CCA & DRM
In the framework of EU Integration

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Jean Monnet Module: Disaster Risk Management in the framework of EU Integration

RISK AND VULNERABILITY

FAKULTETI EKONOMISË

UNIVERSITETI I TIRANËS

Outline of presentation:

- *The components of Risk*
  - *Quantitative Representation of Likehood*
    - *Qualitative Representation of Likehood*
    - *Quantitative Representation of Consequences*
    - *Qualitative Representation of Consequences*
  - *Changes in Disaster Frequency*
- *Computing Likehood and Consequence Values*
  - *Depth of Analysis*
  - *Quantitative Analysis of Disaster Likelihood*
  - *Examples of Modelling Techniques*
- *Risk Evaluation/ Vulnerability*

Risk is Unavoidable

- Risk on individual level
- Risk facing as a society-
- Large –scale hazards
- Disaster

Two components of Risk

Likehood × Consequence = Risk

Quantitative Representation of Likehood

Frequency

- four times per year, one time per decade, ten times each month……

Probability:

- four flood events in the past 200 years /this severity of flooding has a one-in-fifty chance of occurring in any given year, or a probability of 2 percent, or 0.02, each year.

Qualitative Representation of Like hood

• Certain: >99 percent chance of occurring in a given year (one or more occurrences per year)

• Likely: 50–99 percent chance of occurring in a given year (one occurrence every one to two
years)

Possible: 5–49 percent chance of occurring in a given year (one occurrence every two to twenty
years)

• Unlikely: 2–5 percent chance of occurring in a given year (one occurrence every twenty to fifty
years)

• Rare: 1–2 percent chance of occurring in a given year (one occurrence every fifty to one hundred
years)

• Extremely rare: <1 percent chance of occurring in a given year (one occurrence every one hundred
or more years)

Consequence

- 1. Deaths/fatalities (human)
- 2. Injuries (human)
- 3. Damages (cost, reported in currency)

Direct effects

- Fatalities
- Injuries
- Cost of repair or replacement of damaged or destroyed public and private structures
- Loss of possessions
- Relocation costs/temporary housing
- Loss of agriculture and livestock
- Loss of business inventory/facilities/equipment/information
- Loss of usable land
- Community response and cleanup costs incurred
- Loss of historical documents or records

Indirect effects

- Loss of livelihoods/income potential
- Input/output losses of businesses
- Loss of community population
- Loss of community character
- Loss of critical services due to organization or business losses
- Reductions in business/personal spending (“ripple effects”)
- Loss of institutional/tacit knowledge
- Mental illness/psychosocial impacts
- Bereavement/emotional loss

Tangible vs Intangible effects

- Cost of building

  repair/replacement

  - Response costs
  - Loss of inventory or possessions
  - Loss of wages
  - Loss of tax revenue
  - Loss of trained or technical staff

- Cultural impacts
  - Stress
  - Mental illness
  - Loss of community character
  - Poor morale
  - Consequences of a damaged environment
  - Increased health risks
  - Sentimental value
  - Environmental losses (aesthetic value)

Benefits or Positive effects ?????

- Decreases in future hazard risk by preventing rebuilding in hazard-prone areas
- New technologies used in reconstruction that result in an increase in quality of services
- Removal of old/unused/hazardous buildings
- Jobs created in reconstruction
- Greater public recognition of hazard risk
- Otherwise-unobtainable funds available for development or disaster risk reduction
- Environmental benefits (e.g., fertile soil from a volcano)
- Community cohesion

Quantitative reporting of consequences

- *Deaths/fatalities. 55 people killed.*
- *Injuries. 530 people injured, 56 seriously.*
- *Damages. $2 billion in damages, $980 million in insured losses.*

Qualitative reporting of consequences

- None. No injuries or fatalities.
- Minor. Small number of injuries but no fatalities. First aid treatment required.
- Moderate. Medical treatment needed but no fatalities. Some hospitalisation.
- Major. Extensive injuries, significant hospitalisation. . . .
- Catastrophic. Large number of severe injuries. Extended and large numbers requiring hospitalisation. . . . Significant
- Fatalities. (EMA 2000)

