

Challenges in the Integration of Systems Knowledge for Governance of the Earth System

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Background and Objective

Over the past half century, systems modeling has become a powerful tool for earth system science, and our understanding of climate change, for instance, would be far from what it is today without climate systems models. However, there is still much to be done to integrate across the different components of the earth system and to understand their interactions, homeostatic mechanisms and feedback processes as we try to define planetary boundaries and systems limits (Rockstrom et al. 2009).

Efforts to model the complete earth system including the human component have made much less progress. The report to the Club of Rome on the "Limits to Growth" (Meadows et al. 1972) was subject to a campaign of disinformation that left most believing that it had been discredited, and discouraged further efforts at comprehensive modeling of the human system (MacKenzie 2012). Yet with 40 years' hindsight and periodic updates (Meadows et al. 1992; Meadows et al. 2004), nothing has yet proven them wrong, and a recent comparison of real growth with the main scenario of the Limits to Growth report shows a close match (Turner 2008).

There are many challenges in bringing natural and social sciences together in research both on the earth system under pressure and on the type and architecture of governance that could support earth system sustainability. Our objective is here to outline some of the particular challenges for the social sciences that all revolve around the insufficient efforts to adopt a global systems perspective for the human parts of the earth system.

Challenges for a systems perspective in the social sciences

The social sciences are lagging behind the earth system sciences in adopting a systems perspective. There are several underlying theoretical and methodological reasons for this (Karlsson 2007). Here we highlight five areas that illustrate the insufficient systems perspective although we are aware that there are exceptions to each of the statements below and that many researchers are already working in this direction.

1. Research in (environmental) social science is predominantly focused on:

- specific environmental problems ('symptoms') such as climate change, eutrophication, biodiversity loss etc.,
- direct causes ('proximate drivers') such as badly designed economic institutions, transport infrastructure, consumption of toxic substances, etc.

Social science pays less attention to domains where we find the underlying drivers for environmental change, such as:

- the 'inner' processes of the human being; her thoughts and mental models, her sense of identity and beliefs
- the more deeply rooted structures of her society; the model of continuous (material) growth that the economic system is built on, the promotion of materialism and consumption as

endpoints of happiness that our social system is encouraging, or the pattern of competition and conflict that underpins the political system

2. Social scientists usually confine their analysis to:

- stay within geographical/jurisdictional limits (community, region or country) limiting the number of comparable cross-cultural studies
- one governance level (local, national or international) according to disciplinary focus

A system perspective of the human part of the earth system would rather ask for:

- taking the human family in its entirety as the moral and analytical community
- including analysis of the complex linkages in governance from the local to the global level.

3. Social science research on governance to address environmental degradation is often divided by:

- types of measures (economic instruments, institutions, education)
- types of regimes linked to an environmental symptom

A systems approach to governance would call for more analysis of:

- how to integrate a wide range of governance measures that involve actors at all levels and from all stakeholder groups
- how to integrate regimes through interplay management
- how to change governance of human functional activities and underlying drivers (energy, transport, consumption); and
- how to integrate social, economic and environmental dimensions of sustainable development

4. Much of the research on the role of *institutions* (both rules and organizations) in environmental governance tends to center on operational and collective-action type institutions, in the terminology of Kiser and Ostrom (1982), rather than constitutional type institutions. Constitutional type institutions are much more difficult to change but it may indeed be necessary to do so in order to enable a transition towards sustainable societies. Examples of constitutional type institutions that warrant more attention are:

- national sovereignty and citizenship
- institutions that reinforce existing inequalities within and across countries for example in the trade regime and development regimes
- institutions related to intellectual property rights and their influence (positive or negative) on dissemination and adoption of cleaner technologies
- institutions in the field of research funding and evaluation that reinforce a strong pattern of center-periphery relationships in knowledge production.

5. Finally, as research is predominantly carried out in a 'western' cultural context, it underplays cultural diversity in drivers and approaches to address environmental change, for example neglecting the role of faith, cultural values and religious organizations.

Implications for science advisory functions

The insufficient

systems approach in the social sciences has implications for the ability of integrated earth system science to contribute relevant knowledge to policy-makers. The natural sciences are telling us how much pressure the planet is put under, but in the absence of systems-based proposals from the social sciences on alternative ways forward, policy makers do not have holistic alternatives for their consideration. A parallel example we can see in the the 2008 financial crisis, which was partly due to a lack of an integrated view of the financial system (Jamison 2008). We need new visions of social sustainability that are sufficiently well-founded and realistic to be able to attract widespread support.

All of the existing scientific advisory processes need to strengthen their social science component to produce policy-relevant recommendations for action. Systems modeling of nature has shown how complex results can come from simple processes (Dahl 1971, 1973, 1996). Similarly in human systems, the evolution of society is driven at its most fundamental level by relatively simple moral values and ethical principles, yet social sciences are not taking the lead in formulating new *principles* for the global transition to a more sustainable society.

One proposal put forward to Rio+20 is the creation of a specific ethical advisory process in support of policy making, such as an Office of Ethical Assessment in the UN Secretariat, or a Permanent Forum on Ethics and Religion at the United Nations comparable to the Permanent Forum on Indigenous Peoples (IEF 2011). Such an office would make the need for solid social science research more visible as input for ethical analysis.

Integrated social science research on governance mechanisms for the earth system, supported by human/earth system modeling at the global level, is necessary to help us find practical ways forward in learning to live within planetary boundaries and human system limits.

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