# *Informing Sustainability Science through Advances in Environmental Decision Making and Other Areas of Science*

Transition toward Sustainability after 15 Years:
Where Do We Stand in Advancing the Scientific Foundation?
Panel VI: Integrated Analysis

14-15 January 2016

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“Everything has been said before, but since nobody listens we have to keep going back and begin all over again."

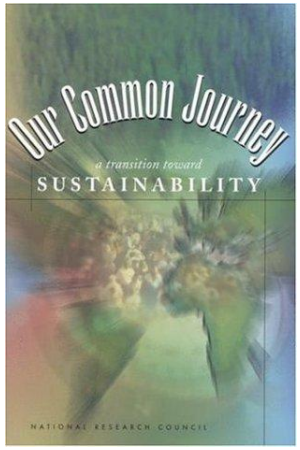
–Andre Gide

*So my job is to instantiate the Lutz/Kandel guidance via repetition.*

“All models are wrong.  Some models are useful.”

--George E.P. Box

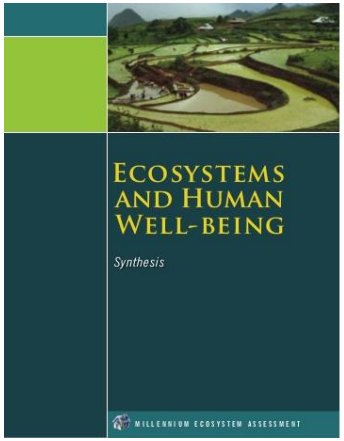
# Well-being and the environment




❖ *Our Common Journey*

"Meeting the needs of people today and in the future while sustaining the life support systems of the planet."

❖ Parallel to the Millennium Ecosystem Assessment emphasis on the relationship between human well-being and ecosystem services.




❖ Matson, Clark & Andersson: Proposed updated formulation "inclusive human well-being." Environment becomes ancillary.

❖ The *OCJ/MEA* approach has led to a body of scholarship on the relationship between human well-being and the environment.

❖ We can ask for any decision, any history, any puzzle:

-What contributes to human well-being now and in the future? and
-What harms the environment, other species?

## What have we learned?

1. Focus on inclusive well-being or on human well-being and the environment.

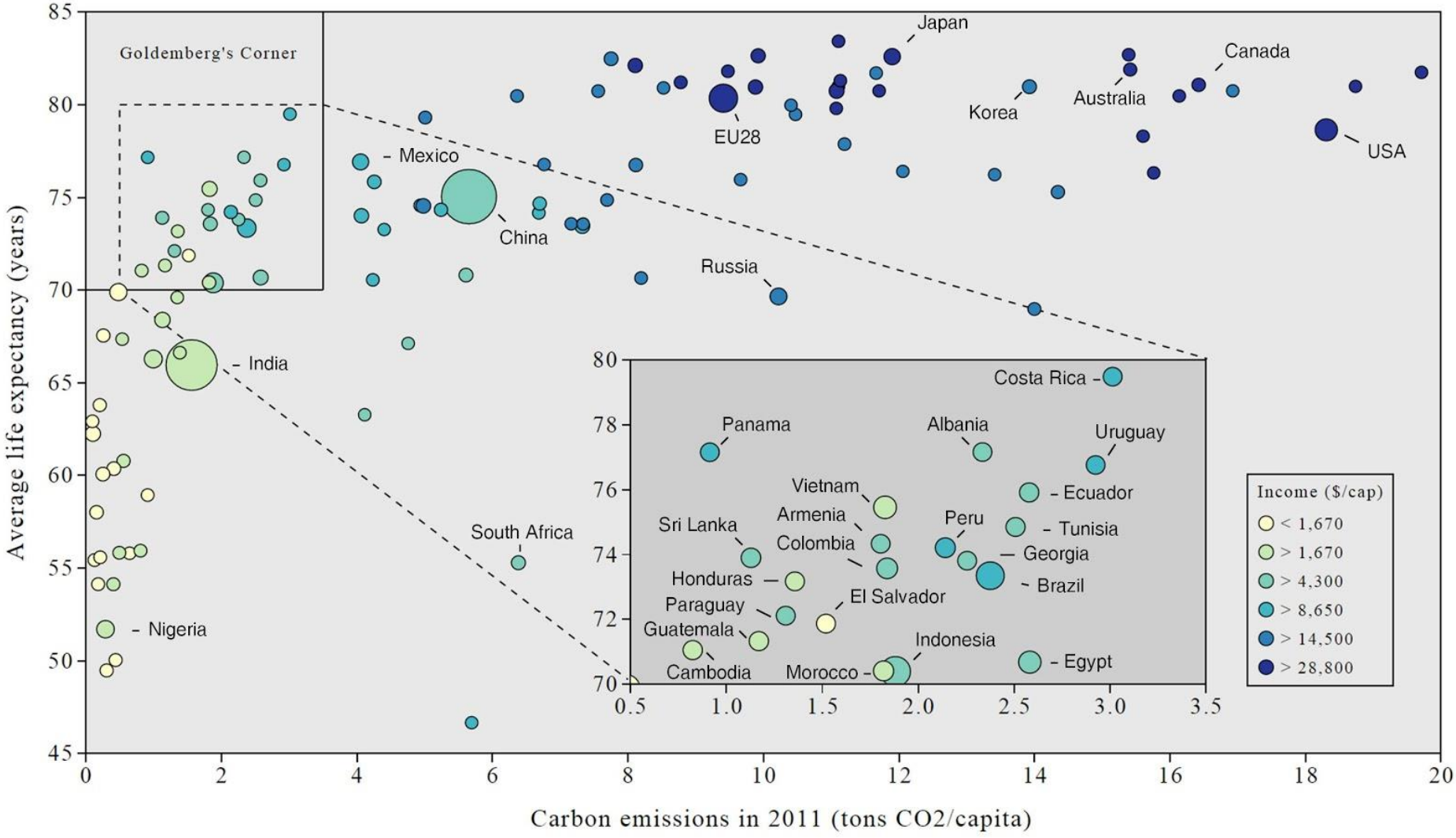
- This avoids the cacophony of hundreds of indicators. We may need them for specific purposes (e.g. SDGs, modeling).

- We can focus on a few for which there is broad normative consensus and good data:
  - Life expectancy/ mortality
  - Subjective well-being

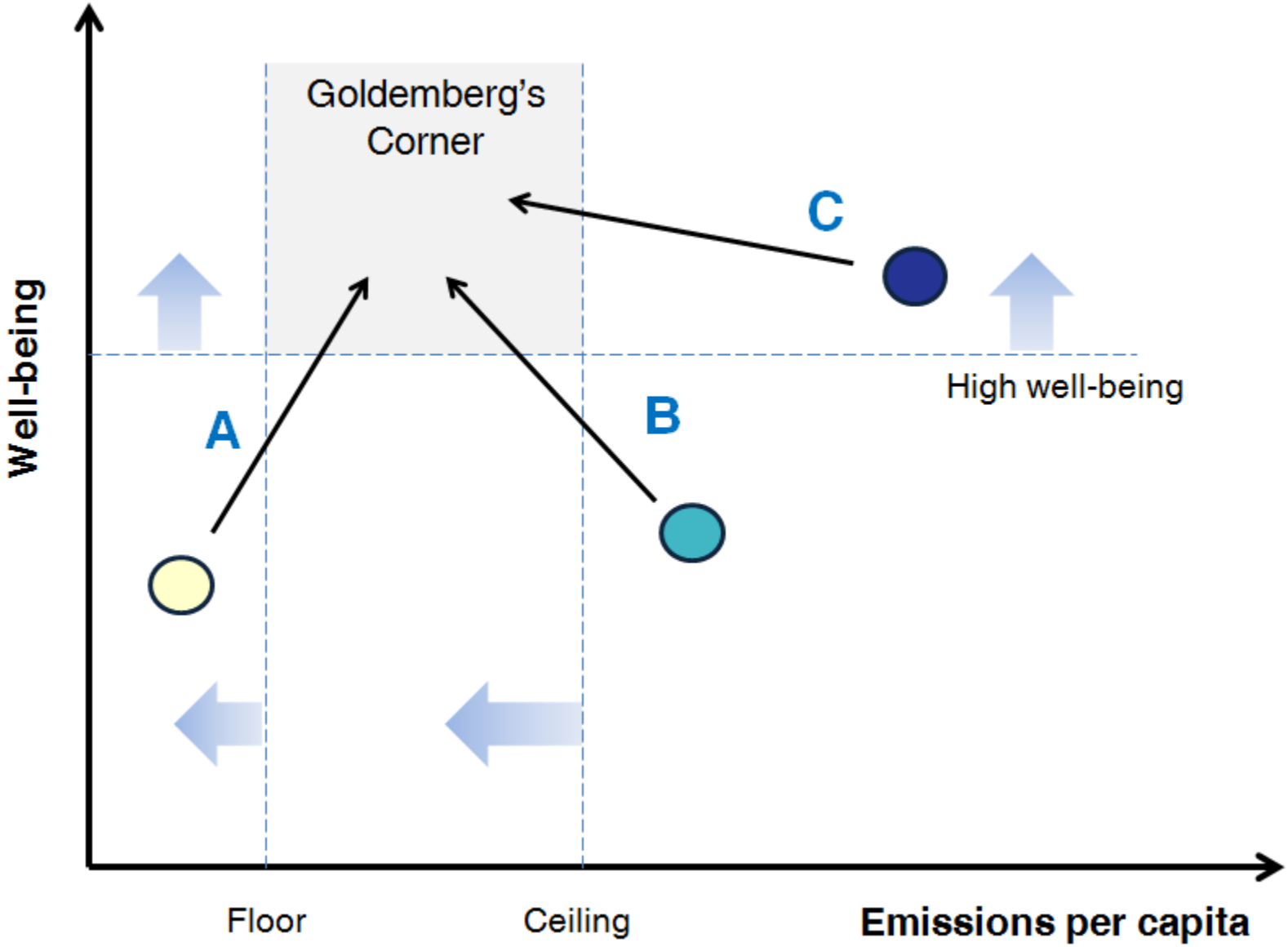
- Measures of resources can be used as inputs with institution, etc. as contexts that shape resource use.