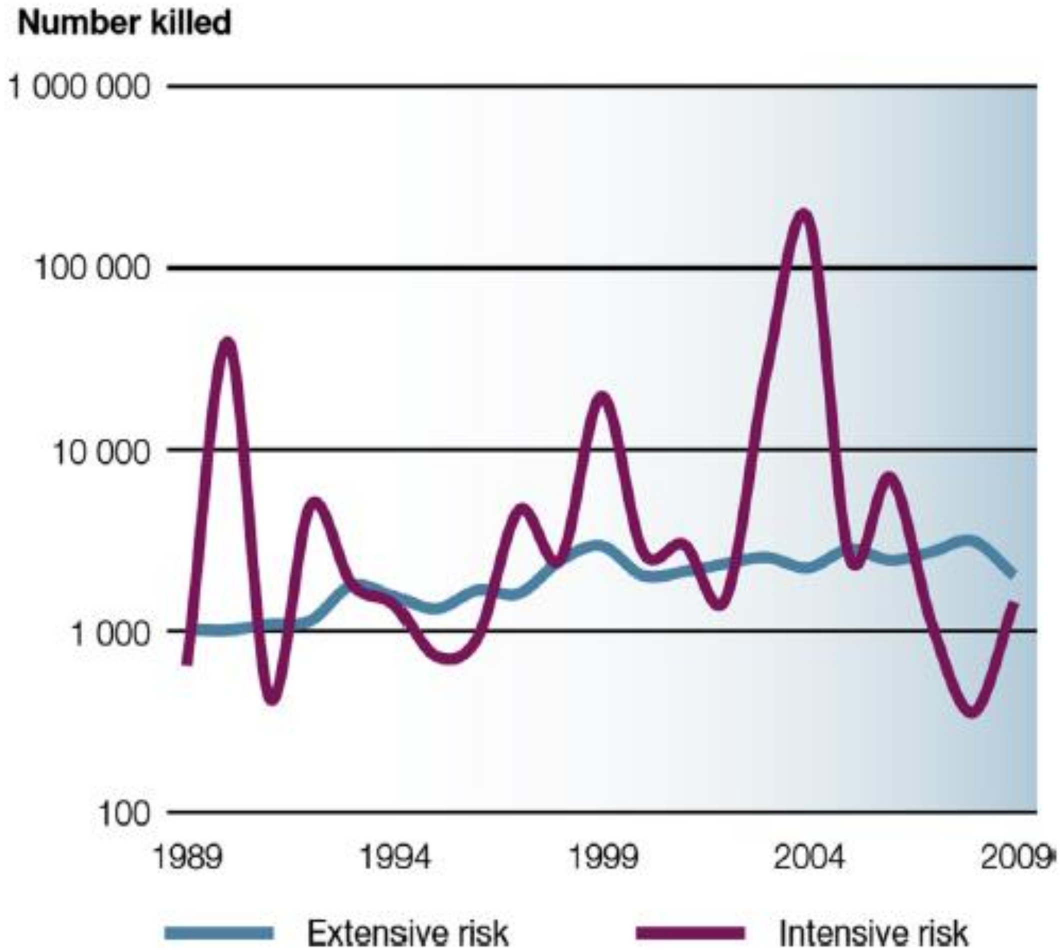


FIGURE 3.1

Mortality from extensive and intensive disasters between 1989 and 2009, in 21 countries in Africa, Asia, Latin America, and the middle East (including Argentina, Bolivia, Chile, Colombia, Costa Rica, Ecuador, El Salvador, Guatemala, India [Orissa and Tamil Nadu], Indonesia, Iran [Islamic Republic of], Jordan, Mexico, Mozambique, Nepal, Peru, Panama, Sri Lanka, Syrian Arab Republic, Venezuela, and Yemen)

Source: UNISDR, 2012.

CHANGES IN DISASTER FREQUENCY

- *Population growth.*
- *Land pressure.*
- *Economic growth.*
- *Technological innovation.*
- *Social expectations.*
- *Growing interdependence.*

DEPTH OF ANALYSIS

1. *Calculate the (quantitative) likelihood of each identified hazard*
2. *Calculate the (quantitative) consequences that are expected to occur for each hazard in terms of human impacts and economic/financial impacts.*
3. *Develop a locally tailored qualitative system for measuring the likelihood and consequence of each hazard identified as threatening the community.*
4. *Translate all quantitative data into qualitative measures for each hazard's likelihood and consequence.*

QUANTITATIVE ANALYSIS OF DISASTER LIKELIHOOD

"In country X, it is predicted that there will be three major snowstorms per year." (For major events that occur less frequently, like a major flood, this number may be less than one. A 20-year flood has a 5 percent chance of occurring in any given year, or would be expected to occur 0.05 times per year.)

