Tracking the Influence of Grey Literature in Public Policy Contexts: The Necessity and Benefits of Interdisciplinary Research

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Abstract: Scientific information (much of it published as grey literature) can play a pivotal role in the search for solutions to serious global environmental problems. This fact is receiving growing attention by a diversity of researchers. How information functions within the interface between science and policy is only weakly understood, in part because most studies have been conducted through single disciplinary lenses. Moreover, determining the life cycles of scientific information and developing an understanding of the use and influence of this information are not trivial tasks. We believe that an appreciable increase in understanding can be achieved through an interdisciplinary perspective and a comparative approach employing a suite of research methodologies to document information pathways. In particular in our research (see www.eiui.ca), we contend that interdisciplinary research, drawing on "information science and management," "marine environmental science," "marine policy development," "fisheries science and management," and "public policy," can substantially increase understanding of the processes by which scientific information is incorporated into environmental policy decisions. This innovative, evolving interdisciplinary perspective enables addressing the question "what role and influence does grey literature have in marine environmental policy and decision-making processes" in an informative, holistic manner, otherwise unfeasible. As this paper shows, multidimensional thinking and analysis stimulated by an interdisciplinary perspective is essential for understanding the role of scientific information at the science-policy interface in marine environmental fields.

Introduction

In 2008, in his book entitled *Environmental Reform in the Information Age: The Contours of Informational Governance*, Arthur P. J. Mol, professor of environmental policy at Wageningen University in The Netherlands, stated forthrightly that "it is the production, the processing, the use and the flow of, as well as the access to and the control over, information that is increasingly becoming vital in environmental governance practices....and the motivations and sources for

changing unsustainable behaviour are increasingly informational" (Mol, 2008). That environmental degradation is a serious global problem has been recognized for decades. September 2012, for example, marked the fiftieth anniversary of Rachel Carson's iconic *Silent Spring*, one of the most influential books of the twentieth century (Carson, 1962). Earlier in 2012, the United Nations Conference on Sustainable Development (the "Rio+20" conference) held in Rio de Janeiro, Brazil, forcefully highlighted the level of international commitment needed to halt environmental breakdown.

In the lead-up to the Rio+20 meeting, the Planet Under Pressure conference, held in London, England on 26-29 March 2012, stressed the seriousness of the matter:

> Research now demonstrates that the continued functioning of the Earth system as it has supported the well-being of human civilization in recent centuries is at risk. Without urgent action, we could face threats to water, food, biodiversity and other critical resources: these threats risk intensifying economic, ecological and social crises, creating the potential for a humanitarian emergency on a global scale. (Planet Under Pressure, 2012, p. 1)

Alarmist as this statement may seem, the London conference, attended by nearly 3,000 leading experts and decision-makers, sought a way forward while recognizing that new solutions would inevitably be required. The "State of the Planet Declaration," approved at the conference, boldly proclaimed:

> The challenges facing a planet under pressure demand a new approach to research that is more integrative, international and solutions-oriented. We need to link high-quality focused scientific research to new policy-relevant interdisciplinary efforts for global sustainability. This research must integrate across existing research programmes and disciplines, across all domains of research as well as local knowledge systems, across the North and South, and must be co-designed and implemented with input from governments, civil society, research funders, and the private sector. (Planet Under Pressure, 2012, p. 3)

Vast quantities of relevant scientific information have been generated, many solutions have been proposed, and some implemented in recent decades to address environmental problems.

However, solutions can be slow in coming, limited in scope, or may even be thwarted by competing, sometimes opposing and fragmented views and an overemphasis on uncertainty rather than a need for precaution. Vociferous debate over the reality and effects of global climate change is one example, although increased understanding is winning out.

Delay in pursuit of solutions is no longer an acceptable strategy even though the hurdles are challenging. A new approach that links "high quality focused scientific research to new policy-relevant interdisciplinary efforts" may, in fact, achieve desirable results. Interdisciplinary research, which encompasses *all* relevant disciplines, is needed because as the "State of the Planet Declaration" noted, "The Earth system is a complex, interconnected system that includes the global economy and society, which are themselves highly **interconnected and interdependent**" (Planet Under Pressure, 2012, p. 2, emphasis in original), and such a system requires a holistic approach to research and understanding.