- Empirical research on what influences well-being (e.g. education elasticity on well being may be 3x affluence elasticity)

Dietz, Thomas, Eugene A Rosa, and Richard York. 2009. "Environmentally Efficient Well-Being: Rethinking Sustainability as the Relationship between Human Well-being and Environmental Impacts." *Human Ecology Review 16:113-122.*
Dietz, Thomas. 2015. "Prolegomenon a Structural Human Ecology of Human Well-Being." *Sociology of Development* 1:123-148.




Roberts et al. 2015 in prep. "Goldemberg" is Jose Goldemberg, former Brazilian Sec of Env.


Goldemberg's Corner
C
High well-being
A
B
Well-being
Floor
Ceiling
Emissions per capita

What more is needed?

1. Focus on inclusive well-being

- How inclusive—is the environment and are other species only means to the human well being end?
- What ethical theory/ values justify the endpoints? How do we reconcile different ethical theories?
- What theories can shape research on how resources, institutions etc. influence the endpoints?
- What are the measurement properties of both endpoints and the variables (indicators) that we conjecture drive them?
- How do we deal with the discount/ substitutability problem?

Do these changes matter intrinsically?

- Glacier National Park without glaciers.
- Isle Royale without wolves.
- Joshua Tree without Joshua trees.

In many populations, concern with biosphere/other species is correlated with but distinct from altruism towards other humans.

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What have we learned?

2. Widespread acknowledgement that we are dealing with human ecology/ coupled human and natural systems/ coupled human and environmental systems.

- Not just climate change but global environmental change.
- Systems are complex and evolving and we have to be cautious about "isolating" subsystems for study or policy.
- Interdisciplinary work is essential.
- Social networks/ telecoupling are fundamental to how we learn and respond to change.

Henry, Adam and Björn Vollan. 2014. "Networks and the Challenge of Sustainable Development." *Annual Review of Environment and Resources* 39:583-610.

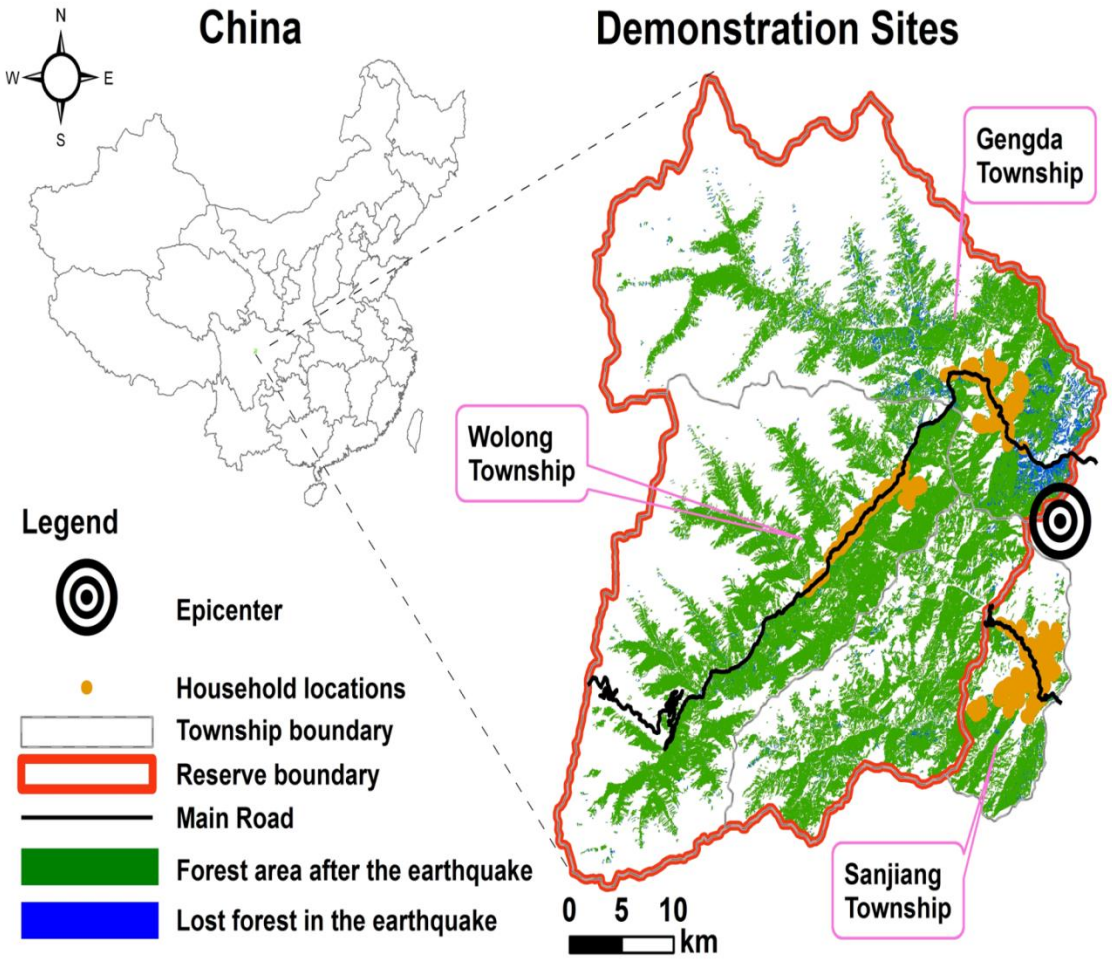
# One case study

2008 Wenchuan earthquake:
M=8,
69,227 deaths, 374,643 injuries, 17,923 missing;
~1 trillion yuan damages;
1.5 M resettled.

-Substantial damage to forests and road system esp for Wolong Nature Reserve

-Less severe in Sanjiang Township (7 deaths/ 4000) than WNR (48 deaths/ 4900 pop).

-Data pre and post earthquake from both WNR and SJT to allow us to look are hwb and es.

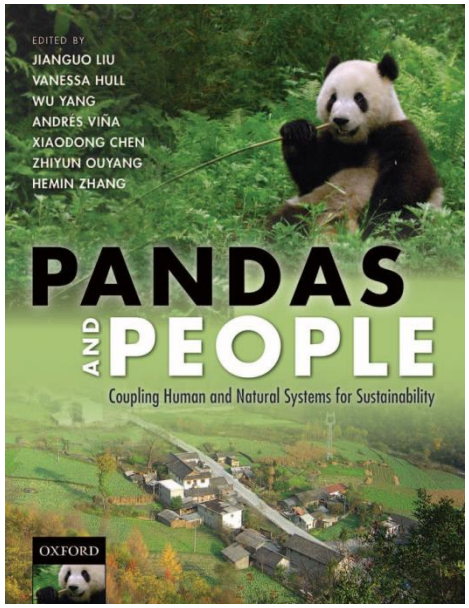


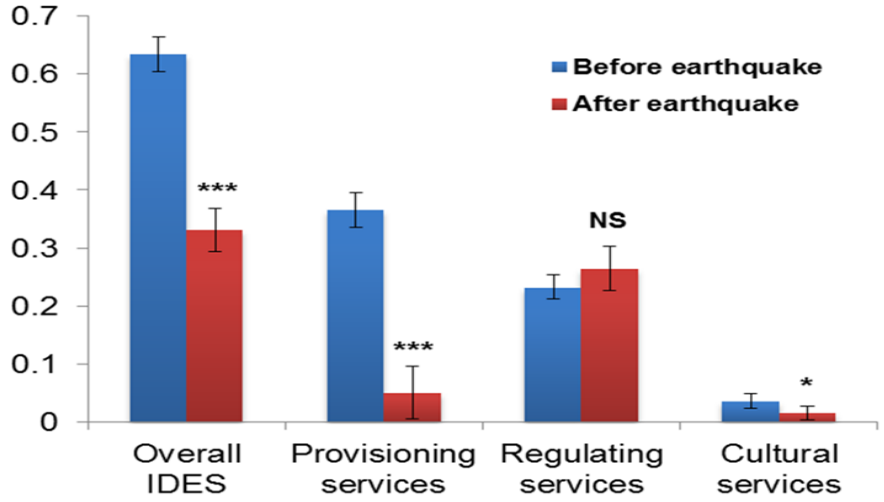
❖Conclusions:

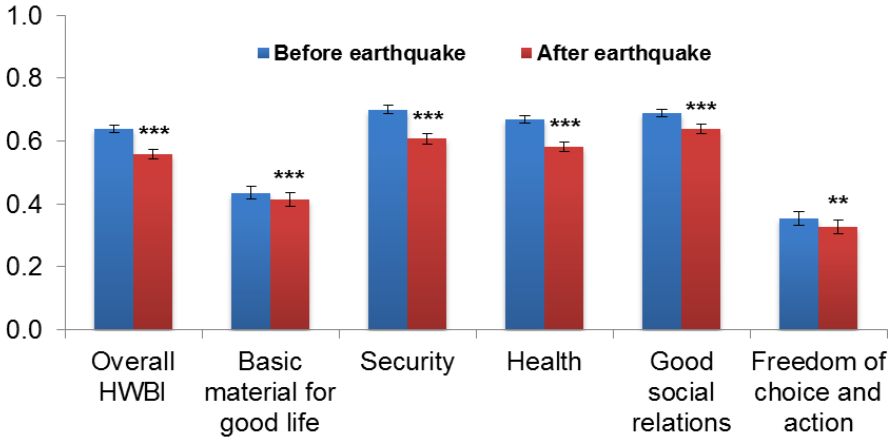
❖ Diversifying types of ecosystem services used reduced vulnerability.

❖ Disadvantaged households with less access to 4 resources suffered more.

❖ Proof of concept: fairly simple household measurements yield results that seem to capture some key dynamics.



What more is needed?

2. Widespread acknowledgement that we are dealing with human ecology/ coupled human and natural systems/ coupled human and environmental systems.
But

Who else should we be talking to?

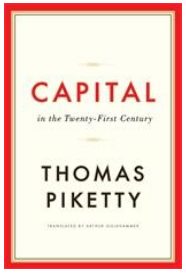
- Sustainability (back to IUCN) is about linking conservation and development.

- What else will affect HWB and the environment?
  - Globalization and teleconnnections
  - Internet of things/ robotics/ AI
  - Bio and nano-technology
  - But also the old problems: poverty, violence, bias

The 21st century will be very different from the 20th.

But we haven't resolved the problems of the 20th or even the 19th.

- Poverty, inequality
- Violence
- Discrimination
- Alienation, depression, mental illness



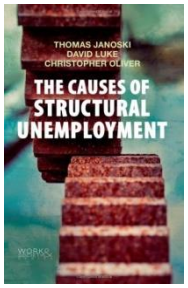
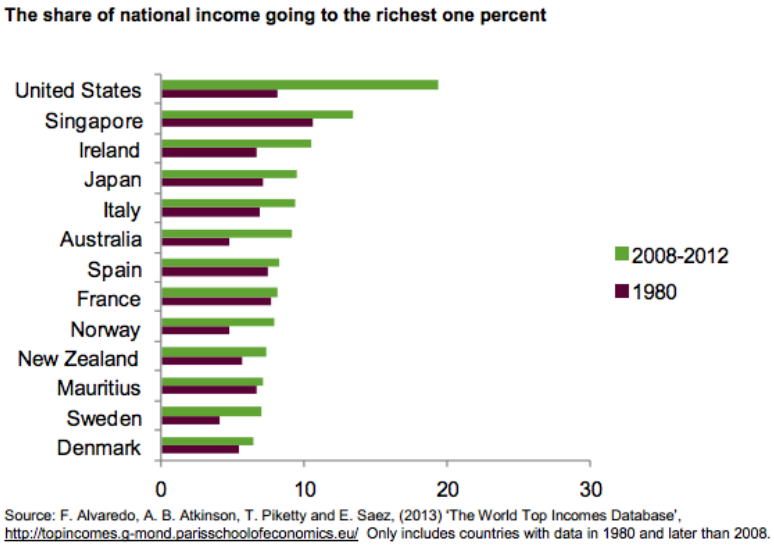





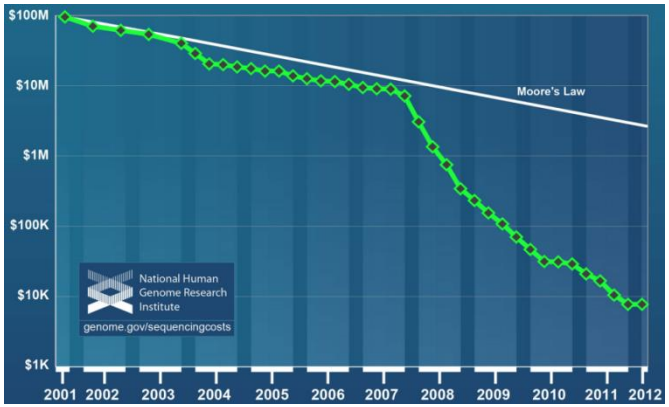
FIGURE I.1. Income inequality in the United States, 1910–2010

http://radioopensource.org/capital-in-10-graphs/



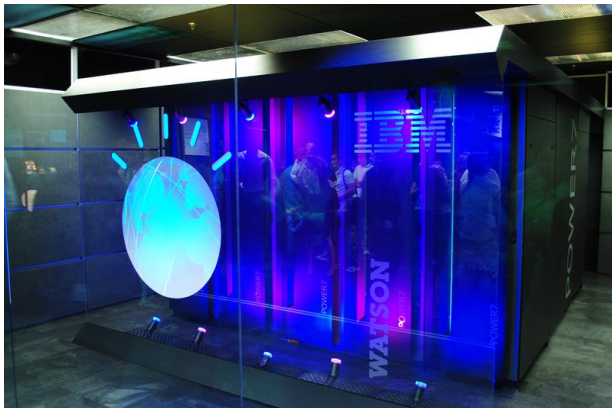

http://www.forbes.com/sites/laurashin/2014/01/23/the-85-richest-people-in-the-world-have-as-much-wealth-as-the-3-5-billion-poorest/

How do we take account of other transformational changes?
How do we learn with the communities engaged around those changes?




- Biotechnology
- Robotics
- AI
- Nanotech
- Web of things
- Etc.

