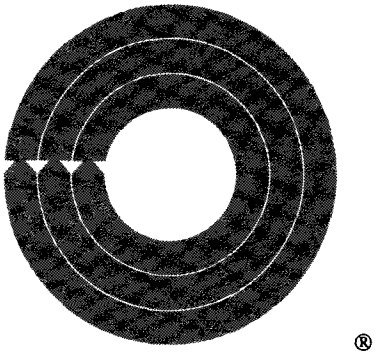
RENEWABLE NATURAL RESOURCES FOUNDATION



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CONGRESS ON RENEWABLE NATURAL RESOURCES: CRITICAL ISSUES AND CONCEPTS FOR THE TWENTY-FIRST CENTURY

RENEWABLE RESOURCES JOURNAL
SPECIAL REPORT

RENEWABLE NATURAL RESOURCES FOUNDATION

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FOREWORD

This report describes a benchmark event in interdisciplinary cooperation. Concerned over the rapid depletion of our renewable natural resources, 135 of the nation's leading scientists and resource professionals gathered at Vail, Colorado, August 19-22, 1992, to forecast critical natural resources issues that will face the United States in the twenty-first century.

The delegates to this congress on "Renewable Natural Resources: Critical Issues and Concepts for the Twenty-First Century" were selected by the 17 professionaI, scientific, and educational organizations that constitute the membership of tbe Renewable Natural Resources Foundation. The synergy created by bringing together a diverse group-resource managers, policymakers, and physical, biological, and social scientists-resulted in scores of recommendations for innovative policies.

Taken together, these ideas constitute a seven-part agenda for action. The delegates called for our nation and its resources community to:

1. Develop and adopt a stewardship/sustainability ethic incorporating a long-term perspective to guide both public and private resources decisions.
2. Improve mechanisms for valuing and allocating renewable natural resources to promote sustainable use.
3. Develop professional incentives for interdisciplinary research and management.
4. Undertake institutional reform and restructuring, particularly within the management agencies and academia.
5. Expand and improve education on renewable natural resources issues for both the public and professionals.
6. Develop and implement mechanisms to improve the fair and open participation of all stakeholders in decision making on resources issues by incorporating techniques for conflict management and resolution.
7. Encourage multidisciplinary, coordinated national and international efforts and standardized techniques for data collection and analysis.

In addition to summarizing discussion that led to many of these recommendations, this report describes the gathering's many innovative aspects, including the organizational structure that was adopted for identifying the issues, producing an interdisciplinary dialogue, seeking consensus, and eliciting recommended actions.

The success of the congress can be attributed in part to William H. Queen, chair of the Congress Program Committee, and the other 18 volunteers who served with him (see roster on back cover).

"The first shot in a long battle" is the way one participant described the congress in Vail. Some findings and recommendations that emerged during the free-ranging discussion characteristic of the congress will undoubtedly be controversial. The delegates tackled difficult issues such as population growth, private property rights, and political reform, among others, and their views are not necessarily those of any organization or agency.

Yet no forward progress is made without a first step. The congress was that step. The next is up to member organizations of the Renewable Natural Resources Foundation. However, success ultimately will require participation by the public and its local, state, and federal representatives.

—Clare W. Hendee
Chairman, Board of Directors
Renewable Natural Resources Foundation

INTRODUCTION

PETER M. MORRISETTE

As the first step in a concerted effort to identify critical issues facing our nation regarding the current and future management and use of renewable natural resources, the Renewable Natural Resources Foundation (RNRF) convened a national meeting of resource professionals to prioritize the issues identified and recommend new policies to address them. The meeting, entitled "Congress on Renewable Natural Resources: Critical Issues and Concepts for the Twenty-First Century," was convened at Vail, Colorado, on August 19-22,1992.

More than 135 invited delegates attended the congress. Among them were some of the nation's most prominent natural resource professionals from various federal and state resource management agencies, academic institutions, non-governmental organizations, research institutes and agencies, and the private sector. The delegates were nominated by member organizations of RNRF and represented a broad geographic distribution, as well as a wide spectrum of disciplines including all of the natural resource fields, the natural sciences, and the social sciences. The congress constituted one of the most diverse groups yet assembled to address renewable resource issues. (A complete list of delegates appears in Appendix B on page 28.)

The author of this report, Peter M. Morrisette is a former member of the RNRF board of directors, has a Ph.D. in geography and works as an independent consultant. He has held positions with Resources for the Future in Washington, D.C., and the National Center for Atmospheric Research in Colorado.

The delegates were attracted to the congress by the opportunity to participate in a unique national forum for identifying and discussing natural resource issues. The overall purpose was to focus the debate and deepen understanding of these issues among the professional, scientific, educational, resource management, and policymaking communities. The specific objectives included: 1) providing a forum for an interdisciplinary dialogue identifying critical renewable natural resources issues in six identified topical areas; 2) determining the priority issues within each of the six areas and major impediments to resolving those issues; 3) seeking a consensus, where possible, on recommended approaches or actions to address the issues; and 4) documenting and conveying results of the congress to leaders, decision makers, public interest groups, industry, and the public.

Rather than focus on a particular resource or geographic area, a specific conflict over the use of a resource, or assessment of data, the congress addressed the full spectrum of resource issues from a national perspective. The scope was limited to the United States, although global linkages for the issues were examined. Six broad themes or topical areas were identified as the focus of discussion and debate. Working groups were organized around each of these themes, which crosscut the traditional resource sectors and disciplines. The six themes were:

1. Population, Economic Development, and Geography.

Population growth and economic development drive land use. The resulting geographic patterns affect the distribution, quantity, and quality of renewable resources. The working groups devoted to this theme were charged with examining whether continued growth is compatible with safeguarding the carrying capacity of resources and considering ways in which growth can be managed or influenced to mitigate effects on the resource base. Topics to be examined included population trends, urbanization and settlement patterns, conversion of forest and agricultural land to urban uses, growth management, and economic incentives for change.

2. **Management Strategies for Maintaining a Healthy Ecosystem.**

The importance of healthy ecosystems to the quality of our lives is beginning to be recognized and valued by the public. What is meant by a "healthy" ecosystem and what can be done to promote it? The delegates in these working groups were asked to take a holistic look at ecosystem management, work on a definition of ecosystem health, and discuss what can be done to maintain healthy ecosystems. Subjects for discussion under this theme included management of endangered species, the definition and maintenance of biodiversity, the harvest of resources in a healthy ecosystem, habitat restoration, and the use of scientific information in the policy process.

3. **Strategies for Renewable Resources Sustainability.**

Concern has shifted from sustaining economic growth to sustaining renewable resource yields. Delegates in these

groups were asked to explore several questions: In the various categories of resources, what are common strategies for obtaining sustainability? When are different strategies needed? What must be done to assure the availability of a land and water resource base for future generations? Topics for consideration included: strategies for achieving sustainability on cropland, rangeland, and timberland; maintenance of fish and wildlife habitat: water management: and sustainability of resources versus economic growth.

4. **Managing Conflicts in Renewable Natural Resources Management.**

Delegates in the working groups concerned with this theme were asked to consider: What are the characteristics of resource conflicts, and how can conflicts best be resolved? Do economic, social, and political principles exist that apply to resolving conflicts between scientific findings and resource policy decisions? Delegates also were asked to examine case studies of resource conflicts and possible approaches to future conflicts. Examples included: energy development versus wilderness preservation in the Arctic National Wildlife Refuge, protection of the spotted owl versus timber harvesting in the Northwest, irrigation versus wildlife protection in the California Central Valley, and water for cities versus water for agriculture in the arid West.

5. **Managing Common-Property Resources.**

Today, issues related to the management of common-property resources are becoming more frequent and more contentious. Various aspects of human behavior and the nation's economy either promote or mitigate competition for common-property resources. Delegates in the groups discussing this fifth theme were asked to examine diverse ideas such as: the concept of the commons, private versus public ownership, regulation of private property, managing common-property resources, and building a stewardship ethic for land management.

6. **Climate-Induced Environmental Change: What Renewable Resource Managers and Professionals Should Be Doing.**

Global climate change has received much attention and discussion in recent years. Delegates in the groups devoted to this final area were charged with examining how global climate change might affect the management and use of renewable natural resources, particularly given the uncertainty about projected changes in regional climate and the fact that such changes are likely to occur over several decades. Questions identified for discussion included: Does society have time to adjust to new conditions, what should resource managers do in the face of conflicting and uncertain climate-change projections, do obvious management strategies exist that should be applied, how adaptable are plants and animals, and what should be done to avoid the divergence of policy from scientific findings.

In order to promote discussion, two sub-working groups were formed to address each theme. Each sub-working group was assigned a chair, rapporteur, and facilitator. The chair presided over the meetings and allocated work tasks. The rapporteur compiled detailed notes, prepared a report for distribution after each sub-working group session, and authored a final summary report. The facilitators, themselves prominent resource professionals, were assigned the task of keeping the discussion focused on the mission: identifying key issues, impediments, and recommended actions. The chairs, rapporteurs, and facilitators met prior to the congress to receive instructions and discuss tactics and approaches. Specific instructions included limiting the number of issues discussed in depth within each sub-working group to five or six, developing a consensus among the delegates on key impediments to resolving those issues, and soliciting recommendations on actions for resolving the impediments and on ways to implement the actions.

Prior to the congress, RNRF distributed two surveys to the invited delegates to help identify and prioritize the issues. In the first, delegates were asked to list five issues that they would like to see addressed by each sub-working group. For each issue or problem, they also were asked to identify two key impediments. Congress program committee chairman William H. Queen compiled the results of this survey and developed a second questionnaire aimed at prioritizing the issues thus identified. Delegates were presented with a list of issues for each of the six themes. The lists ranged in length from 15 to 26 issues. The delegates were asked to rate each issue from 1 to 10 based on their opinion as to its importance, with a "10" given to those that are highly important and "1" to those that are least important. The resulting rankings of issues (which appear as Appendix A on page 26 of this report) were distributed to the delegates at the beginning of the congress and provided a foundation for initiating working group discussions.

