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Training Module for Practitioners:
Sub-module 1: Fundamentals of Disaster Risk Reduction and Climate Change Adaptation
Topic 1.2: Climate Change Adaptation

Colophon

CATALYST Online Training Module for Practitioners	These teaching materials are part of the CATALYST Training Module on "Capacity Development for Hazards risk Reduction and Adaptation.
Title	Sub module 1: The Fundamentals of Disaster Risk Reduction and Climate Change Adaptation Topic 1.2: Climate Change Adaptation
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Learning objective	To develop a basic understanding of terminology of adaptation and the importance of non-normative definitions of adaptive management. To gain Insight into tools for adaptive strategy building and management.
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Materials adapted from	*Where specificed, slides have been adapted from Aerts (2007); CNRD-PEDRR (2012); Ludwig (2012), Pahl-Wostl (2007). Otherwise these are original slides. All notes are the author's.*
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The importance of climate and weather

- Climate related hazards account for 71 % of large scale economic disasters, 45 % of recorded mortalities 69% of economic losses and 90 % of insured losses.
- Of low-intensity hazards 96% was weather-related in 21 countries over 40 years

  (UNISDR, 2011)

Climate change

- IPCC: refers to any change in climate over time, whether due to natural variability or as a result of human activity.
- UNFCCC: refers to a change in climate that is attributed directly or indirectly to human activity, and that is in addition to natural climate variability