The hazard can now be analyzed according to the chosen standard. If the hazard is one that has been divided into individual intensities and magnitudes, a separate figure will be required for each magnitude or intensity.

QUANTITATIVE ANALYSIS OF DISASTER CONSEQUENCES

1. Historical data
2. Teknikat e modelimit

- CAMEO (Computer-Aided Management of Emergency Operations): Used to plan for and respond to chemical emergencies.
- CATS (Consequence Assessment Tool Set): A disaster analysis system for natural and technological hazards used before a disaster to create realistic scenarios for training and planning, during a disaster to estimate damages, and after a disaster to assess needs and locate resources for a sustained response. CATS is used for hurricanes, storm surges, and earthquakes.
- WaterRisk: A floodplain information management application that allows floodplain managers to manipulate and utilize the information currently generated by existing flood-modeling software.
- EM-Tools: A suite of modules developed by Canada's Office of Critical Infrastructure Protection and Emergency Preparedness (OCIPEP) to estimate earthquakes, floods, hazardous materials, and other hazards.
- TUFLOW: Simulates flooding in major rivers; complex overland and piped urban flows; estuarine and coastal tide hydraulics; and inundation from storm tides. It is currently the most widely-used flood modeling software in the UK and in Australia.
- KLAPS: The Korea Local Analysis and Prediction System investigates the relationship between existing weather conditions and past disasters to predict future events; this model only provides

The depth of analyses

1. *Abbreviated Damage Consequence Analysis-*

two sets of data are required.

2 Full Damage Consequence Analysis

Losses to structures

Losses to contents.

Losses to structure use and function and cost of displacement.

The depth of analyses

Structure Loss						Contents Loss					
Name/ Description of Structure	Structure Replacement Value ($)	x	Percent Damage (%)	=	Loss to Structure ($)		Replacement Value of Contents ($)	x	Percent Damage (%)	=	Loss to Contents ($)
		x		=				x		=	
		x		=				x		=	
		x		=				x		=	
		x		=				x		=	
		x		=				x		=	
		x		=				x		=	
		x		=				x		=	
		x		=				x		=	
Total Loss to Structure							**Total Loss to Contents**				

The depth of analyses

Structure Use and Function Loss (Task A.3.)									
Name/ Description of Structure	Average Daily Operating Budget **($)**	x	Functional Downtime **(# of days)**	+	Displacement Cost per Day **($)**	x	Displacement Time **($)**	=	Structure Use & Function Loss **($)**
		x		+		x		=	
		x		+		x		=	
		x		+		x		=	
		x		+		x		=	
		x		+		x		=	
		x		+		x		=	
		x		+		x		=	
		x		+		x		=	
Total Loss to Structure Use & Function									

Structure Loss + Content Loss + Function Loss ($)
Total Loss for Hazard Event

Table 3.2 An Example of a Qualitative Consequence Measurement System

Descriptor	Human Life and Health	Property, Financial, Environmental
Insignificant	No injuries or fatalities. No displacement of people or displacement of only a small number of people for short duration. Little or no personal support required (support not monetary or material).	Inconsequential or no damage. Little or no disruption to community. No measurable impact on environment. Little or no financial loss.
Minor	Small number of injuries but no fatalities. First aid treatment required. Some displacement of people (less than 24 hours). Some personal support required. Some disruption (less than 24 hours).	Some damage. Small impact on environment with no last effects. Some financial loss.
Moderate	Medical treatment required but no fatalities. Some hospitalisation. Personal support satisfied through local arrangements.	Localised damage that is rectified by routine arrangements. Normal community functioning with some inconvenience. Some impact on environment with no long-term effect or small impact on environment with long-term effect. Significant financial loss.
Major	Extensive injuries, significant hospitalisation, large number displaced (more than 24 hours' duration). Fatalities. External resources required for personal support.	Significant damage that requires external resources. Community only partially functioning, some services unavailable. Some impact on environment with long-term effects. Significant financial loss—some financial assistance required.
Catastrophic	Large number of severe injuries. Extended and large numbers requiring hospitalisation. General and widespread displacement for extended duration. Significant fatalities.	Extensive personal support. Extensive damage. Community unable to function without significant support. Significant impact on environment and/or permanent damage.

Source: EMA, 2000.

Risk Evaluation

Risk evaluation is conducted to determine the relative seriousness of hazard risks, whether for a country, community, or other focal area.

