AgBioForum, 15(1): 70-76. ©2012 AgBioForum.

Food Fight: The International Assessment of Agricultural Knowledge, Science, and Technology for Development

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The International Assessment of Agricultural Knowledge, Science, and Technology for Development (IAASTD) was created in 2002 to address global problems of agriculture and food security. More than 400 scientists contributed to the reports, while delegates participated in an ambitious array of regional, thematic, and global conclaves, all of which concluded in 2008. The panel was launched with strong political support and high expectations, but almost everything that could go wrong did. It became a lightning rod for debates on the role of agribusiness, globalization, biotechnology, and the merits of "science" over "traditional" knowledge. Key governments repudiated the final report. Debate on the merits of the IAASTD still rages in agricultural circles even though the IAASTD is defunct.

This article explores the reasons for this failure. Were the issues too intractable? Were there structural problems that prevented an effective dialogue? Or did such ill-assorted delegates simply fail to negotiate effectively? The IAASTD is a cautionary tale on the limits of expert assessments in global governance when "facts are uncertain, values in dispute, stakes are high, and decisions urgent."

Key words: agriculture, assessment, food, AASTD, international, policy, science, technology.

Intergovernmental Assessment Panels

A key innovation in global governance over the past 40 years has been the use of scientific assessment panels to guide the policy-making process on global issues. Until 1988, these scientific assessment panels were organized by National Academies of Science; international non-governmental organizations (NGOs) such as the International Council for Science (ICSU) and the International Union for Conservation of Nature (IUCN); or as technical panels reporting to the management of international organizations like United Nations Environment Programme (UNEP), United Nations Educational, Scientific, and Cultural Organization (UNESCO), and the World Meteorological Organization (WMO). Their objectives were to set the agenda in a specific issue domain, compile the "scientific state of the art," explain it to a target audience (either policy makers or the general public), and develop options for addressing the issue. For a number of reasons, however, the participants in these panels were frustrated that their assessments were not reaching the target audiences in government effectively and were not having the necessary impact in changing policy and practices. In 1988, the key players on the climate change agenda, embedded in both scientific institutions and state agencies, raised the stakes by advocating the creation of an *Intergovernmental Scientific Panel*, a hybrid institution consisting of *both* government delegates *and* scientists meeting in the same forum to address the science of climate change (Table 1). The first full-scale intergovernmental panel, the Intergovernmental Panel on Climate Change, (IPCC), has been followed by the creation of two others: the International Assessment of Agricultural Knowledge, Science, and Technology for Development (IAASTD)—which is the subject of this article—and the fledgling Intergovernmental Panel on Biodiversity and Ecosystem Services (IPBES), which was created by a decision of the United Nations General Assembly in December 2010.

These panels not only bridge the divide between the scientific community and policymakers by packaging the latest scientific information into an accessible format for the latter's use; they also bring state representatives and scientists together in the same forum in order to identify the issues, commission reports on particular topics, negotiate (line by line) synthesis reports, and hammer out policy options, ultimately leading to new treaties, conventions, targets, and plans of action.

There are a number of problematic issues associated with the organization of these panels, raising key questions about institutional legitimacy, in terms of access and transparency. The generation of policy options for

Table 1. Characteristics of an intergovernmental scientific assessment panel.

• Obtained its operating mandate through a resolution from an international organization with a universal membership.
• Reports to, and is governed by, an independent assembly open to all states as well as observer organizations.
• Executes its mandate under the quotidian direction of a governing bureau, with balanced regional representation supported by a full-time Secretariat.
• Undertakes its assessment function in accordance with the established rules of international scientific enquiry: transparent scientific assessment, peer review, and open publication.

the future has proved laborious and controversial, notwithstanding their mantra that they seek to be "policy relevant rather than policy prescriptive." In addition, they have become a cockpit for "North-South" conflict, with developing countries arguing that the South's inability to bridge the scientific divide by fielding scientists in the same numbers as Northern governments erodes the panels' credibility. It is agreed, however, that intergovernmental scientific panels are a key innovation in global governance.