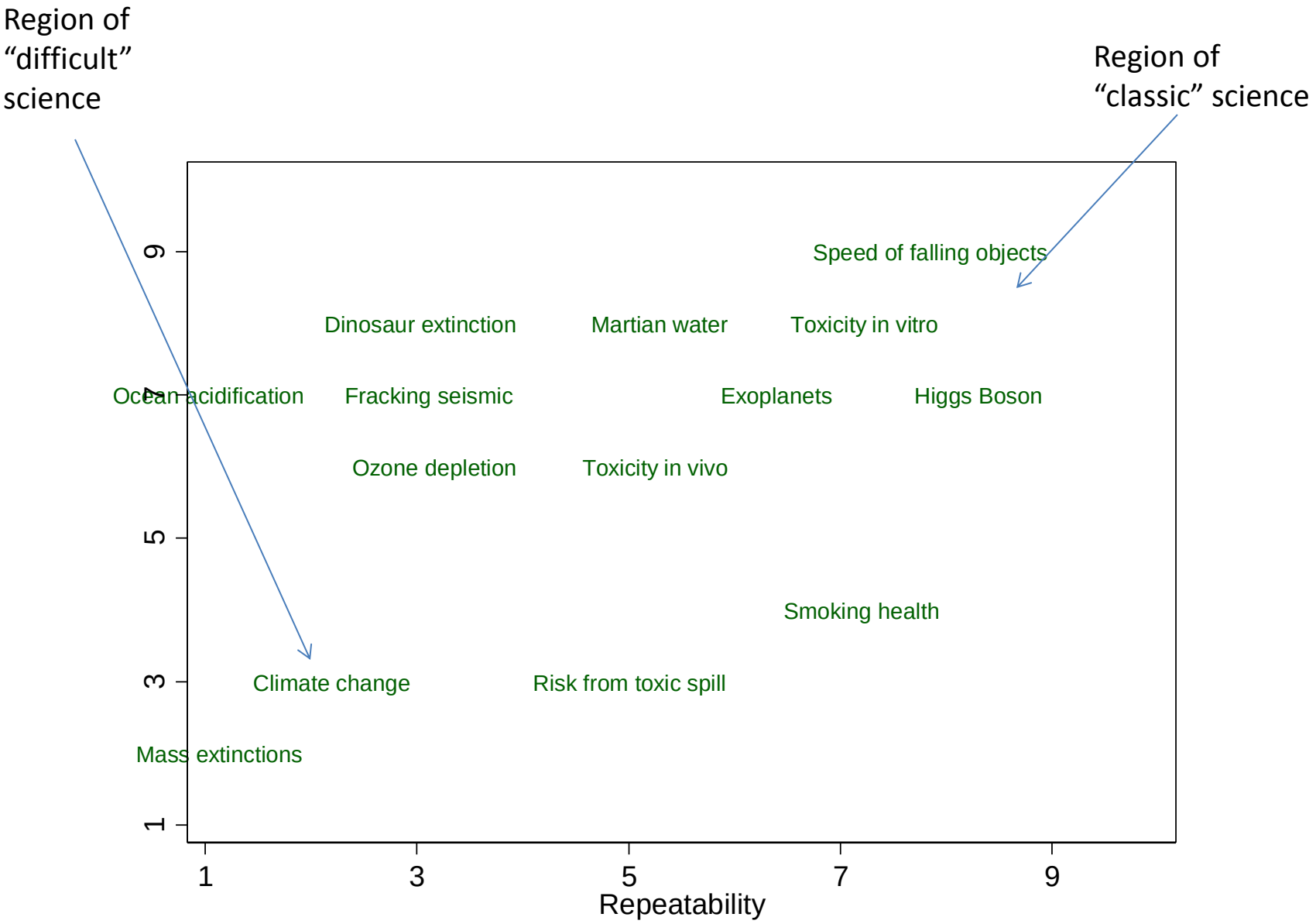
What if robotics and AI substantially reduces the demand for labor? How do we respond?




What have we learned?

3. Uncertainty pervades.

- At best we are dealing with quantifiable risk.
- But typically we are dealing with:
  - Meta-uncertainty: we aren't certain about how to characterize the system or how other subsystems will influence "our" system.
  - Use of science in contexts far from where we have ostensible and repeatable evidence (extrapolation from the general to the local and specific).
- We know this and are developing methods and framing approaches to understand and deal with uncertainty (e.g. adaptive risk management)




After Dietz 2013, Rosa 1998

What more is needed?

3. Uncertainty pervades.
But

What else should we be considering?

- How can we design institutions and networks that learn in the face of uncertainty (Adaptive Risk Management)?

- Can comparative risk analysis help set priorities and provide insights through the comparison (e.g. terrorism and climate change) ?

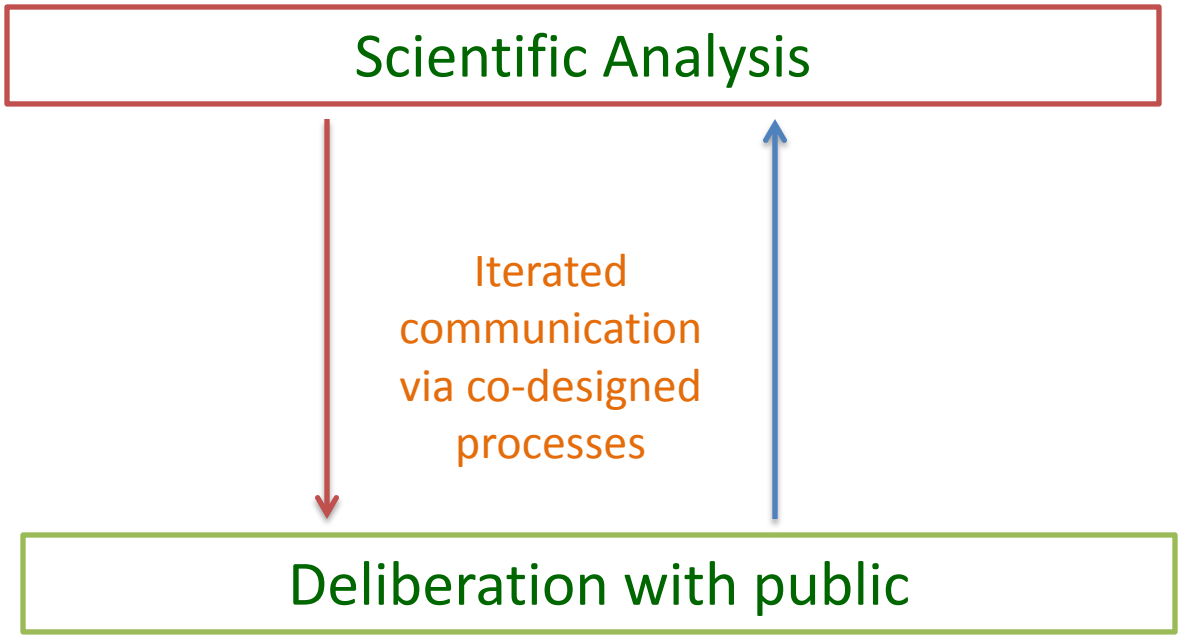
Rosa, Eugene A, Thomas Dietz, Richard H Moss, Scott Atran, and Susanne Moser. 2012. "Risk and Sustainability: A Look at Two Global Threats." *Solutions 3:59-65.*

What have we learned?

4. Both values and facts matter.

- Facts always matter and given the above caveats, we are very good at using science to get the facts right.
- But because tradeoffs are inevitable, built in to sustainability, values will always be important.
- We've learned a lot about values and their influence on decision making (for better and worse).
- We are beginning to learn how to link scientific analysis to public deliberation about values.

# Linking analysis and deliberation

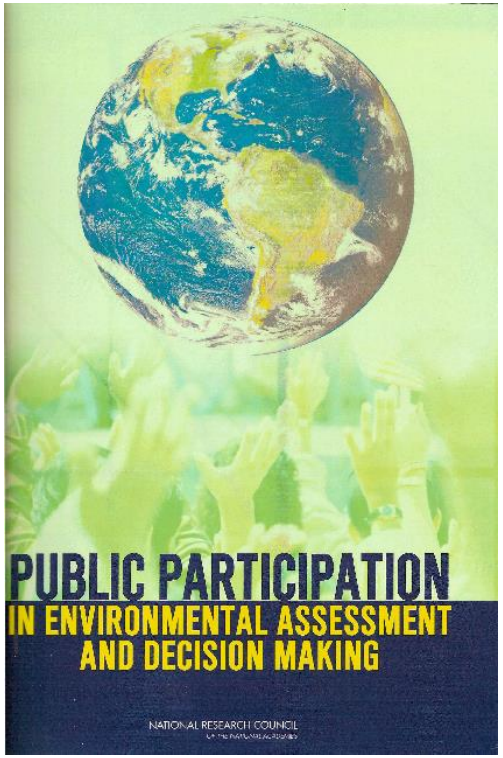



+ Science must address both the issues of concern to researchers and issues of concern to the public.
+ Getting the science right—community expertise can be helpful.
+Getting the right science—addressing issues that are on the community agenda as well as those on the scientific agenda can build trust.

+ Major conclusion: "**When done well, public participation improves the quality and legitimacy of decisions and builds the capacity of all involved to engage in the policy process.**" (U.S. National Research Council 2008: 226).

Three goals can be achieved. When done well, participation improves:

- ❖ the quality of decisions or assessments;
- ❖ the legitimacy of decisions;
- ❖ the capacity for decision making of all involved.




~1000 studies reviewed; 11 diagnostic questions; 15 recommendations

What more is needed?

4. Both values and facts matter.
But

How can we do at least as well handling values as we do facts?

- How do people deploy values in making decisions in the face of complexity, uncertainty, cognitive strain?
- What kinds of processes lead to reaching value consensus and allow tradeoffs?
- How can we scale up from our knowledge of how to do linked analysis and deliberation at the local/regional level to the national and global?
- How can we engage multiple standpoints and types of expertise?
- How can we take advantage of social learning on networks?

