality of product
Water for domestic use	• period of water deficit (months) • number of households face with water deficit • quality of water

Factors and indicators: examples

Factors	Indicators
Coping/adaptation capacity (to flood)	
Household capital	• economic status (poor, rich) • alternative source of income
Health	• access to health services
Supports	• government support (compensation, seed, etc) • Other supports
Coping/adaptation capacity (to drought)	
Household capital	• economic status (poor, rich) • alternative source of income
Supports	• government support (compensation, seed, etc) • Other supports
Social capital	• social strength (sharing, helping each other)

Indicator, criterion, level

- Scientific-based knowledge and tools
- Explicit data, local/indigenous knowledge, truth
- That well represent/reflect reality, quantified, well understood, and easy to communicate with others.

"If the dust-smoke particle is more than 120 microgram → red alert situation (needs scientific probe/detector)

"If there is a lot of dust-smoke at the level that unable us to see Mt. Suthep, means we are under severe situation

Criterion

Indicators	Criterion	Level
• Flooding	• Irregular • Once every 5 yrs •2-3 yrs successively	• low • medium • high
• Rainfall	• < 100 mm/24hrs • >= 200 mm/24hrs	• low •severe / very high
• Crop yield	• decreased 10-25% • decreased > 25%	• medium • high
• Infection rate	• >= 10% • >= 25%	• low •very high

Exercise:

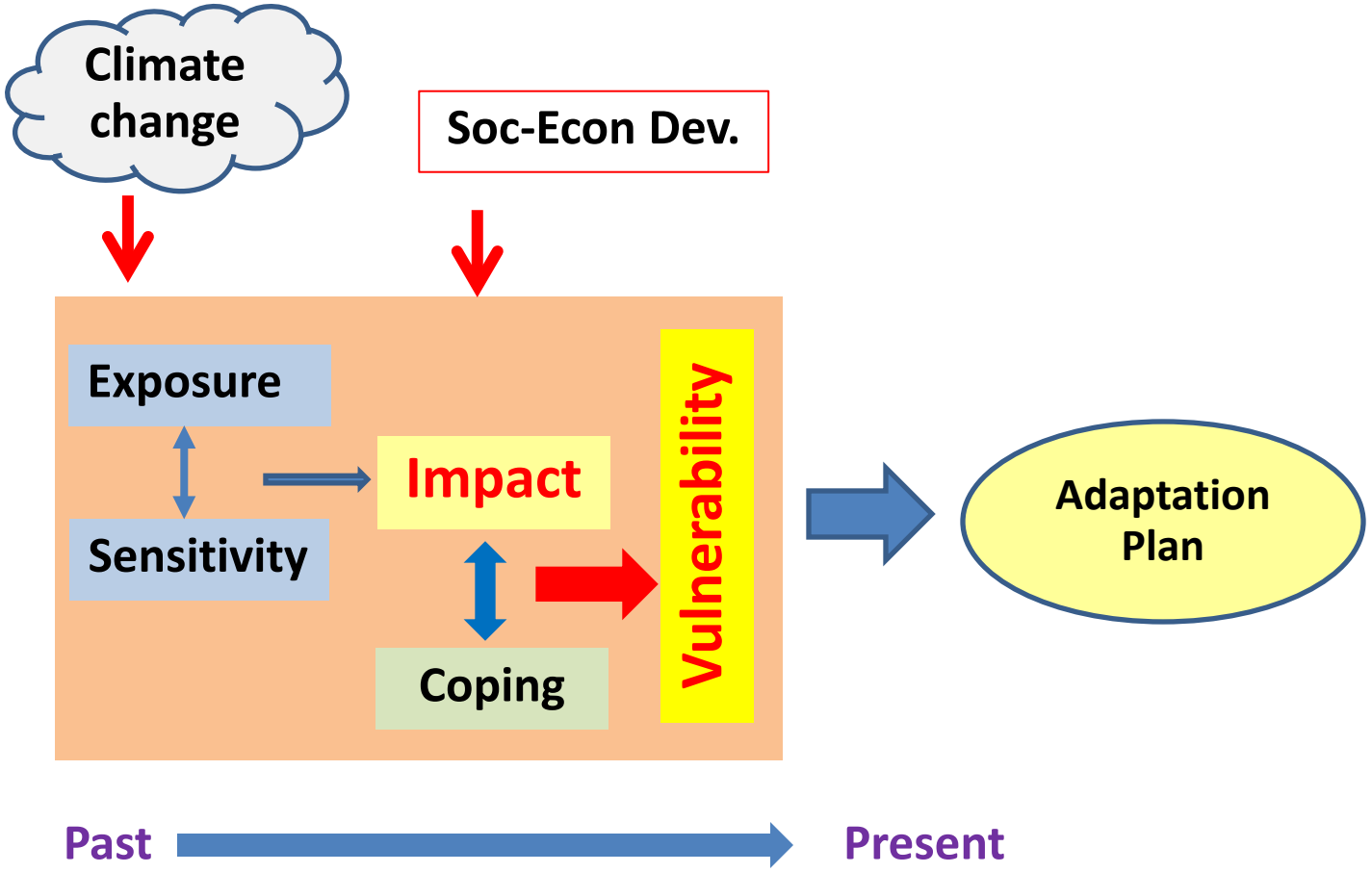
- Continuation of the working group (4 groups)
- Identify factors, indicator (& criterion if possible) of:
  - Exposure
  - Sensitivity
  - Impact/risk
- Identify the knowledge require for better understanding the livelihood system and situation.

Paradigm shift in climate change adaptation planning

IPCC 2007 → *alerts* → *Government plan*

- Forecast future climate change.
- Analyze/assess climate change impact on sector basis;
- For each relevant policy planners:
  - Future climate change projection
  - Analysis impact of climate change on system/sector,
  - analysis risk and vulnerability of system/sector to climate change.
  - Then formulate adaptation planning.