Into the Agora

Michael Gibbons, a leading philosopher of science, argues in a classic text, *The New Production of Knowledge* (Gibbons et al., 1994), that the way scientists produce knowledge is by undergoing a profound process of change. Rather than solve *puzzles*, identified in a disciplinary context and addressed in terms of recognized precepts of sound science, contemporary scientists are called upon to address complex *problems*, embedded within broad social, economic, and environmental frameworks. These problems are generally found at the frontier of existing scientific knowledge. The approach to problem solving is generally transdisciplinary, collegial, and integrates significant normative and ethical challenges. Gibbons has called this "Mode 2" research in order to acknowledge that this new type of science coexists with traditional academic science.

His colleagues, Silvio Funtowicz and Jerry Ravetz, have evocatively termed it "post-normal science," emphasizing the difference between "normal" puzzle-solving science and the application of science to public issues where "facts are uncertain, values in dispute, stakes are high, and decisions urgent" (Funtowicz & Ravetz, 1993, p. 749).

Funtowicz and Ravetz agree with Gibbons et al. (1994) that this new approach to science occurs at the frontier of existing knowledge, which they associate particularly with the rise of environmentalism: problems where science (in the form of technology) may be part of the problem as well as an essential tool of observation. In addition to the strong policy component of this new science, they contribute an additional, crucial dimension inherent in the science itself, which they term "system uncertainty"; not only is the context complex, but the tools currently available to scientists to address environmental issues consist of "soft science"—statistical correlation and computer modeling—rather than the tools of formal observation and experiment. Outcomes are uncertain and non-linear, challenging the scientific premise of predictability.

The concepts of "Mode B" and "post-normal science" are contentious in scientific circles. Dr. Gibbons has commented wryly that this thesis secured more support at first within policy and social science circles than it did in the scientific community (Nowotny, Scott, & Gibbons, 2003). Some physical scientists have reacted to "post-normal science" by reasserting the fundamental norms of what Michael Polanyi called the "Republic of Science" (Polanyi, 1962). Nonetheless, there is a broad consensus that when science is deployed for policy purposes it is infused with contentious issues of ethics, values, and system uncertainty and does not fit easily within the classic scientific worldview. Steve Rayner has summed this up nicely as "wicked problems and clumsy solutions" (Rayner, 2006).

Gibbons and his colleagues have not only examined changes in the context and practice of science, but changes to the social structures where science is debated. Rather than the monopoly and métier of a trained scientific elite, Nowotny, Scott, and Gibbons argue that science is now taking place within the *agora*, a site integrating the political arena, the marketplace, and the academic courtyard (Nowotny et al., 2001). Ravetz describes a similar process of discourse, which he calls "extended peer communities"; he argues this open discourse is essential if post-normal science is to enjoy legitimacy (Funtowicz & Ravetz, 2003).

My initial hypothesis, as I begin my examination of intergovernmental panels, is that intergovernmental scientific panels are a prototype for a new kind of "boundary" science, operating at the intersection of the avenues of science, public debate, and policy making. Scientist advisors in these intergovernmental panels neither make the science, nor implement the policy, but serve as "midwives," transmitting essential scientific information from the bench scientists to the policy implementers, wrapping it in accessible language, and defining a feasible array of policy options along the way. Therefore,

while not always successful—as we will see in the case of the IAASTD—intergovernmental panels do *meet a real need*. The "value added" is derived from scientists and policymakers learning how to turn complex scientific information—much of it expressed in mathematical language—into accessible qualitative and "policy-relevant" information, market it, and commission forward-looking research that challenges the scientific community to explore issues at the boundary of scientific knowledge. As a result, the institutionalization of intergovernmental assessment panels is not only *changing the way we make public policy*; it is *changing the way we do science*.

