Future Directions for Funding: Environmental Challenges and the Need for Integrated Problem Solving

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CEGN THOUGHTLEADER SERIES

This is the fourth in a series of brief analytical articles by some of Canada's leading thinkers on their views of the issues, needs and gaps in funding within Canada's environmental sector. The purpose of CEGN's Thoughtleader Series is to inform and stimulate strategic thinking, discussion and debate among environmental grantmakers and others, and to enhance their individual and collective focus on high priority and high impact grantmaking.

There is wide recognition that the earth's environment is in peril. No one denies any longer such "inconvenient truths" as that the globe is warming and many scientists feel that we may have passed the point of no return. With the polar ice cap melting and the temperature of the ocean steadily rising, these scientists point to the inevitability of flooding in coastal regions, increased drought in dry areas, increased famine, increased water born diseases among other threats. As the recent Millennium Ecosystem Assessment report concluded, most of earth's ecological systems are currently under stress with an accompanying risk of loss of ecosystem services. While the consequences for our human community are not entirely understood, the chances are that we will need, at a bare minimum, to learn to cope with surprise and abrupt shifts, if not increasing disasters of the kind seen with Hurricane Katrina in 2005.

What does this all mean for environmental grantmaking in Canada? One implication is that while in the past funding for environmental initiatives has tended to focus on studies of Canada and support for Canadian environmental organizations, increasingly support is needed to build capacity for understanding patterns at the global level and interpreting these patterns for the Canadian national, regional and local context. This new endeavor requires supporting new forms of knowledge production, forms appropriate for the level of complexity inherent in our most pressing environmental problems. To create these new forms of knowledge production we need new methodologies and protocols, tools and frameworks that challenge the current structure of most university based research endeavors. These methodologies must increase our capacity to combine data and knowledge drawn not only from disparate disciplines, but from disparate perspectives.

Take for example, the constellation of factors that are affecting the polar ice cap. As many have pointed out, the ice cap is melting at an unprecedented rate, due to global warming. Scientists warn of the flooding and rising sea levels that this may cause. Conversely, in areas where the permafrost has held fresh water at the surface, water shortage may become a problem as the permafrost melts. Migration routes across the ice and the permafrost will be disrupted. This is already having an impact on species such as caribou and polar bears, although the ultimate dimensions of this impact are not yet clear. Indigenous peoples dependent on arctic wildlife will find their way of life altered, yet again.

Ironically, however, the shrinking ice cap is opening up commercial possibilities. By some estimates 25% of the remaining untapped oil reserves are under the ice cap: global warming may make them available for exploitation. Similarly, the opening Arctic Ocean will make the fabled "northwest passage" a reality, probably within the next 25 years, expanding transportation options for sea traffic. And fish stocks are moving north as the waters warm.

These new economic opportunities are likely to increase the potential for conflict between nations, as they have since time immemorial. In addition to Canada, the US, Russia, Denmark, Norway and Iceland all could expect to lay claim to some of the fishing and oil rights in the

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newly opened Arctic. Unfortunately, in some areas political jurisdiction is currently not clear. Covered with ice, the lack of clarity surrounding resource rights has not been a driving problem until now. This may all shortly change.

The Arctic, therefore, exemplifies the classic, system based dynamics that under gird most environmental problems. It is a system that is volatile biologically, physically, socially, culturally, economically and politically. Each sub-system has its own dynamics, but they are driven and constrained by the dynamics between the sub-systems, the dynamics of the whole. That in turn is connected to a broader scale - the global system - both in terms of drivers (global climate change) and impacts (sea rise and flooding). To understand and to manage such complex systems, expertise is needed from numerous disciplines and from work focused on numerous scales. But knowledge is not currently organized in ways to make it easy to bring this together in order to modify directions or rates of change.

Disciplinary based knowledge, which has resulted in a steady building of scientific knowledge, theories and data sets in the last 100 years, has shaped our current capacity to understand the environmental challenges facing us. Yet, to paraphrase Einstein's insight, we cannot solve today's problems using the same thinking that created them. We do not need merely to *understand* the scientific and social scientific issues more deeply, we need to bring together marine biologists, social scientists, climatologists, economists, industry analysts, oil and petroleum engineers, policy makers, and indigenous peoples in order to create system understandings and system solutions. And we need not only to bring these knowledge workers together, we *need to create protocols, methodologies, tools and processes to help them work together efficiently and effectively, integrating existing knowledge and forging new knowledge*.

