CHAPTER THREE

Early Warning and Assessment of Environment, Conflict, and Cooperation

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Abstract

Marc Levy and Patrick Philippe Meier recommend that assessments and early warning systems integrate environmental variables more completely and effectively. The authors assert that the international system has little capacity to monitor and assess conflict and cooperation on environmental issues because:

- *There are few incentives to carry out high-quality assessments or monitoring exercises;*
- *The necessary data are not available; and*
- *There is not enough experimentation, testing, and innovation to develop new methodologies.*

To address these deficiencies, the authors recommend:
- *Setting core priorities concerning assessments and monitoring;*
- *Establishing clear incentives and lines of responsibility to produce appropriate data;*
- *Establishing clear financial bases for these activities; and*
- *Creating an information infrastructure to achieve economies of scale, to disseminate data and knowledge, and to bridge cross-scale divides.*

Introduction

To build peace, confidence, and cooperation around environmental issues, we must monitor and assess environmental data in a timely manner. Although the last decade's efforts to develop this field generated only limited data, we are poised on the threshold of an era that is potentially far more productive. Monitoring, integrated assessment, and early warning systems, if properly supported, funded, and formulated, could vastly improve our understanding of the linkages among environment, conflict, and cooperation, and thus help us prevent violence.

In this chapter, we differentiate among three interrelated functions: "monitoring" collects data and information (and sometimes creates indicators) used to evaluate, diagnose, and triage environmental issues. "Integrated assessment" uses empirical observations and mathematical models to support decision-making across environmental and socioeconomic domains; for example, an analysis of vulnerability to climate change would be an integrated assessment. "Early warning" activities seek to rapidly identify critical situations and cooperative opportunities to facilitate early response; for example, the USAID-funded Famine Early Warning System Network (FEWS NET) provides early warning and vulnerability information on emerging or evolving food security issues in Africa. While these functions often blend together in practice, each step requires increased information and analysis:
- Monitoring requires regular observations in limited domains.
- Integrated assessment incorporates data across different domains and uses cutting-edge analytical techniques.
- Early warning assesses advanced data and analysis in a challenging, fast-paced timeframe.

We investigated a range of monitoring, integrated assessment, and early warning efforts—some focus on conflict, others are primarily environmental in scope, and a few examine the interactions between environment and conflict. We found:
1) At the broadest level, the international system's capacity to monitor and assess confidence building, cooperation, and peacemaking based on environmental issues is low. Most policies are only loosely connected to empirically grounded assessments, and most actions pay scant attention to monitoring or empirically based evaluation.
2) Therefore, cooperative measures are underfunded and resources aimed at building cooperation are not effectively allocated.
3) The international system lacks three factors essential to improving monitoring and integrated assessments:
   - Incentives: Very few actors have the appropriate incentives to carry out high-quality assessments or monitoring exercises.
   - Data: The data necessary to assess and monitor cooperative measures are not available.
   - Methods: Understanding environmental-political linkages requires new methodologies, which must be developed through innovation, experimentation, and testing.

To correct these deficiencies, we recommend the following steps:
- Set core priorities and identify the types of assessments to support and actions to monitor;
- Establish clear lines of responsibility and incentives to produce appropriate data;
- Establish clear financial bases for these activities; and

- Create an information infrastructure to achieve economies of scale, disseminate data and knowledge, and bridge cross-scale divides.

Gaps and Opportunities in Early Warning and Assessment

1. Capacity is too low

The international community has identified a wide range of environmental socio-political phenomena to tackle; Table 1 lists questions that monitoring, assessment, and early warning systems need to address for each action.