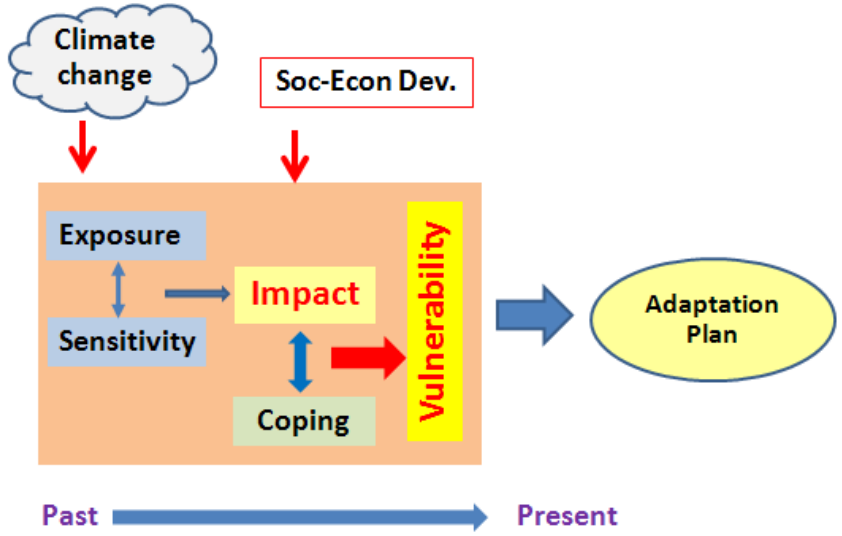
conventional approach

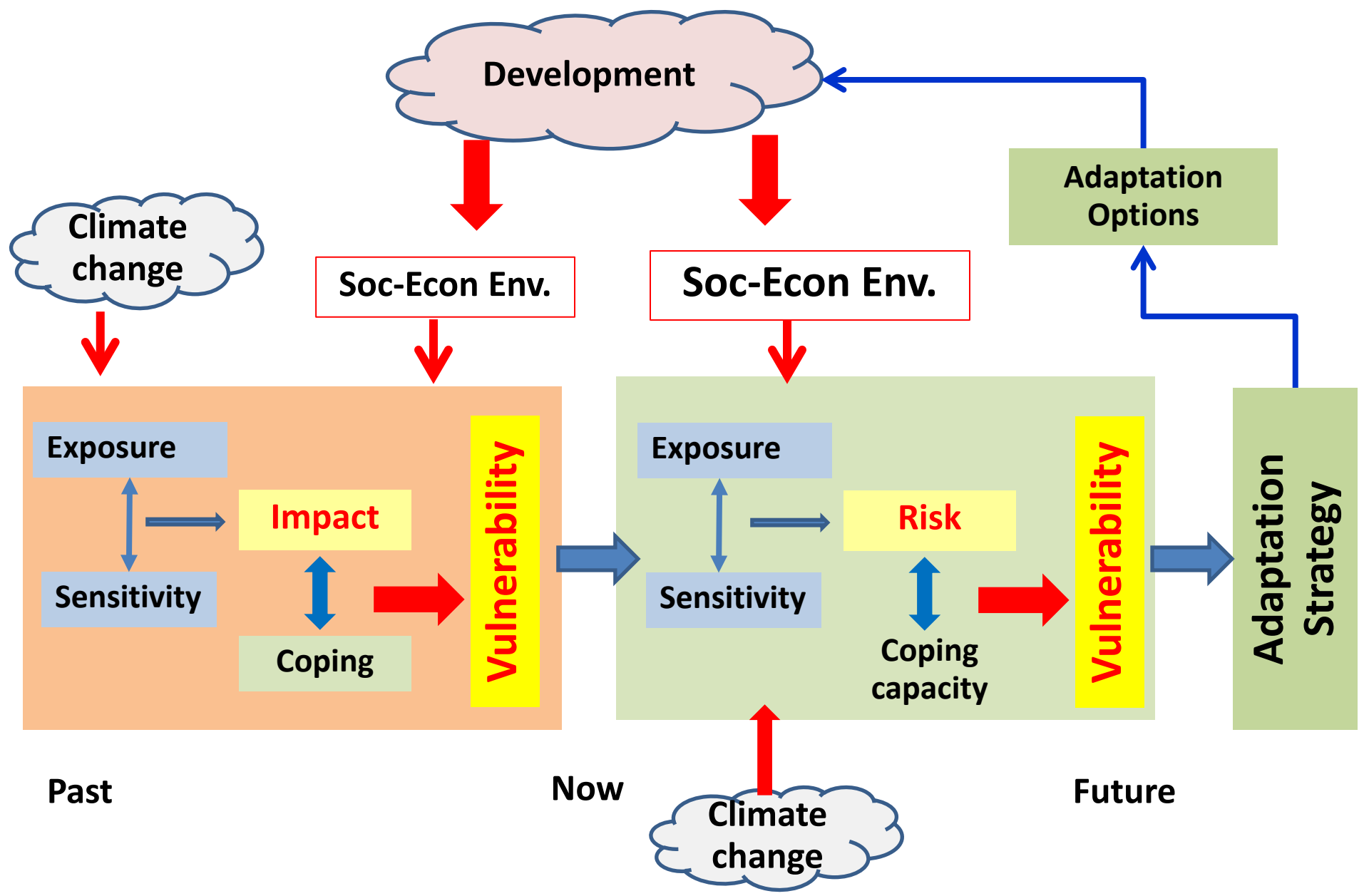

Climate change
Soc-Econ Dev.
Exposure
Sensitivity
Impact
Coping
Vulnerability
Adaptation Plan
Past
Present

