



**INTERNATIONAL SYMPOSIUM/WORKSHOP
"COMBATING DESERTIFICATION:
CONNECTING SCIENCE WITH COMMUNITY
ACTION"
12-16 MAY 1997**

The International Symposium and Workshop on "Combating Desertification: Connecting Science with Community Action" convened in Tucson, Arizona, USA from 12-16 May 1997, under the sponsorship of the United States Bureau of Land Management and the International Arid Lands Consortium. The objective of the Symposium was to allow a significant exchange of ideas between the developers of science and technology related to combating desertification and the community-level decision makers dealing with the problems of desertification and drought on a day-to-day basis. Approximately 200 participants from 32 countries, representing the scientific and academic communities, government agencies and non-governmental organizations, attended the Symposium.

During the week, 18 scientific papers were presented on the Symposium's six topics: stressors, indicators and processes; monitoring and assessing techniques; lessons learned at the community-level; socio-economic and human dimensions; knowledge sharing; and regional aspects of desertification. Additional research on these topics was offered through the submission of 140 poster presentations and papers that were available to participants. The main work of the Symposium was carried out in small discussion groups organized around the six topics. These groups identified obstacles and offered recommendations related to these themes. A number of participants remained in Arizona for an additional week-long "training package" to learn about efforts related to desertification in the southwestern US.

**A BRIEF HISTORY OF INTERNATIONAL
DESERTIFICATION ACTIVITIES**

In 1977, the international community met in Nairobi, Kenya, for the UN Conference on Desertification (UNCOD). This conference raised the world's awareness of the causes and effects of desertification. Delegates to the UN Conference on Environment and Development (UNCED), which met during June 1992 in Rio de Janeiro, Brazil, agreed to consider drafting a convention to combat desertification. Twenty years after UNCOD and five years after UNCED, the international community is preparing to attend the first Conference of the Parties to the UN Convention to Combat Desertification (CCD) in Rome, Italy in September-October 1997. The CCD was formally adopted on 17 June 1994 and opened for signature in Paris on 14-15 October 1994. It entered into force on 26 December 1996. The Convention takes an innovative approach in recognizing: the physical, biological and socio-economic aspects of desertification; the importance of redirecting technology transfer so that it is demand-driven; and the participation

of local populations in the development of national action programmes.

In response to the growing international awareness and action to combat desertification invigorated by the CCD, the US Bureau of Land Management and Environmental Protection Agency convened the "International Symposium and Workshop on Desertification in Developed Countries: Why Can't We Control It?" in Tucson, Arizona from 24-29 October 1994. Approximately 150 scientists and land managers from 15 countries participated. They heard oral presentations of 35 scientific papers, which focused on: social, economic, political and institutional factors; assessment and monitoring; interventions; remote sensing; and case studies.

Six working groups met simultaneously on the final day to discuss and formulate recommendations on: common indicators; stressors; socio-economic factors; innovative approaches; consistent problems; and the 1997 Symposium. Central themes that emerged included: the impact of government policy; the need for scientists to focus on data integration and investigation of cause and effect; and the importance of community involvement and decision making. The working groups recommended, *inter alia*: decentralizing control over natural resource use and providing more local involvement and control; adopting a participatory approach to management decision making among land managers, agencies, policy makers and scientists, taking into account local community values; giving greater consideration to alternative land uses that are beneficial and sustainable; developing new technologies and products for the restoration, maintenance and improvement of functions and systems in dryland areas and sharing this information worldwide; developing long-term data sets using new technologies to detect trends that can be extrapolated into the future; and organizing a symposium in 1997 focused on connecting science with community action in preventing desertification.

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REPORT OF THE SYMPOSIUM

Participants at the International Symposium and Workshop "Combating Desertification: Connecting Science with Community Action" conducted most of their deliberations in small discussion groups organized around six topics:

- stressors, indicators and processes related to land degradation operating at local to global scales;
- effective techniques for monitoring and assessing desertification;
- lessons learned at the community-level in combating desertification and mitigating the effects of drought;
- socio-economic and human dimensions of desertification and its control;
- linking science to community action through knowledge sharing; and
- regional aspects of desertification.

Three papers were presented on each of the first three topics during an afternoon Plenary on Monday, 12 May. Participants reviewed relevant poster presentations on Tuesday morning, 13 May, and then broke into six groups, two for each topic to allow for smaller group discussion and to facilitate translation into French and Spanish, respectively. All participants reconvened on Wednesday, 14 May, to present their recommendations and discuss them as a whole. This process was repeated on Thursday and Friday, 15-16 May, for the final three topics. The following discussion focuses on these presentations and recommendations. It also summarizes statements made during the opening Plenary and by the keynote speaker, Amb. Robert Ryan, Special Advisor to the CCD Interim Secretariat.

OPENING PLENARY

Beaumont McClure (US), Program Committee Chair, opened the Symposium on Monday morning, 12 May. Denise Meridith, State Director of the Arizona State Office, US Bureau of Land Management (BLM), noted that representatives from over 50 countries would be participating through their attendance or by submitting papers. She discussed the BLM's experience in working with stakeholders on desertification issues and its role in the US' participation in UN desertification agreements. She said the training segment following the workshop would allow participants to witness actions being taken in the southwestern US to combat desertification.

Kenneth Foster (US), President of the Board of Directors, International Arid Lands Consortium (IALC), said the IALC is a partnership between organizations researching methods to combat desertification and is funding over 23 active research projects. Issues being addressed in these projects include land reclamation and use, water quality, information technology and ecosystem processes. IALC also supports the Middle East peace process by sponsoring symposia and joint research on deforestation and salinization.

Amb. Robert Ryan, Special Advisor, CCD Interim Secretariat, spoke on behalf of Amb. Hama Arba Diallo, CCD Executive Secretary. He said the Symposium represents an important milestone in translating the CCD's bottom-up approach into reality.

Arizona Congressman Jim Kolbe noted that desertification is not inevitable. He called on Symposium participants and policy makers to work toward sustainable development and to ensure that human beings and marginal environments live in harmony.

Katinda Komando (Tanzania) spoke on behalf of Amb. Daudi N. Mwakawago, Chair of the Group of 77 and China, who expressed hope that the Symposium's recommendations would serve as valuable inputs to the UN General Assembly Special Session in June and to the first Conference of the Parties to the CCD in October. He reminded participants that the international community agreed at UNCED to treat desertification as a global environmental phenomenon that calls for universal mobilization. He noted the current insufficiency of financial resources and emphasized the need for international cooperation in support of a global mechanism to mobilize new and additional re-

sources to combat desertification. He highlighted the following key challenges for CCD implementation: developing preventative measures for slightly degraded lands and corrective rehabilitation measures for seriously degraded lands; integrating socio-economic development with popular participation; establishing consultation mechanisms to involve all interested parties with a bottom-up approach; and forging new partnerships in national action programmes between actors in agriculture, water development, livestock enterprises, treasury and planning departments, industry and trade, forestry and other actors involved in natural resource management.

