Science Policy For Multilateral Environmental Governance

Peter M. Haas

Preface

This paper is part of series of working papers that represents one of the first outputs from a two-year United Nations University Institute of Advanced Studies project on International Environmental Governance Reform, being conducted in collaboration with Kitakyushu University, Japan, and with support from The Japan Foundation Center for Global Partnership.

The project was initiated in response to increasing calls, from both within the UN and from external sources, for a more detailed analysis of the current weaknesses and gaps within the existing system of international environmental governance (IEG) and a more elaborate examination of the various proposals that have been put forward for reform. In responding to these calls, the project has drawn upon the expertise of several renowned academics and practitioners in the fields of international environmental law, science, economics, political science, the humanities, and environmental politics.

The first section of the project focuses on the identification of weaknesses and gaps within the current system of international environmental governance. The individual research papers commissioned within this section have concentrated on six key aspects of international environmental governance: the inter-linkages within the environmental governance system; the science/politics interface; industry/government partnerships for sustainable development; the participation of NGOs and other civil society representatives; the interaction between national, regional, and international negotiation processes; and the role of international institutions in shaping legal and policy regimes.

The second section of the project elaborates upon specific reform proposals that have been generated throughout recent debates and evaluates the potential of each proposal to strengthen the existing IEG system. The papers commissioned within this section of the study have focused on exploring the potential advantages and disadvantages of specific reform models and explained, in detail, how each model may be structured and how it would function. The models of reform that have been explored include: clustering of MEAs; strengthening UNEP; expanding the role of the Global Ministerial Environment Forum (GMEF); reforming existing UN bodies; strengthening financing sources and mechanisms; building up the environmental competence of the World Trade Organization (WTO); different possible models fro a a World Environment Organization; reforming the UN Trusteeship Council; expanding the mandate of the UN Security Council; and establishing a World Environment Court.

The final section of the project combines insights gained through the first two sections in order to provide an in depth evaluation of current reform proposals, elaborate on how they may resolve current gaps and weaknesses, and offers alternative recommendations for reform.

For more information relating to the International Environmental Governance Reform Project and for details of related publications, please visit the United Nations University Institute of Advanced Studies website at http://www.ias.unu.edu or contact Shona E.H. Dodds dodds@ias.unu.edu or W. Bradnee Chambers chambers@ias.unu.edu or visit The Japan Foundation Center for Global Partnership website at http://www.cgp.org/cgplink/ or contact Norichika Kanie kanie@kitakyu-u.ac.jp

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SCIENCE POLICY FOR MULTILATERAL ENVIRONMENTAL GOVERNANCE

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Abstract

This paper examines lessons about the scientific functions that need to be performed to achieve effective multilateral environmental governance, and the institutional design by which such functions may be best performed. The paper suggests that, rather than centralizing science policy functions, it may be better to reform many of the existing arrangements, and build a centralized source for coordinating information flow between the institutions responsible for performing the different science policy functions. Recruitment patterns should be reformed, so they are uniformly based on merit. Each multilateral environmental agreement should have a standing monitoring and science policy body. Open-ended basic research should be conducted, possibly supported by UNEP, in order to anticipate new threats. Greater attention should be focused on the existing gaps in the present science policy structure: waste disposal, fresh water quality, and land-use practices. Concerted efforts should be taken to recruit and train a generation of science advisory experts, capable of working at the interstices of interdisciplinary environmental research, while remaining experts in their own domain, and also capable of communicating effectively to people outside their domain

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SCIENCE POLICY FOR MULTILATERAL ENVIRONMENTAL GOVERNANCE

Peter M. Haas*

Introduction

The need for science policy applied to the management of transboundary and global environmental threats is now widely recognized. This chapter looks at lessons about the scientific functions that need to be performed to achieve effective multilateral environmental governance, and the institutional design by which such functions may be best performed.[1]

Much of the current context of international environmental governance, for which policy advice is needed, is one of uncertainty. Global environmental systems are characterized by non-linear, complex behavior associated with cumulative environmental change with both short-term and long-term consequences. (Kasperson, Kasperson and Dow pp. 2-5) Funtowicz and Ravetz write: (Funtowicz and Ravtetz 2001 p 178)

> Whereas science was previously understood as steadily advancing the certainty of our knowledge and control of the natural world, it is now seen as coping with many uncertainties in urgent technological and environmental decisions on a global sale. A new role for scientists will involve the management of the crucial uncertainties: therein lies the task of assuring the quality of the scientific information provided for policy decisions. Moreover, 'scientific evidence has a long row to hoe to have a distinctive impact on policy.'"

Under such circumstances, decision makers need information about the nature of threats, how each will be affected, as well as the types of arrangements that can be collectively developed to address such transboundary and global risks.

I call the relevant body of scientific knowledge that is need "usable knowledge". Usable knowledge is accurate information that is of use to politicians and policy makers. It must be accurate and politically tractable for its users. It frequently exceeds the mastery of any traditional disciplinary approach.

Clark & Majone offer four criteria of usable knowledge: its adequacy, value, legitimacy, and effectiveness. Adequacy relates to including all the relevant knowledge or facts germane to the matter at hand. Value has to do with contributing to further understanding and meaningful policy. Legitimacy relates to its acceptance by others

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outside the community that developed it. Effectiveness relates to its ability to shape the agenda or advance the state of the debate, and, ultimately, improve the quality of the environment. (Social Learning Vol. 1 p 15; Clark & Majone 1985)

Yet science has become extremely politicized. It is often found that good science falls on deaf ears, or is met with bad science, when the politics favor neglecting it. Writers in the field of Science, Technology and Society investigate the implicit values, and the distributional consequences of science. (Jasanoff et al Handbook, Miller and Edwards eds 2001) Three challenges to the authority are often raised. Science is often suspect because the scientists themselves are part of a broader cultural discourse, and thus lack autonomy or independent stature: scientific findings may reflect the bias of sponsors. Secondly, the use of science is mediated by the political goals of potential users. Thirdly, science is political in its consequences, because some benefit and others suffer as a consequence of policy options that are supported by the application of scientific understanding.