Table 1: Monitoring, assessment, and early warning needs

Action	Assessment	Early Warning	Monitoring
Mitigate and respond to climate change and climate vulnerability	What are the expected impacts of climate change? What actions are most suitable?	Where are groups most vulnerable?	Where is vulnerability increasing or decreasing?
Conserve biological diversity	Where is biodiversity especially rich? What actions will best conserve it?	Where are the "hotspots"?	How are pressures changing? Where is biodiversity being protected?
Manage freshwater resources more effectively	Which areas have the greatest potential for conflict over water resources?	When and where will access to clean water be restricted by drought, poor quality, or inequitable distribution?	Who is effectively managing water quality, quantity, and access problems, and how?
Promote sustainable use of natural resources such as forests, fisheries, arable land, and minerals	Where are use patterns sustainable? What actions will encourage sustainable use?	Where are resources likely to "crash"?	Is natural resource use becoming more or less sustainable?
Achieve the Millennium Development Goals, which span a range of human and environmental phenomena including hunger, poverty, and health	What role do environmental factors play in efforts to achieve goals to reduce poverty, improve health, and ensure access to water?	Are there places in danger of ecocatastrophe, as happened to the Aral Sea?	Where are goals being achieved? What efforts are being implemented?
Reduce vulnerability to natural disasters	What role do environmental conditions play in the risk of natural disasters?	Which places are experiencing conditions that make them especially vulnerable over the short term?	Where is vulnerability increasing or decreasing?

These actions, drawn from the top of the human-environment agenda, could involve hundreds of billions of dollars in investments and potential benefits. However, for the most part, the ability of the international system to meet monitoring, assessment, and early warning needs remains quite low.

Over the past decade, several billion dollars in bilateral and multilateral aid has been spent on environmental activities, yet the results are scarcely monitored. Monitoring overwhelmingly concentrates on procedural or contractual outcomes, like expenditures and accounting; currently, major donor organizations do not have adequate data to draw firm conclusions about the social or environmental consequences of the actions they have financed. The Global Environmental Facility's (GEF) *Second Overall Performance Study*, for example, blamed a lack of baseline data and other shortcomings for its inability to draw robust conclusions about the impact of GEF's projects on the environment (2001). Even though most aid is

linked formally or informally to multilateral environmental agreements, one study concluded that "nearly every international environmental agreement lacks a formal mechanism for rigorous monitoring of compliance" (Victor, 1999, pages 152-153).

Assessments are also inadequate: assessments of climate change vulnerability remain fragmented, unspecific, and imprecise; biodiversity conservation assessments are similarly ad hoc. Global natural resource assessments rely on thin evidence and focus on arbitrarily narrow formulations; for example, forest assessments are often fixated on measuring the forest cover's relative size, and neglect changes in livelihoods or the cover's effects on water, soil, and other resources. The 2003 *World Water Development Report* referred to quantitative assessments of global water resources only in passing (UNESCO, 2003).[42]

Early warning systems are also behind the times: many more environmental crises have occurred than have been successfully anticipated. Although FEWS NET's food security system is an exception, there have not been any sustained efforts to link environmental early warning to conflict early warning, in spite of the significant attention paid to the linkages over the past 15 years (O'Brien, 2002).

2.   Low capacity contributes to poor decisions

The international system's inability to meet these needs has a number of pernicious effects. First, it is partly responsible for the international community's poor track record in environmental decision-making; with some exceptions, the intergovernmental system failed to capitalize on the high level of interest in the early 1990s. There are no meaningful international regulations or action plans for addressing climate change or protecting biodiversity, and global natural resource stocks are declining dramatically in the absence of significant international mitigation. Although the contentious politics of climate change, biodiversity protection, and natural resource conservation account for the slow pace, we believe that feeble data and assessment efforts are also significantly responsible.

For example, many of the Kyoto Protocol's exploitable weaknesses spring from inadequate assessment efforts, especially those that span biophysical and socioeconomic domains. The Intergovernmental Panel on Climate Change, the body that oversaw the primary assessment supporting the Kyoto process, delivered very little usable knowledge to guide negotiations; in the end, the Kyoto Protocol was based almost entirely on diplomatic improvisation and political horse-trading. Better assessment could have foreseen and possibly prevented many of the problems that emerged during implementation.[43] For example, negotiators did not foresee the problems associated with Russian "hot air," nor did they appreciate the complexities of including multiple greenhouse gases and both sinks and sources within Kyoto's ambit.

