

Summary:

Ecosystem Services and Human Welfare

W. G. KEPNER^{1a}, D. A. MOUAT^b, J. M. LANCASTER^b, and P. H. LIOTTA^c

^a*U.S. Environmental Protection Agency, Office of Research and Development*

^b*Desert Research Institute, Division of Earth and Ecosystem Development*

^c*Pell Center for International Relations and Public Policy,
Salve Regina University*

1. Conclusion: Environmental Condition Intrinsically Linked to Human Welfare, Prosperity, Security, and Well-being

Ecosystem services is a framework conceived to engage support among people, especially policy- and decision-makers, for the recognition that human welfare, prosperity, security, and well-being are intrinsically linked to the health of the environment. Simply stated, “ecosystem services are the benefits people obtain from ecosystems” [1]. The concept is designed to address the sustainability of natural assets within the context of human activity, and thus it establishes an anthropogenic perspective to conservation and the management of natural capital. The ecosystem services paradigm promotes the inclusion of natural capital value in all policy, management, and business components in order to inform decisions and positively change individual and collective state behavior to more environmentally sustainable practices.

Conceptually, the framework is still evolving and the science is being defined and investigated across multiple government and nongovernment sectors, scales, and through a variety of natural and social disciplines. In the past, much of the work has focused on a single service, such as soil erosion mitigation, or a small set or bundle of related services [2]. Also, typically the topic has been investigated for the benefit of two distinct communities—conservation and economic development, which have historically lacked integration and agreement. We have now added to the complexity with the challenge of addressing how nontraditional security threats coming from environmental, social, or economic stressors factor into the ecosystem services paradigm.

We argue in this volume that the concept of security includes the protection of human life from environmental, economic, food, health, personal, and political threats and that it represents a vital core value that is reflected in an array of ecosystem services. Linkages and feedback mechanisms further illustrate how protecting the environment from outside threats maintains these services. Hence, we illustrated how scientific research and social change have an important bearing on maintaining

¹ Address correspondence to W. G. Kepner, U.S. Environmental Protection Agency, 944 E. Harmon Avenue, Las Vegas, NV 89119, USA; Tel: +001-702 798 2193; Fax: +001-702 798 2208; e-mail: kepner.william@epa.gov.

sustainable societies and environmental security. Secondly, we have demonstrated that clear scientific understanding provides an important base for evaluating the consequences (or benefits) of choice, especially in regard to effective policy and decision making related to tradeoffs among alternative future scenarios of change.

We mutually investigated how changes in services affect or interact with each other and the way in which proposed actions might affect overall ecosystem function and subsequently manifest themselves within the world of environmental security.

It is our premise that although ecosystem services have been defined in a variety of ways [3-5], in the end they reflect the basic outputs of ecological functions or processes that directly or indirectly contribute to human well-being and a sense of security [6].

2. Integrating Human and Environmental Security through the Ecosystem Services Paradigm

Since the publication of the Millennium Assessment, the concept of ecosystem goods and services has become a widely popularized assessment framework for broad use by decision makers. The challenge, however, is one of a historical nature: to develop applications that work across both political and discipline boundaries to intelligently inform and support effective policy making. The actual translation of theory into responsible action has yet to be fully realized and its real potential for the purpose of maintaining human well-being and reducing risks to sustainable societies remains mostly untested [7].

Nevertheless, although the framework remains in an early adoption stage, many view its application as the most powerful contemporary innovation that has the potential to 1) set rules and guidelines; 2) evaluate the benefits of national policy; 3) assess regional or national conditions and management actions; 4) create private sector market innovation that engages the public in environmental protection; and 5) provides public education in regard to understanding the implications of choice and tradeoff.

Applications of ecosystem services conservation programs have existed throughout the world prior to the publication of the Millennium Assessment. Most examples come in the form of government or public payments in which conservation incentives, such as subsidies, conservation easements, and tax credits are provided by the state to private landowners and corporations in exchange for protecting, enhancing, conserving, or restoring an ecosystem service, such as a fishery. Some private payments are regulation-driven and others, such as nongovernmental philanthropic organizations, are voluntary.

Although there is increasing recognition for the inclusion of ecosystem service markets, the idea of private compensation for these benefits is not universally understood. In the traditional market system, goods or services are regularly bought, sold, or traded with the understanding that 1) secure property rights exist; 2) there is access to the market (goods and services) information; 3) there is sufficient demand; and 4) that it exists within the construct of a legal institution or state. Markets for ecosystem services are based on the same premise; however, they are almost always associated with public or national policy that includes a regulatory framework. For example, wetland mitigation banking in the United States is a result of national policy and regulation [8] and active carbon trading markets in Europe are a result of greenhouse gas limitations set under Article 17 of the Kyoto Protocol (UNFCCC, http://unfccc.int/kyoto_protocol/items/2830.php). Some countries, such as Costa Rica,

have had success in implementing a national ecosystem services program for the protection of services related to water, biodiversity, and carbon storage [9-10]. Others, such as the United States, have incorporated the concept within their national research designs, most notably the Environmental Protection Agency Ecosystem Services Research Program [11], but have drawn short in integrating it within comprehensive environmental and economic decision making.

Ecosystem service markets remain in the proof-of-concept phase, largely because the science to define services, assign value, quantify and verify delivery (transfer function), clarify ownership rights, and assess benefits remains in a state of exploration and development. A further challenge is extending the linkage to environmental security in the effort to translate how social and widespread environmental change relates to maintaining sustainable societies and world stability. From our view, such an approach means that integrating ecosystem services and valuation into policy, planning, and decision making provides an important tool against environmental degradation. Therefore, it can only serve to ensure sustainable resources and provide protection of human life and well-being from environmental, economic, food, health, disease, and political threats.

3. Recommendations for Future Actions

The workshop and the contributions provided in these proceedings embrace a broad spectrum of issues involved with environmental and human security. The Advanced Research Workshop offered the opportunity to view multiple perspectives on the topic and provided ideas to explore the concept in more detail. As we have discovered, there remain a number of scientific gaps and significant challenges to ecologists and social and political scientists. Specifically, we need to understand how human actions affect our ecosystems, the provision of ecosystem services, and their role in promoting sustainable societies and world stability.

Several recommendations emerged during the workshop for future action, especially in fostering greater interaction among natural scientists and social scientists. All focused on a common endeavor to identify important ecosystem services, estimate their value, and integrate the information into decision and policy processes. Clearly, these may need to be prioritized to achieve the greatest advances in science and to take early advantage of the information. An important recommendation lies in understanding the linkages between biodiversity on the one hand with environmental and human security on the other. Recognizing that the status of biodiversity is an indicator of ecosystem services is critical to our protection and management of ecosystem services. As our Earth's population increases and a transforming environment creates change in our natural and social habitats, we see changes in attributes of our most critical resource, such as availability and quality of our water supplies [12]. Clean water for consumption, recreation, and commercial use represents one of the most high-visibility issues of wide interest to the science and security communities [13]. However, not only are water shortages exacerbated by population growth, but changes in these two variables contributes to land degradation, especially in arid and semi-arid regions. These factors are interlinked and cause poverty, social insecurity, and environmental refugee situations [14].

In determining the best course for future research and action, we therefore recommend exploring institutional policy, infrastructure, human behavior, and social

processes relative to water supply, allocation, and delivery for human use. This theme and our interdisciplinary approach offer unprecedented opportunity to elicit new information that could have important bearing on environmental security. Our challenge is to recognize and anticipate change in ecosystem services and to understand how social processes affect our ability to sustain them in the future.

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