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# ANNEXES

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# ANNEX A

## ABSTRACTS OF PRESENTATIONS

### PART 1 FAO WATERSHED MANAGEMENT REVIEW

#### **Preparing the next generation of watershed management programmes**

**Moujahed Achouri, Forestry Department, FAO, Rome, Italy**

Much progress has been achieved in watershed management, especially during the 1990 to 2002 period, when new approaches and methodologies were developed to promote participatory integrated watershed management. However, no clear picture has been drawn on what has proved to be successful and what can be done to improve future watershed management programmes. In fact, the latest systematic effort to review and assess watershed management strategies and approaches at a global scale was conducted 18 years ago by FAO at the expert meeting held in Kathmandu, Nepal, from 25 February to 1 March 1985. Hence, in-depth analysis of watershed management achievements and existing gaps, with particular emphasis on the 1990 to 2002 experiences, is a prerequisite to the further development of watershed management programmes.

This paper reviews and assesses watershed management activities in order to provide reliable information on lessons learned and existing gaps. Such information is greatly needed to justify investment in watershed management activities and to implement such activities in areas where they are most needed. The assessment process was designed to respond to the needs and to take into account the characteristics of different audiences involved in watershed management. It comprises consultation, investigation, stocktaking, case studies, workshops, international conferences and dissemination of the results.

#### **Review and assessment of watershed management strategies and approaches**

**L.C. Tennyson, Watershed Management Consultant, FAO, Rome, Italy**

Watershed management is considered by many to be the most appropriate approach to ensure the preservation, conservation and sustainability of water- and land-based resources and for improving the livelihood of people inhabiting upland and lowland areas. Integrated watershed management with participation of all the relevant key stakeholders has become widely accepted as the approach best suited for sustainable management of renewable and non-renewable natural resources in upland areas. Concerned governments and development assistance organizations have been employing watershed management principles since the 1960s in an attempt to reverse the degradation of water- and land-based resources. Through these years of development, strategies and approaches for implementing watershed management interventions have changed as the discipline moves forward along the learning curve. By responding to research results, lessons learned, failures and successes, the periodic review and evaluation of the discipline continues to be dynamic, with adjustment and

modification as required to meet changing needs. In view of the changes in development during the past decade, FAO decided to conduct a review and assessment of watershed management development strategies and approaches to determine the present status of watershed management development. The review and assessment were to identify any major gaps and formulate guidelines for future development projects and programmes. The previous review was conducted from 1985 to 1986. The overall study includes a survey of key actors; stocktaking of FAO experiences; case studies; regional workshops and international conferences; and preparation of guidelines and strategies for future watershed management development programmes. A summary is given of the experiences of the key actors and FAO in watershed management development projects and programmes during the 1990 to 2000 period. Topics covered include technology, training and education, gender and participatory methods, as well as recommendations for future watershed management programmes.

## **PART 2 LINKS AMONG LAND USE, TREE COVER AND WATER IN WATERSHEDS**

### **Land–water relationships in rural watersheds**

**Jean-Marc Faurès, Land and Water Development Division, FAO, Rome, Italy**

It is often assumed that land-use practices generate significant impacts on water resources and affect the downstream population in river basins. A great deal of controversy exists regarding the direction and magnitude of these possible impacts, their influence in the relations among the different population groups within a watershed, and the mechanisms that would allow a distribution of the costs and benefits among different stakeholders.

The effects of land use on water resources vary with local conditions. Good monitoring of the impacts of land use on water is made difficult by the extensive delays between cause and effects and the interferences between human-induced and natural impacts. These limitations affect our capacity to draw clear and straightforward conclusions on the relations between land use and water in watersheds. Although not fully understood, the issue of scale also greatly affects the relation between water and land use: some experiences indicate that the impacts of land management on the hydrology and sedimentation in river basins are more easily observed in small watersheds than in large basins. On the other hand, scale is less relevant when dealing with issues of water quality, and the negative impacts of agriculture on water quality can be observed at all scales in the watersheds.

Care must be taken to avoid misinterpretation and generalization of results, in particular when scaling up results obtained on relatively small watersheds. Case studies of land–water relations are presented and analysed with a view to recommend possible changes in land-use practices in small watersheds.

## **Watershed management – can we incorporate more evidence-based policies?**

**Ian R. Calder**, Centre for Land Use and Water Resources Research (CLUWRR),  
University of Newcastle, United Kingdom

In the early 1990s the concepts underlying integrated water resource management (IWRM) were developed. These are now agreed and supported by all development organizations (Calder, 1999), and are seen as the necessary, if not always sufficient, prerequisites for achieving the Millennium Development Goals (MDGs). These concepts are also seen as the guiding principles for the “blue revolution” in new land and water management policies, and form the basis for designing watershed development projects.

From consideration of the outcomes of current watershed development projects and land and water policies in different parts of the world, it is concluded that very serious deficiencies exist and in many situations perverse policy outcomes are apparent.

It is argued that the challenge in developing the next generation of watershed development projects is *how to implement* these IWRM concepts in a wider resource management context where there are:

- increasingly severe and conflicting demands on the land and water resource to supply food, water and other goods and services (e.g. timber, fisheries, conservation, amenity);
- sectoral conflicts among the water, land, power generation, irrigation and piped water and sanitation provision sectors;
- concerns that upstream management of land and water in watershed development projects generally ignores downstream impacts, particularly as they affect the lowland rural and urban poor, transnational and coastal interests;
- concerns that the opportunities that better resource management (IWRM) provide in a rapidly globalizing world economy will be captured by the non-poor.

Implementation of the well-meaning IWRM concepts will require confronting the complex and messy real-world situation where it is important to recognize that land and water policies and practices at the international, national and local levels are generally driven, dominated and exploited by the vested interests of sectoral, powerful and wealthier groups (using, knowingly or unknowingly, whatever land and water myth supports their cause), usually at the expense of the poorer in society.

Outcomes are often the opposite of what is expected, and billions of dollars of development funds are being expended on unachievable targets in relation to watershed development projects.