The late arrival of vulnerability and adaptation to the negotiating table in Kyoto was partially due to weak monitoring and assessment processes: the Kyoto protocol focuses on reducing emissions because emissions are monitored, but fails to address vulnerability and adaptation because such phenomena have not been monitored and assessment methods are weak compared to physical models of climate change.

Like the Kyoto process, the slow progress of global biodiversity conservation is also related to the paucity of usable knowledge. How should global biodiversity be measured? Where is it most threatened, and what are the impacts on human well-being? What actions should the international community pursue to protect biodiversity, and what specific modifications would make these efforts most effective under different circumstances? There is no international consensus on the answers to these questions, and as a result, global decision-making is easily derailed.

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[42]   The report's references to the Transboundary Freshwater Disputes Database are a notable exception.
[43]   For example, the Clean Development Mechanism's monitoring framework was not adequately discussed prior to implementation.

The strange fate of environmental issues in the Millennium Development Goals (MDGs) process illustrates the problems created by the absence of good data and assessment processes. The MDGs are a set of 8 consensus goals and 18 associated targets that are intended to guide global efforts to achieve sustainable development (United Nations Development Programme [UNDP], 2003). Although most of the MDGs have clear quantitative targets (e.g., halving the proportion of people living on less than $1 per day, or eliminating gender disparity in primary and secondary education), the environmental targets are a strange brew; for example, there are three targets listed under the goal "ensure environmental sustainability":

• Integrate the principles of sustainable development into country policies and programs and reverse the loss of environmental resources;
• Halve by 2015 the proportion of people without sustainable access to safe drinking water; and
• Achieve by 2020 a significant improvement in the lives of at least 100 million slum dwellers.

Considering that thirty years have passed since 1972's UN Conference on the Human Environment in Stockholm, these goals are extremely unimpressive. The first target cannot be fully measured (although UNDP's *Human Development Report* identifies some indicators for this goal). The third is not closely tied to the environmental agenda and defies rational tracking: as long as the lives of 100 million slum dwellers improve over a 20-year period, the target is met; the lives of the other 700 million slum dwellers could worsen, or the total number of slum dwellers could increase to two billion, and the target would still be met. This vacuous target defies monitoring and fails to guide decision-making.

Only the second environmental target, to provide safe drinking water, is comparable in form and spirit to the other targets. While there is at least one meaningful environmental target in the MDGs, there are no high-quality programs monitoring this goal, and resting the weight of the entire global environmental agenda on a single water indicator is problematic, to say the least.

This is a great irony; the global environmental community, which pushed to mainstream sustainable development, has finally witnessed victory in the form of the MDGs. However, in the course of this transformation, the environmentalists' agenda has faded into the background. Assessment and monitoring infrastructure in the environmental arena has been neglected so greatly that it is simply inadequate to the task. In comparison, poverty, health, and education are measured much more thoroughly, and support a decision-making style that is grounded in quantitative target setting, outcome-oriented planning, and performance-based reviews. Inadequate monitoring and assessment negatively affect environmental policies by:

• Discouraging actors from investing in corrective or ameliorative measures, because they lack the ability to measure results;
• Forcing environmental issues to take a back seat to other issues with stronger monitoring and assessment capacities;
• Limiting the ability of decision-makers to consider the effects of environmental conditions upon other sectors, such as poverty and health, because there are no straightforward ways to link the comparatively data-rich analyses in many other sectors with the anecdotal, scattered data in the environmental domain; and
• Limiting the ability to set priorities across environmental issues, to diagnose consequences, or to chart effective responses.

3.   Why is this?

We can characterize the current state of affairs as an "ignorance trap," held in place by three reinforcing factors: incentives, empirical baselines, and methods.