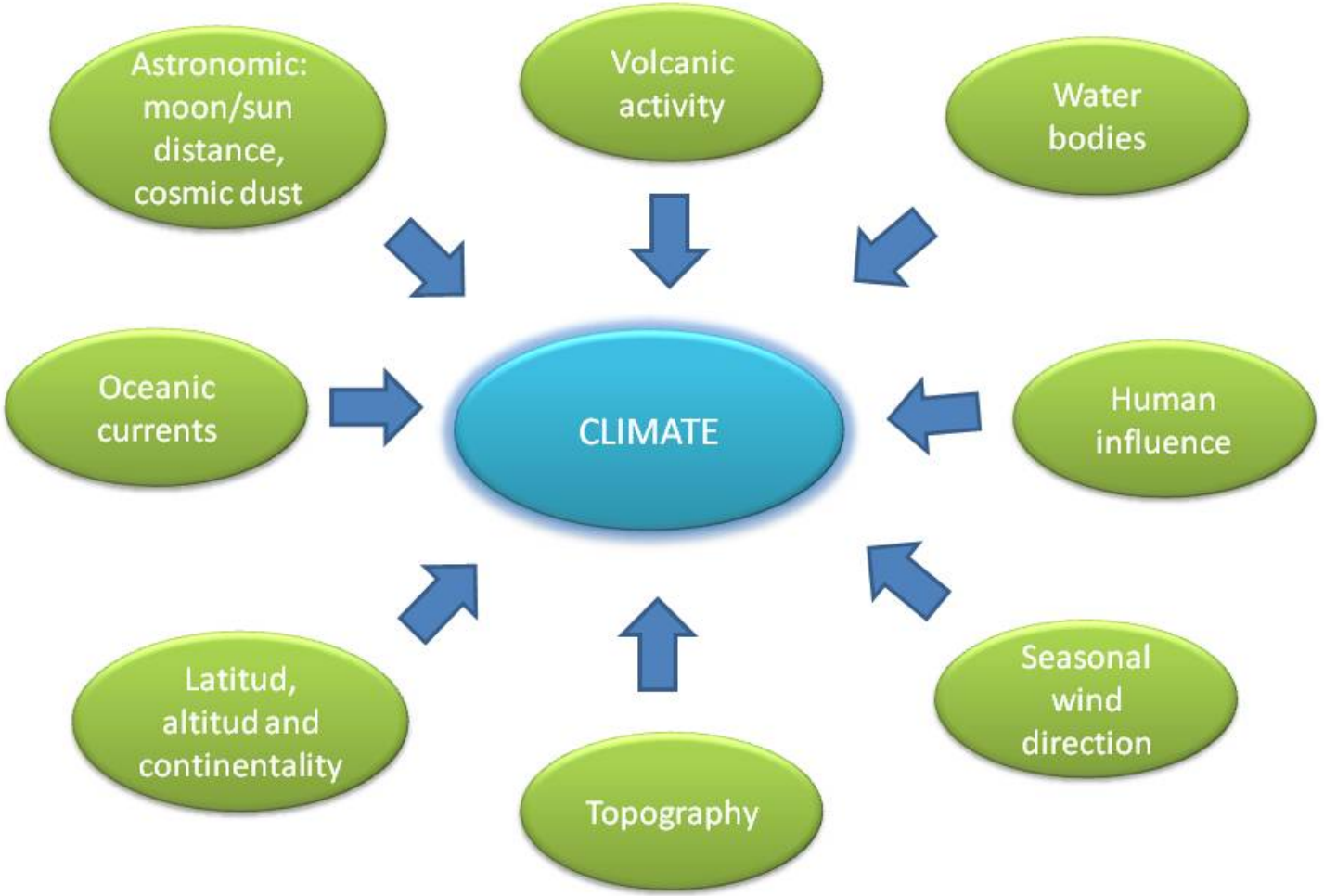
Slide information source: CNRD-PEDRR (2

Weather is not the same as climate

- **Weather** is an atmospheric condition present or expected over a short period of time (1-3 days) in a specific place. e.g. cloud, rainfall, heatwave, wind, hurricane, etc, in London, Barcelona,...
- **Climate** is the average of many weather conditions over a period of months, years or decades, at sub-national, international and global levels. E.g. Drought-prone climates of southern England, Spain, Southern Europe, etc.
- We focus on climate because
  - It tells us about future conditions
  - It determines the weather

Slide adapted from: CNRD-PEDRR (2012)

Factors that influence climate



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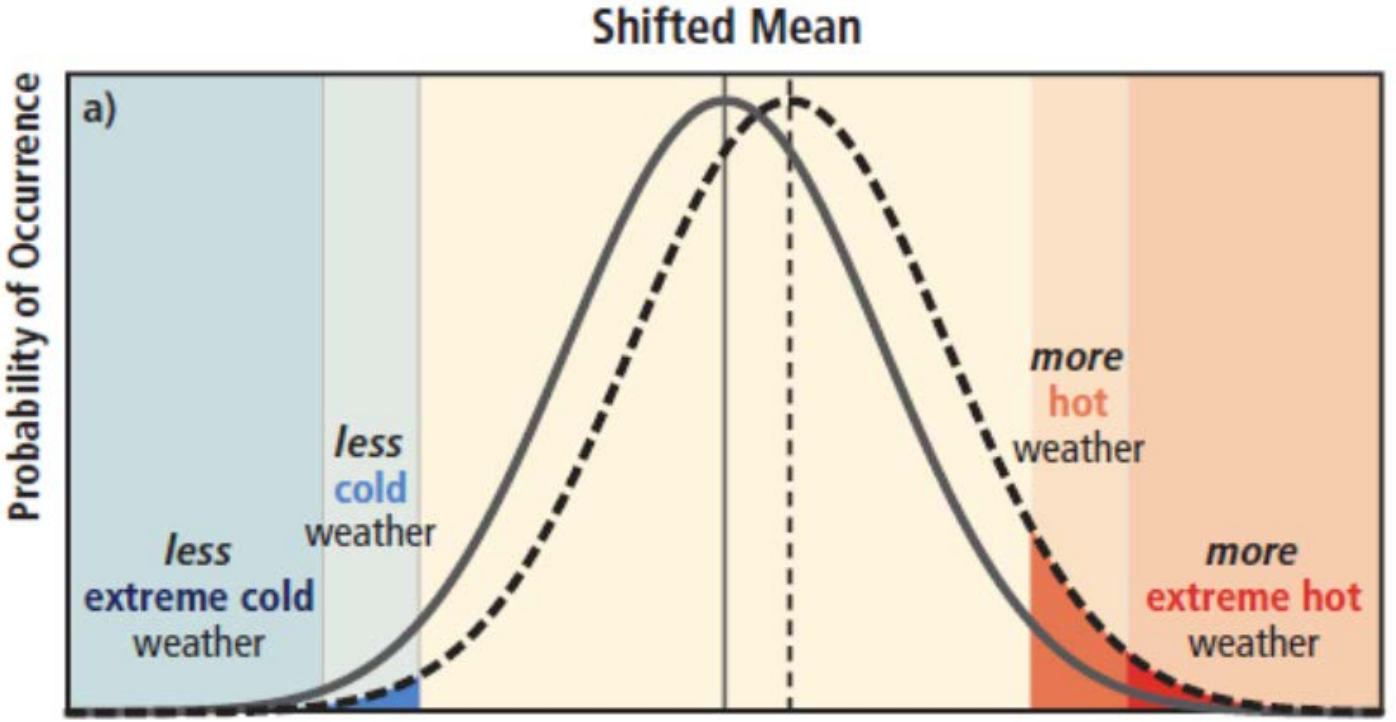
Climate is changing

- Shifted means, e.g. temperatures
  - Glacial retreat, sea-level rise (IPCC, 2008)



