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**Report on the international workshop on climate and land degradation**

**Abridged report on the international workshop on  
climate and land degradation**

**Note by the secretariat\***

*Summary*

At an international workshop on climate and land degradation in Arusha, United Republic of Tanzania, in December 2006, experts in the area of climate and land degradation noted that trends in land degradation are assessed differently in various parts of the world. The increasing occurrence of climate extremes (for example heat waves, droughts, heavy precipitation) is having an impact on land degradation processes, including floods, mass movements, soil erosion by water and wind and salination in all parts of the globe. Climate variability, climate change and land degradation are intimately linked and are generating unexpected effects, for example, an increased occurrence of weather conditions that are suitable for a fire to start or to propagate in the wild (fire-weather conditions) in large parts of the globe. In order to combat land degradation, bottom-up and top-down participatory management approaches that foster income-generating activities are required.

\* The submission of this document was delayed due to the short time available between the fifth session of the Committee for the Review of the Implementation of the Convention and the eighth session of the Conference of the Parties.

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## I. Introduction

1. By its decision 20/COP.7, the Conference of Parties welcomed the offer of the World Meteorological Organization (WMO) to organize and find the necessary funding for an international workshop on climate and land degradation in 2006 to mark the International Year of Desert and Desertification (IYDD). The COP invited the Committee on Science and Technology (CST) to assist the WMO in bringing together experts for the workshop, and to present the results of the workshop to the COP at its eighth session.

2. WMO and the secretariat of the United Nations Convention to Combat Desertification (UNCCD) organized the workshop in Arusha, United Republic of Tanzania, from 11 to 15 December 2006. The workshop brought together experts on climate and land degradation who presented state-of-the-art papers, real world applications and innovative techniques for combating land degradation, and offered recommendations for effectively using weather and climate information for sustainable land management practices. The co-sponsors of the workshop, together with WMO, UNCCD, and the Tanzania Meteorological Agency, were the OPEC (Organization of the Petroleum Exporting Countries) Fund for International Development (OFID), the United Nations Development Programme (UNDP) and the United Nations Educational, Scientific and Cultural Organization (UNESCO). Sixty-four participants from 30 countries and five United Nations agencies (WMO, UNCCD, the Food and Agriculture Organization of the United Nations (FAO), UNDP and the United Nations Environment Programme (UNEP)) participated in the workshop. The workshop focused on how climate induces and influences land degradation and what measures need to be taken to enhance the application of weather and climate information to combat land degradation.

3. The impact of land degradation on global food security and the quality of the environment is of major importance and concern when one considers that only about 11 per cent of the global land surface can be considered as prime land, and that this must provide food for the 6 billion people today and the 8.2 billion expected in the year 2020. Long-term food productivity is threatened by soil degradation, which is now severe enough to reduce yields on about 16 per cent of the agricultural land, especially cropland in Africa and Central America and pastures in Africa. The highest rate of land degradation is seen in sub-Saharan Africa, where the livelihoods of the inhabitants of the dryland areas are constantly under threat. It is estimated that productivity of cropping land in sub-Saharan Africa declines by 0.5–1 per cent annually, suggesting a productivity loss of at least 20 per cent over the past 40 years.

4. Sustainable development of countries affected by drought and desertification can only come about through concerted efforts based on a sound understanding of the different factors that contribute to land degradation around the world. Climatic variations are recognized as one of the major factors contributing to land degradation, as defined in the Convention, and it is important that greater attention be paid to understanding the role of different climatic factors in land degradation. For example, development and adoption of sustainable land management practices is one of the major solutions to combat land degradation over the vast drylands around the world, but to accurately assess sustainable land management practices, the climate resources and the risk of climate-related or induced natural disasters in a region must be known. Many affected countries that are Parties to the Convention have elaborated their national action programmes (NAPs) to combat desertification, and are now in the process of implementing

them. The Conference of the Parties (COP) has called for information and advice on scientific and technological matters relating to combating desertification, with a view to supporting the effective implementation of the NAPs. Only when climate resources are paired with potential management or development practices can the land degradation potential be assessed and appropriate mitigation technologies developed. Climate information must be applied in developing sustainable practices as climatic variation is one of the major factors contributing to, or even acting as a trigger to, land degradation. There is a clear need to consider carefully how climate induces and influences land degradation.

5. WMO contributes to understanding the interactions between climate and land degradation through dedicated observations of the climate system; improvements in the application of agrometeorological methods and the proper assessment and management of water resources; advances in climate science and prediction; and promotion of capacity-building in the application of meteorological and hydrological data and information in drought preparedness and management. However, much more needs to be done and to promote further interest and research in this topic.