Incentives

Environmental decision-making, and decision-making concerning the linkages between environmental and socioeconomic dynamics, are highly pluralistic, extremely multilateral (involving large numbers of states and coalitions), and highly transnational (involving governmental, non-governmental, corporate, and international organizations). On one hand, this style of decision-making has generated many benefits over the past thirty years; it has provided skilled policy entrepreneurs with room to maneuver and the flexibility to shape winning coalitions. It has permitted experts and activists to seize opportunities and rapidly mobilize concern when conditions are ripe. But on the other hand, this style of decision-making does not facilitate the steady accumulation of infrastructure, knowledge, and best practices needed to undergird the increasingly sophisticated and far-reaching efforts found in the sustainable development agenda.

Environmental decision-making is unable to generate information and assessment infrastructure because it lacks the large, well-funded organizations that are capable of internalizing the costs associated with providing public goods. No international environmental actor has the appropriate incentives to adequately monitor trends and conditions, track progress, or build assessment capacity, and as a result, environmental monitoring is an ad hoc pastiche of efforts, assembled on the cheap, and lacks consistent measures over time and strong connections to decision-making processes.[44]

Empirical baselines

To assess vulnerability to future climate change, researchers need baseline data on current vulnerability patterns. To monitor improvements in urban sanitation, policymakers need baseline data on current levels of urban sanitation. However, the landscape of relevant baseline data is depressingly barren, and plans to build an empirically grounded analytical foundation are often abandoned or scaled back in the face of the missing data.

Hamstrung by the lack of relevant baseline data, researchers cannot support quantitatively oriented decision-making procedures, so they fail to invest in data creation efforts, and successive evaluations conclude that they do not have enough data from which to start.[45] As time goes on, the gap between what is needed and what is available grows, and accentuates the difficulty in integrating the environment into assessments of conflict, poverty, health, and other issues.

Methods

Finally, assessment methods have advanced unevenly over the past decade, and research and experiments must be intensified to determine appropriate methods, identify new breakthroughs, and to explore options for interactions across temporal and spatial scales. Scholars have not developed new methods, because the data to test them are inadequate. Only recently, major global collections of household survey data were sufficiently geo-referenced to integrate them with data at other scales. In addition, despite the great interest it attracted, the "Environmental Kuznets Curve" hypothesis has failed to result in any major advances because relevant data are sparse and of dubious quality.

4. Quick fixes will not work

The lack of appropriate incentives and empirical baseline studies, coupled with underdeveloped methods, accounts for the discrete and often limited evolution of early warning mechanisms. These obstacles present distinct challenges that quick fixes will not remedy. First, we need to set clear priorities for monitoring,

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[44] In contrast, the benefits of monitoring, assessment, and early warning of financial conditions are valuable enough to be internalized by individual actors, and therefore a great deal of activity is tracked across multiple scales and domains (see International Monetary Fund, 2002).

[45] Only two of the several hundred data sets considered for inclusion in the Environmental Sustainability Index met the most basic criteria (having a baseline year with regular, consistent updates): CO_2 emissions and energy consumption (Levy, 2002).

assessments, and early warning efforts that should address specific decision-making needs, ranked in terms of priorities.[46]

Next, to ameliorate the incentive problem, the global community should assign responsibility: the most practical model would combine "lead country" models (a single country provides the bulk of the capacity because it serves its own interest), multilateral models (a group of countries pool resources), and centralized agency models (a single international organization works on behalf of the international system).[47] Of these, the multilateral model is most prone to breakdown, especially in meeting the need for continuity. A solid financial basis for activities performed by international organizations or groups of countries is essential. In retrospect, UNEP's early mandate to monitor environmental conditions delivered disappointing results in large part because of the lack of financial support (Downie & Levy, 1999). Creating and regularly updating baseline datasets requires secure, long-term funding. The dramatic advances in monitoring and assessment capacity within the European Union and its neighboring countries following the creation of the European Environment Agency demonstrate the importance of institutional support.

