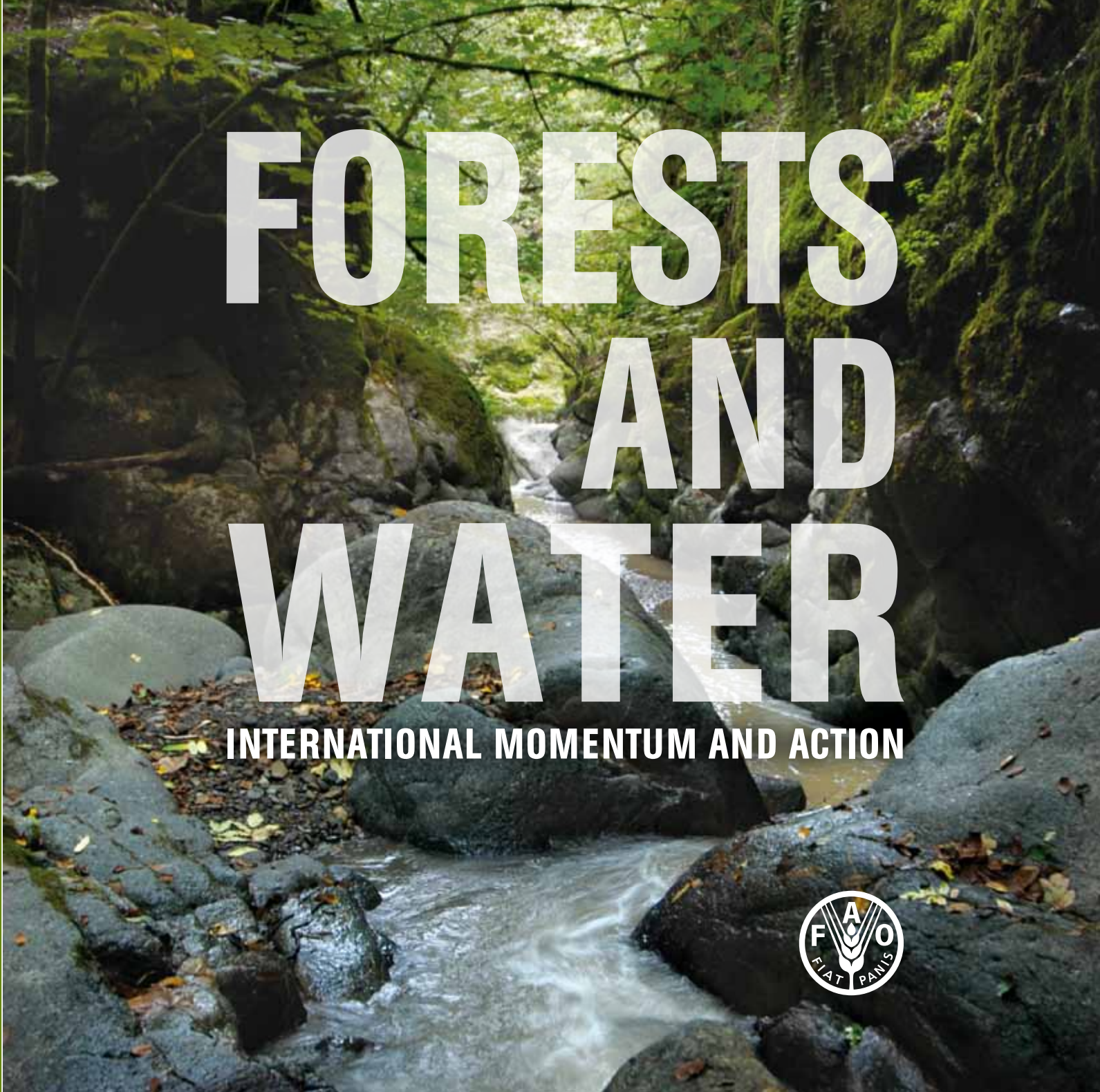


FORESTS AND WATER

INTERNATIONAL MOMENTUM AND ACTION

Forests play a crucial role in the hydrological cycle. Forests influence the amount of water available and regulate surface and groundwater flows while maintaining high water quality. Forests and trees contribute to the reduction of water-related risks such as landslides, local floods and droughts and help prevent desertification and salinization. Forested watersheds supply a high proportion of the world's accessible fresh water for domestic, agricultural, industrial and ecological needs in both upstream and downstream areas.