6. At its 58th ordinary session, the General Assembly declared 2006 as the International Year of Deserts and Desertification (IYDD). In doing so, the General Assembly underlined its deep concern for the exacerbation of desertification, particularly in Africa, and noted its far-reaching implications for the implementation of the Millennium Development Goals (MDGs) that must be met by 2015. The IYDD presents a golden opportunity to get the message across strongly and effectively that desertification is a global problem that we ignore at our peril. It also provides an impulse to strengthen the visibility and importance of the drylands issue on the international environmental agenda, while providing a timely reminder to the international community of the immense challenges that still lie ahead. The international workshop on climate and land degradation was held in the spirit of implementation of IYDD.

7. The specific objectives of the workshop were:

(a) To survey the status of, and summarize information on, trends in land degradation at national and regional levels;

(b) To review and assess the extent to which weather and climate data and information are currently used at national and regional levels in order to adequately monitor and assess land degradation and to develop sustainable land management practices to combat land degradation;

(c) To provide recommendations on appropriate strategies for reducing land degradation through more effective use of weather and climate information and applications;

(d) To assess the historical loss of terrestrial carbon pools due to land degradation, and estimate the potential of carbon sequestration in soil/terrestrial ecosystems through soil restoration and desertification control;

(e) To assess the feasibility of restoring degraded/desertified lands with a view to achieving food security in the affected developing countries;

(f) To document case studies of successful measures to manage land use, protect land and mitigate land degradation;

(g) To suggest ways and means of improving the implementation of NAPs through the effective use of early warning.

8. Dr. Mohamed Mhita, Director-General of the Tanzania Meteorological Agency and Permanent Representative of the United Republic of Tanzania to WMO, Dr. Buruhani Nyenzi, Director of the World Climate Programme of WMO, and Mr. Grégoire de Kalbermatten, Deputy Executive Secretary of the UNCCD, welcomed the participants to Arusha and thanked them for participating in the workshop.

9. Dr. Maua Daftari, Honourable Deputy Minister for Infrastructure Development of the United Republic of Tanzania, thanked the organizers of this workshop for their decision to convene it in the United Republic of Tanzania. She said that it is clear that weather and climate coupled with human activities are the principal cause of land degradation. The disappearing glaciers are an alarming indicator of landscape and hydrologic changes to the environment, not only to Kilimanjaro but also to the entire country and continent. She hoped that the workshop would address all its specific objectives and come up with appropriate recommendations for all organizations involved in land management practices, in particular the national meteorological and hydrological services and those charged with the implementation of the NAPs. She added that we should all strive to assist, as far as is practicable, in putting the recommendations into practice.

10. Dr. Mark Mwandosya, Honourable Minister of Environment of the United Republic of Tanzania stated that his Government recognized the challenges posed by land degradation and desertification and will continue to seek international cooperation in reversing the rate of land degradation and the threat of desertification. He added that this workshop has come at a time when land degradation continues to hamper government efforts to alleviate poverty and bring about sustainable livelihoods, especially in rural communities. He appreciated the role that WMO has played in bringing to the fore the importance of climate information to agriculture, aviation, land-use management, infrastructure development, and disaster preparedness. He also stated that UNCCD is in many respects the most important of the Rio conventions, especially to Africa, and yet it is the least funded; he called for this matter to be addressed appropriately.

## **II. Outcome of discussions in technical sessions**

### **A. Session on trends in land degradation**

11. In this session, four authors gave presentations on the global and regional trends in land degradation in Asia, Latin America and Europe.

12. Land degradation and thus desertification will probably increase due to increased poverty and the continued climate variability and change. In this respect desertification can be best identified by detecting and quantifying a persistent reduced primary productivity relative to the potential productivity of different ecosystems. Collaborative research should be carried out to

make a distinction between actual desertification and desertification risks. Also, there is a need to integrate remote-sensing data and ground-based data and that country experts should verify their country's relevant section of the global maps against the reality on the ground, and in this way validate or contest the methodology.

13. Land degradation in Asia is enhanced by various factors, including human activities, irrational use of land, water and forest resources, rapid increasing populations and overgrazing. Developments in remote sensing, geographic information systems, and global positioning systems have provided powerful technical support for monitoring and assessment of land degradation and will also provide early warning of desertification.

14. Several examples of land degradation in South America were presented; they involve unsustainable practices such as the impact of sugar cane and cotton cultivation, and intensive agriculture and grazing pressure in the populated highlands. The human drivers to land degradation interact in South America with climatic trends and several cases were highlighted.