IPCC, 2012: Summary for Policymakers p.5

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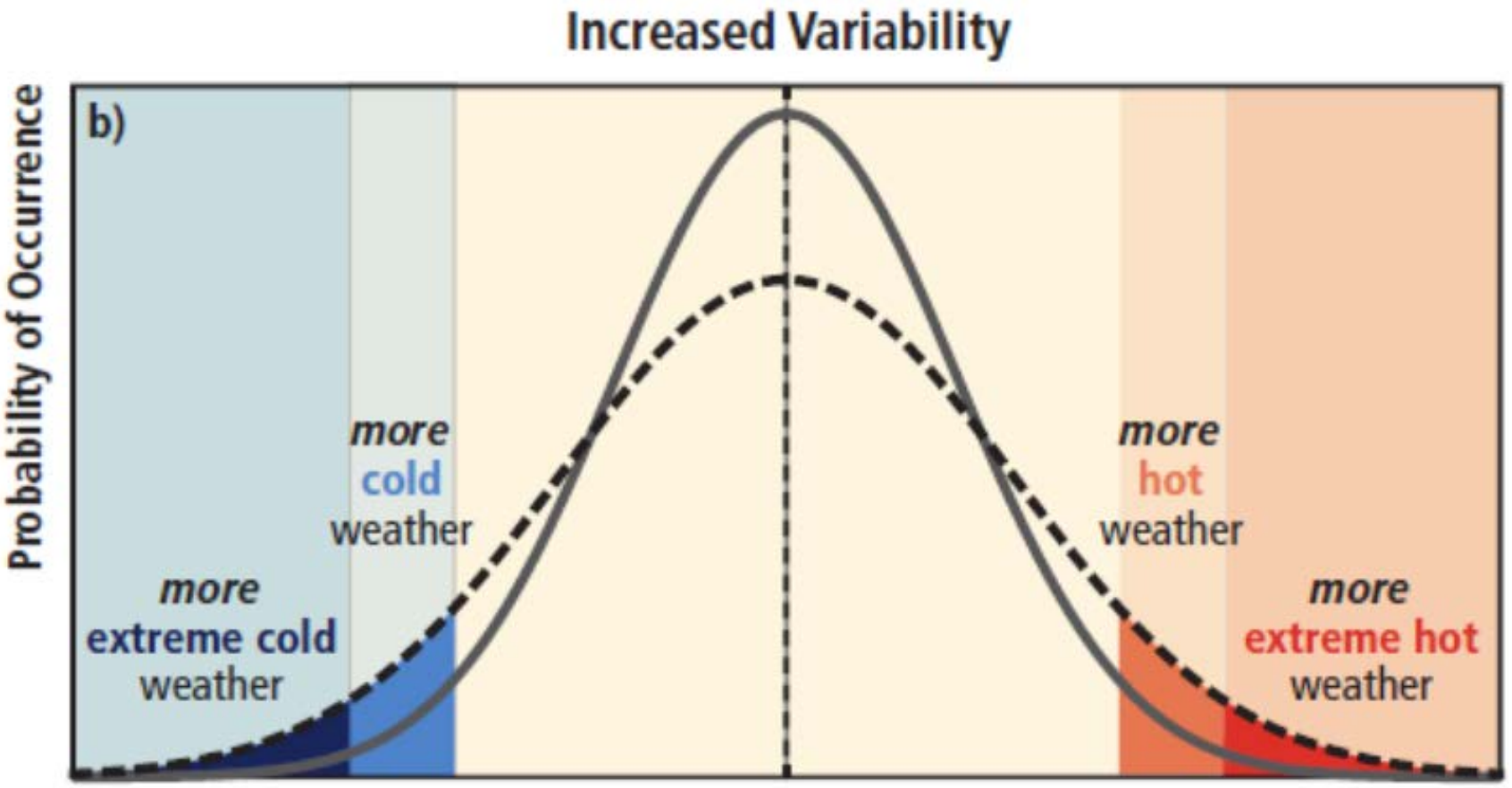
Climate is changing

- Increased variability



IPCC, 2012: Summary for Policymakers p.5

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Examples of past and future impacts of increased variability (IPCC, 2012)

There is *medium confidence* that some regions of the world have experienced more intense and longer droughts

- e.g. southern Europe and West Africa

There is *medium confidence* that, in some regions, increases in heavy precipitation will occur despite projected decreases in total precipitation in those same regions

There exists a *medium level of confidence* that droughts will intensify in some areas of the planet during the coming century

- Southern and central Europe, the Mediterranean region, central North America, Central America and Mexico, northeast Brazil,and southern Africa

Climate Change Adaptation: definitions

- "In human systems, the process of adjustment to actual or expected climate and its effects, in order to moderate harm or exploit beneficial opportunities" (IPCC, 2012)
- In addition ... it entails (see Terwisscha van Scheltinga, et al. 2010):
  - "longer term programmes, ... undertaken to address the ... impacts associated with climate change within the broader setting of sustainable development taking into consideration the social, environmental and economical perspectives".
  - "addressing issues of vulnerability, uncertainty and complexity, ... at different scales."

