How can social science methods be scaled to the global level?

Marco Janssen
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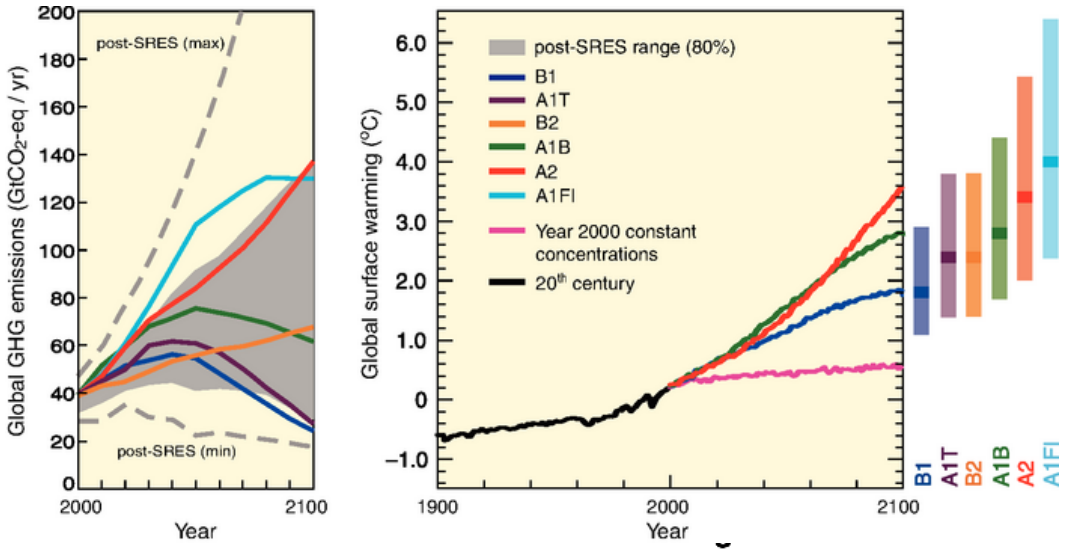
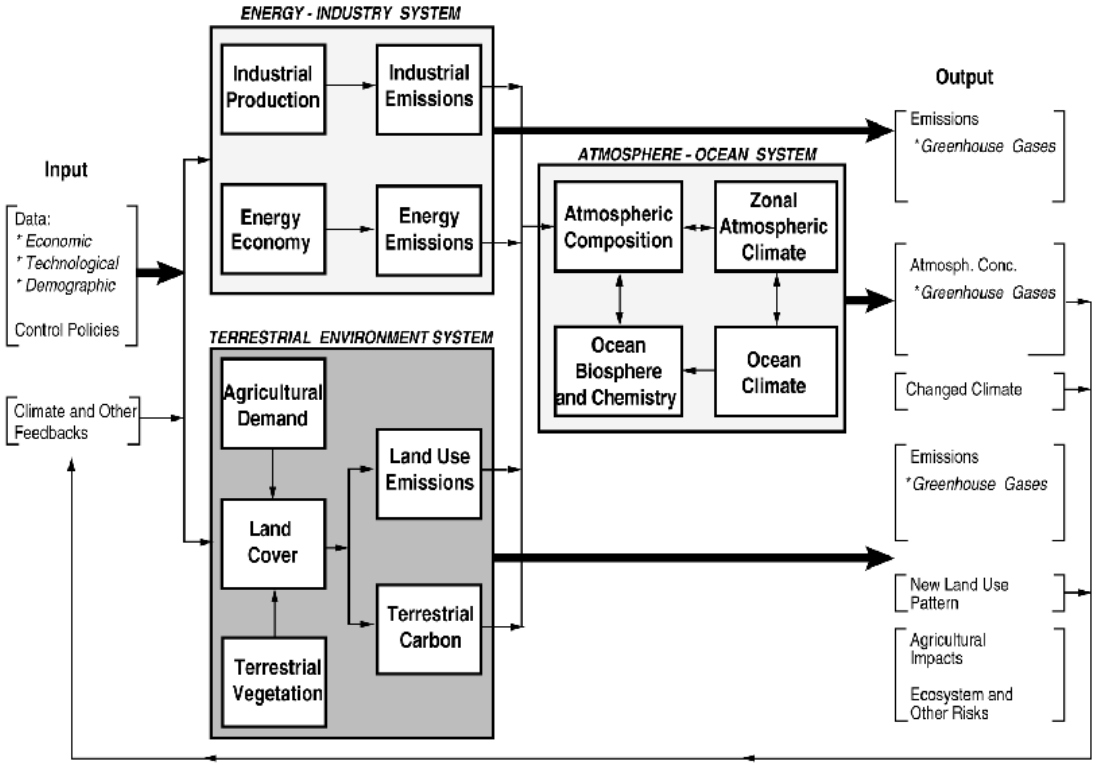
Arizona State University