Interdisciplinary effort is already witnessed in global initiatives such as the Intergovernmental Panel on Climate Change (IPCC). Founded in 1988 by the World Meteorological Organization and the United Nations Environment Programme and later endorsed by the General Assembly of the United Nations, the IPCC produces comprehensive scientific assessments of current scientific, technical, and socio-economic information related to the risk of climate change (Bolin, 2007). The IPCC also played an instrumental role in the creation of the UN Framework Convention on Climate Change (UNFCCC), the main international treaty to address the causes and consequences of climate change. Drawing on the assistance of thousands of scientists and other experts, and obtaining the consensus of the more than 120 country signatories, the IPCC has produced four major climate assessment reports with the fifth planned for publication at the

end of 2014 (IPCC, 2012a). These grey literature reports are the result of the review of a massive number of both primary and grey research literature publications. In addition to these periodic assessments, the IPCC also publishes special reports on subjects related to the implementation of the United Nations Framework Convention on Climate Change, the most recent of which is an almost 1,100 page report on *Renewable Energy Sources and Climate Change Mitigation* (IPCC, 2012b) released in advance of the meetings in Doha, Qatar in December 2012. During the preparation of this report, over 24,000 (24,766) comments were received as the text was being reviewed and finalized. This number alone highlights the extent of the effort to produce authoritative environmental assessment reports. Even though some aspects of the IPCC's work have proven controversial, including its use of grey literature to support some conclusions (see, Meyers & Petersen, 2010; Ravindranath, 2010), this impressive international initiative highlights the immense value and influence of interdisciplinarity in a key environmental field (Bjurström, & Polk 2011a; 2011b).

Commitment to an interdisciplinary perspective does not guarantee that all relevant disciplines have been brought to bear in the search for solutions, however. Information science (information studies, information management, informatics) is sometimes overlooked or is not at the table in some research initiatives. A case in point is the recent report of the Committee on the Use of Social Science Knowledge in Public Policy of the National Research Council in the United States, *Using Science as Evidence in Public Policy*, published by The National Academies Press (Prewitt, Schandt, & Straf, 2012). This report proposes "a framework for research on how policy makers make use of scientific knowledge and how the results of that research might lead to improved policy making and improved preparation of students in policy schools for careers in the

policy world" (p. vii). The report makes no mention of the field of information behaviour, the knowledge and tools of which are surely important for developing an understanding of how people become aware of, use, and are influenced by information.

While an information studies perspective may be explicitly missing from some interdisciplinary undertakings, its absence may be more a matter of language or oversight than actual failure to recognize the contribution of this discipline. For example, the recent book, *Knowledge and Environmental Policy. Re-imagining the Boundaries of Science and Politics,* which draws on research based in political science, and environmental and natural resource policy, employs the term "knowledge" rather than "information" to convey research perspectives that govern information studies points of view (Ascher, Steelman, & Healy, 2010). An explanation of why some disciplines such as information science are overlooked or entirely missing from interdisciplinary research initiatives may be attributed to stereotypical misunderstanding of the potential contributions of such disciplines to such collaborations. Moreover, information specialists may overlook the benefits of working with researchers in other disciplines whose appreciation of the role of grey literature will likely be quite different from their own. These challenges notwithstanding, it is incumbent upon us to seize opportunities for interdisciplinary research along the lines of the urgent appeal of the 2012 "State of the Planet Declaration."

Interdisciplinarity

Interdisciplinary thinking is not new and has increasingly characterized some areas of scientific research for the past half century or more (e.g., toxicology, oceanography, ecology, biomedical sciences, and environmental sciences). Some might argue that twenty-first century interest in

interdisciplinarity is a return to the perspective of Renaissance or Victorian scholars (see, for example, Lightman, 2012), except that today the vast and growing quantity of information and highly specialized techniques, methods and instrumentation, and knowledge have left "most scholars and artists stranded in ever-shrinking islands of competence" (Nissani, 1997). Even though research funding bodies in North America and Europe have given greater prominence to interdisciplinary research and interdisciplinary programs and administrative units have been established within universities (e.g., the Canadian Mountain Studies Initiative at the University of Alberta - www.mountains.ualberta.ca/en/ThinkingMountains.aspx), interdisciplinarity generates no shortage of debate. Moreover, a sizeable number of individuals within and outside "the academy" find it difficult to work at the intersections of their disciplinary boundaries with other researchers and practitioners who operate with different but complementary disciplinary points of view. According to Luhmann (1993), a paradox exists in modern society. The more systems evolve and specialize, the more critical it is for communication and coordination between these systems. Yet, at the same time these systems become more self-referential and unable to communicate between themselves.