### PART 3 FARMING AND WATERSHED MANAGENT IN SUB-SAHARAN AFRICA

#### Runoff and erosion control under improved fallows in western Kenya

Anja Boye, World Agroforestry Centre, Kisumu, Kenya

Alain Albrecht, World Agroforestry Centre, Nairobi, Kenya

Runoff and erosion have been receiving much attention for decades, yet they still constitute a major problem in the humid tropics. Most research on soil erosion has focused on controlling runoff through barrier strips and terracing on the landscape level, and less attention has been given to the processes taking place at the plot level for undisturbed soils. Thus, the aim of this study was to examine runoff, soil and carbon loss for *in situ* soils under two improved fallow species (*Tephrosia candida* [IF-Tc] and *Sesbania sesban* [IF-Ss]) and two tillage practices (conventional tillage [CT] and no-tillage [NT]) for a sandy loam and a clay soil in western Kenya. Runoff and soil loss were measured using a field rainfall simulator for pre-wetted conditions. The hypothesis of this study was that improved fallows (IF) in association with no-tillage would enhance soil properties, thereby increasing infiltration of rainwater and controlling soil and carbon losses. The effect of fallowing on improving soil properties was expected to be larger for the clay soil than for the sandy loam because of the larger capacities of clay particles to bind organic matter and form aggregates.

The results from this study show that improved fallows increased infiltration and reduced soil losses at both sites, with greater effect for the clay soil ( $p \leq 0.001$ ). For the clay soil, IF (IF-Tc and IF-Ss) significantly increased infiltration, by 35 to 38 percent (63 vs. 85 to 87 percent,  $p \leq 0.030$ ), and reduced soil loss, by 88 to 93 percent (50 vs. 4 to 6 g m<sup>-2</sup>,  $p \leq 0.002$ ). For the sandy loam, the differences in infiltration and soil loss between continuous crop (CC) and IF were only significant for IF-Ss, which increased infiltration by 54 percent (48 vs. 74 percent, 0.089) and reduced soil loss by 70 percent (37 vs. 11 g m<sup>-2</sup>,  $p \leq 0.101$ ). For the clay soil, C losses were reduced by 79 to 83 percent (0.19 to 0.24 vs. 1.15 g C m<sup>-2</sup>,  $p \leq 0.004$ ), while IF-Ss reduced C losses by 75 percent for the sandy loam (0.42 vs. 1.69 g C m<sup>-2</sup>,  $p \leq 0.039$ ). For the clay soil, the impact of IF on infiltration, soil and carbon losses was caused by significant improvements in soil properties (soil organic carbon, bulk density and soil aggregation), while for the sandy loam, the improvement in soil properties was only significant for soil organic carbon (SOC) under IF-Tc. Here runoff and soil loss were reduced through control of crusting processes by IF. No-tillage significantly reduced sediment concentration, soil and carbon losses under IF for the clay soil, while for the sandy loam, NT reduced carbon losses only under IF-Ss.

## **Results from ten years of watershed and water resources research in semi-arid southern Zimbabwe**

**F. T. Mugabe**, Department of Land and Water Resources Management,  
Midlands State University, Gweru, Zimbabwe

The semi-arid areas of Zimbabwe, located in natural regions IV and V, receive low and erratic rainfall. Dryland crop production is not reliable, forcing communities living in these areas to rely on stored water. Both surface and groundwater resources depend on the hydrology of catchments; hence, catchment hydrological studies are prerequisite to sustainable management of water resources. Watershed and water resources studies commenced in the early 1990s in southern Zimbabwe. This work concentrated on two headwater subcatchments of the Runde catchment, which were fully instrumented, enabling measurements of all components of hydrology, including rainfall, runoff, groundwater levels and soil moisture.

Results from these studies show that on the catchment scale, runoff from semi-arid areas is generally only a small part of the water balance. Long-term trends in groundwater levels reflect the effect of cycles in rainfall, and surface water redistribution is of particular importance for groundwater recharge in years with low or unevenly distributed rainfall, when it would not otherwise have occurred. Water use from small dams can safely be increased by up to ten times without drying up the dam to beyond allowable levels in 78 percent of the years that were studied.

## **Conservation farming – a strategy for improved agricultural and water productivity among smallholder farmers in drought-prone environments**

**Johan Rockström**, Stockholm Environment Institute, Stockholm, Sweden,  
**Kurt Steiner**, German Agency for Technical Development (GTZ), Germany

Water is a primary limiting factor for crop growth in semi-arid and dry subhumid savannah agro-ecosystems. However, this is not necessarily owing to low seasonal rainfall but rather to poor distribution of rainfall and large losses of water in the on-farm crop water balance. Conservation farming (CF), which aims at maximizing rainfall infiltration, water holding capacity and crop water uptake capacity, is an effective *in-situ* water harvesting strategy for smallholder farmers in drought- and dry-spell-prone savannahs. In this paper, on-farm farmer-driven trials on tractor-based, animal-drawn and manually based conservation farming systems are presented. As shown from trials in semi-arid regions of the United Republic of Tanzania, Madagascar and the Sudan, yield differences between conservation farming and conventional ploughing were significant, and largest during the driest years – an indication of the water harvesting effect. The largest yield increase was realized when water harvesting through conservation farming was combined with soil fertility management, resulting in an average yield increase exceeding 200 percent compared with current local practices. Rainwater productivity increased substantially from the 3 800 m<sup>3</sup>/tonne required in the conventionally ploughed system compared with on average 1 500 m<sup>3</sup>/tonne for maize under conservation farming. The paper further discusses the challenges of achieving wider adoption of CF practices, and the wider advantages in terms of labour saving, which is particularly important in the region at present owing to the HIV-AIDS pandemic.

### **Above-ground transformations in agroforestry systems in watersheds: case of cocoa agroforests of central Cameroon**

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**N. Besingi**, University of Dschang, Cameroon

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Transformations in agroforestry systems in watersheds of the African humid tropics have been continuing for many decades. These transformations have often involved modifications in species as well as spatial arrangements of indigenous trees within tree-based systems. In the forest margins of central Cameroon, these transformations started with the settlement of pioneer populations, their development of cocoa plantations, onwards to the more recent intensification of diverse high-value trees and smallholder plantations systems. These transformations, although largely unmonitored, have been influencing the biophysical dynamics in these tree-based economic landscapes in important ways.

Tree-based systems (mixed and monocultures) are certain to spread in the coming years. This paper presents the results of a characterization study of a complex cocoa system as an example of the issues that resource managers are likely to encounter increasingly in the coming years when dealing with the management of tree-based systems for rural livelihoods.

The study indicates that economic considerations are likely to continue to influence the transformations of tree-based systems in the future. These transformations are expected to be characterized by greater regularity in inter-tree distances (equidistant spacing), lower levels of diversity per farm in favour of greater productivity, and fewer strata as diversity continues to drop. Economic considerations are expected to increase at the expense of environmental ones. This paper raises an important question: How can we ensure that environmental concerns are balanced with economic ones?

