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Knowledge Action Networks: Connecting regional climate change assessments to local action

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KNOWLEDGE ACTION NETWORKS

Connecting regional climate change assessments to local action

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Making knowledge ‘decision ready’

In addressing complex collective action problems, such as mitigation of global climate change and adaptation to its effects, we ask: when is knowledge ready to be conveyed responsibly to non-experts? When do experts know they know something? At what point does research become ‘established knowledge’?

The climate urgency has required acceleration of the process by which recently acquired knowledge becomes decision-ready. New questions arise. Is established knowledge the same as decision-ready knowledge? How can specialists best convey their conclusions to the decision maker? Is the expert community doing all the studies needed for policy analysis? What is the best way to convey the meaning of scientific uncertainty to policy makers and thence to decision makers and to the public?

For climate science, this is problematic. While the climate science community may have reached consensus on the causes of climate change, communicating the science of the consequences of climate change, complete with its complexities and uncertainties, is perhaps the greatest challenge for the contemporary interface between science and policy. The boundaries of ownership of the problem are disputed and dynamic. There is no *certainty* in the scale and range of the mid- to long-term effects of climate change, and global responsibility for decisions does not rest clearly with any single agency or community. The decision-making time-frame of governments varies widely (in the UK, on a cycle of about three to five years); decisions made may affect whole countries, yet the impacts of climate change are highly differentiated at region and state level. The uncertainties only highlight, compound and exacerbate the stresses already present at the intersections between conflicting priorities. The challenges posed by climate change are transgenerational and are therefore significant tests of humanity’s ability to overcome the collective action dilemma – to innovate and to design equitable, flexible, lasting solutions that are locally appropriate and that



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transcend political cycles, national boundaries and conflicts of interest between present-day power elites (both domestically and internationally).

Any expert community will encompass differing opinions about active research. When can the non-expert assume that most researchers believe a question has been answered? How can the non-expert know whether a particular scientist represents the community as a whole? Epistemic communities achieve critical mass when ‘common operating language’ within the community and an agreed research method for operating at the boundaries of new knowledge have been established. Researchers are trained to grapple with the frontiers of their fields and are most comfortable talking about what remains to be discovered. They believe that the scientific method, not consensus, establishes truth. Science knowledge is based on evidence. Aside from consolidating recent progress in review articles and monographs, researchers by and large have relied on the change over generations for issues to settle out and knowledge to be established. Not until the magnitude of the climate change problem became apparent was there a serious need to accelerate the formal coalescence of research into knowledge, a task which we now recognise as ‘assessment’. Making knowledge ‘text-book ready’ is not enough. It must be put into practice in order to become ‘useful’ knowledge.

The Intergovernmental Panel on Climate Change

In 1988, the World Meteorological Organization and the United Nations Environment Programme established the Intergovernmental Panel on Climate Change (IPCC) to provide ‘an objective source of information about climate change’. Globally, the IPCC stands as a boundary organization, between ‘pure science’ and ‘pure politics’. An inclusive cross-section of the world community of climate scientists has been enlisted since 1988 to carry out the most rigorous reviews of a state of scientific knowledge ever attempted.

The IPCC’s influence grew progressively as successive reports updated the scientific community’s understanding of climate change and confidence in its projections. The return over and over again to the same issues proved to be essential in strengthening the global recognition of the IPCC’s findings.

The IPCC devised transparent processes that promote trust: the reviews were restricted to what is in the peer-reviewed literature; the review panels were chosen with great attention to balance between countries, established points of view and institutional interests; and successive panels involved new participants to avoid an institutionalized IPCC point of view. It created rigorous ways to convey its conclusions in forms that policy makers could use, and a uniform language to describe degrees of scientific uncertainty. Its most important innovation was its summaries for policy makers, in which scientists and policy makers together composed, line-by-line, conclusions drawn for their pertinence to policy, with careful attention paid to the uniform characterization of uncertainty and risk.

The IPCC’s Fourth Assessment Report appeared in 2007. Its first volume, by Working Group I, is devoted to the physical science basis of climate change (IPCC, 2007a); the second, to impacts, vulnerabilities and adaptation options (IPCC, 2007b); the third,



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to the opportunities and costs of mitigation (IPCC, 2007c); and the last, to a synthesis of the overall findings (IPCC, 2007d).