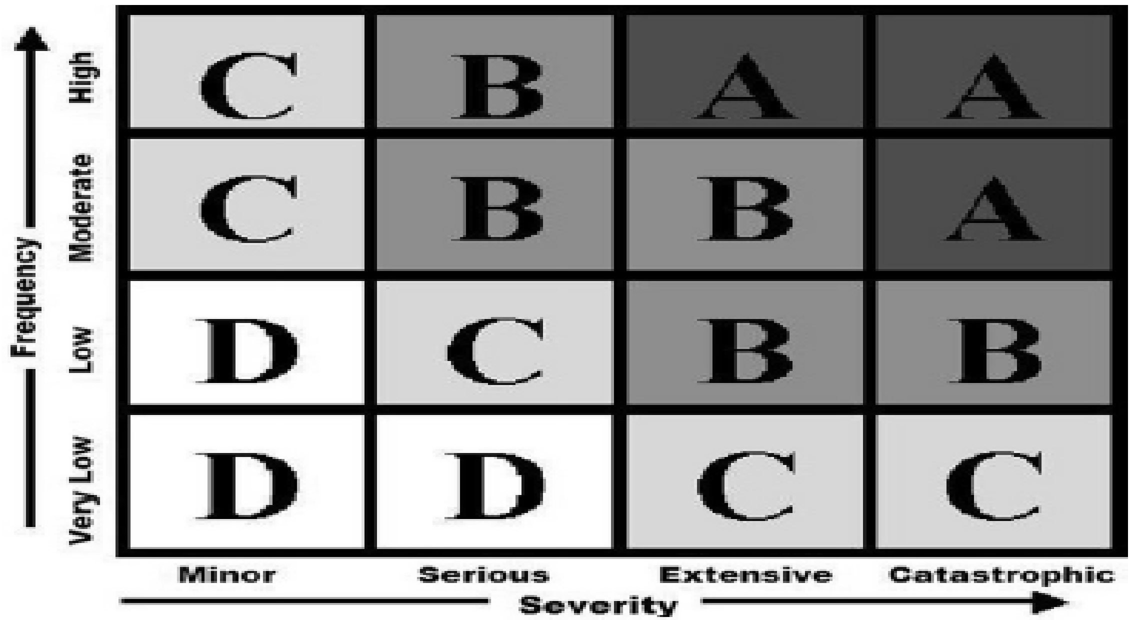
There are a number of proven methods through which prioritization of risk treatment can occur, including:

- Creating a risk matrix

- Comparing hazard risks against levels of risk estimated during the analysis process with previously established risk evaluation criteria

- Evaluating risks according to the SMAUG methodology (seriousness, manageability, acceptability, urgency, growth)

Risk Evaluation



Risk Evaluation

record risk evaluation results using a standard form

•Name of the hazard (including specific magnitude and/or intensity if it has been broken down into subcategories)
• Qualitative likelihood value
• Qualitative consequences value
• Class or level of risk as determined by evaluation on the risk matrix
• Priority rating
Additional information, including any of the following:
• Description of possible consequences
• Adequacy of existing mitigation measures or controls
• Known mitigation options and alternatives
• Acceptability of risk

The purpose of evaluating Risk

1. Identify which risks require referral to other agencies (i.e., is the risk one that is better mitigated

by another local, regional, or national agency rather than one that needs to be considered for mitigation

options by the agency tasked with disaster risk management?).

2. Identify which risks require treatment by the disaster risk management agency or office.

3. Further evaluate risks using judgment based upon available data and anecdotal evidence to determine

the accuracy of the final risk value assigned.

Risk acceptability- SMAUG Approach

1. Seriousness

a. The risk will affect many people and/or will cost a lot of money.

b. The risk will affect few or no people or will cost little or nothing.

2. Manageability

a. The risk could be affected by intervention.

b. The risk cannot be affected by intervention.

3. Acceptability

a. The risk is not acceptable in terms of political, social, or economic impact.

b. The risk will have little political, social, or economic impact.

4. Urgency

a. The risk urgently needs to be fixed.

b. The risk could be fixed at a later time with little or no repercussions.