15. The European Union strategy for soil protection includes an extended impact assessment that has quantified soil degradation in Europe, both in environmental and economic terms. It was stated that over recent decades there has been a considerable increase in soil degradation and that there will be further increases if no action is taken. Climate change, together with individual extreme weather events, which are becoming more frequent, will also have negative effects on the soil.

#### **B. Session on weather and climate information for monitoring and assessing land degradation**

16. In this session, nine authors gave presentations on weather and climate information for monitoring and assessing land degradation.

17. Climatic variations are one of the major factors contributing to land degradation and in order to accurately assess sustainable land management practices, the climate factors and the risk of climate-related or induced natural disasters in a region must be known. Several examples were given of current advances in weather and climate science that can enable the impacts of different climatic parameters on land degradation to be assessed more effectively.

18. The frequency of climate extremes (such as heat waves, droughts, heavy precipitation) is expected to increase during the next century, but there has been little systematic study of the impacts of climate-driven extreme events on land degradation. Several methods of classifying extreme events were discussed and global trends in daily climate extremes in the 20<sup>th</sup> century were reviewed. There was a discussion of how the landslides and debris flows may not always occur during the same rain events.

19. The impact of climate on land degradation in the United Republic of Tanzania was discussed and it was stated that excess rainfall causes floods and lack of rain causes drought, and that these two conditions exacerbate the process of land degradation in the arid and semi-arid areas of the country. There is a need to make an inventory of national land resources, to assess constraints in dryland farming, to adopt more sustainable forms of land use, and to encourage the

use of indigenous knowledge in land preservation. One challenge that countries face is to provide pastoralists with livelihood support and safety nets in times of drought.

20. The complexity of the term 'land' and the many different definitions of land and land degradation were discussed. There are four spatial-temporal scales that should be distinguished in a discussion on land degradation – the regional, watershed, field and point scales – and land degradation assessment may be overestimated due to these different spatial and temporal dimensions. Therefore, it is necessary to study the behaviour of rainfall at these multiple scales and its effects on land degradation.

21. Climate and management have major impacts on natural resources and agricultural production and effective responses by governments and individuals to the risk of land degradation require an understanding of regional climate variability and climate change. Several approaches from Australia were presented that provide climate information to support better management of the risk of land degradation.

22. In recent years there has been a global increase in more intense, widespread and frequent fires that threaten human security and ecosystems and contribute to greenhouse gas emissions, which can result in climate change with feedbacks on both fire patterns and land degradation. There is a complex interplay between fire weather risk (conditions that are suitable for a fire to start or to propagate in the wild) and land degradation. Future land degradation studies need to put greater emphasis on the role of fire weather for a better assessment of burning conditions and interactions with land degradation processes. There was a discussion on the various methods that communities use to control forest fires and of the Southern Africa Fire Network (SAFNet).

23. Global population growth has intensified the pressure on water resources and prolonged drought cycles are a major factor in land degradation processes. Based on experiences in Israel, several factors such as land-use changes, flow diversion, and the increased use of urban treated wastewater for irrigation have exacerbated the negative impact of droughts and caused land degradation. Several solutions have been applied, such as drip irrigation, recycling of wastewater, reduced allocations and increased pricing of water supplies, and desalination plants. There was a discussion on the economic viability of drip irrigation schemes.

24. An overview of the Global Environment Facility (GEF) and UNEP and several projects was given while explaining the environment–agriculture nexus. The relationship between agriculture and environment could be viewed as conflicting (win–lose) or as synergistic (win–win). One central goal of the GEF/UNEP is to mainstream sustainable land management into sectors such as agriculture and forestry, thus assuming that win–win situations are possible.

25. At the end of the session there was a general discussion on several topics of the session. With regard to the impact of extreme events or year-to-year fluctuations on land management, the presenters stated that both are a matter of concern. It is the knowledge of the end-user and land manager that determines how well management decisions take into account the specific climatic conditions and there is a real need to help farmers to be prepared in dealing with climatic variations. It must be acknowledged that extreme weather events place extra stress on ecosystems and pose additional challenges to response actions, which would lead to a reduction in land degradation impacts.

26. Another general discussion topic focused on ecological security and human pressures. Human impacts are often exacerbated due to increased population pressures, often leading to land-use change and intensification, so the notion of ecological security should be linked to development. Incentives for the development of alternative land uses and sustainable land management practices can help curb land degradation, and win-win situations can be achieved for farmers and the environment. It was noted that, especially for developing countries, it is global policies that currently set disincentives or even prevent sustainable land management in developing countries. It is important to change large systems, such as international agricultural policies that currently disadvantage developing countries, in order to seriously address land degradation and drought.

