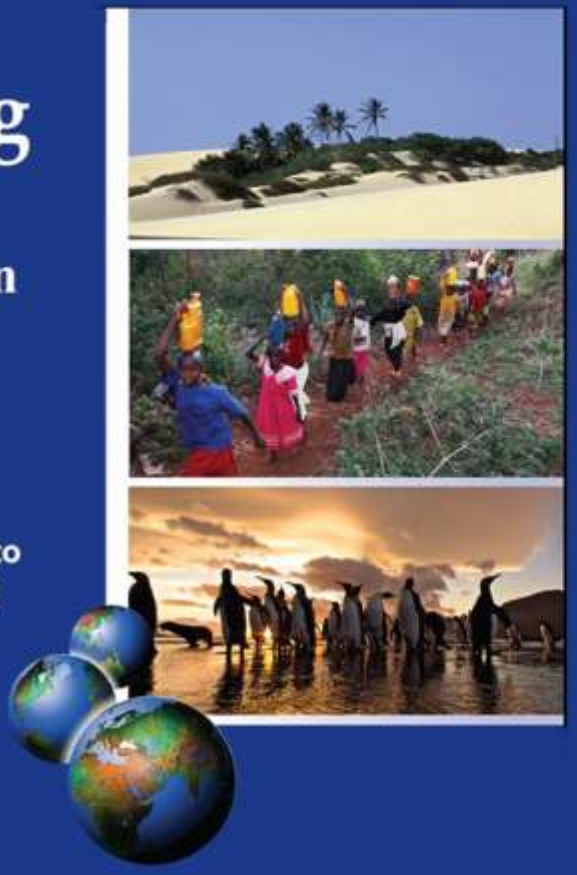
IEA Training Manual

for the Arab Region

Volume Two

Themes

Vulnerability and Impact assessments for Adaptation to Climate Change (VIA Module)



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iisd International Institute for Sustainable Development / Institut international du développement durable

unitar United Nations Institute for Training and Research

Introduction

This module builds on the IEA process and provides training on how to include vulnerability, climate change and adaptation in the process.

It focuses on vulnerabilities, impacts of the changing climate and developing adaptive responses in the context of other issues such as ecosystems and human well-being, capacity and long-term development.

The module aims at defining climate change impacts and dev adaptation and response strategies in the light of current stre and vulnerability to climate change.

Impacts of Climate Change and their Assessment

Climate change is considered a long-term global problem that entails complicated interactions between environmental elements and the socio-economic, political, institutional and technological conditions.

Climate change has become a reality and there is a scientific consensus that the changing climate is a result of emissions basically released by man. There are indicators of this change which leads to significant impacts at the regional and international levels.

Intergovernmental Panel on Climate Change (IPCC) Fifth Assessment Report

Warming of the climate system is unequivocal, and since the 1950s, many of the observed changes are unprecedented over decades to millennia. The atmosphere and ocean have warmed, the amounts of snow and ice have diminished, sea level has risen, and the concentrations of greenhouse gases have increased (see Figures SPM.1, SPM.2, SPM.3 and SPM.4). {2.2, 2.4, 3.2, 3.7, 4.2–4.7, 5.2, 5.3, 5.5–5.6, 6.2, 13.2}

Each of the last three decades has been successively warmer at the Earth's surface than any preceding decade since 1850 (see Figure SPM.1). In the Northern Hemisphere, 1983–2012 was *likely* the warmest 30-year period of the last 1400 years (*medium confidence*). {2.4, 5.3}

The rate of sea level rise since the mid-19th century has been larger than the mean rate during the previous two millennia (*high confidence*). Over the period 1901 to 2010, global mean sea level rose by 0.19 [0.17 to 0.21] m (see Figure SPM.3). {3.7, 5.6, 13.2}

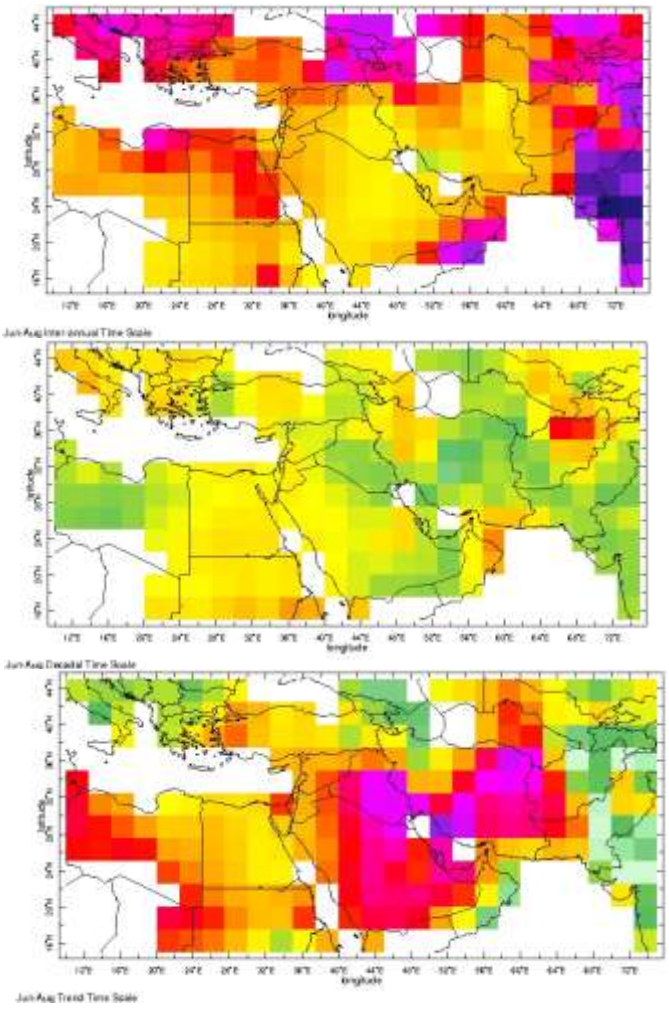
http://www.ipcc.ch/report/ar5/wg1/

Intergovernmental Panel on Climate Change (IPCC) Fifth Assessment Report

Global surface temperature change for the end of the 21st century is *likely* to exceed 1.5°C relative to 1850 to 1900 for all RCP scenarios except RCP2.6. It is *likely* to exceed 2°C for RCP6.0 and RCP8.5, and *more likely than not* to exceed 2°C for RCP4.5. Warming will continue beyond 2100 under all RCP scenarios except RCP2.6. Warming will continue to exhibit interannual-to-decadal variability and will not be regionally uniform (see Figures SPM.7 and SPM.8). {11.3, 12.3, 12.4, 14.8}

Changes in the global water cycle in response to the warming over the 21st century will not be uniform. The contrast in precipitation between wet and dry regions and between wet and dry seasons will increase, although there may be regional exceptions (see Figure SPM.8). {12.4, 14.3}

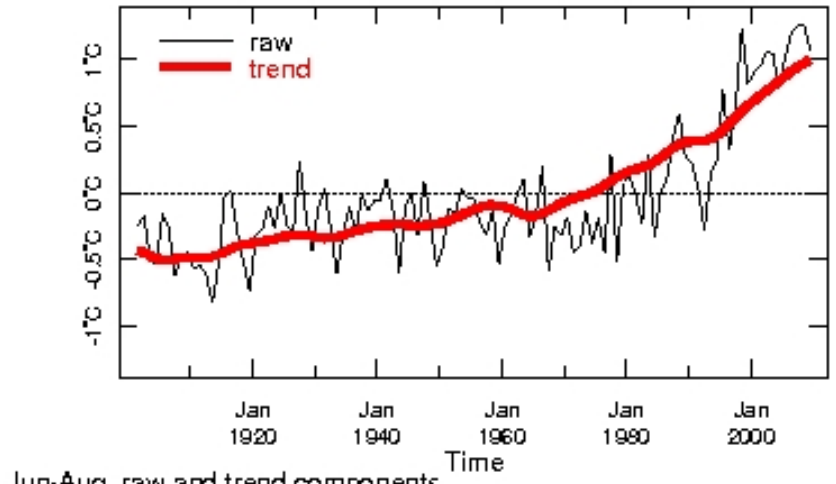
Summarizing 100 years of climate change data in MENA region



Interannual variability – 17% of overall pattern

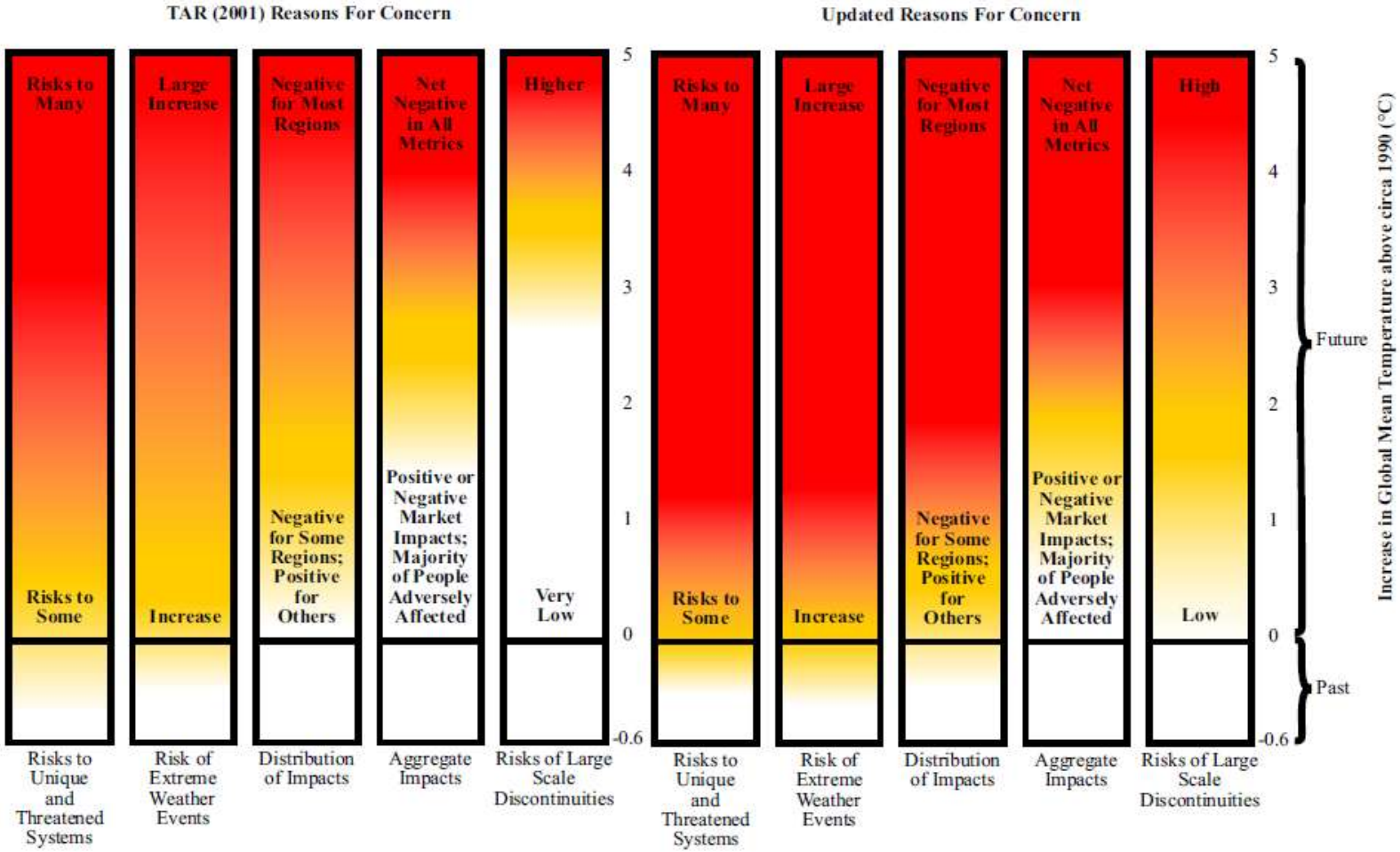
Decadal variability – 11% of total

Long-term climate change – 71% of total



Jun-Aug raw and trend components

You can make maps like these yourself at http://iridl.ldeo.columbia.edu/maproom/Global/Time_Scales/