### **PART 4 SOCIAL ASPECTS OF WATERSHED MANAGEMENT**

#### **The sociological approach in watershed management: from participation to decentralization**

**Jean Bonnal**, Rural institutions and participation service (SDAR)

Sustainable Development Department, FAO, Rome, Italy

Watershed management is based on an integrated approach that also includes human and social dimensions, from the plot or community level to their insertion in broader territories. To ensure sustainability, the participation of the populations directly involved is required. However, the application of participatory approaches implies certain methodological conditions, as well as the use of certain tools adapted to each situation encountered. Decentralization and devolution of authority are necessary for real increases in local participation, and require suitable institutional and organizational prerequisites to associate local needs and expectations with broader political dimensions. In the search for equilibrium

among local and global actors, partnership among all actors becomes paramount. For participatory and decentralized watershed management to be effective, three things are required: sharing of information, strengthening the capacity of local organizations through the formation of local networks and focal points, and promoting dialogue among these. FAO has developed an analytical model (RED-IFO) and field applications that associate participation and decentralization.

### **Catchment property rights and the case of Kenya's Nyando basin**

**Brent Swallow**, World Agroforestry Centre, Nairobi, Kenya

**Leah Onyango**, Maseno University, Kenya

**Ruth Meinzen-Dick**, International Food Policy Research Institute,  
Washington, DC, United States

It is generally acknowledged that insecure and incomplete property rights have large effects on the use and management of watershed resources. The standard policy response to this problem is to privatize farmland, declare riverine areas to be public property, and establish a set of restrictions on the use of both private and public land. This paper presents a more nuanced concept of catchment property rights, drawing on key concepts from watershed hydrology and the multidisciplinary social science of property rights. We present preliminary results from a study of the Nyando river basin in western Kenya. The implications are that policy reforms aimed at catchment property rights need to recognize the complexity and interconnections that make up hydrologic catchments, give greater priority to key catchment resources such as domestic water and sediment filters, recognize the key links between water and land rights, and devise ways to harmonize the multiple sources of authority that govern the use of management of watershed resources.

### **Managing micro-catchment resources: institutional arrangements for water use in Chiwi district, Zimbabwe**

**Nontokozo Nemarundwe**, Center for International Forestry Research, Harare, Zimbabwe

The last two decades have seen the emergence of new strategies for natural resource management and supporting institutions throughout the Southern African region. There is a clear shift from the centralized and State-driven natural resource management regimes of the colonial period and the immediate post-independence years towards decentralized and community-based management regimes. This paper discusses both individual and collective institutional arrangements for managing water resources, focusing on a micro-catchment area in Chiwi district in Zimbabwe. Many rules governing water use are implicit, rather than formal, explicit, rules. In most cases, these institutional arrangements, even if they are implicit, allow conditional access based on appropriate use. Water is used for many purposes and the rules differ according to the type of use. Priority is given to cleanliness around the water sources, in particular where drinking-water is collected. This is key to determining who has access to water sources, especially those that are privately owned. The study shows that there is general compliance and minimal conflict over water use, regardless of the shift in boundaries of use during times of stress, for instance during the dry season or in drought years.

**Participatory approach in watershed management: sustainable agriculture and participatory rural development in the watershed area of Tassaout (High Atlas Mountains of central Morocco)**

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Royaume du Maroc

In Morocco, of 15 million ha of upland areas, 11 million ha are considered to be at high risk, and 3 million ha need urgent management, as reported by various studies. Several experiences have shown the need to replace the narrow concept of watershed management with a broader and integrated one that is based on a participatory and partnership approach, and that includes sustainable agriculture and long-term rural development, besides the fight against water erosion.

The 1990s were characterized by the development of several plans and strategies, among which are the National Environment Action Plan (NEAP), the National Action Programme to Combat Desertification (NAPCD), the National Forestry Programme (NFP) and the 2020 Rural Development Strategy (RDS). These strategic frameworks for planning contain all the necessary elements for the conservation of natural resources, taking into account environmental concerns and the sustainable economic and social development of mountain areas. The Project MOR/93/010, Pilot Project for the Development of River Basins: Participatory Approach to Planning and Management, initiated by the Ministry of Water and Forestry and UNDP, contains essential links to the government's strategy for soil conservation and watershed management using field testing and an approach in which development is central to address the ecological, economic and social impacts of erosion.

The Tassaout Valley is part of the two pilot areas where the project was executed. The pilot watershed management project put in place in Tassaout between 1996 and 2002 achieved a high level of success owing to the novel way in which it was implemented with the following features:

- consideration of both hydrologic and ethnic considerations in defining the areas of implementation;
- recruitment of a local team of organizers who were not overly constrained by existing administrative structures;
- emphasis on novel approaches to agricultural practices that would conserve soil and water;
- a new spirit of cooperation between forestry administration and the local population.

The lessons learned from this experiment have contributed to defining a new approach for the conservation of water and soil, and for watershed management with the participation of populations, who are involved in both the identification of actions to be undertaken and their implementation and monitoring. This will help create a climate of confidence between populations and the forest administration, whose previous relationship was essentially characterized by forest police interventions.

## **Watershed hydrology, livelihoods and poverty: an integrated hydro-social analysis from the Limpopo basin**

**Robert Hope**, Centre for Land Use and Water Resources Research,  
University of Newcastle, United Kingdom

The role of the hydrological cycle in contributing to the livelihoods of rural communities is often said to be important, but clear evidence of this is rarely offered. Furthermore, where such aspects are considered, they are largely focused on the use of water from rivers, boreholes or some form of storage (blue water).

In this study, the hydrological cycle is considered in its entirety. Links among rural livelihoods, land use and the goods and services provided by the evaporation and transpiration components of the hydrological cycle (green water) are assessed through analyses of rural livelihoods in the Luvuvhu catchment, Limpopo Province, South Africa. Results highlight the importance of green water, and thus the importance of access to land and use of the natural resource base in disaggregated rural community livelihood strategies

Finally, we describe a methodology for linking common outputs from hydrological models to rural livelihood impacts. In this way, the potential role of land-use change in disaggregated rural livelihoods can be assessed for various development scenarios, such as increases in commercial afforestation and dryland agriculture.

