Lecture 19
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CM 615

Climate change Impacts & Adaptation

How risks, exposure & vulnerability are associated with extreme events?
Vulnerability assessment

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Evolution of Climate change Vulnerability assessment

- Burton et al. (2002), in broad agreement with Smit et al. (1999), points out that adaptation assessments can serve two distinct purposes.

- 'Type 1' adaptation research is carried out as part of a climate impact assessment by providing aggregate estimates to what extent feasible adaptation might reduce adverse impacts of climate change.

- 'Type 2' adaptation research contributes directly to adaptation policy development by identifying which adaptation policies are needed, and how they can best be developed, applied, and funded.

- The most appropriate assessment approach for a specific climate-sensitive sector and/or region depends on
  - the research or policy questions addressed;
  - the urgency of the threat;
  - the geographical and
  - the temporal scope of the analysis;
  - the reliability of future climate impact projections;
  - the level of previous knowledge; and
  - the availability of data, expertise, and other resources.

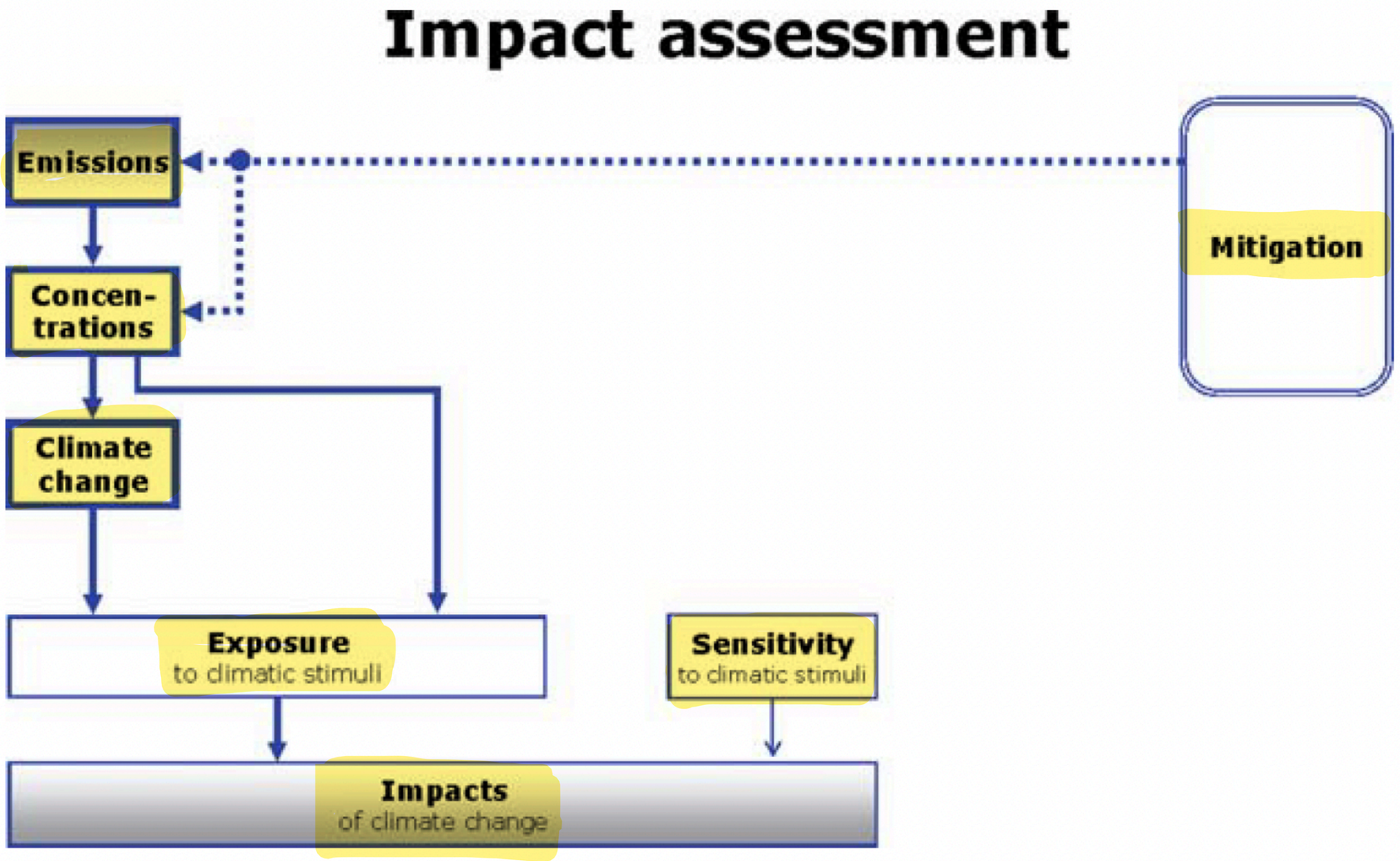

Figure 3. Conceptual framework for a (climate) impact assessment.

Vulnerability assessment (1st generation)