These approaches to new forms of knowledge production have been described variously as Mode 2 knowledge production or the Triple Helix (Gibbons et al., 1994; Etzkotitiz and Leydesdorff, 2000). The argument is that knowledge production is no longer (in the age of instant access through the internet) the prerogative of the academy, but is increasingly produced in think tanks and laboratories outside the university. Instead of scientific effort being directed purely towards increasing knowledge, such forms of knowledge production are geared to *solving problems*, particularly ill-structured and complex problems. Such problems require the integration of multiple disciplines as well as a marriage of theory and practice. Ultimately, this approach collapses or at least narrows the divide between formulation and implementation, a distinction long challenged as specious by management thinkers such as Henry Mintzberg (Mintzberg, 1978). While traditional modes of knowledge production result in knowledge that needs to be "sold" to end users, Mode 2 knowledge producers engage end users in the early stages of design and development, so that when the breakthrough is reached, implementation is much more natural and effortless.

Why are these new forms of knowledge production so key for environmental grantmakers? Environmental problems are among the most complex and, as the arctic example suggests, most demanding of the integration of multiple disciplinary knowledge sets if breakthrough solutions are to be found. Innovation in the environmental domain is as dependent on changed processes as it is on any specific knowledge breakthrough. Time is short, the urgency is high, and so bringing practitioners and theoreticians together in problem identification, analysis and solution, would vastly increase the likelihood that we will be able to introduce "disruptive change" (Christensen and Overdorf, 2000) in negative ecosystem dynamics in time to prevent the kind of hard loss of resilience that is difficult to counteract or reverse.

So how can environmental funders support these new forms of knowledge production? A starting point would be to support projects that are squarely focused on: a) complex and linked social-ecological systems; b) are concerned with restoring or maintaining resilience and sustainability in these linked systems; c) recognize cross scale interactions and are concerned with finding eco-solutions. Such projects would be team based, including not only multiple disciplines from within the university, but also practitioners (managers, policy makers, business representatives, ENGOs and community groups) directly concerned with the outcome.

This should be followed up secondly, by *attention to the particular tools, methodologies and protocols for engagement in these complex, problem-solving exercises*. Recognizing, documenting and articulating these new methodologies and protocols has only been partially accomplished and is still poorly communicated;

the process of 'how" to realize this kind of team based knowledge production remains largely mysterious. However, this makes it a particularly valuable place for environmental grantmakers to strategically intervene, both in support of the observational and experimental research that could establish some "best practices" in this domain and in support of the development of a pedagogy to train future researchers and practitioners in the practice of these methodologies. If students were being trained today in a lexicon of methods, protocols and frameworks for new forms of knowledge production, the skill and effectiveness of tomorrow's environmental problem solvers could be considerably accelerated.

Another applied example is useful here to illustrate what I mean by these methodologies. In 1995 a workshop was held in Kampala Uganda, to identify policy recommendations for the conservation of the endangered mountain gorilla population, at that time limited to two national parks, one in Virunga National Park in Uganda and one in Parc National des Volcans in Zaire/Belgium Congo (Westley and Miller, 2003). The workshop design was one widely used in the endangered species world, and led by an organization affiliated with the International Union for the Conservation of Nature, the Conservation Breeding Specialist Group. Based out of Minneapolis, Minnesota, the CBSG has for the past 20 years been running science based Population Habitat and Viability Assessment workshops to evaluate the extinction risk of small (vulnerable) populations of animals around the world. National and international specialists in the pathology, biology and behaviour of the species gather to identify goals for species conservation and negotiate values to be input into a computer simulation, Vortex (Lacy, 1993), which estimates extinction risks over 25-100 years based on multiple computer "runs". Negotiation is key, because scientists do not always agree on appropriate values, and so small group facilitation is helpful always and at times vital. Ideally, policy makers and NGOs as well as local citizens and managers are present to participate, if not in data generation or integration, at least in the process of turning data into meaningful action recommendations, an equally difficult task.

Of course the Vortex simulation is drawn from a population biology model, but key landscape level variables such as the degree of fragmentation and degradation of the landscape through human activities and direct culling of a species through hunting are critical parameters in the prediction of extinction. It is of course the social scientists who are best able to estimate the impact of economic and social activities on the landscape or the intervention of political or cultural variables in responses to/management of the species and its conservation. However, as the required specialists proliferated in the case of the Ugandan Mountain Gorilla, so did the complexity of integrating knowledge and of identifying acceptable solutions.

