HUMAN DIMENSIONS OF CURRENT ENVIRONMENTAL CHANGE

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În lumea de azi, plină de nedreptate şi instabilitate, evaluarea schimbărilor din mediul înconjurător şi a măsurilor de protecţie a acestuia trebuie să includă cunoaşterea dinamicii sociale, politice şi culturale a relaţiei om – mediu. În tot cazul, înainte ca societatea ştiinţifică să întreprindă investigaţii ample în materie de valori umane şi schimbări curente în mediul înconjurător, inclusiv în ecologia umană şi sănătatea mediului, apar anumite probleme de ordin fundamental privind oportunităţile de realizare a unor asemenea studii. Este nevoie stringentă de o teorie relevantă, date şi specialişti. Totodată, se impune elaborarea unei noi viziuni asupra infrastructurii instituţionale şi a resurselor. În articol se examinează noile pericole şi vulnerabilităţi ale sănătăţii umane, domeniile de cercetare şi obiectivele ce trebuie atinse.

Introduction

We live in an increasingly unequal and unstable world, and any consideration of environmental change and proposals for action have to acknowledge the social, political and cultural dynamics of the environment–human society interactions. In the analysis of these interactions, Adger *et al.* (2005) distinguish two key developments. The first development is an increasingly sophisticated understanding of earth system processes and changes in the environment. This greater understanding is based on the unprecedented enlargement of available data that resulted from rapid acceleration in the amount and accessibility of information about the Earth, including opportunities to see through a range of media, and first of all – via internet, the impacts of environmental change in real time. But this informational explosion does not necessarily make easier to unravel cause and effect, or to distinguish noise from trends, and cause a second development – the broadening of analytical, social-science perspectives on global environmental change, human–environment interactions and policy interventions. The research community is still struggling with how to appropriate this emerging and sometimes fragile knowledge into decision processes and policy formation, whether at national, regional or global scales. As a result, the increasingly sophisticated models and methods have been deployed in the analysis of social and environmental elements of human health and wellbeing vulnerability (Adger et al., 2005).

Our purposes in this article are to summarize shortly what has taken place in planning for research on the human components of global environmental change, to assess the potential readiness of the social science community to undertake large-scale research in this field and to identify areas where large-scale research can and should be undertaken.

New impacts and human health vulnerabilities

A *vulnerability framework* in the assessment of coupled human–environment systems has been proposed to better explain the degree to which these systems are likely to experience harm due to their exposure to a hazard, either it is an exogenous perturbation or an endogenous stress or stressor (Lambin, 2005). Initially, vulnerability was largely conceptualized as state arising from physical exposure to natural impacts, for example, climate change, desertification or other global scale processes. Increased withdrawal of freshwater, decreasing forest cover or threats to natural ecosystems, all suggest risks to future human wellbeing, particularly to the vulnerable populations with limited resources and fragile health and nutritional status. However, evidences suggest that vulnerabilities in social structure are of no less importance than those from physical determinants of an environmental disaster. For example, on average 500 deaths per disaster among industrialized nations increase to over 3,000 deaths in the developing world (Noji, 1997; Soskolne and Broemling, 2002).

Today's researches in environmental health issues are concerned with extending our understanding of how the world works and of how we can better manage our interaction with this world. It is urgently needed to improve our understanding of

the interactions between people and their biophysical environment – the interactions that are driven by human aspirations, social and cultural institutions, but is ultimately constrained by the laws of nature (Newell *et al*, 2005). The processes of global environmental change are also driven and amplified by the natural, social, political and economic trends, being a part of them. As some examples of main trends the following three are especially discussed:

1. *World population growth* that is projected from the present six billions to 9–11 billions in next two- generations time (Vlek, 2004). This trend is a clear indicator that pressure on the Earth will further increase. Additional problems are created by unplanned and unstoppable urban growth created by unsustainable and declining livelihoods of rural communities that drive the millions to migrate into cities. It is expected that by the mid-2030s two-third of humanity would become urban, overstressing municipal services and infrastructure (Bogardi, 2004).

2. *Processes of globalization* that are followed by widening the disparity between rich and poor, both among and within countries. Forty-five percents of the world's population have only nine percents of world income, while the richest 13 percent claims 45 percents (Milanovic, 2002). More than one billion people live in absolute poverty and almost as many without access to safe drinking water. Growing inequality and persistent poverty has profound global and regional consequences, causing permanent geopolitical instability. There are also different manifestations of links between globalization, inequality and environmental degradation (Adger et al, 2005).