At the congress, delegates were given a primary sub-working-group assignment and two secondary assignments. The primary assignments were based on the delegates' major interests and expertise. This approach provided a format in which acknowledged leaders in the field would be given the first opportunity to address the six themes: after that, the discussion was opened to other interested resource professionals by means of the secondary assignments. Delegates were required to spend the entire first day of working-group discussions in their primary group. On the second day, they were asked to meet in the first of their two secondary groups during the morning and in the second during the afternoon. Chairs, rapporteurs, and facilitators remained with their primary assignments throughout the two days. On the last day of the con-

gress, the entire cadre of delegates met in a plenary session to review the final reports of the sub-working groups.

Two keynote addresses were delivered at the congress. The first speaker was F.E. ("Fee") Busby of the Winrock International Institute, who spoke on the evening of August 19 to open the congress. Adopting a Will Rogers style, Busby used a local Vail newspaper to illustrate the pervasiveness, diversity, and local roots of environmental problems. The second keynote speaker was Ambassador Robert J. Ryan, Jr. of the U.S. Department of State, who spoke on the afternoon of August 22 to close the congress. Ambassador Ryan, who served as a key member of the U.S. delegation to the United Nations Conference on Environment and Development (UNCED) in Rio de Janeiro—the "Earth Summit" held June of 1992—spoke on the environmental implications of the agreements, particularly Agenda 21, that were negotiatedduring the UNCED meetings. Although Ambassador Ryan took an international perspective and F.E. Busby took a local view, both messages were the same: all environmental problems are interconnected and thus require an integrated approach when seeking solutions.

This report presents the findings and conclusions of the delegates who attended the congress. Summaries of the issues, impediments, and actions identified by the two sub-groups working in each of the six theme areas are included, based on the reports by the rapporteurs. During the congress, no effort was made at reaching a formal consensus among all of the delegates on each and every issue, impediment, and action. Therefore, the issues, impediments, and actions reported here represent the consensus and findings of individual subworking groups. However, through the process of working-group rotation described above, each delegate was able to contribute to the deliberations of three of the six working-group themes.

To the extent possible, the summaries capture the spirit and content of the discussions that took place at the congress. The uniqueness of the different groups led to a diversity of approaches and styles used to report findings and conclusions. In some cases, rapporteurs for the two sub-groups organized around a theme chose to produce a final, joint working-group report. In those instances, the merged approach is maintained in this report. In other cases, individual final reports were prepared for each sub-working group. Sometimes these two final sub-group reports ate very different; other times they are similar. In those instances where they differed, the findings of each are reported separately. Where the subgroups' fmdings are similar, the two are combined into a single summary for this report.

The findings and conclusions reached at the congress and included in this report represent the opinions and ideas of the delegates assembled at the congress and not necessarily those of the Renewable Natural Resources Foundation and its member organizations, the agencies and organizations that provided support, or the author. Every effort has been made to report the activities of the congress in as much detail as possible, and to maintain the meaning and content of the original rapporteurs' reports. The quality of the individual reports of the rapporteurs was uniformly excellent, and this final summary report would not have been possible without their contributions.«

POPULATION, ECONOMIC DEVELOPMENT, AND GEOGRAPHY

Population growth and economic development are placing increasing demands on renewable natural resources in the United States. According to the 1990 census, the nation is growing at an annual rate of 1.0 percent per year. Although far below that for most developing countries, this rate of growth is one of the highest among developed, industrial nations. If the present rate continues into the future, the population of the United States is expected to double in 70 years.

Population growth in the United States is being driven by two factors: natural increase (births in excess of deaths) and immigration. Demographers estimate that roughly 44 percent of the population growth in the United States during the past two decades can be traced to immigration since 1970, plus the children born to these recent arrivals. How to deal with the pressures that a growing population places on renewable resources was the focus of the two sub-working groups formed around the theme of population, economic development, and geography.

These two groups had perhaps the most wide-ranging theme of the congress. This breadth was reflected by the set of issues and actions identified by the delegates who participated in the various sessions of the two sub-working groups. The issues ranged from how to control population growth to how to increase environmental awareness. The focus and content of the two population sub-groups differed significantly, with the first taking a look at specific issues, while the second group's approach was more general in scope.

Furthermore, the professional composition of the delegates who attended the three sessions of the two sub-working groups varied greatly, and thus the character of the issues and corresponding actions differed considerably from session to session. This latter point was particularly true for the second sub-working group, where population stabilization proved to be a major topic during the first two sessions. The rapporteur for this second group noted that a large number of anthropologists attended the third session, and he speculated on how the outcome might have been different had the members of the third session been the participants in the first instead. Because the approach and content of the two sub-groups differed significantly and no combined report was made, the two groups are covered separately here, and a final working-group synthesis for population, economic development, and geography is provided to highlight similarities.

SUB-WORKING GROUP A

The first sub-group established a common framework for discussing issues related to population and economic development by reviewing the Rio Declaration on sustainability. Noting that the declaration is a statement of moral principle and not an operational definition of sustainability, the group underscored the need to develop a management definition of sustainable development. This sub-group also reviewed an equation dealing with population and environment popularized by biologists and population specialists Paul and Anne Ehrlich, and recently used by Herman Daly and other ecological economists: $EI = P \times A \times T$, where EI = environmental impact, P = population, A = affluence, and T = technology. During the working-group sessions, the equation was used to establish a context for viewing the interface of population and environment that was the focus of this sub-group's discussions. The group then identified five key issues, assessed impediments to addressing these issues, and suggested actions for resolving the impediments and addressing the issues.

The first issue that was identified centered on the need to understand sustainability by developing a consensus on what sustainability means in different cultural, spatial, and temporal contexts. Impediments to addressing this issue include the short-term time horizon of political and economic decision making, the incompatibility of geopolitical boundaries and those for environmental and resource systems, local pressures such as the "not in my backyard" or NIMBY syndrome, and conflicts between key stakeholders. Suggested actions include development of policies for compensating those who are negatively affected by environmental regulations, establishment of a national population policy with the goal of achieving zero population growth, and examination of the impact of different technologies on sustainability.

The second issue was the need to understand the nature of conflicts over economic and environmental issues and their relationship to population growth and economic development. The impediments identified by the group con-

cerned limitations or shortcomings in current decision-making and management processes. These include an inability to identify and manage cumulative impacts, limitations on what management agencies can do, the bureaucratic nature of agencies, limited understanding of issues on the part of decision **makers,** the narrow focus of professional organizations, the lack of institutional rewards for professional involvement in conflict resolution, and harassment of scientists and professionals for voicing unpopular opinions.

Suggested actions or solutions include promoting broad-scale analysis of the root causes of resource problems and conflicts by developing a national database and network, encouraging an interdisciplinary approach to conflict resolution, integrating negative environmental consequences into conflict evaluation, promoting informed debate based upon an understanding of the goals and needs of conflicting groups and rooted in improved education on the issues.

The need for integrated decision making at all levels of government concerning problems of development, environment, population, and resource management was the third issue identified by the group. Impediments to developing an integrated decision-making approach include the perceptions of land as simply a commodity, failure to internalize the environmental costs of using a resource, poor judgments about the costs and benefits associated with using a resource, and increasing polarization of environmental issues. Actions recommended by the group are: creating an institutional structure for integration at all governmental levels, developing incentives for pursuing a long-term approach to resource use (e.g., tax relief) and disincentives for pursuing a short-term approach, and encouraging a shift in values toward a stewardship ethic and long-term perspectives.

The fourth issue was tbe need to develop institutional capacity at the national and international levels to address renewable resource issues. Impediments to developing this institutional capacity include the lack of an available forum for addressing issues, lack of trained individuals, and an inadequate database. Among the suggested actions were encouraging federal agency participation in and cooperation with international agencies, establishing a partnership between private environmental organizations and traditional resource users, helping other countries build needed resource-management institutions, and m-evaluating the mission statements of federal agencies for consistency and compatibility with the goal ofsustainability.

The need to combine ecological and social approaches to achieve a sustainable society was the fifth issue discussed by this sub-group. Impediments to this issue ranged from continued population growth to cultural barriers and a lack of interdisciplinary work among scientists. Solutions or actions identified include developing interdisciplinary centers that encourage integration of natural and social sciences, encouraging the exchange of academic and public agency personnel at all levels, investigating the possibility of developing "endangered ecosystem" legislation to protect resources, and promoting the professional development of environmental ethics-perhaps through the creation of a new academic discipline,

SUB-WORKING GROUP B

In pursuing a somewhat more general approach, the second sub-group working on the theme of population, economic development, and geography took 15 issues identified in the pre-congress survey and selected six major issues that emerged from the recast list. The six issues were:

1. How can population growth be managed?
2. **How can** populationdistributionbe managed?
3. How can resource need/demand be made environmentally sound in light of growing population pressures?
4. **How can we** determine a regional population density that will afford an acceptable quality of life, yet not adversely affect environmental quality?
5. How can agricultural and natural resources be effectively managed?
6. **How can** public values be incorporated in decision making and management of natural resources?

The group focused its discussion of these six issues on the general question of how to maintain resource sustainability in the face of increasing environmental pressure from population growth and economic development. After identifying the six issues and discussing impediments (impediments were not formally identified in the group notes), participants of the first session of this sub-group identified recommended actions for each issue. The second and third sessions refined the list of actions, and the third session prioritized these actions through the use of a ballot in which each participant was allowed three votes per issue. The three votes could be used on one action or spread among two or three. The three actions receiving the most votes are listed for each issue.

1. How can population growth be managed?

- **Recommend increased investment** in economic and health child-related programs in inner cities.
- Design and implement a national action program to inform the public of the consequences (social and environmental) of continued population growth.
- Promote free trade with developing countries.