Thus the possibility for accuracy is questioned, and the political tractability is undermined by the reduced political authority of science to offer meaningful statements about the threats, their urgency, and responses. If recipients are not confident in the usefulness of scientific knowledge it will not be used.

Yet, many still regard science advice as necessary, even if its philosophical expectations are somewhat reduced. Current research from comparative politics, IR, policy studies, and democratic theory suggests that science remains influential if its expertise and claims are developed behind a politically insulated wall. (Botcheva 2001; Andresen et al 2001, Social Learning Group 2001) Ravetz and Funtowicz argue for a procedural approach to developing usable knowledge by including multiple disciplines and multiple stake holders. (Ravetz & Funtowicz in Costanza, and Ravetz 1986)

An emerging consensus from political scientists who study the use of science in international regimes is that science must be developed authoritatively, and then delivered by responsible carriers to politicians. The more autonomous and independent science is from policy the great its potential influence (Andresen et al ch 1, Botcheva 2001, Haas 2001b) Consensus in isolation builds value and integrity, and then its consequences should be discussed publicly. Measures of autonomy and integrity include the selection and funding of scientists by IOs rather than by governments, their recruitment by merit on important panels, and reliance on individuals whose reputation and authority rest on their role as active researchers rather than policy advocates or science administrators. Accuracy can be achieved via peer review, interdisciplinary research teams, and independence form sponsoring sources.

International institutions can help foster and disseminate information, and sanitize it so that it is not seen as compromised by sponsoring authorities.

Scientific Functions

Usable science covers a range of understandings. A recent *ISQ* submission distinguishes between 1) knowledge about the extent of the problem, 2) knowledge about the causes of the problem, and 3) knowledge about its consequences for human societies. The Social Learning volumes distinguish between 6 different categories of knowledge as it is performed in the conduct of policy formation: monitoring, risk assessment, options, goals and strategies, implementation, and evaluation. (Social Learning 2001).

I focus here on a smaller number that need to be performed: basic knowledge, environmental monitoring, and policy advice. Data is based on a survey administered to MEA (multilateral environmental agreement, or regime) secretariats (see appendix II), secondary literature on MEAs, and the *Yearbook of International Co-operation on Environment and Development*. (http://www.ext.grida.no/ggynet) A summary of the findings is presented as a table in Appendix I.

In conjunction, if done well, contribute to effective environmental governance. Examples where well designed science performance correlates with good science include Stratospheric Ozone Protection, and European Acid Rain. Efforts to protect the Mediterranean Sea from pollution is a moderate example, where mobilized science informed policy making, but the quality of the monitoring remains sketchy. Efforts to protect other regional seas from pollution often lack any systematic scientific involvement, and have few accomplishments to date in terms of their ability to reverse environmental degradation. (Haas 2001a)

The presumptive causal links are multiple: usable knowledge can influence states' political will and technical ability to address environmental threats through the provision of an institutional venue for holding cooperation, by improving the capacity for environmental planning and protection, and by enhancing the concern of government officials and elites about the nature, extent and magnitude of environmental threats. Each scientific function, if well performed may contribute to more effective multilateral environmental governance as states learn of new threats and of new ways to respond to problems that confront them. (Haas 2001a)

In addition, well designed and performed scientific functions may be interactive. For instance climate change monitoring has provoked political action to set meaningful goals for reducing greenhouse gas emissions. Stratospheric ozone monitoring states to ban CFCs, and then move to accelerate the pace of their elimination as well as expanding the list of regulated substances. Ozone monitoring has also eased verification of state compliance with their obligations, as well evaluating the effectiveness of the regime. In European acid rain regulation, monitoring led to the formulation of alternative policy responses to prevent acidification, as decision makers became aware of new ecosystems at risk. (Social Learning 2001 Vol 2 ch 16, 21) Below I look at ways to better organize monitoring and policy advice to improve effectiveness.

Basic Science is the development of understanding of the behavior of transboundary and global ecosystems, at a level of resolution that provides meaningful information to policy makers about environmental effects at national and sub-national levels. Improvements in basic science can contribute to agenda setting and policy choice.

Monitoring is the systematic collection of information about environmental quality. Accurate monitoring may lead to prompt agenda setting, as well as to improving implementation by virtue of the shaming effect of monitoring data, and to evaluation by providing data about regime performance and observed environmental change in the target variable. Most verification, though, relies on direct information about policy implementation, rather than on indirect measures of national environmental performance. (Victor, Raustiala, and Skolnikoff eds1999, Weiss and Jacobson eds. 1998) I do not discuss systems of verification as they generally do not rely on science but on voluntary submission or observations by third party observers.

Policy advice involves the choice of specific national and collective measures to address environmental degradation. Policy advice is likely to influence the substance of international regime obligations and national environmental policy, as well as national compliance and regime effectiveness.

Science is necessary for good policy, albeit not for cooperation. It is necessary for good regime performance and well-crafted policy. MEAs that have successfully reduced environmental degradation all had arrangements for the provision of usable knowledge, leading to the collective adoption of policies that were reasonably linked to achieving tolerable levels of environmental protection at socially acceptable costs. Moreover, supported by influential international institutions usable knowledge helped to persuade governments that their own self interest was associated with preserving ecological integrity.

Yet usable knowledge is neither necessary nor sufficient for environmental cooperation, alone. For instance, the North Sea governments adopted a series of Ministerial declarations during the 1980s to achieve 30-50% reductions in the emissions of a large number of contaminants. However, in the absence of usable knowledge about the transfer and deposition of contaminants in the North Sea, the environmental effects of such regulations are unknown. In compliance with North Sea Ministerial Declarations, the UK government has stopped dumping sewage sludge in the North Sea, even when scientific evidence suggests that the UK contribution marginal to North Sea environmental quality.

National Ability to Engage in Multilateral Environmental Governance

Ultimately, environmental monitoring requires participation by most states. Yet many governments lack capacity to effectively perform most of these environmental functions. Many states lack the staff and technology to effectively monitor their environments. Governments vary broadly in their administrative ability to develop and enforcement environmental policies. A widespread problem facing developing country governments is

the small number of professional staff, small budgets, and weak political influence over policy within the rest of the government. Since foreign environmental policy if generally the result of consultations amongst a number of functionally responsible agencies, a politically weak environmental body undermines the overall ability to form effective national environmental policy.