My second hypothesis is that intergovernmental scientific panels represent a new site of discourse, an "agora," as Gibbons terms it, a new "domain through which people enter the research process," populated by "arrays of competing experts and institutions" as well as "variously jostling publics" (Novotny, Gibbons, et al, 2003: 192). One has to wonder why so many busy scientists have voluntarily engaged in a time-consuming and onerous editorial review process, which offers them—at first sight—very little in the way of formal scientific recognition. But entering the agora offers them prestige; an opportunity to network with colleagues, perhaps leading to fruitful scientific collaborations; and above all a "pulpit" to directly influence policy: *to make a difference in the world*.

My third hypothesis draws from the work on NGO assessment panels led by the Global Environmental Assessment Group. They argued that the *effectiveness* of these panels lies in their capacity to mobilize and combine the institutional *credibility* associated with science, the *legitimacy* of democratic representation and "right process," and the *salience* of their findings, defined as the "potential users' belief that the information is relevant to their decision-making" (Mitchell, Clark, Cash, & Dickson, 2006). But I would argue that salience goes beyond the delivery of timely and relevant data. It involves a significant element of leadership in terms of creating a public interest in a given issue; defining the terms of the debate; and nudging the discussion in certain desirable directions by, for example, inviting new actors into the agora. It is not just a matter of responding to the winds of change, but sometimes whistling them up.

William Clark advises that students of international assessments should concentrate on the process rather than the outcome—the institutional interplay rather than the final reports (Mitchell et al., 2006). This advice has guided me to concentrate my examination on institutional and social processes, especially the development of norms, values, practices, and procedures embedded in these panels. I am interested in how assessment panels learn—or fail to learn—adjusting their constitutive processes, and borrowing ideas and operating procedures from other institutions (Siebenbruner, 2006). I am equally interested in the negotiation process at the assemblies where policymakers and scientists directly interact, particularly in the editing of summaries for policymakers. In the "*liveworld*" of negotiations (Depledge, 2006; Scoones, 2009), how do the policymakers and scientists interact? Do the participants retain their very different worldviews, or do they, in the course of time, adopt a common vision, with shared norms, values, and common policy objectives? Do the countries send, or do the participants in time learn, to become bilingual and bicultural envoys shuttling between the worlds of policy and science? Do these negotiations "feel" different in atmosphere from traditional UN negotiations or traditional scientific congresses?

Last but not least, how have policymakers and other stakeholders "used" these assessments as an input to broader debates, decision-making, and governance arrangements? Among the possibilities are for policymakers to deploy the assessment reports as canonical texts, designed to close the debate on a given issue. They could be used to defuse controversy, to "take the politics out of policy making" (Jasanoff, 1990, p. 1). They could be used as a vehicle to build a successful national or transnational coalition for action. They could be used as a learning tool, to educate the public on a new issue. Or, they could be used as a substitute for action, a vehicle for delay in decision making.

The International Assessment of Agricultural Knowledge, Science, and Technology for Development

The IAASTD was announced in 2002 as a "deliverable" from the World Summit on Sustainable Development and was formally launched in 2004 at an Intergovernmental Conference on Agriculture as a "multi-thematic, multi-spatial, multi-temporal intergovernmental process" with the mandate to forecast and propose responses to the agricultural and food security challenges facing the world, from now until 2050 (IAASTD, 2009).

It was created to respond to four distinct pressures within the international community.