2. How **can population distribution be managed?**

- **Encourage consideration** of demo-

graphic shifts in long-term national planning.

- Provide information related to sensitive environments.
- Manipulate infrastructure to control population distribution.

3. How **can resource need/demand be made environmentally sound in light of growing population pressures?**

- Determine resource needs of individuals and societies.
- Change economic accounting processes to include environmental externalities such as pollution or loss of aesthetic value, factors not currently internal to accounting procedures.
- Encourage RNRF to address the question of defining a basic standard of living.

4. How **can we determine a regional population density that will afford an acceptable quality of life, yet not adversely affect environmental quality?**

- Encourage RNRF to explore the creation of an index for different regions of the country to measure environmentalquality.
- Promote research on the ecosystem impacts of environmental change.
- Fund research on human perceptions of environmental quality.

5. How **can agricultural and natural resources be effectively managed?**

- Revamp national policy and planning to include the concept of ecosystem functioning and sustainability.
- Encourage an interagency, interdisciplinary response to resource management.
- Encourage dialogue among resourcedisciplines.
- . Include full-cost accounting of resource use.

6. How **can public values be incorporated in decision making and management of natural resources?**

- Encourage empowerment at the lowest administrative level that effectively involves all legitimately interestedpublics.
- Identify common goals of different publics.
- Develop a consensus-building process at local, regional, and national levels.

SYNTHESIS

Despite the differences in approach pursued by the two groups, they reached a number of similar conclusions about needed actions. These include developing a national population policy, refining the concept of sustainability and making it operational at all decision-making and management levels, better understanding human impacts on ecosystems and managing those impacts, revamping existing decision-making and management processes so that they more fully capture environmental values and incorporate the full economic and environmental costs of resource use, improving interagency cooperation and interdisciplinary research, and educating the public and professionals on environmental ethics. This is a wide-ranging list of recommendations that underscores thefundamentallyinterconnectednature of renewable resources issues. Many of these same recommendations will appear again in other groups' lists.«

MANAGEMENT STRATEGIES FOR MAINTAINING A HEALTHY ECOSYSTEM

The two sub-groups addressing the problem of management strategies for maintaining a healthy ecosystem followed a similar approach to identifying and discussing key issues, impediments, and recommended actions. Their reports have been combined, and a summary of their findings is provided below. Three key issues and associated impediments are identified first, and then four sets of actions and solutions that crosscut these issues are outlined.

The two sub-groups established some common ground by identifying some of the components of ecosystem health. These include functional attributes such as energy and element cycling, maintenance of biodiversity and critical habitats, maintenance of spatial and temporal structure, quality of inputs and outputs such as air and water, and resources used by humans such as recreation or timber. The two sub-groups came to general agreement about the urgent need to define a baseline for ecosystem health. It was further determined that the baseline must be defined in the context of management goals and regional ecological and social considerations, and it must be relevant to global as well as local concerns. Lastly, the two sub-groups concluded that any statement regarding ecosystem health is a statement of values.

KEY ISSUES ANDIMPEDIMENTS

Issue 1: Scientific and technological limitations to understanding ecological systems and applying an ecosystem approach to management.

Impediments:

- Lack of basic tools for analysis such as techniques for scaling up data from the local to the global level, long-term data sets, adequate conceptual models, and suitable researchmethodology.
- Inadequate funding for long-term, integrated ecosystem research.
- Lack of operational definitions and indices of environmental health.
- Lack of interdisciplinary collaboration among the natural and social sciences.
- Paradigm constraints and inertia (lack of adequate conceptual models).
- Lack of professional incentives or rewards for using an ecosystem approach.
- Failure to apply the concept of sustainability in ecosystem management.

Issue 2: Limitations of existing resource-management approaches for addressing the concepts involved in ecosystem management.

Impediments:

- Tendency of management to be reactive rather than proactive.
- Lack of regional and national coordination of management strategies.
- Selection of management criteria too often political (role of special interests).
- Difficulty in learning to deal with problems of appropriate scaling.
- Lack of mechanisms to evaluate cumulative impacts on ecosystems.
- Lack of conflict-resolution and consensus-building skills.
- Inappropriate institutional structures for approaching ecosystem management.
- Inability of present resource-evaluation system to accommodate nonmarket values.
- Lack of understanding of objectives and methods required for ecosystem restoration.

Issue 3: **Social, political, and economic constraints to maintaining healthy and sustainable ecosystems.**

Impediments:

- Lack of stewardship ethic to guide decision making and management.
- Public's poor understanding of ecosystems and management problems, plus unrealistic expectations for science and management.
- Lack of political leadership for resolving ecosystem-management problems.
- Fragmentation of regulatory and management policy among agencies and disciplines.
- Short-term perspective in political and economic decision making.

SOLUTIONS AND ACTIONS

1. Science and Research Needs. Actions for stimulating more interactive and interdisciplinary research, supporting more long-term ecosystem research, and providing better management of science and research:

- Support ecosystem research to address management issues through a

system of competitive grants, new agency research programs, and improved coordination of research.

- Improve incentives and rewards for interdisciplinary ecosystem research by creating a quality program based on a strategic plan and encouraging cross-discipline team work as well as team work within disciplines. Also provide support to dual-career-track professionals.
- Conduct more long-term ecological research focused on the biophysical behavior of ecosystems and the interaction of social and economic systems.
- Develop a national initiative on environmental issues to support more scientific research and better integrate scientific information into the policy process.
- Develop a set of indicators of ecosystem health that include social and economic as well as biological and ecological factors.
- Improve communication and collaboration among researchers, managers, policymakers, and the public.
- Improve the availability and reduce the costs of basic data sets. Also establish standards for data acquisition and analysis.

2. **Management Issues. Actions for stimulating integrative and interdisciplinary ecosystem management, promoting regional ecosystem management, and focusing management on maintaining ecosystem health:**

- Conduct management as a scientific process in which strategies and approaches are open to constant testing and revision just as scientific hypotheses are. Also design monitoring programs so as to test management strategies and provide accountability.
- Establish effective mechanisms for communicating management needs to scientists and scientific information to managers.
- Improve outreach programs to include better communication with businesses and tbe public, and develop ways to explain the ecosystem concept in understandable terms.
- Focus on proactive or "up-front" management approaches. Create an environmental extension service with a focus on resource management.
- Establish operational goals and management strategies for restoration of ecosystem health.
- Establish public/private partnership centers within "eco-regions" to foster scientific collaboration, policy development, strategic management planning, and public communication.
- Integrate ecology, economics, culture, and politics in regional management and research.

3. **Awareness and Education. Actions for improving public awareness of and education on ecosystem science and management, and actions for improving professional training:**

- Expand educational system for professional managers of natural resources, resource users, landowners, public officials, and the public (including children) to explain how ecosystems work.
- Influence public attitudes about ecosystems by producing credible and understandable science and by developing interpretive and public education programs.
- Develop and provide information on curriculum development and teaching materials.
- Establish educational programs to assure that college graduates are conversant with ecosystems.
- Direct efforts at the mass media as a means of educating the public about ecosystems.
- Develop programs for professionals to improve theircritical-thinking skills about ecosystems, and teach new tools on ecosystem management.
- Re-emphasize the systems approach (including social and economic factors) in education and training on ecosystem management.

4, **Social and Political. Actions for improving national environmental leadership and fostering public values toward the environment:**

- Work toward development of an environmental or stewardship ethic. Solicit the support of spiritual leaders to collaborate on developing an environmental ethic.
- Work toward a national vision or policy on ecosystem management by developing a consolidated natural resource agency at the cabinet level, consolidating legislative committees dealing with natural resources, and involving all segments of the public in an informed debate on the issues.
- Vertically integrate natural resource laws and legislation from the local through the federal level.
- Develop a trust fund for environmental improvements through a resource users tax.«

STRATEGIES FOR RENEWABLE RESOURCES SUSTAINABILITY

The two sub-groups working on identifying strategies for renewable resources sustainability grappled with one of the great questions facing society today and into the next century: How can society manage interacting ecological and social systems in a way that maintains their health and allows society to develop and meet its needs essentially in perpetuity?

Like other groups at the congress considering this topic, the two subgroups focusing specifically on sustainability had difficulty defining the concept. Nevertheless, they believed that the concept represents a valid and important shift of professional and ethical attitudes in natural-resource management and thus compels concerted effort to develop a definitional perspective. Such a perspective could be used to frame the issue as it develops in the environmental management field over the next several years.

The two groups identified five perspectives. First, humanity must use natural resources to meet social desires for healthy economies, sound social communities, and good standards of living, recognizing that these desires differ among social groups. Second, the use of a natural resource must not cause irreversible economic, social, or natural resource damage. This means maintaining the integrity of ecological systems and their air, soil, water, and biological constituents. Third, the need to accommodate future use while maintaining options for future generations must be acknowledged by incorporating a longer time horizon in resource planning. Fourth, sustainability implies analysis of interacting economic, social, and ecological processes and working at multiple geographical and temporal scales, ranging from the annual cycle of a wheat field to the intergenerational cycles of industrial development or atmospheric change. Fifth, sustainability must be defined in the context of specified natural and social systems, and environmental resources and services to be sustained also must be specified. These specifications will change over time, and thus sustainability must be thought of in the context of social, technological, and environmental change, and therefore it must be framed in dynamic and adaptable ways.

ISSUES AND IMPEDIMENTS

The two groups identified dozens of impediments to sustainability, but also hundreds of actions that could help society move toward a sustainable ecological and economic future. The six most important issues emerging from the two groups are reported below.

First, certain social values and reward systems tend to conflict with resource sustainability. Economic values focused on consumption and political realities often allow only short-term planning. Yet society wants to provide a healthy environment, equitable access to natural resources, and a sound environment and social community for future generations. Such values could begin to constitute an ethic of "stewardship" or "sustainability," but the societal ramifications of true global resource sustainability in perpetuity have only begun to be recognized in recent years.