3. *Climate change* where the impacts of human actions on every form of life are especially evident. The impacts of climate change fall disproportionately upon poor countries and the poor persons within all countries, thereby exacerbating the inequities in *health status* as well as in access to adequate food, clean water and other resources. Those who have limited incomes and wealth have also, almost by definition, limited opportunities for creating new choices; moreover, climate change impacts result in a further narrowing even of these existing choices (Parry *et al.,* 2007; Opopol *et al.,* 2006).

The continuing integration and dialogue between natural and social sciences along these and other lines form adequate responses and policies.

Human responses to global environmental change are driven, on the one hand, by underlying demands of environmental management and sustainable development and, on the other hand, by resistance to new perspectives in the societies' vulnerability and resilience (Lambin, 2005).

Environmental health impacts occur through the multitude of pathways, some of which are understood, but many remain unknown. In eco-epidemiology the determinants (exposures) have a longer duration than, for example, in disaster epidemiology, following to the eroding of natural environment and degradation of ecological systems. Although the exposures are long-term (chronic) the effects may be both chronic and acute due to so-called *threshold effects* (Broemling, 2002).

The illnesses within populations are manifested in various ways, and epidemiologists must unravel their patterns in proper time. Usually, in the epidemiology of communicable and chronic diseases the relevant measurements of factors increasing people's risk, their exposure and interventions for tackling the health drivers and health outcomes allow determining whether population well-being is improving or not. However, some other branches of epidemiology, like disaster- or eco-epidemiology, do not easily conform to this model. One-third to one-half of the global burden of diseases (the brunt of which falls on children under five years) are attributed to environmental risk factors, and new approaches to address the eco-epidemiological needs are needed. The challenge in maximizing the policies designed to maintain or improve human health status lays also in finding new ways to measure the environmental effects (Anielski and Soskolne, 2003; Soskolne and Broemling, 2002).

Research frontiers

Now, may be more than ever before, in epidemiological research the *alternative measures* of health status, such as social wellbeing, are needed. The psychosocial and economic factors impacting human health could be more sensitive to the altered environmental conditions than, for example, the standard measurement of life expectancy. A socio-economic status and degraded environmental conditions that long time were considered as a confounding factor in ecological analysis could be intergarated, and an aggregate indicator is likely to be the most appropriate measure of social health. So, the *Genuine Progress Indicator (GPI),* conceived as a replacement for Gross Domestic Product (GDP) in measuring economic wellbeing, takes into consideration 30-50 economic, social, health, environmental and other factors, including crime, suicide rates, air pollution, the value of unpaid household,

parenting, eldercare, etc. (Soskolne and Broemling, 2002).

The behavior of human–environment systems cannot be also understood in terms of linear cause-effect chains. The behavioral complexity arises from the mutual constraints imposed by individual parts of a system. The consequent feedback effects can cause a range of unexpected and unwanted responses to apparently straightforward management actions, and the understanding of the non-linear dynamics of feedback systems is one of the foundation stones of an integrated approach to human–environment research (Newell et al, 2005)**.**

Effective policy-making must start from good understanding of a system to be managed. However, there is a growing dissatisfaction with researches that are carried out in a purely discipline-based manner and are necessary, in principle, to provide with essential insights into the mechanisms of our world. But such efforts cannot provide the systemic approaches that are needed to support the transition to sustainability. The long-standing separation of the disciplines has produced profound divisions between the natural sciences, the social sciences and the humanities (Newell et al, 2005). In the face of mounting evidence that human activity is beginning to have a significant negative impact on the environment, and that environmental challenges can severely affect human welfare, the integration of knowledge across a wide range of sources as well across disciplines is obligatory. There is also needed an integration within disciplines, especially across different temporal and spatial scales (Newell et al, 2005).