There is a strong need for resource transfers to build national capability. A policy implication is to concentrate institution-building efforts on countries in important geographic regions facing pressing transboundary and global environmental threats, such as China, Brazil, and India. International institutions can exercise limited forms of conditionality in order to increase public resources to environmental agencies, and international institutions and NGOs can work to elevate the profile of national environmental agencies and their staffs.

Partial lessons are available from national experiences with use of science policy, and their design of institutions to generate usable science. A lesson from the USA – USA NTSB, OTA, and ITC – is political impartiality, terms of leadership that don't correspond to political election cycles, and recruitment on merit. The timely submission of reports according to the legislative cycle is also key. (Brown) While national monitoring efforts have been critiqued for their mismatch with the legislative time scales, at the international level, where regimes are administered by secretariats and COPs (Conference of the Parties) that meet periodically, surprising monitoring results can be effectively introduced into the following year's agenda for addressing new threats.

Basic Science

There is a need to generate usable knowledge and a basic understanding of complex systems. Keckes argues that a number of research programs are underway intended "to improve the knowledge about the physical, chemical and biological processes which from the bais for maintenance and functioning of marine ecosystems and the interaction of these processes with those taking place in the atmosphere and on land, including social and economic development." (Keckes 1997p 1)

The Global Environmental Change program is an example of this, but has yet to provide the consensus for a systematic understanding of global ecosystems. (The Global Environmental Change Programmes 2001). SCOPE panels, organized under the auspices of the International Council of Scientific Unions has also tried to organize knowledge about the behavior of core ecosystemic cycles. The current Millennium Ecosystem study focuses on living systems, and similar efforts have been made to accumulate knowledge about specific ecosystems. Much of this understanding remains to be developed. Knowledge remains concentrated on the behavior of specific ecosystems, rather than of the earth as a whole.

Studies of global change science also address the substantive nature and the process by which such basic understanding is to be achieved. William Clark argues that substantive "knowledge systems for sustainability will require an unprecedented degree

of integration. Expertise from the communities of environmental conservation, human health, and economic development will need to be harnessed in problem-solving efforts. Particularly challenging will be drawing into these collaborative endeavors the vast resources of informal expertise that comes from practical experience in grappling with particular sustainability p-problems in particular social and ecological settings." (Clark 2001 p 1)

The organization and communication of such systematic knowledge is essential. Not only does such basic knowledge come from collaborative work of groups of scientists representing different disciplines – both from the natural and the social sciences – they must also be skilled in communicating their knowledge to people from other disciplines, as well as to the media, politicians, and the popular audiences. (Albritton in NYT and on web) In addition to basic science there is a need to better develop the communication skills for imparting such knowledge to various audience, and to train global change scientists in such techniques.

Monitoring

Effective environmental policy needs an overall assessment of ecosystem health, as well as monitoring of ongoing trends. These are useful for establishing baselines and early warning systems, as well as for ongoing monitoring or existing efforts to determine if additional effort is required to achieve environmental protection. Monitoring should be impartial, comprehensive, and synoptic. Participants in monitoring programs should be selected on merit.

Many monitoring schemes are conducted globally. (Keckes 1997, UNEP 1992) The open oceans are studied through UNESCO's IOC and the International Council for the Exploration of the Sea (ICES). Species specific fisheries councils, the FAO, and ICES monitor fisheries. Atmospheric monitoring is conducted by the WMO (World Meteorological Organization). Joint programs of UNEP (United Nations Environment Programme), FAO (Food and Agriculture Organization), WMO and WHO (World Health Organization) conduct some fresh water quality and urban air quality monitoring. Stratospheric ozone is monitored by UNEP. European acid rain through LRTAP (Long Range Transport of Atmospheric Pollution regime, administered by the United Nations Economic Commission for Europe). Biodiversity monitoring is conducted by the World Conservation Monitoring Centre and the World Conservation Union (IUCN). UNEP was initially designed to be responsible for conducting global environmental assessments through is world watch program but these have taken a long time to develop and UNEP lacks the budgetary resources to perform extensive monitoring. (Gosovic 1992, Fritz 1998) UNEP issued a *Global Environmental Outlook* in 1997 and 2000, summarizing trends in some of the major global ecosystems. But the degree of aggregation to achieve public recognition for such global reviews often sacrifices the kind of resolution that would make the monitoring data useful for evaluating actual change over time in controlling emissions and human activities responsible for those emissions.

Most monitoring efforts are organized regionally, within the broader institutional design of MEAs designed to address specific environmental threats, such as UNEP's many regional seas programmes. Some noticeable monitoring gaps remain, such as land use, and solid waste disposal.

In practice, environmental monitoring responsibilities as stipulated in MEAs vary widely. 48 MEAs call for environmental quality monitoring. Submission of monitoring reports is mandatory in 81% of the cases, and voluntary in 19%. Annual reports are required in 17% of the MEAs, biannual reports in 19%, and triennially 2%. The rest are unspecified. Governments are responsible for conducting monitoring in 69% of the MEAs. International institutions are charged with conducting monitoring in 8% of the cases, and governments are instructed to provide their monitoring results to international institutions in 4% of the MEAs. Nineteen percent of the MEAs have no provisions for who is responsible for performing monitoring. Some MEAs provide for free standing monitoring committees, nominated by the secretariat based on merit. Other MEAs rely on national submissions, or defer to independent commissions (such as the global monitoring programs discussed above). Others have rotating bodies, coordinated by the COPs or the rotating chair of the MEA. These last arrangements suffer from poor administration, and poorly intercalibrated results. Diffuse national networks, are capable of providing information, but suffer from political skepticism because the networks are too closely tied to governmental sources.

Still other MEAs rely on *ad-hoc* committees convened periodically to study the environmental quality of an environmental resource – such as the North Sea and Baltic Environmental Quality Status Reports- these efforts have little persistent political influence, and do not generate ongoing useful material. While they may serve a short-term agenda –setting function by publicizing environmental threats, they do not fully serve the full monitoring function because assessments may only be made every 5 years, and the reports do not systematically monitor for the same substances, so no comprehensive picture of the health of the environment can be achieved. More often these surveys are conducted in order to identify "hot spots" for policy attention.