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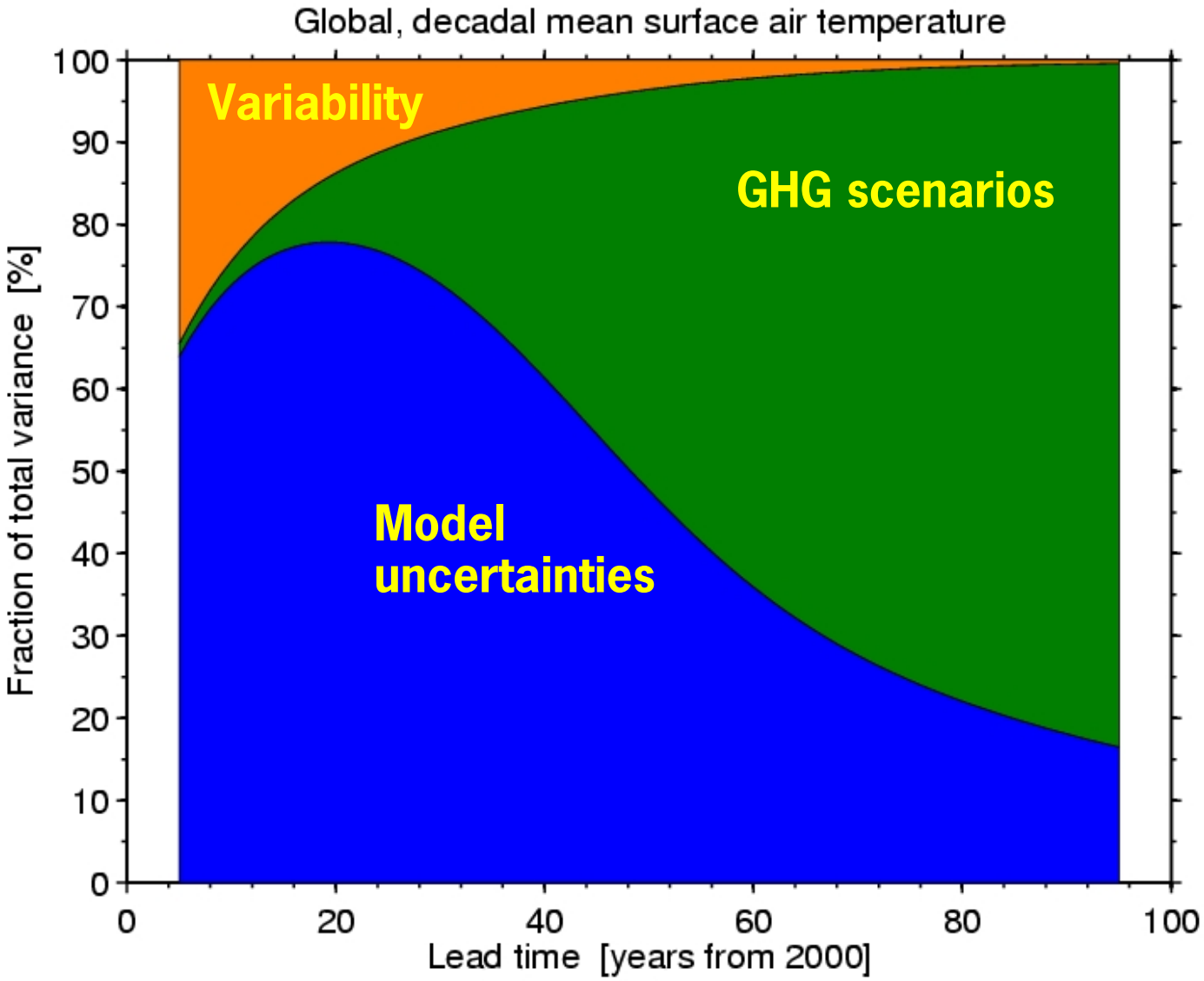
So, what are we adapting to?

- **Climate Change Adaptation** is adaptation in the face of
  - long term changes in climate, e.g. regional shifts in the rainy season; in mean temperature
  - stressor events, i.e. extreme weather events
  - … and the impacts of the above (social, environmental, economic, etc.)
  - … and uncertainty about in what form and when those changes and events may occur

Relative importance of sources of uncertainties in climate models over time



Slide source: (Ludwig,2012)

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What is adaptation and mitigation?

- **Adaptation** is a process leading to „an alteration in the state of a system in response to a stressor in which key variables are conserved or enhanced“ (Pelling et al., 2008: p870)
- **Adaptive capacity** is the ability of a system to make such an alteration a positive thing (Brooks & Adger, 2007)
- **Mitigation** (in climate change terms) is „the prevention of dangerous interference within the climate system“

Resilience, sustainability, adaptation

- **Resilience** is a characteristic of a system which determines to what degree it can:
  - „anticipate, absorb, accommodate, or recover from the effects of a hazardous event in a timely ... manner, ... through ensuring the preservation, restoration, or improvement of its essential basic structures and functions“ (IPCC, 2012)
- **Sustainability** is a characteristic which determines to what degree it can conserve itself in the long term
- **Adaptation** and **adaptive capacity** *can* lead to high levels of system resilience/ sustainability

Adaptation is an everyday thing

- We are all adapting at all times, at different levels
  - Development of intelligence
  - Evolution
  - Motor-sensory development
  - Phenotypic developments
  - Monitoring, appraisal, revision and decision-making
- Ecosystems and societies continuously adapt
- „let's start adapting“ is a naïve proposal

Adaptation is a common sense response to danger and uncertainty

- What would you do …
- If you knew that a negative event was going to happen in some point in the future, but you are not sure when or what the impacts of it will be, and you want to make sure you are resilient to whatever happens?