The global environmental change, with causes and consequences at multiple spatial, temporal and socio-political scales, is best understood as processes that are manifested in localities. Available research demonstrate that global environmental problems are not merely larger versions of local problems, and local-scale solutions cannot be simply 'scaled-up', just as the global solutions cannot be simply 'downscaled'. Recognition of different manifestations of observed environmental changes across scales is important to balance research and resulting policies. In explaining the observed changes the research initially swung to a dominance of the global scope of research, but then swung back to a local scale or even the individual (Soskolne and Broemling, 2002). For example, small-area studies (regional, local, individual) have already proved to be successful in reducing the camouflage of localized environmental health effects and in improving statistical relationships for the industrial point sources. Usually, non-threshold environmental health effects must be understood to occur within populations rather than at the individual level because the population consists of individuals with varied genetic sensitivity to slowly mounting environmental collapses. But while the expected consequences of human activity are global ones, the occurrence of *extreme events* or threshold effects, their superposition with the creeping environmental deteriorations is usually a local or regional phenomenon that may be better defined within the context of individual human security, than using global or national scales (Bogardi, 2004).

In any study of ways to improve the sustainability of human–environment systems, basic concerns are caused by *adaptive processes*. For example, in confronting the anticipated climate change an adaptation to adverse consequences, which cannot be avoided by the mitigation of greenhouse gases only, is one of principal strategies (Parry *et al.,* 2007). Adaptive mechanisms and adaptive management of all kinds require the use of history, either of the humanity or environment. We need to remember and retain those approaches that have worked well in the past. In developing an understanding of the dynamics of complex human–environment systems, there is necessary to observe the way of change in the wide range of behavioral variables over a variety of time scales. Because some of these changes could be unexpected in the future, and can take tens or hundreds years to appear, a sound approach to adaptive management requires a broad range of historical observations over times greatly exceeding human lifetimes. Given also that we cannot easily experiment with human–environment systems, the lessons of the past are a crucial issue (Newell et al, 2005). The scientific literature is rich on insights on the factors that have allowed societies or communities to innovate successfully to avoid a severe deterioration of their natural environments. The understanding of historical experiences can help to forge and test theories of human–environment interactions, which can then be used to guide future actions (Lambin, 2005).

As local, regional and global communities have become more aware of environmental degradation and the complexity and fragility of coupled natural-social systems, there has been an increasing focus on issues of *sustainability* (Newell et al, 2005)**.** Transition toward a more sustainable development world is one of the great challenges facing humanity for the decades to come, and the time horizon of this concept covers several generations. Human-

environment research is expected to contribute in a major way to this endeavor because changes in human–environment systems are not the product of intentional decision-making, but rather of a gradual evolution based on unconscious selection of strategies (Lambin, 2005).

Meaningful eco-epidemiology can be conducted given a corresponding administrative, or managing infrastructure is provided. A distinguishing characteristic of human–environment systems is that they are *'managed'*. It is not possible to understand and influence the dynamics of such systems without developing an understanding of the active role played by managers and policy-makers (Newell et al, 2005)**.** In case of human–environment systems, the challenge is in developing the management schemata or theories that lead to sustainable operations. Sustainability requires good management, and good management requires good policies. Policies summarize theories of cause-and-effect relationships within the managed system and specify actions that, as anticipated, will move a system from a specific observed state toward a more desirable one. It is not possible to design good management policies with predictable outcomes without a good understanding of the dynamics of a managed system (Newell et al, 2005)**.**

In the transition of societies towards *sustainability* human-environmental interactions will be also crucial in defining the role of *technology*. Enormous transformations are waiting to happen in the areas of energy, transport, information and communications, nano-engineering and biomedicine, which taken together offer humankind the potential for more sustainable and equitable living (Adger et al, 2005).

Tasks to be solved

The success or failure in environmental management is controlled by three components of human–environment interactions: information on the state of the environment, motivation to the sustainable management of the environment, and capacity to implement such management (Lambin, 2005).

The ***information component*** relates to understanding by decision-makers of resource degradation and of alternative management practices. For sustainable resource management, agents need to access necessary information about the resource systems being governed, as well as about the human–environment interactions affecting those systems, at a scale that is congruent with environmental events and decisions. This information component involves temporal, historical, social, economic, sociopolitical and other dimensions (Lambin, 2005).

(i) a temporal dimension—anticipation and early perception of the current state of the environment via reliable environmental indicators and monitoring systems;

(ii) a historical dimension—detecting the signal of (human) perturbation from the background noise of natural variability in environmental conditions, which requires a deep knowledge of ecosystem functioning;

(iii) a social dimension—recognition of the importance and relevance of the change in environmental attributes;

(iv) an economic dimension— a proper valuation of services provided by natural ecosystems; and

(v) a sociopolitical dimension—ability to communicate the environmental information from local land managers to higher-level decision makers, avoiding delays and distortions in the transmission of information which are often associated with large, complex and hierarchical societies. This component is largely about dealing with uncertainty, understanding natural variability, and being able to make an accurate diagnostic on the causes of and solutions to environmental change. This requires making use of and combining different knowledge systems (Lambin, 2005).