The best arrangement for organizing monitoring is through freestanding regular standing committees reporting to the MEA. Standing committees provide for uniform reporting, with no loss of institutional memory. In conjunction with recruitment provisions based on merit they can confer accurate data about which decision makers may be confident. It is easier to to mobilize and consolidate a policy network around standing committees than ad hoc ones, or independent commissions unconnected to the MEA. Such committees should also study a standard list of substances over time, so as to be able to provide synoptic information about environmental quality, and provide the data for evaluating the success of a regime at stemming environmental degradation.

NGOs sometimes serve as monitors, particularly in conservation regimes. They may suffer problems with public credibility, though, as their reports are widely suspected of not being partial. However, NGOs serve as useful counterweights to national monitoring reports to ensure accountability.

Monitoring is often insufficiently complete to get a thorough picture of environmental quality. In addition monitoring programs often fail to study the same substances over time, shifting substances in order to provide an early warning service rather than an overall monitoring function. Even UNEP's two *Global Environmental Outlooks* treated different substances in each review.

Much of the environment can be monitored remotely from satellites, and does not require the active collection and submission of data by governments. Remote sensing and satellite monitoring would also enhance verification of trends in natural resource use, marine pollution from organic sources and from oil as well as in monitoring levels and production of greenhouse gases, although ground truthing is still necessary confirm remote sensing data. Satellite and airplane base monitoring is less effective at monitoring inorganic marine contamination and urban air quality, for instance, which requires localized sampling.

While most monitoring appears to be subcontracted by governments to universities or government laboratories, it is important that those engaging in the monitoring be suitably trained so that the results are compatible with those from other countries. Some international institutions have provisions for evaluating and calibrating data submitted from national agencies, through some arrangements for 3rd party evaluation of data – as with LRTAP's two regional data processing centers.

Funding for monitoring should come from a stable single international source, to counter the short term political funding cycles from national governments. Some programs may periodically have insufficient funding, or the substances monitor may have gaps over time because the sponsors shifted the monitoring agenda to reflect immediate political concerns in their countries.

More attention could be directed to establishing indirect measures of environmental stress. Few efforts have been undertaken to monitor the social driving forces behind environmental contamination, rather than engaging in direct observation of degradation. Closer attention could be paid to human populations at risk as an early warning sign of environmental degradation, or to patterns of human activity known to generate specific and serious environmental threats. Few examples of such anticipatory monitoring yet exist, and generally exist only for Europe, where data is better. The two Dobris Assessments released by the European Environmental Agency (1991, 1995) looked at social indicators, as have OECD (Organization for Economic Cooperation and Development) reports, and some World Bank publications on energy use and on deforestation.

Policy Advice

Scientific consensus can inform policy, when groups responsible for articulating consensus have stable access to decision-makers. For instance, in LRTAP, Stratospheric ozone, and the Mediterranean MEAs, stable institutional arrangements were in place to transfer scientific consensus about the source and extent of

environmental threats, as well as policy responses. In each of those MEAs policy was adopted based on the scientific consensus, and the quality of the environmental improved, or at least the rate of degradation was slowed.

However, for consensus to be acceptable to leaders it must emerge through channels that are viewed as legitimate by the leaders. Typically these are when the scientists have a reputation for expertise, when the knowledge was generated beyond suspicion of policy bias by sponsors, and when the information is transmitted to governments through personal networks. (Haas 2001b) These networks, called epistemic communities, can be supported by international institutions – such as UNEP and the Mediterranean Action Plan – and the advice policy advice will be disseminated from international institutions to governments; from national laboratories and networks up to governments; and from within government administrations to the top levels of decision making when these individuals are hired as consultants or environmental agency officials. The spread of policy advice is generally through interpersonal channels.

Most science policy is provided in the context of individual regulatory regimes. Thus, different networks are mobilized for each MEA. This is generally the case because usable policy knowledge is highly issue specific: experts in marine policy lack expertise in the management of other environmental media. In addition, national environmental agencies and international institutions are organized functionally to address environmental threats by media: for instance air pollution experts do not work in the same agency as marine pollution experts and are members of entirely distinct policy networks. The Joint Group of Experts on Scientific Aspects of Marine Pollution (GESAMP) is a rare body that provides periodic reviews of the health or state of the marine environment with a high degree of policy legitimacy for decision-makers. (Taylor 1993,Windom 1991) Some efforts, based on bureaucratic desperation in the face of scarce finances and on arguments of economic efficiency, have been taken to combine and cross-fertilize these policy networks by encouraging shared participation in climate change policy seminars with membership from multiple regional seas MEAs. Such consolidation of efforts may serve to broaden policy networks and to share policy information, but should not substitute for building organic geographically based networks around common environmental topics.

Policy advice should be developed and circulated by multidisciplinary international panels. Individuals should be selected by merit and serve in their personal capacity. Ideally they should be chosen by international institutions rather than governments. The need for independent scientific advice is a matter under current discussion in the Convention on Biodiversity. Policy advice should be based upon peer reviewed materials.

It is important to keep the basic science and science policy functions distinct, so that the substance of policy suggestions is not tainted by potential influence from funding sponsors. Sponsors of science groups should be different from sponsors of the basic research and activities that generated initial consensus.

Climate change science policy is performed by the Intergovernmental Panel on Climate Change (IPCC). The IPCC's authority is hampered by governmental nomination of experts, that has the effect of limited the perceived political autonomy of the institution. Some political integrity and authority is retained by the extensive peer review network that scrutinizes all the IPCC publications, yet observers express concern that government nomination of expert may bias the policy analysis towards analyses of social adaptation over mitigation strategies (Rayner ed. IPCC 3rd State of the Art Report, chapter ?)

Most MEAs rely on standing subsidiary policy bodies to articulate policy relevant scientific knowledge, draft reports, and to respond to queries from the secretariat and government members of the MEA. The Biodiversity regime, and Climate Change regimes are arranged like this. The ozone regime relies on standing panels of experts that meet regularly. CCAMLR has scientific experts involved in technical working groups, but the experts are nominated by member governments.

