

Overview

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Abstract.—The purpose of this conference was to increase people's awareness of the potential contributions of watershed management to conservation, sustainable development, and use of natural resources to land stewardship in the 21st century. Through exploration of global, national, and regional perspectives, a review of issues likely to be confronted in the coming century, a retrospective viewpoint of watershed management entering the 21st century, anticipated watershed management contributions to future land stewardship, and future protocols necessary to attain these contributions, information was provided to accomplish the conference purpose. The conference included 2 and a half days of synthesis papers presented in plenary sessions by invited United States and international speakers from public and private research, management, and educational organizations. Two poster sessions complemented the synthesis papers to broaden the conference scope.

Introduction

To meet a growing population's need for conservation, sustainable development, and use of natural resources, land stewardship effectiveness must improve in the 21st century. Ecosystem-based, multiple-use land stewardship is necessary to present and potential future uses of natural resources on an operationally efficient scale. Holistically planned and carefully implemented watershed management practices, projects, and programs will always be needed to meet the increasing demand for commodities, amenities, clean water, open space, and uncluttered landscapes in the 21st century.

Watershed Management

Watershed management means different things to different people. Even watershed managers have different perspectives about what watershed management entails, and how it should be accomplished. It was important,

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therefore, that a perspective of watershed management be adopted before the conference to enable presenters of invited synthesis papers and contributed poster papers to focus their contributions. This adopted watershed management perspective is in the following definitions and concepts (Brooks et al. 1992, 1994, 1997).

Watershed - a topographically delineated area that is drained by a stream system; also a hydrologic-response, a physical-biological, and a socioeconomic-political unit for management planning and implementation purposes; a smaller upstream catchment that is part of a river basin.

River basin - similar to a watershed but larger in scale.

Watershed management - the process of organizing and guiding land and other resource use on a watershed-basis to provide the goods and services demanded by society while minimizing adverse impacts to soil and water resources. This concept recognizes the interrelationships among soil, water, and land use, and the linkages between uplands and downstream areas.

A common misconception is that watershed management is based only on physical interrelationships. Watershed management also involves economic and institutional interrelationships. Keeping this in mind helps to guide design practices and institutional mechanisms needed to implement more effective watershed management practices for better land stewardship.

Watershed management practices - changes in land use, vegetative cover, and other nonstructural and structural actions on a watershed that achieve ecosystem-based, multiple-use watershed management objectives. Integrated concepts and operational applications of watershed management provide a framework for the conservation, sustainable development, and use of natural resources. Watershed management practices are the tools that make the framework operational.

Synthesis Papers

The conference consisted of 2 and a half days of synthesis papers presented by invited speakers from the United States and international public and private research, management, and educational organizations. These papers were presented in plenary sessions on global, national, and regional perspectives of watershed management, a

review of land-stewardship issues likely to be confronted in 21st century, a retrospective viewpoint of watershed management entering the 21st century, anticipated watershed management contributions to future land stewardship, and future protocols necessary to attain these contributions.

Watershed Management Perspectives

The role of watershed management in moving toward conservation, sustainable development, and use of natural resources was considered in a series of invited papers presenting global, national, and regional perspectives of watershed management. The regional paper focused on past, present, and future watershed perspectives in the Southwestern United States, which was the conference setting. Issues of concern, lessons learned, and future directions that might be followed to promote watershed management were also reviewed. It was thought that successful watershed management will advance because organizations responsible for its use as a land management strategy are highly adaptive, constantly seek new information sources, and effectively use processes that foster innovation.

Issues to be Confronted in the 21st Century

Global and national issues, and issues in the Southwestern United States that are likely to be confronted in the 21st century when implementing watershed management practices, projects, and programs were the topics of a second series of invited papers. Many issues discussed in this series concerned the current status and success and the future of the watershed management planning process. This planning process is complex and often difficult to understand due to physical, biological, and social interactions, which are the foundation of watershed management. The point was made that society has a responsibility to act together to conserve natural resources and to preserve their integrity for future generations. The outcome of this joint effort is sustainability.

Case Studies

Contributions of watershed management research to land stewardship in the United States and internationally were reviewed in a series of case studies that reinforced information presented in the earlier papers. Management-oriented research to learn more about the effects of natural and human-induced disturbances on the functioning, processes, and components of ecosystems in the regions of the United States and internationally was described in these synthesis papers. To this point in the

conference, the papers presented provided background to presenting a retrospective viewpoint of watershed management.