## **PART 5 AFRICAN EXPERIENCES IN WATERSHED MANAGEMENT**

### **Processes that will influence resource allocation in the Republic of South Africa**

**S. Rademeyer**, National Water Resource Planning,  
National Department of Water Affairs and Forestry, Pretoria, South Africa

Under the 1956 Water Act of South Africa, the management of water and the provision of water were designed to benefit a very limited section of the population. Water use was primarily for irrigation, which resulted in depriving a large sector of the community of a basic water supply. Thus, the availability of water for development and for the sustainability of the environment was not present. Since the advent of a democratic South Africa in 1994, government policy has focused on equitable and sustainable social and economic development for the benefit of all people. In 1997, the Cabinet adopted a National Water Policy (NWP) for South Africa in response to the new direction of government policy and as part of the process of a thorough review of the existing water law. The NWP was preceded in 1996 by the development of 28 Fundamental Principles and Objectives for New South African Water Law. The National Water Act (NWA) of 1998 (Act No. 36) was published and derives directly from the Fundamental Principles and Objectives for New South African Water Law and the NWP proposals for managing water resources. Although the NWA is the principal legal instrument, water resource management in South Africa is supported by other legislation as well. Successful water resource management will therefore depend on cooperation among all spheres of government, and the active involvement of water users and other organizations and stakeholders.

Public trust is fundamental to South Africa's new water resource management regime, and the national government's responsibilities and obligations in this regard have found legal expression in the NWA. Effective implementation of these responsibilities and obligations implicitly requires that they be exercised within the framework of some kind of national water management plan. The National Water Resource Strategy (NWRS) is intended to provide this framework. A strategy was called for in the NWA, a draft was then published for comments, and the strategy was recently finalized. As part of the fundamental reform process of the law relating to water resources, the NWA recognizes the need for integrated management of all aspects of water resources and, where appropriate, the delegation of management functions to the regional or catchment level so as to enable everyone to participate. To this end, Catchment Management Agencies (CMAs) will progressively be established. These CMAs will develop Catchment Management Strategies (CMS) within the framework as set out by the NWRS. Until such time as the CMAs are established and are fully operational, the national Department of Water Affairs and Forestry (DWAF) will have to continue managing the water resources in the various water management areas through its regional offices. In light of this responsibility, DWAF's corporate perspective on how the water resources should be managed has been put on paper through the establishment of Internal Strategic Perspectives (ISPs).

The intention of this paper is to inform the reader about these processes, which will have a significant influence on future procedures, structures, programmes and the allocation of resources in the Republic of South Africa.

### **Putting integrated water resource management into practice – Ghana's experience**

**Kwame Odame-Ababio, Water Resources Commission, Accra, Ghana**

For nearly a decade, Ghana has been implementing reforms in the water sector to promote the objectives of integrated water resources management (IWRM) in line with the approach proposed at the 1992 Dublin International Conference on Water and Environment (ICWE), which was also emphasized at the United Nations Conference on Environment and Development (UNCED) held in Rio de Janeiro that same year.

In 1996, a significant step was taken by the Government of Ghana to address the diffused state of functions and authority in water resources management and to put them into an integrated form. An Act of Parliament (Act 522 of 1996) was promulgated to establish the Water Resources Commission (WRC) with the mandate to regulate and manage the country's water resources and to coordinate government policies in relation to them.

Since its establishment, the Water Resources Commission has developed strategies and policies that will ensure sustainable water resources management.

This paper gives an overview of some aspects of water sector reforms in Ghana. It concludes by highlighting some of the tasks that WRC is focusing on to promote IWRM in Ghana.

## **Water sector reforms in Zimbabwe: the importance of policy and institutional coordination on implementation**

**H. Makurira**, University of Zimbabwe, Civil Engineering Department, Harare, Zimbabwe

**M. Mugumo**, Zimbabwe National Water Authority, Harare, Zimbabwe

Increasing water scarcity because of increasing demand on a finite water supply, unpredictable climatic variations and deteriorating water quality has led many governments to join a worldwide call for an integrated and more sustainable approach to water management. In sub-Saharan Africa, environmental degradation is accelerated by poverty and poor access to water, which has led to even less water availability for basic human sustenance. The integrated approach to water management attempts to promote greater efficiency of water use, while protecting water catchment areas. However, it has been observed that the success of such reforms depends largely on a sound base of institutional linkages with policies that do not conflict. The timing of implementation, financial sustainability and a general sound capacity base are all ingredients to a successful water reform process.

## **Water erosion and silting in the Niger River basin in the context of watershed management**

**Ousmane S. Diallo**, Autorité du Bassin du Niger (ABN), Niamey, Niger

The Niger River basin is of great importance to the population and the economy of the region. Decades of continuing soil erosion are causing silting of the river and endangering the stream flow. Small-scale projects successfully developed relevant approaches and methodologies to address the problem. However, these projects were mainly sectoral and have not been implemented on a larger scale.

The process of silting in the Sahelian-Saharan part of the basin is a serious threat to the regular flow of the river. Fully aware of the gravity of this situation, the ABN member states have obtained support from the African Development Bank to start up a multinational programme to resolve water erosion and silting in the Niger River basin.

The programme intends to reinforce cooperation and regional integration through the sustainable management of natural resources by providing all ABN member states with suitable tools for coordinated and sound watershed management. This paper describes the several components and impacts of the programme, as well as the methodological approach used for implementation.

## **The broken link in the agricultural production system in Ethiopia and its impacts on natural resource management**

**Gete Zeleke**, Amhara Regional Agricultural Research Institute, Ethiopia

Why famine in Ethiopia again? What are the external and internal policy issues related to natural resources management? What are the impacts on Africa's development of the Western world's wrong intervention? What should be the right balance between food aid and development assistance?

## **Regional programme for the integrated management of the Fouta Djallon highlands**

**Amadou Maiga, FAO, Conakry, Guinea**

The main objectives of the FEM project (PDF-B phase) are the sustainable use and protection of the international watershed area, natural resources and biological diversity of the Fouta-Djallon highlands. In order to meet these objectives, an integrated and sustainable natural resources management programme for the Fouta Djallon highlands will be developed as the overall development objective of the project. This objective will be accomplished through the enhancement of knowledge; complementing methodologies; identification of suitable conservation strategies; and sharing of useful experiences and lessons learned concerning natural resources management.