Don't put all your eggs in one basket!

- Manage the risk
  - Implement multiple measures so that if one fails another one may work
  - Try to prevent impacts, rather than fixing things after the impact
  - Try not to spend all your money on one solution if you know it could fail
- Keep monitoring the situation
- Learn about the situation and potential hazards and risks

Don't put all your eggs in one basket!

- Don´t do something you cannot easily change, should you receive new information
- If you can, test out and experiment with different approaches
- Get some help from others, surround yourself with potential help - (participation!)

What is successful adaptation? - a discussion topic -

- If, after severe extreme weather events and long term climate change, the elements that are key to the integrity of a system remain
- Society: … what we perceive or choose to be the key elements to preserve
- Ecosystem: … no such thing as „successful“?
  - Depends on scale; depends on what we decide?
- Climate change adaptation effects ecosystems and society, but is ultimately a human construct and involves societal decision-making

Adaptive management

- the ability to carry out adaptive management is an inherent part of adaptive capacity
- It is a 'systematic process for improving management policies and practices by learning from the outcomes of implemented management strategies' (Pahl-Wostl, 2007b).
- It permits effective management under the types of high levels of uncertainty and complexity associated with future extreme climate change events (le Corre et al., 2010)

Slide adapted from Pahl-Wostl (2007))

Prescriptive views of adaptive management

- Adaptive managers should be
  - „applying management experimentally … to test hypotheses of effect“ (Allen & Gunderson, 2011: p1380)
  - implementing polycentric governance, social learning, widescale public and stakeholder participation, cross-sectoral analyses, transboundary management, a mixture of private and public financing and decentralisation of infrastructure (Pahl-Wostl, et al., 2007).

Setting the bar too high for adoption by managers?

- Adaptive management requires the implementation of „fundamental change“ and an „evolutionary step“ (Moench, 2010: p967)
- Tools and concepts that do not fit within current managerial institutions, related to authority, responsibility, and statutory as well as informal decision making processes, or that do not work within the dominant form of democracy (e.g. representative democracy), are not likely to be adopted (Borowski and Hare, 2007; Hare, 2011).

A non-prescriptive definition

- "Adaptive management starts with the decision about what it is that one desires to maintain in the face of change, and what one is prepared to sacrifice to be able to do so" (Hare, in preparation)
- A political decision for a society in facing climate change :
  - How do we identify key elements of a system?
  - What, if anything needs to be sacrificed to maintain these elements and why?

Adaptive governance

- Determines the institutional enabling environment for adaptive management
- Determines the formal and informal institutions of a management system (it laws, rules and agreements)
- **Polycentric governance** is the most resilient form (a claim by Huitema et al, 2009)
  - Authority is distributed and overlapping between different levels of governance
  - If one part fails the other will continue

Adaptive strategy examples

- Two examples:
  - Portfolio approach
  - Room for rivers

Adaptive strategies

- Adaptive strategies
  - are a tool of adaptive management
  - can increase the adaptive capacity of a system
  - support management under extreme uncertainty
  - are themselves adaptive
  - are effective in the face of different potential events
  - are composed of a portfolio of different measures

See also Mysiak et al (2010)

Adaptive strategies

- Adaptive strategies
  - Must avoid technological, financial and institutional lock-ins, so that they...
  - … can be modified in the face of changes in knowledge, goals, and climate
  - Should take into account environmental, economic and social sustainability goals

See also Mysiak et al (2010)