27. The third topic of general discussion focused on the real improvements achieved by the UNCCD. Several participants noted that in those countries with NAPs and relatively good financial and other support, some good progress can be demonstrated. Some participants also noted that land degradation has to be addressed in the long-term investments into reducing land degradation, and that it is essential to prepare farmers and land managers for adaptive and sustainable management, especially under difficult climatic conditions.

28. The fourth discussion topic concerned the apparent lack of evidence of land degradation at certain scales, and whether new land degradation definitions are needed. There was no strong agreement among the participants on this topic. It was stated that land degradation and desertification are often observed at a local level. The responsibility of scientists to provide a balanced view on the extent, impact and threat of land degradation at the local level and higher aggregated levels was highlighted. Scientists need to think about which messages we want/should formulate and propagate to achieve more sustainable land management and development.

29. The fifth discussion topic focused on the apparent need to determine risk/hot spot areas. In principle, it is useful to identify risk/hotspot areas (in terms of both climate and land degradation risk) so that targeted support actions can be carried out in such areas. However, not only biophysical risks will determine the impact but also socio-economic factors as well as past and current land uses and management practices. There is a need to keep the diversity of local conditions in mind and continue to develop and apply specific and targeted responses. It has to be accepted that such systems and requirements continuously change, so management practices need to be continuously adapted accordingly. The Millennium Ecosystem Assessment (MA) framework on ecosystem services is useful in this context and the UNCCD should apply an ecosystem approach in the broadest sense to its work.

30. The last general discussion topic was the lack of human and socio-economic issues in analyses. Some participants thought that poverty should be addressed systematically as it is a key driver as well as an outcome of drought, climate change, and land degradation. It was recognized that the deliberations of the workshop need to take a stronger socio-economic and development outlook. Considering that globally a majority of people are subsistence farmers, often poor, who inhabit large land areas, the empowerment of local farmers needs to be a key focus of climate and land degradation work.



31. This session provided several recommendations under the three themes of links between climate and land degradation, monitoring and assessment, and information and its application.

32. There are clear links between climate and land degradation, and the provision and integration of climate and weather data in land degradation assessment and management is important. It is as important to address natural year-to-year climatic variability as to address extreme events in the climate–land degradation context because both may impact considerably on land conditions, in both the shorter and longer terms. A special consideration may need to be placed on climate–land degradation effects on fire weather; fires and the management thereof can be an important tool in support of more sustainable land management.

33. The conclusions arising under the second theme – monitoring and assessment – were the following:

(a) Monitoring and assessing are important to provide relevant information and generate knowledge and understanding on climate and land degradation and the links between them;

(b) The MA applied ecosystem service framework provides a useful context for land degradation assessments, also including climate and weather information. At least an ecosystem approach in the broadest sense should form a foundation for assessment work;

(c) The identification of risk areas and hotspots is useful to guide targeted priority actions and responses;

(d) It is important to integrate socio-economic elements in risk analysis; additionally vulnerability assessments (providing information on, for example, the local coping capacities in a risk area) need to be carried out to allow for appropriate responses;

(e) Currently climate and land degradation information and data sources are inadequate in most areas of the world and the establishment of a better network of observatories should be promoted and supported especially in developing countries;

(f) After decades of assessing land degradation there is no unifying view of the extent, threat and full impacts of land degradation. Recent assessment results on the global scale do not necessarily reflect local scale realities. Because of these discrepancies – and uncertainties - it is important to communicate the information resulting from these assessments in the most responsible manner – and in light of intended best responses.

34. From the discussions on the third theme – information and its applications – it was concluded that information, knowledge and understanding have to be systematically and adequately communicated to the relevant key users. This may include higher level decision makers in service organizations and reach to the level of the individual land manager and farmer. The different communication needs of land managers around the world should be strongly acknowledged and efforts must be made to devise and implement appropriate communication strategies. It is believed that the development of incentive measures, and the removal of perverse incentives, will be an appropriate tool for reaching more satisfactory implementation levels and

impacts. It is especially recognized that perverse incentives are often international in extent and have to be addressed in a multi-lateral context.

### **C. Session on strategies for more efficient use of weather and climate information and applications for reducing land degradation**

35. In this session, eight authors gave presentations on strategies for more efficient use of weather and climate information and applications for reducing land degradation.

36. It was stated that landslides are normally initiated by heavy rainfall over a short period and that landslides mainly occur on steep slopes. Four available methods for linking available weather and climate information to landslide formation were discussed. Both models and empirical approaches are needed to assess severe landslides and related hazards, and linking real-time climate data with physically based landslide models may prove beneficial for assessments of the phenomenon in high-risk areas.