Outcomes of the project include:

- a *diagnostic transnational analysis* of the environment and management problems of the Fouta-Djallon highlands;
- *strengthened coordination mechanisms*, including the establishment of a Pilot Committee and a Scientific and Technical Committee for the project;
- a *legal framework* emphasizing the international character of the area of the Fouta-Djallon highlands and a framework of agreement on the cooperation among the benefiting nations of the watershed area of the Fouta-Djallon highlands;
- a detailed project document based on the results of the activities to be submitted to FEM.

## ANNEX B OPENING REMARKS

### **DR DENNIS GARRITY, DIRECTOR-GENERAL, WORLD AGROFORESTRY CENTRE**

Good morning everyone, and welcome to the beautiful city of Nairobi and to the science park campus of the World Agroforestry Centre. Our centre is delighted to have the honour of hosting you here during the coming days of this important meeting.

Mr John Munyes, Assistant Minister for Water Resources Management and Development, Republic of Kenya; Professor R.W. Michieka, Director-General of the National Environmental Management Authority; Mr Bruce Isaacson, Representative of FAO to Kenya; Mr El-Hadji Sène, Director of the Forest Resources Division, FAO, we are indeed grateful that each of you is with us today to grace the opening of this workshop. As we are all aware, in a world of growing interrelatedness and interdependency the global community is awakening to the utter tragedy of the fact that hunger and poverty continue to afflict such a huge proportion of our fellow human beings. It is a tragedy because we know the means exist to rectify this, but sadly, the will to do so is still inadequate to the task.

Nearly 1 billion people continue to live their lives in desperate poverty when we all know that this simply does not need to be the case. And a very large proportion of these disadvantaged, often excluded, people are the rural poor who occupy watersheds, and particularly upper watersheds throughout the globe.

There is indeed a high correlation between the incidence of poverty and residence in the key watershed areas of so many countries in the developing world (and in the developed world as well).

People are at the centre of the drive to achieve the Millennium Development Goals, the framework that the global community has targeted for united approaches comprehensively to attack hunger and poverty in the coming years.

If watersheds are the basis of the livelihoods of so many of these disadvantaged people, and if their activities in the watershed are so crucial to the quality and quantity of water that impinges on the downstream communities and cities of the world – as they most definitely are – then finding ways of better managing the world's watersheds can only grow enormously in importance in the coming years.

Thus, understanding the past experience in managing watersheds nationally, regionally and globally will be assuming an ever-greater importance. Synthesizing that experience into ever-improving guidelines for future action is assuming more urgent attention, and developing better means of networking among all those involved in this endeavour will be crucial.

These profound issues are what this meeting is all about, and what the series of meetings around the world of which this is a part, are all about.

Thus, I anxiously look forward to the outcome of this process and the leadership it will provide for accelerating progress in watershed management for the benefit of the entire global community, particularly the poorest of our brethren.

Agroforestry focuses on the role of trees, at the farm level and the landscape level, in addressing hunger, poverty and environmental regeneration. Agroforestry fosters the deployment of trees that work for people, particularly the rural poor, in ways that enable them to make a better living, while at the same protecting and enhancing the quality of the environmental services that matter to them, and that matter to the wider society as well. Thus, the science and practice of agroforestry is well acknowledged to be a central pillar in achieving success in watershed management under a very wide range of conditions throughout the world's watershed area. Recognizing the significance of this role, we at the World Agroforestry Centre see the application of agroforestry science to watershed management as one of our most important areas of work and endeavour. Thus, we, along with many partner organizations, have been continually deepening and broadening our efforts to apply agroforestry to discovering and applying better methods of pro-poor watershed management.

Likewise, we see the connectedness of improved watershed management with efforts better to conserve and use the precious biodiversity resources that reside in both the protected areas in watersheds and outside those protected areas throughout the agricultural landscape. And we are working on exploiting the growing opportunities that the deployment of trees by smallholder farm families will contribute to carbon sequestration in ways that can generate additional financial resources for improving their livelihoods.

All of these interrelated aspects of the potential for agroforestry (pro-poor watershed management, biodiversity conservation, and carbon sequestration for climate change amelioration and adaptation) make up our major organizational theme on Agroforestry for Environmental Services, which Dr Brent Swallow, our session chair, is leading.

In this context, we are working and networking with scores of partner institutions to seek ways of rewarding upland dwellers for the environmental services that they provide to society, thus generating financial resources for their own development while fostering better husbandry of watershed resources, biodiversity resources and carbon. This is the basis for a new network in Asia that is coordinated by our centre. It is known as RUPES, or Rewarding Upland People for Environmental Services.

Here in Eastern Africa, and particularly in Kenya, we have been engaged in ambitious work, along with many partners, in developing and deploying the principles of pro-poor integrated watershed management in key watersheds that are of crucial significance, particularly in the Lake Victoria basin.

Mr Minister and Mr Director-General, we are fortunate to have the opportunity to work with you and your colleagues on these and other watershed management challenges here in Kenya, not only in the Lake Victoria basin, but increasingly also on Mount Kenya and Mount Elgon (which are the key water towers for this nation's people).

All of this work, and more, has instilled in us a passion for pushing forward towards much better ways of working. In this work, we are involved in developing an integrated natural

resource management framework. It is an approach in which the research process is not separate from, but rather deeply embedded in, the development activities that the research seeks to enhance. This places research within an action environment, and fosters ever-accelerating cycles of adaptive management.

This is an innovative concept for research – “research within development” – but one that we see as a crucial foundation to greater relevance and effectiveness. We see it as fundamental to achieving what we are really aiming for, which is demonstrated success in showing how watershed management can be done on the ground in a wide range of circumstances, pragmatically, realistically and cost-effectively, to the clear benefit of the poor who de facto manage watershed resources in so many situations around the world.

Thus, we look forward earnestly to being a part of this process of learning and sharing experience and methodologies, looking to the greater goal of finding and fostering watershed management solutions that work ever-better for our partners and clients.

I would like to end by expressing our deepest thanks to you Mr El Hadji Sène, Mr Moujahed Achouri, Larry Tennyson and all our friends at FAO for their foresight and drive in spearheading the process in which we are engaged today, bringing us together as a community of concerned practitioners in better watershed management, and moving us forward vigorously to the identification of best practices in applied watershed management that can serve as guidelines for so many in future years. And to all of you who are with us here today, I bid you to exercise yourselves to engage, vigorously, in making these discussions really stimulating, thought-provoking and productive.

Thank you.