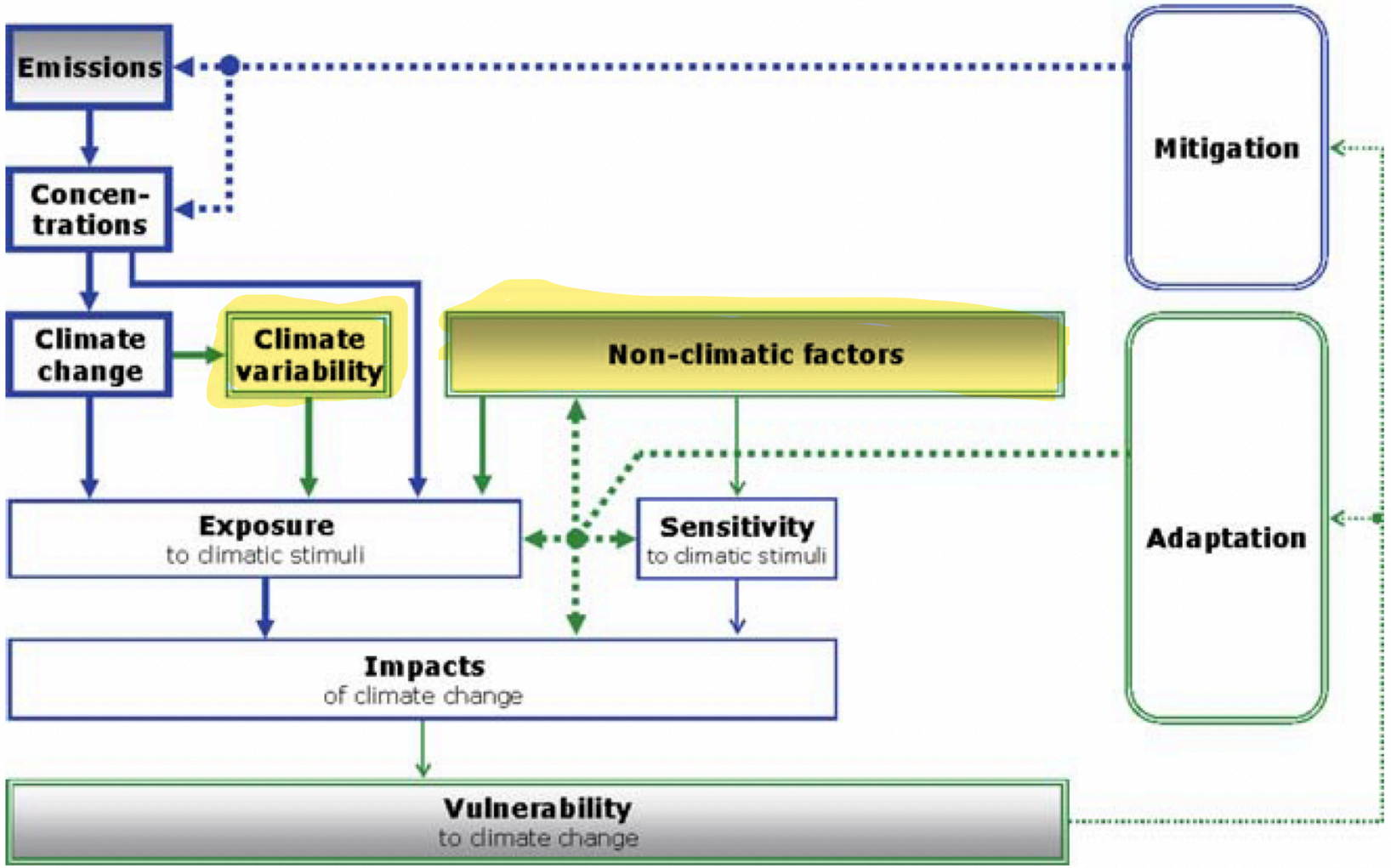

Figure 4. Conceptual framework for a first-generation vulnerability assessment.

Vulnerability: *The degree to which a system is susceptible to, or unable to cope with, adverse effects 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.*

- A (climate) vulnerability assessment is an extension of a (climate) impact assessment.
- We distinguish between two generations of (climate) vulnerability assessments.
- The step from climate impact assessment to first-generation vulnerability assessment is characterized primarily by the evaluation of climate impacts in termsof their relevance for society and by the consideration of potential adaptation.

Vulnerability assessment (2nd generation)