Paradigm shift in climate change adaptation planning

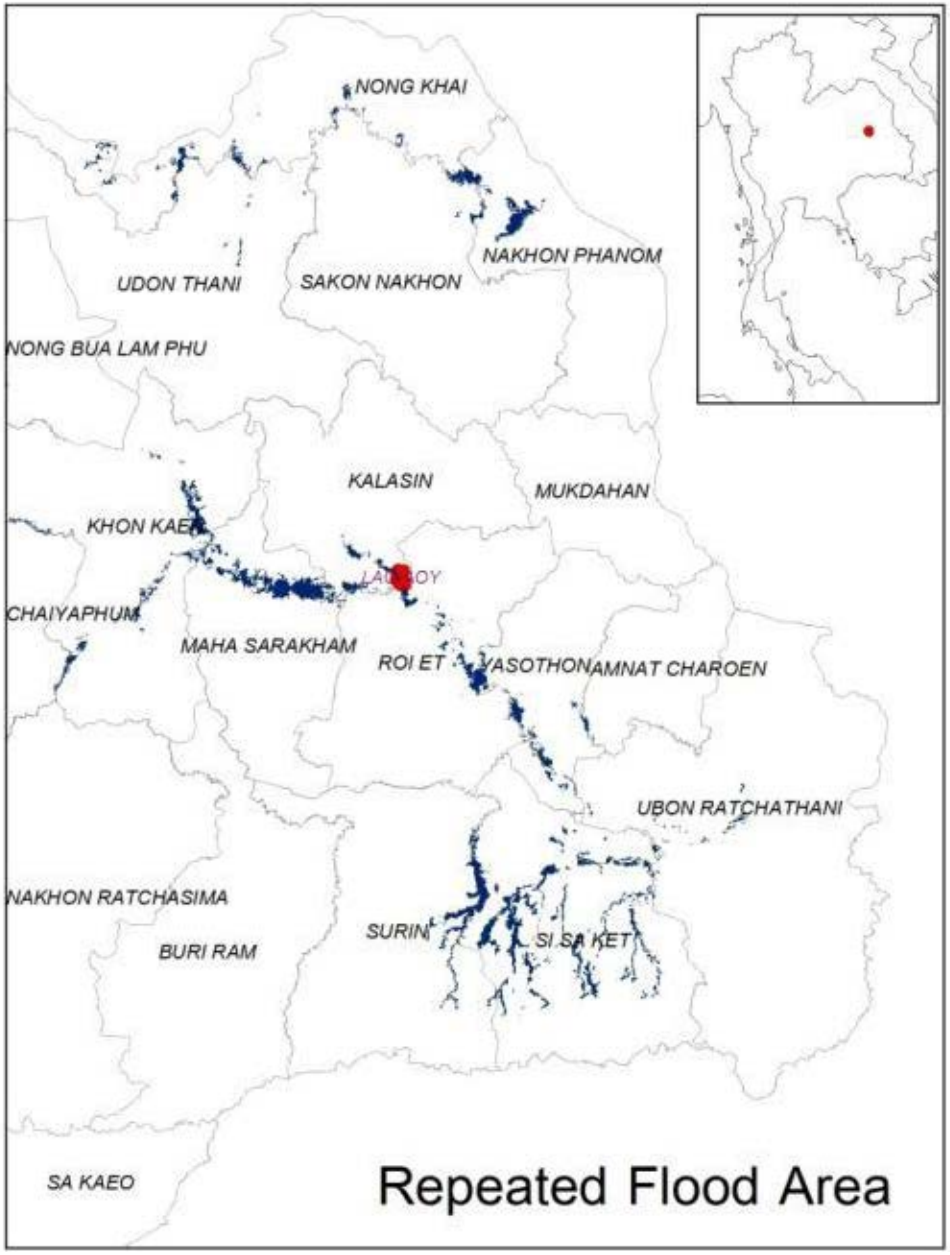
What is going wrong?

