
Climate Change: An Inter-disciplinary Approach to Problem Solving (CLIMATE 480 // NRE 480)

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Class Information and News

- Canvas site: [CLIMATE_480_001_W17](#)
 - Record of course
- Rood's [Class MediaWiki Site](#)
 - http://climateknowledge.org/classes/index.php/Climate_Change:_The_Move_to_Action
- Rood's Class Tumblr Site: <http://openclimate.tumblr.com>

Required Reading and Response

- Assignment: See Ctools
 - [Dilling and Lemos: Usable Science](#)
- Recorded – longer – version of this lecture
 - [Knowledge Systems](#)

Resources and Recommended Reading

- [Cash et al: 2002: Knowledge Systems](#)
- [Usable Science? Tang and Dessai \(2012\)](#)
- Hines, Hungerford, Tomera, [Responsible Environmental Behavior](#), 1987
- Rood: [Solving the Problems of Climate Change and Sustainability](#), Michigan Journal of Sustainability, 2, 2014.

Outline: Class 13, Winter 2017

- Knowledge system / examination of successful problem solving
 - Formal construct or theory to approach problems

- This is the lite version.

Assumption

- That we are satisfied that the scientific investigation of climate change is robust, and we want to incorporate knowledge about climate change into our jobs or our daily lives.
 - How do we do that?

A question then,

- Why haven't we done more about climate change than we have?

Knowledge System

Knowledge System: Translation

- Need to bring together disparate information and different points of view to develop strategies for applied problem solving
- Key to development of successful strategies: iterative process or co-development with information providers and information users

[Cash et al: 2002](#)
[Lemos & Morehouse, 2005](#)
[Dilling & Lemos, 2011](#)

Knowledge System, Science Focused

Science &
Research

Applications

Dilling & Lemos, 2011

- Information brokers
- Collaborative group processes
- Embedded capacity
- Boundary Organizations
- Knowledge Networks

Cash et al: 2002

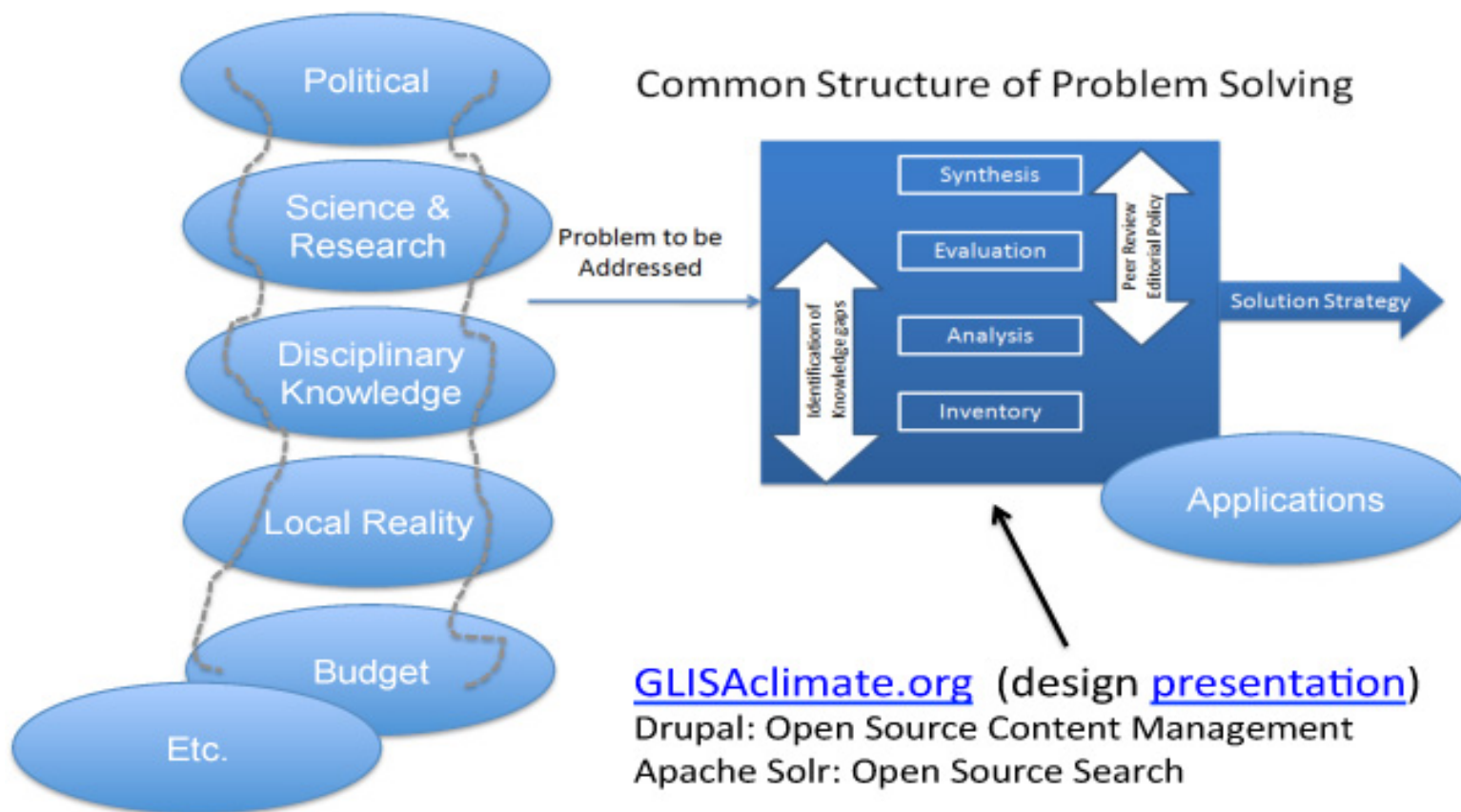
- Boundary Management
- Dual Accountability
- Boundary Objects

Cash et al: 2002

- **Legitimacy**
- **Credibility**
- **Salience**

Common Structure Problem Solving

Knowledge System Utilizing a Common Structure of Problem Solving



In Complex Problem Solving Bring Attention to Interfaces

- Climate – Energy – Population – Economic Success
- Climate – Health – Economic Success -
- Climate – Agriculture – Population – etc.
- etc ...

- What are the major sensitivities?
- What is entrée into the field and access to experts?
 - access, scan, and evaluate knowledge
- Interpretation, translation and communication
 - salient communication
 - not dumbing down

Credibility, Legitimacy, Salience

- Credibility is an attribute of scientific adequacy.
- Legitimacy is an attribute of objectivity, fairness, and a lack of political bias.
- Salience requires that information be relevant to the problem to be addressed.

Skill Set

- Analysis
 - Determination of knowledge that is important to the application
 - Distinguish between facts and inferences
 - Identify advocacy
- Evaluation / Judgment
 - What is the quality of the knowledge?
- Synthesis
 - How do pieces fit together?

Elements of Evaluation

- Source of information
- Process for development of knowledge
 - Scientific method?
 - Simple observation?
 - Externality?
- Peer reviewed?
- Reproduced?