Bahman Mansuri, Deputy Assistant to the President, International Fund for Agricultural Development (IFAD), presented a paper entitled "Combating Desertification: Lessons Learned at the Community-Level and their Implications." He highlighted the CCD's role as the first international treaty to squarely address poverty and environmental degradation. It also provides new opportunities for collective action and empowering partnerships for local level action by poor women and men in the drylands. He said IFAD considers desertification to be a product of unsustainable natural resource use and its solution to be the modification of resource use patterns and the integration of conservation into agricultural activities. He said past approaches to resource conservation that excluded resource users failed because they: generated active local opposition; ignored the need for tangible incentives to farmers; and degenerated to an absence of management rather than the expected state management of dryland resources. Externally-supported development designed to initiate independent local processes also failed because they: neglected community dimensions; overemphasized private property and individuals; and depended on exotic material inputs, technologies and institutions. The paradox of governments discussing local community action while simultaneously weakening the ability of communities to effectively manage their natural resources must be reversed. He recommended that governments create enabling policy environments for participatory development based on local materials and techniques within the framework of existing indigenous and common property institutions.

Samuel Nyambi, Director of UNDP's Office to Combat Desertification and Drought (UNSO), stressed that deterioration of land resources is a principle barrier to sustainable livelihoods and is a day-to-day local reality in much of the developing world. He said drylands pose challenges to sustainable development, and identified drought, desertification and desiccation (a process of aridification resulting from dry periods lasting as long as ten years) as problems occurring in African drylands. He stressed that, in light of shifting paradigms, these problems must be disaggregated and understood in order to craft appropriate policies. He noted that a new paradigm is emerging that recognizes the following: many arid rangelands never achieve equilibrium between grazing resources; indigenous pastoral systems are useful; and multi-disciplinary and livelihood-centered approaches that emphasize participation are required. He identified three ways that science could be linked with community action: the use of modern scientific knowledge in a top-down approach, which has prevailed in the past; cooperation between scientists and field technicians, taking into account the needs and interests of drylands populations, which is increasingly being followed; and the approach that should increasingly be employed -- "when bottom-up meets top-down" -- where local pastoralists are recognized as custodians of scientific knowledge and experience and where indigenous knowledge is used as the starting point of scientific action.

Mary K. Seely, Desert Research Foundation of Namibia, addressed the question "Can Science and Community Action Connect to Combat Desertification?" She noted that the transfer and adoption of technology have dominated both scientific and community action efforts in combating desertification. Scientists most often control these efforts and are not fully responsive to connections between science and community action. More recently, the importance of indigenous knowledge has been recognized but is usually seen as a source of knowledge to be taken and used by scientists rather than as an input

into scientific or decision-making processes. She said the possibility exists for science, community action and indigenous knowledge to connect to combat desertification, provided there is full participation and the proper framework conditions. In Namibia, the proper conditions in the policy and planning, environmental and socio-economic frameworks do not exist. She described actions being undertaken by Namibia's Programme to Combat Desertification to alter existing frameworks, including the production and applied use of a report assessing the direct and indirect effects of policies on desertification.

Asim I. El Moghraby, Emeritus Professor of Ecology, Sudanese Environment Conservation Society, introduced the documentary film "The Tale of Almataourat," which provides an example of the impact of desertification on rural communities and the suffering of tribal communities that have been forced to migrate due to desertification. He noted that awareness and sensitivity to the problem of desertification remain low and the film is a vital step toward awareness-raising. Symposium participants viewed the film, which depicted the process of change in Almataourat following the establishment of a water station and a large influx of migrants from drought-stressed areas. Ensuing slash and burn agriculture, fuelwood collection and hunting resulted in mass forest degradation and desertification. A drop in the water supply followed, and the water demands of people and livestock could not be met, causing people who had migrated there to suffer from severe hunger, an extremely poor quality of life and limited income generating opportunities. El Moghraby called on the Symposium to learn from past mistakes and to consider the CCD's impacts on people affected by desertification, such as those represented in the film.

KEYNOTE SPEAKER

John Garamendi, Deputy Secretary, US Department of Interior, acted as the Master of Ceremonies during the Symposium banquet on Tuesday, 14 May. He said the Symposium's work on sharing scientific knowledge is extraordinarily important for the one billion poor people at risk from desertification and famine in the world's drylands. He recognized the Symposium's International Steering Committee and the following financial supporters: IFAD, the German Ministry for Economic Cooperation and Development (GTZ), UNEP and the US Bureau of Land Management.

Amb. Robert Ryan, Special Advisor, CCD Interim Secretariat, and Chair, International Panel of Experts on Desertification (IPED), was the keynote speaker. He updated participants on the contents and current status of the Convention. He highlighted the success of the International Negotiating Committee in agreeing on major issues related to science and technology, including the terms of reference for the Committee on Science and Technology (CST). He said the CST will consist of government experts and maintain a roster of government-nominated experts. Its work programme is expected to include: surveying information-sharing networks; furthering research on benchmarks and indicators; and inventorying local and indigenous technology.

He contrasted the top-down, "technology fix" approach to scientific and technological cooperation with the bottom-up, democratic approach pioneered by the CCD. The outdated "technology fix" paradigm incorporates development assistance projects and technology transfer, including research results and products, through the sale of patents and licenses. This approach fails to put local people in the driver's seat and treats technology as if it were a "secret, fix-all drug" rather than a complex mixture of procedures and practices residing with local people in developing countries and to be shared in the public domain. The CCD's bottom-up approach should give local people the power to decide and the tools to do so. It should also create an enabling environment that makes this possible, especially for women.

He highlighted key CCD provisions related to science, technology and community action that require further support including:

- bottom-up research that is useful and understandable to communities;
- links between scientific research and community needs and living

standards, particularly on benchmarks and indicators;

- unprecedented roles and mediating functions for NGOs to design and implement initiatives relating science to communities;
- integration of socio-economic data with biophysical data at national and local levels;
- capacity-building for developing country research institutes and scientists;
- South-South scientific and technological cooperation, especially related to alternative livelihoods;
- inventories of traditional technological knowledge with the participation of local people and establishment of links to modern technological knowledge; and
- dissemination and extension methods, including participatory rural appraisal, in cooperation with field agents, mediators, rural organizations and NGOs, to connect scientific communities with local communities.

STRESSORS, INDICATORS AND PROCESSES RELATED TO LAND DEGRADATION OPERATING AT LOCAL TO GLOBAL SCALES

PRESENTATIONS: Amrita de Soyza, US Department of Agriculture, presented a paper entitled "Sensitive Indicators of Desertification: Examples of Tests in the Chihuahuan Desert." He defined desertification as a change in the scale of spatial distribution of soil resources, which in the case of the Chihuahuan desert has led to the replacement of grass-dominated rangelands by widely spaced shrublands. Desertification indicators were tested in sites with long-documented histories of management ranging from: livestock enclosures; grazing intensity gradients around livestock watering points; exotic species introduction; and range restoration by bulldozing and herbicides. He proposed the following desertification indicators that could be used in areas with an unknown management history: unvegetated patch size, total vegetative cover, shrub/grass cover, native/exotic species cover, short-lived/long-lived species cover and forage value indices. A bare patch index was found to be sensitive and related to other desertification indicators with the exception of annual and resilient vegetative cover.