A number of less effective institutional designs for mobilizing science policy have been used as well. Some MEAs rely only on international commissions – such as GESAMP – to provide policy data. Other MEAs policy foundations are based on *ad hoc* panels convened by MEA bureaus or by the COP chairs, such as pollution control for the South East Pacific (SEPAC). These ad hoc arrangements do not provide usable policy knowledge, because they lack legitimacy, and often lack institutional memory. (Kimball 1996) Rotating chairs of the COPs - CCAMLR and SEPAC – is a serious detriment to maintaining stability in the science policy network.

Since the Med Plan and subsequent efforts to generalize the experience to address other transboundary and global environmental threats, the following lessons are apparent about mobilizing usable policy knowledge for environmental governance. (Haas 2001a, Tolba and Rummel-Bulska 1998, Hordijk 1991, Eckley 1999)

> Lessons About Mobilizing Networks of Scientific Expertise for Multilateral Environmental Governance
>
> 1. Carefully survey the population of scientists. In the Mediterranean a UNEP consultant spent 9 months visiting national laboratories to inventory national capabilities and to personally build the scientific network.
> 2. Ensure that networks and international panels have interdisciplinary representation, including the social sciences. Individuals should have high regard in their own disciplines as well as be able to talk to experts from other disciplines.
> 3. Recruit carefully for national and regional institutions. Base judgements on professional credentials and networking ability.
> 4. Avoid relying on 1 national institution to provide research and training.
> 5. Provide professional outlets for members through conferences and publications in refereed professional journals. This also elevates the domestic profile individual scientists in the community of expertise who may then be recruited to fill positions in national administrations.

6. Promote scientific discussions on topics that are likely to lead to consensus, i.e. ripe research topics.
7. Avoid government designation of scientists to international meetings
8. Try to make use of joint international panels for environmental risk assessment rather than relying on national assessments. Avoid capture by 1 scientific discipline or school of expert analysis.
9. Assure the timely submission sin advance of meetings avoid single state sponsorship of collective research,
10. Arrange for focused interactions between scientists and policy makers to discuss the technical substance of the issues. In LRTAP the International Institute for Applied Systems Analysis (IIASA) arranged for 2-day sessions to familiarize policy makers with acid rain transfer and deposition models developed by scientists.
11. Maintain momentum within the community by continuing to have projects and research opportunities so those members don't drift away. This avoids having to reconstitute the community each time a new problem emerges.

Broader considerations of the proper institutional design of science policy entails timing: When consensus has been achieved before an issue reaches the agenda and policy discussions begin, then scientists can merely be introduced as experts, following the lessons above. However, at times it is necessary to simultaneously develop scientific consensus and advance policy debates. For such issues, such as was the case in the Mediterranean and Ozone regimes, the development of science policy must be kept insulated from ongoing policy debates, with the two streams united only when consensus has been achieved. In other cases, where consensus remains elusive and policy debates have already attained their own momentum, as in climate change and biodiversity, it may be best if the two activities can be kept as separate as possible.

Financing Science

Most secretariats of MEAs responsible for performing various aspects of science policy complain of financial limitations. The budgets of most MEAs, paid by member states, are meager, and no international institutions have suitable financial resources to perform all the science functions by themselves. The Global Environmental Facility (GEF) provides some support, but not enough, and secretariat officials are leery of becoming overly reliant on one funding source. The United Nations Development Program, World Bank, or private foundations could exercise a profound influence on improving usable knowledge and disseminating it by supporting research programs and convening conferences and panels to apply basic knowledge to environmental policy.

Conclusion & Recommendations

In preparation for Rio Plus 10 many policy analysts have pondered what to do with the existing haphazard arrangement of international institutions performing various aspects of science policy and environmental governance. (Interlinkages 1999, Pocantico

Dialogue Site, German Advisory Council on Global Change 2001; Haas 2001a pp 345-6; Global Environmental Politics 2001) Aspiring institutional designers consider how to streamline and enhance synergies between regimes. Some urge the creation of a new Global Environmental Organization, that would centralize all science policy functions, as well as performing policy analysis, centralizing the administration of all the current existing MEAs, and verifying compliance with the MEAs. In principal a GEO would be the single authority – consolidating all existing arrangements – for monitoring the environment, and collecting monitoring data.

UNEP was created, in 1973, to serve such a centralizing role. But this was in a period where no organizations performed any significant environmental governance functions. In the intervening years other institutions have assumed environmental responsibilities, so the administrative design question is whether to reform the current array of responsibilities or to create a new, centralized organizational structure.

Current thinking in organizational theory seems to run counter to a centralized authority, though. The best designed institutions for dealing with complex and uncertain policy environments are loose, decentralized, dense networks of institutions, that are able to quickly relay information back and forth, and where there are sufficient redundancies in the performance of functions that the elimination or withdrawal of funding for one institution does not jeopardize the entire network. (Aggarwal 1998)

Rather than centralizing science policy functions, it may be better to reform many of the existing arrangements, and build a centralized source for coordinating information flow between the institutions responsible for performing the different science policy functions. Recruitment patterns should be reformed, so they are uniformly based on merit. Each MEA should have a standing monitoring and science policy body. Open ended basic research should be conducted, possibly supported by UNEP, in order to anticipate new threats. Greater attention should be focused on the existing gaps in the present science policy structure: waste disposal, fresh water quality, and land-use practices. Concerted efforts should be taken to recruit and train a generation of science advisory experts, capable of working at the interstices of interdisciplinary environmental research, while remaining experts in their own domain, and also capable of communicating effectively to people outside their domain.