A key challenge faced by land, forest and water managers is to maximize the wide range of forest benefits without detriment to water resources and ecosystem function. This is particularly relevant in the context of adaptation to climate change, which increasingly reinforces the importance of sustainable forest management.

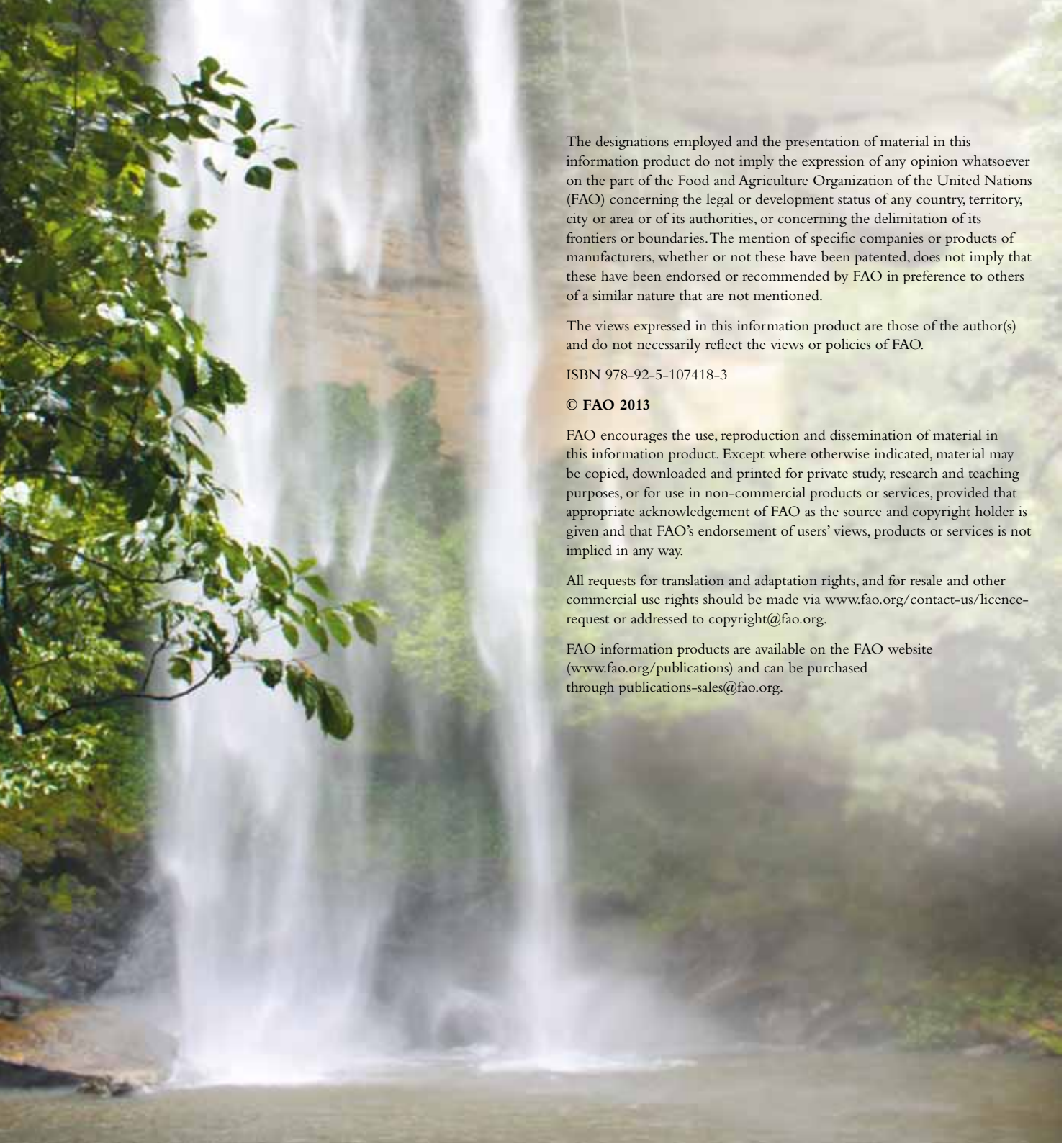
As part of the follow-up to the Shiga Declaration and to the Warsaw Resolution 2, many events on forests and water were organized by FAO and other institutions between 2008 and 2011. Presenting experiences ranging from research to project implementation worldwide, these events provided new, up-to-date insight into the topic as well as important recommendations for the way forward.