37. An overview of the UNDP approach to adaptation was given with regard to the UNDP adaptation fund and projects. The goals of this fund are to develop pilot or demonstration projects to integrate adaptation into national policy, to meet global environmental objectives and achieve development benefits, and to provide resources to include adaptation within projects on climate change, biodiversity, international waters and land degradation. There are four phases of the UNDP–GEF adaptation strategy: the methodological development, improvement and dissemination phase, the regional assessment phase, the national assessment phase, and the implementation phase. UNDP–GEF has full- or medium-size projects in 43 countries.

38. There are many positive case studies and best practices on drought-hazard and land-degradation management in southern Africa. There are climate and land degradation links between water scarcity, food insecurity, potential health impacts, low incomes and potential land/resource degradation. Three drought impact and land degradation management responses were emphasized: local level responses, early warning systems and policy instruments. It was concluded that actions are needed at the local level of the natural resource user/farmer, and that the challenge is to outreach to these levels.

39. An overview was given of the role of Southern African Development Community (SADC) institutions in drought monitoring and of recurrent droughts in the region and their impacts. Products and training activities from SADC's Drought Monitoring Centre were discussed together with the partnerships with other sectors and the user community. The challenges in drought monitoring centre on data flow and capacity-building.

40. Carbon sequestration concepts, relevant management approaches to avoid land degradation and foster carbon sequestration, and a summary of research projects quantifying soil carbon sequestration were presented. Due to greenhouse gases emissions and the need to reduce fossil fuel use, there is a need to retain carbon dioxide in plant material. Several recommended management practices were listed, such as planting crops, good tillage practices, using less organic fertilizer, using less intensive tillage, planting trees, rotation of cropland and grasslands, using green manure cropping systems, and using animal manure to increase yields.

41. A presentation was given on practising sustainable land management through organic carbon management and sequestration. It was noted that soil organic carbon is sensitive to changes in land use and there is a need to document soil organic carbon by drawing appropriate maps, to improve national assessment methodologies, to develop specific research objectives and to develop a transferable system to quantify current soil organic soil organic carbon and to analyse the impacts.

42. Results were given of research on the relationship between the seasonal variation of carbon dioxide, rainfall, the normalized difference vegetation index (NDVI), and land degradation in the United Republic of Tanzania. Studies at the global scale show large increases in atmospheric carbon dioxide resulting in global warming, but few regional studies have been carried out to demonstrate changes at regional level. It was stated that NDVI and rainfall have been decreasing in most of the United Republic of Tanzania and that lower rainfall results in less vegetation and hence in land degradation. The conclusion was that the increase of carbon dioxide will increase land degradation due to increases in frequency and intensity of severe weather and extreme climatic events.

43. An overview on strategies for controlling land degradation was given. In order to combat land degradation, there is a need to introduce sectoral systems, avoid duplication of activities, elaborate thematic databases, identify potential change, and examine climate change impacts.

44. During the general discussion of this session, the workshop participants focused on how to obtain reliable land degradation information from users. They stressed that governments should not impose a large numbers of reporting, monitoring and permit-application requirements on land managers (farmers and pastoralists); it is unreasonable to expect individual users to undertake large amounts of administrative paperwork. Filling out forms will not solve land degradation problems. Another discussion topic focused on how carbon sequestration is considered in international agreements.

#### **D. Session on successful measures to manage land use, protect land and mitigate land degradation**

45. In this session, nine authors gave presentations of case studies on successful measures to manage land use, protect land and mitigate land degradation.

46. Issues relating to sustainable land management and small island developing States (SIDS) were discussed using Mauritius as an example. Climate change, climate variability and sea level rise will further exacerbate current land degradation in this country, and the effects of extreme weather events are already being seen. Some adaptation measures include research and the creation of databases, mainstreaming climate change and sustainable land management concerns into policy and regulatory frameworks, capacity-building, and field level intervention.

47. The role of environmental and financial synergy on the afforestation of degraded lands in Romania was discussed. It was stated that from scientific, technological and practical points of view there are solutions to land degradation but the lack of major financing makes it difficult to implement them on a large scale. A favourable carbon-emissions trading regimen can act as an incentive for national resource mobilization and hence offer multiple opportunities for land use

improvement. Forestry projects oriented toward carbon sequestration have several multiple risks such as forest fire, increased vulnerability due to illegal cutting, unsustainable management practices and climate change.

48. A presentation was given on the MEDCOASTLAND project that aims at combating land degradation in the Mediterranean coastal zones. Soil erosion by water and wind, salination, overgrazing and degradation of vegetation, and loss of organic matter and biodiversity are the most alarming causes of land degradation in the region. Projected high population growth and the problems of land degradation and desertification should become strategic priorities of national and regional importance. The project has demonstrated many good examples of sustainable land management and rural development and has disseminated the findings through publications and the Internet.