Respects multiple forms of expertise

**-Scientific expertise about substance**: expert knowledge about the systems and processes that will be affected by decisions

**-Scientific expertise about process and decision making:** expert knowledge about individual and collective decision making including valuation

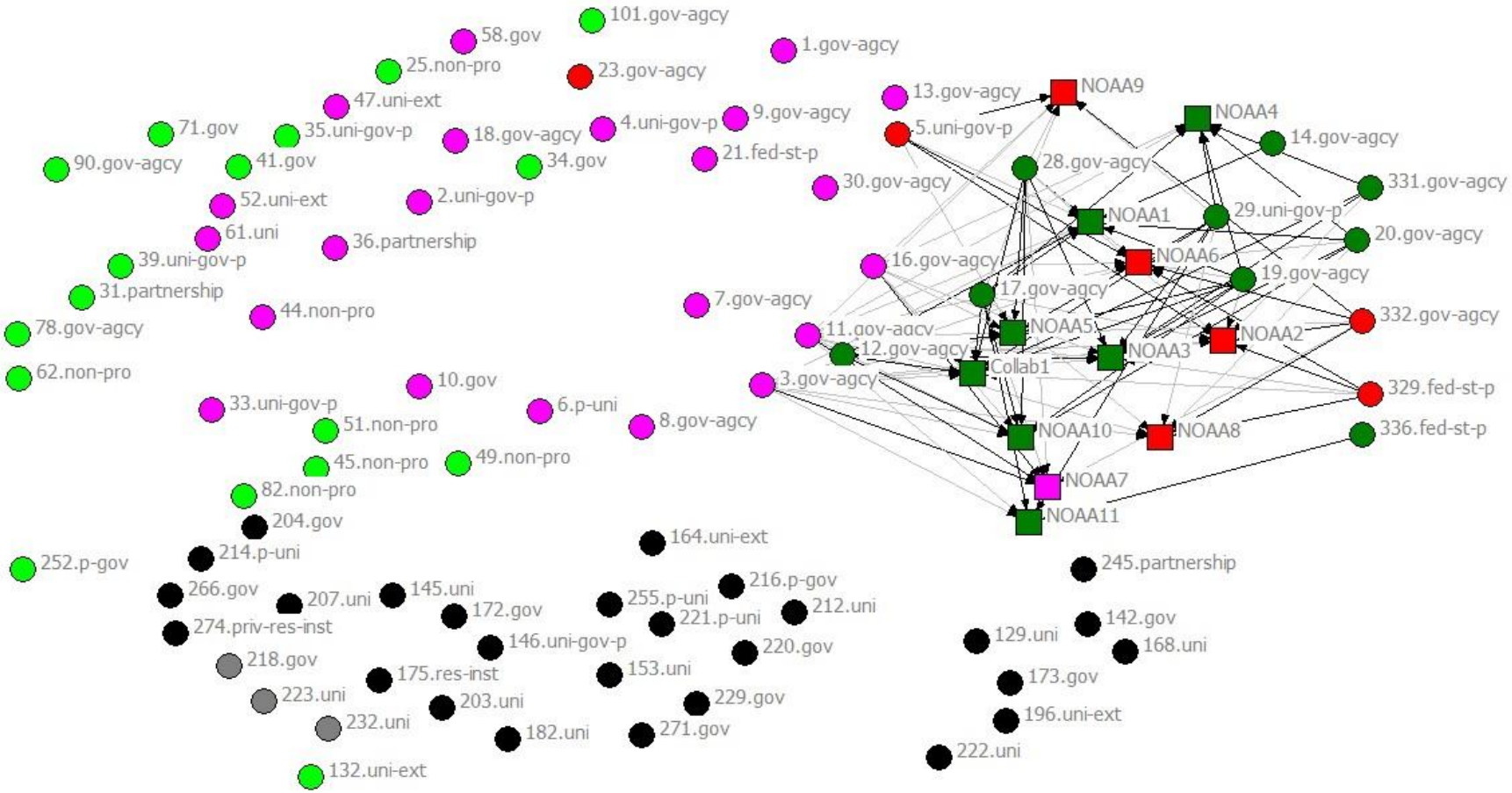
**-Community expertise**: knowledge based on life experience living in systems that will be affected, "traditional ecological knowledge"

**-Political expertise**: knowledge about conflicts, assumptions, trust, informal institutional arrangements based on engagement in policy systems

**-Value expertise**: Everyone has legitimacy with regard to values. But good process and research may help articulate values and reduce value conflict.

Dietz, Thomas. 2013. "Bringing Values and Deliberation to Science Communication." *Proceedings of the National Academy of Sciences 110:14081-14087*.

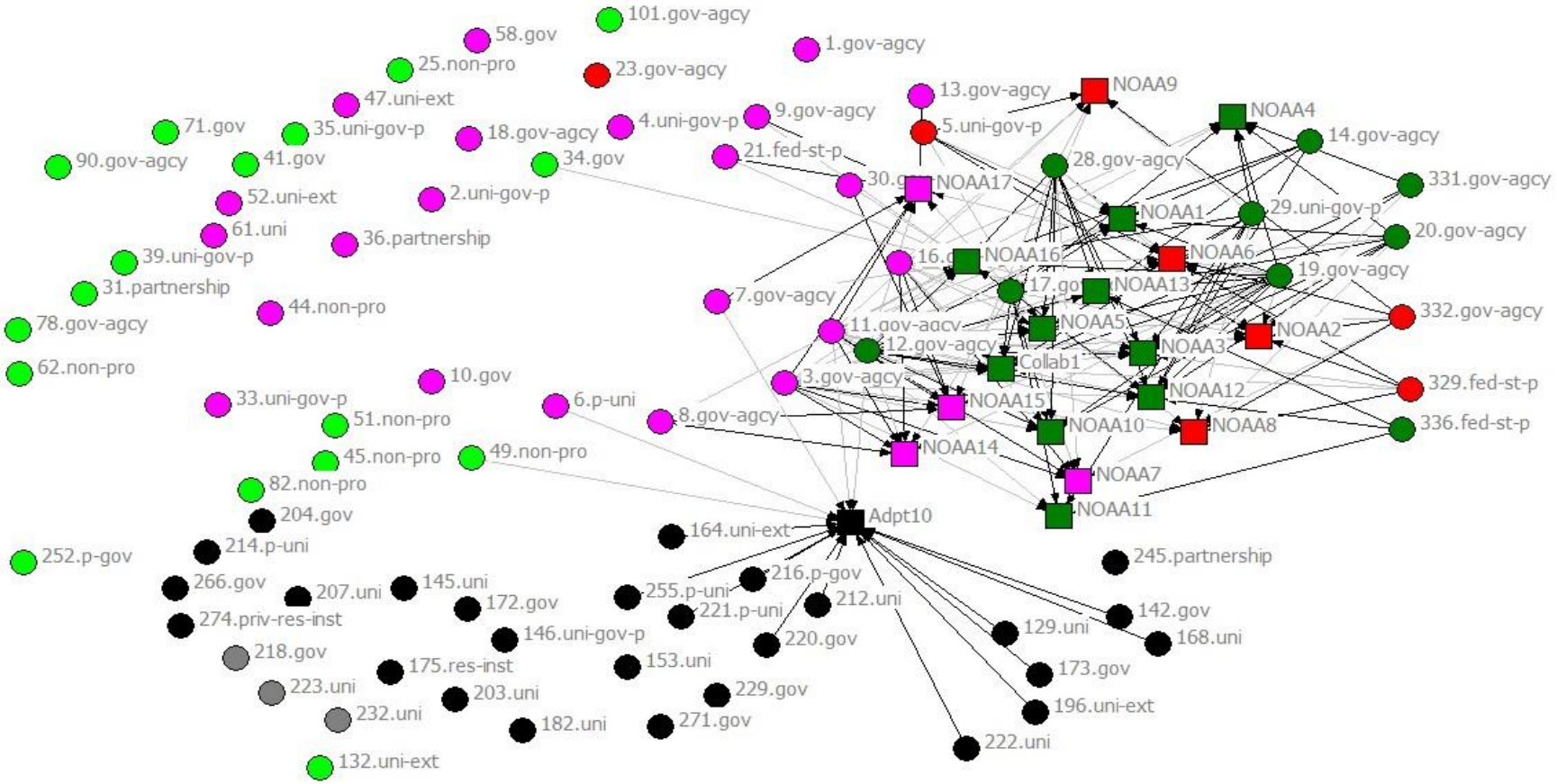
# Social Learning on networks.
# Evolution of Climate Network: Great Lakes Region 2009






Frank, K., et al., 2014.