Samuel K. Mutiso, University of Nairobi, presented a paper entitled "Towards a More Reliable Socio-economic Technique for Land Degradation Assessment in the Arid and Semi-arid Lands of Africa." He demonstrated how the National Land Degradation, Assessment and Mapping project of Kenya is supplementing ecological indicators with quantified socio-economic indicators and local perceptions and techniques to assess land degradation. Socio-economic indicators of desertification include: human, livestock and wildlife population distributions; human settlements; livestock watering points; income and nutrition levels; vegetative cover; soil erosion; land use; and range utilization. Local perception indicators of desertification developed include: soil productivity; the emergence of secondary vegetation; water table levels; land tenure; and changes in the mobility of natural resource use patterns. He said a major challenge will be to merge socio-economic and ecological indicators to create useful composite indicators and to establish parallels between traditional and scientific knowledge systems.

K. D. Sharma (India), Central Arid Zone Research Institute, shared the results of thirty years of desertification research in Jhodpur, India, with his paper "Hydrological Indicators of Desertification." He stressed the critical role of long-term hydrological indicators in assessing the degree and severity of desertification. Suitable indicators of Indian land degradation include changes in: water sources, areas, flows and salinity; water table levels; sediment loads and deposition in water bodies; and streambank vegetation loss and soil erosion.

DISCUSSION AND RECOMMENDATIONS: The groups considering stressors, indicators and processes related to land degradation were facilitated by Helmut Wohl (Germany), GTZ Desertification

Control Programme, and Walter Whitford, US Environmental Protection Agency. Their objectives were to identify stressors, indicators and processes related to land degradation in dryland areas at the local, national, sub-regional, regional and global levels and to make recommendations as to how they could best be used and assimilated into assessments that provide scientists, policy makers and managers with quality information for combating desertification.

Participants debated issues related to ecosystem functions and hierarchy, landscape structure, thresholds and (non)equilibrium in dryland systems. A distinction was made between stressors and disturbance, the latter being those events that have an evolutionary history of occurrence such as drought or fire. It was noted that interaction between disturbance and stressors can push ecosystems past a threshold to desertification. Stressors discussed included grazing, exotic plant introductions and resource extraction, all of which are linked to the economic realities that limit indigenous and local peoples' options. Indicators of degradation should not describe the endpoint of desertification but should indicate when a dryland is at risk of reaching a threshold of severe degradation. They should be inexpensive and simple.

Using the list of desertification indicators from the 1994 Symposium, biophysical indicators were evaluated in terms of: data availability; usefulness in demonstrating cause and effect; effectiveness in monitoring existing degradation or in early warning; representativeness and relevance to different areas at multiple scales; and data collection cost and interpretation.

It was decided that the best indicators using these criteria were: the presence of nitrogen fixers; cover type and distribution; depth to water table; water quality; the normalized difference vegetation index based on satellite data; and the ratios of native to exotic species and shrub cover to bare patches. Other indicators discussed and requiring further research include: soil surface conditions; soil infiltration and permeability; the presence of soil crusts; and water-holding capacity.

Participants also discussed to what end such indicators are needed, by whom, to make what decisions and the reasons for gaps between science, community action and local resource users. They felt that problems causing this missing link include, *inter alia*: prevailing perceptions of what scientific work is or should be; inappropriate mechanisms for knowledge exchange and dialogue; the "product-orientation" of science; inadequate community involvement in the identification of research needs; the lack of incentives for scientists to work with communities due to funding, academic and time constraints; and insufficient political will.

The following recommendations were intended to address problems of connecting science and community action. Stepwise approaches should be taken to associate communities and resource users from the onset of research programme elaboration, which should be integrated, involve multi-disciplinary teams and provide adequate time and funds for follow-up and dissemination of results. Research should be linked as much as possible to ongoing in-country development initiatives. Institutional links should be established with partner countries and scientific communities. Educational opportunities and incentives should be provided for researchers to further their understanding of local field contexts. Mechanisms for the transfer of research knowledge to communities should be created and strengthened by involving NGOs, community-based organizations and government services. Scientific capacity-building of these institutions should be a component of research proposals. Consultation mechanisms should be instituted to involve researchers in local development planning and national desertification action programmes. A bibliography and literature survey on desertification indicators could be compiled by the University of Arizona and made available to Symposium participants. Participants of the workshop should be linked to the ongoing information-gathering and research of the informal CCD working groups on benchmarks and indicators.

During the Plenary discussion on these recommendations, some participants proposed adding indicators related to distances to fuel-

wood and water sources, energy and biodiversity use and livestock condition and health. One participant called for research into combining indicators and highlighted the difference between local and global indicators. Others participants expressed concern over the lack of discussion and paucity of understanding of human and socio-economic indicators and policy frameworks related to land degradation as well as the ability to operationalize bottom-up approaches with scientists, NGOs and community-based organizations.

EFFECTIVE TECHNIQUES FOR MONITORING AND ASSESSING DESERTIFICATION

PRESENTATIONS: Gabriel del Barrio (Spain), Estacion Experimental de Zonas Aridas, presented a paper entitled "Two Inductive Approaches for Generating Raster Overlays of Input Data to Land Degradation Assessment: Maximum Likelihood and Decision Trees." He described an inductive approach to produce spatially continuous landscape maps. This method includes: assessment of field samples; derivation of a series of predictors; development of a data matrix; query; development of a model; validation by gathering additional samples; and preparation of the final map. He suggested that this approach is suitable for assessing large or remote areas.

Christo Fabricius, International Institute for Environment and Development, addressed the issue of "Land Use and Biodiversity in Xeric Succulent Thickets: Policy Implications for Fragile Ecosystems." The study examines an area of the Eastern Cape of South Africa and finds a positive correlation between small bushclumps and lower numbers of species per clump and a negative correlation between terrestrial reptile abundance and bushclump size. The study concludes that, *inter alia*: processes at the landscape level have impacts at the community and population levels; any single form of land management conserves only a subset of species; and land degradation led to landscape simplification, a harsher environment, more severe species interactions and a smaller variety of micro-climatic conditions. He proposed that land use policies: promote farming practices that sustain low stocking rates; maintain and increase protected area networks; ameliorate the effects of historical social engineering policies; promote a diversity of land ownership; and accept that conservation and land use are two sides of the same coin.

Mike Pellant, US Bureau of Land Management's Idaho State Office, discussed "A Qualitative Procedure to Assess Rangeland Health Degradation." He described a low-tech technique to assess rangeland health using qualitative indicators. The assessment examines physical and biotic characteristics, including: the amount of cover and lack thereof; the existence of rills and gullies; indications of soil movements; pedestals due to erosion around plant roots; evidence of wind erosion; soil crusting; lifemorph diversity; the presence of exotic plants; the length of the photosynthesis period; plant vigor; and the presence of nitrogen-fixing plants. Reference areas are used for comparison in determining the level of degradation. This qualitative approach places these desertification indicators on a continuum and bases its assessments on empirical observation.

DISCUSSION AND RECOMMENDATIONS: The two groups considering effective techniques for monitoring and assessing desertification were facilitated by William Kepner and David Mouat, both with the US Environmental Protection Agency. Their objectives were to identify effective techniques for monitoring and assessing desertification and to make recommendations on how they can be made available to other scientists, policy makers and managers in all regions.