Finally, the information infrastructure needs to be modernized. Obstacles block integration across functional domains and geographic scales; data are proprietary and inconsistently stored, documented, and formatted; and information is inefficiently shared. Some obstacles will remain regardless of the efforts to remove them, and dataholders will continue to have strong incentives to reduce access, but appropriate commitments and investments could spur significant progress.[48]

Early warning case study: FAST and CEWARN
The limitations in the global community's ability to monitor and assess environmental conditions contribute to the disappointing track record of environmental conflict warning systems. In spite of NATO and the U.S. Department of Defense's great interest in environmental security in the 1990s, none of the concomitant efforts to build early warning systems bore fruit (Matthew, 2002). For example, the U.S. government's State Failure Task Force (now known as the Political Instability Task Force), a group of U.S. academics working with unclassified data and operating with a significant budget, was unable to identify any methods for linking environment or natural resource phenomena to patterns of political conflict (Esty et al., 1998; Goldstone et al., 2000). To its credit, the Task Force's models predicted political breakdowns 80 percent of the time, and Phase II demonstrated that deforestation and soil degradation were associated with higher infant mortality rates, but it was forced to abandon its initial hopes of modeling environment-conflict links.

More recent efforts have paid careful attention to decision-making needs, invested in data collection, and experimented with new methods to exploit the availability of new environmental data. FAST (Early Analysis of Tensions and Fact-Finding), which is operated by Swisspeace in 23 countries, systematically monitors and assesses the causes of conflict and peace, coding any political, social, economic, or environmental

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[46] Monitoring based on decision-making needs should devote greater attention to measuring phenomena relevant to policy targets (of which there are currently almost none) and to measuring systemic attributes rather than discrete stocks and flows (for example, critical thresholds or poverty-environment linkages).

[47] Examples of efforts following the lead country model include Norway's acid rain assessments, which are utilized throughout Europe; U.S.-funded famine early warning systems used by multiple donor countries; Canadian models of global Persistent Organic Pollutants (POP) emissions; and Global ISO14001 certifications tracked by the German Umweltbundesamt. In these cases, the investing countries concluded that their benefits justify the costs. The recently completed Global Land Cover 2000 process illustrates the multilateral model, as governments, think tanks, and international organizations pooled their efforts to classify land cover. The World Meteorological Organization's weather monitoring efforts represent an example of a centralized international agency process.

[48] For example, there is no consistent way to identify subnational administrative units within countries, which has hindered efforts to integrate such data. The World Health Organization is organizing a multilateral effort to establish standards and to set spatial boundaries to permit integrating geographic data, but the pace of this effort is disappointingly slow due to the lack of adequate resources.

event that affects the escalation or de-escalation of subnational, national, or international conflict. Therefore, FAST not only tracks violent events, but also those that ease tension or build peace through cooperative behavior. FAST uses 186 event types, covering human security and civil rights, crime and internal security, conflicts and violent actions, domestic politics, and social and political change, along with natural resources, environmental degradation, infrastructure, migration, ethnicity, and religion. FAST established Local Information Networks consisting of local analysts (Field Monitors and Country Coordinators) to generate observations that are analyzed using integrated Event Data Analysis. Although other efforts monitor and classify event data in this fashion, we believe that FAST is the only one that has successfully tracked natural resource conflicts.

FAST developed CEWARN (Conflict Early Warning and Response Mechanism) to provide early warning of conflicts in the Horn of Africa; CEWARN uses FAST's methodology to monitor (and prevent) pastoral conflicts across border areas in Eastern Africa (Mwaûra & Schmeidl, 2002).[49] Since beginning operations in July 2003, CEWARN has correctly forecasted and prevented a violent raid in Northern Uganda: a country coordinator passed information gathered by the field monitor to CEWARN analysts, who in turn alerted the local district commissioner. Integrating data and analysis of environmental and conflict dynamics could generate useful early warning outputs in other parts of the region, such as in Somalia, which suffers from a continuing low-intensity conflict and deforestation and flooding related to the charcoal trade.[50]