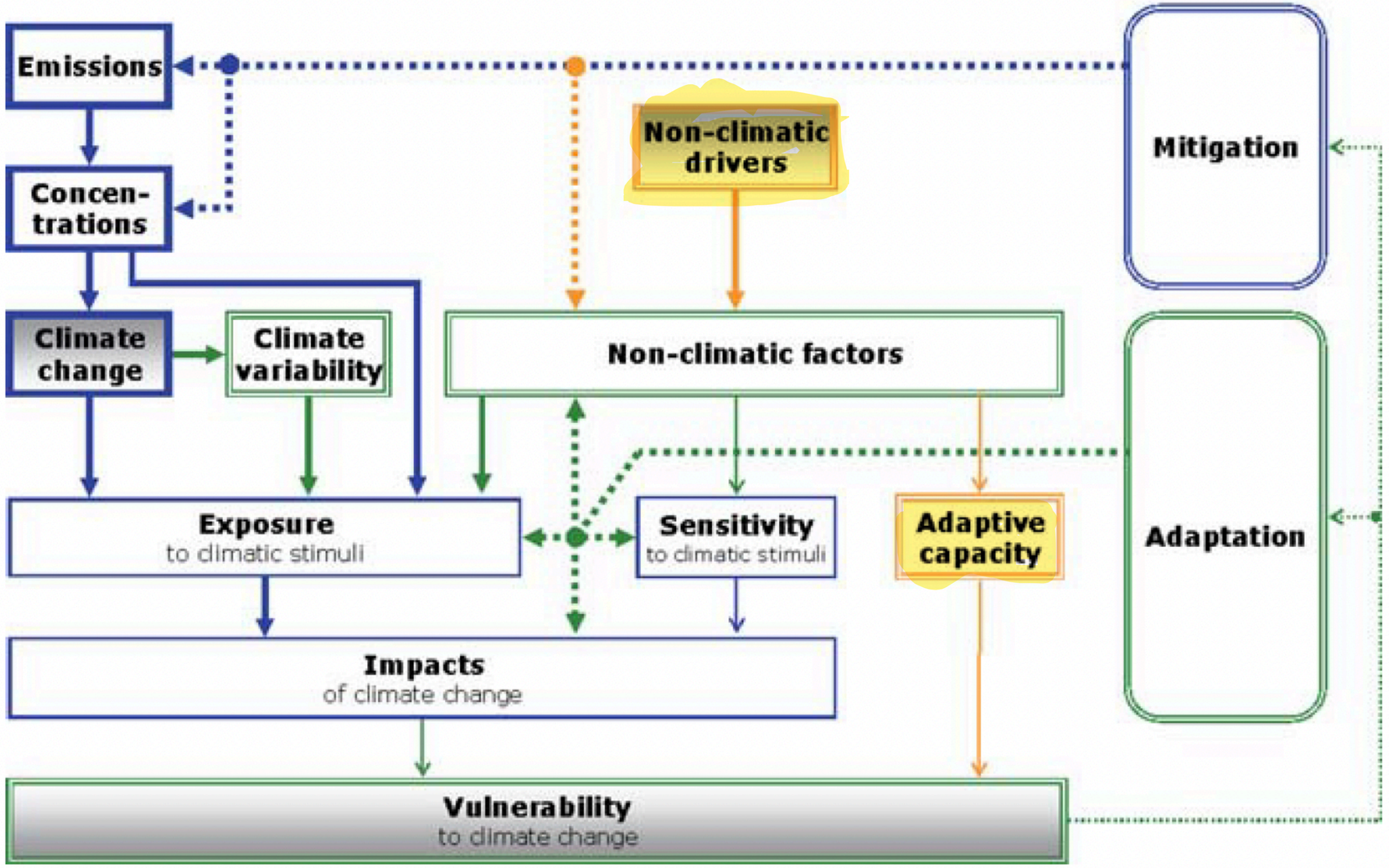

Figure 5. Conceptual framework for a second-generation vulnerability assessment.

- A (climate) vulnerability assessment is an extension of a (climate) impact assessment.
- We distinguish between two generations of (climate) vulnerability assessments.
- The step from climate impact assessment to first-generation vulnerability assessment is characterized primarily by the evaluation of climate impacts in termsof their relevance for society and by the consideration of potential adaptation.
- The main novelty of second-generation vulnerability assessments is the more thorough assessment of the adaptive capacity of people, thus shifting the focus from potential to feasible adaptation.

Reasons why the above discussed stages of Vulnerability assessment do not provide adequate information for the development of adaptation policy

- Insufficient consideration of more pressing immediate and short-term policy issues, in particular in developing countries.
- Insufficient knowledge of future climate conditions on the scale relevant for adaptation decisions.
- Insufficient consideration of diverse adaptation options in most climate impact models.
- Insufficient consideration of the factors determining the adaptation process itself, including adaptive capacity.
- Insufficient consideration of key actors and of the policy context for adaptation.