Smith et al 2009

Understanding about climate change impacts has led to accelerating concern

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Impacts of climate extremes can be felt locally or regionally

AGRICULTURE	**"Mongolian herdsmen face starvation"** *March 14, 2000, BBC World News*
ENERGY	**"Heatwave hits French power production"** *August 12, 2003, The Guardian*
WATER	**"Drought returns to haunt Ethiopia"'** *May 19, 2008, Reuters*
PUBLIC HEALTH	**"Cholera confirmed in Pakistan flood disaster"** *August 14, 2010, Associated Press*
TOURISM	**"Alpine resorts feel heat during record warm spell"** *December 08, 2006, CNN World News*
TRANSPORTATION	**"Flash flooding causes train to derail"** *July 30, 2001, Chicago Sun Times*

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Climate Change Impacts in the Arab Region as Cited in National Reports

Tunisia: By 2030, the following impacts are projected:•

• A 1.1 ° C average increase in temperature

• Extremity of drought events and a 28% reduction in water resources

•Loss of about 20% of the agricultural land and 50% of the un-irrigated forests in the south .

Arab Republic of Egypt: Potential impacts of climate change :

• A substantial decline in major crop yields (wheat and maize)

• An erosion in the Delta shores , seawater intrusion into freshwater and the degradation of some ecosystems as a result of climate change

• A potential sea level rise of 0.5-1 m during the next hundred years will lead to the drowning of 30% of the coastal areas in Alexandria and subsequent economic damage including the following:

• The dislocation of at least two million people

• The loss of 195,000 jobs,

• The absence of any remedial measures will lead to an economic loss estimated at about 35 billion U.S. dollars and the most affected sectors will be agriculture, industry and tourism respectively.

Republic of Lebanon: Potential impacts of climate change:

• The high temperature will lead to the dislocation of plant communities in the mountainous areas and the migration of species to other higher places,

• Decrease in rainfall rate and the inundation of some coastal areas and small islands.

Climate Change Impacts in the Arab Region as Cited in National Reports

Kingdom of Morocco: By 2020, the following impacts are projected:

• A 0.6 -1.1 ° C rise in temperature

• A 4% reduction in the precipitation rate and an increase in drought frequency and severity which will lead to a 15% decrease in water resources.

• A 50% decline in agricultural production in years of drought and a 10% reduction in normal rainfall years,

• A 7-12% increase in irrigation allocations

kingdom of Saudi Arabia: **Potential impacts of climate change**

• A 2.2-2.7 ° C **increase** in summer temperature in the northwestern regions of the Kingdom and a rise of 0.2-0.4 ° C in the south and south-west of the country,

• This increase will lead to a 5-25% reduction in agricultural production in all regions.

• A sea level rise of 0.5 m by the year 2100 will drown 2663 hectares of sandy beaches in the Kingdom.

Republic of Sudan: By 2060, the following impacts are projected:

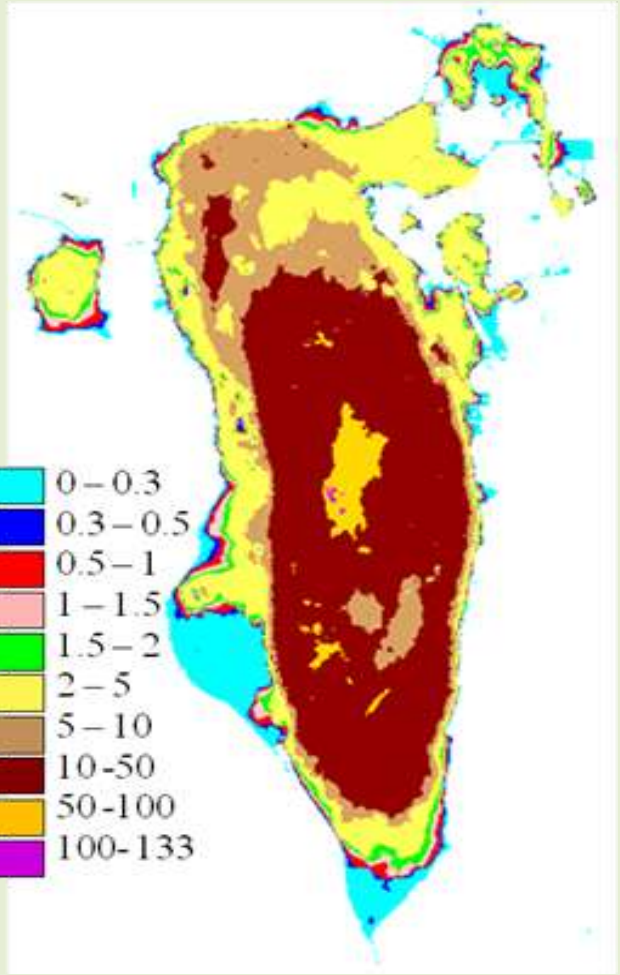
• A significant increase in temperature ranging between 1.5 -3.1 ° C according to seasons,

• A decrease in the average precipitation rate of about 6 mm per month during the rainy season,

• These changes will have a negative impact on agriculture, water resources and public health. Climate scenarios for Northern Kordofan anticipate a 1.5 ° C rise in surface temperatures between 2030 and 2060, and a 5% decrease in rainfall, which could lead to a 70% reduction in white maize crop yields.

Source: National communications and various countries' reports.

Impact of Sea Level Rise on the kingdom of Bahrain



-The Kingdom of Bahrain occupies an area of 740 Km2. It is an archipelago of small islands that might be at great risk of losing significant land mass as a result of sea level rise.

-Eighty Km2 or more than 10% of the total area of the kingdom is estimated to be only 0.5 m above mean sea level.

- More than two-thirds of the population live within 2.0 km of the coastline.

-Sea level rise may pose a substantial threat to Bahrain's resources because of their low-lying physiographical setting as well as the vulnerability of the residential, economic, tourist, and other vital activities. -As a small island state with high population density and high population growth rates, the Kingdom of Bahrain has a limited capacity to adapt to relative sea level rise which underlines the need to undertake risk assessment measures and develop an appropriative adaptive strategy to cope with impacts of sea level rise.

- Drought persistence had a devastating effect on agricultural production in Syria. Most notably was the disastrous drought that occurred during the agricultural seasons of 1999/2000 and 2007/2008, which led to substantial decline in cereal production and caused damage to thousands of families and livestock herders.

- In 2008, drought reduced wheat and barley production by 47 and 67 percent, respectively, as compared to the previous year.

- In 2009 frequent and persistent drought had forced 300,000 people to desert their villages in the north-eastern region of the country.

- A decline in health and education standards was evident in this region and poverty has soared.

Actual crises have tended to be worse than predicted


Thursday, July 31, 2003
Penticton Herald
Water crisis
By JOHN MOORHOUSE
Penticton Herald
The hot, dry Okanagan summer may be about to claim its first victims.
If current conditions persist, Summerland could be out of water by September, Mayor Tom Johnston said Wednesday.
And that has community officials eyeing water allocated for preservation of fish habitat in Trout Creek and tighter controls on agricultural water consumption.
Summerland council has also approved increased domestic water restrictions. In addition to the twice-weekly restrictions already in place, no lawn or garden sprinkling is permitted between 9 a.m. and 5 p.m.
Agricultural water use will be closely monitored.
Johnston said although many growers are conscientious about their water consumption, some are not.
"We're going to have to go after the abusers," he said. "We're going through 30 million gallons per day, and half the community is not watering at all."
Johnston said Summerland is in a water supply crisis. At current consumption rates, it could run out of water in its upper reservoirs by mid-September.
"It's a crisis and the next step is an emergency," he said. "Ultimately, the mayor does have the power to declare an emergency — and if all the factors are there to do so, I'll do that."
■ Summerland could run out of water by this fall, says mayor
This would enable the municipality to order people to consume less water and even shut off water if they don't comply.
"We've got to make it through the growing season and we can't allow our homes not to have any water."
The entire Okanagan Valley is experiencing one of its driest summers on record, coming on the heels of a below-average snowpack, especially in the Summerland watershed, where the municipality has several storage reservoirs.
The municipality has acquired a portable measuring device to accurately determine water consumption by industrial growers.
"We're not minimizing the fact that we have to get the agricultural consumption down by 20 to 25 per cent," Johnston said. "Based on the measurements that have been done already, there's a number of abusers that are taking four or five times the amount of water they should be."
Meanwhile, the district also wants to utilize the 14 acre-feet of water the municipality must release daily from its reservoirs into Trout Creek to preserve trout habitat under federal fisheries regulations. One acre-foot is equal to 217,800 gallons of water.
Johnston said although this would cause the lower part of the creek to dry up, the municipality has offered to restock the fish supply with young fish reared at the provincial government's Summerland trout hatchery.
An emergency response team meeting was held Tuesday with Okanagan-Coquihalla MP Stockwell Day and Okanagan-Westside MLA Rick Thorpe. Both have promised to help.
Day said Wednesday he contacted federal Fisheries Minister Robert Thibault, who promised to look into the possible diversion of fisheries water for community use, although he could not guarantee approval at this time.
"We're asking for common sense and acceptance of a plan that will save the agricultural community and look at actually enhancing the fish population," Day said.
Johnston said the fisheries department has stated approval can't be given without a study, which could take up to six months to complete. Summerland simply doesn't have that long, he said.
Another option calls for pumping water from Okanagan Lake to allow it to run back down the creek. The Penticton Indian band has suggested restoring fish habitat on Shingle Creek through the reserve, since Trout Creek historically has occasionally dried up in the summer.
Fisheries officials could not be reached for comment Wednesday.