Some fields of inquiry are inherently interdisciplinary, however. Take for example, environmental toxicology. This field "takes and assimilates from a variety of disciplines" (Landis & Yu, 2004, p. 1), as Figure 1 illustrates. Terrestrial and aquatic ecologists, chemists, molecular biologists, geneticists, and mathematicians all contribute to the evaluation of impacts of chemicals on biological systems (Landis & Yu, 2004). As the authors note in their *Introduction to Environmental Toxicology*, "biometrics...provides the tools for data analysis and hypothesis testing. Mathematical and computer modeling enables the researcher to predict effects and to

increase the rigor of a hypothesis. Evolutionary biology provides the data for establishing comparisons from species to species and describes the adaptation of species to environmental change" (pp. 1-2). Even though this field is decidedly multi- and interdisciplinary, some disciplines are notably absent in Figure 1. Chemical toxicity can trigger far reaching effects in human society with social, economic, and/or political implications (e.g., the use of Agent Orange in Vietnam in the 1960s). As a consequence, social science disciplines could quite easily be included in the sizeable suite of largely natural and physical science disciplines populating this diagram. Although only one example, it is likely that even established and highly interdisciplinary fields of research and practice can benefit from broadening and illustrating the scope of their disciplinary perspectives.

As researchers have pursued interdisciplinary work over recent decades, they have generated an extensive body of literature on the subject of interdisciplinarity and the flow of publications continues (e.g., Huutoniemi, Klein, Bruun, & Jukkinen, 2010). Since interdisciplinarity can be difficult to achieve in some contexts, interdisciplinary research or knowledge can be misunderstood of undervalued. This latter perspective emphasizes pitfalls to interdisciplinary study, and there are such; nonetheless, the potential and achievable benefits can be measurable (see Campbell, 2005; Elfner, et al., 2011; MacMynowski, 2007; Nuijten, 2011; Pickett, Burch, & Grove, 1999; Strang, 2009; Turner & Carpenter, 1999).

In the words of one scholar, "interdisciplinarity is best seen as bringing together distinctive components of two or more disciplines" (Nissani, 1997, p. 203). "In academic discourse," Nissani has written, "interdisciplinarity typically applies to four realms: knowledge, research, education, and theory."

> *Interdisciplinary knowledge* involves familiarity with components of two or more disciplines. *Interdisciplinary research* combines components of two or more disciplines in the search or creation of new knowledge, operations, or artistic expression. *Interdisciplinary education* merges components of two or more disciplines in a single program of instruction. *Interdisciplinary theory* takes interdisciplinary knowledge, research, or education as its main objects of study. (Nissani, 1997, p. 203)

While we are interested in each of the four realms in this suite of options, we have chosen to collaborate and focus primarily on interdisciplinary research due to the benefits that arise when considering the multiple dimensions comprising the information-communication-policy interface or, more simply, the science-policy interface. We recognize that interdisciplinary research will result in unique and hopefully important interdisciplinary knowledge. Our research also flows into our educational work, which will see greater emphasis in a new graduate course entitled "The Role of Information in Public Policy and Decision Making," being offered in 2013 at Dalhousie University.

The Challenge - The Science-Policy Interface

The necessity of interdisciplinary investigation becomes clear when the complexity of the science-policy interface is described. Tracking the movement and use of grey literature in this context poses challenges in framing research questions, determining what data to collect, deciding which methodologies or suite of methodologies must be applied or developed, and gaining access and establishing the trust of numerous stakeholders to undertake research within the ambit of governmental organizations, all the while appreciating that many dimensions of personality, culture, economics, politics, and social factors contribute to the processes of decision making and policy development. The magnitude and variation of these components outstrip the capacity of expert understanding of any single discipline. Quite simply, interdisciplinary is

required. Figure 2 attempts to capture many of these dimensions beginning with knowledge generation through to policy formulation, decisions, and generation of new knowledge.