Second, the existing institutional infrastructure (both governmental and non-governmental) has evolved in ways that may not be suited to ecosystem sustainability and the services that society values and needs. For example, some agencies are pressed to pursue short-term goals, and some resource subsidies reward exploitation rather than sustainability. Fragmentation of disciplines, organizations, and agencies often keep professionals from dealing with problems of "whole systems" (both natural and social).

Third, society lacks mechanisms for sharing responsibility for resource sustainability, especially across the public/private divide, and has not settled on the appropriate role of government and private property owners in resource management. Questions involving private land-use decisions tend to polarize viewpoints. Government intervention thus becomes necessary for resolution of many sustainability and environmental issues, but this creates further polarity until progress becomes politically impossible.

Fourth, research approaches and our knowledge base still lack integration (especially of natural and social sciences) and the ability to deal with complex systems that would allow us to make credible statements and projections about resource system sustainability, the dynamics and limits of ecosystem capacity, rates of renewability, and integrated social and ecological indicators of sustainability.

Fifth, understanding and acceptance of sustainability by both professionals

and the public is lacking for the most part. Mechanisms for educating public officials, resource managers, and citizens about sustainability are weak.

Sixth, natural-resource sustainability is a global issue. We cannot define sustainability in a vacuum or address it by acting as if we are an isolated country. The social and ecological systems that we want to sustain operate at all scales: local to global. Local and regional actions have global implications, but we lack understanding of the global consequences of local land-use decisions, and opinions differ greatly on the consequences of resource actions in different cultures.

KEY ACTIONS FOR A SHIFT TOWARD SUSTAINABILITY

1. Adopting new value and reward systems for sustainability.

Society must develop new social mechanisms that reward sustainability rather than the resource exploitation and degradation that is currently driven by affluence in some parts of the world and poverty in others. Society should consider, for example, stewardship-based incentives, while recognizing that reward systems interact with social value systems and must complement those values to be socially sustainable. The question is whether institutions can be established that work with social values to develop an "ethic of sustainability"?

Society must examine whether current environmental and social policies engender or thwart the move toward resource sustainability. In particular, it must identify and eliminate policy interactions that work at cross-purposes to resource sustainability. We should also identify and examine social institutions that favor a short-term rather than long-term focus in resource management (e.g., credit systems, tax structures, and land-transfer mechanisms).

2. **Improving the nation's institutional infrastructure, both public and private, in favor of sustainability.**

Changes must be made in existing institutions, both government and private, with an aim toward moving resource decisions away from exploitation and toward sustainability. As a start, natural resource sustainability should be articulated as an overarching national policy, implemented through statutes and other means. Guidance must be provided to resource agencies on regional ecosystem-management approaches and on further involvement of public, grass-roots organizations, and other constituent bases in management and decision making. Incentives must be built into governmental systems at all levels to take integrated approaches to resource sustainability, working up from the local to the regional and national levels in renewable resource planning.

A national policy for sustainability calls for a mechanism for inter-agency coordination, such as a national "sustainable natural resources council" to facilitate information exchange and problem identification. Such a council might be linked to the proposal for a new National Institutes for the Environment. A national policy also must encourage active participation by state and local governments, as well as the participation of non-governmental organizations. One tool that might be developed is a national "sustainability assessment act."

3. **Sharing responsibility for sustainability.**

Mechanisms for sharing responsibility for resource protection and sustainability, especially across the public and private realms, must be developed. Property rights, regulatory versus voluntary approaches, and economic versus non-monetary incentives must be examined. Opportunities for equitable sharing of responsibility among public and private interests need to be assessed. Finally, voluntary, market-based, and non-market incentives for achieving resource sustainability should be favored over the use of regulatory measures.

4. **Improving the role of research and practice.**

The positive move toward integrated research involving both the natural and social sciences must be continued and invigorated. Professionals need to work harder on interdisciplinary approaches and must better integrate social and biological factors, seek common ground and languages, and link the various time and space scales of ecosystems, social systems, and resource systems. Researchers must develop social and ecological indicators of sustainability with meaning across cultures, as well as temporal and spatial scales. The role of science in decisions on resource sustainability should be increased and made more credible. At the same time, scientists and professionals must become involved in policy debates and help popularize the idea of sustainability with the public. If not scientists and professionals, who else will advance the issue? The structure of academic institutions also should be examined and perhaps changed so as to encourage this integration of science and policy.

Research must be made meaningful and useful to resource practitioners. Mechanisms must be made available to assess and maintain sustainability. Concepts and tools such as sustainable landscapes, credible measures of sustainability, allowable change, and means for dealing with uncertainty and extreme events must be developed in cooperation with resource managers.

5. **Enhancing education about sustainability.**

Landowners, resource professionals, industry representatives, policymakers, and the public must be educated about sustainability. Two target audiences stand out: first, policymakers, to whom a word like *sustainability* may be confusing or even threatening; and second, the public who must be involved in decisions about sustaining ecosystems. The question with respect to policy-

makers is how to give sustainability a useful and concrete meaning for making resource decisions. With respect to the public, *sustainability* must become a meaningful term not only for landowners, but for schoolchildren as well.

Success stories on sustainability from a variety of geographical settings and resource sectors should be documented and disseminated. Establishing large-scale demonstration projects might be one useful way of accomplishing this goal.

Part of the education process should be to assist various social groups in articulating their values and understanding how these values affect the environment and resource sustainability. A process that enables managers to project and document, in a credible way, consequences of short- and long-term resource-management decisions should be developed. Perhaps this can be accomplished through the use of computer simulation games. Tools such as these must be made available to the various groups associated with resource decisions (e.g., professional managers, policymakers, and the public).

6. **Recognizing the global implications of resource actions.**

International communication must be improved. The environmental implications of emerging issues such as free trade, the General Agreement on Tariffs and Trade (GATT), Agenda 21 of UNCED, and the tension between developed and developing countries should be explored. The role of international business and the implications of domestic policies for sustainability of ecosystems in other countries must be evaluated, and tools must be developed for assessing the global implications of local and regional land-use decisions.

THE CHALLENGE TO RESOURCE PROFESSIONS

The challenge to resource professions and RNRF from the two sustainability sub-groups is to move vigorously from this first step (the RNRF Congress) to prepare an agenda (the Vail Agenda)-a "vision statement"—for developing and enhancing the substance and credibility of resource sustainability as a paradigm for the future evolution of social and natural systems. The agenda must help infuse the concept into the resource professions and into the daily interaction between society and the ecosystems on which it depends. Specific tasks might include: 1) examining what the call for sustainability means to natuml-resources research, teaching, and technology transfer: 2) developing educational materials that articulate the concept of sustainable natural-resources management, including computer simulations that help project the consequences of alternative resource decisions: and 3) creating demonstration projects and seeking examples of eco/social system sustainability, and disseminating the results.

Most importantly, the resource professions and RNRF can facilitate and energize-starting with this congress and the hundreds of ideas formulated by the working groups-a national (and even international) dialogue leading to a new vision for resource management that is less focused on production and more focused on sustainability, and that can be translated into a positive research, educational, and management infrastructure for sustainability. This process is needed to help determine what sustainability means to the resource professions, and why and how to seek sustainability in the Earth's interacting ecological and social systems.«

MANAGING CONFLICTS IN RENEWABLE NATURAL RESOURCES MANAGEMENT

Hardly a major resource decision is made today that does not involve conflict. In fact, many important decisions are delayed for years because of political and legal tactics that prevent a resolution. Indeed, for those who see themselves coming out on the losing side of a decision, no decision at all may be the preferred outcome. Furthermore, it increasingly seems to be the case that decision makers prefer to avoid making the hard decisions rather than endure the firestorm that will almost certainly follow any decision on a controversial issue. The result is decision-making deadlock, and in the end it is often the resource that loses because of lack of management or protection. Finding a more efficient and equitable means of resolving major resource conflicts, such as the spotted owl issue in the Northwest, is one of the most pressing resource issues facing society today, and it was the focus of the two sub-groups organized around the theme of managing conflicts in renewable natural resources management. Because the two sub-groups approached the problem differently, separate summaries of their discussions and recommendations are presented.

SUB-WORKING GROUP A

The first sub-group began by identifying both positive and negative aspects of conflict. On the positive side, constant competition for resources and the conflict it engenders stimulates change and adaptation in society. Conflict is a natural and potentially healthy by-product of an open and democratic society. Finally, new knowledge and better decisions often emerge from conflict. On the negative side, conflict can lead to a cessation of discussion, hardening of positions and attitudes, and inability of organizations and institutions to take meaningful actions on renewable natural resources issues.

The sub-group then identified some of the generic origins of conflict. For example, conflict can result from mutually exclusive goals, disputes over means to shared goals, resource scarcity, or differences in values. The remainder of this sub-group's discussion focused on three general issues and a set of actions that RNRF should take.

Role of the Lay Public in Conjlict

Public values and ethics are diverse, and different publics have different goals and resource utilization needs. Furthermore, resource issues are complex and difficult to understand-even for trained professionals-and thus the public may be confused over facts, overwhelmed by information, or apathetic. All of these factors can contribute to conflicts in decision making.

Role of the Resource Professional in Conjlict

Resource professionals are constrained by the fact that often too little time is available for developing good alternatives or carefully thought-out solutions. Also, political pressures create muddy, ambiguous situations. The professional resource manager operating in that atmosphere may not be able to make a decision simply by applying the "best available" scientific knowledge. In addition, professional employees who deal directly with natural resources and the public are often left to cope with conflict without direction or assistance from higher level administrative personnel.