A Retrospective Viewpoint

Evolving perceptions of watershed management from the ancient concept discussed in Indian texts dated from 1,000 B.C. to that expressed in 19th and late 20th century texts, permitted a comprehensive review of the watershed lesson learned in the past 100 years. Advances in computer technologies in recent years to facilitate storage, retrieval, and summarization of historical natural resource-based data sets for use by watershed researchers, managers, and decision makers were illustrated to the conference participants through computer demonstrations. Other emerging tools and technologies for the capture, storage, and use of spatial data sets for improving the scientific understanding of watershed processes were also demonstrated. The importance of socio-cultural perspectives regarding development of watershed management partnerships between public and private sectors in the 21st century were next examined.

Contribution to Future Land Stewardship

Securing clean water has been and will continue to be a significant watershed management contribution to land stewardship. Generally, agencies have taken a regulatory approach to meeting this goal; however, at this conference it was suggested that, in recent years, a government trend has been to move decision making and action taking to the local level. Another paper emphasized that watershed management will contribute to land stewardship by sustaining physical and economic flows of crucial natural resources into the coming century. Maintaining the future health and stability of sensitive riparian ecosystems through the watershed-riparian connection is another important contribution of watershed management. The historical adverse impact of people on riparian sites through their action on surrounding watersheds was examined. Maintaining landscape integrity through restoration of degraded riparian ecosystems was discussed in a case study on the White Mountain Apache Reservation in Arizona.

Future Protocols

Future watershed management protocols will probably focus on anticipating future watershed conditions, responding to increased demands for water and watershed resources, and then implementing the appropriate

effective policies. The conference dealt broadly with watershed and natural resources management and with the multiple outputs from this management. However, the authors of one paper felt, like others, that water will be a key land stewardship issue in the 21st century. Furthermore, these authors believe that water will be a unifying theme drawing integrated watershed management elements together. However, new, effective policies that incorporate ecological understanding into their structure and promote democratic ideals will be necessary. Authors of the concluding synthesis paper identified guidelines to achieve this end. Guidelines included immediate integration of the political process, building bridges to citizens, reexamining laws, rights, and responsibilities, strengthening administrative capacity, and looking beyond the watershed to a broader scale.

Contributed Poster Papers

Fifty contributed poster papers supplemented and expanded on the synthesis papers. These poster papers reported on the results of watershed-related research projects, applied watershed management activities, and innovative technology transfer mechanisms for watershed-based information.

Watershed-Related Research Projects

Poster papers on watershed-related research projects included studies of vegetation relationships, the role of dendrochronology in natural resources management, erosion and sedimentation processes, riparian ecosystems and wetlands, fire effects on ecosystem processes, simulation techniques, and mathematical modeling. A poster paper on a research-support program for enhancing ecosystem management along the United States-Mexico border was also presented. A paper on the International Arid Lands Consortium, a partnership of organizations dedicated to research, education, and training activities relative to the development, management, and restoration of arid and semi-arid lands throughout the world, and programs the consortium has supported in water and watershed management was included in this group of poster papers.

Applied Watershed Management Activities

Applied watershed management activities were illustrated by poster papers on implementing watershed management practices to meet specified goals, the role of

agroforestry interventions on watershed lands, erosion and sedimentation control, restoration of riparian ecosystems and wetlands, impacts of fire on the management of watershed resources, and a variety of operational watershed management programs in the United States and internationally. Included in these poster papers were examples of management programs and monitoring activities on a regional government's approach to natural resources management planning, challenges of coastal management in Baja California, and applications of remotely-controlled vehicles in Taiwan to monitor changes in watershed land-use. Other international programs on water and watershed management were also presented.

Technology Transfer Mechanisms

Applications of geographic information systems and the use of the World Wide Web in making watershed-related information more accessible to practitioners were the focus of a series of poster papers on technology transfer mechanisms. Demonstrations on accessing watershed management information from the World Wide Web were presented to conference participants, who were encouraged to interact with the systems illustrated.

Watershed management's need to have a central "voice" to gain the attention of political, agency, university, and business leaders was addressed in a poster paper about increasing the visibility of watershed management as a land management profession. As part of this presentation, a questionnaire was available to conference participants, soliciting their thoughts on the need to heighten the visibility of watershed management as a land stewardship discipline.

Conference Contributions

The conference provided a forum for researchers, resource specialists, managers and practitioners, decision makers, and other interested people to share their experiences, opinions, and knowledge about the contributions that watershed management can make to improve land stewardship in the 21st century. The conference presenters updated the state-of-knowledge on a wide range of watershed management and practices topics in the United States and internationally. This conference and the published proceedings represent a beginning for planning and implementing watershed management practices, projects, and programs leading to improved land stewardship in the 21st century.

Literature Cited

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