#### **DR EL-HADJI SÈNE, DIRECTOR, FOREST RESOURCES DIVISION, FAO**

I am pleased and honoured to welcome you, on behalf of the Director-General of the Food and Agriculture Organization (FAO), to this important regional workshop on Preparing the Next Generation of Watershed Management Programmes. I sincerely thank you all for your presence and participation in this major event dealing with watershed management past, present and future perspectives. I would like also to extend my thanks to ICRAF for co-organizing this regional workshop, to Dr Dennis Garrity for his openness and strong drive to develop partnership and cooperation among our institutions. I extend special thanks to Dr Brent Swallow and his team for the assistance they have provided, and the kind and efficient support throughout the preparation process, which has made this workshop a reality open to promising developments. At FAO, and I believe mostly so at ICRAF, we treasure and apply cooperation and multidisciplinary approaches, and that is why this workshop and the process in which it is included are supported by many departments in FAO, three of which are participating in and supporting your workshop.

### **Why should we focus on watershed management?**

The conservation, use and sustainable management of watershed resources to meet the demands of growing populations have been a high priority of many countries in the world for the past several decades. In this respect, integrated watershed management through people's participation has become widely accepted as the approach that ensures the sustainable management of natural resources and a better agriculture economy for upland people, as well as for those living in downstream areas.

Integrated watershed management was also recognized as a suitable approach to address poverty and food insecurity for people living in the same basins. Ecology, soils, physical climatology and other sciences should also integrate all social and human dimensions. Thus, it can offer balanced options and help provide guidelines for choosing acceptable and viable management alternatives.

Chapter 13 of UNCED Agenda 21, for which FAO is the UN Task Manager, stresses, "Promoting integrated watershed development programmes through effective participation of local people is a key to preventing further ecological imbalance. An integrated approach is needed for conserving, upgrading and using the natural resource base of land, water, plant, animal and human resources".

### **Why we are here**

Although much progress has been achieved in watershed management, no clear picture was drawn on what has been really working and what can be done to improve future watershed programmes. Therefore, an in-depth analysis of watershed management practices, achievements and existing gaps was identified at FAO as a prerequisite to further satisfactory development of watershed management programmes.

In addition, a number of key issues of major concern to watershed management development come at the forefront. They relate to participatory processes, matching technologies and desired results, sustainability and replicability, institutional, organizational and legislative arrangements, the adequate policy and strategic framework. All these need in-depth analysis, adaptation and fine-tuning.

Therefore, it was proposed to review and assess watershed management activities with the aim to provide reliable information on lessons learned and existing gaps. The following major steps were identified as necessary for the proposed review and assessment of watershed management activities: 1) stocktaking exercise; 2) case studies analysis; 3) regional workshops; 4) international conference – synthesis of findings; and 5) formulation of guidelines and dissemination of results.

A series of regional workshops have already been conducted in Mégève, France (European Regional Workshop), Aleppo, Syrian Arab Republic (Near East and North Africa), Arequipa, Peru (Latin American Regional Workshop) and Kathmandu, Nepal (Asian Regional Workshop). These workshops were important steps in the process, providing an opportunity to watershed management groups all over the world to exchange and discuss achievements and

to exchange gaps of diverse nature in watershed management. They have helped generate insights on possible new directions and innovative approaches and strategies for future watershed management programmes.

The present FAO/ICRAF African Regional Workshop provides to you, dear colleagues, professionals working in the region to share lessons learned on watershed management, to identify from your diversified experience the elements that constitute effective watershed management and contribute to opening new perspectives and building a vision on more efficient and sustainable ways of doing the job.

### **What are the workshop objectives?**

The broad objective of this regional workshop is to promote the sharing, dissemination and exchange of information on watershed management achievements and present gaps, and thus to provide required support for the development of enhanced practices, more effective watershed management through better designed and adequately implemented projects and programmes.

The workshop aims to achieve the following specific objectives:

- assess and identify the nature and extent of achievements and existing gaps in the state-of-the-art of watershed management programmes and approaches in Africa;
- identify lessons learned and principal issues emerging from past experiences in the region, with particular focus on the 1990 to 2002 period;
- identify guidelines for the formulation and implementation of the next generation of watershed management projects/programmes, with special focus on the role of effective watershed management in the conservation and sustainable use of water resources.

### **What are the expected results?**

By involving many experts and institutions dealing with watershed management, it is expected that in addition to outlining the state-of-the-art watershed management in the region, the workshop will contribute to raising awareness and support for implementation of effective watershed management at the local, national and regional levels. From this workshop, you should depart with stronger drive, interest and advocacy for appropriate initiatives on watershed management in the many places where it is needed in Africa.

This workshop is built in the process I have just introduced, and of course its outcome will be an important input for the international conference Integrated Watershed Management: Water Resources for the Future, Porto Cervo, Sardinia, Italy 22 to 24 October 2003 that tops it. It will bring your contribution to the formulation of guidelines for the design and implementation of the next generation of watershed management programmes.

The workshop findings will also contribute to the follow-up of the International Year of Mountains and to achieving the expected results of the International Year of Fresh Water, which 2003 is.

Once again, I thank you all and I look forward to a great contribution of the Nairobi workshop, with an African flavour, to this endeavour to develop appropriate policies and strategies for future watershed management programmes. Thank you for your patience.

**PROF. R.W. MICHIEKA, PH.D., EBS, DIRECTOR-GENERAL, KENYA NATIONAL ENVIRONMENT MANAGEMENT AUTHORITY**

Hon. John Munyes, Assistant Minister for Water Resources Management and Development (for the Minister, Hon. Martha Karua), Dr Dennis Garrity, Director-General, World Agroforestry Centre; Dr EI Hadji Sène, Director, Forest Resources Division, FAO; distinguished participants, ladies and gentlemen, I am delighted to have been invited to participate in this very important African Regional Workshop. I am indeed honoured to join this distinguished gathering of researchers, teachers, extension workers, policy-makers and experts in watershed management from around Africa, which will spend the next few days in preparing the next generation of watershed management programmes for our African region. I wish to thank the World Agroforestry Centre and the Food and Agriculture Organization of the United Nations for spearheading this effort, and the World Agroforestry Centre for providing pleasant and conducive facilities for the workshop.

The presence of our Minister for Water Resources Management and Development is indeed a firm indication of the commitment of the Government of Kenya to proper water management, and particularly the need continually to look for and adopt innovative approaches and strategies for watershed management programmes.