Figure 2 illustrates the complexity of the processes in which information is used (or not) in the activities within the science-policy interface. Two features should be noted. First, information comes from a variety of sources – non-governmental driven sources, governmental sources, and local knowledge. These three interact in interesting and complex ways to contribute to all environmental knowledge. Second, filters are typically applied to this body of all environmental knowledge resulting in usable knowledge. Those filters may be institutional cultural factors or individual biases, or they may involve professional biases and the uncertainty characteristic of scientific observations. This knowledge is then filtered even further due to attention and focus of particular agendas. This information may inform policy making in a context that is influenced by legal precedents and other constraints. Ultimately, the policymaking and decision making can stimulate new questions and new knowledge and a feedback loop will occur. This summation, which has simplified a complex amalgam of activities, shows that the scenarios encapsulated by the diagram are far from trivial processes (Nutley, Walter, & Davies, 2010).

Environmental Information: Use and Influence (EIUI) Initiative as an Example of Interdisciplinary Research

In a paper entitled, "From research to policy and back," Aletha C. Huston stated that "policymakers are influenced by politics, ideology, interest groups, and the institutional rewards and pressures in governmental agencies. They sometimes appear indifferent to empirical evidence" (Huston, 2008, p.1). Some governments may ignore or discourage evidence-based policy making (Grisé, 2013). As a result, the "unpredictable and volatile world of ... policy has

led some researchers to renounce efforts to inform it because they believe that decisions are entirely political and that data are invoked at best only to support a position that someone has already decided to endorse" (Huston, 2008, p. 1). Such pessimism, while understandable, may be a reflection of attempting to understand the activities of the science-policy interface through a single disciplinary lens, an approach that is bound to falter in gaining a meaningful appreciation of both visible and underlying dynamics of decision making work.

We are fortunate to work in an interdisciplinary team, which is making headway on opening new avenues of research to advance understanding of the use and influence of information published as grey literature in governmental and intergovernmental arenas. The composition of this team has been achieved in part because our multidisciplinary academic unit at Dalhousie University is staffed by faculty members of diverse disciplinary backgrounds, with interests in various aspects of management that demand and benefit from collaboration. Our team began with specialists in Information Management and Marine Environmental Science and expanded to include Governance and Public Administration, Marine Policy Development, and Fisheries Science and Management (Figure 3). More recently, additional expertise in Information Management, namely Social Network and Social Media Analysis, has been included and research students at the Masters and Doctoral levels complement the team. Individually, each of these disciplines tend to be outward looking, i.e., tend to draw on theories and methodologies of a variety of disciplines, which may contribute to shared interest in gaining greater understanding of the life cycle of environmental and fisheries information in policy development and decision making contexts (e.g., MacDonald, Cordes, & Wells, 2007; Soomai, Wells, & MacDonald, 2011; Soomai, MacDonald, & Wells, 2013).

Benefits of Interdisciplinary Research

In a 1997 paper, Moti Nissani of Wayne State University in the United States suggested that the rewards of interdisciplinary knowledge and research fall within three overlapping categories: 1) growth of knowledge, 2) social benefits, and 3) personal rewards. Including the personal rewards (which are genuine and motivating), our EIUI research (see www.eiui.ca) has demonstrated the potential of substantial contributions to growth of knowledge with related social implications as noted in Table 1. The results of our efforts will have practical value in a world that is not demarcated by single disciplines.

Table 1 – Some Benefits of Interdisciplinary Research Identified by the EIUI Researchers

Category*	Benefits
# 1 - Growth of Knowledge	- Big problems have many dimensions, requiring enquiry from multiple perspectives. - Creativity in problem solving is facilitated and extends beyond the comfort zone(s) of disciplines. - Greater capacity exists for determining core questions. - New methods are developed since measuring use and influence of information is complex.
# 2 - Social benefits	- Increased understanding occurs regarding different institutional cultures at the science-policy interface. - Many types of stakeholders can be involved as the interdisciplinary perspective requires more comprehensive approaches and understanding.
# 3 - Personal rewards	- Credibility increased with funding sources and partner organizations. - Important societal issues are resolved.

* Based on Nissani (1997)

Conclusion

The influence of scientific information (much of which is published as grey literature) in the complex social contexts in which information is used can only be well understood if that context is comprehensively studied. Environmental problems and related policy decisions are multidimensional, as the *State of the Planet Declaration* emphasized (Planet under Pressure, 2012). "In one lifetime," the declaration stated, "our increasingly interconnected and interdependent economic, social, cultural, and political systems have come to place pressures on the environment that cause fundamental changes in the Earth system....But the same interconnectedness provides the potential for solution: new ideas form and spread quickly, creating the momentum for the major transformation required for a truly sustainable planet." Information published as grey literature will have an instrumental role to play in facilitating these solutions, as shown by the IPCC work on climate change. Thus, development of a clearer understanding of the function of this information and literature and its exchange at the science-policy interface, where these solutions will play out, is urgently needed.