The scale of the enterprise required simply to assess the peer-reviewed literature about climate change is impressive. The 2007 report of Working Group I was started in 2004 and completed in 2007. It involved 152 authors, 400 contributors and 600 expert reviewers, and responded to more than 30,000 comments. Working Group II, on the physical and biological impacts of climate change, reviewed 577 peer-reviewed studies. Working Group I's strong attribution of recent climate change to human activity was in large part due to new and better observations of the physical climate system. Working Group II established that physical and biological systems on all continents and in most oceans have *already* been affected by climate change. Of more than 29,000 observational data series from 75 studies that show significant change, more than 89 per cent were consistent with the direction of change expected as a response to warming (IPCC, 2007e). This survey was designed to inform global decision makers about the scientific evidence from which they, the decision makers, would have to determine which policies to enact. Working Group II also arrayed impacts on a large region by large region basis, and began the task, still unfinished, of addressing the highly specific concerns of local decision makers. It is the findings of Working Group II that have special relevance to the subject of this group of papers.

The IPCC assessments have transformed the international debate about climate and are almost globally accepted as the definitive assessment of the scale and rate of climate change. The IPCC shared the Nobel Prize for Peace only a few months after its 2007 report was released. Assessment has taken its place alongside experiment, theory and modelling as a basic scientific activity wherever science and public concerns overlap. It is the most important social technology devoted to science to emerge out of the 20th century.

Confronting the hierarchy of scales: global, regional, local

Regional climate differs in complexity and character from global climate. The factors that combine on average to drive global climate may have a different balance regionally. State-of-the art global models (IPCC, 2007a) necessarily average over regional details in favour of workable concepts and computations. A true regional climate model differs from a regionalized global model in its spatial specificity; topography and coastal proximity create local climatic and ecological zones that cannot be resolved by contemporary global models, yet must be evaluated to make a regional impact assessment meaningful (e.g., the State of California is divided into 16 distinct climatic zones). Increasing the spatial resolution of global models is necessary but not sufficient alone; new processes and regional dynamics need to be taken into account.

Understanding regional climate variability and change is only the beginning of evaluating the ensuing ecological, economic and social impacts. We have to ask how climate change affects key natural systems such as watersheds, ecosystems and coastal zones, and the cycles and local patterns of variability. With a full system characterization that includes economic and social impacts, it is possible to create an informed basis for decision support relating to adaptation.



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Many of the most complex natural and human responses to climate change are local. In disaster management, it is well understood that infrastructure resilient to single stresses can fail in a ‘perfect storm’, where multiple vulnerabilities and stresses come together. By analogy, localities are subject to multiple social and environmental stresses that change at different rates, only one of which is climate change. Further, climate change may compound and exacerbate existing stresses. The effects may not always be additive, but could be subject to threshold responses, or tipping points.

Not only do different multiple stresses interact differently in different places, but the ways in which people make decisions about their environments are highly variable. Key decisions are made locally about such things as land use, transportation, the built environment, fire management, water quality and availability, and pollution. The contexts in which such decisions are made are shaped by local considerations, and to many preoccupied decision makers the globe seems a distant abstraction.

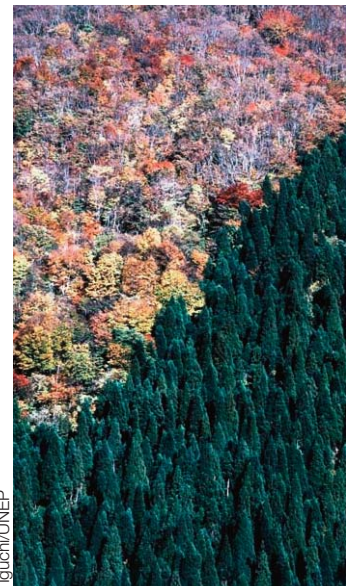
Climate change is only one of the problems local leaders face. It often appears less pressing than ongoing environmental degradation and resource depletion, or the need for social and economic development. Yet these challenges are connected. The global climate problem has called forth a community of researchers and practitioners who can help local leaders deal with the great problems of environment and development with which climate change is intertwined. Critically, for such complex issues as climate and environmental change, it follows that the scale of decision making and design of policy interventions should suit the scale and boundaries of the system that the intervention is designed to benefit.