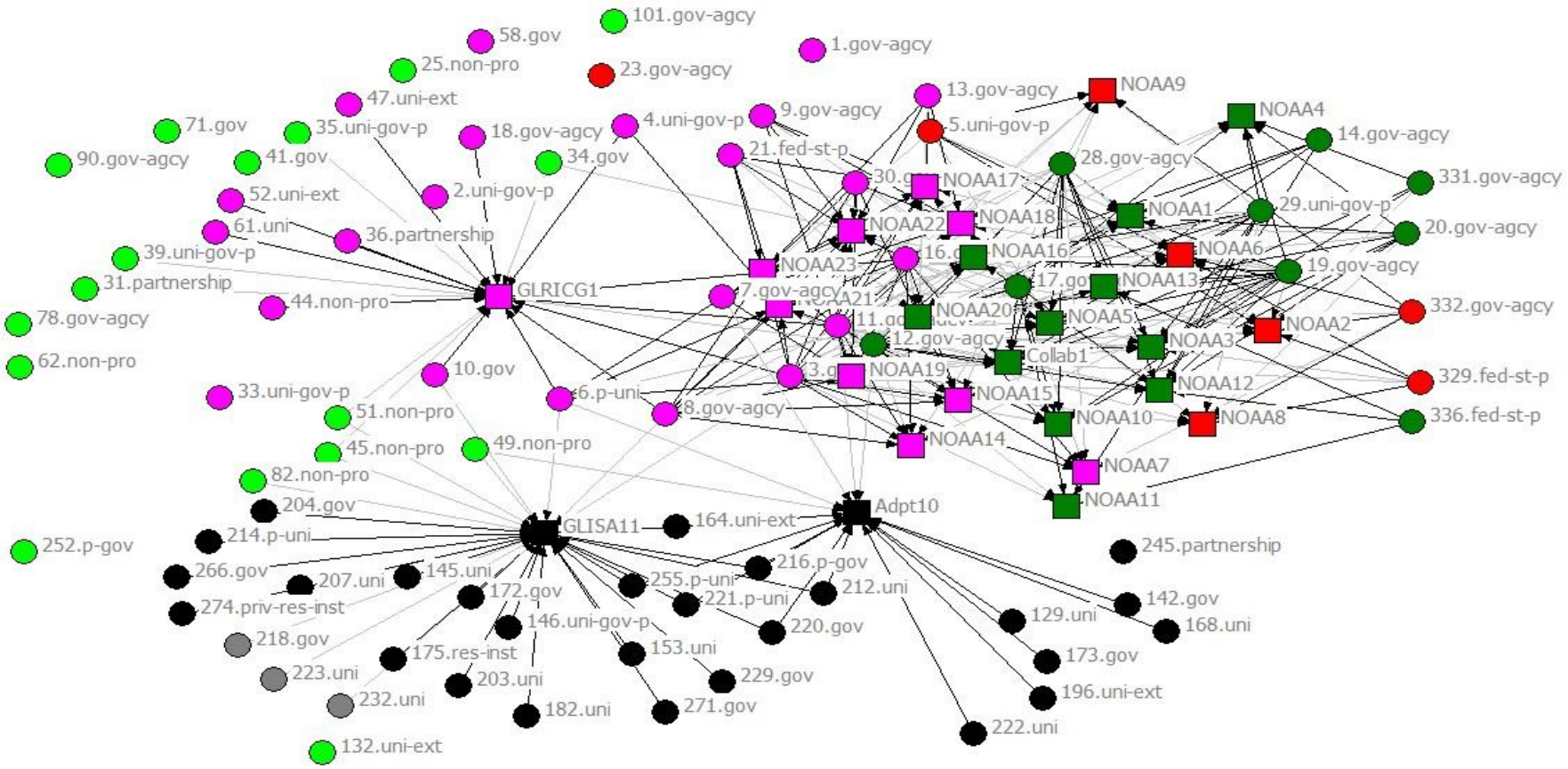
# Social Learning on networks.
# Evolution of Climate Network: Great Lakes Region 2009-2010






Frank, K., et al., 2014.

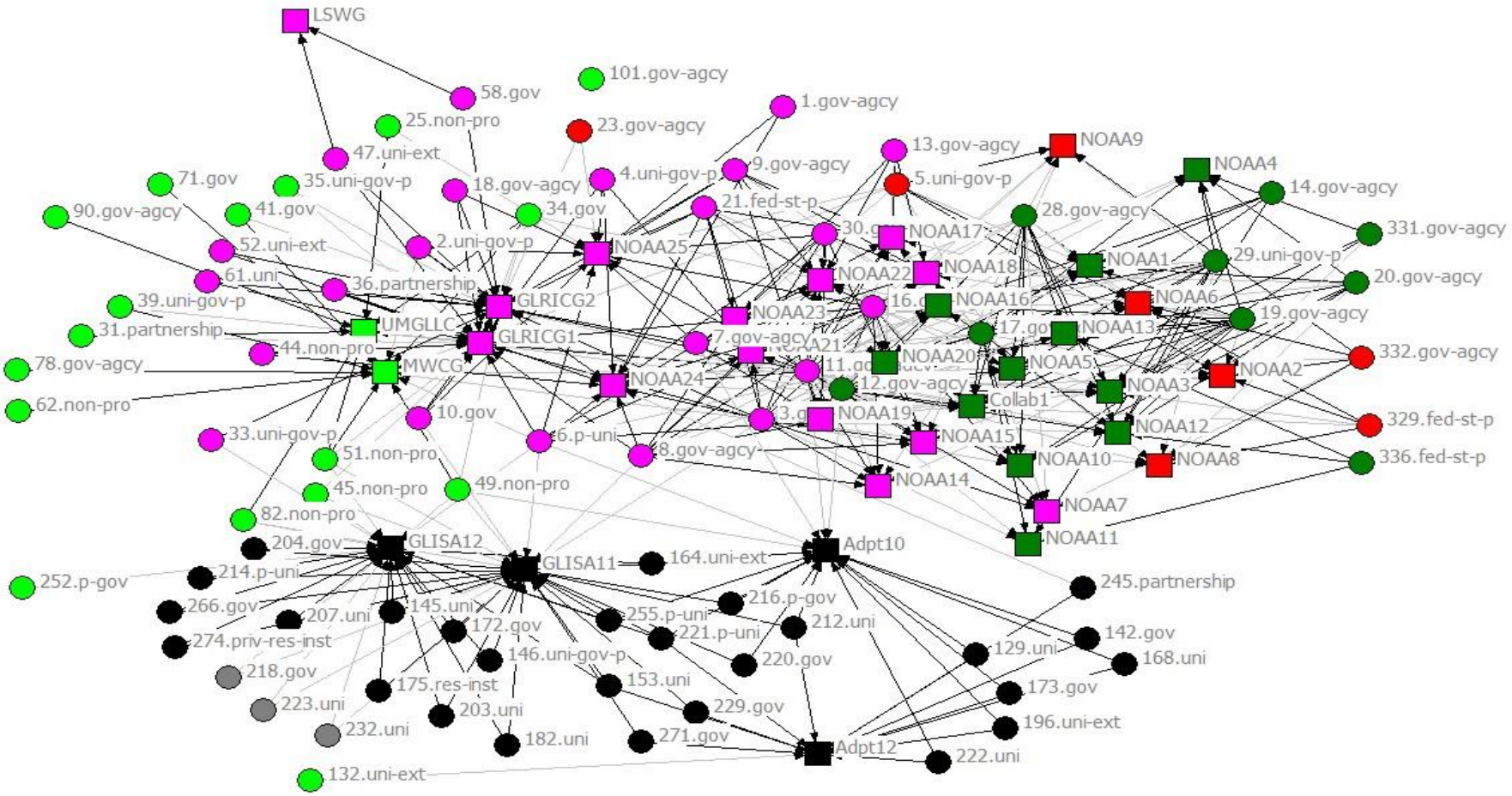
# Social Learning on networks.
# Evolution of Climate Network: Great Lakes Region 2009-2011






Frank, K., et al., 2012.