Burton et al. 2002, Fussel & Klein 2007

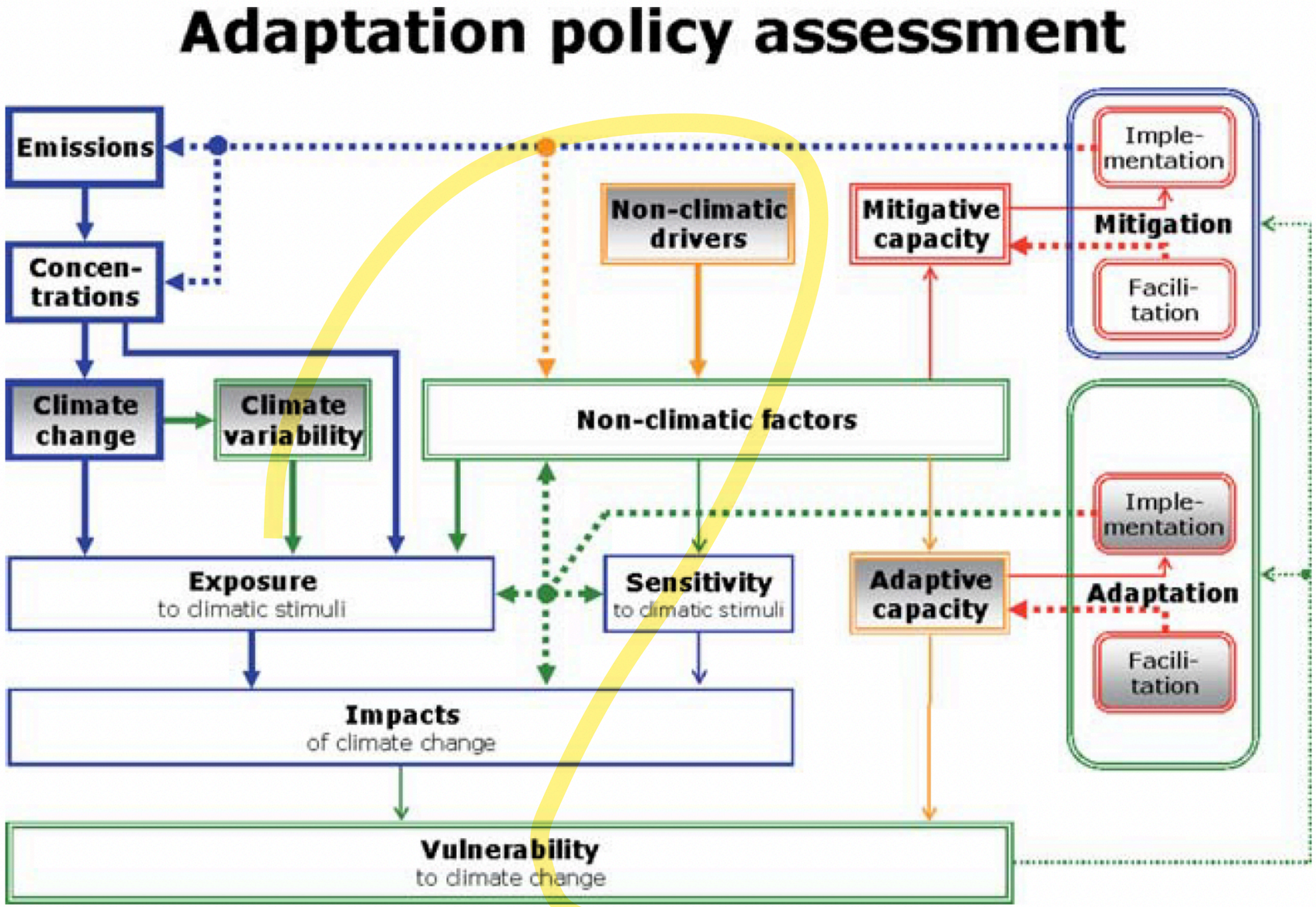

Figure 6. Conceptual framework for an adaptation policy assessment.

TABLE II
Characteristic properties of four different stages of climate change vulnerability assessment

	Impact assessment	Vulnerability assessment		Adaptation policy assessment
		First generation	Second generation	
Main policy focus	Mitigation policy	Mitigation policy	Resource allocation	Adaptation policy
Analytical approach	Positive	Mainly positive	Mainly positive	Normative
Main result	Potential impacts	Pre-adaptation vulnerability	Post-adaptation vulnerability	Recommended adaptation strategy
Time horizon	Long-term	Long-term	Mid- to long-term	Short- to long-term
Spatial scale	National to global	National to global	Local to global	Local to national
Consideration of climate variability, non-climatic factors, and adaptation	Little	Partial	Full	Full
Consideration of uncertainty	Little	Partial	Partial	Extensive
Integration of natural and social sciences	Low	Low to medium	Medium to high	High
Degree of stakeholder involvement	Low	Low	Medium	High
Illustrative research question	What are potential biophysical impacts of climate change?	Which socio-economic impacts are likely to result from climate change?	What is the vulnerability to climate change, considering feasible adaptations?	Which adaptations are recommended for reducing vulnerability to climate change and variability?

- Key characteristics of the four stages of climate change vulnerability assessment
- The most appropriate assessment approach for a specific climate-sensitive sector and/or region depends on
  - the research or policy questions addressed;
  - the urgency of the threat;
  - the geographical and
  - the temporal scope of the analysis;
  - the reliability of future climate impact projections;
  - the level of previous knowledge; and
  - the availability of data, expertise, and other resources.

Quantification of vulnerability

Quantitative assessment of vulnerability is usually done by constructing a ‘vulnerability index’. This index is based on several sets of indicators that result in the vulnerability of a region.

The literature on index number construction emphasizes that there should be good internal correlation between these indicators

However, the relevance of this criterion depends on the relationship between the indicators and the construct they are supposed to measure.

The index may be based on either (a) **reflexive** or (b) **formative** model

In reflexive measurement model, the construct is thought to influence the indicators. For ex. – ‘Poverty Index’ influences indicators such as literacy and expenditure (and are correlated)

In formative measurement model, the indicators are assumed to contribute to the construct. For ex. – all indicators of ‘Vulnerability Index’ have impact on vulnerability of a region to climate change
(frequency of extreme events such as flood, drought .. all contribute Vulnerability of the region to climate change)