In particular, to prevent harm to human health from degrading ecosystems, epidemiologists need specific *indicators* that are responsive to those shifts in health status that might parallel these declines. Some environmental health indicators already have been developed. Traditional measures of health (e.g., life expectancy or infant mortality) are intuitively linkable to effects from environmental degradation or extreme climatic events (e.g. heat-related mortality as an indicator of heat-wave impacts on human health), but they do not appear to provide early warning indications of possible negative ecological impacts on health. If we are to have any chance of detecting the health effects associated with declines in environmental integrity, the appropriately sensitive health indicators are needed. The criteria for design of transparent, well-documented indicators are especially important when research is directed at policy formulation. The search for sensitive environmental health indicators has led some researchers to consider above mentioned aggregate indicators that better reflect the full scope of adverse environmental health effects, but introduce additional uncertainty with the relatively subjective weighting of disease severity (Soskolne and Broemling, 2002).

And, at last, viability of the information com-

ponent is impossible without development of resulting databases linking a variety of environmental, social and health data gathered through the established procedures or targeted monitoring systems. If such infrastructure is available, direct comparisons of negative health impacts could be made between different regions undergone to the different kinds of environmental degradation. Furthermore, time trend studies following the population health changes vs. changes in environment would become possible.

The ***motivation componen***t relates to the sources of behavior of stakeholders and is largely about how they evaluate response options to environmental change. It also has multiple dimensions (Lambin, 2005). For example, *an economic dimension* includes the balance of risk-adjusted benefits and costs in resource management; *a policy dimension* relates to conflicts of interest between various actors, which affects the willingness of decision-makers to intervene, given private interests, short-term or long-term stakes in the environment and health improvement; *an institutional dimension* relates to the fit between environmental health status and national institutional systems.

(i) a cultural dimension related to local environmental attitudes, deeply held values and knowledge, clashes between short-term and long-term motives, or psychological denial of the existence of the problem that can create ideological barriers;

(ii) an economic dimension—balance of risk-adjusted benefits and costs, taking into account the time horizon of management and the fraction of real costs of resource management practices that appear as nonmarketed externalities and are therefore ignored by private decision-makers;

(iii) a policy dimension when perverse subsidies and tax incentives result, over the long term, in both economic inefficiency and the erosion of natural services;

(iv) a dimension related to conflicts of interest between various stakeholders which affects the willingness of decision-makers to intervene, given private interests, short-term or long-term stakes in resources by different agents, divergence of objectives between social groups, and governance issues; and

(v) an institutional dimension, related to the fit between ecosystems and institutional systems—the closer the congruence or compatibility between, on one hand, the rules, decision-making procedures and social practices that assign roles to agents in the management of ecosystems and, on the other hand, the specific configuration of that ecosystem, the better the relevant institutions will perform in terms of sustainability (Young, 2002). This component is largely about how agents evaluate response options to environmental change (Lambin, 2005).

The ***capacity component*** is about resources to address global and regional change in the environment and is related to the provision of appropriate physical, technical and institutional infrastructure necessary for a sustainable management of human health response and policies. The dimensions of this component are also multiply and relate to policy, technology, institution, culture, recourse availability and other issues:

(i) policy—capacity to rapidly modify rules governing access to and use of resources, and to implement new policies throughout a territory;

(ii) technology—availability of a diverse portfolio of skills and new technologies to manage natural resources;

(iii) institutions—a high level of social capital between resource users to deal with conflicts between stakeholders and reconcile varying perspectives, interests and attitudes, and an institutional system that induces compliance with rules, based on a good balance between incentives and sanctions;

(iv) resource constraints—availability of a production (and labour) surplus to allow for the capital investments which are required to experiment with new solutions; and

(v) culture—a readiness to change and adapt, as stirred by inspiring leaders.

Thus, before the social science community can undertake comprehensive research on the human dimensions of current environmental change, including human ecology and environmental health, certain fundamental questions should be raised about whether it has the capacity to do this research. There is an evident need in relevant theory, data, and people. Equally important is to maintain a new focus in the necessary research activities, including in the Academy framework, to have corresponding institutional infrastructure and resources.

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