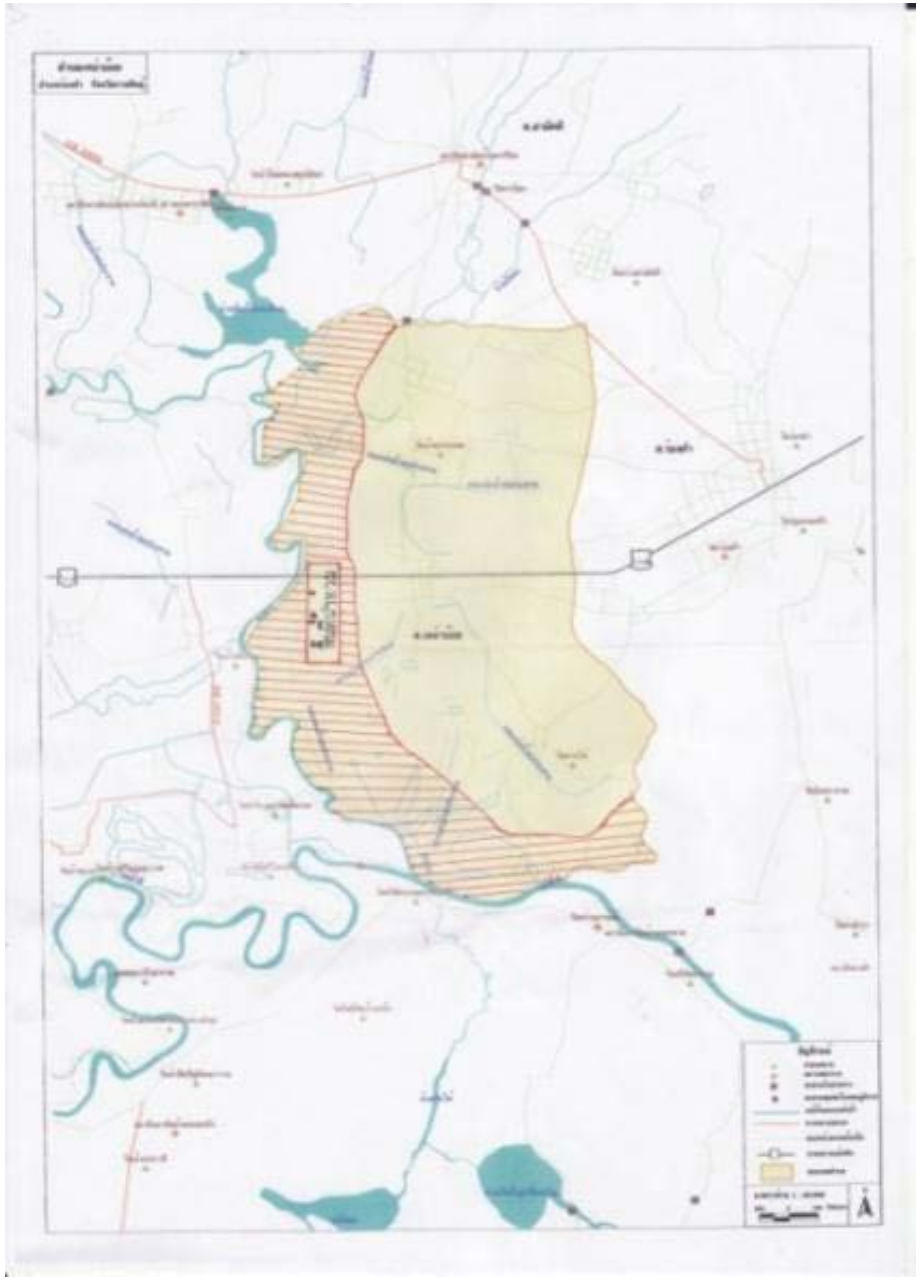
- Addressing future risk using past/present impact!!
- Neglect socio-economic dynamic result from other development plans (Dev. Plan, poverty alleviation, bio-energy, AEC, etc).
- These on-going development plans (privates & government) are driving changes and may also create impact on society much faster than climate change.





Adaptation plan (now) under Risk & Soc-econ (now) would also drives change in Risk &Soc-Econ (future), Thus the plan may not be sustain/applicable in the future.


NONG KHAI
NAKHON PHANOM
UDON THANI
SAKON NAKHON
NONG BUA LAM PHU
KALASIN
MUKDAHAN
KHON KAEN
CHAIYAPHUM
MAHA SARAKHAM
ROI ET
YASOTHON
AMNAT CHAROEN
UBON RATCHATHANI
NAKHON RATCHASIMA
SURIN
SI SA KET
BURI RAM
SA KAEO
Repeated Flood Area



Context

Community: 12 villages, 1,000 HHs, 4,700 people.

Geographical: lowland area between 2 rivers, Lum-poa & Chi.

Key livelihood: Community is doing wet-season rainfed rice farming along river.

Climate threat (pressure) → Flood right before rice harvesting (2-3 weeks, Oct-Nov) almost every years.

Impact/risk → 40% of crop damage.