Elements of Evaluation: Data

- Spatial and temporal homogeneity
- Instrument calibration
- Comparison to observations and standards
- Statistical characteristics
 - Statistics common quantitative language across many fields
- Relevant to my application
 - Conform to existing practice in an application field

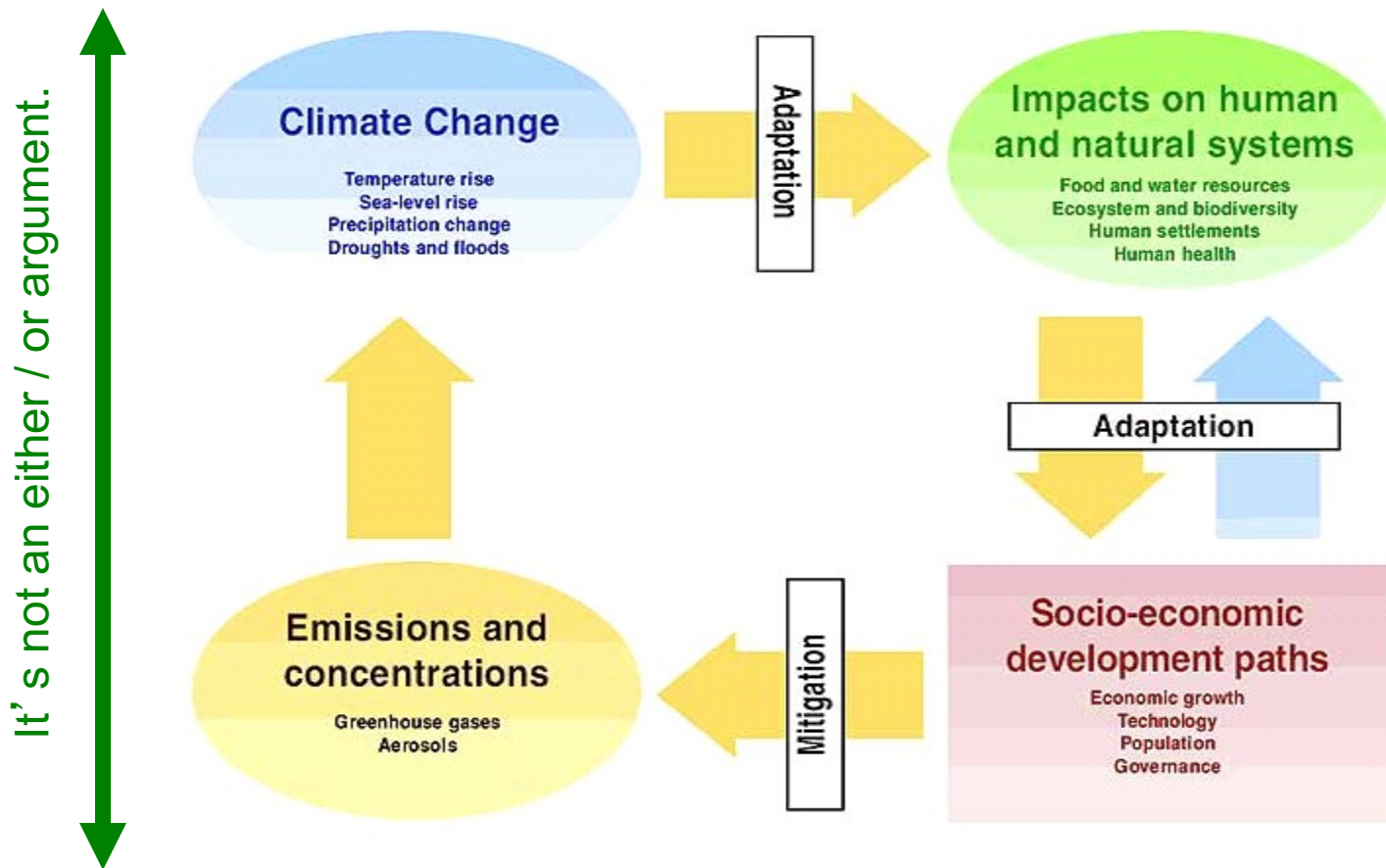
Some approaches to analysis

- There are attributes of analysis and evaluation that are shared
 - Evaluation is intrinsic in the analysis process
 - Evaluation becomes more rigorous as the problem advances through its iterative steps

Breaking the Problem Down

Science, Mitigation, Adaptation Framework

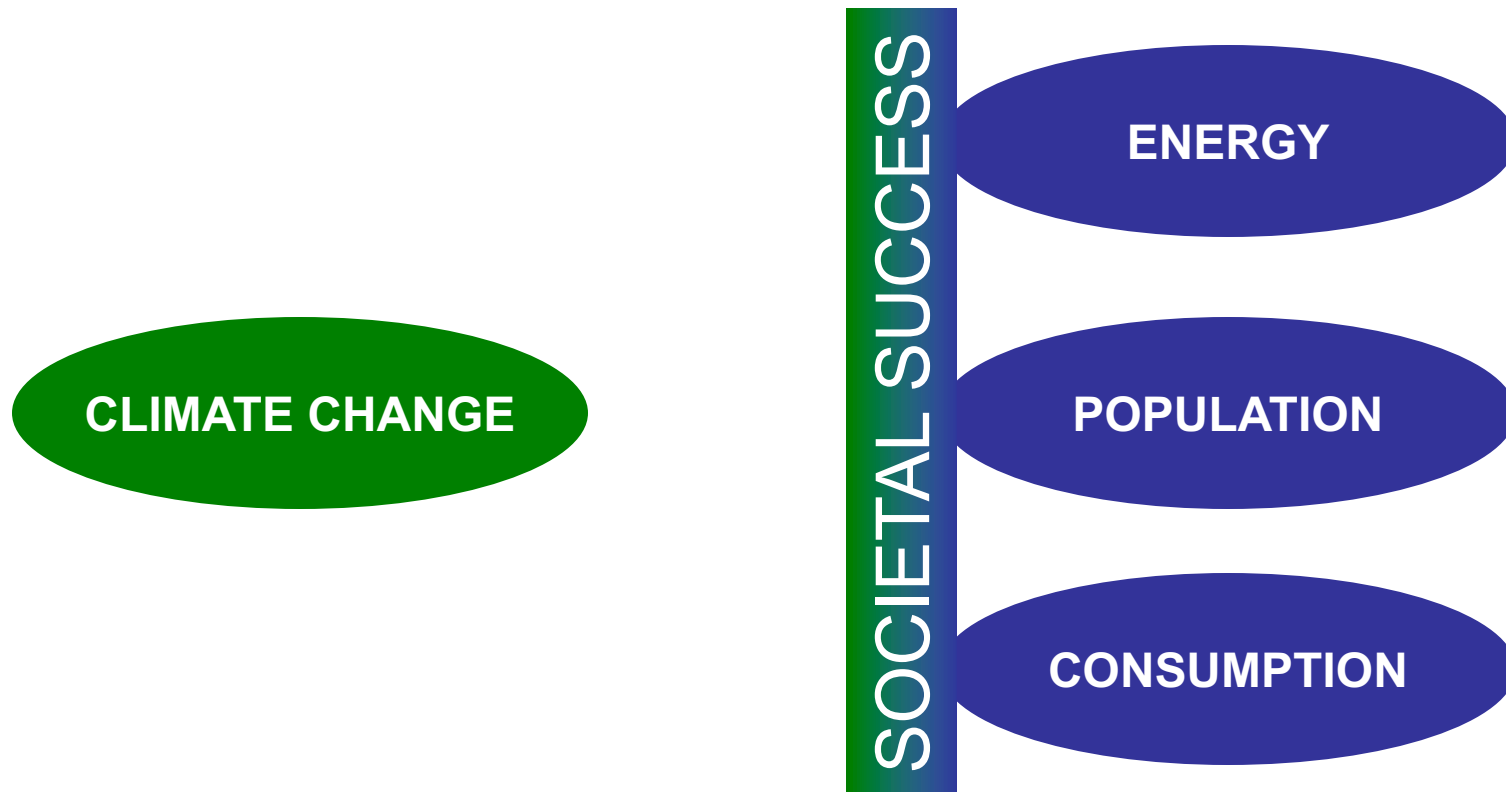
Adaptation is responding to changes that might occur from added CO₂