Resource professionals often do not take the public into their confidence early enough in the process. They frequently have different values tied to narrow disciplinary interests, and this leads to a failure to educate the public proactively on issues. It may even lead to a disinterest in 'people issues" altogether, despite the fact that such issues are often at the center of the conflict. Resource professionals who may have sensitivity to "people skills" often do not receive support from traditionally trained administrators. Furthermore, when resource professionals *do* engage the public, they often are tom between serving the preferences of various publics and utilizing their professional knowledge and skill to take the lead in forming solutions.

Resource professionals also tend to have little exposure to knowledge and tools from the social sciences that might prove useful in conflict resolution. Often, the training of resource students is primarily focused on research rather than on conflict resolution or people management.

Institutional Issues in Conflict Management

At the root of many resource conflicts lie unresolved, fundamental societal issues pertaining to individual rights or property rights versus responsibility to society (e.g., volunteerism versus regulation as an approach to resolving problems). Furthermore, certain segments of society (the media, legal community, user groups) have a vested interest in promoting, or at least not reducing, conflict over renewable natural resources. And in a winner-take-all environment, there are few incentives for conflict resolution.

Opportunities to practice alternative dispute-resolution techniques are limited, short of going to court or deciding the battle on the basis of political clout. Also, few rewards or incentives exist for developing or implementing alternative dispute-resolution techniques, particularly when such strategies are not institutionalized in the legal system.

Substantial legal, institutional, organizational, and personal disincentives incline resource professionals (and resource educators) against operating in the interdisciplinary manner necessary for resolving many conflicts over the use and management of resources. Research funding niches tend to follow traditional lines and discourage interdisciplinary efforts. Furthermore, the climate in agencies often is not conducive to open discussion of issues and problems.

Finally, there is a lack of coordination among federal agencies on natural-resource issues. Federal agencies operate like "little empires," viewing themselves as having a monopoly on the issues. The responsiveness of agencies is guided by the legislative appropriation process and the political or economic power of client groups.

Recommended Actions for RNRF

- Develop a casebook of examples of conflict management, both successful and unsuccessful, for use in university courses and professional development.
- In partnership with universities, develop a model curriculum in resource conflict management that could be incorporated into degree programs and the continuing education programs of RNRF member organizations. As part of this activity, guidelines might be disseminated to resource agency administrators to indicate the kind of educational backgrounds job candidates should have to engage successfully in conflict management.
- Develop and manage an annual program to broker interdisciplinary exchanges of resource professionals among public, private, and academicinstitutions.
- Advocate the establishment of science advisory panels, including social, natural, and biological scientists when appropriate, charged with developing statements of scientific facts and scientifically sound options for policymakers.
- Develop a position paper on a national program to support interdisciplinary research on natural resources, including social science research relevant to conflict management and advocate that program.
- Develop a stewardship ethic, including a statement in support of sustainable development, for use by RNRF member organizations, and promote the acceptance of this statement by governments, the private sector, and the public.
- Present an annual award for excellence in resource conflict management.
- Support current efforts to develop a national infrastructure and computer network for environmental data for use by all agencies.
- Establish a corporate council charged with the task of developing an action plan on private-sector roles in resource conflict management.
- Charter a task force to develop environmentally based accounting procedures and demonstrate their application in sample cases.
- Develop and distribute fact sheets that provide information relevant to specific contemporary renewable natural resources issues.
- Sponsor an interagency forum on common-property issues that brings together experts from academia and the agencies.
- Charter a task force to identify the role RNRF might play in environmental education.

SUB-WORKING GROUP B

The second sub-group organized around the theme of dealing with conflicts over the management of renewable natural resources began its discussions by reviewing the list of issues derived from the pre-congress surveys. The group concluded that the issues fell into five broad categories: value of resources, resource allocation, conflict management, availability of information, and legal issues. The group decided to focus on the first three and then formulate recommendations that would improve the resource-valuation process, improve resource-allocation decisions, and reduce conflicts over resource-management decisions. This sub-group took a national perspective, and the recommendations identifiedcan be implemented by a variety of agencies and organizations, including the Renewable Natural Resources Foundation.

Resource Valuation

A major source of conflict over renewable natural resources is the lack of widely accepted and well-understood methods of valuing common-property resources (e.g., resources held by the public, plus private resources such as wetlands in which the public has an in-

terest). Particularly, non-market values such as landscape aesthetics are poorly understood. Furthermore, acceptable methods do not exist for readily incorporating social and environmental costs into the resource management decision-making process. Incorporation of these costs and inclusion of non-market values will lead to greater use of markets for allocating resources, reduction of subsidies, and lessening of controversy over management and allocation decisions.

With respect to resource valuation, the group ranked two issues as highest in priority out of a set of eight and identified existing impediments. The top issue is the need for a better means of valuing common-property resources when making decisions. Impediments include basic differences in values, inadequate inclusion of public interests and opinions, lack of objective means for determining whose values or interests are correct, and the public's limited understanding of risk assessment. The second issue is the need to account for all environmental costs at both the micro and macro levels. Major impediments include the lack of accounting techniques for internalizing environmental costs (e.g., air and water pollution or loss of wilderness quality), lack of anational accounting framework that reflects all environmental costs, the fact that the public would likely resist higher prices for goods, and the fact that it is difficult to ascertain future uses and values.

Resource Allocation

Much of the conflict over renewable natural resources involves decisions on how to allocate available resources. Conflicts may arise because of different values held by resource users, resource managers, Native Americans, environmental groups, industry, and the public. The differences among these groups may be increasing. Conflicts also may arise over the goals of resource management, the means by which these goals are achieved, the adequacy of scientific information and understanding upon which decisions are based, and the estimated or perceived environmental damages associated with management decisions.

Decision makers responsible for the allocation of resources lack a set of basic criteria that incorporate ethical, economic, and ecological principles witb which to evaluate options. Frequently they do not consider future resource uses, and they make decisions that may preclude future resource production and management options. The situation is complicated by pressure to make resource decisions based on today's resource values and the desire to meet certain resource commodity production goals, as opposed to a goal of maintaining resource sustainability. The assumptions and information upon which decisions are based may not be clearly articulated. Finally, seldom are *post hoc* evaluations done to determine the effectiveness of the existing decision-making process. This lack of review may lead to a lack of accountability.

For resource' allocation, the subgroup prioritized two issues from a list of six and identified key impediments for each. The first issue is the problem of making allocations based on today's resource value rather than the future's. Impediments include the inability to estimate the future value of resources, lack of a national vision of the future of the private property issue, and limited public incentives to private landowners to preserve future land-use options. The second issue is the fact that decision makers often make choices without due consideration of ecological principles. Key impediments include lack of consensus on whether it is ethical to place a price on some resources, traditional attitudes toward ownership of resources, lack of knowledge for making decisions, lack of proper training on the part of managers for incorporating ecological factors into the decision process, lack of a ***post hoc*** decision review process, and lack of decision-maker accountability to the public.

Conflict Management

The best way to manage conflicts over renewable resources management is to avoid them. This can be achieved by assuring that the public and all stakeholders participate in the decision. Although some organizations may have a vested interest in promoting or maintaining conflicts, efforts placed on early public involvement in decisions, preparation of quality environmental impact statements, and assuring that all stakeholders participate in the decision should result in better planning, higher quality decisions, reduced conflict, and less litigation.

Many recent conflicts over renewable natural resources focus on the public interest in private property. A lack of consensus exists on the future direction of private property rights in the United States. Some in this sub-group noted that the time has come to re-evaluate private property concepts and the laws affecting private property, and to chart a new direction.

Once conflict occurs, attempts must be made to resolve it before litigation becomes necessary. Because lawsuits ate so costly, other methods should be utilized to the maximum extent possible. It is not clear that the full range of conflict resolution activities are currently being used by those involved in resource management. Training in the application of conflict resolution techniques may be desirable.

The key issue highlighted out of the six identified is the need to make every effort to involve the public in decisions in order to avoid unnecessary conflict. Impediments to doing this include a lack of resource managers trained in conflict resolution, political agendas thwarting the process, lack of full stakeholder involvement, refusal on tbe part of some parties to participate, uncertainty about the process, and the process

itself discouraging participation.

Actions and Recommendations

Legislation

- Review public natural-resource law, eliminate conflicts present in the myriad of existing laws, and propose strategies for responsible legislative and executive action.
- Review the impact of federal law on private property rights and devise strategies to facilitate conflict resolution.
- Consider national land-use policy and planning-assistance legislation that pertains to both public and private lands, and includes incentives for regional land-use and resource planning to be coordinated at the federal level.

Agency Policies and Programs

- Establish department-wide negotiation/arbitration panels in both regulatory and resource-management agencies.
- Seek aggressive compliance by all federal departments and agencies with existing environmental laws, rules, regulations, and policies.
- Review and identify gaps in resource information coverage and scientific understanding needed to manage natural resources and recommend needed actions.
- Encourage public involvement in agency decision making.
- Use modern conflict resolution techniques to resolve resource conflicts before they reach the courts.
- Encourage RNRF to sponsor a forum to explore mechanisms to reduce and resolve natural resources conflicts.
- Revise federal cost-benefit guidelines to incorporate social welfare and environmental costs and benefits.
- Explore the possibility of RNRF convening a task force for scientific review of the impact of the Endangered Species Act on resource management practices and programs.

Research

- Encourage the establishment of a national interdisciplinary research program to evaluate and recommend means for accounting fully for the environmental costs of resource use.
- Develop improved methods for identifying and detining the values of common resources.
- Develop and test methodologies in the social and natural sciences designed to estimate the future value of natural resources.

Education

- Establish training programs for resource professionals focused on new techniques of resource allocation, evaluation, and conflict resolution. A compendium of case studies illustrating successes and failures of selected resource conflicts should be developed as part of this program.
- Establish public outreach programs to explain specific planning processes in order to encourage participation in decisions.
- Establish model programs at the secondary and college levels to educate the public, including traditional user groups, on the importance of a stewardship ethic.<<

MANAGING COMMON-PROPERTY RESOURCES

The two sub-working groups tackling the issue of how to manage common-property resources began by establishing a definition: Common resources include both common property and common interests, both of which have explicit legal definitions. Conceptually, common property and common interests can be broken down into three general subsets: 1) public lands and commonly held lands that are subject to management; 2) public interest in private property, which can be expressed through incentives and regulations to achieve specific goals such as protecting wetlands or endangered species; and 3) unowned and unallocated resources such as air or the climate.