- Five minutes, and everything was on fire

Chinese floods kill 15, displace 550000

Drought in Africa: Ethiopia's bitter harvest

1. **Characteristics of vulnerability and scope of the assessment**
2. Vulnerability assessment and the DPSIR framework
3. Monitoring vulnerability
4. Creating responses - determining the adaptation options
5. Prioritizing the adaptation options
6. Developing a basic implementation plan and a communication strategy

Defining Vulnerability

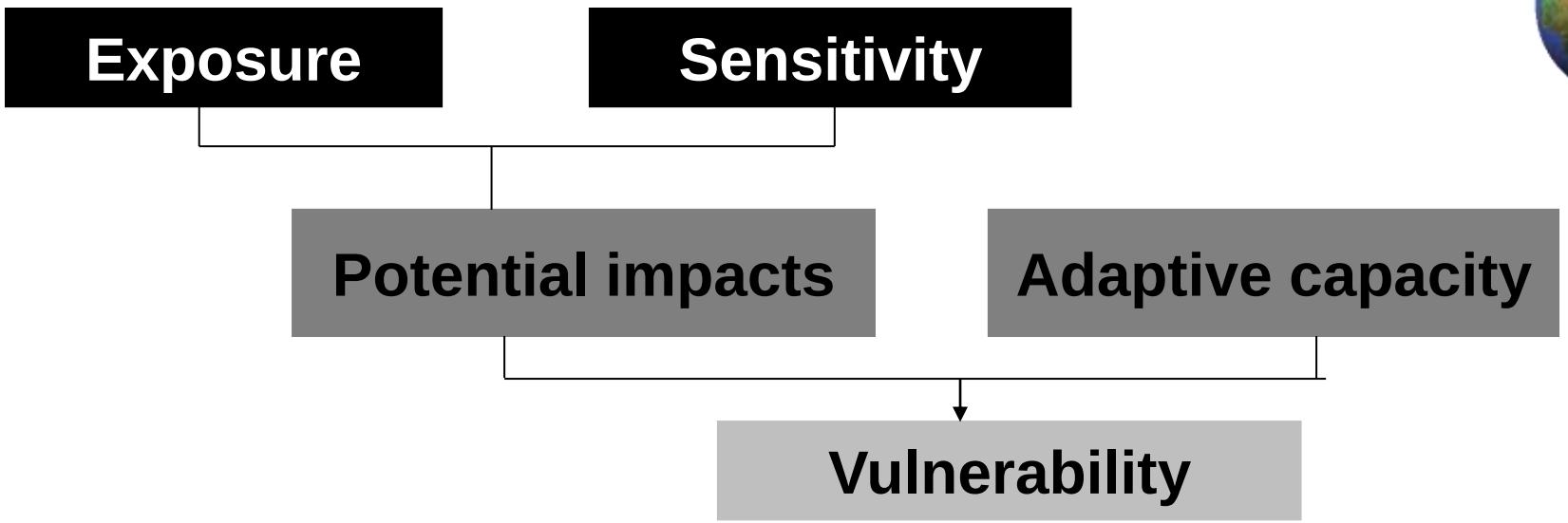
- People and communities are experiencing a number of threats such as climate change , environmental degradation and social and economic changes
- Impacts of these challenges interact and cumulatively increase the vulnerability of local and regional areas and populations
- **Vulnerability** could be defined as the degree to which human-environment systems are susceptible to, and unable to cope with, the adverse impacts.

Vulnerability to Climate Change

- Vulnerability could be described as the degree to which a system is susceptible to, or unable to cope with, adverse effects of climate change, including climate variability and extremes.
- It could include for example: whole vulnerable areas such as low-lying islands or coastal cities; negative impacts of climate change on agricultural lands, forced migration; or the mechanism causing these impacts, e.g., disintegration of the West Antarctic ice sheet.

  (UNEP, 2009).

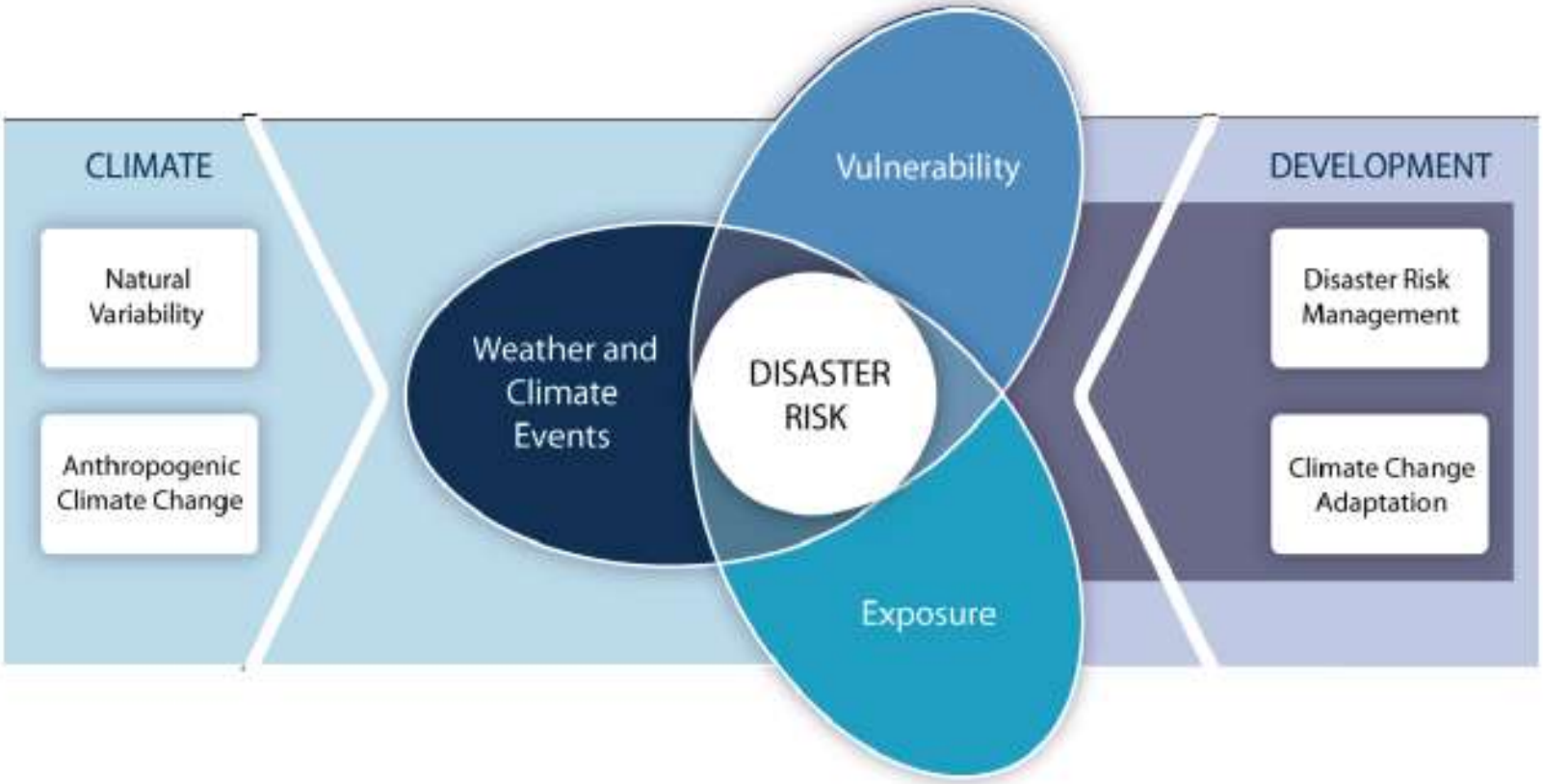
Characteristics of Vulnerability



The **exposure** can be to hazards such as droughts, conflicts or extreme price fluctuations, and also underlying socio-economic, institutional and environmental conditions. The **vulnerability** not only depends on the exposure, but also on the **sensitivity** of the specific unit exposed (such as an ecosystem, a watershed, a household, a village, a country) and **the capacity to cope or adapt**.

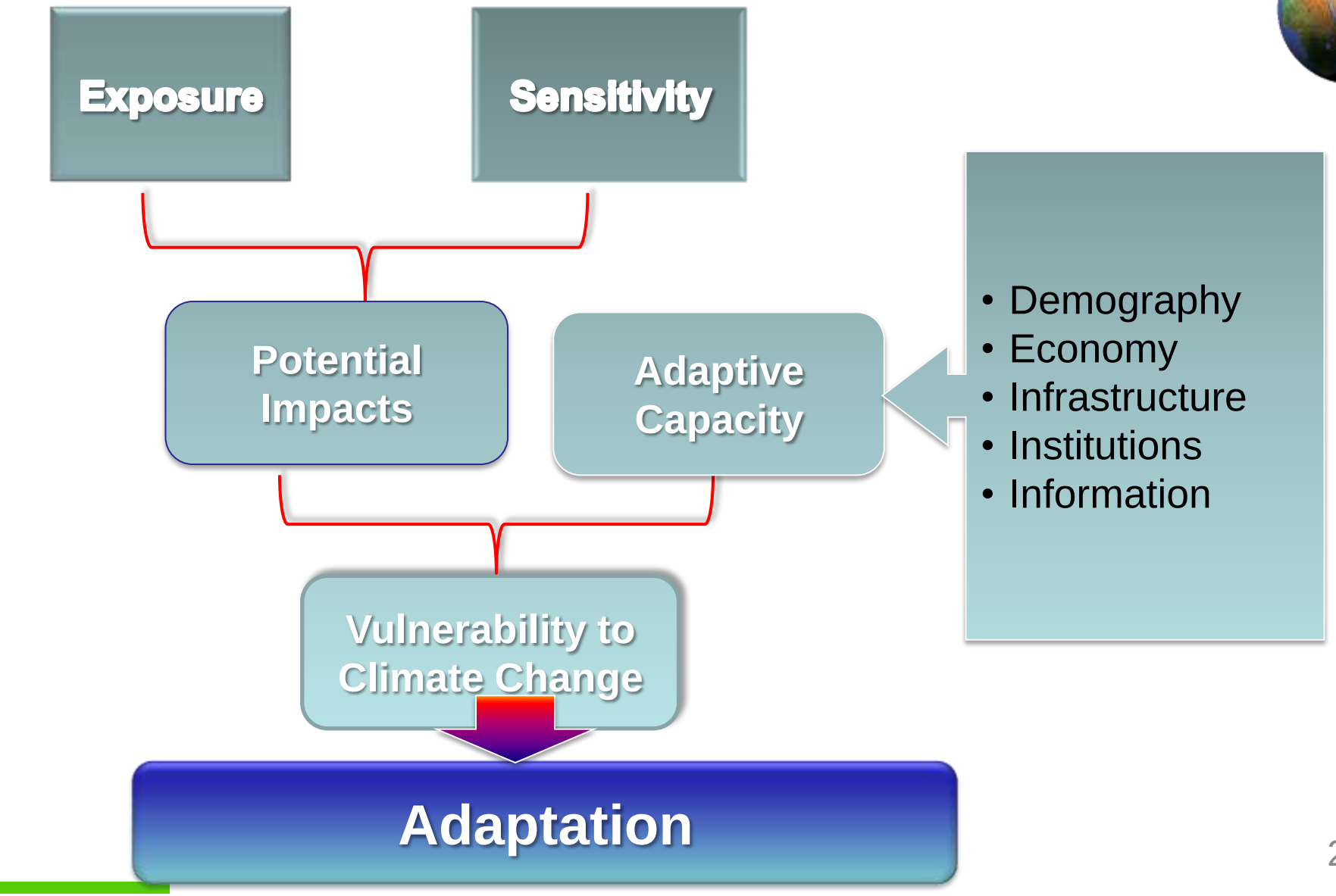
Allen consulting (2005)

Current IPCC framework



Coping and Adaptive Capacities

- They are context-specific
- **Capacities** depend **on access to resources** that could help in responding to threats and exposures (i. e. functioning community networks, access to low-rate loans, accessible services - health care and sanitation, irrigation systems and water storage etc.).
- **Capacities** of the communities are **often depleted** when they are in conflict zones, when they are forced to migrate and in areas with low law enforcement.