FAO took the initiative of synthesizing the main outcomes and recommendations resulting from this process to develop a comprehensive and practical international forests and water agenda to address future course of action.

FORESTS AND WATER

INTERNATIONAL MOMENTUM AND ACTION

Food and Agriculture Organization of the United Nations - Rome 2013



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SUMMARY

ACCESS TO CLEAN WATER IS ONE OF THE MOST FUNDAMENTAL HUMAN RIGHTS. WORLDWIDE, MORE THAN ONE IN SIX PEOPLE STILL DO NOT HAVE ACCESS TO SAFE DRINKING WATER AND APPROXIMATELY 80 PERCENT OF THE GLOBAL POPULATION LIVE IN AREAS WHERE WATER RESOURCES ARE INSECURE.

Pressure on water resources is expected to increase in the future. By the year 2025, 1.8 billion people will be living in regions with absolute water scarcity and two-thirds of the world's population might experience water stress conditions. We are witnessing increasing problems with extreme events such as droughts and floods. The availability and quality of water in many regions of the world is increasingly threatened by overuse, misuse, pollution and projected negative impacts of climate change.

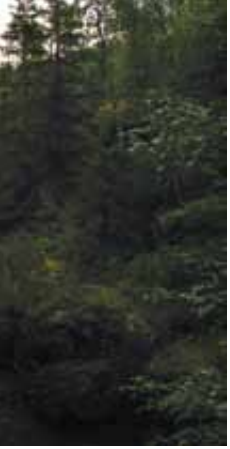
Forests play a crucial role in the hydrological cycle. They influence the amount of water available and regulate surface and groundwater flows while maintaining high water quality.

Moreover, forests and trees contribute to the reduction of water-related risks such as landslides, local floods and droughts and help prevent desertification and salinization. Forested watersheds supply a high proportion of the world's accessible fresh water for domestic, agricultural, industrial and ecological needs in both upstream and downstream areas.

A key challenge faced by land, forest and water managers is to maximize the wide range of forest benefits without detriment to water resources and ecosystem function. This challenge is particularly relevant in the context of adaptation to climate change, which increasingly reinforces the importance of sustainable forest management.

To address this challenge, enhanced synergy is needed between the water and forest communities through institutional mechanisms aimed at implementing action programmes at the national and regional levels. Similarly, there is an urgent need for an even better understanding of the interactions between forests and water, and for embedding the research findings into policy agendas.

The International Expert Meeting on Forests and Water held in November 2002 in Shiga, Japan, in the context of the 3rd World Water Forum was a fundamental step towards improved understanding of forest and water interactions and their implications for policy and management. The Warsaw Resolution 2 on Forests and Water, adopted on the occasion of the 5th Ministerial Conference on the Protection of Forests in Europe held 5-7 November 2007 in Warsaw, Poland, was another milestone marking the path for the development of an international process focusing on forests and water.