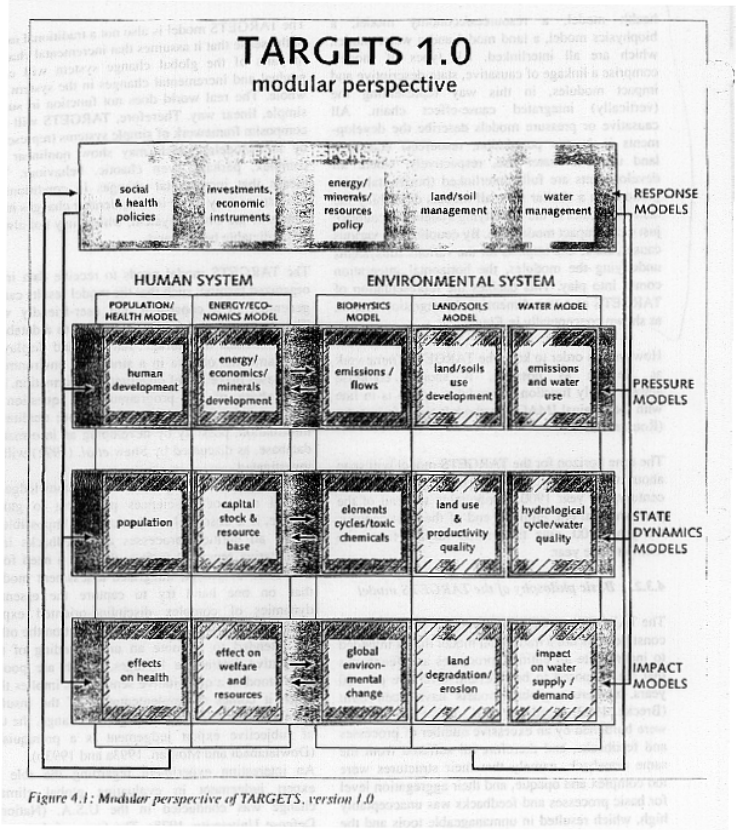


Figure 4.1: Modular perspective of TARGETS, version 1.0

Global Change models

- System Dynamics (Scenarios):
  - World 3 model (Meadows et al)
  - International Futures (Hughes et al.)
  - Causal loop diagrams

- Macro-economics (Optimal control):
  - DICE & RICE (Nordhaus): Infinitely longlived actors who maximize the utility of their discounted future.

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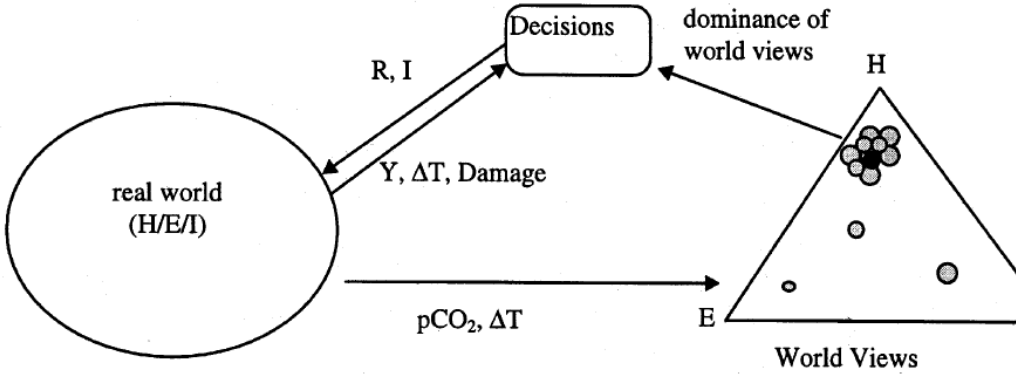
ECOLOGICAL ECONOMICS