Exposure
Sensitivity
Potential Impacts
Adaptive Capacity
• Demography
• Economy
• Infrastructure
• Institutions
• Information
Vulnerability to Climate Change
Adaptation

The Concept of Double Exposures

The Arab region is home to 5% of the world's population but has access to only 1% of global fresh water resources.

Some of the world's biggest and longest-running conflicts are playing out in the region: Somalia, Iraq, the occupied Palestinian territories and Sudan.

Concept of Resilience

- It has been used to characterize a **system's ability to bounce back** to a reference state after a disturbance, and the capacity of a system to maintain certain structures and functions despite disturbance. If the resilience is exceeded, collapse can occur.
- The focus of the vulnerability reduction efforts should be on helping **increasing resilience** both for people and ecosystems instead of only reacting to actual impacts.

(Gunderson and Holling, 2002; Jäger and Kok, 2008; UNEP 2009)

Criteria for Climate Change Vulnerability Assessments

- The knowledge base engaged for analysis should be varied and flexible (**collaborative**).
- Vulnerability assessments should be "**place-based**," with an awareness of the nesting of scales.
- The global change **drivers** examined should be recognized as multiple and interacting.
- Vulnerability assessments should allow for **differential adaptive capacity**.
- The information should be both **prospective and historical**.
- **Institutional aspects** to uncover how they address vulnerability and implement adaptation responses

Easy in theory; hard in practice

Defining the scope of the assessment

Resource Unit versus Jurisdictional

Table 2: Comparing SoE reporting in regions with ecosystem versus political boundaries (modified after Pintér, Zahedi and Cressman 2000).

Ecounit boundary	**Advantages** • More meaningful interpretation of environmental trends relevant to specific ecosystems. • Better understanding of ecosystems as functional units. • Direct connection to ecosystem-scale policies.
	Disadvantages • Limited availability of some data expressed at the scale of ecounit (particularly socio-economic data). • Political complexity arising from analysis of resources under shared jurisdiction.
Jurisdictional (political) boundary	**Advantages** • More uniform regulatory environment. • More simple data collection. • Direct connection to jurisdiction-wide policies.
	Disadvantages • Resource-specific trends masked by data collected on the level of political jurisdiction. • Difficulty detecting differences in ecosystem impacts of specific policies.

Source: Module 5

Thematic Versus Sectoral Approaches

- **Thematic approach:**
  - A more traditional approach; i.e., water, air
  - Challenge is that different themes can be impacted by the same policies or sectors

- **Sectoral approach:**
  - i.e., transportation, agriculture, energy
  - Challenge is that one environmental theme can be impacted by multiple sectors

Source: Module 5

Design new assessments in context of self-evaluation regarding prior assessment activities

- What were the contexts of the previous State of the Environment reporting processes in the country?
- Having considered the contexts of previous reporting processes and the existing environmental and climate change information needs for decision making, what is the best context for assessment process in your country?
- How might the new assessment process and report be designed to minimize the “cutting the cake dilemma?”

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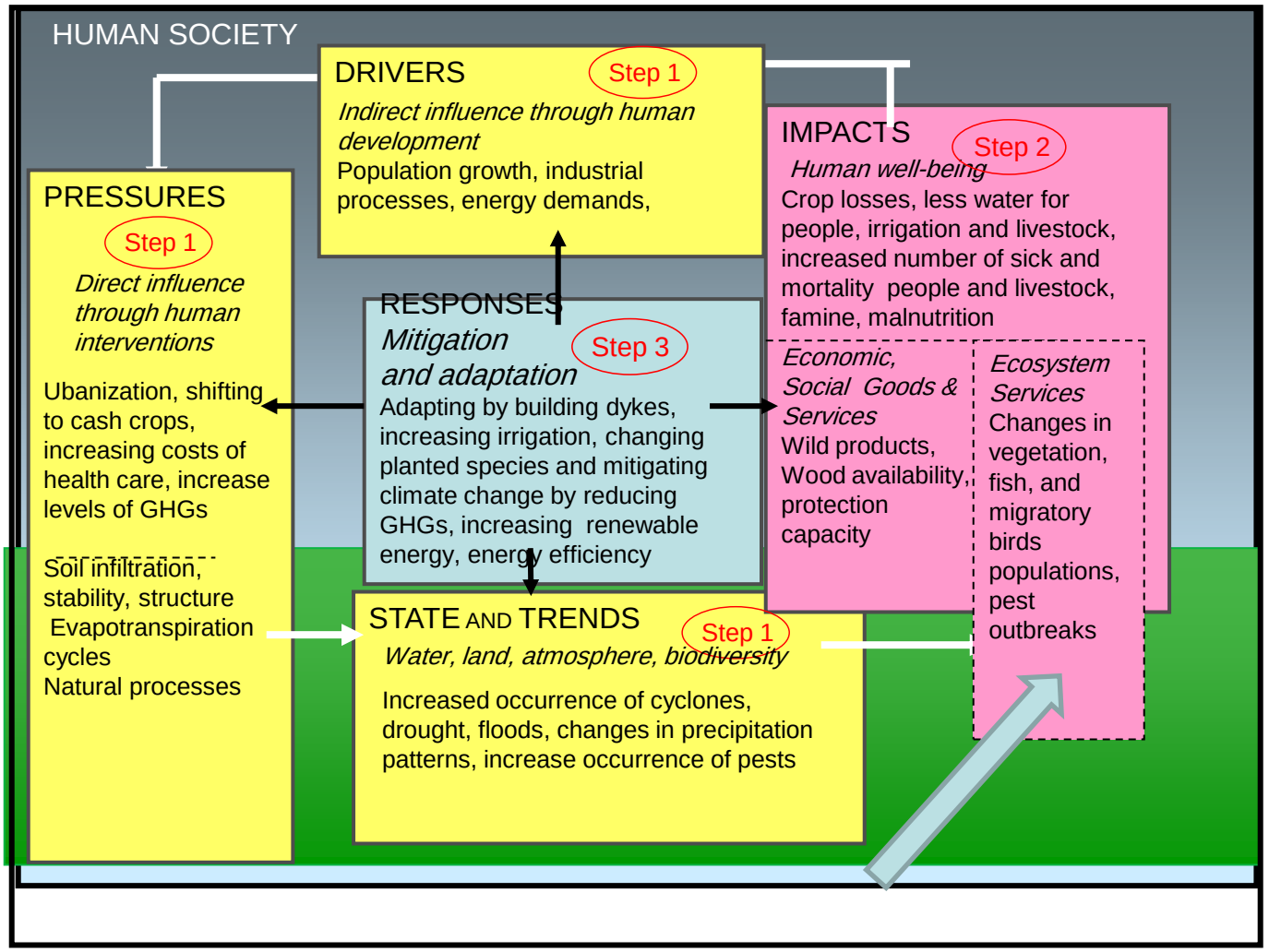
Vulnerable to What, When and Where?

- Focusing on identifying how different drivers and pressures interact and lead to vulnerability: processes such as epidemics or environmental changes, including climate change, are not occurring in isolation of one another, or in isolation of other drivers and pressures.
- Vulnerability is a dynamic concept, and stressors on the human-environment system are constantly changing, as are the available capacities over time.
- Differences in vulnerability between countries, regions, communities and even within households


HUMAN SOCIETY
DRIVERS
Step 1
Indirect influence through human development
Population growth, industrial processes, energy demands,
PRESSURES
Step 1
Direct influence through human interventions
Ubanization, shifting to cash crops, increasing costs of health care, increase levels of GHGs
Soil infiltration, stability, structure
Evapotranspiration cycles
Natural processes
RESPONSES
Mitigation and adaptation
Step 3
Adapting by building dykes, increasing irrigation, changing planted species and mitigating climate change by reducing GHGs, increasing renewable energy, energy efficiency
IMPACTS
Step 2
Human well-being
Crop losses, less water for people, irrigation and livestock, increased number of sick and mortality people and livestock, famine, malnutrition
Economic, Social Goods & Services
Wild products, Wood availability, protection capacity
Ecosystem Services
Changes in vegetation, fish, and migratory birds populations, pest outbreaks
STATE AND TRENDS
Step 1
Water, land, atmosphere, biodiversity
Increased occurrence of cyclones, drought, floods, changes in precipitation patterns, increase occurrence of pests