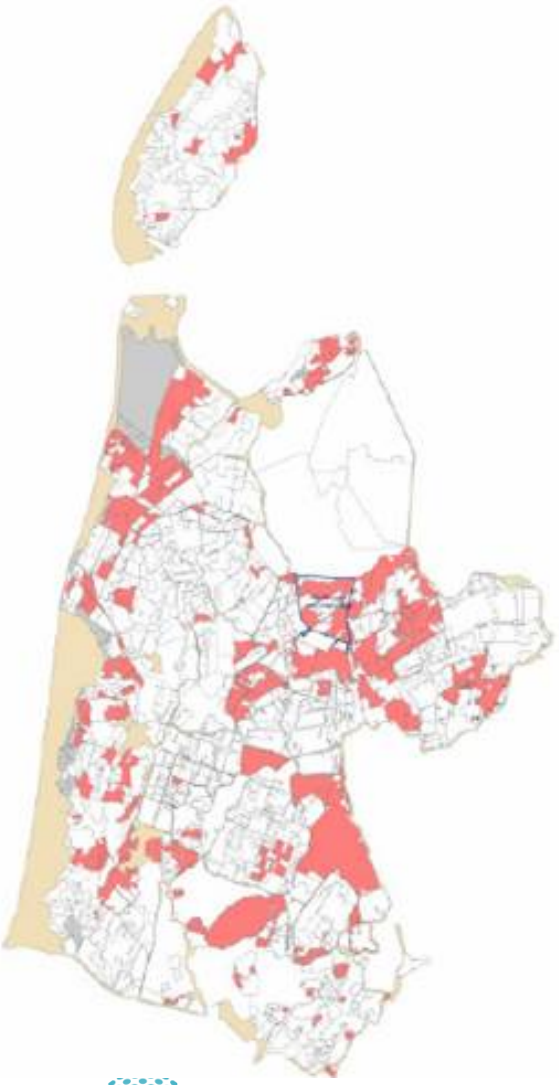
Portfolio approach

- **Function:** supports the selection of measures to create a strategy that reduce the overall risk
- **Description:** Adoption of multiple measures to cover and distribute the risk of being effected by extreme, uncertain events
- If you measure fails, another will cover the risk
- Includes tools for calculating the distribution of risk between measures using Modern Portfolio Theory
- See Aerts et al. (2008)

Case study from the Netherlands

Flood safety standards

Urban area: 1:100
Crops 1:50
Grassland, 1:10

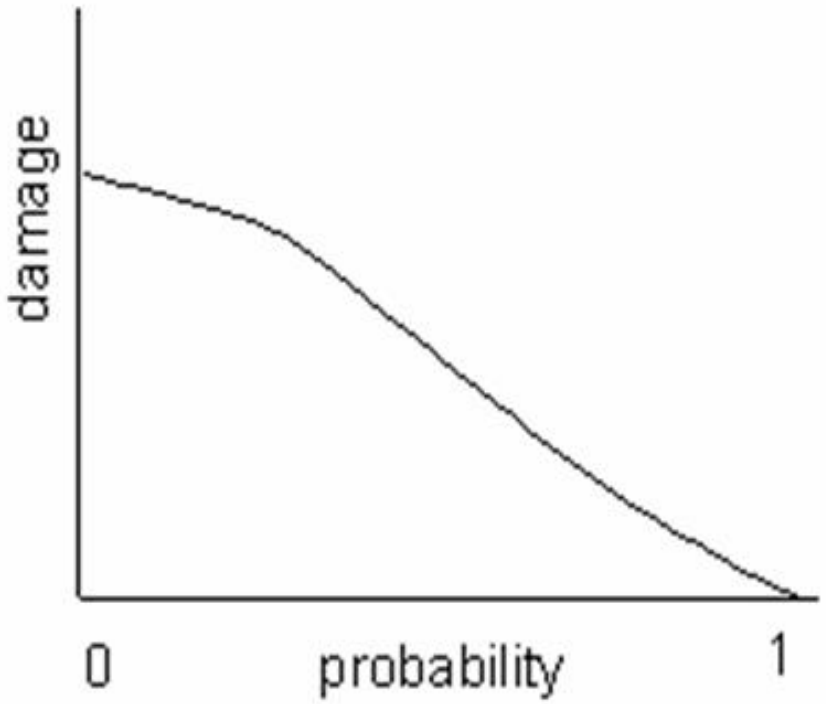


220 (red) of 1770 areas do not meet standards

Possible measures
•Pumping stations
•Storage areas
•Insurance

Slide adapted from Aerts (2007)

The damage risk curve

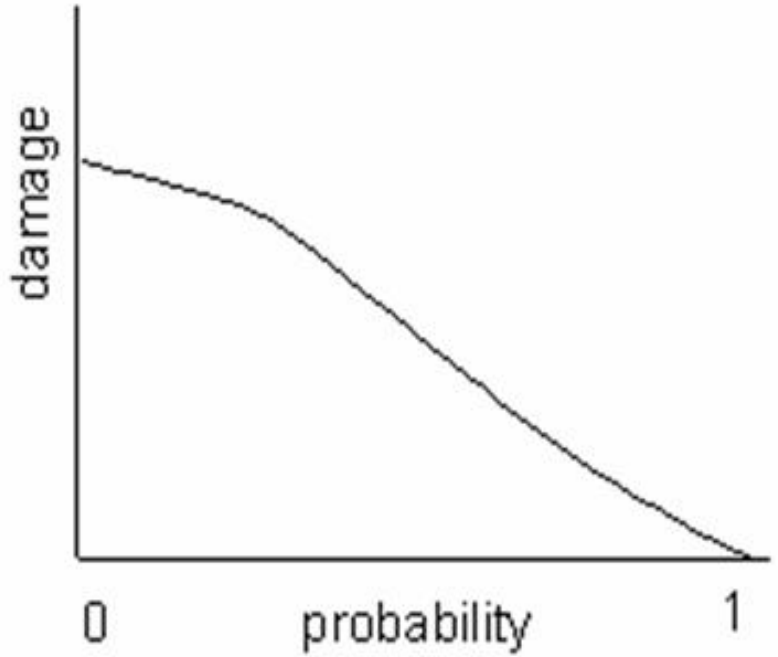


Source: Aerts et al. (2008)