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As part of the follow-up to the endorsement of the Warsaw Resolution 2, many events on forests and water were organized by FAO and other institutions between 2008 and 2011. These events were essential in furthering the dialogue on forests and water. Key partners in this process included the Government of Switzerland, the Government of Turkey, the Finnish Forest Research Institute (METLA), the Polish Forest Research Institute (IBL), the United Nations Economic Commission for Europe (UNECE), the UNECE Convention on the Protection and Use of Transboundary Watercourses and International Lakes, the Ministerial Conference on the Protection of Forests in Europe (FOREST EUROPE), the Mediterranean Regional Office of the European Forest Institute (EFIMED), the Red Latinoamericana de Cooperación Técnica en Manejo de Cuencas Hidrográficas (REDLACH) and the United Nations University.

Presenting experiences ranging from research to project implementation worldwide, these events provided new, up-to-date insight into the topic as well as important recommendations for the way forward. However, in spite of its importance and the many conferences and workshops in recent years, forests and water are still not receiving adequate attention by the international community and there is a need to move from conceptual discussion to concrete action. FAO is fully committed to help move this agenda forward.

In close collaboration with the key partner institutions which were the drivers of the different events organized in past years, FAO took the initiative of synthesizing the main outcomes and recommendations resulting from this process to develop a comprehensive and practical international forests and water agenda to address a future course of action. This publication provides an overview of forest and water interactions and describes the increasing international momentum gained by this topic. It then presents, in chronological order, summaries of the various events held between 2008 and 2011, as well as their main outcomes and recommendations. It concludes with the most important part of the publication; namely, the analysis of the key recommendations and the forests and water agenda for the next years.

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FORESTS AND WATER: A COMPLEX RELATIONSHIP

THE RELATIONSHIP BETWEEN FORESTS AND WATER HAS BEEN OF INTEREST TO SCIENTISTS FOR MANY YEARS. IT IS COMMON KNOWLEDGE THAT FORESTS INFLUENCE THE HYDROLOGICAL CYCLE AND THAT, ACCORDINGLY, THEY HAVE AN EFFECT ON WATER RESOURCES BOTH QUANTITATIVELY AND QUALITATIVELY.

Forests are crucial to the sustainable management of water ecosystems and resources, while water is essential for the sustainability of forest ecosystems. Policy-makers should be aware of the important interactions between forests and water.

THE BENEFITS OF FORESTS FOR THE SUPPLY OF WATER ARE MULTIPLE

The benefits of forests for the supply of water are multiple. It is by maintaining high water quality that natural and managed forests make their most significant contribution. Forest management usually results in low input of nutrients, pesticides and other chemicals compared to more intensive land uses such as agriculture. By minimizing erosion, forests reduce the impairment of water quality due to sedimentation. By trapping sediments and pollutants from up-slope land uses and activities, forests help protect water bodies and watercourses. Through the stabilization of river banks, tree and shrub roots reduce erosion in riparian zones, preventing siltation downstream.

A meta-study conducted in 2003 for the World Wide Fund for Nature (WWF) on the role of forest protection in drinking water provision showed that about one-third (33 of 105) of the world's biggest cities, including New York, Mumbai and Bogotá, obtained a significant portion of their drinking water directly from forested watersheds