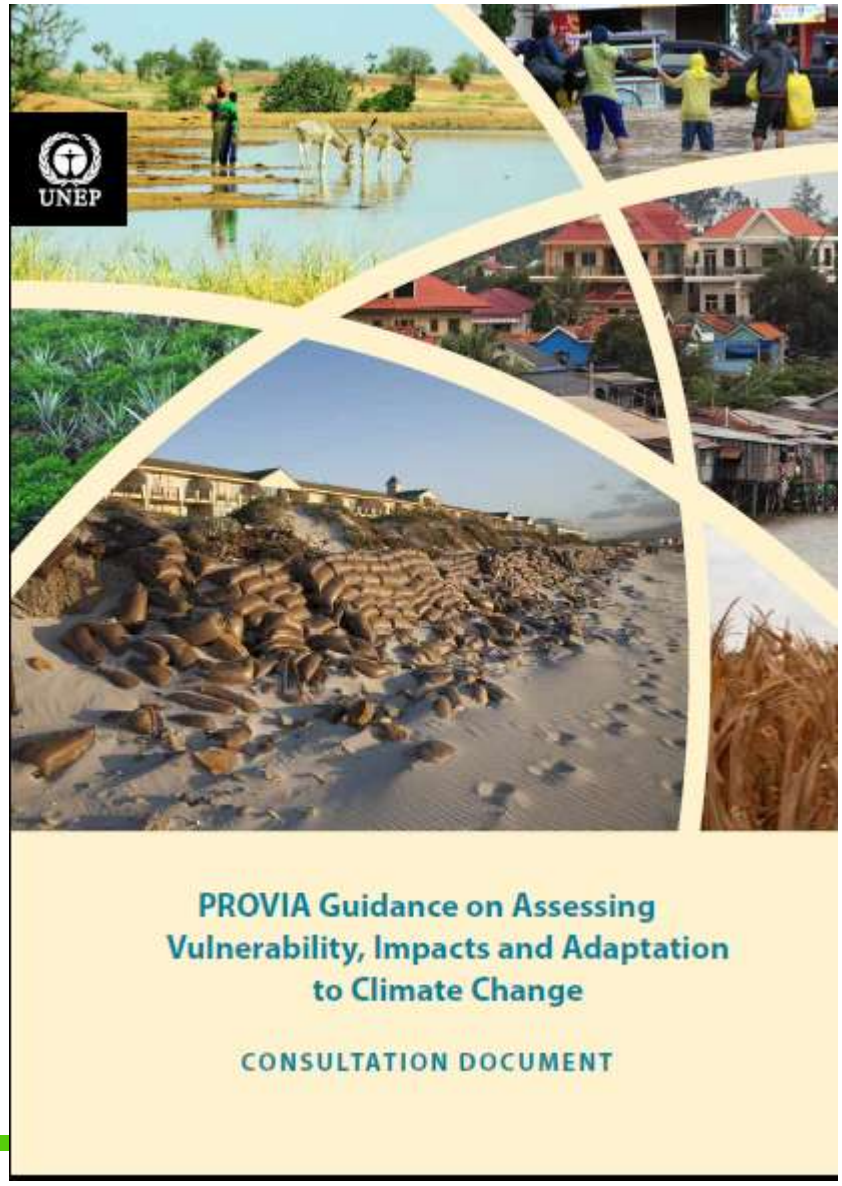
Key questions

- How often do the identified impacts including disasters hit the community?
- Based on the elements of the DPSIR, what are the main causes of vulnerability?
- What coping strategies exist for each identified impact?
- What are the capacities that are lacking to address the identified impacts?
- Which organizations/institutions, if any, support existing coping strategies or promote new strategies?
- Who has access to/uses these capacities?
- Are capacities available to address potential future adaptation strategies?

Example of impacts: Changes in precipitation

State Changes	Environmental /Ecosystem Impacts	HUMAN WELL-BEING IMPACTS			
		Human Health	Food Security	Physical Security and Safety	Socio-economic Effect
↑↓ Precipitation	↑ Flood damage	↑ Water-related diseases	↑ Crop destruction	↑ Drowning and flood damage	↑ Damage to property
	↑ Drought	↑ Malnutrition	↑ Crop reduction		

Source: Jäger and Kok, 2008



- New resource released last month
- http://www.unep.org/provia/RESOURCES/Publications/PROVIAGuidancereport/tabid/130752/Default.aspx

Exercise

- In small groups indentify an ecosystem or an area and complete the following tasks
- Identify major current exposures and sensitivities.
- What are the main coping strategies and capacities that people use to respond to the exposures?
- Write down key drivers and pressures that also contribute to the identified exposures, sensitivities and coping responses and stick them next to the impacts written on the flipchart.
- Try to identify examples of policies and measures that help and halt coping and maintaining capacities.

Focus: Area /Ecosystem/	
1. Current exposures	Current sensitivities
1. Examples of coping responses	
1. Current policies and measures that help in coping with exposures	1. Current policies and measures that are limiting capacities to cope with exposures

1. Characteristics of vulnerability and scope of the assessment
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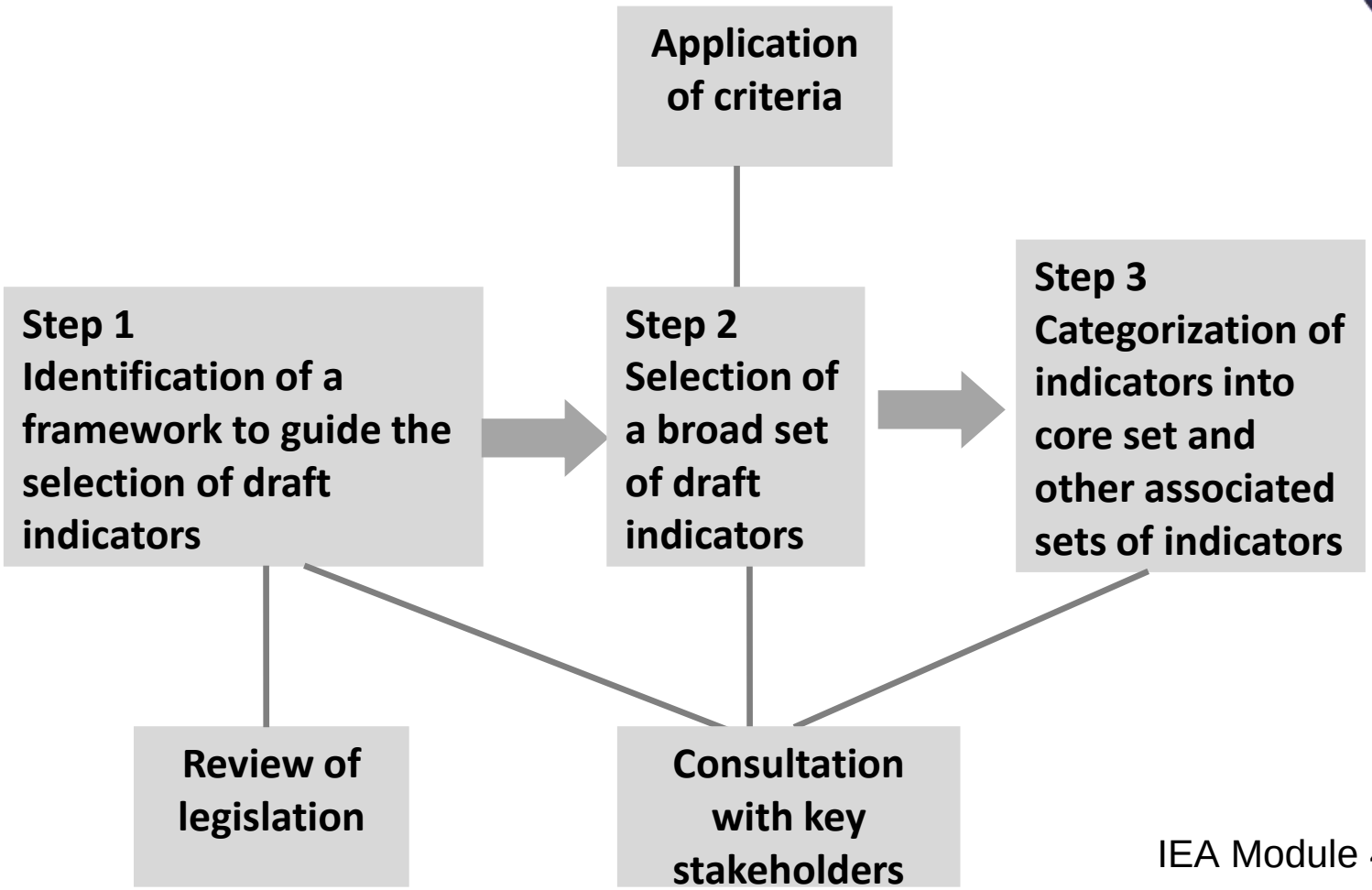
Monitoring Vulnerability

- So far we looked at vulnerabilities related to current climate and climate variability
- We can use indicators to monitor changes in vulnerability over time and help guide decision-making
- Same processes that are outlined in module 4
- Vulnerability can be monitored by identifying indicators and by creating indices that could both be presented spatially and non-spatially.

Example of an indicator development process from South Africa



IEA Module 4

Examples of Indicators

- Frequency of natural events (droughts and cyclones)
- Infrastructure (road network, coastal defense etc.)
- Wildfires (location, intensity)
- Land use
- Assets, land value, house value
- Household size –
  female-headed households
- Food sufficiency
- Population affected by disasters
- Crop types, cropping systems
- Irrigation rate, irrigation source
- Households below poverty
- Level of education or literacy
- Health care delivery

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TABLE 2 A COMPARISON OF IMPACTS OF SEA LEVEL RISE ON INDICATORS OF VARIOUS REGIONS, IN PERCENTAGE TERMS

Indicators	World	LA	MENA	SSA	EA	SA
			1m SLR			
Area	0.31	0.34	0.25	0.12	0.52	0.29
Population	1.28	0.57	3.20	0.45	1.97	0.45
GDP	1.30	0.54	1.49	0.23	2.09	0.55
Urban extent	1.02	0.61	1.94	0.39	1.71	0.33
Ag. extent	0.39	0.33	1.15	0.04	0.83	0.11
Wetlands	1.86	1.35	3.32	1.11	2.67	1.59
			5m SLR			
Area	1.21	1.24	0.63	0.48	2.30	1.65
Population	5.57	2.69	7.49	2.38	8.63	3.02
GDP	6.05	2.38	3.91	1.42	10.20	2.85
Urban extent	4.68	3.03	4.94	2.24	8.99	2.72
Ag. extent	2.10	1.76	3.23	0.38	4.19	1.16
Wetlands	7.30	6.57	7.09	4.70	9.57	7.94

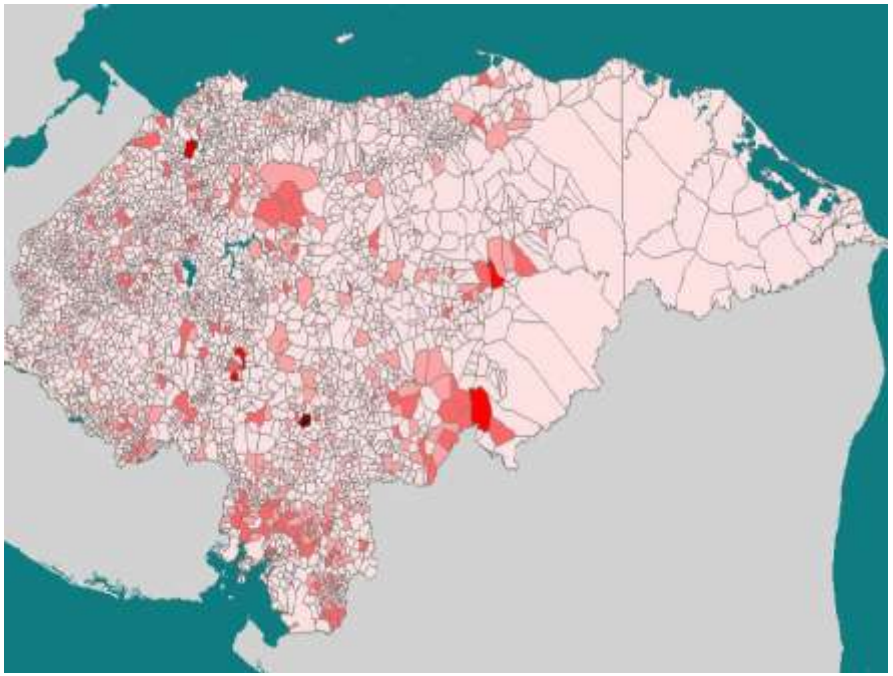
LA: Latin America and Caribbean; MENA: Middle East and North Africa; SSA: Sub-Saharan Africa; EA: East Asia; SA: South Asia.