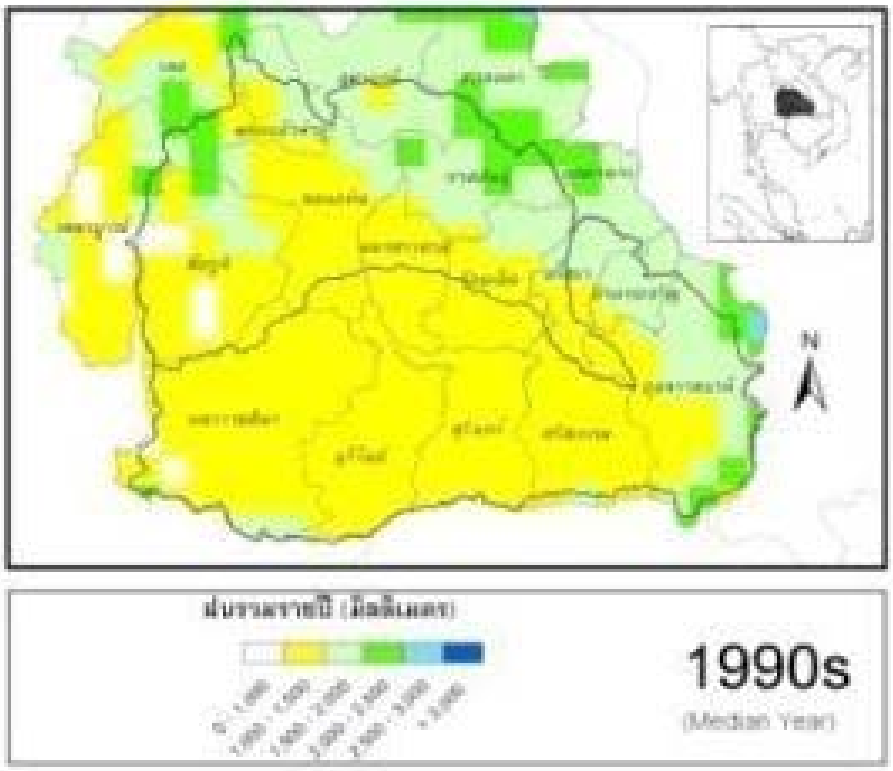
Climate risk & farming vulnerability

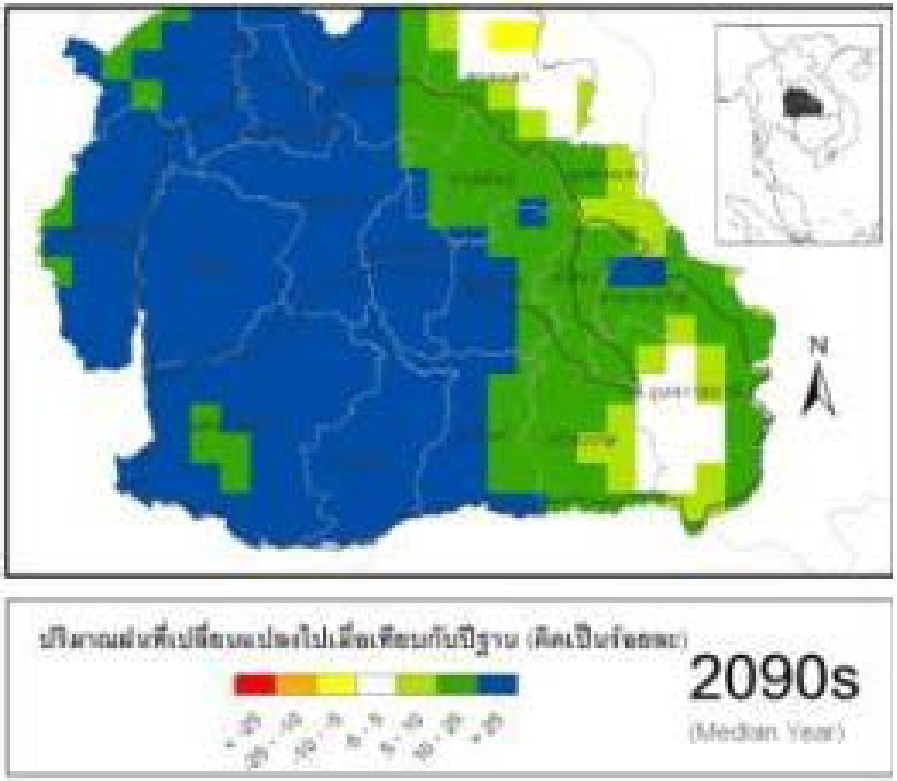
Exposure	Sensitivity	Coping capacity
Flood before harvest, 7-8 times in a decades. Community locates at the joint of 2 rivers. **High**	Rice has low tolerance to flood (over 10 days = total loss). **High** Average loss (past decade) = 40% of total production	Dry season rice along the riverside. **Limited** Rely on government compensation and seasonal migration.

This community is vulnerable to flood

Strategy: Shifting crop calendar into dry season rice & expansion pump-based irrigation system.

Strategy: Shifting crop calendar into dry season rice & expansion pump-based irrigation system.

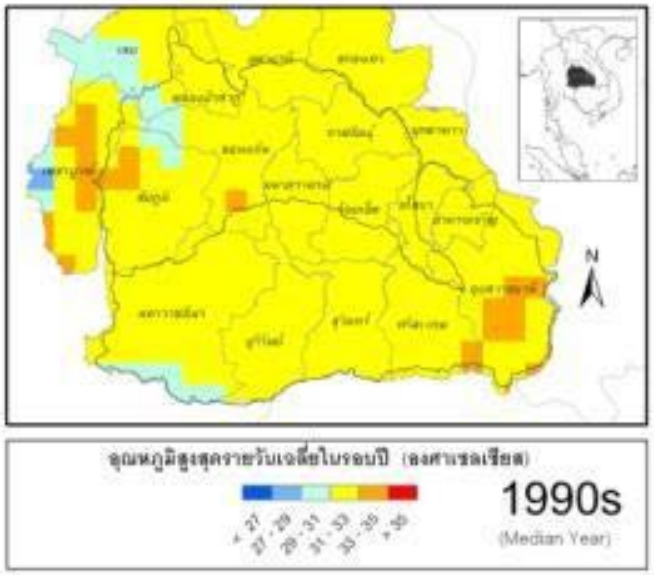


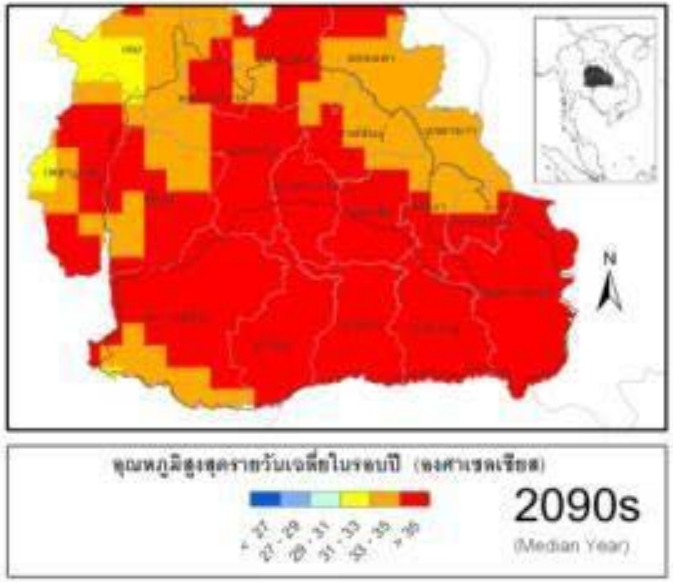


Climate change scenario → Higher precipitation in NE of Thailand → imply that flood risk is likely to be more severe .

Climate trend: Higher rainfall in rainy season – longer and warmer summer.