STEWARDSHIP ETHIC

The first issue identified by the two sub-groups is the need to develop a stewardship ethic to guide the use of common-property resources. They explain that wise use of common-property natural resources is fundamentally dependent upon an ethical framework that should be based upon the concepts of sustainability and intergenemtional responsibility. In his famous essay on a land ethic in the ***Sand County Almanac,*** conservationist Aldo Leopold noted that philosophically an ethic is "a differentiation of social from anti-social conduct," while in ecological terms an ethic is "a limitation on freedom of action in the struggle for existence." The two sub-groups concluded that society needs to develop an ethic that compensates for the fact that the individuals who make up society have inherited evolution's fatal flaw-a built-in instinct that calls for survival and reproduction in the present, with no instinctual concern for survival of the species in the long term.

The two sub-groups further concluded that no common understanding currently exists regarding: 1) the ecological basis for natural resource management, 2) the responsibility of each individual for stewardship of resources, and 3) the requirement that each individual must be responsible for his or her actions concerning natural resources. Making choices consistent with this ethical framework is dependent upon an adequate understanding of the biophysical implications of resource use. We are, however, still accumulating scientific knowledge on the biophysical requirements necessary to maintain common-property resources.

Recommended actions by the two sub-groups include: 1) a call for the Renewable Natural Resources Foundation to support and conduct research regarding the inter-relationship of biophysical requirements and ethical decision making: 2) a mandate to academic, religious, and professional institutions to teach normative values associated with a natural resources ethic; 3) a suggestion that all institutions, public and private, adopt and use a stewardship philosophy (examples of activities that might fall under this rubric include promoting mass transit, alternative energy, and community development planning); and 4) a request that the foundation continue to sponsor and expand dialogue among natural resource professionals on these topics.

ALLOCATION OF COMMON-PROPERTY RESOURCES

The second issue the two sub-groups focused on concerned the allocation of common-property resources. The groups believe that allocation should be based upon the concept of sustainability as defined by the Bruntland Commission in the 1987 report entitled ***Our Common Future:*** "Development that meets the needs of the present without compromising the ability of future generations to meet tbeirown needs." In addition, all nations must share in the development of sustainable approaches towards resource management.

In particular, the two groups suggest that a proper allocation process should first define what is necessary to sustain an ecosystem absent human considerations. Allocation for consumptive use should then be based solely upon the surplus. Such an approach does not imply an absolute answer, and the two groups recognize that at some point both ecological and social factors need to be incorporated, within a scientific framework, into the decision process. They also suggest that, to the extent possible, existing mechanisms for allocation should be used with only those modifications that are necessary to ensure sustainability.

POLICY AND INSTITUTIONS

The two sub-groups next focused on issues related to policy and institutions. They concluded that the current policymaking process and the institutions to implement policies are not able

to adequately integrate the many, often conflicting, public demands on resources into a comprehensive and workable approach. Thus, an effort needs to be made to link public values and participation with planning and decision making.

The two groups identified solutions and actions to address this problem: 1) develop a long-term natural resource policy; 2) revise federal cost-benefit analysis guidelines to reflect contemporary understandings of natural resource economics: 3) work toward revising NEPA and other decision-making processes to engage various publics in the development and selection of alternative policies; 4) develop mechanisms to facilitate public and private cooperation on common goals and management programs at the landscape level; 5) create, implement, and maintain an on-going, standardized, and comprehensive resource use database to support decision making; 6) promote greater use of environmental mediation and compensation; and 7) diversify agency work forces to broaden the pool of values in agencies,

INFORMATION AND EDUCATION

With respect to information and education, the two sub-groups concluded that present knowledge may be inadequate or insufficiently utilized to support decisions that promote sustainability. Resource professionals need to become more adept at communicating with the public. Further, as the public becomes more involved with the resource decision-making process, education on resource sustainability should be improved.

The two groups specifically recommended that RNRF, related associations, and public agencies develop a process whereby technical information is compiled and synthesized into formats that are accessible and informative so that the public has accurate disclosure about current resource management practices. Positive natural resource conservation efforts should be identified and highlighted. Research, management, communication, and education efforts should be coordinated within and among agencies. Support should be encouraged for a new cadre of scientists/professionals who deal with the synthesis and integration of information. Environmental literacy courses should be included in undergraduate college curricula, and environmental field experience should be part of K-12 education. A variety of communication media (not just print) should be utilized to teach the public. Finally, as a means of fostering education, conservation leaders across all levels and sectors should serve as public role models.

ECONOMICS

The final issue concerned resource economics. The two groups concluded that current methods of economic analysis do not adequately account for and allocate all costs and benefits of resource use and thus fail to provide economic incentives for sustainable use. Also, current policies often create artificial markets for resources, and national economic constraints often limit the flexibility to develop solutions.

Recommended actions include a call for resource professional associations to review, compile, and synthesize, as well as support valuation research to improve our ability to assign economic value to non-market resources. RNRF should review, synthesize, and develop accessible information on full market prices for the consumptive uses of resources (e.g., grazing, timber harvesting, etc.). Fee structures for natural resources should be designed with incentives for sustainable use and penalties for exploitative use. The move should be away from subsidizing production and toward encouraging environmental outputs. Subsidies that no longer support a social good and those that contribute to long-term resource damage should be eliminated. Finally, an "index for sustainable economic welfare" should replace the GNP as an indicator of the country's economic health.«

CLIMATE-INDUCED ENVIRONMENTAL CHANGE

The two sub-working groups organized around the theme of climate-induced environmental change pursued a similar approach to identifying issues, impediments, and solutions. A combined description of the two groups' accomplishments is presented below. To place the issue in context, the two groups prepared a joint preamble outlining key issues and concerns. The preamble reads:

> The working group recognizes the immense complexity of environmental changes that will occur at all geographic scales as a result of both natural and human processes. Because of this system complexity, there may not be an immediate recognition that human economic and political responses are caused in part by climate-induced environmental change. We also recognize that human interactions with natural, and with urban, agricultural, and other economic landscapes produce climate changes at both human and geologic time scales that must be addressed. Simply stated, we believe that the issues, impediments, and solutions to climate-induced environmental change must be addressed irrespective of whether they are caused by human or natural factors. This conclusion is based in part on: 1) the collapse of earlier civilizations in the Mediterranean region, Central America, the American Southwest, and elsewhere due to their ignorance of progressive climate change; 2) the fact that, unlike earlier civilizations in history, existing cultures and societies have no new territory to expand into; and 3) the fact that, because of this, the United Nations recognizes environmental refugees as perhaps the greatest single global problem to be faced in the new century.
>
> Food security, energy consumption, the production of goods and services, global economic competitiveness, quality of life, and sustainable environmental health are only a few of the reasons why society in the 21st century will need to understand the regional and global rates and directions of climate change. To be unprepared for climate change or to lack the scientific and technical means for modeling and predicting these changes is to abdicate our responsibility to future generations.
>
> The scientific literature describing the fundamental biogeochemical dimensions driving climate change is growing, and a corresponding (but smaller) body of knowledge now exists to address the economic and policy issues surrounding these anticipated changes. What seems to be lacking is a societal and governmental commitment to link these bodies of knowledge to influence education and behavior. All of the issues, impediments, and solutions identified represent our collective recommendations for alerting society and our government leaders to the climate-induced environmental changes that could occur in the next two to three decades and beyond.

ISSUES, IMF'EDIMENTS, AND SOLUTIONS

Issue 1: Scientific uncertainty about and research needs on the environmental consequences of climate change.

Key weaknesses in the existing knowledge base concerning the environmental impacts of global climate change include poorly defined error bounds on the General Circulation Models (GCMs) and other model output, the need for better ecosystem response models and risk assessments, and a lack of attention to ecosystem adaptation to global change. Key impediments to resolving these weaknesses include: the complexity of the problem, insufficient funding for research or loss of funding, poor coordination of research activities, lack of trained researchers who can synthesize information from different fields, lack of long-term data sets at a regional scale, lack of baseline data sets against which to measure change, insufficient computer capability for modeling efforts, and lack of funding for interdisciplinary research.

Recommended Solutions:

- Develop more rational approaches to allocating research funds and improve the existing system for allocating funds.
- Establish an executive or congressional institute to redirect funding for scientific research on global change.

- Develop a single federal agency to guide global change research. This agency must have an interdisciplinary focus. (Some disagreement over this action occurred in the sub groups. Benefits of decentralization were noted, as were problems of credibility for the new agency.)

Issue 2: Lack of coupling of natural and social sciences research.

Several key impediments to fostering interdisciplinary research were identified, including differences in disciplinary training, institutional barriers to developing interdisciplinary programs, disciplinary jargon and the lack of a common language, and a lack of policy-oriented research.

Recommended Solutions:

- Develop interdisciplinary education programs (provide training to instructors).
- Use GIS as a teaching tool to train students in the natural and social sciences.
- Integrate the natural and social sciences during the educational process.
- Encourage and reward interdisciplinary team research.
- Encourage RNRF to publish a set of case studies showing successful integration of natural and social science data sets.

Issue 3: Structure of the existing decision-making process.

Decision making occurs at levels and scales that are not appropriate for responding to global problems or ecosystem management. In addition, decisions at higher levels often do not filter down to local resource managers. Impediments to improving the decision-making process include entrenched special interests who resist change, lack of economic incentives and too much emphasis on a negative regulatory approach, resistance or inability of the political process to address long-term problems, and the fact that political decision-making boundaries do not match ecosystem boundaries.