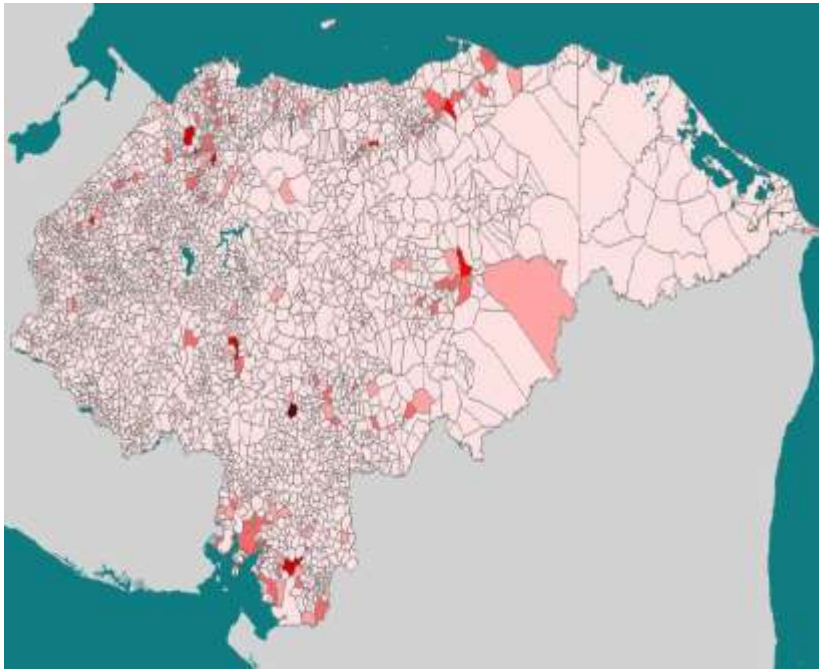
Source: Dasgupta et al., 2007

MENA Region includes: Algeria | Bahrain | Djibouti | Egypt | Iran | Iraq | Israel | Jordan Kuwait | Lebanon | Libya | Malta | Morocco | Oman | Qatar | Saudi Arabia | Syria Tunisia | United Arab Emirates | West Bank and Gaza | Yemen

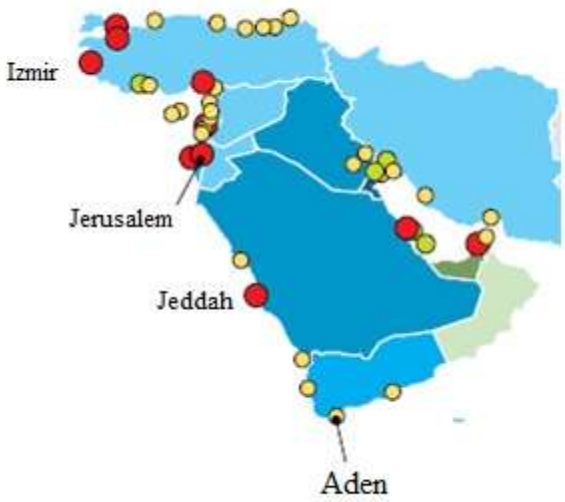
Spatially represented indicators for Honduras

Population at the risk of flooding and landslides (indicate by shades of red)





Source: CIAT, 2000



Urban population percentage in the low-lying coastal areas

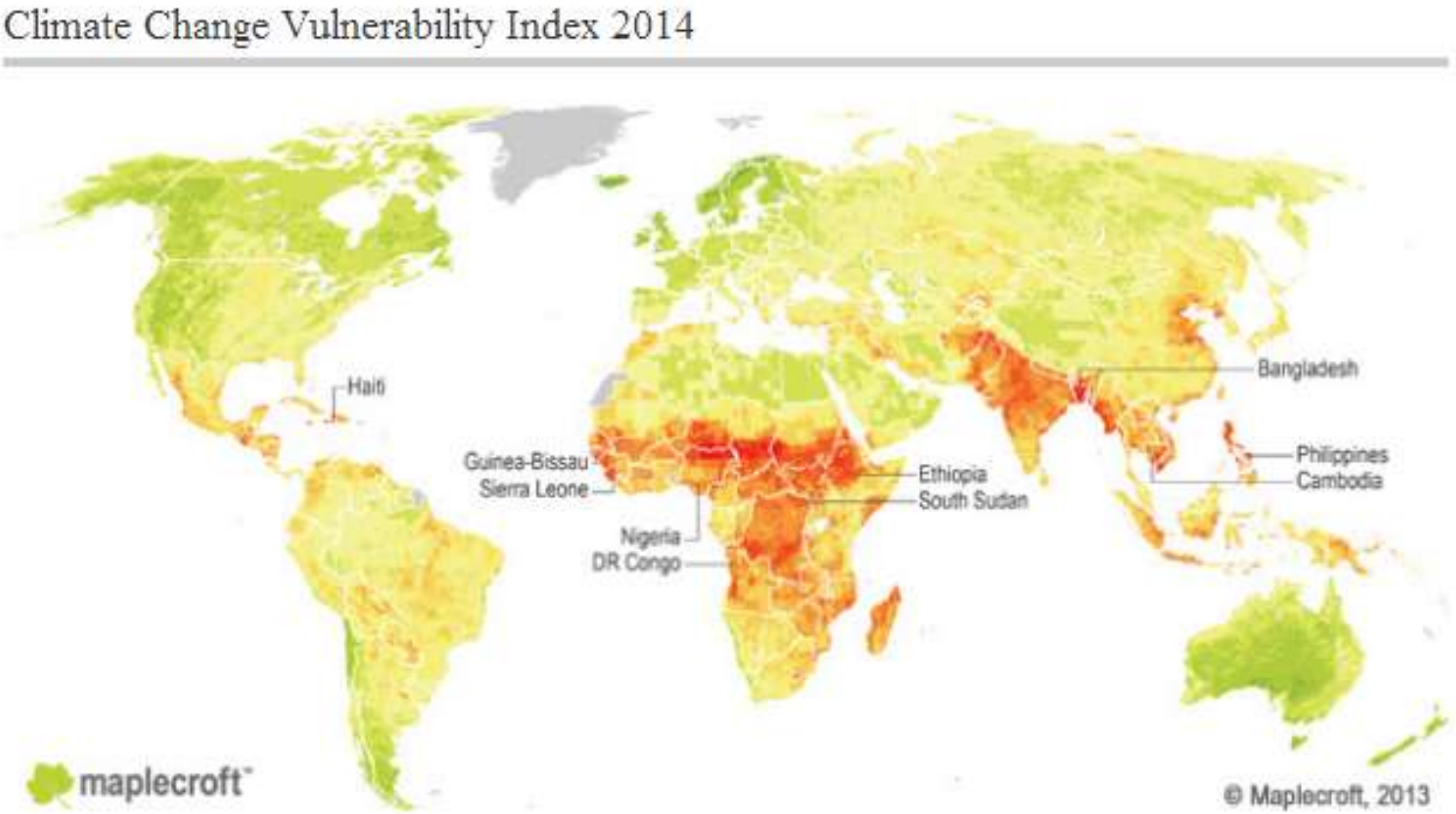
Coastal areas which are not low-lying:
0.0-5.0
5.1-10.0
10.1-15.0
15.1-20.0
20.1-25.0
25.0 <

Size of city
Small
Medium
Big

Cities Population:
Small cities: 100,000 – 500,000 people
Medium cities: 500,000 – 1,000,000 people
Big cities: more than one million people

Source: Coastal areas' Analysis data- Gramps Project, Centre for International Earth Science Information Network, the Earth Institute, University of Columbia
Figures refer to an area of one km2

Composite vulnerability maps becoming more popular



Principles of effective monitoring

- Indicators strongly linked to a vulnerability framework
- Stakeholders understand the framework and how the indicators fit it
- The implications of changes in the indicators are well understood
- There are clear connections to specific behaviors and policies

These provide a basis for accountability and improvement

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Adaptation

Adaptation refers to a group of policies, practices and projects that aim at effecting changes that could improve and raise the efficiency of social structures and economic activities to increase the resilience of these systems to the potential impacts of climate change and to make use of available opportunities. Adaptation to climate change includes averting risks through reducing vulnerability, enhancing adaptation and developing strategies based on accumulative assessment of risks.

Example

Managing the risks: heat waves in Europe

Risk Factors

- lack of access to cooling
- age
- pre-existing health problems
- poverty and isolation
- infrastructure

Risk Management/ Adaptation

- cooling in public facilities
- warning systems
- social care networks
- urban green space
- changes in urban infrastructure

Projected: *likely* increase in heat wave frequency and *very likely* increase in warm days and nights across Europe

ipcc
INTERGOVERNMENTAL PANEL ON climate change

Mainstreaming Adaptation

- Climate change is not just an environmental issue – it is a development issue.
- Mainstreaming includes compromises and tradeoffs among competing local, national and/or regional interests and priorities.
- Finally, climate change adaptation mainstreaming process should contribute to sustainable development goals of the country at hand, talking into account all elements, including local/indigenous coping strategies.

Adaptation to climate change is an important future investment. It is the best available option.

During the first half of this century a number of objective factors underlined the inevitability of climate change and necessitated the adoption and prioritization of adaptation measures for the following reasons:

- GHGs emissions
-The limited effect of mitigation procedures
- Socio-economic and natural environmental conditions
-The effective role of adaptation measures in saving lives and reducing risks related to climate change and climate variability.

Types of Adaptations

- **Infrastructure development** for example building dykes, flood-resistant roads and dams.
- **Ecosystem- based adaptation**s help to preserve and restore natural ecosystems that can provide cost-effective protection against some of the threats that result from climate change (coastal ecosystems like wetlands and mangroves provide shoreline protection from storms and flooding and many other services)
- **Capacity-development** to help communities learn new farming practices, use of technologies (processing), marketing and vocational skills, to assist extension agencies in using early warning systems and forecasts, government's officials in integrating climate change into day-to-day planning.