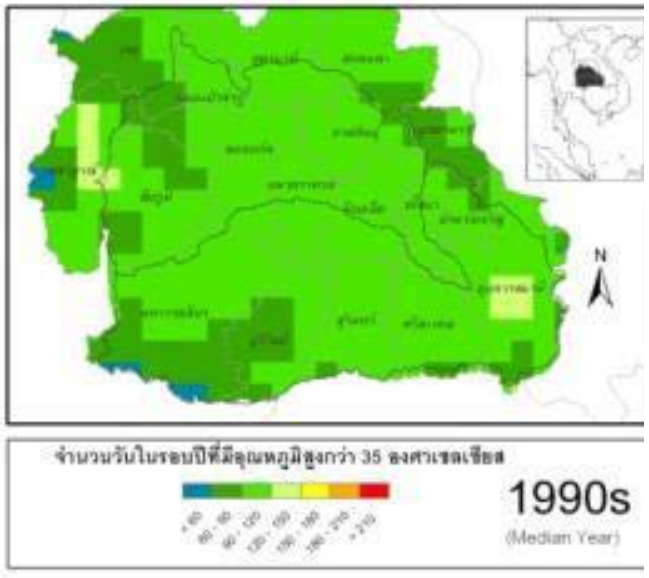
Phenomenon[a] and direction of trend	Likelihood that trend occurred in late 20th century (typically post 1960)	Likelihood of a human contribution to observed trend [b]	Likelihood of future trends based on projections for 21st century using SRES scenarios
Warmer and fewer cold days and nights over most land areas	*Very likely*[c]	*Likely*[d]	*Virtually certain*[d]
Warmer and more frequent hot days and nights over most land areas	*Very likely*[e]	*Likely (nights)*[d]	*Virtually certain*[d]
Warm spells / heat waves. Frequency increases over most land areas	*Likely*	*More likely than not*[f]	*Very likely*
Heavy precipitation events. Frequency (or proportion of total rainfall from heavy falls) increases over most areas	*Likely*	*More likely than not*[f]	*Very likely*
Area affected by droughts increases	*Likely* in many regions since 1970s	*More likely than not*	*Likely*
Intense tropical cyclone activity increases	*Likely* in some regions since 1970	*More likely than not*[f]	*Likely*
Increased incidence of extreme high sea level (excludes tsunamis)[g]	*Likely*	*More likely than not*[f,h]	*Likely*[i]

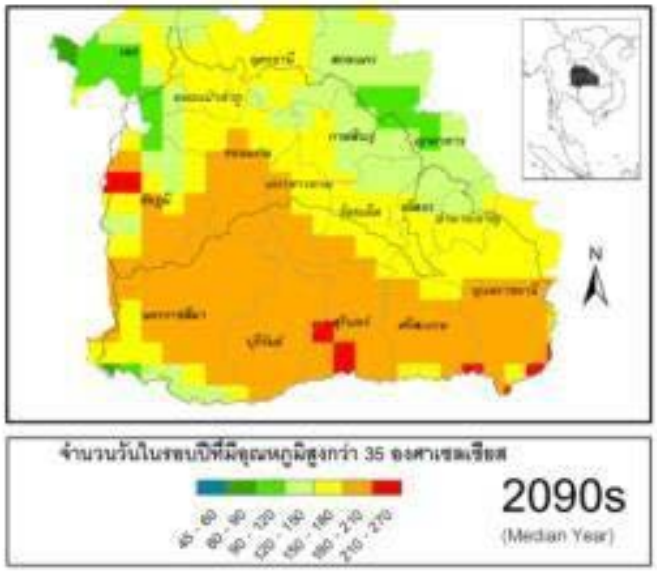




Temperature

A future climate simulation shows tendency of higher temperature (above) and longer warm period (below) throughout northeastern region of Thailand,