- First was the debate over the concept of "sustainable development." Delegates from developing countries attending the Johannesburg Summit were skeptical about sustainability, a concept they considered held little resonance for the poor. The summit proposed that the world community should take on one of the big poverty and development issues—food security—and apply a "sustainability" analysis to it to demonstrate that sustainability did matter for the poor.
- Second was the concern in agricultural circles that the world was entering a period of food *insecurity*, characterized by growing demand for food (especially for protein for the burgeoning middle classes in Asia) for oilseed production in Europe and North America, and roller-coaster price fluctuations for staple grains.
- Third was the ambition within the research community, led by the Consultative Group on Agricultural Research (CGIAR), to launch a high-profile review on science and technology for agriculture as a lever to reverse the stagnant or declining investment in public agricultural research.
- Fourth was the debate over biotechnology between Europe and North America, a debate which had led in 1988 to a unilateral moratorium on the import of genetically modified (GM) products into the European Union (EU). This led, in turn, to a challenge by the United States and Canada against the EU at the World Trade Organization. This political conflict was beginning to spill over elsewhere, with big developing country producers like India, China, South Africa, Brazil, and Argentina beginning to experiment with GM seeds just as some countries in Africa—notably Zambia and Zimbabwe—were blocking the importation of GM foods, even in the form of food aid. There was a general agreement that before the world split into pro- and anti-GM blocs, a neutral scientific assessment should be launched to explain the science underlining GMOs and hopefully reduce the differences between the key protagonists in the GM debates.

In view of these multiple agenda items, it was agreed that the World Bank, which is a key donor to agriculture and host to the secretariat of the CGIAR, should host the Secretariat for the new International Assessment of Agricultural Knowledge, Science, and Technology for Development. It was also agreed, given the political sensitivity of the issues on the table, that this would be an *intergovernmental* assessment, with states fully involved at all stages of the process.

Defining the Agenda

The first year, after the announcement of the creation of the IAASTD, was devoted to a series of workshops bringing together interested parties, with a view to developing a plan of action and a mandate for the panel. It soon became clear that there was a pent-up demand for such a review, and that its mandate should be defined as broadly as possible. While the creators had intended the panel to focus on science and technology in the narrow sense of the term, there was a strong message in the workshops that the mandate should include "knowledge" in the widest sense, capturing such categories as indigenous knowledge, traditional knowledge, and local knowledge. This would not only provide a measure of recognition for these concepts: it would welcome into the agricultural agora individuals who had generally been excluded from such deliberations in the past—peasant farmers, market sellers, indigenous people, and women.

Second, there was a strong sense that agriculture itself was changing, in ways that were not fully understood or legitimized. There was a perception that agriculture was declining in political importance, in both the North and the South. The rapid pace of urbanization in the South was leading to the waning of rural power bases. There was evidence of a declining state investment in food security, in the form of a cutback of extension services and agricultural research, and the dismantling of food reserves and other strategies such as the maintenance of rural roads, which were important components of national food security strategies.

Agriculture was increasingly corporatized, with key functions such as the distribution of farming inputs, seeds, and fertilizer in the hands of large national or multinational corporations. There was a growth in contract farming, where smallholder farmers relied on inputs provided by corporations and then marketed their products exclusively to them. There were major changes in the distribution of food products, from markets and corner shops to national supermarket chains. Smallholder farmers feared they were caught in a vise, between sprawling urban growth and corporate consolidation of farmlands into huge industrial scale farms.

There was also a pronounced anxiety about the longer-term prospects for farming (in view of climate change) and declines in biodiversity, symbolized by the reports of the die-off of honey bees and other useful

insects. These trends could lead to a decline in agricultural productivity and more frequent crop failures. Furthermore, there was considerable unease over whether agricultural productivity could keep up with the anticipated population growth of another 3 billion people by 2050.

As a result of these discussions, the IAASTD was given an exceptionally broad mandate—to assess the state of global agriculture to the year 2050, organized under eight themes: bioenergy; biotechnology; climate change; human health; natural resource management; trade and markets; traditional and local knowledge and community-based innovations; and women in agriculture.

It was clear in this early stage that governance was a sensitive issue with the workshop participants. They wanted the deliberations to be as open as possible, involving not just states and agricultural scientists but also farmers' groups, NGOs representing the interests of consumers, and the private sector. Participation should be balanced between North and South. The delegates should be able to meet in their regions, as well as at global level. The Internet should be used to reach people who could not come to the gatherings. Nobody should be left out.