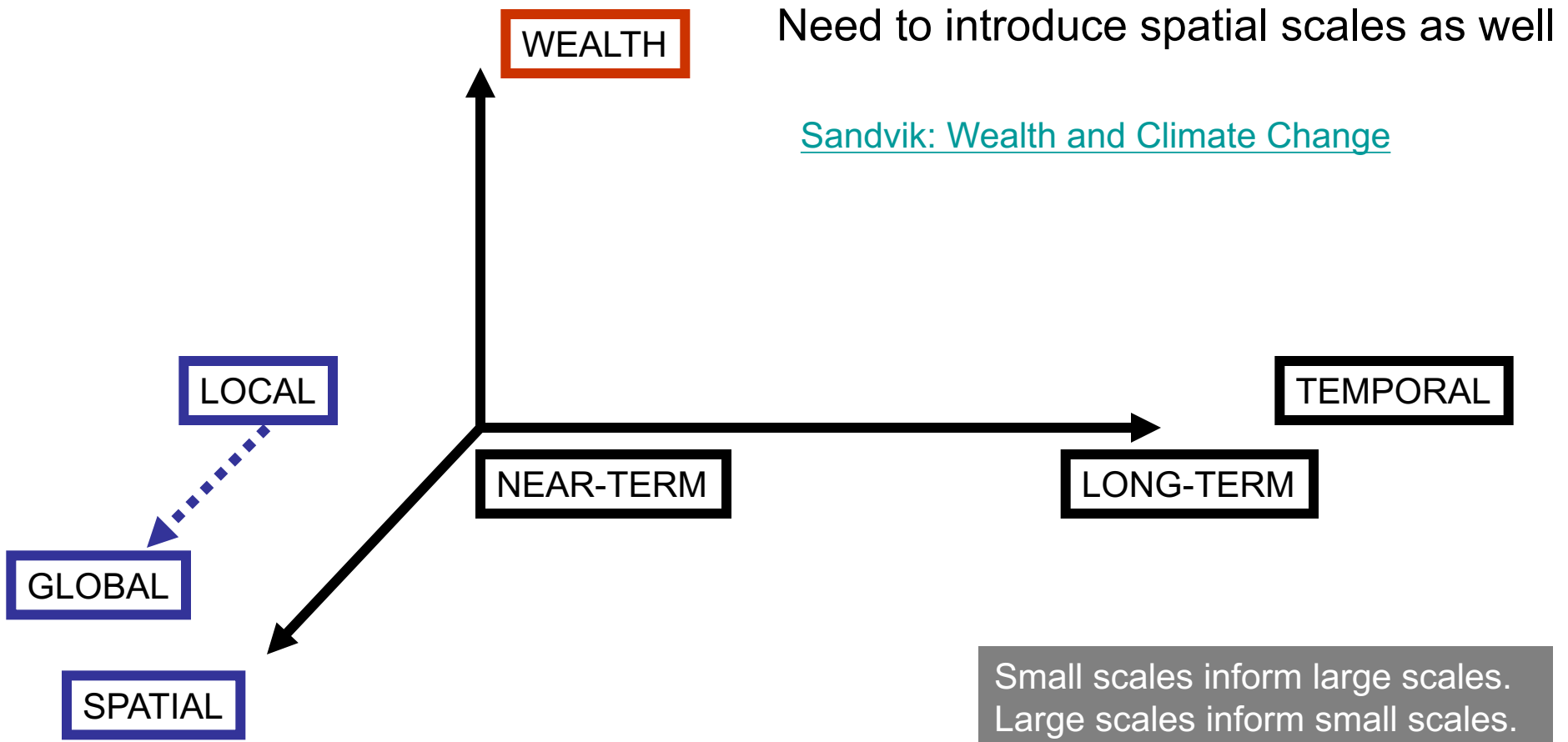
Mitigation is controlling the amount of CO₂ we put in the atmosphere.