For example, two threats linked to the civil war seemed to be particularly significant. These were: a) the presence of civil war in the Belgian Congo, which was turning the park into a refugee camp, with the accompanying contamination of the forest through fecal and other human waste and its destruction through deforestation and b) the possibility of similar political upheavals in the future which might change the fate of the park and the protected status of the gorillas.

In the case of the refugees, some excellent data collected by one of the researchers in the park, allowed for a pretty accurate calculation of the pressure of the refugee camp on the forest itself (rates of deforestation etc.). This in turn, was fairly easy to translate into diminishing habitat area for the gorilla. But despite the fact that civil war of this nature is a common occurrence in that part of the world, it was difficult to predict its frequency and/or severity. So how could this dynamic, important as it was, be effectively integrated into risk assessments for the species?

When it came to the issue of mortality based on zoonotic disease the situation was even more frustrating. It was clear that some of the diseases that most affected the mountain gorillas were transmitted from humans, and waste was one of the culprits, but despite the fact that there were models of disease transmission in humans and other models for disease transmission in gorillas, there was no simple mechanism for linking these in the "real time" of the workshop. Both veterinary epidemiologists and human epidemiologists were in the room, and both were concerned about the risk of certain zoonotic diseases such as measles. However, their data was incommensurate, having been coded and embedded in knowledge structures that despite their similar subject matter were difficult to reconcile in practice.

This example underlines, in finer, more process oriented detail, some of the obstacles to integrating knowledge across disciplines and across research and practice. These challenges fall into two kinds, transactional and translational competencies. Transactional competencies are those skills that facilitate active and creative participation in multi-disciplinary problem solving teams. Many of these skills have been widely recognized in the private sector as those associated with innovative teams. These include, at the level of the team itself an understanding of team dynamics, constructive conflict management, and stages in problem solving, and an ability to actively listen to others. At a more macro level it involves understanding how to engage multiple concerned stakeholders and work at the policy science interface.

Translational competencies include, at the micro level, a sophisticated understanding of epistemology and of the philosophical tenets underpinning different "thought worlds" (such as indigenous knowledge, for example, or industry specific business knowledge). This kind of understanding is the starting point for the serious engagement required in Mode 2 knowledge production. Building on that understanding, translational competencies also involve the capacity to bridge, translate or integrate knowledge embedded in these different disciplinary/thought world structures. This is the most poorly understood of the Mode 2 knowledge production competencies, but work in computer science on knowledge markers (Westley and Miller, 2003), in development studies on Participatory Rural Assessment (PRA) tools for integrating expert and indigenous knowledge (Chambers, 2005), in organizational theory on systems modeling (Senge, 1990), in business strategy on scenario planning (Schwartz, 1996) – to name just a few approaches – offers fruitful paths for exploration. The challenge, however, is to move this body of knowledge from tacit to explicit, to increase the expertise of researchers and practitioners interested in environmental knowledge in using these methodologies and protocols and to create a pedagogy based on this explicit knowledge, so that the next generation of environmental problem solvers will not need to learn only by doing.

Lastly, environmental grantmakers in Canada, like all kinds of grantmakers, need to deal with the challenge of investing in true innovation, where it is difficult to evaluate progress, at least in the annual time frames usually required. In Sweden, for example, the MISTRA foundation (a foundation for strategic environmental research) recently awarded twenty-two million euros to the University of Stockholm to create a new center for studying resilience in linked social and ecological systems. The mission of this center is to "advance transdisciplinary research for governance of social-ecological systems with a special emphasis on resilience - the ability to deal with change and continue to develop". This is a seven year grant, and it has high visibility. Yet the exact deliverables are not yet clear.The hope is clearly for breakthrough research that transforms practice; but the investment is not in deliverables but in the team already formed at the University of Stockholm and the processes proposed for approaching problems. In such cases, the implementation of forms of evaluation which emphasize the dynamics of early stage innovation are tremendously helpful (Westley, Zimmerman and Patton, 2006). Such evaluative approaches have the potential to create transparent accounts of innovation that should provide confidence for grantmakers and grantees that the process of innovation is unfolding as it should. Nonetheless, it requires courage and vision for a grantmaker to invest in large and lengthy projects of this nature. Ultimately, however, if we are to change not only our understanding of how environmental and social dynamics interact, but also our understanding of how breakthrough or disruptive knowledge is created, environmental grantmakers must truly become investors in innovation, with all the accompanying risk that may entail. Given the importance and urgency of the environmental dilemmas confronting this planet, it is a risk well worth taking.

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