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Appendix 1

Institutional Design for the Performance of Science Policy Functions within MEAs

Regime	Environmental Monitoring	Policy Verification	Environmental Policy Advice for Setting Environmental Standards	Budget
Climate Change 1992 Framework on climate change	-monitored domestically, submitted to UNFCC	**Subsidiary Body for Implementation (SBI**) -composed of representatives of the Parties -assesses and reviews effective implementation of convention -develops recommendations to assist the COP in the assessment and review	**Conference of the Parties (COP**) -the supreme body of the convention -composed of ministers and high ranking officials of participating countries -meets to adopt/reject potential amendments to the convention **Subsidiary Body for Scientific and Technological Advice (SBSTA**) -composed of representatives of the Parties -established by Convention -draws info from existing competent international bodies	-funded by UN -developed countries have responsibility of assisting developing country parties with financial and technological resources
Ozone Depletion -1985 Vienna convention -1987 Montreal Protocol -1990 London amendments -1992 Copenhagen amendments	-monitored domestically submitted to COP of convention	**Implementation Committee** -composed of ten Parties, two each from five geographical groups (Africa, Asia, Eastern Europe, Latin America and the Caribbean, and Western Europe and others (Canada, USA, Australia, and New Zealand)) -considers and reports to the **Meeting of the Parties (MOP)** any cases of non-compliance -MOP responsible to implement full compliance with the Protocol **Executive Committee of the Multilateral Fund** -responsible for developing and monitoring the implementation of specific operational policies, guidelines, and administrative arrangements	- **basic administrative mechanism for the Vienna Convention is the** COP Meeting of Ozone Research Managers -est. by COP of the Vienna Convention -composed of government experts -assesses national and international research and monitoring programs -produces a report to the COP with recommendations for future research ---------- **MOP** (for Montreal Protocol) -meets annually -3 expert panels est. by Montreal Protocol: Scientific Assessment Panel -reviews scientific knowledge based on specific national needs **Technology and Economics Assessment Panel** -estimates the amount of controlled substances needed by developing countries for their basic needs and availability of supplies -analyzes technical solutions and their costs versus the benefits of reduced use of controlled substances, and issues of technology transfer **Environmental Effects Assessment Panel** -looks at effects on health and the environment from altered ozone	**Executive Committee of the Multilateral Fund** and **Fund Secretariat** -two subcommittees: **Subcommittee on Project Review** advises on project approval and related issues **Subcommittee on Monitoring, Evaluation, and Finance** advises on project implementation and financial matters **-**in charge of the disbursement of resources in order to achieve the objectives of the Fund –disbursements of over $1.1 billion, to support almost 3600 projects and activities through Dec. 2000 -Executive Committee has approved multi-year funding projects (i.e.- for CFC

			levels and increased ultraviolet radiation **Open-Ended Working Group of the Parties** and the **Bureau of the Montreal Protocol** meet in between sessions to negotiate recommendations for the MOP regarding protocol revision and implementation issues	production in China -$150 million and India $82 million) -funded the establishment and the operating costs of ozone offices in 107 countries
European Acid Rain -1979 Convention on long-range transboundary air pollution -1984 Protocol on monitoring and evaluation -1985 Sulfur protocol -1988 Nitrogen oxides protocol -1991 Volatile organic compounds protocol -1994 revised Sulfur protocol	Implementation Committee -established by Executive Body -reviews compliance by Parties with their obligations under the protocols to the Convention -composed of nine legal experts and technical experts, nominated by Parties and elected by the Executive Body	Executive Body -composed of the Contracting Parties -reviews the implementation of the Convention -has established working groups to for studies and recommendations	-Subsidiary bodies to provide the necessary scientific expert advice for policy-making decisions -est. by Executive Body Working Group on Effects -composed of government experts and others **Working Group on Strategies and Review** -composed of government experts EMEP STEERING BODY -composed of government experts and others	funded by UNECE
Marine Dumping London Dumping Convention	IMO acts as reporting facility and maintains a list of independent experts to judge	**Scientific Group** -reviews Annexes -creates guidelines for monitoring and implementation programs ***ad hoc* groups** -created by Consultative Meeting -composed of government experts -provide advice on specific issues (reporting and compliance)	SCIENTIFIC GROUP -subsidiary body of Consultative Meeting -composed of government experts -advises on scientific and technical cooperation -reports to **Consultative Meeting of the Contracting Parties** to the London Convention (the main governing body) Joint Group of Experts on Scientific Aspects of Marine Environmental Protection (GESAMP **-** composed of specialized experts nominated by the sponsoring agencies (IMO, FAO, UNESCO/IOC, WMO, WHO, IAEA, UN, and UNEP)	Funded by IMO
Oil Pollution International convention for the prevention of the pollution of the sea by oil				

Convention relating to intervention on the high seas in cases of oil pollution casualties	IMO acts as reporting facility and maintains a list of independent experts	IMO through independent experts	IMO maintains independent experts for scientific research	funded by IMO
Convention on civil liability for oil pollution damage	commitments are not regularly reviewed	Commitments are not regularly reviewed, does not have its own institutional apparatus, but IMO, as depositary organization, can call a conference of States Parties if requested by at least one-third of the Parties	CLC has no system to incorporate scientific and technical knowledge into the decision-making process.	funded by IMO
Convention on the establishment of an international fund for compensation for oil pollution	-governments provide the Secretariat with reports of oil quantities received	**International oil pollution compensation funds (IOPC funds**), led by the Director, is responsible collecting contributions and settlements of claims -two decision-making organs- **Assembly of all States Parties** **-**meets annually **Executive Committee** **-**composed of 15 States Parties elected by the Assembly -meets several times a year	none	IMO→IOPC Funds
Convention for the prevention of pollution from ships	Domestically monitored, reported to division of IMO	**Marine Environment Protection Committee** (MEPC) is the main forum -consists of all member States of IMO -adoption and amendment of convention -measures to ensure enforcement	**Sub_Committees on Bulk Liquids** and **Gases and Flag State Implementation** -subsidiary bodies of MEPC to provide expert technical advice	Funded by IMO
Regional Convention for the protection of the Mediterranean	Monitored by local agencies, reported to coordinating unit of region which then reports back to UNEP	UNEP division of environmental conventions has several local, specialized agencies to monitor specific regions intergovernmental organizations UNEP Coordinating Unit for the Mediterranean Action Plan (MEDU)	panel of experts established by UNEP and/or local committee	Funded by UNEP
Convention on the protection of the gulf of Kuwait		Regional Organization for the Protection of the Marine Environment (ROPME)		
Convention on the protection of the Rea Sea		Regional Organization for the Conservation of the Environment of the Red Sea and Gulf of Aden (PERSGA)		
Convention for the protection of the South Pacific		South Pacific Regional Environment Programme (SPREP)		