Climate Change Relationships

- Consumption // Population // Energy

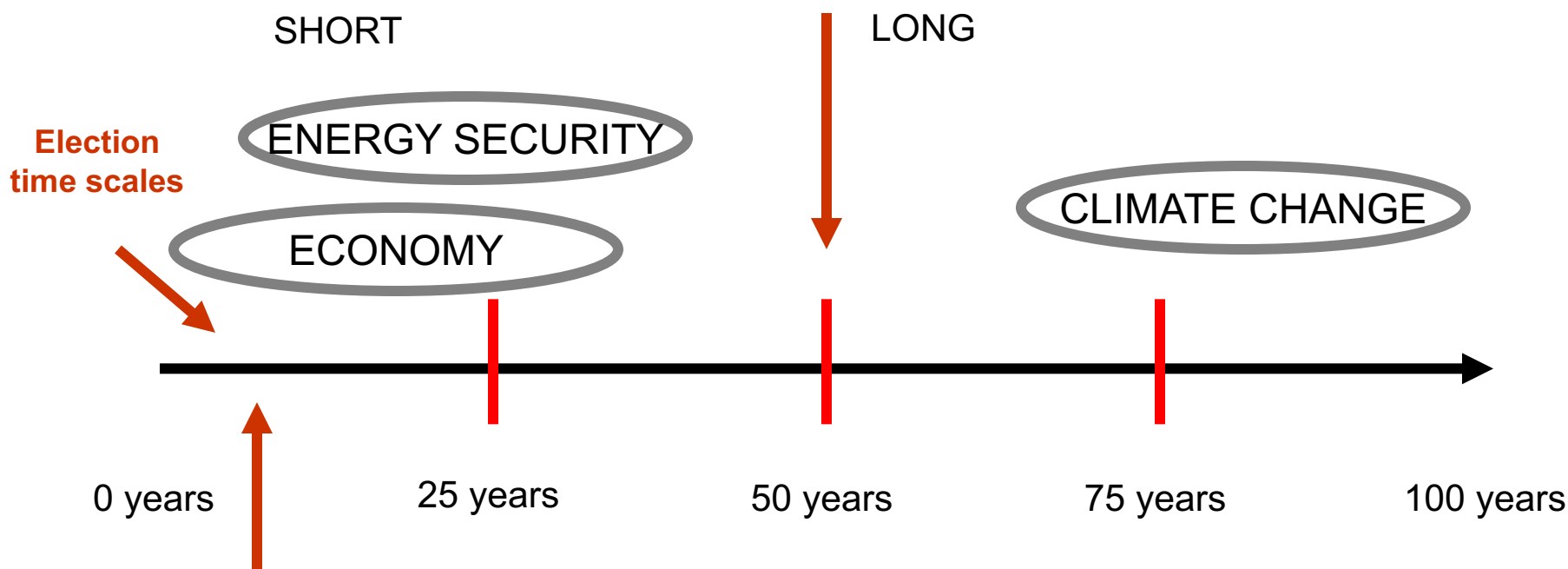


Reducing Climate Complexity



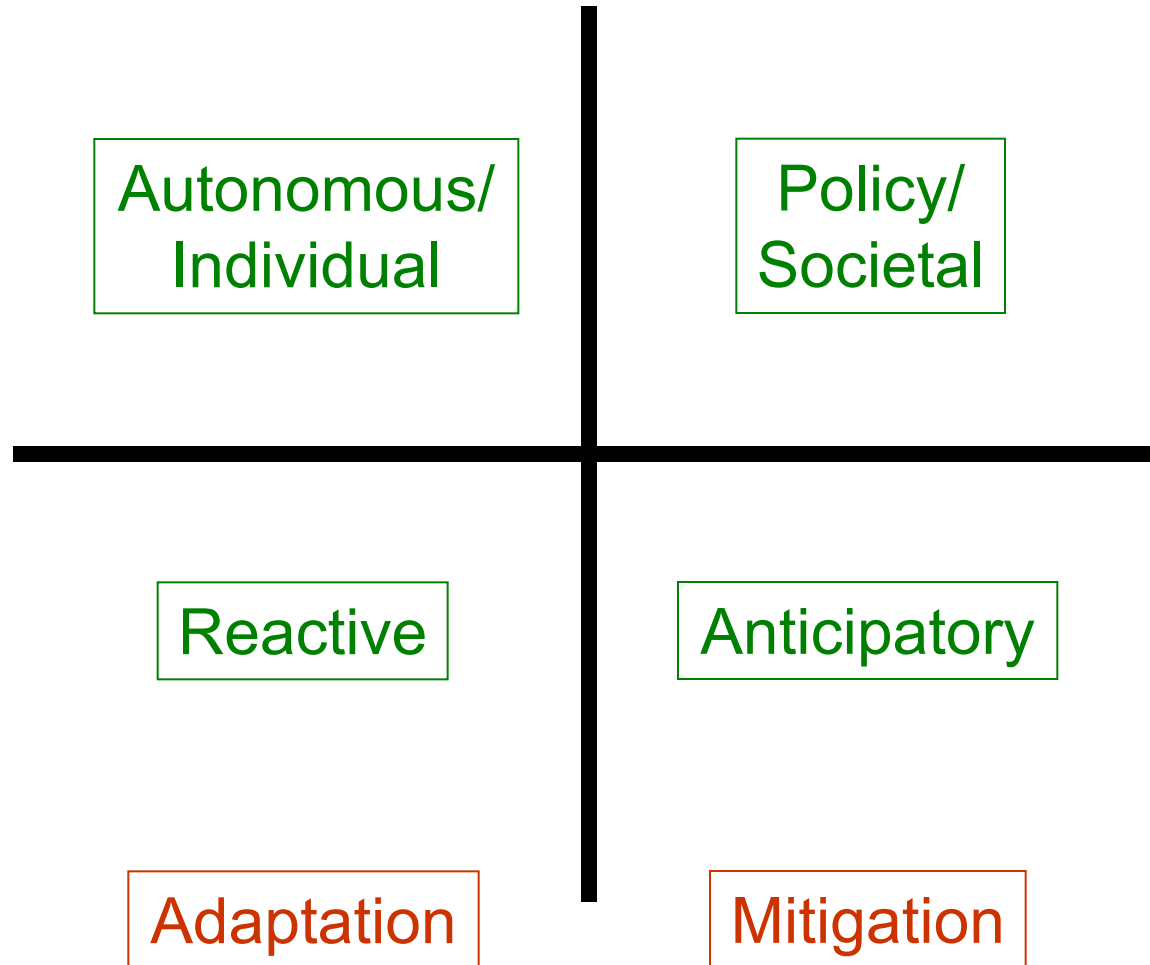
What is short-term and long-term?

Pose that time scales for addressing climate change as a society are best defined by human dimensions. Length of infrastructure investment, accumulation of wealth over a lifetime, ...



There are short-term issues important to climate change.

Responses to the Climate Change Problem



Experience from Climate Change Problem (We are early in this process)

<http://www.glisclimate.org/climate-information-guide>

What Has Happened?

What Will Happen?

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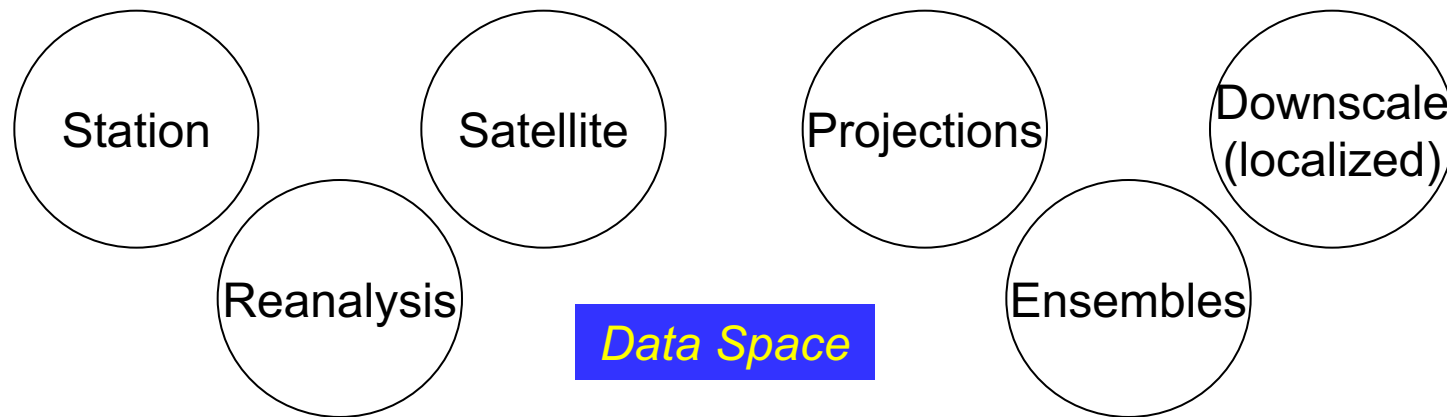
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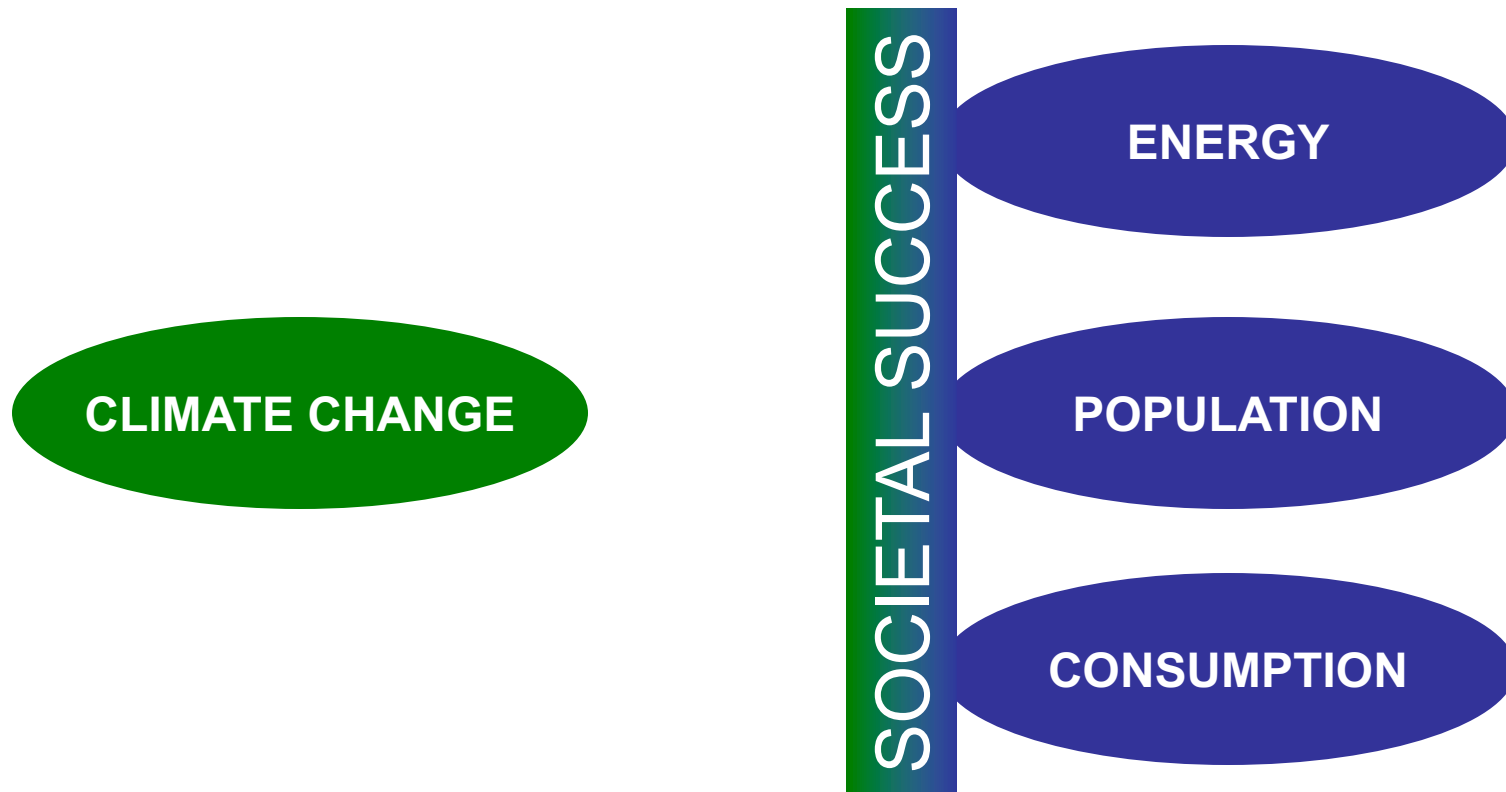
Characteristics of Successful Use