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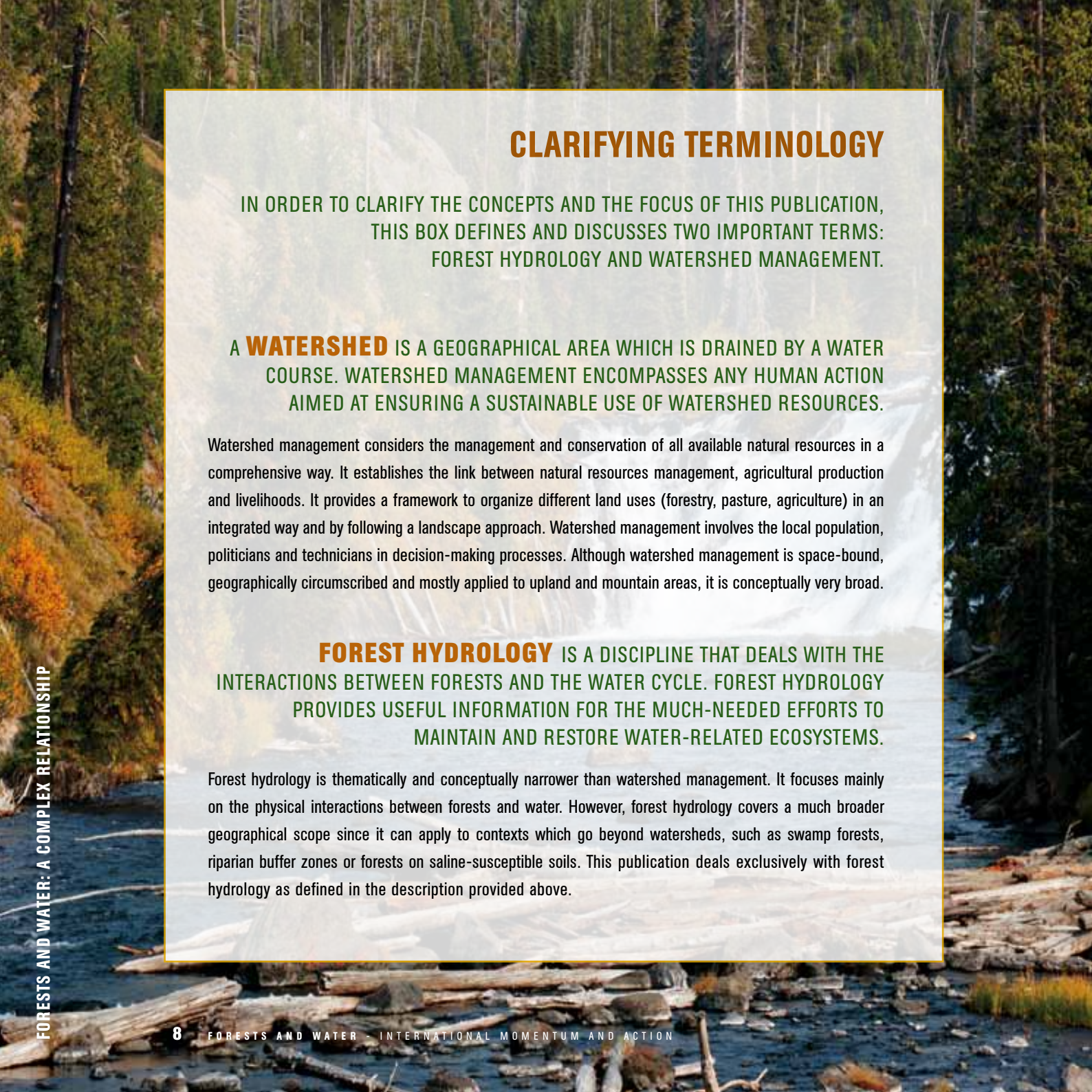
and protected areas. This statistic emphasizes the role of forests in providing high quality water and shows that the proper maintenance of forested areas can be a cost-effective way to ensure a steady provision of safe drinking water.

Forests are important water users. Water use by forests is influenced by the seasons, climate, topography, soil, forest composition (age and tree species) and forest management practices. With the exception of cloud forests, forests return less water to the soil than, for example, well-managed grassland or cultivated areas, as a greater quantity of water is given back to the atmosphere through evapo-transpiration. However, the dense and deep root system of forest soils and the high porosity of its essentially organic horizons make for excellent water infiltration and retention capacity. Surface runoff is minimal and groundwater recharge more efficient, resulting in regular stream flow during the year.

Besides influencing water resources, forests provide a wide range of ecosystem services:

FORESTS PROVIDE A WIDE RANGE OF ECOSYSTEM SERVICES

- Forests protect soils and reduce erosion rates. Deep tree roots stabilize slopes and give the soil a certain amount of mechanical support which can help to prevent shallow mass movements. However, deep-seated landslides are not noticeably influenced by the presence or absence of a well-developed forest cover, but rather by tectonic and geological factors.
- Forestry operations such as cultivation, drainage, road construction or timber harvesting increase the risk of erosion. The implementation of best management practices and a commitment to ensuring forest cover on erosion-prone soils and run-off pathways can help control this risk.
- Forests have been found to be able to mitigate small and local floods but do not appear to impact either extreme flood events or those at a large catchment/river basin scale.
- Forest cover influences all variables of microclimates: solar radiation, air and soil temperature, wind and air humidity. Compared to the open ground, forest cover generally buffers the daily and seasonal temperature differences and thereby alleviates microclimatic extremes.



