

Landscape Assessment and Environmental Security – An Overview to the NATO/CCMS Pilot Study on the Use of Landscape Sciences for Environmental Assessment



William Kepner

U.S. Environmental Protection Agency, Office of Research and Development, 944 E. Harmon Ave., Las Vegas, Nevada 89119 (kepner.william@epa.gov)



Felix Mueller

University of Kiel, Ecology Center, Schauenburgerstrasse 112, D-24118 Kiel, Germany (felix@ecology.uni-kiel.de)

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Abstract

The purpose and scope of the landscape sciences pilot study is to establish a working group representative of NATO Member and Partner nations to exchange information about landscape science approaches useful for environmental assessment and to transfer landscape assessment technologies among the study group participants for use in environmental protection and preservation programmes. Both land use and land cover characterization and the use of landscape indicators will be demonstrated for environmental assessment. Multiple geographic areas in Europe and the continental United States have been selected for this demonstration study. The pilot study will explore the possibility 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.



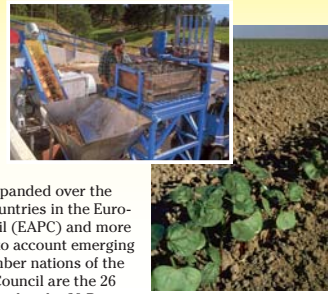
Introduction

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

The NATO Committee on the Challenges of Modern Society (CCMS) was created in 1969 by the North Atlantic Council for the purpose of addressing problems affecting the environment of the member nations and the quality of life of their citizens. The activities have been expanded over the years to include Partner countries in the Euro-Atlantic Partnership Council (EAPC) and more recently adapted to take into account emerging issues to security. The member nations of the Euro-Atlantic Partnership Council are the 26 Member countries of NATO, plus the 20 Partner countries. The North Atlantic Council in Ministerial Session later decided that CCMS activities should also include experts from the seven Mediterranean Dialogue countries. The basic approach of CCMS is to provide a key focus on environmental security and societal problems that may be under study at the national level and, by combining the expertise and technology available in NATO and Partner countries, develop conclusions and recommendations for action to benefit all.



A key goal of the NATO/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* in March 2001. 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 (Table 1). 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 Web site (see <http://www.nato.int/ccms/pilot-studies/lsea/lsea-index.htm>).



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Table 1 A Summary of the National Contributions, NATO/CCMS Pilot Study on the Use of Landscape Sciences for Environmental Assessment

Participating Country	Project	Author(s)
Australia	Evidence Based Environmental Management	Joseph Walker, Mirko Stauffacher, and Simon Veitch – CSIRO Land and Water and DAFF, Canberra
Austria	Landscape in Transition – Integrated Study on Environmental and Human Factors Driving Urbanization	Thomas Blaschke – Centre for Geoinformatics, University of Salzburg
Bulgaria	Use of Bioindicators for Landscape Assessment in Yantra River Basin – Central North Bulgaria	Soyan Iankov, Mariyana Nikolova, and Soyana Nodkov – Institute of Geography, Bulgarian Academy of Sciences
Finland	Landscape Assessment of Reindeer Herding for the Development of Sustainable Land Use Strategies	Time Kumpula – University of Joensuu, Finland Felix Mueller and Benjamin Burkhard – University of Kiel, Germany
Georgia	Landscape Assessment of Georgia's Protected Areas based on Aerial and Satellite Imagery and GIS Applications	Gia Sopadze and Nino Sulchashvili – Union of Sustainable Development "ECOVISION", Georgia
Germany	Human Society – Environment Problem Sheet: Theoretical Basis, Methodological Developments and Practical Applications	Felix Mueller – Ecology Center, University of Kiel, Roman Leuz – University of Applied Sciences, Nürtingen, Jamil Sabbagh – University of Maine, and Ralf Seppelt – Centre for Environmental Research, Leipzig
Italy	Development of a Risk Assessment Model at the Landscape Level	Giovanni Zurlini, Nicola Zaccarelli, and Irene Petrosillo – Landscape Ecology Laboratory, University of Lecce
Latvia	Introduction to Space Information Technologies for Environmental Assessment	Juris Zagars – Ventspils University College and University of Latvia
Lithuania	Quality Assessment of the Environment at the Landscape Level	Benediktas Janankas – Lithuanian Institute of Agriculture Algimantas Tikinis and Vitalijus Juska – Klaipėda University
Norway	Monitoring Agricultural Landscapes	Wendy Fjellstad and Wenche Dramstad, Norwegian Institute of Land Inventory