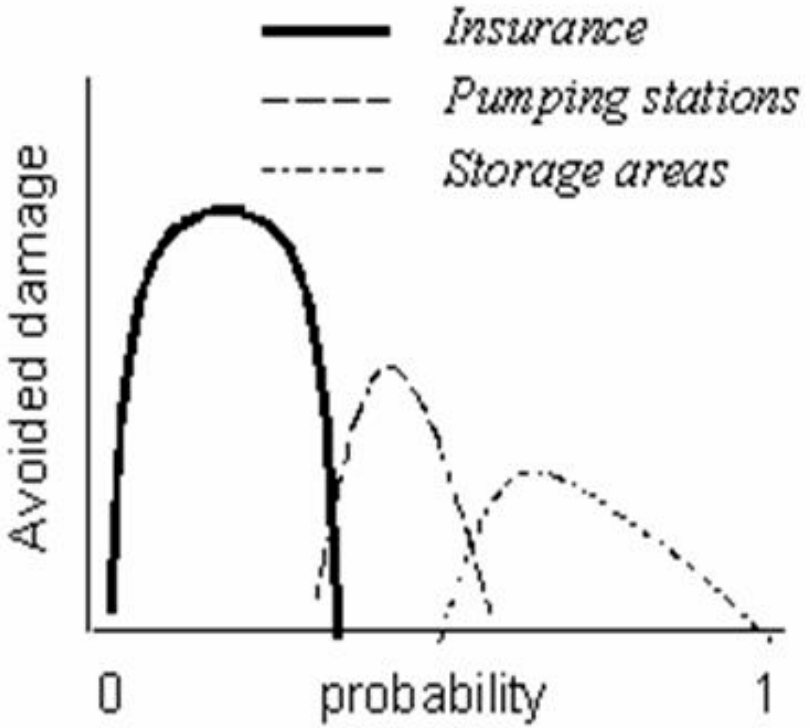
Slide adapted from Aerts (2007)

Covering risks with different measures

Damage without measures



Avoided damage



Source: Aerts et al. (2008)

Slide adapted from Aerts (2007)

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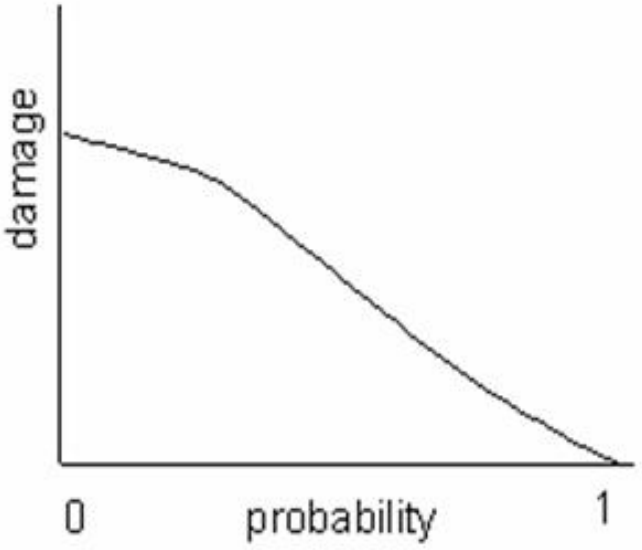
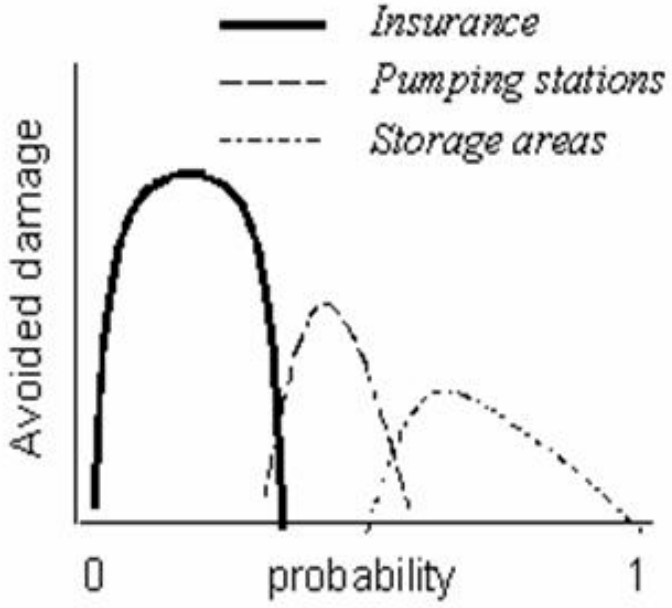
Reducing the overall damage risk curve