Recommended Solutions:

- Endorse market-based policies such as "polluter pays," trading of pollution rights, and incentive-based regulation.
- Encourage election reform to address the entrenchment of special interests.
- Work for implementation of the new global climate convention.
- Encourage the use of proven ecosystem-wide management systems (such as exists for the Chesapeake Bay region).
- Enhance the use of peer review of government technical reports to reduce the politicization of science and reduce pork barrel funding.

Issue 4: Information needs and management.

A need exists for a coordinated and integrated scientific and data management system for global change research. Also needed is improvement in the quality and quantity of baseline data on the condition of natural resources and improvement in the knowledge base concerning the rate and magnitude of global climate change. Finally, interagency planning and coordination is needed for incorporating the impacts of climate-induced change into natural-resource management. Impediments to resolving these problems include: lack of commitment to long-term data collection and database development despite existing programs such as NASA's Earth Observing System and Data Information System (EOSDIS), poor linkage and quality control in many existing databases, the large computer needs for global scale models, lack of long-term data sets at a global scale, and the long time periods required for collecting measurements and developing a record.

Recommended Solutions:

- Develop and use common standards and methods of data collection across agencies and institutions.
- Prioritize important data set needs.
- Develop a national database for GIS analysis.
- Improve planning focused on human and environmental adaptation to global change.
- Increase national computer networking capabilities.
- Create a data management system for biotic resources that includes non-economic species and that can be used to manage and protect imperiled ecosystems.
- Develop and publish environmental indices, perhaps through a new Bureau of Environmental Statistics.
- Encourage sharing of information among federal, state, and local agencies, as well as the private sector.

Issue 5: Lack of effective and efficient science management strategies to address global change problems including lack of interdisciplinary approaches and poor intra-organizational collaboration.

(Delegates employed by federal agencies did not believe this is a problem to the same degree as did delegates from academic institutions.) Impediments to developing more effective management strategies include conflicts arising from fragmented or overlapping programs, lack of a uniform terminology, a cumbersome congressional committee structure, and the fact that the agencies each have different missions.

Recommended Solutions:

- Improve incentive and reward systems for inter-agency and interdisciplinary research.
- Mandate cooperative efforts.
- Provide specific funds for cooperative research efforts.
- Develop a common terminology, perhaps through an inter-agency committee on standards.
- Hold congressional forums to integrate issues and focus congressional staffers on the need for inter-committee cooperation.

Issue 6: Consequences of increasing population.

Commitment for dealing with the

problem of population growth is lacking, and too much emphasis is placed on the belief that technology will solve the population problem. Impediments to facing the issue of population growth include overdependence on technological fixes to solve problems of growth, lack of commitment to facing the twin problems of population growth and material consumption, and the existing high rate of global population growth.

Recommended Solutions:

- Identify population control as a national priority by supporting family planning at home and abroad.
- Identify alternative means of maintaining lifestyles and quality of life that are not as resource intensive as present lifestyles are.
- Base economic growth in developing countries on efficient use of resources.

Issue 7: Lack of social commitment to dealing with the problem of global climate change and lack of a national policy on the problem.

In order for the concept of "think globally, act locally" to be effectively implemented at the national and local levels, people need to be educated on the global environmental consequences of local activities (e.g., pollution, erosion, etc.). Impediments to developing a commitment to dealing with global change through local actions include the inability to motivate society to change social and political behavior; unwillingness of decision makers to take action in light of present scientific uncertainties; lack of a long-term perspective in our political system; conflicting social messageson materialism and environmentalism: poor communication among resource professionals, politicians, and the media; and lack of interdisciplinary communication and scholarship.

Recommended Solutions:

- Improve education on global change issues at both the college and K-12 levels. (RNRF should suggest improvements to environmental curricula at both the college and K- 12 levels.)
- Improve non-conventional approaches to education (e.g., extension service or science centers).
- Identify areas of scientific consensus and suggest policy recommendations in those areas, and identify research needs for the areas that lack consensus.
- Encourage the scientific community to undertake long-term risk assessment of global change problems.
- Strengthen the nation's automobile mileage standards and implement a carbon tax.
- Increase research on alternative fuels and support increased utilization of mass transportation.
- Educate the public about global change issues and policy alternatives. (RNRF could support activities in this area.)

Issue 8: Lack of public understanding of the environmental and social consequences of global climate change.

Key impediments to improving public understanding are an inability to communicate the complexity and uncertainty of the issues to the public and educators, the fact that the media does not have a sophisticated understanding of global change issues, and the lack of appropriate curriculum material in our schools.

Recommended Solutions:

- Improve and foster education on global change issues for the public, policymakers, resource managers, and the scientific community, with the aim of developing a national strategy on global climate change.
- Focus on K-12 education by using museum exhibits and demonstrating how to interpret and use data.
- Work on improving and expanding use of the current knowledge base.«

SYNTHESIS: TOWARD AN AGENDA ON RENEWABLE NATURAL RESOURCES

This report represents the combined reflections and ideas of a number of the nation's leading natural resource professionals regarding the issues and conflicts that managers and researchers concerned with renewable natural resources will face in the coming decades. Also included are their thoughts on the impediments that are likely to stand in the way of finding solutions and their recommendations for actions to overcome the impediments and develop working solutions. Few constraints or limits were placed on how far the individual groups could range in addressing these questions. Thus, some of the findings and recommendations will undoubtedly be controversial. The subgroups often tackled difficult issues such as population growth, private property rights, and political reform. The opinions expressed represent those of the individual working groups.

A wealth of ideas and information was produced at the congress that, when taken togetber, represents an agenda for action on resolving conflicts and improving the management of the nation's renewable natural resources. In particular, seven general sets of recommendations emerge from the congress. These seven overarching sets of recommendations, like the original six themes, crosscut traditional natural resource sectors and disciplines. Each of the seven is discussed in turn below:

STEWARDSHIP ETHIC

The congress participants agreed in calling for a stewardship or sustainability ethic that would guide both public and private natural resource decision making. Such an ethic would require a fundamental shift in existing values. In particular, the current short-term outlook employed in resource and economic decision making would have to be replaced by a long-term perspective. In addition, the current system of valuing resources would have to be revised to account fully for non-market values (e.g., aesthetic values). New social and economic incentives that reward sustainable development of resources will need to be developed, and decision makers and managers (both public and private) will need to be accountable for their actions. A stewardship ethic will depend upon the willingness and capacity of individuals and institutions to assume responsibility for the sustainable use of natural resources. It will also depend upon committed and effective national and international leadership. Finally, shared concepts or definitions of stewardship and sustainability must be developed that have meaning across different temporal and spatial scales and across cultures, and these concepts and definitions will need to be translated into specific and workable management actions and procedures.

VALUE OF RESOURCES

Many of the groups identified fundamental deficiencies in current methods of valuing and allocating renewable natural resources. A general belief emerged that current methods and procedures do not adequately account for or fully and fairly allocate all costs and benefits associated with the use of most renewable natural resources and thus do not provide economic incentives for sustainable use. The delegates expressed general agreement that greater emphasis should be placed on the market allocation of resources, particularly in pricing and regulation. All costs associated with the consumptive use of a resource (e.g., pollution, damage to the environment, loss of recreational or aesthetic values) should be fully incorporated into existing resource-pricing mechanisms. Subsidies that promote degradation of resources or do not promote sustainable use should be eliminated. Finally, mechanisms need to be developed and implemented for accurately assessing the non-market value of renewable natural resources.

INTERDISCIPLINARY RESEARCH AND MANAGEMENT

All working groups identified the lack of interdisciplinary research and/or management of natural resources either as a critical issue or as an impediment. Both researchers and managers need to work harder at developing interdisciplinary approaches that integrate natural and social factors and seek a common language and understanding of concepts and issues. In particular, the groups cited a need for increased funding and institutional support for interdisciplinary research and management.

Specific recommendations include developing a system of professional rewards and incentives for interdisciplinary research and management, as well as establishing new regional and national centers for interdisciplinary research and management.

INSTITUTIONAL REFORM

Another recommendation common to the various working groups is the need for institutional reform and restructuring, particularly within the management agencies, but also within academia. The burdens of bureaucracy, lack of communication and coordination among agencies, differing and competing mandates, and an overly politicized decision-making process were cited as impediments to improved management of renewable natural resources. Several groups endorsed the need for new national policies, such as a national policy on sustainability. New institutional arrangements also were suggested, such as a national sustainable natural resources council to coordinate decision making or a cabinet-level department of natural resources that would consolidate the existing natural resource and environmental agencies and departments. The need for improved coordination of national, state, and local policies and activities also was cited, as was the need for improved mechanisms for involving the public in decision making. Within universities, the major suggestion for institutional reform was for improved interdisciplinary research, collaboration, and teaching, perhaps by establishing and funding new interdisciplinary centers for resources management and developing new curriculum programs.

EDUCATION

Almost every set of recommended actions identified at the congress incorporated a call for more and better education on renewable natural resources issues for both the public and professionals. The formation of a stewardship ethic and the development and adoption of new concepts such as sustainability or ecosystem management depend fundamentally on education. Environmental ethics need to be taught at both the K-12 and college levels. Professionals need to update and expand their training through continuing education progmms. New concepts such as sustainability and ecosystem management should be incorporated into the current resource-management curricula at universities, and new environmental-awareness teaching materials need to be developed for the K-12 level. Non-conventional means of education such as the development of science or environment centers should be pursued. Finally, mechanisms for informing the public about natural-resource issues and choices need to be improved. In particular, the information that is available needs to be made more accessible to the public in formats that are easy to understand.

CONFLICT RESOLUTION AND DECISION MAKING

Improved management of renewable natural resources will likely hinge on our ability to develop new techniques for resolving conflicts over management decisions. In particular, mechanisms need to be sought that will improve the fair and open participation of all stakeholders, including the public, in the decision-making process. Efforts should be pursued to reduce the power and influence of special interests, and to separate management decisions from politics. The development of a stewardship ethic, improved professional and public education, market-based pricing and regulation of natural resources, and restructuring of resource-management agencies at all levels would likely help prevent conflicts over resource-management decisions.