Regional assessment: bridging the global and local

A global assessment develops a decision context for global decision makers – heads of state, international organizations, multi-national corporations and others charged with setting global, long-term directions. These decision makers largely focus on issues associated with mitigation of climate change at a global, transboundary scale. Many of the key decisions about adaptation to climate change will be taken at the local level. These decisions affect how people live (University of Cambridge/UCSD, 2009).

Regional impact assessments convey information to local decision makers that a global assessment cannot. They speak powerfully to the things people care about. They involve decision makers in a much more direct way than a global assessment. The paths from information, to knowledge, to decision support, to adaptive management run through regional assessment.

In just one of many examples, the State of California has been a leader in modelling, assessing and monitoring potential climate change impacts. It began to study the issues 20 years ago, and two years ago committed to biennial formal assessments to identify and quantify impacts on its massive water-supply systems, agriculture, health, forestry, electricity demand and many other aspects of life. The first California assessment, *Our Changing Climate* (2006), predicted that the snow cover in the northern Sierra Nevada will decline by 50-90 per cent by mid-century (California Climate Change Center, 2006). This conclusion was particularly compelling for citizens of California, since the most productive agricultural region in the US, the Central Valley, derives



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most of its water from rivers with headwaters in these mountains. In addition, northern Sierra water is a major source for the 20 million people living in arid southern California. *Our Changing Climate* was an important influence on California's Administration and Legislature, which beginning in 2006 enacted a series of climate-related measures and forged cooperative programmes with neighbouring states and internationally. California's example shows how powerful regional assessments can be: Californians learned how they will be affected by climate change and this motivated political action. Until people can answer the question, '*What does it mean for me?*', they cannot develop their own strategies for adaptation.

The global assessments made by the IPCC should be supplemented by a mosaic of regional assessments of the impacts of climate change on natural and human systems. We should not expect that the globe can be sub-divided neatly into non-overlapping regions with sharp boundaries, nor can we expect regions to restrict themselves to the same geographical area for the different kinds of assessments they need. Each physical, biological and human system has a natural spatial configuration that must be respected. We should think, therefore, of a complex, hierarchical network of loosely connected, self-assembled regional assessments rather than a unitary project.

The impacts of climate change are being (and are expected to be) most severely felt in the developing world. International support for regional impact assessments will encourage capacity-building, promote creation of local knowledge obtainable in no other way, and disseminate and propagate a two-way understanding that helps make the response to climate change genuinely global.

Regional assessments will be needed throughout this century, so the world will continue investing in the infrastructure supporting them. Each region will have to monitor, model, assess and decide, and monitor, model, assess and decide – again and again. This need will spark continuous improvement of observations, models, information systems – in and above cities, streams and farms, mountains and oceans – to follow, dissect and forecast the ongoing interacting changes.

Regional impact assessments are a step – but not the only step – on the path to adaptive management. They are used today to frame decision options and provide advice to policy makers. But, as experience accumulates, we anticipate that the infrastructure supporting the assessments will also provide information directly to managers on an ongoing basis. In other words, regional assessments will breed decision support *systems*.

Connecting knowledge to action

Assessment for adaptation differs from assessment for mitigation in one important aspect: key adaptation decisions will be needed from very many local actors, rather than from the relatively smaller number of international leaders dealing with mitigation policy. This defines a basic question: how should the tools and institutions deployed to assess global climate change be adapted to the needs of local decision makers in hundreds of regions around the world? What new social, institutional, technical and financial innovations are needed?



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The knowledge needed to support decision making for adaptation cannot be managed from the top down. Adaptation requires a systems approach that links the physical and biological aspects of climate change to social response, and vice-versa. Integrated solutions should be sought through linked innovation in science, technology, policy, politics, institutions and finance. It should be a distributed effort that is guided but not directed. It requires a variant of institutional reform which recognizes that boundaries and borders are themselves institutions.