Ladies and gentlemen, water is vital for the sustenance of all life. Access to water is restricted, and its availability for socio-economic and ecological demands is primarily influenced by its quantitative distribution in space and time, and also by its quality. The distribution countrywide varies from one drainage basin to another. The surface runoff and groundwater recharge rates are influenced by variation in rainfall intensity, soil types, vegetation cover and presence or absence of wetlands.

The Environmental Management and Coordination Act of 1999 has provisions for protection and management of rivers, lakes, wetlands, hill tops, hillsides, mountain areas and forests, all of which are relevant to management of water catchments. Indeed, the Director-General of the National Environment management Authority (NEMA) of Kenya must be given written approval for any activity in relation to a river, lake or wetland, which must be supported by an environmental impact assessment study report.

Additionally, the Minister for Environment, Natural Resources and Wildlife may issue general and specific orders, regulations or standards for the management and protection of riverbanks, lakes shores, wetlands or coastal zones.

Wetlands in the country include swamps, deltas, bogs, floodplains, areas bordering water bodies such as mangrove forests, riverine ecosystems, lake shores, estuaries, and marine mudflats that have moisture most of the year. Their multiple contributions to water bodies include provision of nutrients that sustain primary productivity, forming the basis of food chains, act as filters of polluted water, silt, eutrophication, etc. Wetlands are exploited on both

seasonal and long-term bases through grazing, direct harvesting of plant material and fishing. They form important habitats for fish breeding, as well as other forms of life. They are major water sources for industrial, domestic, livestock and agricultural uses, and also function as natural water reservoirs and regulators, as well as providing opportunities for recreation and tourism. Kenya is a signatory to the Ramsar Convention on wetlands conservation and management, and has set aside lakes Nakuru and Naivasha as Ramsar sites.

Soil erosion is a major problem in many river catchment areas. This has direct impact on the water quality and the life of reservoirs and irrigation channels, and the life of aquatic ecosystems.

Flooding is a recurring problem affecting areas like the Lake Victoria basin and the Tana River basin. Flood control, therefore, is a priority concern because of the frequency and the magnitude of the damage that floods cause.

Mountain ecosystems are an important source of water. However, human activities adversely affect these ecosystems, which are rapidly changing, as they are susceptible to accelerated soil erosion, landslides and rapid loss of habitat and biological diversity. Hence, proper management of mountain resources deserves immediate attention.

Mountains/highland ecosystems influence climate and are main water catchment zones. Interference with these ecosystems can have major impacts on land productivity and biodiversity, as well as the quality of the environment.

Forests cover a very small proportion of Kenya's total land area, but they conserve biological diversity, water and soil. The destruction of forests is threatening ecological functions, including protection of water catchments and conservation of valuable gene pools of fauna and flora. It also endangers the nation's water supplies for a large proportion of the population and causes severe siltation problems for the major hydroelectric and irrigation schemes. Excessive deforestation also upsets carbon dioxide balance in the atmosphere, which results in adverse climatic changes such as global warming.

Ladies and gentlemen, development of innovative approaches to the conservation of water catchment in Kenya calls for:

- establishment of national instruments for attaching appropriate economic and financial values and benefits to water resources;
- promoting cooperation between water catchment preservation and water-use stakeholders;
- providing incentives to accelerate integrated management, through community institutions and private sector partnerships;
- establishing new administrative structures for managing water resources, which make the user responsible to other users and not to the government alone;
- developing the capacity of local communities to participate in watershed and water resource conservation efforts, supply decisions and maintenance skills;
- integrating all production systems in all sectors, i.e. agriculture, forestry, industrial, urbanization, settlement, etc., to the preservation and wiser use of water resources;
- devolve planning, implementation and monitoring and evaluation to communities and other stakeholders.

Mr Chairman, I wish to conclude by once again thanking the organizers of the workshop for bringing these experts together to:

- assess and identify the nature and extent of achievements, as well as challenges, in watershed management;
- identify lessons learned from past experiences;
- identify appropriate approaches for future watershed management.

Thank you.

#### **HONOURABLE MARTHA KARUA, MINISTER FOR WATER RESOURCES MANAGEMENT AND DEVELOPMENT**

*Presented by Hon. John Munyes, Assistant Minister*

Director-General, World Agroforestry Centre, Dr Dennis Garrity; Director, Food and Agriculture Organization, Nairobi Office; distinguished workshop participants, ladies and gentlemen, I am delighted to be with you this morning during the start of this esteemed workshop as you embark on mapping out the next generation of watershed management programmes. Indeed, this is an important forum, and the task ahead is no doubt challenging.

However, before I continue with my message this morning, I wish to take this early opportunity to welcome you to Kenya, and Nairobi in particular, those of you that have come from other parts of the world. Feel at home and take time out of your busy schedule to sample some of Kenya's hospitality and beautiful sceneries. We love visitors and take pride in hosting our guests.

Ladies and gentlemen, this important forum has come at the right time for us in Kenya, when we are operationalizing the Water Act 2002. The act, which became effective from March this year, heralds a new chapter for the water sector reforms in the country. The act recognizes the role of other actors and stakeholders in the management of water resources, and also defines the role of the government, through the ministry in charge of water affairs, as that of policy formulation direction, sector coordination and financial aspects of development.

The ongoing water reforms, which are geared to improve efficiency and effectiveness of water resources management and provision, are derived from the fact that water resources and services have in the past been managed unsustainably. In this regard, establishing institutions that will manage water services, including protection and conservation and proper management of watersheds in the entire country, is of paramount importance in our plans.

In the overall strategy, efforts are focused on major key areas, including but not limited to institutional framework, capacity building, private sector participation, finance, monitoring and information dissemination.

Ladies and gentlemen, allow me to share with you some data of my ministry's water programme. There are currently more than 1 500 water supplies under various management agencies. The ministry itself runs more than 600 rural water supplies, out of which 200 schemes

are gazetted for revenue collection. The National Water Conservation and Pipeline Corporation, which is a parastatal body under my ministry, runs more than 48 water supplies. Local communities within the watersheds, combined with self-help groups and NGOs, run more than 865 schemes. It is important to mention here that 9 000 boreholes have been registered with the Registrar of Water Rights.

Further, approximately 57 million m<sup>3</sup> of water are extracted annually for various purposes across the country. Out of these, 50 percent is used for domestic and livestock purposes, while the rest is used for irrigated agriculture. Hand-dug wells sustain 12 percent of the total household water needs in Kenya. This information underscores the partnership and collaboration among stakeholders in water services and the importance of proper management of watersheds. The ministry's vision is complete access to water services for all, including the ecosystem requirements.