ANALYSIS

The battle of perspectives: a multi-agent responses to climate cha

Marco Janssen *, Bert de Vrie



EXPERIMENTS WITH AN "INTELLIGENT" WORLD MODEL

Hartmut Bossel and Michael Strobel

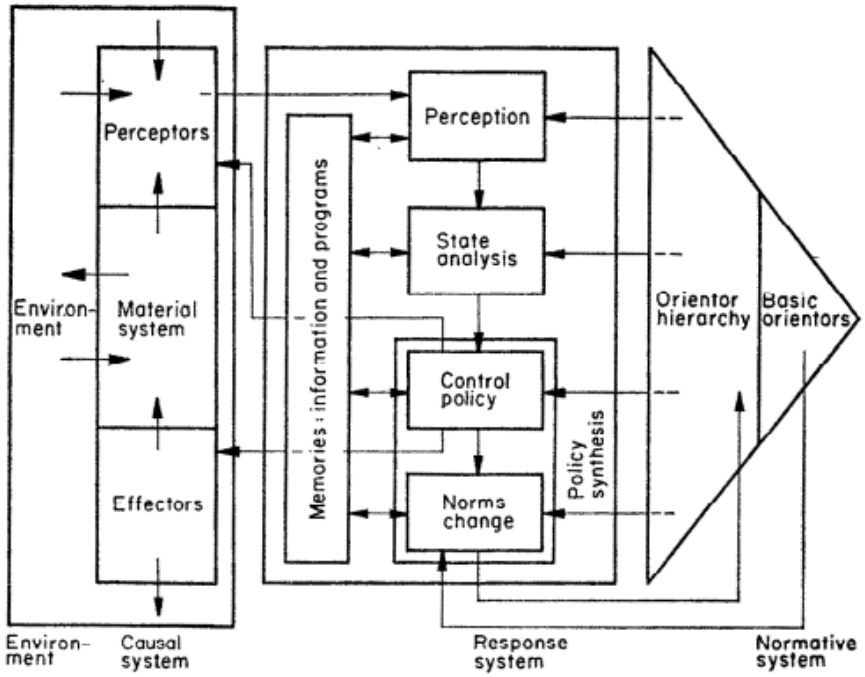


Figure 2. Information processing and orientation of an actor system

Behavioral approach

- Commons dilemmas focus of sustainability
- Agent-based modeling
- Lab and field experiments
- Formalizing diversity of behavioral theories (SESYNC).

What are relevant social dynamics for scaling up?

- Many models focus on resource users (farmers, households) or nations.
- What is the relevant agency for large scale problems?
- We need to disentangle the political economy of the problem at hand.
- What social dynamics to include is context specific (framing of problem).