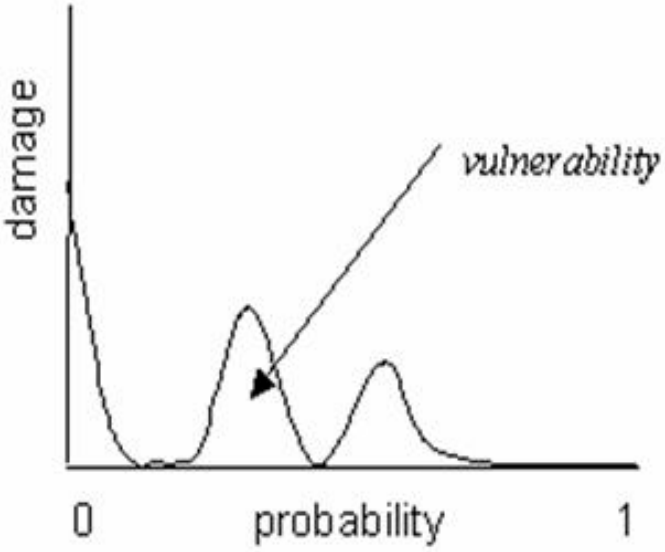
Damage without measures



Avoided damage



Damage with measures



Source: Aerts et al. (2008)

Slide adapted from Aerts (2007)

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Pros and Cons of Portfolio approach

- Pros
  - Conceptual as well as quantitative approach to selecting measures and estimating final risk of strategies
- Cons
  - The quantitative calculations are not trivial
- Further Information: Aerts et al. (2008)

Example adaptive strategy: Room for rivers

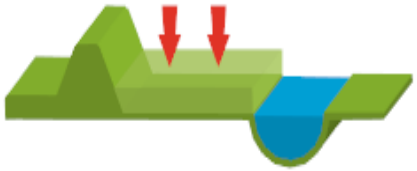
- Allow more room in the landscape into which rivers can flood without damaging livelihoods, property or infrastructure
- Institutional development:
  - Integration of spatial planning and water management
  - Changes in planning and zoning laws in floodplains
    - e.g. Housing, industry, agriculture ---> reserve
  - Compulsory land purchase; Temporary closure of land to human use
- Structural measures

How will the river be given more room?

(Structural measures ...)

http://www.ruimtevoorderivier.nl/meta-navigatie/english/types-of-measures/

Lowering of floodplains



Lowering (excavating) an area of the flood-plain increases the room for the river at high water levels.

Dike relocation

Relocating a dike land inwards increases the width of the floodplains and provides more room for the river.

Depoldering

The dike on the river side of a polder is relocated land inwards. The polder is depoldered and water can flood the area at high water levels.

Deepening summer bed

The river bed is deepened by excavating the surface layer of the river bed. The deepened river bed provides more room for the river.

Lowering groynes

Groynes stabilise the location of the river and ensure that the river remains at the correct depth.
However, at high water levels groynes can form an obstruction to the flow of water in the river. Lowering groynes increases the flow rate of the water in the river.

Removing obstacles

Water storage

The Volkerak-Zoommeer lake provides for temporary water storage when exceptional conditions result in the combination of a closed storm surge barrier and high river discharges to the sea.

High-water channel

A high-water channel is a diked area that branches off from the main river to discharge some of the water via a separate route.

Strengthening dikes

Dikes are strengthened in areas in which creating more room for the river is not an option.

Room for Rivers: Pros and Cons

- Pros
  - It can reduce human and material losses due to flooding
  - May increase the economic value of the region
  - Less need for costly raising of dykes
- Cons
  - The immediate impacts may be controversial. It needs a lot of political will, inter-ministry cooperation and public support to implement (and communication).
  - Compensation payments

Further Information: http://www.ruimtevoorderivier.nl/meta-navigatie/english/types-of-measures/

The International Scene: IPCC

- Intergovernmental Panel on Climate Change
- Established in 1988 by the WMO (World Meteorological Organization) and UNEP (*United Nations Environment Programme*).

What does the IPCC do?

- Analyses scientific information relevant to the understanding of climate change and its causes
- Interprets scientific data to project future possible risks and evaluates possible means of mitigating and adapting to these risks
- It does not do its own data collection but makes use of published literature and the expertise of panels of invited scientists to evaluate and interpret it
- Communicates its evaluations, projections and conclusions to decision makers.

The increasing importance of adaptation in international politics

2010	Parties affirmed that adaptation must be addressed with the same level of priority as mitigation. The Cancun Adaptation Framework is launched at the COP 16 (Cancun)
2006	The Nairobi work programme on impacts, vulnerability and adaptation to climate change“ is launched at the COP 12 (Nairobi)
2004	the first NAPA (Mauritania) was submitted to the UNFCCC secretariat
2003	Parties request initiation of works on scientific, technical and socio-economic aspects of impacts of, and vulnerability and adaptation to, climate change at the COP 9
2001	The LDC programme for technical guidance and advice to LDCs for the preparation and implementation of NAPAs is launched at COP 7 (Marrakesh)

Review Questions (for groups or individuals)

- In your own words explain and compare the terms resilience, adaptation and adaptive capacity.
- What is successful adaptation?
- What are the key non-normative features of adaptive management?
- Does a system always need to adapt to be resilient?
- What is a portfolio approach to managing risk?
- What is the difference between DRR and CCA? How do they relate to each other?

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