5. Growth

a. The risk will increase quickly.

b. The risk will remain static (Lunn 2003)- Frequency, Awareness

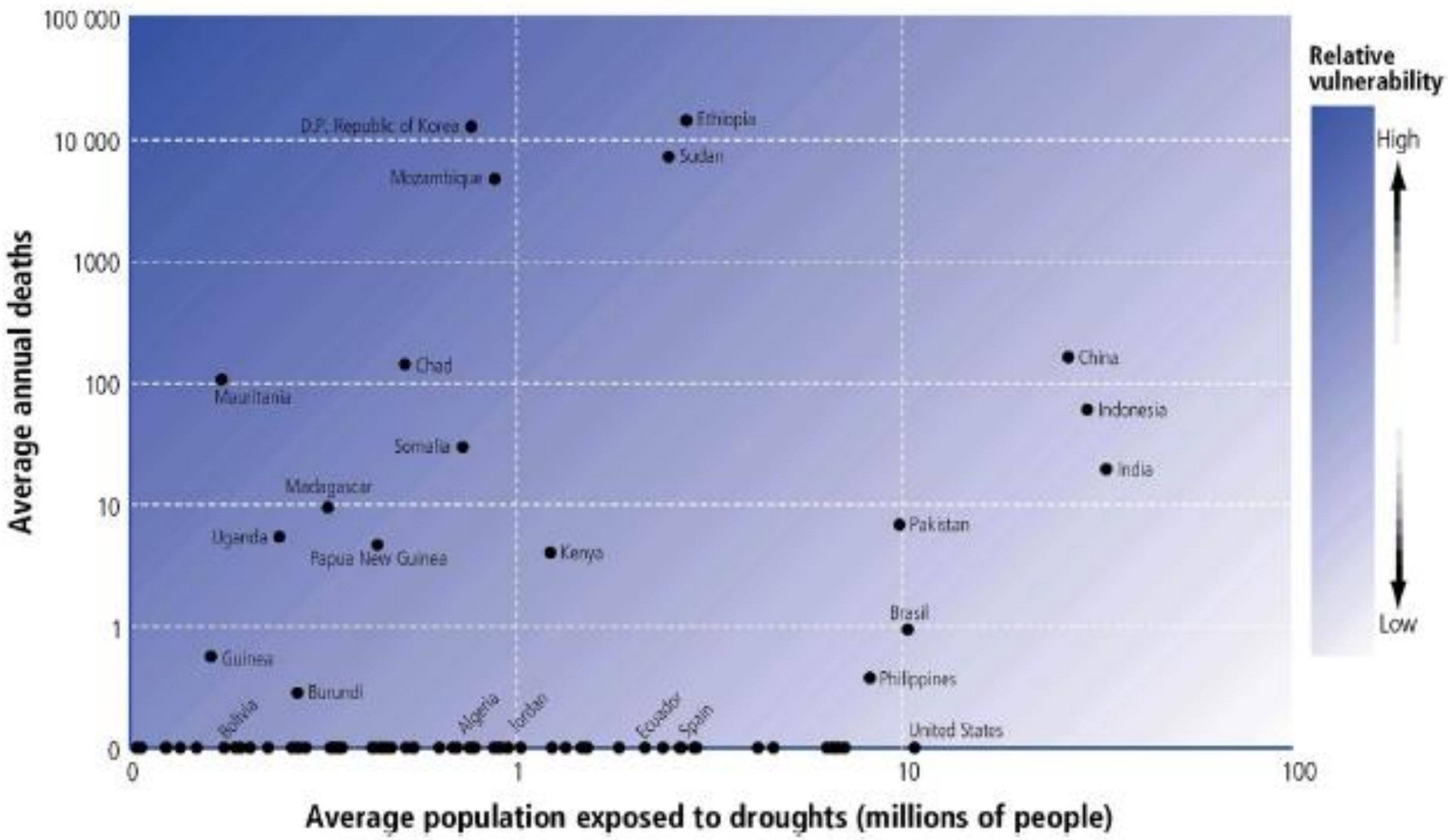


FIGURE 3.10

National vulnerabilities to drought risk as a factor of population exposure

Vulnerability

Physical Profile- geography, infrastructure, and populations

- Land cover (vegetation)
- Soil type
- Topography
- Slope
- Aspect (the direction something such as a mountain slope faces)
- Water resources (lakes, rivers, streams, reservoirs, etc.)
- Wetlands and watersheds
- Seismic faults
- Climate (wind, rainfall, temperature)

Infrastructure factors

- Land use
- Location and construction material of homes
- Location and construction material of businesses
- Zoning and building code delineations
- Critical infrastructure components
- Hospitals and clinics

Vulnerability

Schools
- Senior citizen centers
- Daycare/child care centers
- Government and other public facilities
- Prisons and jail facilities
- Power generation facilities and transmission
- Water purification facilities and pipes
- Wastewater treatment and sewer lines
- Gas lines
- Oil and gas transport pipelines
- Oil and gas storage facilities
- Transportation systems
- Roads and highways
- Railroads
- Airports
-