CLARIFYING TERMINOLOGY

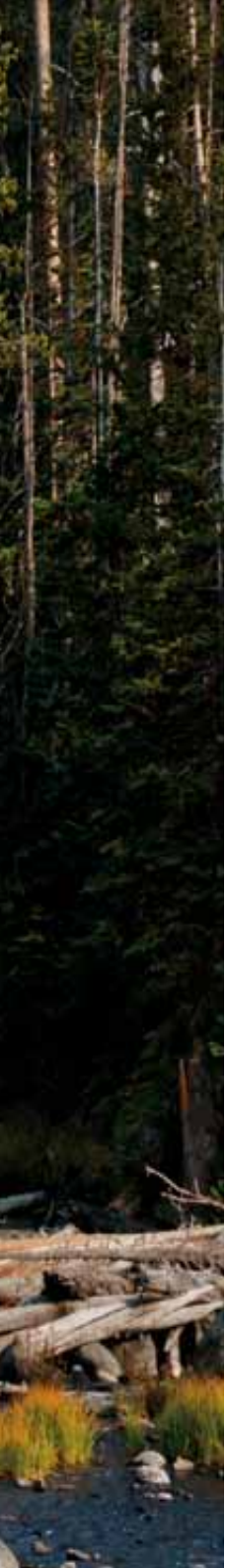
IN ORDER TO CLARIFY THE CONCEPTS AND THE FOCUS OF THIS PUBLICATION, THIS BOX DEFINES AND DISCUSSES TWO IMPORTANT TERMS: FOREST HYDROLOGY AND WATERSHED MANAGEMENT.

A **WATERSHED** IS A GEOGRAPHICAL AREA WHICH IS DRAINED BY A WATER COURSE. WATERSHED MANAGEMENT ENCOMPASSES ANY HUMAN ACTION AIMED AT ENSURING A SUSTAINABLE USE OF WATERSHED RESOURCES.

Watershed management considers the management and conservation of all available natural resources in a comprehensive way. It establishes the link between natural resources management, agricultural production and livelihoods. It provides a framework to organize different land uses (forestry, pasture, agriculture) in an integrated way and by following a landscape approach. Watershed management involves the local population, politicians and technicians in decision-making processes. Although watershed management is space-bound, geographically circumscribed and mostly applied to upland and mountain areas, it is conceptually very broad.

FOREST HYDROLOGY IS A DISCIPLINE THAT DEALS WITH THE INTERACTIONS BETWEEN FORESTS AND THE WATER CYCLE. FOREST HYDROLOGY PROVIDES USEFUL INFORMATION FOR THE MUCH-NEEDED EFFORTS TO MAINTAIN AND RESTORE WATER-RELATED ECOSYSTEMS.

Forest hydrology is thematically and conceptually narrower than watershed management. It focuses mainly on the physical interactions between forests and water. However, forest hydrology covers a much broader geographical scope since it can apply to contexts which go beyond watersheds, such as swamp forests, riparian buffer zones or forests on saline-susceptible soils. This publication deals exclusively with forest hydrology as defined in the description provided above.



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Climate change will very likely have an important adverse impact on the availability and quality of water in many regions of the world. The Fourth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC) forecasted considerable changes in the amount, the temporal and the spatial variation of precipitation in every region.