- Frequent Characteristics of Successful Use of Climate Knowledge and Data
 - Local observation or experience
 - Alignment of projections with regional observations or experience
 - Alignment with known vulnerability
 - Alignment with the narrative of the models

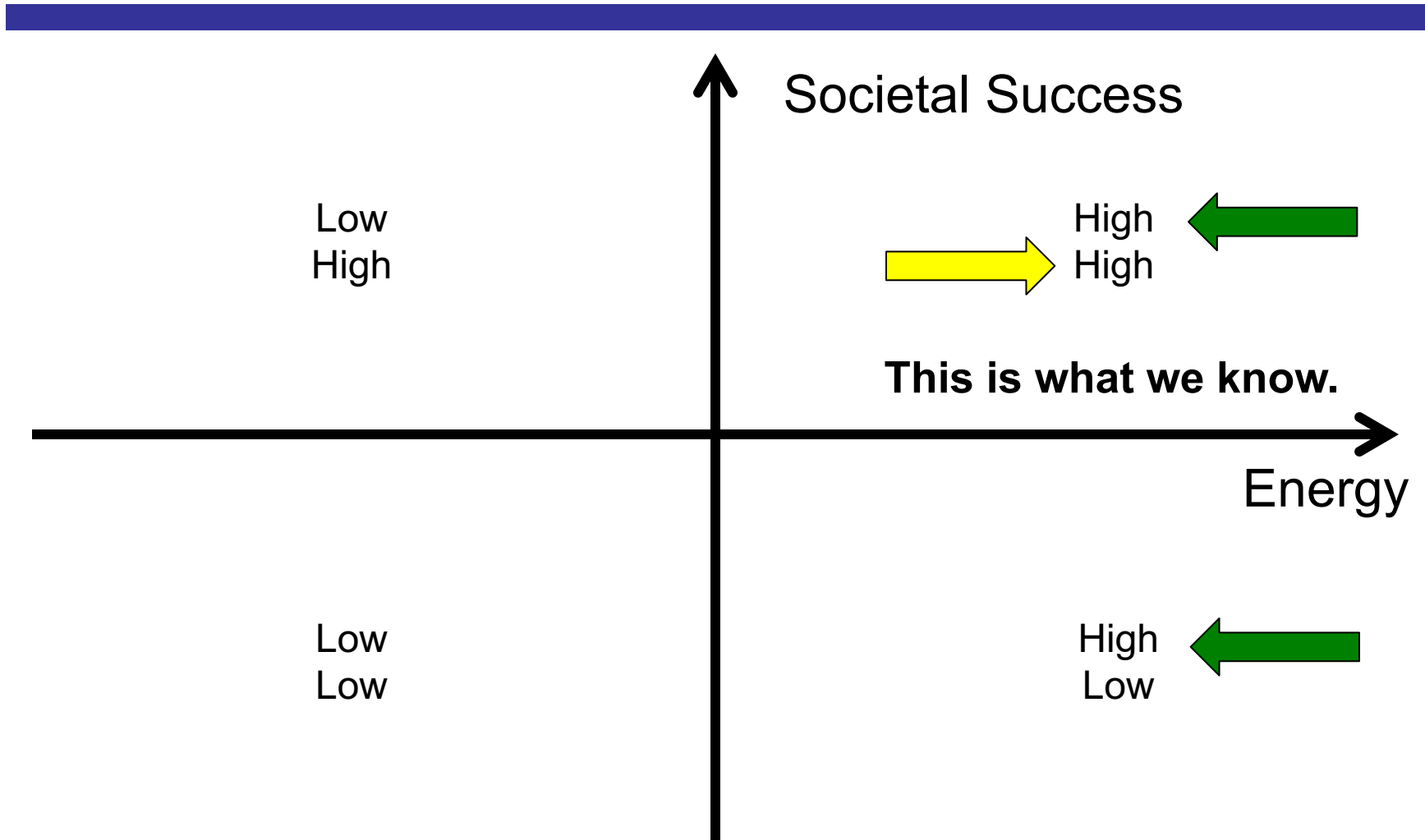


Climate Change Relationships