DATA COLLECTION

A major need of both managers and researchers is for more, better, and less expensive data of all types. Standardized techniques for data collection and analysis also need to be developed and used across disciplines. Major weaknesses include a lack of long-term records of environmental health and change as well as social and biological indicators of sustainability. Many suggestions were offered for coordinated national and international efforts at data collection and standardization.

THE NEXT STEP

The RNRF congress is only the first step in a carefully planned process for identifying and seeking solutions to the critical renewable natural resources issues that society will face in the coming decades.

The next step will be the convening of a summit of the elected and appointed leaders of RNRF's 17 member organizations. The purposes of the summit will be twofold. First, leaders of RNRF's member organizations will determine priorities among the many recommended actions. Implementing all or some of the recommended actions will be a long-term proposition. Second, RNRF's members will seek agreement on the nature and manner of their joint activities in advancing the recommendations. Activities could range from the commissioning of studies and research to the collective advocacy of public policies. The long-term goal is to improve communication of scientific information to policymakers and the public so as to insure the sustainable use and management of renewable natural resources.<<

APPENDIX A SURVEY RESULTS

WORKING GROUP I
POPULATION, ECONOMIC DEVELOPMENT, AND GEOGRAPHY

RANK	PROBLEM
1	Public Attitude on Growth vs. Environment
2	Inability to Manage Population Growth/Economic Development
3	Urbanization of Rural Lands
4	Inadequate Definition of Sustainable Economic Development
5	Lack of Agreement on What America Should "Lock Like" Ecologically
6	Shift of U.S. Population to Ecologically Sensitive Coastal Environments
7	Inadequate Renewable Natural Resources Database
8	Inability to Integrate Natural and Social Science Data
9	Depletion of U.S. Natural Resources to Meet Needs of Increasing World Population
10	Impacts of Metropolitan Living/ Employment Patterns on Renewable Natural Resources
11	Inability to Determine Carrying Capacity
12	Lack of Demand Management for Renewable Resources
13	Lack of Landscape Management
14	Growth of Recreational Activities in "Wildland" Areas
15	Population Growth of the U.S.

WORKING GROUP II
MANAGEMENT STRATEGIES FOR MAINTAINING A HEALTHY ECOSYSTEM

RANK	PROBLEM
1	Public Attitude of "Ecology vs. Economy"
2	Inadequate Knowledge of System Interrelationship
3	Lack of Regional, Watershed, etc. Focus in Management Programs and Regulations
4	Failure to Identify Realistic Objectives for Maintaining Ecosystem Health
5	Loss of Biodiversity/Critical Habitats
6	Lack of a Defiiition of and Indices for a Healthy Ecosystem
7	Inability to Assess Cumulative Impacts
8	Fragmentation of Management Programs
9	Poor Understanding of the Role of Science In Policy Decision Making
10	Endangered Species and Cost of Extinction and Protection
11	Exploitation Mentality of Industry/ Government/American People
12	Lack of Econanic Incentives
13	Fragmentation of Ecosystem Ownership
14	Impacts of Resource Harvesting on Ecosystem Health
15	Lack of Comprehensive Ecosystem Studies
16	Inability to Allocate Public/Private Environmental Funds to Most Important Ecosystem Problems
11	Lack of Monitoring Programs
18	Uncertainty Concerning the Value of Restoration/Mitigation Efforts
19	Lack of Local Involvement in Ecosystem Management
20	Failure to Think/Manage in Terms of Agro-Ecosystems
21	Uncertainty Concerning Who Should Make Ecosystem Health Decisions
22	Limited Pool of Properly Trained Professionals for Ecosystem Management
23	Failure to Adequately Use Satellite Data

WORKING GROUP III
STRATEGIES FOR RENEWABLE RESOURCES SUSTAINABILITY

RANK	PROBLEM
1	Government Policy That Promotes Short-Term Production, Not Sustainability
2	Emphasis on Short-Term Benefits of Resource Exploitation
3	Sustainability of Resources vs. Economic Growth
4	Absence of Widespread Public Support (Understanding) of Resource Sustainability
5	Absence of Economic Incentives for Sustainability Pmctices
6	Inability to Define Sustainability
7	Failure to Develop/Enforce No-Net-Loss Policies for Critical Land Types
8	Government Subsidies to Corporate Users of Natural Resources
9	Inability to Allocate Public/Private Environmental Funds to Most Pressing Sustainability Problems
10	Sustainability Policies Difficult to Implement Because our system Emphasizes Personal Gain
11	Uncertainty About Who Will Pay for the Adoption of Sustainable Methodologies
12	Inadequate Knowledge Base
13	Desire to Remove From Productive Use Rather Than Manage for Sustainability
14	Lack of Regional Cooperation
15	Lack of Institutions With Goal of Maintaining Natural Systems to Match Institutions With Goal of Exploiting Resources of Natural Systems
16	Inability to Quantify Some Resource Yields (e.g., Wildlife)

WORKING GROUP IV
MANAGING CONFLICTS IN RENEWABLE RESOURCES MANAGEMENT

RANK	PROBLEM
1	The "Jobs vs. Environment" Issue
2	Limited Public Understanding of Resource Management
3	Lack of Stewardship Ethic
4	Unrestrained Urban Growth

5 Inadequate Knowledge or Improper Use of Ecological Values

6 Valuation of Commodity vs. Non-Commodity Resources

7 Political Outcomes Biased by Unequal Competing Interests

8 Inadequate Knowledge and/or Improper Use of Economic/Social Values

9 Lack of Management "Tools" for Conflict Management

10 Limited Public Understanding/Acceptance of Multiple-Use Management

11 Limited Training of Resource Agency Personnel in Conflict Resolution Techniques

12 Conflicting Demand/Protection Requirement Imposed by Congress

13 Media Hype in Major Resource Use Conflicts

14 Failure to Develop Methods for Avoiding Conflicts

15 Cultural Differences That Exist Among Major Players in Resource Use Conflicts

16 Limited Use of Mediation and Other Out-of-Court Procedures in Conflict Resolution

17 Special Interest Group "Harassment" of Natural Resources Professionals Involved in Natural Resources Conflicts

18 Impact of Endangered Species Act on Private Property Rights

19 Lack of Good Case Studies of Past Resource Conflict Resolutions

20 Conflicts Between Indigenous Groups and Non-Natives

21 Unrealistic Dependence on Science

22 Cost of Conflict Resolutions

23 Limited Opportunities for Public Involvement in Managing Resource Use Conflicts

WORKING GROUP V

MANAGING COMMON-PROPERTY RESOURCES

RANK PROBLEM

1 Water Allocation

2 Private Use of Public Land-The "Giving" Issue

3 Management of Public Grazing Lands and Coastal Lands

4 Lack of Stewardship Ethic

5 Lack of Econanic Incentives

6 Institutional Obstacles to New Management Systems

7 Who Benefits and Pays in Common-Property Management

8 Uncertainties Concerning the Role of Science in Policy Decisions Concerning Environmental Management

9 Lack of Definition of Cause-Effect Relationship in Resource Declines

10 Threats to Private Property Rights Imposed by Common-Property Legislation and Regulations—The "Taking" Issue

11 Difficulty Comparing Commodity and Non-Commodity Values

12 Emphasis on Regulation Instead of Other Methods

13 Lack of Agency Cooperation and Poorly Defined Management Objectives

14 Who Decides

15 Conflicting Laws/Government Policy

16 Pervasiveness of "NIMBY" Attitude

17 Inabiity to Allocate Public/Private Funds for the Environment for the Most Serious Common-Property Resources Problems

18 User Fees

19 Inadequate Management "Tools"/Strategies

20 Failure of Public Participation Process

21 Inadequate Definition of Common-Property Resources

22 Cost of Common-Property Management Strategies

23 Tax Considerations

24 Unwillingness of Policymakers to Distinguish Between Low-Cost and High-Cost Options

25 Immigration Policy as a "Commons" Problem

WORKING GROUP VI

CLIMATE-INDUCED ENVIRONMENTAL CHANGE

RANK PROBLEM

1 Political System Not Interested in Long-Term Problems

2 Global as well as National Problem

3 Lack of Knowledge of Ecosystem Responses to Global Climate Changes

4 Lack of a Multi-Disciplinary Approach to the Problem

5 Lack of Economic Incentives for Taking Long View

6 Inabiity to Develop a National Consensus and Strategy on Global Climate Change

7 Lack of Guidance on How to Factor Global Climate Change Information Into Resource Management Plans

8 Lack of Public Understanding

9 Fragmented Approach to Problem

10 Unwillingness of Policymakers to Take Action in Light of Scientific Uncertainty

11 Ignorance About Potential "Winners" and "Losers" Amidst Global Climate Change

12 Inadequate Funding for Basic Economic and Social Science Studies of Global Climate Change Impacts

13 Uncertainty Concerning Who Pays for Adjustment Strategies

14 Lack of Credibility for Centralized Planning Efforts

15 Failure to Weigh Investment in Climate Change Studies With Their Long-Term Implications Against Mae Immediate Issues (e.g., Resource Depletion, Pollution)

16 Poor Inter-Agency Collaboration

17 Uncertainty Concerning Role of Managers and Professionals

18 Use of Global Climate Change Issues to Generate Research Funding

19 Lack of "What If' Scenarios

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The Renewable Natural Resources Foundation (RNRF) was incorporated in 1972 as a nonprofit operating foundation and today has 17 member organizations. The foundation was established to advance education in renewable natural resources, promote sound, scientific management of resources, foster cooperation among professional, scientific, and educational organizations, and develop the Renewable Natural Resources Center, an office park complex in Bethesda, Maryland, for member organizations.

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