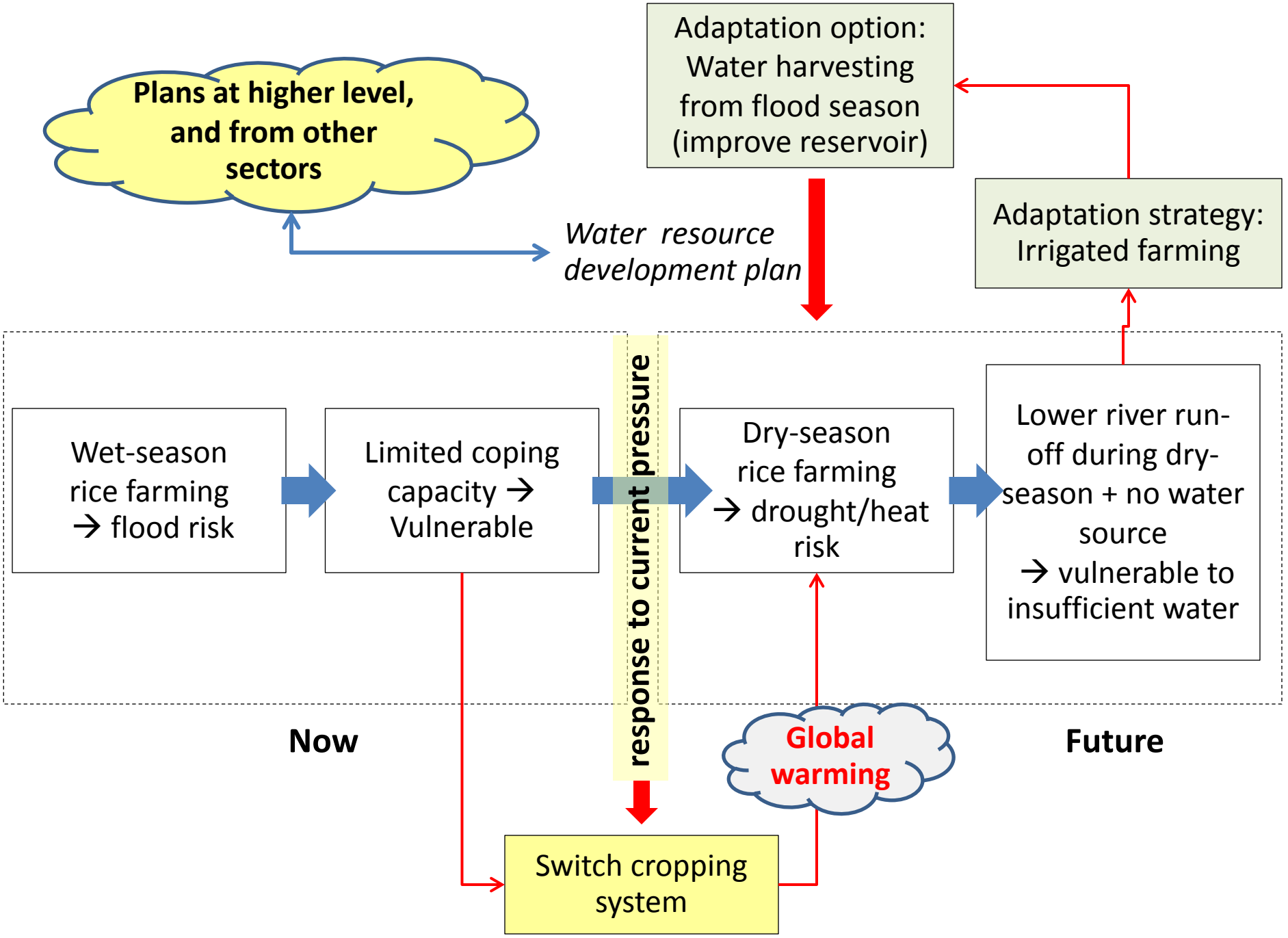


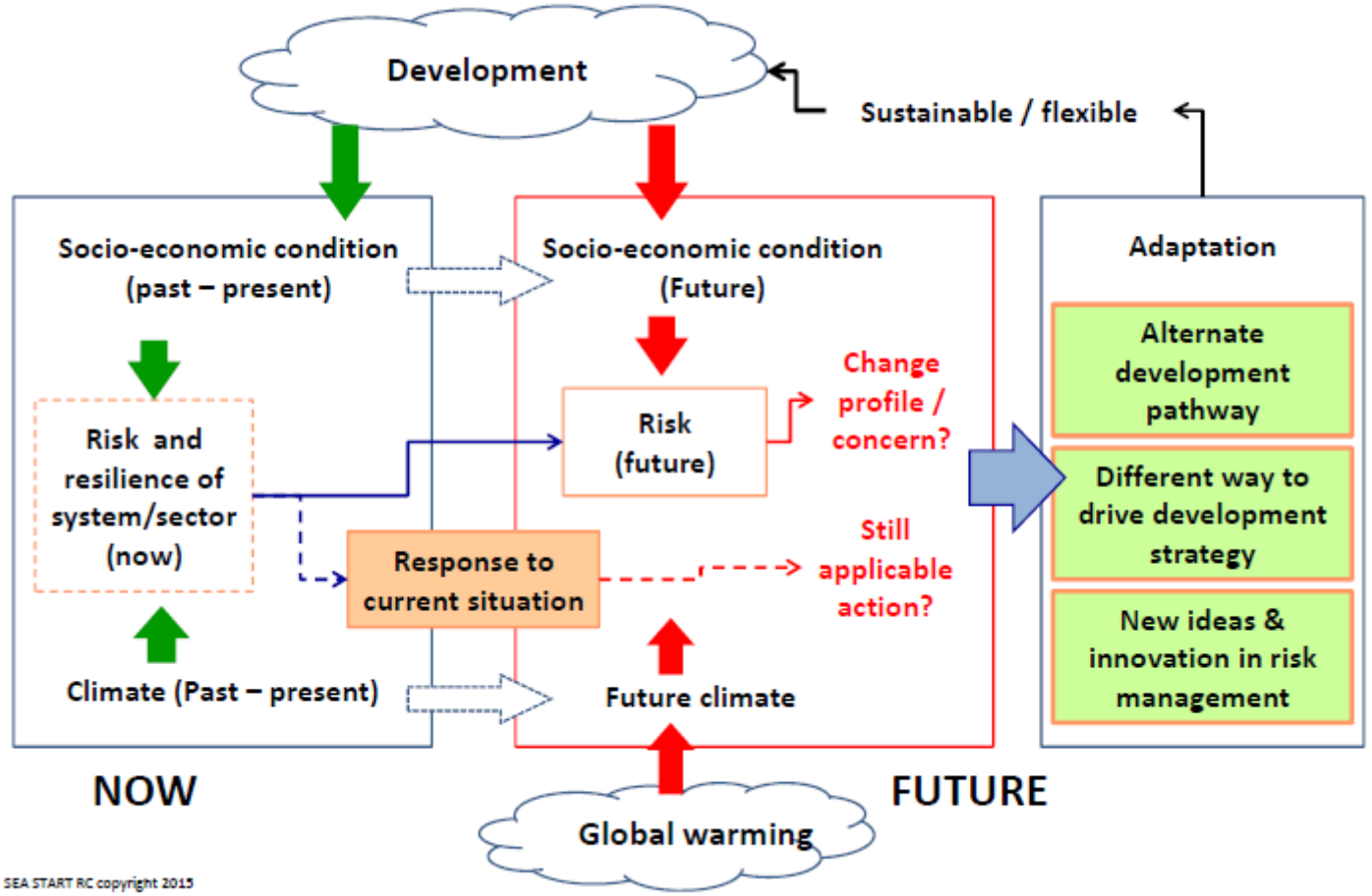
#Days with temp. > 35C

Changing exposure to climate threat of Lao-oi district from flood to drought and heat stress.