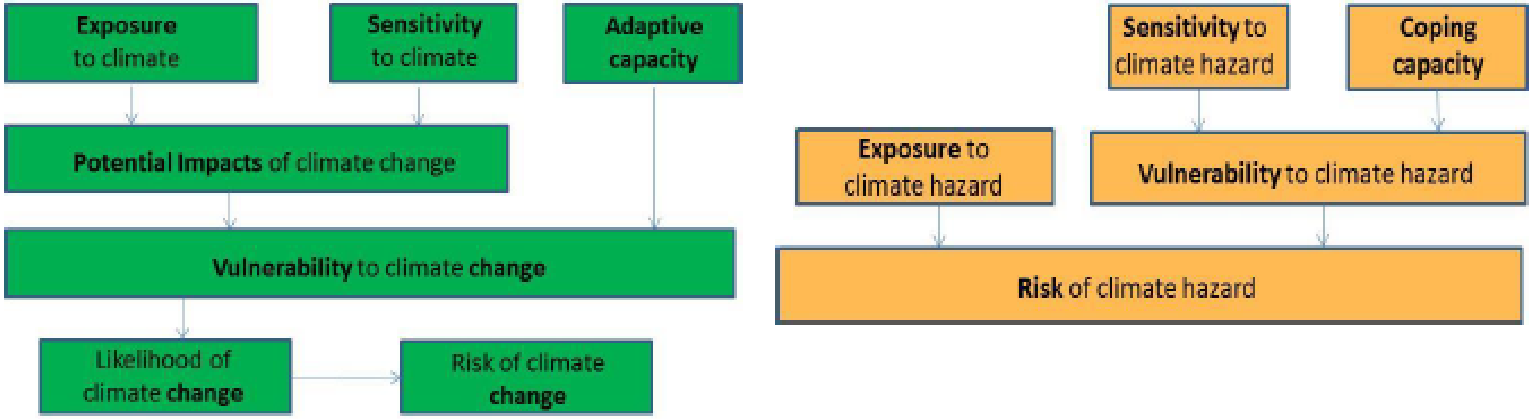
Public transportation systems
- Waterways and port facilities
- Bridges
- Communication facilities
- Landfills
- Dikes and flood protection structures and facilities
- Nuclear power generation plants
- Dams
- Military installations
- Industrial sites that manufacture and/or store hazardous materials
- Emergency management systems
- Ambulance services
- Fire services
- Law enforcement services
- Emergency first response services
- Early warning systems

Vulnerability

Social Profile
Religions
• Age breakdown
• Gender-related issues
• Literacy
• Language
• Health
• Politics
• Security
• Human rights
• Government and governance (including social services)
• Social equality and equity
• Traditional values
• Customs
• Culture

THE ECONOMIC PROFILE
• Gross domestic product
• Debt
• Access to credit
• Insurance coverage
• Sources of national income
• Availability of disaster reserve funds
• Social distribution of wealth
• Prevalence of business continuity planning
• Economic diversity (the range of products and resources that drive the economy)
• Philanthropic giving

The evolution of the definition as per IPCC



2a. Framing of vulnerability assessment from a natural science/climate impacts viewpoint (subset of diagram from EEA (EEA, 2012)

2b. Framing of vulnerability assessment from a risk management, DRR and international development viewpoint – changes in terminology

Examples of Frameworks for Vulnerability Assessments

IPCC Technical Guidelines for Assessing Climate Change impacts and Adaptation 1998

UKCIP Risk, Uncertainty and Decision-making Framework

UKCIP Wizard

Climate-ADAPT Adaptation Support Tool

PROVIA Guidance on Assessing Vulnerability, Impacts and Adaptation to Climate Change

EU Adaptation Strategy Guidance

Sustainable Livelihoods Framework (SLF)

Literature

Coppola (2015) Introduction to international Disaster Risk Management

Assessing Adaptation Knowledge in Europe: Vulnerability to Climate Change- Final Report © Ecofys 2016 by order of: the European Commission, February 2017

Assessment of Vulnerability to Natural Hazards A European Perspective- Edited by Jörn Birkmann, Stefan Kienberger, David E. Alexander- Theoretical and Conceptual Framework for the Assessment of Vulnerability to Natural Hazards and Climate Change in Europe- Move framework