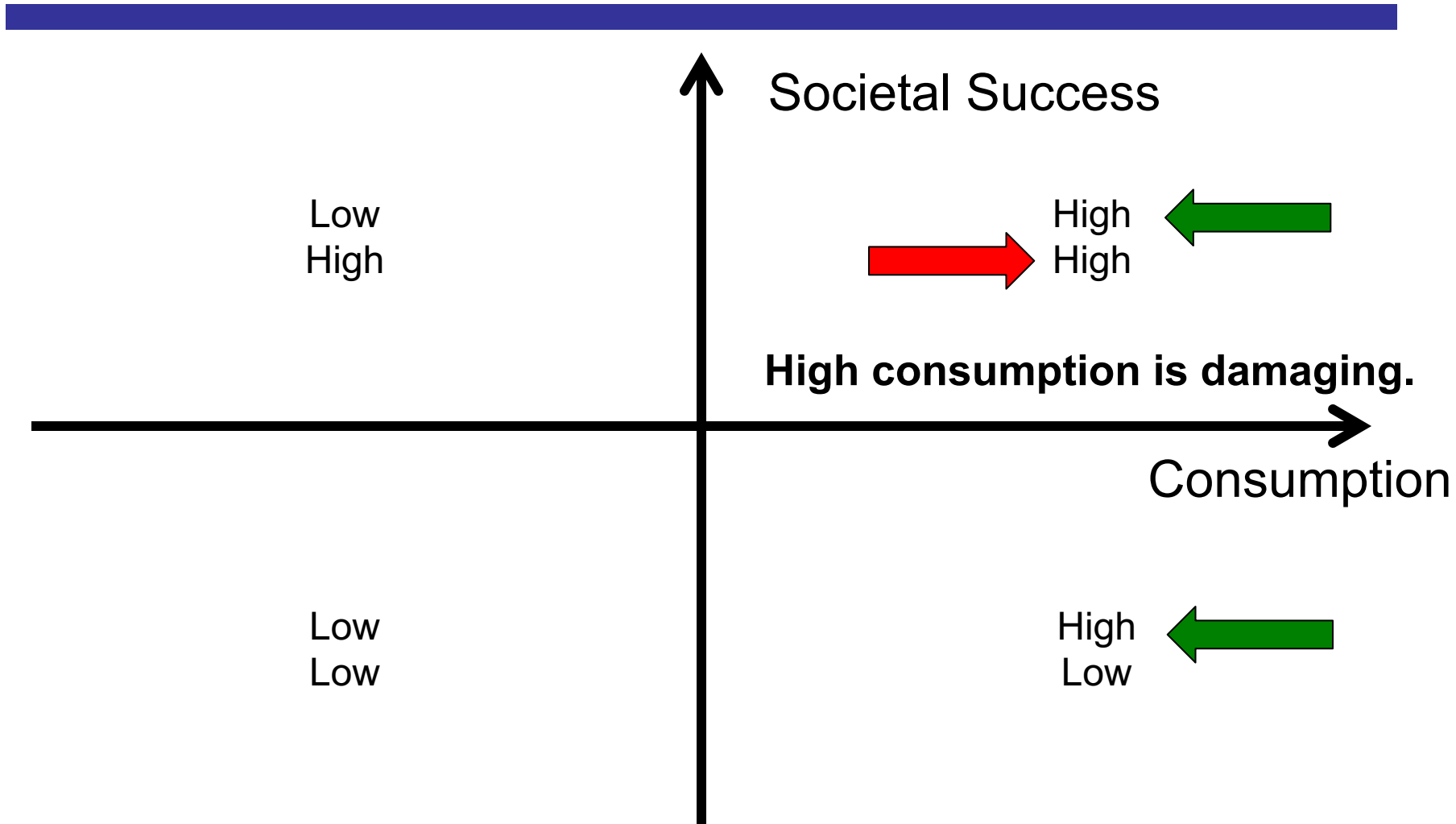
- Consumption // Population // Energy



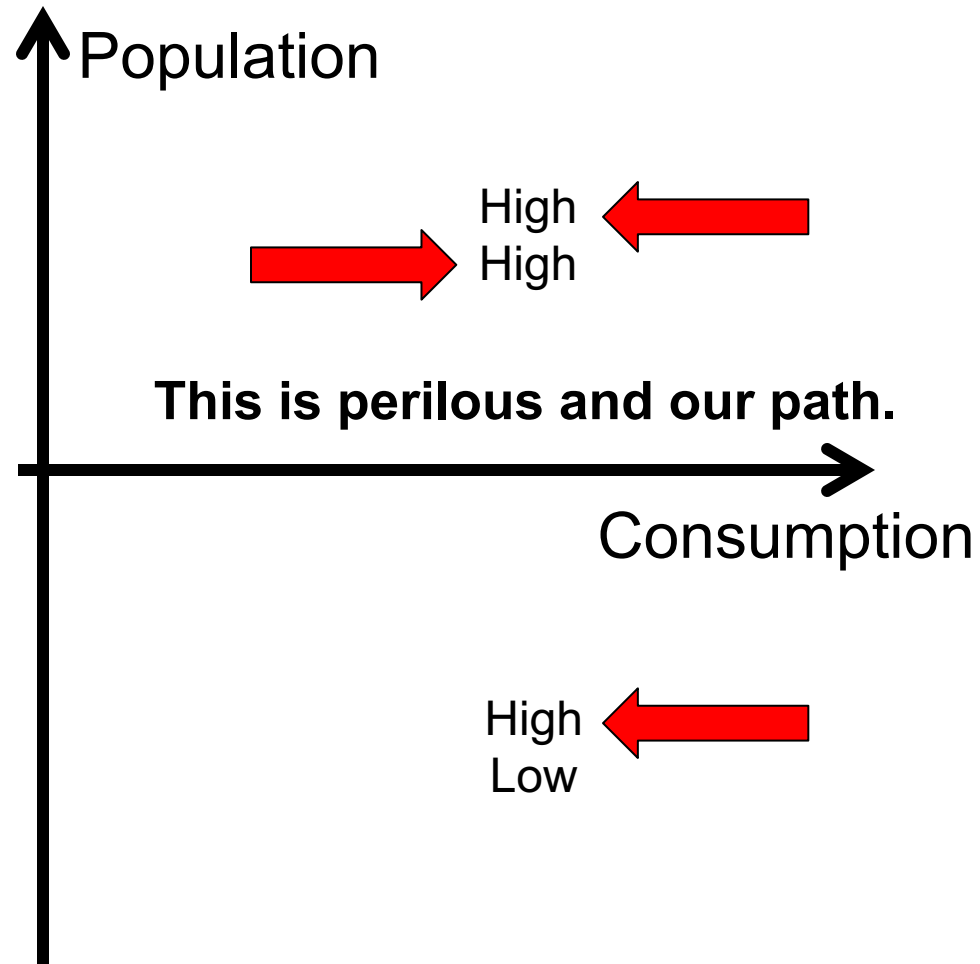
Societal Success and Energy



Societal Success and Consumption



Population and Consumption



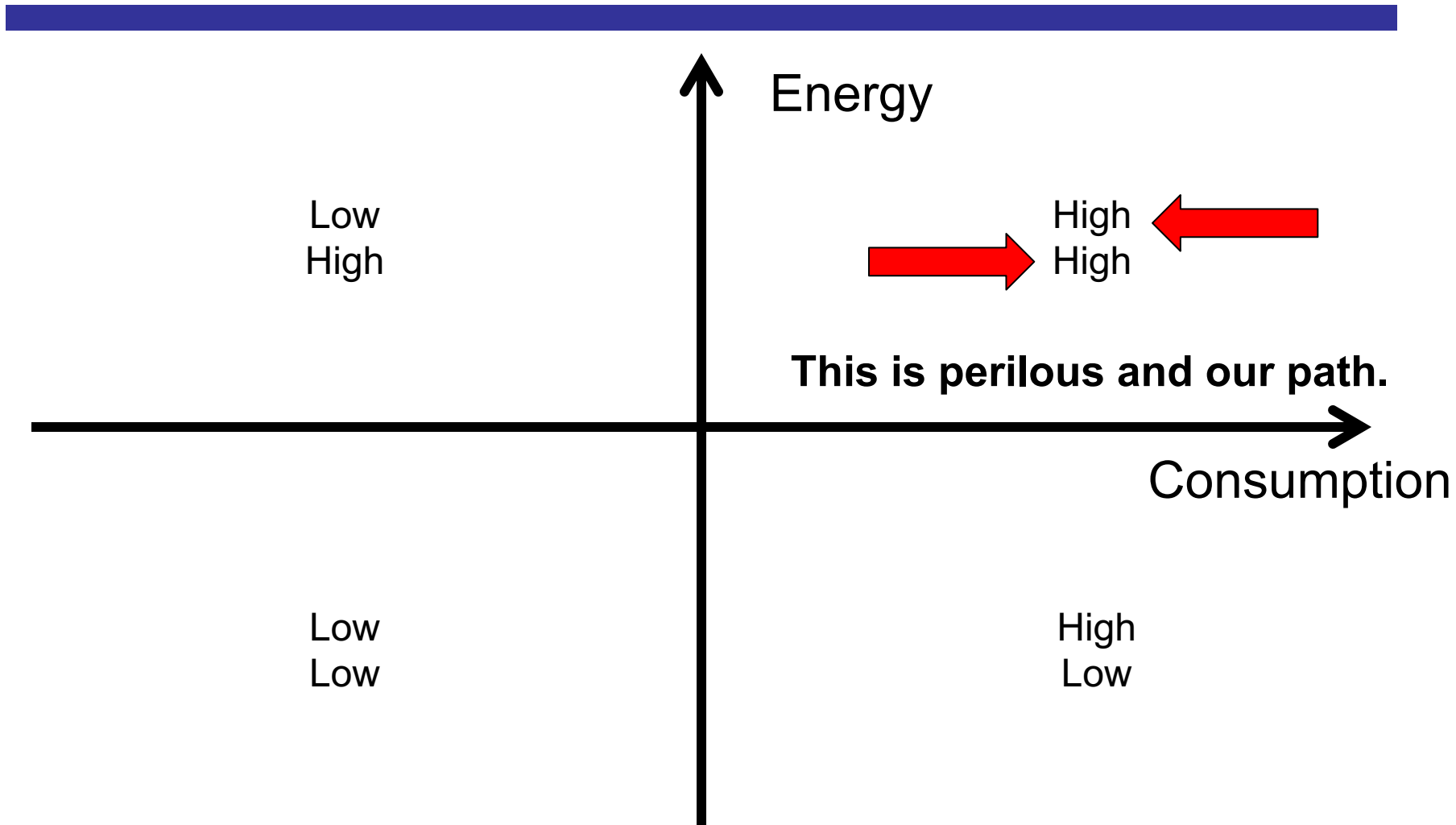
- **This is not likely in our lifetime.**
- **Past CO2 emissions by small population**