The organizers addressed this demand by adopting a blend of practices drawn from the IPCC and from the Millennium Ecosystem Assessment (MA). There were two co-chairs—both eminent agricultural scientists—drawn from Switzerland and Kenya. The Secretary-General, Robert Watson, was Chief Scientist at the World Bank (Watson, 2005). The IAASTD Bureau was structured to balance all the relevant interest groups with 30 country representatives, regionally balanced with a majority from developing countries. In addition, there were 22 representatives from civil society, including 6 from business, 4 from consumer groups, and 6 from producer groups. The Bureau steered the process, but formal decision-making was vested in the IAASTD Plenary, where there was universal country membership, as well as participation by civil society and interested international organizations. According to the IAASTD website, "the intergovernmental process ensures ownership by governments while the integrated Bureau allows the full range of stakeholders to meet as a single body, creating opportunities for constructive exchanges and building consensus" (IAASTD, n.d.).

This was, by any measure, the largest scientific assessment ever undertaken in the field of agriculture, involving well over a thousand participants. It was a huge logistical challenge as well as an impressive experiment in consensus building. Expectations were very high.

The Assessment Stage

The next stage was the formal assessment, involving more than 400 scientists, drawn from 86 countries, serving in their personal capacities, nominated by the IAASTD Bureau but participating with the formal approval of their home governments. Their job was to assess the "state of the field" in terms of available published research, as well as relevant "grey literature" provided by states and NGOs, organized into chapters in the final report. The draft chapters were then forwarded to all the participating countries and agencies for further review and line editing. Review editors then took this material and subjected it to a final scrubbing before it was submitted to the conference plenary. Another team of writers took the whole manuscript, which is inches thick, and developed the Synthesis Report, the key document which was submitted to the plenary for line-by-line review in early 2008.

The timetable was extremely ambitious. After the 2004 Plenary (which kicked off the process), the Secretariat organized a series of five regional and eight thematic meetings before bringing all the delegates and coordinating scientists together again in a concluding plenary session. Meanwhile, the Bureau was keeping track of the process through Executive Sessions every six months. More than 110 countries participated at some stage in the process.

IAASTD began with strong political support, institutional legitimacy drawn from its eight co-sponsors, and experienced leadership. But almost anything that could go wrong, did. Civil society representatives clashed with agronomists over the value of physical science vs. traditional knowledge. Business delegates clashed with civil society representatives over the merits of large-scale agribusiness vs. small-scale village farming systems. State delegates and civil society representatives clashed over who could legitimately speak for peasant farmers: their governments or international NGOs working directly with farmers. Everyone deplored the fact that hardly any "real farmers" attended the gatherings. There were public walkouts by some business representatives, while other NGOs simply dropped out of the process. In the end, three key agricultural producers—Canada, Australia, and the United States—declined to endorse the Synthesis Report.

The plenary settled for language that papered over the real differences on GMOs, satisfying no one. The

Synthesis Report acknowledged the disputes over the safe use of transgenic seeds and called for "…new kinds of support for the public to critically engage in assessments of the technical, social, political, cultural, gender, legal, environmental, and economic impacts of modern biotechnology…much-needed emphasis on participatory breeding projects and agroecology" (IAASTD, 2009). This formulation was a long way from usefulness as a vehicle to build a successful national, or transnational, coalition for action, or as a learning tool to educate the public on a new issue. Instead, it proved to be a substitute for action—a vehicle for delay in decision-making.