49. National efforts and challenges to address poverty and sustainable development and combat desertification and land degradation in the United Republic of Tanzania were discussed. Sustainable land management can be achieved by integrating international and national efforts at different levels; there should further support from developed countries to support the implementation of NAPs and improved links between the UNCCD and the United Nations Framework Convention on Climate Change (UNFCCC). Discussion focused on relationships between the country focal points for the UNCCD, the Convention on Biological Diversity (CBD), the UNFCCC and the GEF.

50. Climatic variations, climate change and land degradation are serious environmental issues for the Philippines given their effects on economic growth. Many coping mechanisms relating to drought and flooding are becoming inadequate due to economic growth, population increase, urbanization, and changing consumption and production patterns that are combining to create intense pressures on the country's limited resources. It was stressed that the role of scientific information cannot be understated. It was recommended that policies relating to agriculture, land use and energy systems need to be integrated with policies on climate change mitigation and adaptation.

51. A case study from north-western Australia illustrated the regeneration of degraded rangelands. Success in such rehabilitation projects requires more than technical expertise; it requires a strong commitment from Government, a willingness to make hard decisions and an initial acceptance that the timeframe of the project will be long.

52. An overview of land degradation management in southern Africa showed that land degradation in the region results mainly from soil erosion, loss of nutrients, depletion of organic matter, and acidification and biological depletion. Several recommendations were listed such as adopting "people centred" interventions taking into account access to land, land ownership, land development and management; an increase in training and awareness on land-use planning and management, fertility and farming systems; and improved coordination and networking. Problems of land management appear to be the same for all small-scale farmers in Asia, Africa and Latin America, and there is a need to study the differences in how large- and small-scale farmers respond to mitigation incentives.

53. Three case studies from Peru described successful measures for sustainable use of arid coastal and semi-arid Andean mountain ecosystems. The case studies dealt with agroforestry and herding, agrobiodiversity of Andean crops, and harvesting of water from fog for use in the reforestation of the high zones for livestock, human consumption, and food crops.

54. Various aspects of organic agriculture aimed at preventing and reversing land degradation were presented. Basic organic farming methods encourage and enhance biological cycles within the farming system, maintain and increase long-term fertility in soils, using renewable resources, and minimize all forms of pollution. Examples from Africa were given to demonstrate how organic farming is already contributing to improved land management, food security, and combating poverty. It was highlighted that organic farming can increase agricultural biodiversity, reduce weeds, increase soil moisture retention, and produce better disease and pest resistant crops, better economic returns and better tasting food.

55. At the end of the fifth session, there were discussions on the nature of the successes reported in the case studies, on what the presenters had learned from their past experiences, and on how these experiences could be used to better organize and plan case studies in the future. It was stressed that given that adaptation to climate change is important, it is necessary to recognize that the disasters (including land degradation) are occurring in the present and that current adaptation strategies are also important.

#### **E. Session on improving implementation of national action programmes**

56. In this session, four authors gave presentations on weather and climate information for monitoring and assessing land degradation.

57. An overview was given on using better climate prediction techniques in the implementation of NAPs. The climate prediction capabilities of some Eastern European countries were described together with climate change scenarios for Eastern Europe and their relation to the UNCCD and NAPs. The Drought Management Centre for Southeastern Europe will serve as an operational centre for drought preparedness, monitoring and management.

58. An overview was given of the various food security early warning systems at global, regional, subregional, national and subnational level. It was proposed that these current early warning systems could serve as model for establishing similar early warning systems relating to environmental hazards such as desertification. The design of the parameters and indicators of a desertification early warning system would take into consideration the primary causes, processes, manifestations and impacts of land degradation.

59. An overview of drought monitoring and management in relation to NAPs was given using an example from the Islamic Republic of Iran. The issues of drought in Iran are similar to other countries in the arid zones. A discussion about drought as the primary focus of NAPs concluded that in order to control the impacts of drought in land degradation, an integrated management model is needed. When efficient drought monitoring and management systems have been established, both people and the environment will be less vulnerable to drought.

60. Programmes to combat desertification in South and Central America were presented. These programmes have the general objective of providing a sound basis for addressing dryland degradation and drought; they have a set of socio-economic and environmental indicators identified in all participating countries and use a common baseline of indicators to establish common ground for the simulation of future scenarios. The global warming trend is likely to change the distribution patterns of such indicators and this should be taken into account in NAP implementation and be given due consideration in the formulation of public policies towards combating desertification. Discussions focused on the possible need to redefine desertification within the UNCCD and on the development of a list of common indicators for all countries, and institutional arrangements for collecting these indicators in the field.