Participants identified a number of obstacles and important considerations for effective techniques and making them available. One obstacle was the absence of an interdisciplinary approach between the natural and social sciences. The lack of an integrated approach presents another obstacle, and extends to questions of project formulation, funding, participatory processes, long-term political commitment to monitoring and making the results known to decision-makers and local communities. Technological capability, including costs compared to available resources, complexity of and access to available

technology and the transfer of information, also presents constraints. Spatial and temporal variability, as they relate to a study's scale and the technique used, are issues that require attention. Selection of indicators and measures that are appropriate and relate to the process and function examined were identified as possible obstacles, as were data availability and its uniformity. Proper or appropriate identification of the problem was discussed as an obstacle to monitoring and assessing desertification.

The groups identified possible solutions and recommendations, calling for support for:

- interdisciplinary research design and peer review;
- long-term monitoring;
- establishing regional information networks with some standardized format and content;
- developing technological capacity (including training) in less developed countries and more low-tech, qualitative methodologies for use on smaller scales;
- training communities to recognize desertification;
- defining indicators for multi-scale assessments;
- developing cross-scaling linkages;
- encouraging research across national boundaries;
- encouraging local-level technology, mapping and evaluation;
- minimizing follow-up costs;
- using robust measures that reflect the behavior of the indicator;
- selecting user-friendly indicators;
- employing predictive modeling linked with ecosystem processes and functions;
- using remote sensing to determine areas of data needs;
- using local knowledge as a data source;
- conducting risk assessment through predictive modeling;
- developing information for the target audience;
- providing relevant education at all levels;
- evaluating causes of the changes that are monitored; and
- identifying the stakeholders and listening to them regarding problem identification and solutions.

A framework was developed for monitoring and assessing desertification. The steps include: identifying the problem and stakeholders; developing the question to be answered; identifying the appropriate scale to address the question; determining the appropriate indicators and how to measure them with the given technology; identifying the costs and resources and who will do the work; evaluating the results; assessing the implications for society and the ecosystem; designing a solution and implementing it; gathering feedback information; and evaluating the process.

During the Plenary discussion following the groups' reports, one participant asked how local stakeholders are to assume a greater role in defining how this process works. He stressed the need for a new framework where communities are enabled to take the lead. Another participant noted that the CCD clearly identifies the stakeholders. One proposed the preparation of a reference guide on monitoring and assessing techniques that have proven to be effective. Samuel Nyambi, UNSO, called participants' attention to related CCD projects, including an inventory of networks of institutions working on desertification issues, an upcoming experts meeting on monitoring and assessment, and efforts to achieve a new level of advocacy for and awareness of drylands issues.

LESSONS LEARNED AT THE COMMUNITY LEVEL IN COMBATING DESERTIFICATION AND MITIGATING THE EFFECTS OF DROUGHT

PRESENTATIONS: Alejandro E. Castellanos (Mexico), Centro de Investigaciones Científicas y Tecnológicas de la Universidad de Sonora, presented a case study on the "Effects of Land Use Cover Changes and Buffel Grass Spread Within Desert Plant Communities in

Central Sonora, Mexico." The study focused on the biological aspects of desertification and addressed the role of biodiversity in land use cover changes and in desertification. It examined the distribution and concentration of species and revealed a rapid rate of land conversion to buffel grass, which was considered a productive alternative for an arid region and was spread with the aim of increasing productivity. He stressed, however, that efforts to combat desertification should not be exclusively productivity-oriented but must also be process-oriented. The introduction of buffel grass did not take into account the effects on other plant species. In introducing exotic species, the processes to be affected must be considered, as should the effects on vegetation and the regional climate.

Scott Lewis (US), US Peace Corps Office of Training and Program Support, and Sadio Diarra (Mauritania), US Peace Corps-Environment and Agriculture, discussed "Combating Desertification at the Community Level: Lessons Learned from the Sahel by the Peace Corps." Lewis provided an overview of the Peace Corps' environmental projects in the West African Sahel, which include agriculture and agroforestry, natural resource management and environmental education. He described early efforts to combat desertification by assisting communities to establish tree nurseries, plant woodlots and stabilize sand dunes. He said the Peace Corps has learned important lessons from its activities in the Sahel, for example: a multi-sectoral approach building on indigenous knowledge is the most effective approach; women must be involved in all levels of project design, implementation and management; participation at the grassroots level is crucial; and sustainable solutions to desertification will only be achievable with a long-term commitment to environmental education, targeted particularly toward youth. Diarra described Peace Corps projects in Mauritania, which seek to improve income generation and natural resource management. He outlined, *inter alia*, forestry and agroforestry projects, installation of water pumps appropriate for community use, tree planting and fence-building. He highlighted the effectiveness of long-term projects and close cooperation with women and identified organizing communities for action as a particular challenge.

Salah A. Tahoun (Egypt), University of El-Zagazig, Cairo, presented "The Qasr Rural Development Project (QRDP): An Egyptian-German Project to Combat Desertification." He described the approach of the QRDP as working with and for the people to create a model to improve living conditions along the northwest coast of Egypt. He highlighted the positive results of the project, including: the improvement in the economic well-being of the people; the enhancement of local agencies' ability to apply a multi-disciplinary approach to land and water resource management; and the implementation of preventive measures and rehabilitation processes to combat desertification. He said the QRDP must now resolve two issues: the need to improve rainwater harvesting and to consider the sustainability of the project once external funding is no longer available.

DISCUSSION AND RECOMMENDATIONS: The two groups considering lessons learned at the community level were facilitated by Mary K. Seely, Desert Research Foundation of Namibia, and Charles Hutchinson, Office of Arid Lands Studies and University of Arizona Remote Sensing Center. The objective of these groups was to identify examples of good natural resource management at the community level in combating desertification and mitigating the effects of drought and to make recommendations for sharing these and other lessons learned with others facing similar circumstances.

The groups identified several obstacles impeding the fulfillment of these objectives, including difficulties in: identifying and using appropriate criteria to measure success; sustaining local participation and project continuation when external funding runs out; taking pilot-level projects further; defining "community;" integrating ecological with socio-economic sustainability; understanding and translating technical scientific language for local communities; and understanding local existing knowledge. Differing cultural perspectives, land ownership patterns, women's rights, government inefficiency, information dissemination and the lack of frameworks and mechanisms to work together were also highlighted as problematic.

Other problems identified during group discussions emphasized that: communities are dynamic and complex; many scientific organizations take short-term approaches and have limited time frames; projects often do not first seek to understand the needs of the community; there are differences between science and management regarding sound natural resource management; information on stakeholders' values is lacking; processes for information transfer are incomplete; goals shift; and scientific peer pressure to publish and meet funding goals may inhibit connection with community action.

Participants formulated several recommendations. Regarding science and technology, they recommended that discussion, implementation and selection of appropriate action and research designs include both indigenous and scientific knowledge, and that sharing and communicating results include open two-way discussions and time to understand and communicate the dynamics. On the social and cultural front, they recommended recognizing the need for community participation and the existence of social and cultural differences and developing appropriate and feasible strategies, methods and tools to promote optimal community participation. The need for an enabling framework that provides all necessary stakeholders with mechanisms and tools to participate equitably and effectively in sustainable, community-driven natural resource management was emphasized.