Participating Country	Project	Author(s)
Poland	1. Principles of Application of Geographic Information Systems in Water Management and Environmental Protection 2. The Influence of River Basin Biotic Structure on Water Dynamics – Ecological Framework	1. Irene Piegowska, Lutzumora Skoracka, and Danuta Kubacka – Institute of Meteorology and Water Management 2. Maciej Zaleski and Kinga Kranze – International Centre for Ecology, Polish Academy of Sciences
Romania	1. New Gold Exploitation at Rosia Montana 2. Environmental Decline Assessment in Copsa Mica Area (Romania); GIS Approaches for Environmental Assessment	1. Mihaela Lazarescu – National Institute for Research and Development in Environmental Protection 2. Octavian-Lavinia Muntean, Lucian Dragut, Nicolae Baciu, and Titus Man – University of "Babeş-Bolyai"
Russian Federation	1. Impact of Land Cover and Land Use Changes on Runoff and Substances Washout in Catchments and Loading on Surface Waters and Coastal Zones 2. Coastal Zone Landscape Change Detection Using Remote Sensing Technique and in situ Data: Case Study of the Baltic Sea	1. Sergey Kondratyev – Institute of Limnology, Russian Academy of Sciences, Sergey Victorov – Institute of Remote Sensing Methods for Geology (VNIIGAM) 2. Sergey Victorov – Institute of Remote Sensing Methods for Geology (VNIIGAM)
Turkey	Landscape, Demographic Developments, Biodiversity, and Sustainable Land Use Strategy	Engin Nurlu, Umit Erdem, Manir Ozgur, Ayhan Guvenen, and Tervik Turk – Ege University
Ukraine	Use of Landscape Science Approaches for Development of a Concept of Ecological Corridor Networks in Ukraine	Vladimir Kuznetsov – Ukrainian Scientific Research Institute of Ecological Problems (US-RIEP), Ministry of Environment of Ukraine
United States	A Landscape Assessment of Oregon with a Future Scenario Analysis of the Willamette River Basin, Oregon, USA	William Kepner, Daniel Heggen, and Darius Summens – U.S. Environmental Protection Agency, Office of Research and Development, Marian Hernandez and David Goodrich – U.S. Department of Agriculture, Agricultural Research Service

Anticipated Contributions

It is anticipated that the Pilot Study will illustrate the utility of adopting a landscape sciences 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 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?

The relationship between environmental change, stress, and environmental degradation relative to the issue of security has garnered increased importance as new challenges have emerged since the end of the Cold War. The question of the relationship between environment and security is now a common interest among both the scientific and policy

communities especially as the traditional security concepts based on national sovereignty have been revisited following changes in the European political landscape at the end of the last century. The definition of security now at least incorporates non-traditional threats and their causes, including environmental stress, and social, economic, and environmental factors are now being factored into an evolving definition.

The predominant considerations in many parts of the world for environmental management decisions and ecosystem protection include understanding and establishing land and resource use priorities, establishing time frames for management, using comparative evaluation and assessment analyses, and clarifying where decision authority resides (i.e., local, regional, national, international).

It is a challenge for both scientists and decision-makers to include all these considerations and communicate effectively among multiple user groups. As a direct result of increasing discussion and research about the potential for large, regional-scale environmental changes and the general acknowledgment of the relationship between environmental change and human social, economic, and demographic issues, there is now more attention paid to the question of the relationship between environment and security. Thus this CCMS Pilot Study on the use of landscape sciences provides a multi-lateral forum for cooperation, information exchange, and dialogue among the environmental, development, foreign and security policy communities. Additionally, it provides an "enabling environment" to facilitate joint work programmes and further advance the NATO/CCMS goal of utilizing a science framework to promote international cooperation and peace.

For further information and publications regarding the NATO/CCMS Landscape Sciences Pilot Study, please consult the project Web site,

<http://www.nato.int/ccms/pilot-studies/lsea/lsea-index.htm>