Keystone Actors

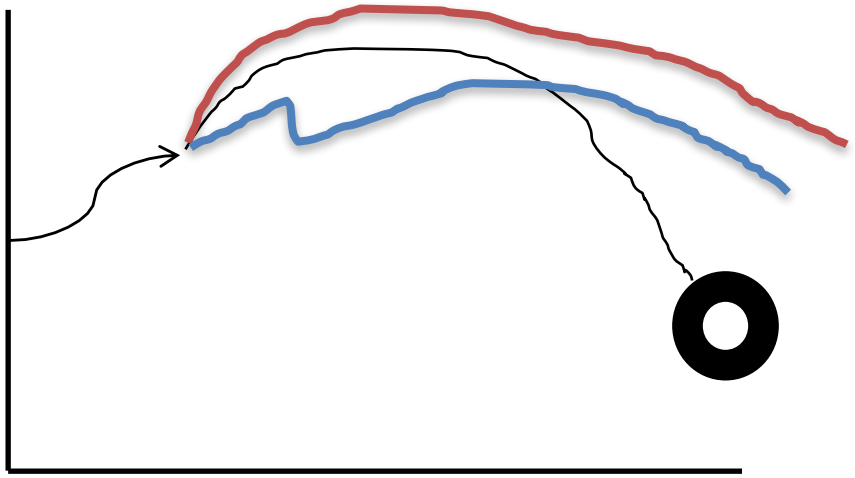
- Where is the agency? Who makes what decisions? What is relevant to include at larger scales?
- Follow the material flows?
- Österblom et al. (2015) Transnational Corporations as 'Keystone Actors' in Marine Ecosystems, PLoS ONE:
  - 13 corporations control 11-16% of the global marine catch (9-13 million tons) and 19-40% of the largest and most valuable stocks.

Critical social dynamics (?)

- Social learning, innovation and adaptation
- Mental models and framing of problems
- Delays in decision making and implementation
- Agency and property rights
- Infrastructure decisions: investments, maintenance, distribution

How to reach future targets?

- Instead of a top-down policy implementation, model muddling through: what solutions are available, focal events, delays in implementation, lockin effects.



The Basin of Mexico

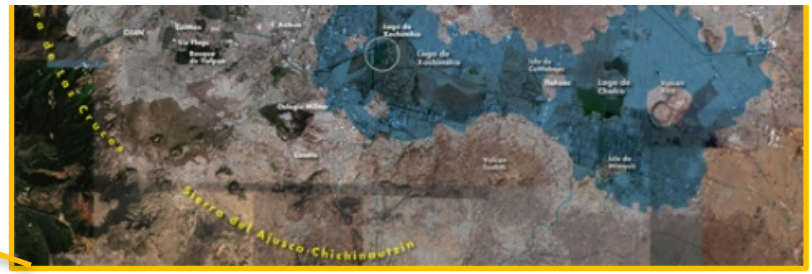
Water and Mexico city are co-evolving for more than 500 years. Population copes with floods &lack of clean fresh water.

Inequality of impacts & shortage of funding.

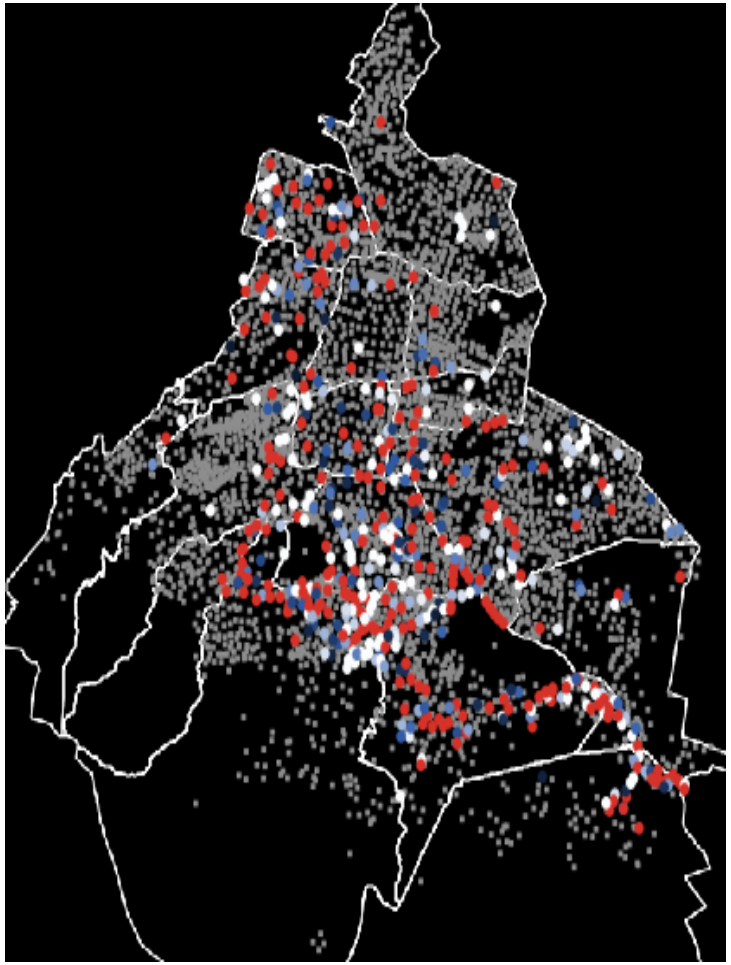
How will climate change impact the growing city?