Convention for the protection of the South-east Pacific		Comisión Permanente del Pacífico Sur (CPPS)		
Convention for the protection of the Caribbean		UNEP Regional coordinating Unit for the Caribbean Environment Programme (CAR/RCU)		
Convention for the marine and coastal environment of west and central African region		UNEP Regional coordinating Unit for the West and Central African Action Plan (WACAF/RCU)		
Convention for the protection of the Eastern African region		UNEP Regional coordinating Unit for the Eastern African Action Plan (EAF/RCU) -has a Conference of parties (COP) -ad hoc committee of legal and technical experts		
Convention for the protection of the Black Sea against pollution -Land-based sources protocol -Emergency cooperation protocol -Dumping protocol		Black Sea Environmental Programme (BSEP)		
Baltic Sea Helsinki convention	monitored nationally by contracting parties and reported to the commission	**Baltic Marine Environment Protection Commission-Helsinki Commission (HELCOM)** -meets annually -promotes the purposes of the convention -headed by an executive secretary appointed by the commission **Program Implementation Task Force** -composed of representatives from the contracting parties -coordinates implementation of action programs	**Five subsidiary bodies:** STRATEGY GROUP -policy strategies **Monitoring and Assessment Group** -quantitative studies of the discharges and activities of the marine environment **Sea-based Pollution Group** -issues dealing with marine pollution and national/international sea pollution response **Land-based Pollution Group** -issues dealing with land pollution and emissions **Nature Conservation and Coastal Zone Management Group** -ecosystem approaches to sustainable development	

Agreement for cooperation in dealing with pollution of the North sea by oil	North sea area divided into zones monitored by a contracting party -reported to other contracting parties	Contracting parties are held to agreement by eachother oil situations in one zone that necessitate the help of other contracting parties, not specific to that zone are reported to the Inter-Governmental Maritime Consultative Organization	Contracting parties are responsible for having individual experts to assess their respective zones	
Convention for the prevention of marine pollution by dumping from ships and aircraft	Parties monitor compliance in their respective territory and report to the commission	Commission of the convention -recommends best methods of implementing convention, but it is up to the individual contracting parties to ensure full compliance in their specified area	Contracting parties establish complementary or joint programs of scientific and technical research	
Convention for the prevention of marine pollution from land-based sources	Contracting parties are obligated to establish and operate a permanent monitoring system (individually or jointly systematic and ad hoc monitoring) -monitoring reports submitted to the commission	commission of the convention -supervises the implementation of provisions of convention	Contracting parties responsible for establishing scientific and technical research programs -also responsible for coordinating research with the research of other parties	
Antarctic treaty	Contracting parties have right to inspect any area of the Antarctic at any time and are considered the primary monitors -observations are reported to Antarctic Treaty consultative meeting	Each Contracting Party whose representatives participate in meetings has the right to designate observers to carry out any inspection -observers have complete freedom of access at any time to any or all areas of Antarctica -Aerial observation may be carried out at any time over any or all areas of Antarctica	**Antarctic Treaty Consultative Meeting** (ATCM) is the principal decision-making forum adopts measures to regulate the activity in the area -other inter- and non-governmental organizations (i.e. Scientific Committee on Antarctic Research (SCAR) may designate experts to attend the ATCMs **Committee for Environmental Protection** (CEP) is an advisory body to the ATCM	
Convention for the conservation of Antarctic seals (CCAS)	nationally monitored against nationally established regulations and laws contracting parties report to eachother and to the Scientific Committee on Antarctic Research (SCAR)	conference of parties held when necessary -SCAR assesses information received and makes recommendations regarding scientific research and implementation	SCAR makes recommendations for scientific research -composed of nationally appointed representatives -divided into eight working groups that specialize in specific topics SCAR may use UN Food and Agriculture Organization for technical assistance in assessments	SCAR has a standing finance committee and is funded by national contributions

Convention for the conservation of Antarctic marine living resources (CCAMLR)	individual parties of the convention report to the **Commission for the CCAMLR**	**Commission for the CCAMLR** **-**implements a system of observation and inspection -identifies conservation needs and evaluates effectiveness of conservation methods **CCAMLR Ecosystem Monitoring Program** (CEMP) (set up by the Commission) -amendments to the convention are established by consensus of the parties within the commission	The Scientific Committee -composed of experts representing governments -collection, study, and exchange of information -analyze data, and formulate proposals - decisions in the Committee are reached by consensus	**Standing Committee on Finance and Administration** (SCAF) -subsidiary body of the Commission meets at the Commission's annual meeting - budget is financed principally through contributions by all members
Convention on the regulation of Antarctic mineral resources activities (CRAMRA) - Protocol on environmental protection	Monitored nationally by contracting parties, reported to the executive secretary of the commission -all areas of convention are open to inspection by observers appointed by the commission	**Commission of the convention** -headed by executive secretary -handles all matters that affect implementation	**Scientific, technical and environmental advisory committee** -composed of experts representing contracting parties	
Wetlands Convention on wetlands of international importance (RAMSAR)	National reports are submitted to the COP by the contracting parties	**Conference of the Contracting Parties** (COP) -primary governing body -reviews the implementation of the convention	**Scientific and Technical Review Panel** -composed of independent scientific experts representing six RAMSAR regions of the world -guide policy decisions by the COP -meets twice a year	most of the core budget from contributions from contracting parties
Migratory Species Convention on the conservation of migratory species	Monitored nationally, reports submitted to the convention six months in advance to the next COP	**Conference of parties (COP)** -adopt resolutions -improves conventions implementation -meets every three years **Standing Committee** of the COP -consisting of regional representatives and the depository government –carries out and enforces activities of the conference in-between sessions	**Scientific Council** -provides advice on scientific matters to the COP, the secretariat, and any party (when instructed) -can recommend research -can advocate specific conservation and management measures to be included in agreements -consists of experts appointed by individual parties or the conference	UNEP administers trust fund
Polar Bears Agreement on the conservation of polar bears	Individual contracting parties are responsible for monitoring their own regions	Conferences of party representatives are held at the request of an individual contracting party -contracting parties are responsible for developing and implementing specific regulations to uphold the agreement in their designated region	Contracting parties are responsible for nationally conducting research on polar bears and for coordinating their research with that of other contracting parties	