### **III. Outcome of deliberations by working groups**

61. After the technical sessions, participants formed three working groups with specific terms of reference. Each group was asked to provide additional recommendations to be incorporated into the workshop draft statement.

#### **A. Working group on the current use of weather and climate information for monitoring and assessing land degradation and in developing sustainable land management practices**

62. The first working group stated that although some useful data and products were available, there were constraints to their optimum use, such as: inadequacy of data/information coverage and verification due to poor infrastructure; poor accessibility of data and information; inconsistent quality of data/products; weak cooperation between producers and users; weak communication/dissemination strategies; costs attached to data/information impede accessibility; the need for tailor-made products for users; and the need to improve timeliness of data and products. The group listed the data that are currently available historically and in real-time: precipitation, air and soil temperature, wind, sunshine, derived evaporation, and radiation. Satellite data provide rainfall estimates and NDVI. Then there are the climate information and prediction products and customer services. The group noted that countries need to improve data coverage, allow selective cost-recovery of data/product delivery, adopt ISO standards in data and products, improve the availability of specialized data (precipitation, temperature, soil moisture and temperature, and evaporation), and provide tailor-made products together with users in a timely manner and provide training.

63. The first working group also noted the need to increase spatial coverage of data-collection stations in collaboration with private agrometeorological networks if possible, to ensure timely delivery of information and products, and to attain an international standard for data and product quality under the auspices and control of WMO. In order to facilitate the delivery of products, adequate resources need to be provided and capacity strengthened. The group acknowledged that the data and information should be made as accessible as possible for the public good and where necessary they should be packaged for end-users, especially for those engaged in sustainable land management, with the recognition that different users have different data and information needs. Finally, they noted that institutions developing information on climate variability and change should be encouraged to examine various scale projections that would take into consideration feedbacks between land cover change and land degradation and on

future precipitation and temperature patterns to aid in developing scenarios for adaptation and mitigation

**B. Working group on promoting more effective use of weather and climate information for reducing land degradation**

64. The second working group made the following conclusions concerning different ways and means to make the use of weather and climate information more effective for reducing land degradation:

(a) The diversity of stakeholders with a role in land and water management must be appreciated in the development of any strategy to address land degradation.

(b) The wealth of hydrometeorological data and information in both developing and developed countries is not available to local populations and end-users for several reasons, including restriction of access by the data-holding institutions. Data need to be made freely available to end-users;

(c) There is a need to differentiate raw data, summarized data, interpreted information and final integrated assessment of land degradation phenomena;

(d) The language in which the information is packaged needs to be tailored to the end-users' needs;

(e) More detailed spatial resolution of climate data is needed for area-specific assessments. There is the need to maintain the density and quality of data-collection stations, and to improve maintenance and operational aspects, of existing networks;

(f) Networks of data-collection stations need to be adapted to areas that are highly susceptible to land degradation, such as mountainous areas;

(g) Interpretation of information and integrated land degradation assessments needs to be delegated to appropriate institutions and experts with competence in the respective scientific areas;

(h) Dissemination of information and final products for specialized demand-driven applications requires additional training of technology transfer specialists and local staff;

(i) The important role of WMO in standardizing meteorological data should be continued and enhanced;

(j) Meteorological and relevant remote sensing data alone are not sufficient. Any integrated assessment of land degradation may need a combination of various data including hydrological information, soil data and socio-economic information.

65. The group made the following conclusions regarding needs in the area of training and capacity-building to make more effective use of weather and climate information for reducing land degradation:

(a) Training and capacity-building need to be organized in a proactive way for stakeholders at all levels in order to make the final information useful for the end-users and assure long-term sustainability of the process of technology and information transfer;

(b) Prior to any training and capacity-building initiative there must be a clear identification of needs by the end-users;

(c) End-users must be able to fully understand the implications and value of the information provided;

(d) The uncertainties and risks of the decision-making process need to be reduced and their implications eventually fully explained;

(e) Every step from raw data collection to the final integrated assessment needs to be covered by specific training and capacity-building activities;

(f) There is a need to strengthen the capacities of national meteorological services to perform the raw data collection and interpretation tasks and to improve their visibility in the local and national media. This would ensure the much needed long-term sustainability of the national services concerned;

(g) Without similar training and capacity-building efforts also in other areas, such as land-use planning and soil survey, it will be difficult to have an integrated approach to land degradation assessment and mitigation.