The following concepts were recommended to provide general guidance: there is no "cookbook" or general formula that will apply to all circumstances; communities are complex and include a number of constituencies defined by livelihood systems, economic class and gender, and each of their needs and aspirations must be considered; all subsidies should be questioned; initiative and guidance must come from the community and/or those affected at the local level; all relevant disciplines (agriculture, resource management, economics and social sciences) must be involved; education is a two-way process through which scientists and communities must learn from each other; and alternative income sources should be developed.

The groups also recommended:

- defining the community to be addressed and the issues that are perceived to confront it;
- empowering the community to make decisions regarding development;
- using participatory techniques such as participatory or rapid rural appraisal to engage the community in establishing goals, objectives, priorities and measures of success for monitoring and evaluation;
- identifying problems, resource availability, the people involved and the specific area affected;
- building on indigenous knowledge and traditional concepts of management;
- legitimizing and/or building local and community-based organizations;
- creating an enabling environment at each level of administration to encourage and support local initiatives; and
- using NGOs as facilitators.

It was recommended that activities be analyzed and evaluated by: making costs and benefits of recommendations explicit and compelling to stakeholders at all levels; taking account of natural resource degradation in cost-benefit analyses; explaining costs and benefits over time; and clearly identifying beneficiaries -- society as well as the individual and the community.

Participants commented on these recommendations following their presentation in Plenary. One noted that the need for projects to be locally based is becoming a truism, but if taken literally it raises a number of difficulties. He stressed that outsiders can catalyze community-driven initiatives to follow a bottom-up approach, and techniques such as participatory appraisals work well at local levels. The challenge is to identify how such techniques can be up-scaled to facilitate aggregate conclusions at larger scales. Another participant stressed the

need for methods to determine and validate the credibility of local communities and assess their capacity to manage their land. It was also highlighted that the lack of organization and the breakdown of culture in many communities are serious impediments that must be addressed and reversed before communities can successfully initiate and carry out projects.

SOCIO-ECONOMIC AND HUMAN DIMENSIONS OF DESERTIFICATION AND ITS CONTROL

PRESENTATIONS: Rita Ndidi Hedo (Nigeria), University of Ibadan, discussed "Women and Land Degradation in Southeastern Nigeria: Consequences and Adjustment Patterns." This study of 500 women in southeastern Nigeria found that the degradation of land exerts pressure on women by increasing their workload and impinging on their health. Women have made efforts to control land degradation, but time constraints and the lack of land ownership, alternative sources of livelihood and incentives hamper their efforts. She recommended, *inter alia*: legal reforms and enforcement; improved access for women to education and health care services; environmental education; improved access to technology, including labor and energy saving devices; and collaborative research on alternative sources of energy.

Tatyana Saiko (Russia), University of Plymouth, United Kingdom, presented a paper on the "Geographical and Socio-economic Dimensions of the Aral Sea Crisis and their Impact on the Potential for Community Action." She said irrigated land dedicated to cotton production has been expanded at the expense of the region's sustainability and the living standard of the local population. Among the outcomes are desertification, the shrinking of the Aral Sea, decreased food self-sufficiency, contamination of water supplies and inadequate sanitation. Health conditions in the region are poor. She said the local population believes it is ignored by the large externally-financed projects that are assisting the region and recommended that projects be based on local knowledge and participation. She also noted that the officials responsible for the increase of cotton production are still in power.

Suzanne Milton (South Africa), Fitzpatrick Institute, University of Cape Town, discussed her efforts on a "Rangeland Health Assessment: A Practical Guide for Ranchers in Arid Shrublands." She said that one socio-economic indicator for land degradation in Karoo, South Africa, is a rapid increase in wealth. The rangeland health assessment guide is designed for use by commercial ranchers with limited knowledge of plants and soil processes. The guide addresses soil formation, cryptogamic crusts, water acquisition and storage by plants, plant population renewal and vegetation change. It instructs ranchers on how to subjectively assess their rangeland's health according to five criteria: vegetation cover; forage value; utilization intensity; plant demography; and soil health and protection. She said such a guide may not address the needs of smaller farmers, and suggested that "land reading" courses be introduced at the primary education level.

DISCUSSION AND RECOMMENDATIONS: One group considered the socio-economic and human dimensions of desertification and its control, and was facilitated by Mike Kirby, US Bureau of Land Management, Mary Seely, Desert Research Foundation of Namibia, and Helmut Wohl (Germany), GTZ Desertification Control Programme in Namibia. The group's objectives were to identify the socio-economic and human dimensions of desertification and its control and to make recommendations for ways to minimize socio-economic impacts and to provide for sustainable development.

The participants grouped their recommendations into the following categories: local economics and alternative livelihoods, policies, indigenous/local knowledge, networking, planning, research, migration, training, population control, governance, poverty, implementation, and appropriate technology.

Policy-related recommendations included a call for each government to implement the provisions of the CCD by establishing a consultative process, raising awareness and elaborating national action programmes in a participatory manner. Participants also suggested that members of civil society mobilize themselves to lobby their govern-

ment with their priorities, constraints and solutions regarding the development of national natural resource management policies. On networking and information sharing, they suggested the initiation and reinforcement of networking between communities, NGOs, community-based organizations, governments, scientists and all concerned parties in exchanging information and best practices through community radio, exchange programmes, the Internet and other mass media. Participants proposed that action programmes for combating desertification be built on local knowledge and cultural specificities.

With regard to planning, governments, with the support of local communities, were called on to promote efficient settlement systems within the framework of local, cultural, regional and national land use plans and to link new housing and settlement policies with national resource management policies. To reduce migration and poverty, the group promoted the use of incentives to help maintain populations or livelihoods in desert-prone areas through income-generating activities such as market gardening, fruit tree planting and local education. Training and education were called for as a part of every programme or activity to combat desertification, particularly at the local level and for women and youth.

To respond to local economic issues, participants recommended drought-coping mechanisms, fodder banks, alternative livelihoods, micro-enterprises, the preservation of seed diversity, education and training on efficient market opportunities, and the availability of appropriate credit systems. It was recommended that research include the impact of policies on desertification, be interdisciplinary and investigate traditional land use. Population control methods recommended included: empowering women; expanding family planning; encouraging women's economic independence; increasing access to birth control; and addressing health issues at all levels, especially at the village level. The establishment of village-level environmental and health resource centers was supported along with national desertification funds.

Governance-related recommendations extended to: creating policies and incentives to promote participation in land use planning; prioritizing intervention in terms of bare ground production; formalizing programmes for rangeland monitoring and management; facilitating dialogue on drought-coping strategies between and within governments and local populations; developing policies to promote the protection of human rights; and promoting integrated land use. In regard to appropriate technology, participants noted that affected communities should participate in its development and that it should extend to appropriate livestock management, water harvesting and surface/groundwater management.

One participant in the Plenary dialogue following the presentation of these recommendations noted that mechanisms and methodologies to ensure that communities participate in national action programmes are lacking.