Trade in endangered species Convention on international trade in endangered species (CITES)		**Conference of parties** (COP) to CITES -meets about every two years -examines progress of convention -revises the Appendices as appropriate **Standing Committee (SC)** -meets annually -composed of representatives from the major geographic regions of CITES	**Animals Committee** and **Plants Committee** -meet annually -composed of experts elected by the regions -provide specialized knowledge -**Nomenclature Committee** -composed of persons chosen by the Parties -voluntary membership -used to standardize nomenclature of CITES documents -all committees have a chairman and vice-chair elected by the COP.	Total expenditures in 2000: 4.66 million USD (CITES uses USD and Swiss francs for currency- but is hoping to convert to all USD due to problems with fluctuation in exchange rates) -funded by UNEP (conservation trust fund)
Whaling Convention for the regulation of whaling	National inspectors appointed by contracting governments along with international observers appointed by the commission ensure compliance with catch limits (Currently working on a new method of supervision that will include new controls)	International Whaling Commission -meets annually Scientific committee does a "comprehensive assessment" of whale stocks	three standing committees: Scientific Committee Technical Committee Finance and Administration Committee -composed of experts representing governments	
Biodiversity Biodiversity treaty	Individual parties submit reports to the COP	**Conference of Parties** (COP) -establishes subsidiary bodies as are necessary to further implement the convention -evaluates parties' reports on their individual implementation of the convention -adopts protocols, amendments, and annexes	**Subsidiary Body on Scientific, Technical, and Technological Advice** (SBSTTA) -composed of experts representing governments -provides the COP with advice relating to the implementation of the Convention **ad hoc technical expert groups** on thematic areas -established by SBSTTA. -currently includes expert groups on marine and coastal protected areas, mariculture, dryland biodiversity, and forest biodiversity -open-ended ad hoc Intergovernmental Committee for the Cartagena Protocol on Biosafety (ICCP) -information sharing and expert advice	

Trade in Hazardous Wastes Convention on the control of transboundary movement of hazardous wastes and their disposal	National governments individually monitor and report to the COP -are obliged by the convention to implement and enforce its provisions -allowed to take measures to prevent and punish actions against the convention	**Conference of the Parties** (COP) -can establish subsidiary bodies as necessary to further implement the convention **Working Group for the Implementation of the Basel Convention** - implementation of the Convention -meets between the meetings of the COP -prepares work for consideration of the COP **Legal Working Group** (LWG) -studies issues related to mechanism for monitoring the implementation of and compliance with the Convention	**Technical Working Group** (TWG) -prepares technical guidelines and provides guidance on technical matters to the COP -develops criteria on hazard characteristics of hazardous wastes→what constitutes hazardous waste according to the convention?	Funded by UNEP

Source List

http://sedac.ciesin.org/entri/summaries-menu.html
http://www.basel.int
http://www.biodiv.org
http://www.ccamlr.org
http://www.cep.unep.org
http://www.cites.org
http://www.cpps.org.ec
http://www.greenyearbook.org
http://www.imo.org
http://www.iopcfund.org
http://www.ramsar.org
http://www.scar.org
http://www.sprep.org
http://www.unece.org
http://www.unfccc.int
http://www.unep.ch
http://www.unep.ch/seas
http://www.unep.ch/seas/main/eaf/eaf
http://www.unep.org

Appendix 2

Survey of Institutional Design for the Performance of Science Policy Functions within MEAs

I am writing a background paper on Science Policy for Environmental Governance, for the Rio Plus 10 Conference for a United Nations University sponsored project on Environmental Governance.. I would like to ask some questions about the way in which science is organized and used in your Multilateral Environmental Agreements (MEA) for comparative treatment in this study. I would appreciate it if you could respond to the following questions:

In general I am interested in the institutional design by which science is provided, and whether you find these designs sufficient for assuring the timely provision of usable impartial advice for governance.

Environmental Monitoring

What institutional arrangements exist for environmental monitoring in your MEA? Is monitoring conducted by member parties, by a standing committee, by ad hoc committees responsible for conducting periodic assessments, or through some other arrangement? By what criteria are institutions and individuals chosen to participate in monitoring arrangements? What role do NGOs play? What substances or resources are monitored? Are the same substances or resources routinely monitored over time? Is the quality of the monitoring data to date sufficient to assess changes in environmental quality or resource management over time, and the effectiveness of the MEA?

Risk Assessment and Policy Advice

How is policy advice provided to governments for environmental standard setting in this MEA? How are experts chosen, and by whom? By what criteria are institutions and individuals chosen to provide policy advice? Is this selection of advisers done by member governments, by geographic distribution, or merit?

Is policy advice framed in terms of setting environmental standards, resource management guidelines, or as sustainable development? Has this framing changed, and if so, since when, and why?

Policy Verification

What provisions and procedures are made to verify state compliance with MEA commitments? Are provisions made to verify compliance by firms or private actors? By what criteria are instituitons and individuals chosen to participate in policy verification procedures?

Lessons

Finally, I would like to ask you to assess the effectiveness of collective arrangements to protect the environment within your MEA. Is environmental quality or resource quality better than it was before the MEA was established? To what extent are observable changes in environmental quality or resource quality the consequence of deliberate policy decisions undertaken by governments? Are these policy changes the consequence of the MEA?

What lessons can you recommend for others involved in multilateral environmental governance? What do you feel are the most pressing needs for your MEA to make it more effective?

Thank you very much. I will be happy to send you a copy of the chapter when it is completed, or any of my own writings on such MEAs as UNEP's Regional Seas Programmes, the Mediterranean, the North Sea and Baltic, Stratospheric Ozone Protection, LRTAP, and overall lessons from multilateral environmental governance.