66. This group made the following recommendations:

(a) There is a need for detailed, accurate and spatially distributed rainfall intensity data that can be used for surface erosion assessment and modelling, and for design of draining structures;

(b) Historical climate data and climate change scenarios are needed for future strategic planning, agroclimatological zoning and crop pattern scheduling;

(c) Targeted weather forecasts at all levels are needed at local scales to help stakeholders make appropriate decisions;

(d) Every effort should be made to identify relevant entities outside the WMO structure that operate and maintain networks (national or international) and that possess climate information. The release of that information to the interested stakeholders should be pursued.



### **C. Working group on weather and climate information to improve the implementation of national action programmes**

67. The third working group made the following conclusions:

(a) In some countries, national meteorological and hydrological services (NMHSs) are not currently included as members of bodies responsible for the implementation of NAPs;

(b) Although climate and weather information is routinely collected, in some cases this information is not accessible to the agencies/departments who are responsible for implementing NAPs;

(c) In some NAPs, adequate use is currently not being made of climate and weather information;

(d) In some countries, lack of adequate trained personnel and weak institutional capacity is recognized as a constraint to the efficient use of climate and weather information.

68. The third working group made the following recommendations:

(a) Weather and climate data should be made available in a timely manner and be synthesized for use in the implementation of NAPs. Hence, it is important to strengthen the capacity of NMHSs in the acquisition, analysis and dissemination of data;

(b) Multi-disciplinary teams (MDTs) of data providers and data users should be established to develop early warning systems for drought and desertification at the national level to determine how information would be analysed and packaged for the end-users;

(c) MDTs should take into account local community knowledge to complement scientific expertise;

(d) Given the current technological advances in the availability of satellite data, greater efforts should be made to use these data in the implementation of NAPs;

(e) Given current concerns with recurrent droughts and their impacts on local communities, it is important to develop and implement a national drought policy that supports effective implementation of the NAPs;

(f) Representatives of NMHSs should be included in the national delegations to the sessions of UNCCD COP to ensure that the issue of climatic factors in land degradation is effectively addressed;

(g) NMHSs, in collaboration with agricultural extension services and national coordinating bodies of UNCCD, should give seminars on weather, climate and land use to farmers to promote implementation of NAPs.

69. At the final plenary, participants recommended that the proceedings of the workshop could be published as a book by Springer in time for presentation and distribution at COP 8.

#### IV. Main conclusions and recommendations

70. Land degradation is a threat to natural resources with consequences on food security, poverty, and environmental and political stability. The workshop noted that trends in land degradation are assessed differently in various parts of the world. The increasing occurrence of climate extremes (such as heat waves, droughts, heavy precipitation) is having an impact on land degradation processes, including floods, mass movements, soil erosion by water and wind and salination, in all parts of the globe. Climate variability, climate change and land degradation are intimately linked and are generating unexpected effects, such as more frequent fire-weather conditions in large parts of the globe. In order to combat land degradation, bottom-up and top-down participatory management approaches that foster income-generating activities are required.

71. The participants of the workshop recommended that:

(a) As the relationship between locally observed land-degradation processes and their aggregation at different scales (national, regional and global) requires further exploration of scale transfer methodologies and procedures, it is essential to improve the monitoring of land degradation as well as climate at these scales. Global assessments need to take into account the reality of land degradation as perceived or experienced by local populations;

(b) There is a need to strengthen knowledge and understanding of climate and of the functions of ecosystems (thresholds, resilience and dynamic equilibria) in order to better understand, predict and evaluate the risks of land degradation and fully understand the complex interrelations between land use and environment;

(c) Innovative and adaptive land management responses to inherent climatic variability and natural hazards (droughts, floods, landslides, sand and dust storms, wildland fires, etc.) must be identified and implemented in order to achieve sustainable land management;

(d) Land-management practices in affected areas, particularly in Africa and other developing countries, should focus on improving the amount of rainfall that is used in biomass production. This can be facilitated by unlimited provision of hydrometeorological data and increased human and institutional capacity-building;

(e) The network of climatological, hydrological and agrometeorological stations around the world should be expanded and strengthened to provide data on rainfall intensities, soil temperature and soil moisture for land degradation monitoring and assessment and for the implementation of the NAPs. Climatological and hydrological end products should be developed in coordination with end-user needs by relevant and competent people and institutions;

(f) There is a need to adopt an integrated approach backed up by institutional support and regeneration of affected areas by means of agroecological practices and other physical interventions to reduce land degradation. Direct interactions between NMHSs and the land users can help enhance the direct communication of weather and climate information. There is a need to develop a cost-effective system to communicate early climate forecasts to various stakeholders, in particular to farmers, so that they can improve their land management practices;

(g) Given the current concerns with recurrent droughts and their impacts on local communities, it is important to develop and implement a national drought policy that supports effective implementation of NAPs.

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