LINKING SCIENCE TO COMMUNITY ACTION THROUGH KNOWLEDGE SHARING

PRESENTATIONS: Timm Hoffman (South Africa), National Biodiversity Institute (NBI), discussed "Science, Rural Livelihoods and Natural Resource Management in the Communal Rangelands of Namaqualand." He described NBI's rural development research programme, which collaborates with an NGO and communities in the Lelifontin communal reserves of Namaqualand. Using a range of participatory techniques, the programme's interdisciplinary team of social and natural scientists is investigating the impact of current land use patterns on community livelihoods and natural resource management and asking how these drylands will be able to accommodate future resource use and an expected influx of returning miners. Land degradation on the communal reserve is apparent when compared to a neighboring commercial farm. Ongoing initiatives connecting research knowledge to community action include: livestock monitoring in farmer-recorded stock books; farmer-led establishment of an exhibit at the NBI botanical garden and an environmentally- and culturally-friendly tourist camp; and the creation of a local development fund. He

highlighted lessons learned including: building local-level institutional frameworks rather than technological solutions; strengthening relations between disciplines; and combining interdisciplinary research teams with development agencies. He said the entrepreneurial scientist actually has a narrow role in contextualizing desertification, and links to community action should be expected primarily from local and national governments, NGOs and planning agencies.

Thomas Knoll (Namibia) presented a paper by Albetus S. Kruger (Namibia), National Sustainable Animal and Range Development Programme (SARDEP), entitled "The Negotiation Approach to Closing the Gap between Farmers and Support Organizations in Namibia." As one of the most arid countries in Africa, Namibia is concerned with livestock production and rangeland utilization in its communal areas. Social and land degradation are due to: the decline in local natural resource management leadership and institutions; male rural out-migration; the disappearance of extended families and social safety nets; modern education contributing to labor shortages; and state research and extension service orientation to commercial farmers rather than communal agro-pastoralist households. He described SARDEP's use of the negotiation approach and the four major steps this has entailed. First, the following principles to guide the development process were established: interactive participation, empowerment of target communities, transparency, promotion of self-help, responsibility and accountability, coordination and cooperation, replicability and sustainability. Second, farmers' perceptions of their present situation and hindrances to reach their 5-10 year goals were analyzed. The third step involved farmers' identification of possible solutions, which included: the resettlement of commercial farms to title deed areas; land tenure reform; institution-building on communal lands; improvement of livestock production and marketing; creation of alternatives for capital accumulation, local investment and credit; and alternative income generation to reduce dependence on livestock. Fourth, SARDEP, with communal farmers and NGOs, developed a national strategy conducive to sustainable rangeland utilization and comprised of: land tenure and policy framework reforms; reorientation of agricultural extension support toward communal farmers; and strengthening community-based organizations and their capacity to identify and voice their problems and demands. He noted that the opportunity accorded by such a Symposium to invite community-based organizations and grassroots leaders should not be missed again.

André van Rooyen (South Africa), Agriculture Research Council, discussed "Combating Desertification in the Southern Kalahari: Connecting Science with Community Action in South Africa." He presented the initial outcome of a community-requested research project intended to study the dynamics, develop conceptual models and increase expertise on land degradation and rehabilitation with local farmers in the southern Kalahari. Some of the challenges faced by the project were that: biodiversity loss and desertification may not be rural priorities; Northern donors have unrealistic requirements; the extent to which communities should be involved is unclear; and alternative ecological paradigms about (non)equilibrium can be misused. Positive outcomes of the project include: collaborative research with community members, including women; linking commercial and communal farmers to each other and to researchers; and developing alternative forms of land use, such as game ranching and ecotourism. He stressed that: desertified rangelands can be used for other purposes while they are being restored; combating desertification should be considered to be a multi-disciplinary challenge; all stakeholders should be included at equal levels; no discrimination should be made based on education or literacy levels; trust, ownership and responsibility should be fostered; and where decisions have potential impacts on community lives, scientists should provide information and risk assessments but never make decisions for them.

DISCUSSION AND RECOMMENDATIONS: The objectives of the groups on linking science to community action through knowledge sharing were to identify effective methods for knowledge sharing and to make recommendations as to how these methods can be shared with and used by others, including individuals, government agencies,

NGOs and academics. William Kepner, US Environmental Protection Agency, and Charles F. Hutchinson, Office of Arid Lands Studies and the University of Arizona Remote Sensing Center, facilitated two groups that also focused on discussing obstacles to information sharing and possible solutions. Participants collectively noted that communication from scientists to other actors is insufficient and that communication needs to be improved between all actors and in all directions.

Participants identified effective knowledge sharing methods, including: environmental education; field and training courses; public forums between governments, NGOs and research advisory councils; simple qualitative desertification assessment techniques; and accessible publications, such as popular books, pamphlets, brochures, handbooks, fact-sheets, posters and Internet web sites.

Participants categorized obstacles preventing knowledge exchange. Those related to cultural and language barriers include: conflicting goals and paradigms; differences in social status, position and control of information; incompatibilities between vernacular languages, dialects and scientific jargon; weak informal information exchange networks; misunderstanding and lack of recognition of available local knowledge; and inadequate mechanisms for exchange between foreign scientists and host country institutions. Attitudes considered to be barriers included: personal biases, mistrust, fear, disrespect, resistance to change and unwillingness to relinquish power. Problems related to methodology and approach were identified as: failure to listen and identify common tools and questions; research irrelevance to local desertification contexts and constraints; unrealistic expectations of collaboration; inadequate efforts to formally understand local knowledge and to localize environmental education; and the scientific process being input- rather than demand-driven. Physical and technical barriers discussed included: large physical distances; mismatched information technologies; and technology interests being placed before people interests. Organizational constraints limiting knowledge sharing were also identified, such as: intellectual and territorial turf battles; unequal partnerships and institutions; weak local research infrastructure; dysfunctional extension services; weak links between research and extension; the absence of local forums and repositories for scientific results; and lack of project follow-up at all levels.

The groups offered some simple recommendations to improve information sharing about desertification:

- support citizens as local group leaders and third party intermediaries such as extension agents, NGOs or community-based organizations;
- involve alternative communication media such as pictures, local radio or television;
- translate technical language and include literacy/numeracy programs for scientific exchanges;
- publish extension and scientific materials in vernacular languages;
- integrate social and natural science research;
- involve communities in research needs assessment;
- organize participatory outreach workshops, farmer-farmer and scientist-farmer exchanges and field trips;
- organize participatory outreach and exit workshops to design, present and follow-up on research;
- collaborate to craft creative solutions rather than to seek consensus or compromise;
- put indigenous knowledge into scientific formalized structures and vice versa;
- return research results to communities for evaluation;
- establish local inter-sectoral working groups;
- hold local science/community fairs to exchange perceptions;
- elevate local priorities to national agendas;
- establish local, national and regional information sharing and resource centers and networks to share value-added environmental

information and locally meaningful and interpreted desertification data; and

- link these centers and other recommendations to the deliberations of national desertification committees and as part of national action programmes.

During the Plenary discussion, one participant added that policies formulated with short time horizons are often done so without input from scientists and communities. She suggested that a solution to this problem would require more effort on the part of researchers to involve policy makers.

REGIONAL ASPECTS OF DESERTIFICATION

PRESENTATIONS: Juan Puigdefábregas (Spain), Consejo Superior de Investigaciones Científicas, presented "Perspectives on Desertification: Western Mediterranean." He described historical changes in the region's vegetation and the present situation of increasing areas covered by shrublands. The evolution of western Mediterranean landscapes has been triggered by large disturbances, including human activity. The area of irrigated land has increased since the 1970s, causing a lowering of water tables and the consequent destruction of wetlands, soil salinization and sand encroachment. Climatic variability and demographic changes are the driving forces of desertification in the region.