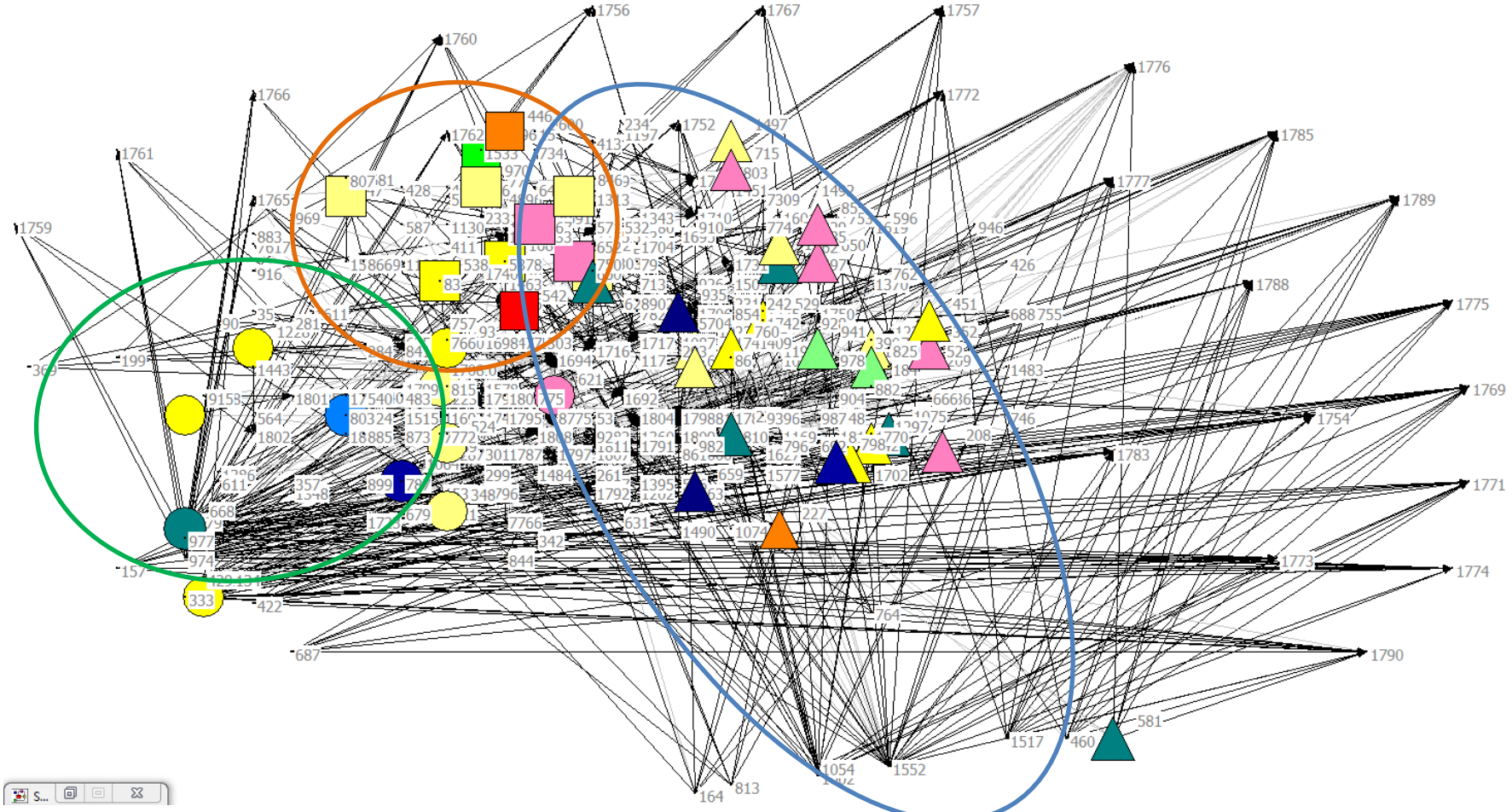
# Social Learning on networks.
# Evolution of Climate Network: Great Lakes Region 2009-2012






Frank, K., et al., 2014.

# Social Learning on networks.
# Network of research on lake levels: Diffusion of information **is** occurring

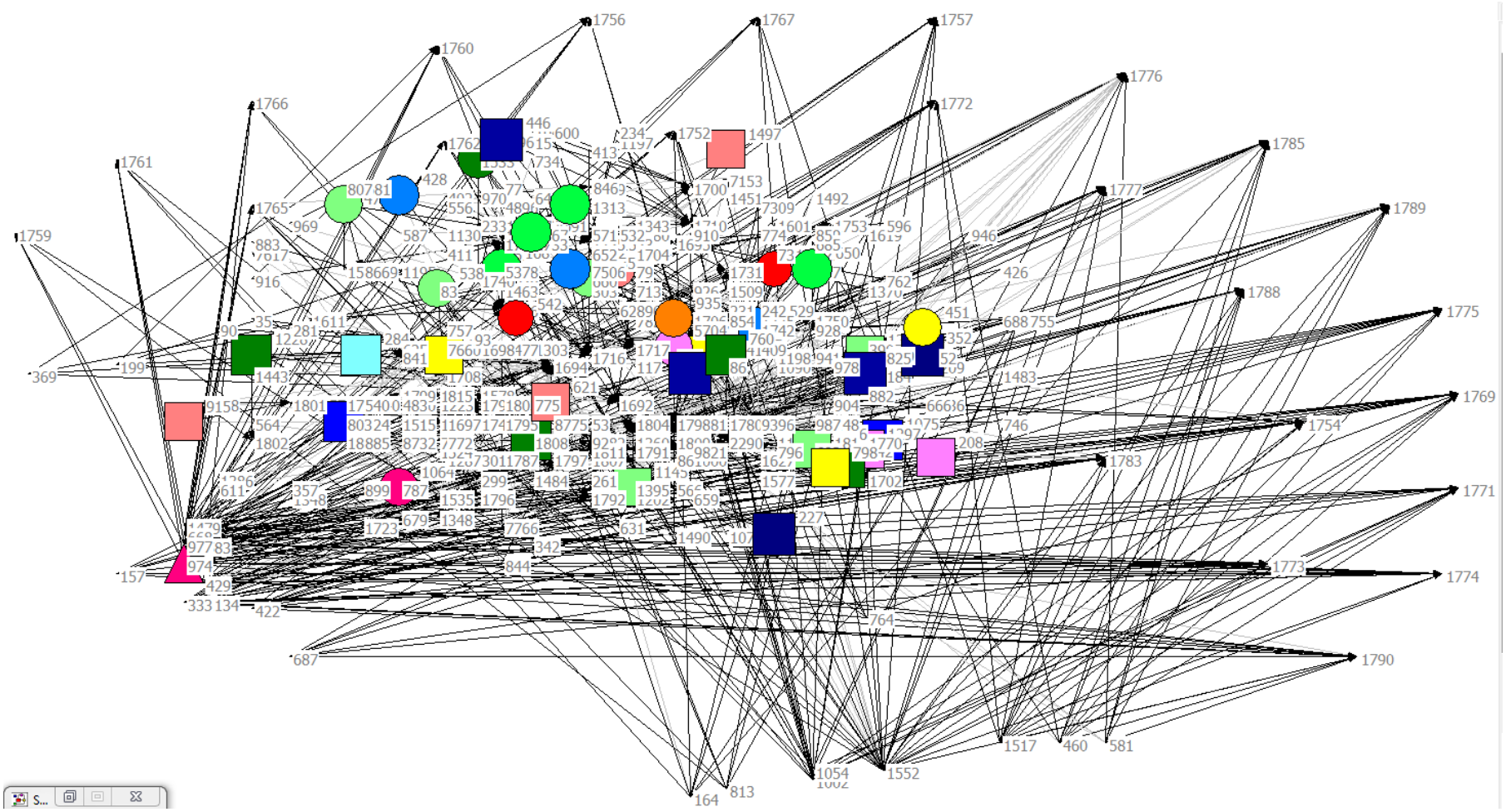





Frank, K., et al., 2014.

# Social Learning on networks.

## Network of research on freeze-thaw cycles: Diffusion of information **is not** occurring





Frank, K., et al., 2014.

What have we learned?

5. Sustainability is about decisions and making tradeoffs under uncertainty.

- We have strong research traditions on decision making:
  - Rational actor model (RAM)
  - Heuristics and biases (H&B)
  - Values, beliefs, norms (VBN)
  - Organizational decision making (ODM)
  - Advocacy Coalition Framework (ACF)
  - Institutional and Development Framework (IAD)
  - Etc.

- Context matters.

What have we learned?

5. Sustainability is about decisions and making tradeoffs under uncertainty.

But

- How do we integrate the theories?
- Which theory explains what in which contexts?
- In general need to be more attentive to context,
  - Individuals embedded in communities embedded in nations, etc.
  - Tradition of place based studies and micro level/ individual work is part of the puzzle.
  - Large cross national, historical and cross-institutional comparisons is another

Context matters!

- Individual and local studies reveal part of the puzzle.
- Macro-comparative (across nations, time and/or institutions) reveal part.
- But can we integrate?
- In at least the social sciences we have methods for contextual analysis and some theory.
  - But we lack the data sets that provide comparable data on representative samples of individuals across a large number of contexts.
  - We know how to collect this data (e.g. World Fertility Survey).
- We also have a long tradition (50+ years) of data archiving and curation.

What have we learned?

6. A science is emerging.

- These talks are evidence.
- We are good at small very high quality meetings.
- There are publications venues but they are either very high prestige or not very recognizable yet.
- We are training students.

What have we learned?

