

The Use of Landscape Sciences for Environmental Assessment - Overview

Background

The assessment of land use and land cover is an extremely important activity for contemporary land management. Human land-use practices (including type, magnitude, and distribution) are the most important factors influencing natural resource management at local, regional, national, and global scales. In the past, environmental policies have often reflected a reactive response to environmental perturbations with management efforts focused on short-term, local-scale problems such as pollutant abatement. Currently, environmental management philosophy is evolving toward examination of critical environmental problems over larger spatial scales and assessment of the cumulative risk resulting from multiple problem sources. Today's environmental managers, urban planners, and decision-makers are increasingly expected to examine environmental and economic problems in a larger geographic context. Specifically, they are often asked to 1) understand the scales at which directed management actions are needed; 2) develop environmental management strategies; 3) formulate sets of alternatives to reduce environmental and economic vulnerability; and 4) prioritize, conserve, or restore valued natural resources, especially those which provide important economic goods and services.

Goals

A key goal of the NATO Committee on the Challenges of Modern Society (CCMS) is to utilize a science framework to promote international cooperation. To meet the challenges associated with evaluating environmental problems related to land use at multiple spatial scales, the CCMS initiated a pilot study on the *Use of Landscape Sciences for Environmental Assessment*. Specifically, the pilot study has been developed to explore the potential of quantifying and assessing environmental condition, processes of land degradation, and subsequent impacts on natural and human resources (including security) by combining the advanced technologies of remote sensing, geographic information systems, spatial statistics, and process models with landscape ecology theory. The CCMS Pilot Study is designed to enhance the ability of environmental managers and the public to:

- address a range of environmental problems that have inherently different scales,
- evaluate cumulative impacts to ecological and hydrological resources,
- provide a framework for large-scale assessment in which to put surrounding communities in perspective,
- communicate analysis and assessment results to a wide range of technical and non-technical audiences, and
- develop products, such as regional and watershed assessments, analysis tools, digital maps, and databases, for a variety of audiences.

Conceptual Approach

The Pilot Study enlists a working group of representative NATO member and partner nations to exchange information and technology about landscape science approaches useful for environmental assessment. The landscape sciences project uses landscape ecology, i.e., the study of the distribution patterns of communities and ecosystems, the ecological processes that effect those patterns, and changes in both pattern and process over time, as its foundation. The research is focused on the interaction between landscape patterns and ecological processes and their relation to environmental security.

Environmental assessment is defined as a process by which scientific evidence and technological information are analyzed for the purpose of evaluating present condition or forecasting the outcomes of alternative future courses of action. The assessments are directed toward specific ecological resources and socially relevant endpoints such as watershed condition (water quality, quantity, and vulnerability to flooding), landscape resilience (ability to sustain ecological goods and services when subjected to conditions of anthropogenic and natural stress), and biodiversity (wildlife habitat).

Implementation

The program is proceeding simultaneously along two lines: (1) a research component to develop and test landscape indicators and assessment protocols, and (2) an implementation component to demonstrate the application of landscape analysis protocols to multiple-scale, ecological assessments. The research and implementation agendas are being accomplished through the completion of multiple national studies throughout Europe and the United States which emphasize thematic areas related to landscape characterization, land cover change detection, landscape indicators, landscape assessment, and landscape theory and models. The Pilot Study participants meet annually to report their findings and share their results. The information is consolidated into published proceedings and is made publicly available via the NATO CCMS Pilot Studies website (*see* <http://www.nato.int/ccms/pilot-studies/lsea/lsea-index.htm>).

Anticipated Contributions

It is anticipated that the Pilot Study will illustrate the utility of adopting a landscape science approach in public health and environmental decision making, natural resource management and planning, and ecological preservation/restoration projects. The landscape assessment framework and methodologies should provide a number of benefits to environmental managers and the public in regard to determining how different land-use choices impact ecological integrity and subsequently, environmental security. Lastly, it is anticipated that national decision-makers should be able to address transborder issues especially in regard to complex questions such as:

- How does a landscape function?
- How does landscape function change with land-use changes?
- How does land use impact landscape function?
- How might a landscape be changed to achieve an environmental benefit?
- How should a landscape be changed to meet societal goals?
- Is landscape modification possible without compromising ecological function and environmental security?
- Can the impacts of landscape modification be ameliorated?

For Further Information, contact the NATO/CCMS Landscape Sciences Pilot Study Co-Directors:

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