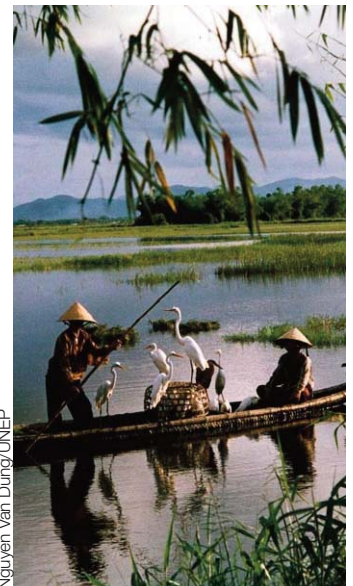
Particularly important is the need to recognize that ‘old-world’/20th century fixes are not suited to the complexity of contemporary challenges. To avoid a form of neoliberal institutionalism, efforts must be truly innovative at all levels, requiring two-way communication and sharing, celebrating and employing knowledge about appropriate solutions that is *already in the region* of focus. Ultimately, solutions must suit the scale of the problem they are designed to benefit. In building confidence, empowering people to innovate and to contribute, each region should design and lead its own assessments, with international support but not direction. Each regional effort will grow organically and last only as long as a need is perceived. It is difficult to see how a directed project approach could cope with the scale, diversity and complexity of the information projects to come. Simply gathering the financial resources in one place seems a daunting task. Furthermore, it seems unlikely that a directed approach can assemble fast enough to keep up with the changes in climate and society.

It is to modern informatics thinking that we must turn for guidance. Organizations and individuals should be able to develop their own decision support systems at times and places of their choosing. Is it not more productive to ask whether each level of assessment and decision making can get the information it needs? In confronting the challenge of complex environmental change, a key enabling development is to deliver the right information, to the right place, at the right time.

Knowledge action networks

Knowledge action networks that focus on specific regions and impacts can link the global science, technology and policy communities to local initiatives, and local knowledge to the global science community. These are sponsored social networks connecting the generators of local, regional and global climate knowledge with local decision makers. Those tasked with making decisions may not always be the creators or owners of the knowledge needed to underpin effective decisions. Decision makers in different spheres may communicate with one another much more frequently than with experts; equally, experts cannot anticipate the needs of decision makers unknown to them. They need to be connected up. Translation and communication are key requirements – between discipline, culture, language, community of practice, territory and agency.

Much remains to be done before knowledge action networks devoted to regional climate assessment become commonplace. First and foremost, an international fund to which those incubating networks can apply for support is needed. The international community, working with such organizations as the IPCC, the United Nations Environment Programme and the Group on Earth Observations, should develop a framework of terminology, standards, information and communication policies,



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archiving and certification. Informal knowledge action networks are growing around the world, developing and building on ad-hoc networks and cultures of communication (similar to the development path of the early internet). Interactions and discussion, for example through multidisciplinary conferences and workshops devoted to what works and what does not, are an important next step. In all parts of the world, ICT-supported social communication may grow the innovative linkages between and within the local, regional and global levels that bureaucratic methods cannot. We can draw inspiration from the growth of the non-directed internet, which spread around the globe in just a decade, perhaps offering a model for innovation and connection which is suited to the scale and urgency of the present-day challenge.

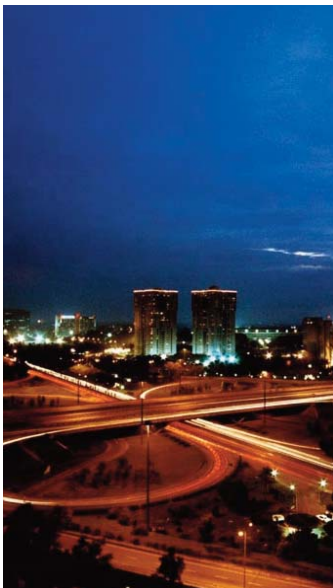
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- *Ice, Snow, and Water: Impacts of Climate Change on California and Himalayan Asia, La Jolla (USA), May 4-6, 2009*
- *The Impacts of Climate Change on Water In Africa, Cambridge (UK), September 21-23, 2009*

and a special adjunct session of the *Science and Technology in Society Forum (STS 2009)*, Kyoto, October 3, 2009: 'Developing a framework for regional climate change assessment and local action'.

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