Integrating monitoring more tightly across environmental and sociopolitical domains could improve early warning systems in Somalia, drawing on such sources of useful data as FEWS NET, FAST, and the Food Security Assessment Unit (FSAU) of the Food and Agriculture Organization, which collects environmental, agricultural, and health data on Somalia.[51] Along with the information collected by the UN's seven field security offices in Somalia, data from these monitoring mechanisms could be fed into FAST's flexible methodology. Merging coded weather and food security data from FEWS NET and FSAU with FAST's political, economic, and social indicators of conflict and cooperation would produce an integrated early warning system combining sophisticated remote-sensing data with highly developed social event data.

This fusion of political, economic, social, and environmental data would produce a more effective understanding of the dynamic between environmental factors, scarce resources, and conflict, and could monitor the increasing tensions over resources and the environment, particularly in southern Somalia. It could also monitor the relationship between human and physical capital in the Somali conflict, thus enabling UN development agencies to evaluate entry points for preventive action on a near-real time basis, and it could draw on reliable and comprehensive analyses to identify vulnerable communities, thus providing credible early warnings and entry points for economic peace building. In addition, an integrated network could provide a stronger focus on local capacity building by working more closely with local staff.

How do we establish such a system? We could start by cataloguing operational conflict early warning systems, identifying those that use environmental data, and verifying if such information is available in the appropriate format and the correct frequency. UNEP could offer expert guidance on how to improve or augment existing environmental information systems, and could consider investing in information systems to address unmet needs. The divide between environment and conflict experts remains wide, and methods

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[49] Also see Forum on Early Warning and Response's "Conflict Early Warning and Response Mechanism (CEWARN) Project" at http://www.fewer.org/intergov/igad/main.htm and Protocol on the Establishment of a Conflict Early Warning and Response Mechanism for IGAD Member States, dated 9 January 2002, at http://www.iss.co.za/AF/RegOrg/unity_to_union/pdfs/igad/Protocol.pdf

[50] This section is based on research, interviews, and analysis performed by Patrick Meier in Nairobi from May-August 2003.

[51] FSAU collects and researches information on the following indicators, which are logged into the FSAU database in Nairobi each month: crop data, market price information, food aid, rainfall, pasture, livestock, coping mechanisms, displacement, migration, health, and security. Trends are analyzed by district and provide essential information for early warning.

and datasets intended to unite them are still crude; for example, conflict modelers continue to rely on the Global Assessment of Human-induced Soil Degradation (GLASOD) dataset even though the soil science community has discredited it.[52] Although environmental data remains the weak link in global assessment efforts, some collections of environmental data could be useful to existing conflict early warning systems; information on climatic anomalies is especially promising.

Conclusion

We have argued that environment-conflict early warning systems need more data and information from the international system, and without it they are vulnerable to deficiencies in monitoring and integrated assessment of environment-conflict dynamics. These deficiencies prevent decision-makers from gaining a useful understanding of trends, patterns, and diagnoses.

We have also argued that such deficiencies could be corrected, as demonstrated by the example of integrated early warning in East Africa and the Horn. We conclude that useful assessment and early warning systems require the following building blocks:
1)	Clearly articulate phenomena of interest, with explicit links to decision-making;
2)	Identify data and methodological requirements for assessments and warnings;
3)	Invest in data creation and methodological development to fill gaps; and
4)	Financially support these activities on an ongoing, sustainable basis.

Because environmental change is relevant to high-priority global policy goals, such as poverty reduction, public health, and conflict prevention, investments in environmental information systems could pay off in clearly useful ways; however, if such investments are ruled out because of organizational timidity or fiscal miserliness, we will fail to capitalize on the opportunity to improve our understanding of the linkages between environment, conflict, and cooperation.

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[52]	See Stalley (2003) for a recent use of the GLASOD data; see Niemeijer and Mazzucato (2002) for an explanation of GLASOD's shortcomings.

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