The other lightning rod at the panel proved to be the use of scenario modeling to identify policy options for the future. Scenario models have served as a critical analytical tool in the IPCC and the MA. The Secretariat proposed to use these as a centerpiece of the IAASTD discussions and to stimulate debate on potential policy options for identifying trends in agriculture to 2050. A highly respected policy research center—the International Food Policy Research Institute (IFPRI)—was commissioned to undertake this work. Unfortunately the scenario modeling was rejected by a large number of civil society delegates on the grounds that it "embedded" a single model of agricultural production—high technology, high output, and global market oriented—at the expense of other, more sustainable and community-oriented modes of production. In the end, the use of models was largely abandoned, and with it the possibility of a creative discussion on the future prospects of agriculture. The authors settled for a description of agriculture in 2008. According to a number of participants, this decision proved to be a turning point, signaling a breakdown in trust in the assessment process and an unwillingness to explore common ground. From that point on, the drafting process became an exercise in each interest group fighting for language that reflected their entrenched positions, at the expense of the other stakeholders. This conflict spilled over to the Internet, with various parties staking their positions publicly in highly partisan websites (CropLife International, n.d.; IAASTD Watch, n.d.; Pesticide Action Network North America [PANNA], 2006).

The one thing delegates could agree on was to terminate the IAASTD assessment process after the issuance of the Synthesis Report. The World Bank shut down the Secretariat in record time. The sponsors lost the power to convene the debate on agriculture and food security—at a time when the issues of food security have never been more salient.

An Assessment of the Assessment

Political failures can be interesting because they throw into high relief the underlying issues of an assessment process. Here was an assessment panel built explicitly on the experience of the IPCC, a role model that had overcome many contentious issues—and entrenched opposition—in the past. But in this case, despite careful attempts to "engineer" consensus by managing balanced participation and executive control, the process was derailed. Was it because the underlying issues were too intractable? Were there underlying organizational problems with the development and implementation of the agenda that prevented an effective dialogue? Or did such ill-assorted and highly engaged delegates, drawn from very different epistemic communities (Haas, 1980), simply fail to come together in a single community during the negotiations process?

The IAASTD has sparked highly opinionated commentaries, and the debate on its merits—and the possibility of its revival—certainly continues. (Feldman, Biggs, & Raina, 2010; Lappe, 2010) A major independent evaluation commissioned by the World Bank provides a scathing account of IAASTD operations, challenging it both as to substance and as to value for the money (Independent Evaluation Group, 2010; Watson, 2009). On the other hand, the UN Special Rapporteur on the Right to Food has rated it as a high water mark in its enlightened discussion on food security (De Schutter, 2009).

My own experience in studying this case through documentary research and interviews with participants is of being transported to the world of Rashomon: recollections are so vivid and disagreements on the merits of the exercise so profound that it is hard to believe that the delegates all attended the same gathering.

The one issue on which there is general agreement is that the timetable, which called for the full report to be issued in 2008, was far too ambitious given the scale and breadth of the assessment exercise. Participating states, in particular, were given relatively little time to digest the assessment reports and discuss them within their national bureaucracies. There was no time to adopt the useful IPCC practice of organizing technical working parties to address the most contentious issues and hammer out compromises; instead, the issues were ventilated in the large, unwieldy Bureau, and the even more unwieldy Plenary, which was characterized by more heat than light. The issues may not have been inherently intractable, but the tools available to address these issues were not fit for purpose.

Above all, there was a breakdown in trust—mistrust of the Secretariat (symbolized by the repudiation of the modeling project as the centerpiece of the deliberations) and mistrust of the other delegates representing competing stakeholder groups. The Plenary did not come together as a single community, all speaking the language of agriculture; instead, it turned into a cacaphonous babel, with each constituency trying to outshout the others.

As one key participant described it to me, the IAASTD became a "giant, noisy buffet."

- Everyone ate what they wanted but would not try anything new;
- everyone sat at their own tables and would not speak to anyone new;
- nobody listened to the speeches;
- a lot of people left early;
- nobody thanked the organizers; and
- no-one cleaned up afterward.

Sooner or later, given the importance of agriculture and the stark challenges confronting us, we will need a renewed mechanism to discuss these issues at a global level with mutual respect and understanding.