6. A science is emerging

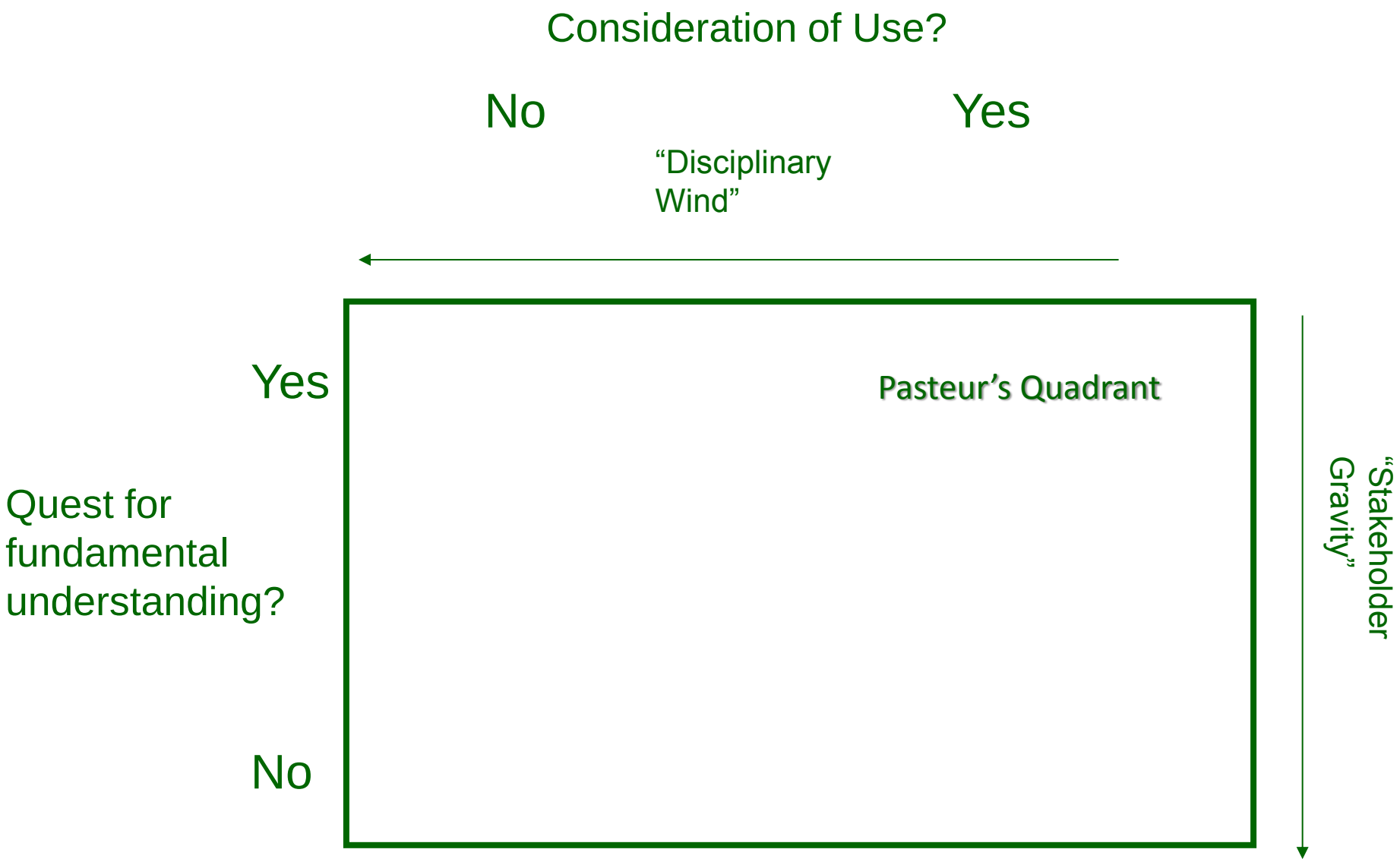
But

We need to do more to build the community especially for newer scholars and practitioners.

As one of Pam's informants said

"Develop new professional organizations and publications venues."

# We need that to resist the push away from Pasteur's Quadrant




After: Donald Stokes. 1996. Pasteur's Quadrant: Basic Science and Technological Innovation. Washington, D.C.: The Brookings Institution Press.

In sum:

1. Focus on inclusive well-being or on human well-being and the environment.

2. Widespread acknowledgement that we are dealing with human ecology/ coupled human and natural systems/ coupled human and environmental systems.

3. Uncertainty pervades.

4. Both values and facts matter.

5. Sustainability is about decisions and making tradeoffs under uncertainty.

6. A science is emerging.

## On elephants

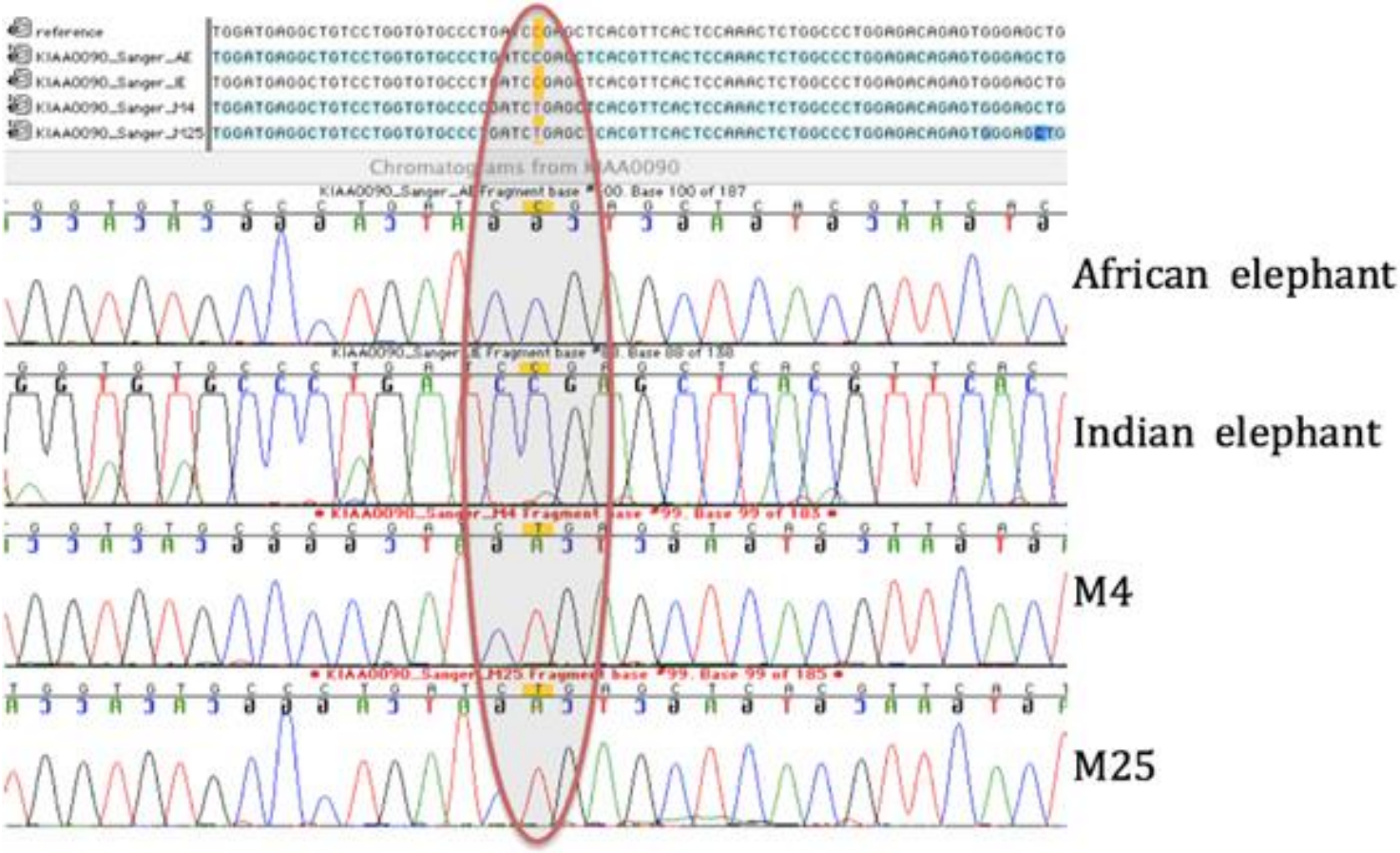
❖ We need an integrated picture of the elephant—not just the pieces.

❖ To talk to each other we have to discuss facts and values, and acknowledge uncertainty.


Hanabusa Itchō (1652–1724)

Source: http://upload.wikimedia.org/wikipedia/commons/4/45/Blind_monks_examining_an_elephant.jpg

This is indicative of our factual understanding. It is profound.




But it is not sufficient for making decisions that involve elephants, let alone mammoths.

For decisions we need to engage our values as well.

In 2005, the Detroit Zoo decided that it was not ethical for them to keep elephants, who need social groups. They retired Wandy and Winky to a California animal sanctuary. This was very controversial.

That decision required analysis and deliberation about both facts and values.

So do all good decisions.

Thank you!

Image by Joe Zammit-Lucia, used with permission.