Adaptation type	Example	Implementation level
Anticipatory	Water harvesting	Individual- society
Reactive	Expanding water harvesting establishments to absorb great quantities thereof	Society
Top down	Changing the building code	National
Bottom up	Societal measures related to building	Societal and institutional
Autonomous	Farmers changing agricultural schedules	Society- individual
Planned	Changing sectors' water allocations/provisions	Society- institutions

Complementary Adaptations

Infrastructure and changes in practices	Ecosystem-based measures	Governance, training and capacity development
Building grain silos Improved post harvest technologies Building small and medium dams Building flood-resistant roads to ensure market access	Promoting sustainable agriculture, organic farming and appropriate technology to reduce degradation Erosion control Restoring vegetation around river beds to limit flooding	Sustainable water management Farmers education – water harvesting and contour farming Training centers and microfinance for off-farming season activities Vocational training – especially for youth, in places with high in-migration; and creation of markets and training in other sector skills. Agricultural extension services, Education

Adaptations not only to Impacts

Elements of the DPSI		Responses – Adaptation
States, trends	**Increased occurrence of droughts**	
Drivers and pressures	Population growth Migration from the affected areas Planting cash crops Reduced house-level food production	Local and community food storage, seed banks Training to obtain skills for work in other sectors Promote inter-cropping, natural fertilizer/pesticides Promote small-scale water storage, rainwater harvesting, mulching and composting
Impacts on environ-ment and human well-being	Reduced yields Lack of water for livestock Increasing poverty Malnutrition	Changes in cropping patterns, natural soil erosion control, create local ecosystems through planting indigenous trees and diversifying vegetation Social support networks, rotational credits, and indigenous medicinal plant knowledge

Adaptation in the Field of Public Health

- Securing minimum water requirements for household use
- Intensifying water pollution control/surveillance programs, and ensuring safety upon the re-use of wastewater.
- Enhancing medical services.
- Promoting health education and public awareness.
- Developing a national strategy for disaster control in addition to management plans to deal with anticipated hazards.
- Improving and controlling health records and ensuring their credibility through national information systems.
- Involving all parties working in the Health Services Field in a program aimed at developing strategies to cope with climate change infectious diseases.
-Promoting climate change diseases' current prevention programs
-Enhancing capacity- building for Health Sector employees and institutions.

Example 1 - Mainstreaming

- **Bangladesh -** Agricultural policies in Bangladesh aim at food-grain self sufficiency. In drought-prone areas promotion of high yielding varieties and increasing cropping intensity have created a more vulnerable production system. New policies currently implemented are anticipating increased drought frequencies and move towards diversification of agriculture, including promotion of horticulture that will also help poverty alleviation.

Source: Kok et al., 2006

Example 2 - Mainstreaming

- **Senegal -** For the vulnerability of forest and agricultural system in Senegal, climate change poses an additional stress. Restoring soil fertility is a key factor in increasing and stabilising agricultural production levels and carbon sequestration offers development opportunities. Currently biomass accounts for 43 % of total energy consumption; in rural areas this can go up to 80%. Agro-forestry for the local energy supply contributes to the rehabilitation of degraded lands and provides energy sources for the rural poor.

Source: Kok et al., 2006

Example: Impacts and adaptations in selected regions of Ghana

Zone	Climate impacts	Adaptation options
Northern Savannah	Increased morbidity and disease prevalence Increased vulnerability of the poor Increased outmigration , loss of human capital	Strengthening traditional social security support systems Strengthening public healthcare delivery Targeted social transfers and safety nets Increased investment in urban social services
Transition	Increased demand - water, energy and basic services Decreased income for people in fish industry Increased out migration Increased food insecurity Threats to forest-based livelihood Potential conflicts and social tensions	Public private partnership in service provisions Develop early warning systems and awareness raising Promotion of conflict management mechanisms Provision of social safety nets for communities and migrants Develop alternative and additional livelihood

Bizikova and Bailey, 2009

Adaptation Practices to Climatic Impacts

Drought	**Sudan:** Expanded use of traditional rainwater harvesting and water conserving techniques; building of shelter-belts and wind-breaks to improve resilience of rangelands; monitoring of the number of grazing animals and cut trees; set-up of revolving credit funds.
Sea-level rise; storm surges	**Philippines**: Capacity -building for shoreline defense system design; introduction of participatory risk assessment; provision of grants to strengthen coastal resilience and rehabilitation of infrastructures; construction of cyclone-resistant housing units; retrofit of buildings to improved hazard standards; review of building codes; reforestation of mangroves.
Landslide	**China:** Dense and deep-rooted vegetation helps to bind soil together, resisting slippage of surface layers. China's grain for green program bans logging and agriculture on steep slopes and prohibits forest clearing for shifting agriculture in the mountains of Southwest China. In exchange, the local communities get grain provisions and cash subsidies as well as resilience against flooding events.

Sources: **Schneider et al., 2007 and World Bank, 2009**

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Adaptation Prioritization

- There are number of options available to adapt to expected climate impacts and depending on for example available capacities, cultural, social and economic preferences, urgency for actions, adaptation options need to be evaluated and prioritized.
- Prioritizing between adaptation options based on criteria that recognizes the importance of sustainable development also helps to realize synergies and create long-term adaptation options

Work methodology as cited in the Intergovernmental Panel for Climate Change Technical Guide for Adaptation and Assessment of Climate Change Impacts

1- Identification of the problem

2- Selection of the approach of action

3- Assessment of approach vulnerability

4- Selection of scenarios

5- Impact assessment

6-Assessment of the adaptive capacity

7- Assessment of adaptation options

Examples of criteria

Category	Criteria
Sustainability	Mitigation co-benefits
	Environmental impacts
	Equity
	Implementation Cost
	Operating and Maintenance Cost
Effectiveness	Robustness
	Reliability
Risk and Uncertainty	Urgency
	Degree of risk or impact
	Precautionary
Opportunity	Ancillary benefits
	No-regret option
	Window of Opportunity
Implementation	Public acceptability
	Funding sources
	Capacity (information, technical, staff, resources)
	Institutional

Scoring the criteria

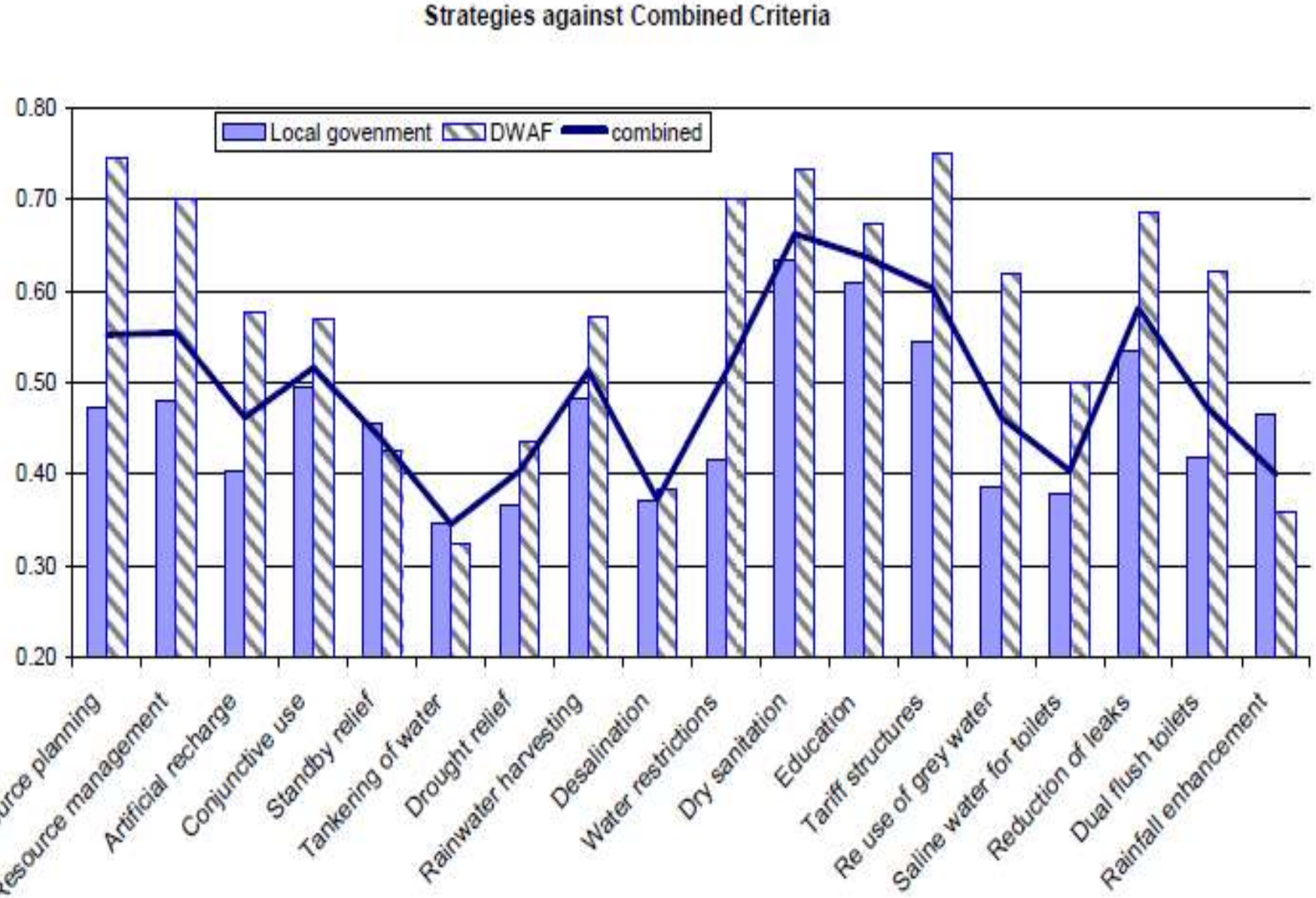
Technology required	Is the technology for the intervention readily available? 1 = Not available, 2 = must be imported, 3 = available in the country, 4 = locally available, 5 = already installed
Additional running costs	Will the intervention incur additional running costs? 1 = High costs, 2 = Medium, 3 = Low, 4 = No O&M costs
Local employment	To what extent will the intervention impact on job creation? 1 = Loss of jobs , 2 = Neutral, 3 = Few jobs (<10), 4 = Many jobs (10-30)
Local capacity to implement	What level is the institutional capacity currently at with respect to the intervention? 1 = Very low, 2 = Low, 3 = Adequate, 4 = High
Acceptability to local community	What is the consumer acceptability of this intervention in terms of additional cost to them and convenience? 1 = None (high additional costs) , 2 = Low (some additional costs or inconvenient), 3 = Neutral, 4 = High (no additional costs)
Long -term applicability	What is the period of impact of the intervention? (short - long term) 1 = <2 years, 2 = 2-5 years, 3 = 5-15 years, 4 = 15-25 years, 5 = >25 years

Adaptation Prioritization

- Using multi-criteria assessment ,options will be classified in categories such as :
- A = Urgent adaptation options which can be done by communities themselves
- B = Urgent adaptation options for which communities needed assistance from the Government; options will be then allocated to the responsible ministries
- C = “No-regrets” options that help to address problems that need to be dealt with anyway
- D = Adaptation options that were less important/urgent
- E = Adaptation options for which there was no need or willingness to implement

Example

- Municipal water management in the context of changing climate in arid regions of South Africa
- The most severe impacts of climate change in the form of reduced rainfall are likely to occur along the western part of South Africa, where small towns and subsistence farmers are most vulnerable.
- Adaptation responses obtained from the stakeholder group were evaluated to create a portfolio of strategies relevant for a future water resource management strategy



Mukheibir, 2005.