Degrowth Movement

and Catastrophe



Energy and Consumption



This thought **model** leads to

- Economic success needs to be decoupled from
 - Consumption, Energy Use
- Consumption needs to be decoupled from energy use.
- Energy use needs to be decoupled from CO₂ emissions to mitigate warming.
- High population, high consumption, high energy use is not sustainable.
- Have not considered other resources and other pollutants.

Climate Change Relationships

- Climate change is linked to consumption.
 - The economy depends on us consuming
 - Consuming generates the waste that causes climate change.
 - The consumption that has set us on this road of global warming has been by a relatively small percentage of the population.
 - Wealth is an important variable.
 - Hence, social equity is an issue.

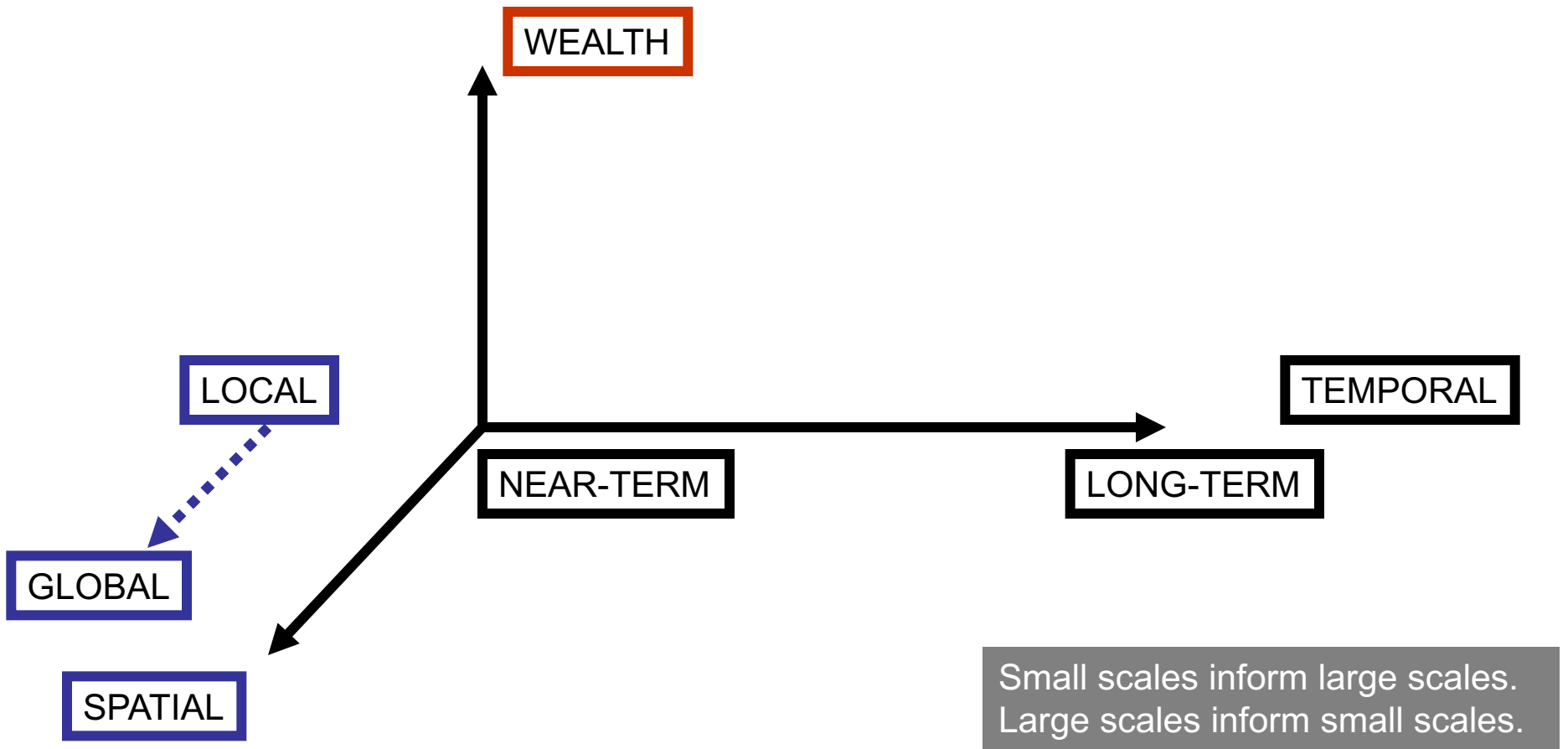
Solution Space: For Warming Problem

- Our current behavior suggests the most desired solution is high energy, high consumption, which leads to the need for energy use to not pollute.
- Don't forget about water. (And a myriad of other resources and sources of pollution.)