I wish further to inform this forum that specific areas of water services not adequately accounted for have been identified. These include the following:

- large quantities of unaccounted water;
- occurrences of leakages within water supplies;
- poor reticulation of water in old pipes;
- poor network designs and low water tariffs that encourage water wastage.

Because of increased human population in this country, many activities have been taking place in recent years particularly in water conservation areas. Extensified cultivation to increase food production, as well as poor farming practices have led to serious soil erosion and overall reduction in water recharge capability into soils. As a result, rivers and streams have run dry, because of depletion of water sources across areas that had plenty of water before. This scenario has been replicated almost in the whole region. This trend cannot be allowed to continue. Mitigation measures must be sought, deliberated upon and urgently implemented.

The ministry has formulated a water resources management strategy, at present in draft form, to capture some of the challenges of watershed management. A Water Resources Management Authority will soon be launched with the goal of ensuring that the water resources of this country are protected, conserved and allocated in an equitable manner. Our present challenge is how to integrate river basin approach and administrative boundaries for the Water Boards established to be economically viable.

Ladies and gentlemen, it is therefore important for this workshop to throw light on the way forward, strengthening the regional strategies on watershed management. This workshop should also address all the problem features of watershed management within the region, and chart out a well thought programme for the implementers to use, now and in the future. I would also urge you to strive and consider affordability and situational considerations of your recommendations.

With those few remarks, may I wish you fruitful deliberations, a safe journey back home and also declare this workshop officially opened.

Thank you.

## ANNEX C WORKSHOP PROGRAMME

### WEDNESDAY 8 OCTOBER 2003

**08.00-09.00** Registration of participants  
Moderator/presenter: Elizabeth Were and Antonia Okono

#### Workshop Opening

Chair: Brent Swallow

**09.00-09.15** Introduction/Moderation  
Moderator/presenter: Brent Swallow

**09.15-09.45** Welcoming statements  
Dennis Garrity, Director-General, ICRAF  
El-Hadji Sène, Director, Forest Resources Division, FAO  
Prof. R. W. Michieka, Director-General, NEMA

**09.45-10.15** Official opening  
Hon. John Munyes, Assistant Minister for Water Resources Management and Development, Republic of Kenya

**10.15-10.30** Participant self-introduction

#### Session 1: Presentation and discussion of technical papers: An overview

Chair: Gete Zeleke  
Rapporteur: David Mungai

**10.40-11.00** Moujahed Achouri: *Preparing the next generation of watershed management programmes*

**11.00-11.20** Larry Tennyson: *Review and assessment of watershed management strategies and approaches – Phase I*

**11.20-11.40** Ian Calder: *Watershed management – can we incorporate more evidence-based policies?*

**11.40-12.00** Jean-Marc Faurès: *Land-water relationships in rural watersheds*

**12.00-12.40** Discussions

**Session 2: Presentation and discussion of technical papers: Upland-lowland linkages and interactions**

Chair: Sène El Hadji  
Rapporteur: Moujahed Achouri

**14.20-14.40** Gete Zeleke: *The broken link in the agricultural production system in Ethiopia and its impacts on natural resource management*

**14.40-15.00** J.I. (Seef) Rademeyer: *Evolution of water use and water law, and the effect of this on water management in the Republic of South Africa*

**15.00-15.20** Alain Albrecht: *Runoff and erosion effects of agroforestry*

**15.20-15.40** Francis Mugabe: *Results from ten years of watershed and water resources research in semi-arid southern Zimbabwe*

**15.40-16.00** Discussions

**Session 3: Presentation and discussion of technical papers (continued)**

Chair: Hodson Makurira  
Rapporteur: Jean-Marc Faurès

**16.30-16.50** Brent Swallow: *Watershed property rights*

**16.50-17.10** Jean Bonnal: *Sociological approaches to basin management: from participation to decentralization*

**17.10-17.30** Amadou Maiga: *Regional programme for the integrated management of Fouta Djallon highlands*

**17.30-18.00** Discussions

**THURSDAY, 9 OCTOBER 2003**

**Session 4: Presentation and discussion of technical papers: Case studies on watershed management-related issues**

Chair: Mohamed Bakarr  
Rapporteur: David Nyantika

**08.30-08.45** Robert Hope: *Integrating watershed hydrology and rural livelihoods: a case study from the Limpopo Basin, South Africa*

**08.45-09.00** David Mungai: *Land-water relations in high water stress areas of Kenya*

**09.00-09.15** Ousmane Diallo: *Water erosion and silting in the Niger River basin in the context of watershed management*

**09.15-09.30** Discussions

**09.45-10.00** Abdellah Zitan: *Participatory approaches to basin management: sustainable agriculture and participatory rural development in the Tassout watershed (Upper Atlas in Central Morocco)*

**10.00-10.15** Kwame Odame Ababio: *Putting integrated water resource management (IWRM) into practice – Ghana's experience*

**10.15-11.00** Discussions

**11.30-17.30** Alex Awiti and David Mungai: *Field trip (packed lunch)*

**FRIDAY, 10 OCTOBER 2003**

**Session 5: Working group discussions (three parallel working groups)**

Moderator/presenter: Larry Tennyson and Moujahed Achouri

**08.30-11.00** *Group 1:*  
*Watershed management: upland-lowland linkages and interactions*  
Facilitators: Jean Marc Faurès and Gete Zeleke;  
Rapporteur: Alex Awiti

*Group 2:*  
*Policy and institutions: context of integrated watershed management*  
Facilitators: Jean Bonnal and Brent Swallow;  
Rapporteur: David Mungai

*Group 3:*  
*Watershed management experiences: to include technical, socio-economic, scale of implementation and other relevant topics*  
Facilitators: Larry Tennyson and Antonia Okono;  
Rapporteur: Abdellah Zitan

**11.30-13.00** **Session 6: Working group discussions (three parallel working groups)**  
Chair: Joy Turkahirwa  
Rapporteur: Ian Calder

**14.00-15.00** **Session 6 (continued – plenary): Presentation/discussion of working group findings**  
Chair: Joy Turkahirwa  
Rapporteur: Ian Calder

**15.00-16.00** **Session 7: Closing session**  
Chair: Dennis Garrity  
Moderators: Brent Swallow and Moujahed Achouri

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