Ed Fredrickson, US Department of Agriculture-Agricultural Research Service, presented "Perspectives on Desertification: Southwestern United States." He reviewed vegetation changes in the southwestern US over time, particularly the transition from coniferous woodlands to grasslands and ultimately to the desert scrublands present today. He described the evolution in land use, in particular the livestock boom of the late 19th century, which had destructive impacts on the land and its productivity. In response, the government took a more active role in managing the land and established forest reserves and research areas to protect land and study the effects of grazing. However, despite improved land management, desertification processes continue. He outlined the current polarized debate, largely between ranchers and environmentalists, over how best to use drylands. He stressed the need for scientific action and solutions, as well as the need to involve and educate the public to better understand the dynamic nature of their environment and to lessen the human influence on desertification processes.

Anton Imeson (Netherlands), Universiteit Van Amsterdam, discussed "Concepts and Real Issues of Desertification and Remediation in the Mediterranean and the Southwestern US: Transcending Local Values Through a Focus on Ecological Functions." He noted that desertification is perceived to be a problem in both the Mediterranean and the southwestern US, but perceptions of desertification are based on widely disparate concepts. The invasion of grass is perceived as problematic in Europe but as advantageous in the US. He stressed that, in developing remediation approaches, the objectives must be clearly defined and the criteria to be used must be developed independently of preconceived notions of "ideal" or "historic" vegetation. These criteria should be based on the relative capacity of the current system to perform specific functions. It must also be recognized that the human population is placing intense pressure on the land and that desertification is a larger issue involving the way humans organize their economic systems, both locally and globally. The definition of desertification must explicitly recognize that processes are at issue rather than changes in ecosystem states. He stressed the need for more work towards defining sustainable land use.

Salah El-Zoghby (Egypt), Desert Research Center, presented a study on "Sustainable Planning for Land Reclamation Projects: A Prerequisite for Combating Desertification." He said increasing pressures on land in Egypt require management of the natural resource base in arid and semi-arid areas, and will be facilitated by comprehensive planning for sustainable desert farming systems in land reclamation projects. The aim of his study is to achieve a balance in population lo-

cation, water resources and cropping patterns between the Nile Delta and valley and newly reclaimed areas.

DISCUSSION AND RECOMMENDATIONS: One group considered regional aspects of desertification, which was co-facilitated by Jeff Herrick, US Department of Agriculture-Agricultural Research Service, and David Mouat, US Environmental Protection Agency. The group decided they should identify the issues or problems affecting or resulting from land degradation, identify ecological and geomorphological processes driving desertification that are common to two or more regions, and make recommendations as to how these issues, factors or problems can be resolved. They agreed that both physical (ecological, climatic and geomorphological) and socio-economic factors and processes should be considered.

The group identified a number of obstacles hindering the achievement of these objectives, including: government subsidization of economic activities; overuse of fragile systems; climatic variability; anti-science attitudes; population pressures; imposition of unsuitable external technologies; exploitation of resources by outside interests; use of top-down approaches for problem-solving; inadequate reliance on science by government agencies; fear of change; invasions of exotic species; water use issues; and productivity issues (ways of interpreting productivity and desertification).

The group formulated solutions to overcome these obstacles:

- establishing regional research facilities to study climate change, water use and demographics;
- assisting developing countries in building capacity at local levels;
- changing methods for transferring technology;
- implementing "local science;"
- keeping resources at the local level;
- increasing economic complexity, e.g., by adding value to local products;
- distinguishing between "fossil" and "active" desertification;
- identifying and reducing stressors; and
- developing conceptual frameworks (system components) of desertification that would include driving forces, structural components and boundary conditions.

Other solutions included: education and family planning; educating scientists on local issues and "bridging science and reality;" integrating biophysical and socio-economic policy programmes; developing risk assessment and risk management strategies; identifying system threshold trajectories; and determining the "possibility space" for given systems to move from one state to another. The group also proposed involvement in UN policy making as a solution. They agreed that solutions to overcome issues and impediments are not to be found but are system-dependent.

The group consolidated these solutions into six recommendations:

- It is imperative to recognize that the impacts and consequences of desertification differ in developed countries and developing countries.
- Measures to overcome "issues" are not to be imposed from the outside but rather to be found within the system, accounting for the system's biophysical and socio-economic nature.
- The roles of stakeholders operate at four levels: local actions, policy actions, scientific actions and conceptual frameworks.
- Policies must consider prevention of desertification.
- A network of existing research and educational facilities should be established to transfer effective, inexpensive and appropriate technology, identify gaps and improve the global network, for example by creating a global mailing list.
- Desertification information should be standardized and common language should be used.

A number of comments were made on the recommendation regarding differing impacts and consequences of desertification in de-

veloped and developing countries. One participant observed that the primary difference is that in developing countries, particularly in Africa, people's lives are often dependent on the resources of drylands and the impacts of desertification can be life-threatening, whereas in developed countries, people can easily emigrate from deserts or rural areas. It was suggested that the recommendation specify that it is socio-economic impacts that differ. Another participant noted that people in developed countries often do not even know what desertification is, but in Africa, everyone is acutely aware of the problem.

CLOSING REMARKS

Following the presentation of recommendations, the Symposium Chair Beaumont McClure delivered a brief closing speech. He informed participants of the three methods to be used to disseminate information about the Symposium's proceedings: the publication of this Sustainable Developments report and its distribution via e-mail and a World Wide Web site (at http://www.iisd.ca/linkages/sd/sd_csd.html); a more detailed report of the Symposium's recommendations to be available during summer 1997; and a peer-reviewed collection of Symposium papers to be published in a special edition of the Journal of Arid Land Environments in 1998. He appealed to participants to share what they had learned at the Symposium with at least one colleague in order to spread the word about the rich discussions and progress made in bridging the gap between science and community action to combat desertification.

A BRIEF ANALYSIS OF THE SYMPOSIUM

The International Symposium's themes of dryland degradation, science and community action were welcomed by participants as important and timely and will undoubtedly activate thinking at a time when the UN Convention to Combat Desertification (CCD) has just entered into force and is preparing for its first Conference of Parties. The CCD's unique emphasis on bottom-up approaches and scientific cooperation were the driving force behind this symposium, whose contribution to further raising the profile and recognition of dryland issues was commended by participants. The 1997 Symposium linked participants that attended the 1994 Symposium and newcomers into a larger informal network of researchers from universities, government institutes, aid agencies and a few NGOs working on land degradation in over 30 countries.

By bringing together natural scientists, the Symposium's deliberations will likely enrich CCD debates on arid land agriculture and development with concerns pertaining to ecological parameters, such as ecosystem functions and biodiversity. During the Symposium, complexities surfaced regarding divergent paradigms of ecosystem change, proposals for alternative dryland use and distinctions to be made between stressors, endpoints, threshold indicators and subtle day-to-day degradation processes, demonstrating that the "science" of desertification is far from complete. At times, even the definitions of "desertification" and "community" were subject to different interpretations by participants. Discussions revealed that dryland ecology and operational mechanisms to merge science with informal local knowledge require further exploration.