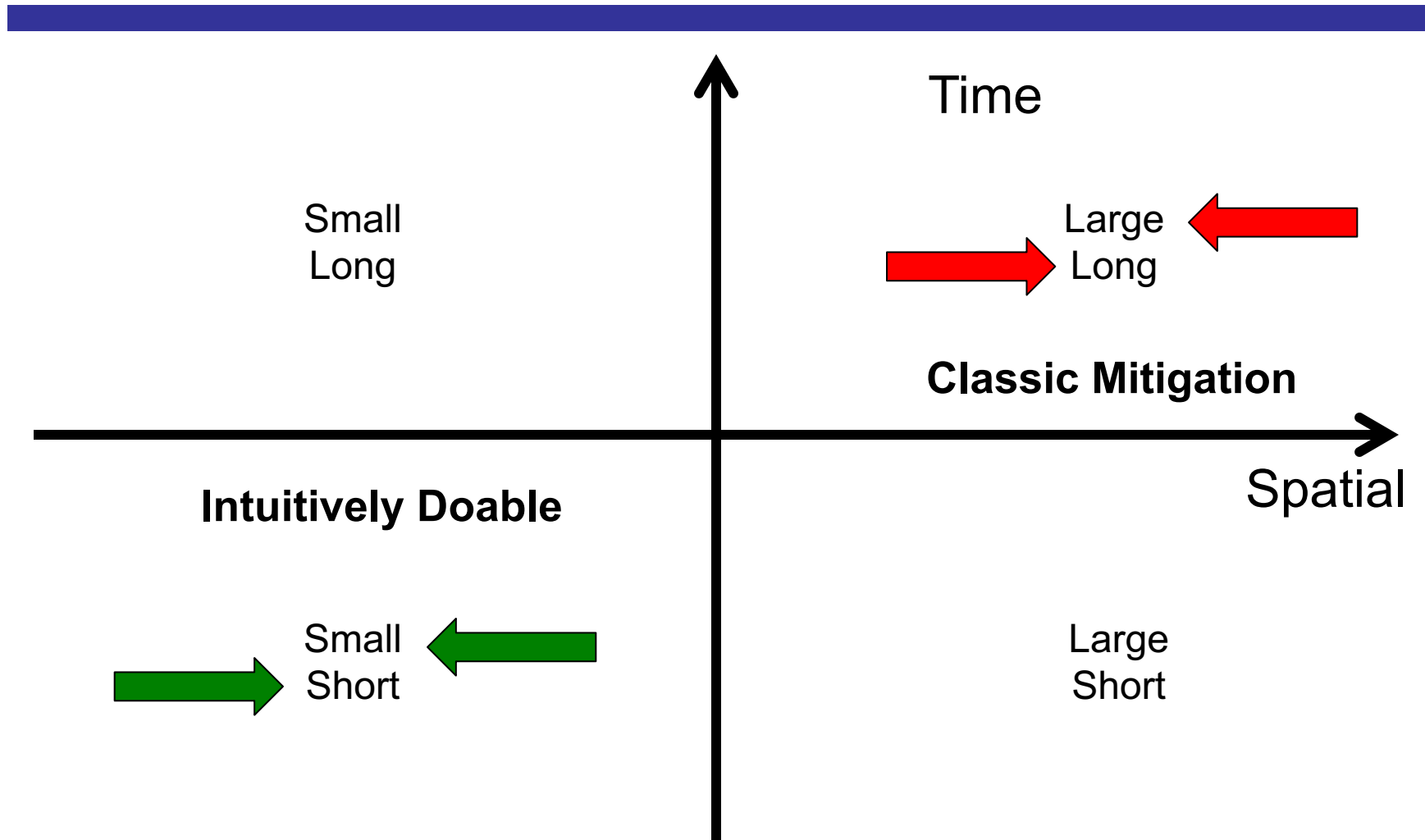
The previous viewgraphs have introduced some structure /
some language

- This is a classic short-term versus long-term problem.
 - Ethics
 - Economics
 - Reaction versus anticipation
- Similarly, regional versus global
- Rich and poor
- Competing approaches
 - Mitigation versus adaptation
 - Transportation versus electrical generation
 - This versus that

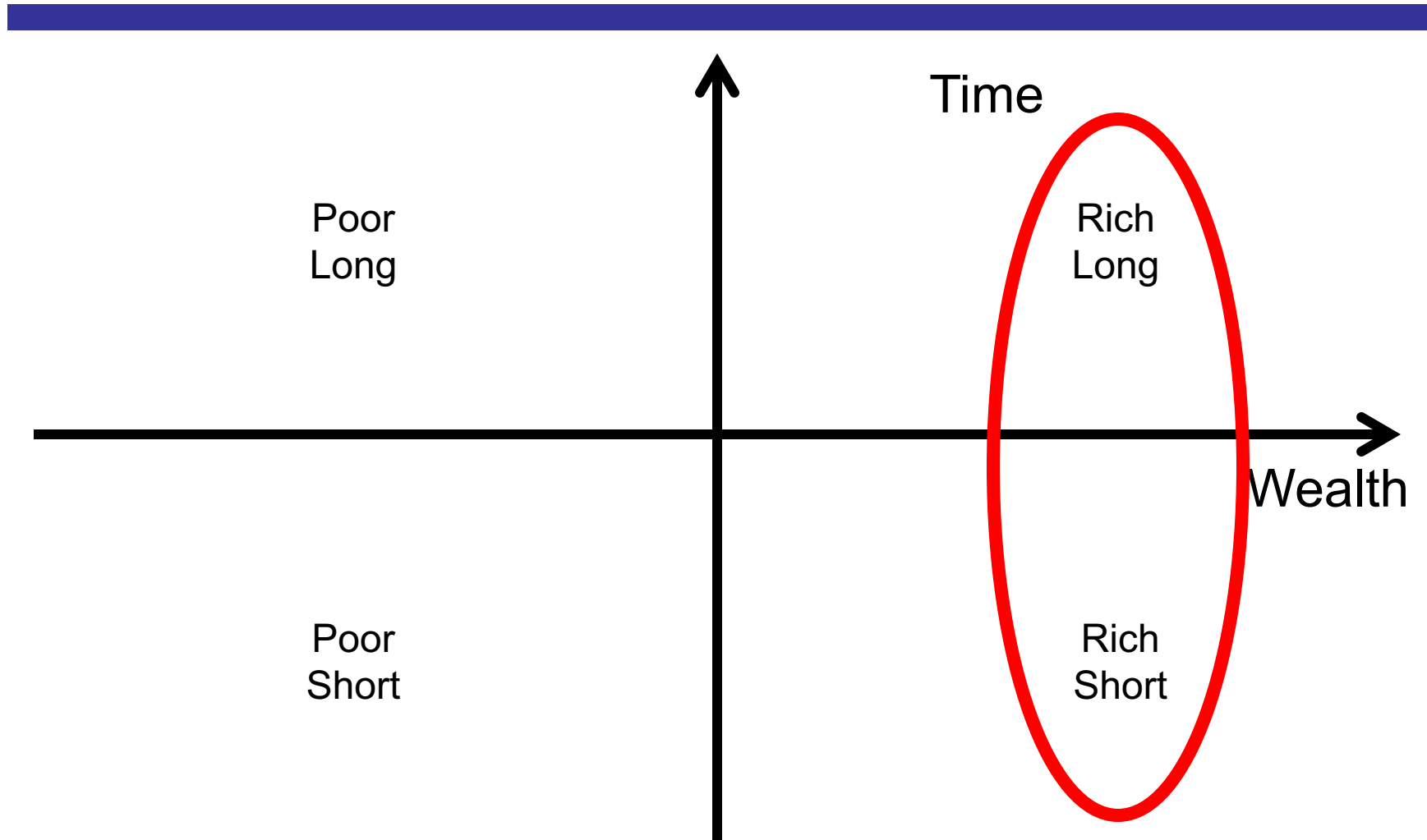
Reducing Climate Complexity



Space and Time



Wealth and Time



Why is “Rich” Different?

Summary: Class 13, Winter 2017

- Breaking the problem down →
 - Temporal, spatial, wealth, cultural values and norms
- The need to evaluate data, information and knowledge
 - Statistics, statistics, statistics
 - Establishes credibility
 - Establishes legitimacy
 - Establishes salience
 - Establishes trust

Summary: Class 13, Winter 2017

- Evaluation: An important part of the climate knowledge system is the need to evaluate the suitability of data, information and knowledge for a particular application. The unmet need for evaluation stands as a barrier to delivering the most appropriate and readily usable data for particular purposes.
 - Saliency

Summary: Class 13, Winter 2017

- Human “Experts”: Human experts are an integral part of the knowledge system. Learn early to identify the needed expertise, stakeholders, find them, and involve them in problem solving. To accelerate problem solving focus on organization of human expertise and improving the efficiency of the human expert.
 - This is often contrary to the schoolbook approach of individuality, testing unique contributions. A paradigm shift.

Outline: Class 13, Winter 2017

- Organization: structure and language
 - Identification of complexity
- Knowledge system / examination of successful problem solving
 - Formal construct or theory to approach problems
- Breaking the problem down →
 - to, ultimately, build back up
- The need to evaluate data, information and knowledge