Even if greater information exchange between communities is possible, problems persist. A cybernetic understanding of control points to three components to a control system, namely, information gathering, standard setting, and behaviour modification. Information exchange in the absence of common standards and behaviour modification will leave a system uncontrolled. In some respects, information sharing can be a "light touch" form of regulation. Problem solvers assume that, by sharing information, standards and behaviour modification will occur. Without an appropriate incentive structure, this latter scenario might be wishful thinking.

The challenge, therefore, will be to move beyond information exchange and into the role of establishing standards and changing behavior. This latter stage will be much harder to achieve. It requires power-sharing between disciplines and communities. In many respects, the result is a flat, leaderless approach to problem solving. Egalitarian structures, however, tend to be risk-averse; they strive towards consensus and in so doing potentially neglect and even undermine innovation and risk-taking. In this regard, grey literature may provide a half-way house: an opportunity for different communities to negotiate research findings, take risks, and propose alternatives. In some respects this form of publication lowers the constraints of the high academic standards of each individual discipline in order to allow something more innovative to emerge at the interface. An interdisciplinary research perspective, as we have discussed, is vital to achieve that outcome.

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Figure 1. Environmental Toxicology and Some of Its Components

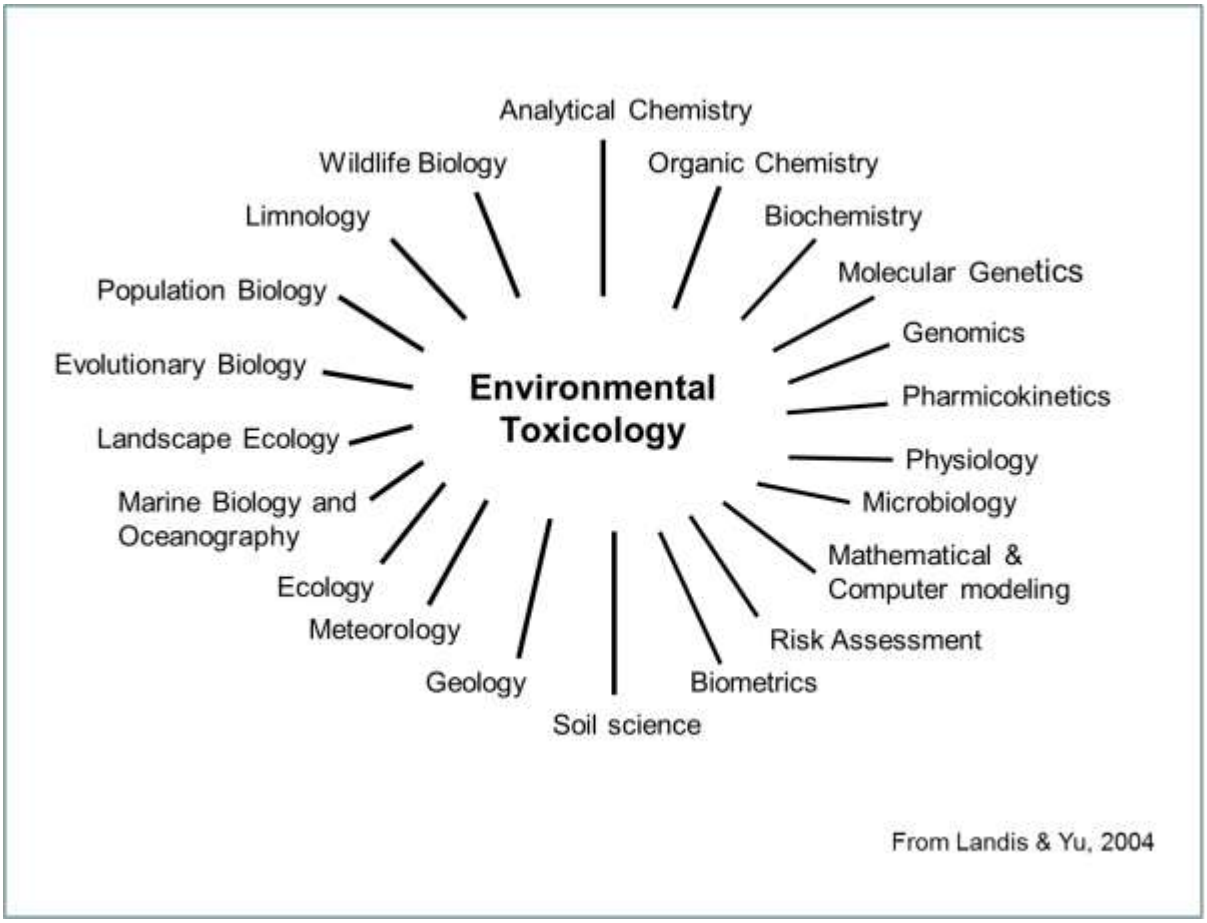

Figure 2. Generation, Transmission, and Use of Environmental Information

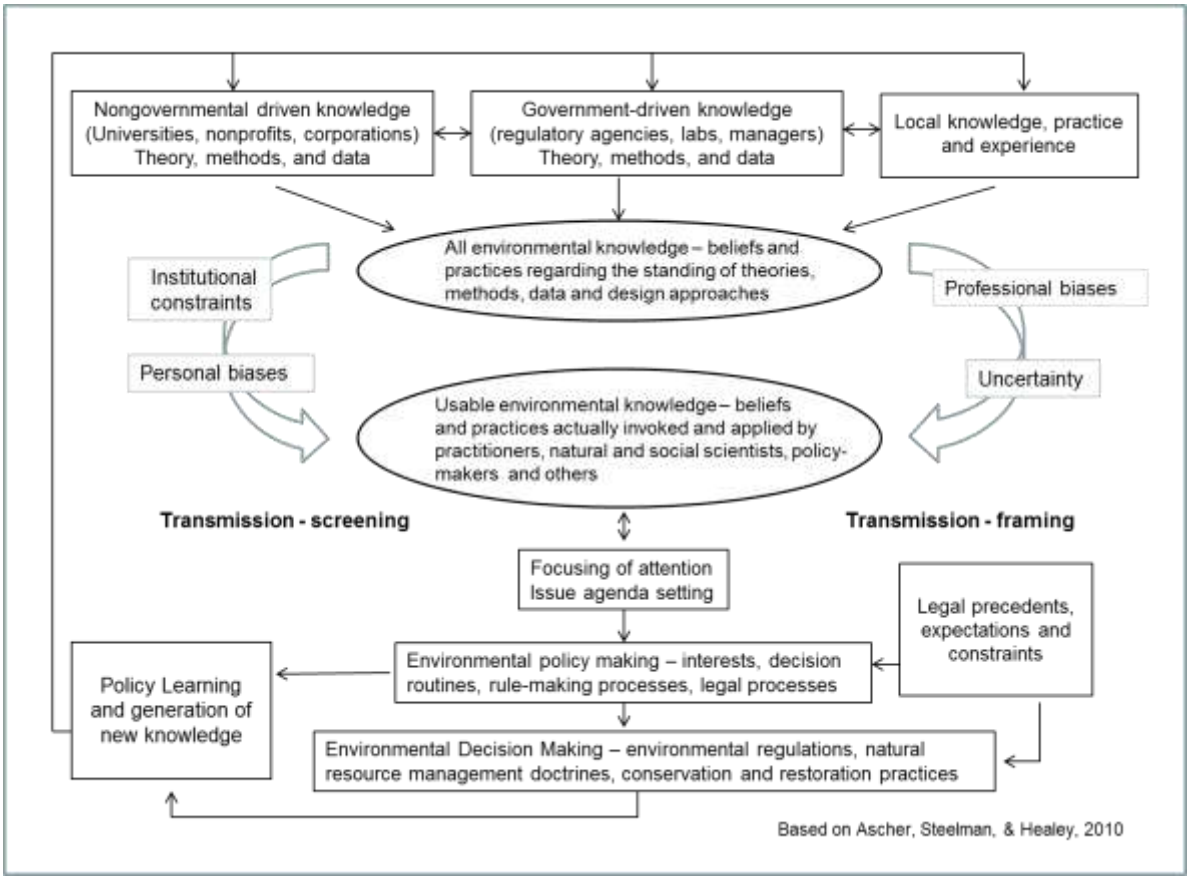

Figure 3. Environmental Information: Use and Influence Interdisciplinary Research (from www.eiui.ca)