Development of integrated model to use with stakeholders.

Models of streamflow, subsidence, groundwater, local climate, water infrastructure, and ABM of neighborhoods Interacting with water authorities.

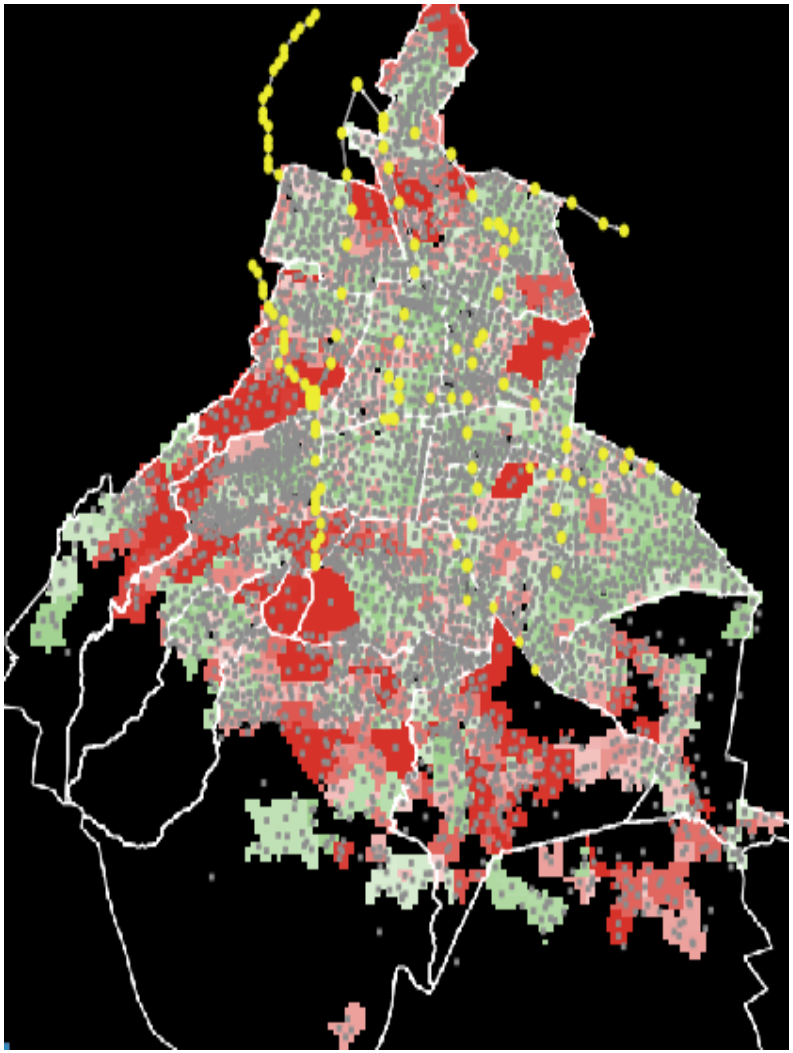


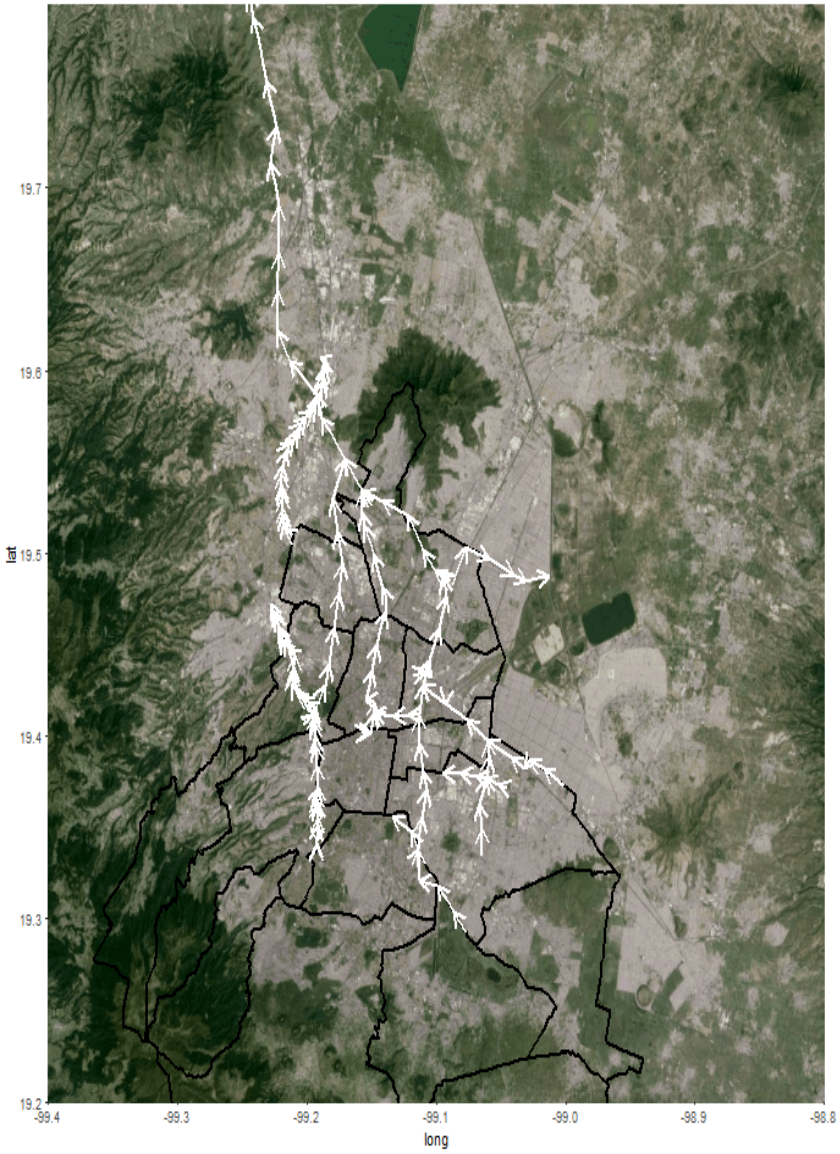
CNH-NSF project led by Hallie Eakin

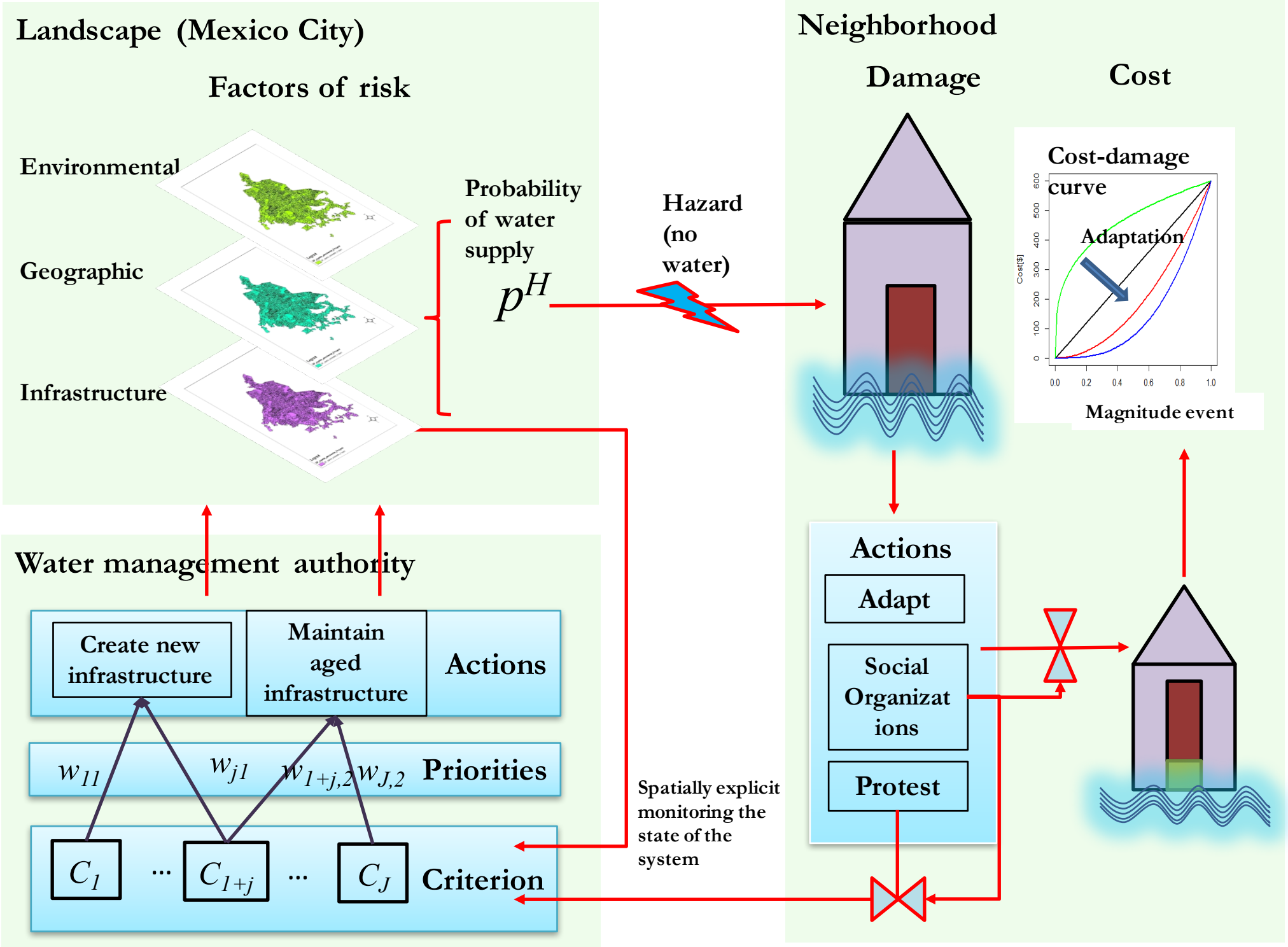


Water supply Mexico city
Red dots: not-working wells
Blue tones: working wells
Lines district's limits

Drainage System






Landscape (Mexico City)
Factors of risk
Environmental
Geographic
Infrastructure
Probability of water supply
p^H
Hazard (no water)
Neighborhood
Damage
Cost
Cost-damage curve
Adaptation
Cost[$]
0
100
200
300
400
500
600
0.0
0.2
0.4
0.6
0.8
1.0
Magnitude event
Water management authority
Create new infrastructure
Maintain aged infrastructure
Actions
w_{11}
w_{j1}
$w_{1+j,2}$
$w_{J,2}$
Priorities
C_1
...
C_{1+j}
...
C_J
Criterion
Spatially explicit monitoring the state of the system
Actions
Adapt
Social Organizations
Protest

Model analysis

Scenario	Efficiency	Inequality	Vulnerability
Scenario 1			
Scenario 2			
Scenario 3			

- What are the perverse effect of policies? (focus on short term local vulnerability could reduce long-term system level vulnerability)
- How does climate change affect diverse outcomes and effectiveness of policies?

Summary

- What are relevant focal questions? How to frame the problem?
- What are the relevant human actions?
- What is the relevant agency?
- Ecology of models of social dynamics.

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