Illustration of an application in West Africa

	Scalability	Relative cost	Ease of implementation	Return time	Adverse impact on Environmental	Potential impact on poverty alleviation
Drought tolerant/improved seed varieties	High	Medium	Medium	Short	Low	High
Soil and water conservation	High	Medium	Med	Medium	Low	High
Irrigation	Low	High	Low	Short-Med	Moderate	High
Early detection and destruction of locust	High	Medium	High	Short	Moderate	Low
Community level food and fodder banks	High	Med	Med	Short	Low	High
Vaccination programs	High	Med	Med	Med	Low	High
Contingent financing (	High	Low	High	Short	Low	Low
Shortening emergency response time	Med	Low	Med	Short	Low	Low
Strategic de-stocking	Low	Medium	Low	Med	Low	Low
Insurance	Low	Low	Med	Med	Low	Low

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Implementation of Responses

- Adaptation options include activities that are new and untested, but most of the activities are well-known to communities.
- Local communities should be seen as a valuable knowledge about climate change impacts and adaptation, even if the options are not explicitly recognized as helping to reduce vulnerability to climate change.
- Building on this familiarity helps to empower local communities and decision-makers to engage in developing relevant responses to climate change.

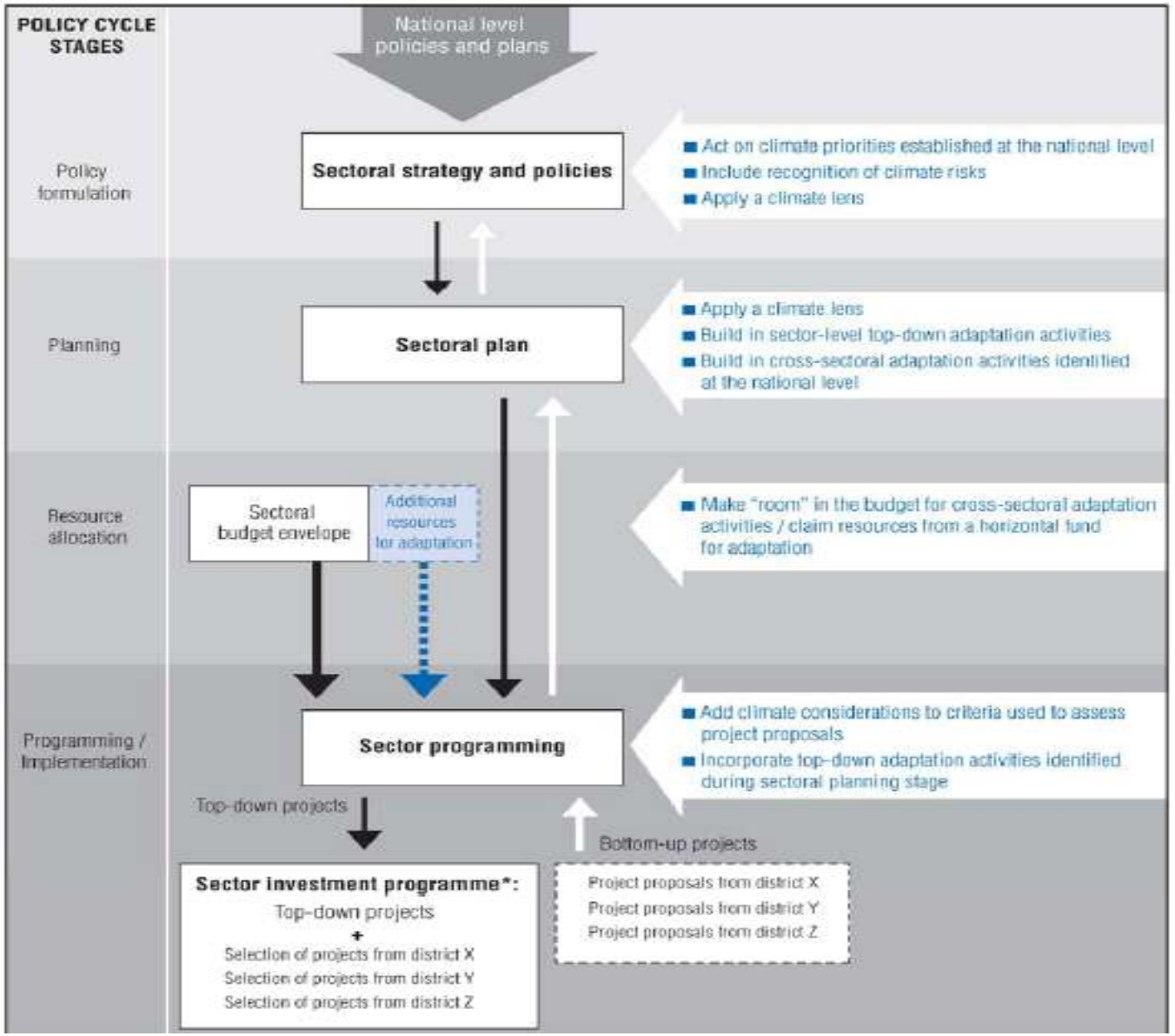
Some Issues in Short and Medium term

- A preferred option (often a win – win solution) that it is supported by consensus
- A ‘low-hanging fruits’ option: It includes responses that require minimal recourses and is easy to implement
- An area of the highest urgency (if it is applicable) to minimize major sources of vulnerability
- An area that provides a “no-regret option” that addresses problems that need to be dealt with anyway

Levels of Governance and Adaptation

- Two types: decision-making *at* and *for* local levels as both cases involve different scales and actors.
- Local level adaptation is strongly related to the other levels of decision-making.
- Local actors should both benefit from and shape adaptation decision-making at other levels in order to ensure successful adaptation responses.
- Lessons and experiences with adaptation at the local level must feed into higher levels of decision-making to make sure that local strategies remain relevant and appropriate, and provide a basis for transferring knowledge to other sectors and communities.

(OECD, 2009)


POLICY CYCLE STAGES
National level policies and plans
Policy formulation
Sectoral strategy and policies
Act on climate priorities established at the national level
Include recognition of climate risks
Apply a climate lens
Planning
Sectoral plan
Apply a climate lens
Build in sector-level top-down adaptation activities
Build in cross-sectoral adaptation activities identified at the national level
Resource allocation
Sectoral budget envelope
Additional resources for adaptation
Make "room" in the budget for cross-sectoral adaptation activities / claim resources from a horizontal fund for adaptation
Programming / Implementation
Sector programming
Add climate considerations to criteria used to assess project proposals
Incorporate top-down adaptation activities identified during sectoral planning stage
Top-down projects
Bottom-up projects
Sector investment programme*:
Top-down projects
+
Selection of projects from district X
Selection of projects from district Y
Selection of projects from district Z
Project proposals from district X
Project proposals from district Y
Project proposals from district Z

National Priorities

- Improving the coverage and quality control of climate monitoring data. Commissioning national-level assessments of climate change impacts, vulnerabilities and adaptation options;
- Moving the co-ordination for adaptation into powerful central bodies (Office of the President or Prime Minister or planning agencies);
- Including considerations of climate change risks within long-term visions, PRSPs and SD plans;
- Making an economic case for adaptation through *horizontal funds* for the incorporation of adaptations in policies, plans and programs (OECD, 2009)

Sectoral Priorities I.

- Carrying out an assessment on sector-specific impacts and vulnerabilities;
- Raising awareness among both sectoral planners and donor agencies of the implications of climate change in specific areas;
- Boosting in-house capacity within sectoral ministries and donor agencies to better evaluate the implications of climate change;

(OECD, 2009)

Sectoral Priorities II.

- Reviewing sectoral regulations based entirely on historical climate information– such as more frequent updating of the climatic baseline (*e.g.* in water resource management);
- Collecting better information on the costs and benefits of adaptations so that decision makers can factor such information into their decision- making;
- Making ”room” in the budget for adaptation responses identified in the context of cross-sectoral plans, or claiming resources from a horizontal fund for adaptation.

(OECD, 2009)

Integrating the Adaptation Strategy into National Plans

- Proper scientific assessment and a better understanding of climate change impacts and risks represent the first step towards developing an adaptation policy to tackle potential effects of climate change.
- This requires capacity- building in the field of scientific assessment of the vulnerable sectors and fragile ecosystems, and the provision of the necessary financial resources to carry out this mission.
- According to various social circumstances as well as the economic and political environment in the country, appropriate measures and mechanisms are developed to integrate these policies into national plans.

Communicating Adaptation Options

- Priority adaptation options must be delivered to the masses and target groups including decision-makers.
  - Much easier if they have been involved in evaluating them
- Learned lessons and knowledge, especially local (inherited practices and information) must be disseminated and technology transfer should be encouraged.
- Focal points have to be expanded and appropriate messages have to be transmitted.

Communicating Adaptation Options

- The options identified need to be communicated in a language that speaks to the target audience.
- Communication also helps in collecting knowledge from the experiences and practices of at-risk groups, including traditional knowledge.
- Communication could also be used to motivate, support and ensure that skills of policy-makers and leaders at the local level are improving on these issues.

Dissemination of Information

- Ensure you have a **good distribution network**
- Ensure your distribution list matches your **target audience** and update it if needed.
- Consider **different ways** of distributing your strategy
- **Keep thinking** about distribution long after your product has been produced (even if it is hard to do so)

Adaptation never ends

Managing risks of disasters in a changing climate benefits from an iterative process

Learning-by-doing and low-regrets actions can help reduce risks now and also promote future adaptation

You aren't doing this alone

PROVIA PROGRAMME OF RESEARCH ON CLIMATE CHANGE VULNERABILITY, IMPACTS AND ADAPTATION

http://www.unep.org/provia/

The Nairobi work programme on impacts, vulnerability and adaptation to climate change

http://unfccc.int/adaptation/workstreams/nairobi_work_programme/items/3633.php

https://www.facebook.com/The.Adaptation.Exchange

Good adapters are good networkers