References

CropLife International. (n.d.). [website]. Available on the World Wide Web: http://www.croplife.org.

Depledge, J. (2006). The opposite of learning: Ossification in the climate change regime. *Global Environmental Politics*, *6*(1), 1-22.

De Schutter, O. (2009). *Guidance in a time of crisis: IAASTD and the human right to food message from the UN special report on the right to food*. Paper presented at the United Nations CSD-17 (Commission on Sustainable Development) Intergovernmental Preparatory Meeting, New York.

Feldman, S., Biggs, S., & Raina, R. (2010). A messy confrontation of a crisis in agricultural science. *Economic & Political Weekly*, *XLV*(3).

Funtowicz, S., & Ravetz, J. (1993). Science for the post-normal age. *Futures*, *25*(7), 739-755.

Funtowicz, S., & Ravetz, J. (2003, February). Post-normal science. *Online encyclopedia of ecological economics*. Boston, MA: International Society for Ecological Economics.

Gibbons, M., Limoges, C., Nowotny, H., Schwartzman, S., Scott, P., & Trow, M. (1994). *The new production of knowledge the dynamics of science and research in contemporary societies*. London: Sage Publications.

Haas, P.M. (1980). Introduction: Epistemic communities and international policy coordination. *International Organization*, *46*(1), 1-35.

Independent Evaluation Group. (2010, June). *International Assessment of Agricultural Knowledge, Science and Technology for Development (IAASTD)*, corporate and global evaluations and methods. Washington, DC: World Bank.

International Assessment of Agricultural Knowledge, Science and Technology for Development (IAASTD). (n.d.). [website]. Available on the World Wide Web: http://www.agassessment.org.

IAASTD. (2009). *Agriculture at a crossroads: International Assessment of Agricultural Knowledge, Science and Technology for Development* (Synthesis Report). Washington, DC: Island Press.

IAASTD Watch. (n.d.). [website]. Available on the World Wide Web: http://www.agassessment-watch.org.

Jasanoff, S. (1990). *The fifth branch*. Cambridge, MA: Harvard University Press.

Lappe, A. (2010, April 29). Don't panic, go organic. *Foreign Policy.*

Mitchell, R.B., Clark, W.C., Cash, D.W., & Dickson, N.M. (Eds.). (2006). *Global environmental assessments information and influence*. Cambridge, MA: MIT Press.

Nowotny, H., Scott, P., & Gibbons, M. (2001). *Re-thinking science: Knowledge and the public in an age of uncertainty.* Cambridge, MA: Cambridge Policy Press.

Nowotny, H., Scott, P., & Gibbons, M. (2003). Mode 2 revisited: The new production of knowledge. *Minerva*, *41*(3), 179-194.

Pesticide Action Network North America (PANNA). (2006). *A road map for reviewers: A detailed outline of selected chapters of the first draft of the global report of the IAASTD*. San Francisco: Author.

Polanyi, M. (1962). The republic of science. *Minerva*, *1*(1), 54-73.

Rayner, S. (2006, July). *Wicked problems: Clumsy solutions—Diagnoses and prescriptions for environmental ills*. 2006 Jack Beale Memorial Lecture, University of New South Wales, Sydney, Australia.

Scoones, I. (2009). The politics of global assessments: The case of the International Assessment of Agricultural Knowledge, Science and Technology for Development (IAASTD). *Journal of Peasant Studies*, *36*(3), 547-571.

Siebenbruner, B. (2006). Can assessments learn, and if so, how? A study of the IPCC. In A.E. Farrell & J. Jager (Eds.), *Assessments of regional and global environmental risks*. Washington, DC: Resources for the Future.

Watson, R.T. (2005). Turning science into policy: Challenges and experiences from the science-policy interface. *Philosophical Transactions of the Royal Society B*, *360*, 471-477.

Watson, R.T. (2009). Open letter regarding the independent evaluation of the IAASTD commissioned by the World Bank. Washington, DC: IAASTD.