Future community context: Won't fight with flood – change to dry season rice – use water from main river through pumping station and underground pipe system

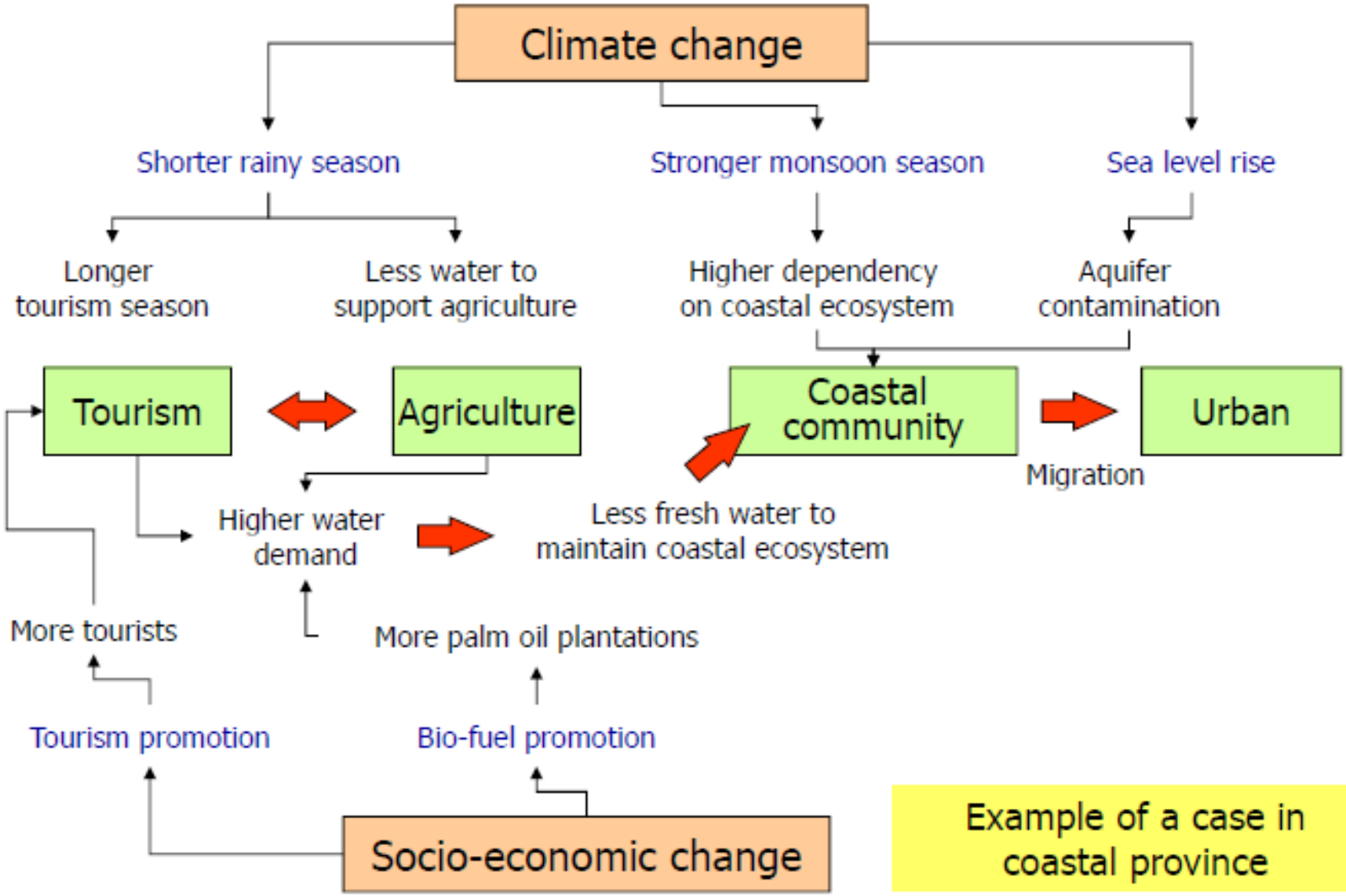
Development pathway leads to dead end in light of climate change?


Plans at higher level, and from other sectors
Adaptation option: Water harvesting from flood season (improve reservoir)
Water resource development plan
Adaptation strategy: Irrigated farming
Wet-season rice farming → flood risk
Limited coping capacity → Vulnerable
response to current pressure
Dry-season rice farming → drought/heat risk
Lower river run-off during dry-season + no water source → vulnerable to insufficient water
Now
Global warming
Future
Switch cropping system


Development
Sustainable / flexible
Socio-economic condition (past – present)
Socio-economic condition (Future)
Adaptation
Alternate development pathway
Different way to drive development strategy
New ideas & innovation in risk management
Risk and resilience of system/sector (now)
Risk (future)
Change profile / concern?
Response to current situation
Still applicable action?
Climate (Past – present)
Future climate
NOW
FUTURE
Global warming
SEA START RC copyright 2015

SOUTHEAST ASIA START REGIONAL CENTER

Climate Change and Vulnerability



Example of a case in coastal province

Breaking dilemma in CCA planning

Dilemma: Current impact → so concern about reliability of risk/impact assessment of future climate change.

Breaking dilemma:

- Linking current plan with broad indicator of future climate change;
- to support decision making in selecting options for the development planning.
- Broadening CCA context beyond just climate factor and its direct impact, using system approach, multi-dimensional analysis, multi-cross-sectoral planning.

SOUTHEAST ASIA START REGIONAL CENTER

Various aspects of climate change adaptation

Multiple dimension and various aspects of climate change adaptation

- New strategic direction in development - improved / revised policy & plan
- Alternative actions to implement strategy
- New initiatives to manage risk

Multiple levels of adaptation:
Household / Community / Provincial / National / Regional

Multiple approaches of adaptation:
Individual / Collective

Multiple methods of adaptation:
Engineering – technical solution / Social – livelihood – economic aspect / Institutional aspect/ etc.

Exercise:

- Continuation of the working group (4 groups)
- Develop the future climate scenario.
- Re-analyze the risk profile (re-contextualization of the system).
- Propose adaptation alternatives
- Assess risk and vulnerability of each adaptation plan.