The contributions of the policy makers and social scientists present were calls for developing socio-economic and policy indicators of desertification and even more calls for linking science to communities through participatory, action-oriented research and development. Amb. Ryan's contrasting of the "technology fix" paradigm to the bottom-up approach espoused by the CCD captured this concept. Several Symposium participants emphasized the need for a paradigm shift by exploring existing obstacles and initiating debate about what such a shift would entail. It proved difficult, however, for the Symposium to clarify precisely what actions and institutional frameworks would be needed to make bottom-up approaches a reality. Many commented that the greatest accomplishment of the Symposium was that participants were able to begin to learn from each other's experience and approaches to dryland management. The impact of this

learning process will be magnified if all participants respond to the Symposium Chair's challenge to tell at least one colleague about the lessons they learned.

For some, the important roles that the CCD and the Symposium ascribe to scientists in connecting their science with community action may not be the right question to address. The point, some suggested, is rather to address socio-economic factors causing land degradation and to focus on issues of governance, institutions and appropriate policy frameworks and roles for national and local governments and civil society in dryland management. While many of the recommendations formulated by the groups emphasized the importance of sensitizing scientists to local concerns and traditional knowledge and practices, it became apparent in many instances that this was problematic. Scientists are often not aware of or focused on policy-level efforts and initiatives to address desertification, nor do they necessarily think it is the scientists' place to take on the task of communicating and consulting with communities. This revealed the considerable gaps between science, policy and community action. The recommendation for NGOs to serve as mediators between scientists, policy makers and communities in this regard provided a tangible and constructive recommendation for how to connect science with community action.

Relative to other environmental issues being considered at the intergovernmental level, desertification has received disproportionately less attention from scientists, political officials and the public. The 1994 and 1997 symposia have contributed to increasing the awareness of desertification by bringing together policy makers, scientists and, to a lesser degree, representatives of communities affected by desertification, to inform each other and the wider international community that there is a considerable level of interest and activity on the problem. Although the recommendations may not be ground-breaking or explicitly operational, they reflect an awareness of the complexities driving land degradation and a recognition that much remains to be learned, paradigms need to be shifted, thinking must be reoriented, action must be taken in a more collaborative manner, and the dialogue must be opened to voices emanating from local communities.

THINGS TO LOOK FOR

FOLLOW-UP TO THE 1997 SYMPOSIUM: This issue of Sustainable Developments provides a summary of the meeting and is available on the World Wide Web at: http://www.iisd.ca/linkages/sd/sd_csd.html. For more information on Symposium participants, abstracts, papers, recommendations and other follow-up, contact: Beaumont McClure, Special Assistant for International Programs, US Bureau of Land Management, 222 N. Central Avenue, Phoenix, AZ, US, 85004; tel: +1 (602) 417-9430; fax: +1 (602) 417-9398; e-mail: bmclure@az.blm.gov.

SECOND AFRO-ASIAN EXPERT MEETING ON THE IMPLEMENTATION OF THE CCD: Niger will host a meeting on implementing the CCD in Niamey, Niger, from 27-30 May 1997, for African and Asian experts. For information contact: Harouna Oumarou, Conseiller, Secrétariat Exécutif du CNEDD, P.O. Box 578, Niamey, Niger; tel: +227 72-25-59/72-31-89; fax: +227 73-58-59.

CHANGING WATER REGIMES IN DRYLANDS: The Desert Research Institute and the Center for Environmental Sciences and Engineering of the University of Nevada, Reno, will host this conference from 9-13 June 1997 in Tahoe City, California, USA. For information contact: Nicholas Lancaster; tel: +1 (702) 673-7304; fax: +1 (702) 674-7557; e-mail: nick@maxey.dri.edu. Also see the conference's World Wide Web site at: <http://www.sage.dri.edu/Conferences/>.

INTER-REGIONAL DESERTIFICATION CONFERENCE OF THE COMMONWEALTH OF INDEPENDENT STATES: The Commonwealth of Independent States will host an inter-regional conference in Tashkent, Uzbekistan, in August 1997, to develop a sub-regional desertification action programme. For information contact: Anatoli Ovchinnikov, Deputy, Hydrometeorology at the Cabinet of Ministers, 72 St., Tashkent, Uzbekistan; tel: +737(12)35-69-56; fax: +737(12)33-20-25 / 33-20-50.

INTERNATIONAL WORKSHOP ON SEVERE DEGRADATION AND DESERTIFICATION OF RANGELANDS: Iceland will host this workshop from 16-19 September 1997, in Reykjavik, Iceland. For information contact: Olafur Arnalds, Department of Environmental Research, Agricultural Research Institute, Keldnaholt IS-112, Reykjavik, Iceland; tel: +354-577-1010; fax: +354-577-1020; e-mail: ola@rala.is.

CONVENTION TO COMBAT DESERTIFICATION: The resumed session of INCD-10 is scheduled from 18-22 August 1997 in Geneva. COP-1 is scheduled for 29 September-10 October 1997 in Rome. For information contact: CCD Secretariat, Geneva Executive Center, 11/13 Chemin des Anémones, CH-1219 Châtelaine, Geneva, Switzerland; tel: +41 (22)979-9419; fax: +41(22)979-9030/31; e-mail: secretariat@uncdd.ch. Also see the INCD World Wide Web site at <http://www.uncdd.ch/>.

INTERNATIONAL FORUM OF MAYORS ON DESERTIFICATION AND URBANIZATION: The City of Rome and the CCD Secretariat are hosting meetings in Rome, Italy, in October 1997 concurrently with COP-1 to discuss strategies for decentralized cooperation in implementing the CCD in cities. For information contact: N. Mattana, CCD Secretariat, Geneva Executive Center, 11/13 Chemin des Anémones, CH-1219 Châtelaine, Geneva, Switzerland; tel: +41(22)979-9419; fax: +41 (22)979-9030/31; e-mail: nmattana@uncdd.ch.

NGO FORUM ON EMPOWERING LOCAL COMMUNITIES AND INSTITUTIONS FOR SUSTAINABLE DRYLAND DEVELOPMENT: The International NGO Network on Desertification (RIOD) will facilitate an NGO Forum in Rome, Italy, from 29 September-10 October 1997 to bring together NGOs during a parallel event to CCD COP-1. For information contact: Baudouine Kamatari, Global Focal Point of RIO, Environmental Liaison Centre International (ELCI), P.O. Box 72461, Nairobi, Kenya; tel: +254 (2)56-20-15 / 56-04-76; fax: +254 (2)56-21-75; e-mail: bkamatari@elci.sasa.unep.no or bkamatari@elci.gn.apc.org.

The International Symposium and Workshop "Combating Desertification: Connecting Science with Community Action" was sponsored by:

US Department of the Interior, Bureau of Land Management and the International Arid Lands Consortium

in collaboration with

The University of Arizona
US Department of Agriculture - Agriculture Research Service
US Environmental Protection Agency
Centro de Investigaciones Sobre Desertificación

It was supported by

International Fund for Agricultural Development
Bureau of Land Management National Applied Resource Sciences Center
US Agency for International Development
United Nations Environment Programme
Ministry for Economic Cooperation and Development-Germany/GTZ

Interim Secretariat, UN Convention to Combat Desertification
European Society for Soil Conservation