While increased water availability is expected in the moist tropics and in higher altitudes, decreasing precipitation and soil moisture are likely to affect adversely other areas such as large parts of Africa, central, south and east Asia, southern and eastern Australia and New Zealand, southern Europe, Amazonia and semi-arid areas of Latin America, the already water-stressed areas of North America and several of the small islands. The consequences of these changes could be far-reaching and substantive: forest productivity may increase in some regions, but, in others, vegetative cover could experience drastic decline. In areas where precipitation increases or its patterns change, harmful impacts could include torrential rain, floods and landslides, with negative consequence for human lives, infrastructure and water quality.

Through the regulation of microclimates, the provision of products substituting fossil energy and through carbon storage and sequestration, forests play a crucial role in climate change mitigation. In addition, and very important in the context of this publication, forests have a great potential to reduce impacts of climate change on water resources. Intact forest ecosystems with their buffering functions (e.g. cooling effects, interception of precipitation and evapo-transpiration, water storage and wind shield) can significantly contribute to the mitigation of and adaptation to extreme weather events and resulting catastrophes such as floods, droughts and temperature increase. For example, the shade of riparian forests can help reduce thermal stress to aquatic life as climate warming intensifies. Forest cover reduces the speed of water discharge, the risk of local floods during the rainy season and droughts in the dry season.

Increasingly, the role of forests in climate change mitigation is recognized and there are ambitious initiatives, in particular those related to Reducing Emissions from Deforestation and Forest Degradation plus (REDD+), to tap into the opportunities offered by forests and forestry. It should be emphasized, however, that forests can only take up carbon if they take up water at the same time. Since part of the price of carbon sequestration is paid in water this will also accentuate the debate about the role of forests in the hydrological cycle; in particular, the trade-offs between the water consumption of forests and the ecosystem services (including climate change mitigation) they provide.

Forests themselves are vulnerable to climate change. Reduced and more erratic rainfall and runoff will influence the vitality, resilience and even survival of trees and forest ecosystems. Action needs to be taken to reduce the vulnerability of forests and enhance their resilience to climate change with the aim of ensuring the continued provision of vital ecosystem services and protective functions ensured by forests.

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These adaptation measures need to be consistent with sustainable forest management principles and practices based on improved knowledge of the functioning of forest ecosystems.

Sustainable management of forests requires continuous efforts, financial resources and political commitment. One constraint to halting and reversing global forest loss is the fact that those who manage forests receive little or no compensation for the services (i.e. water) they provide. Funds should be made available through incentives, transfer-payments, subsidies or Payments for Ecosystem Services (PES) to those who provide the ecosystem services (i.e. forest owners), by those who benefit from the services (i.e. water users). In fact, the linkage between forests and water can generate significant economic benefits. It is promising to see an increasing number of successful PES schemes under implementation in industrialized as well as in developing countries.

Despite significant advances in the scientific understanding of forest and water interaction, the role of forests in relation to the sustainable management of water resources remains a contentious issue. Difficulties persist in transferring research findings to different countries, regions or even watershed scales. In addition, site-specific examinations regarding forest and water interactions are necessary for any concrete interventions.

Furthermore, there is a gap between research and policy. This gap persists partly because of the difficulties involved in formulating general principles about forest and water interactions, and partly because of a failure to communicate effectively the results of hydrological and forestry research to policy-makers. Further education and capacity-building across disciplines is necessary in order to address this problem.

The numerous interactions and benefits between forest and water sectors highlight the need for strengthening existing and establishing new linkages between them, and fostering their collaboration. This cooperation is of particular importance as the forest and water sectors need to shape their responses to climate change, resulting in possible adjustments of relevant policies and legislations, institutional development, research reorientation and integrated management strategies and plans.

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FORESTS AND WATER: INCREASING INTERNATIONAL MOMENTUM

THE INTERNATIONAL EXPERT MEETING ON FORESTS AND WATER HELD IN NOVEMBER 2002 IN SHIGA, JAPAN, IN THE FRAMEWORK OF THE 3RD WORLD WATER FORUM, WAS A FUNDAMENTAL STEP TOWARDS IMPROVED UNDERSTANDING OF FOREST AND WATER RELATIONSHIPS AND A MORE EFFECTIVE IMPLEMENTATION OF POLICIES, PLANNING AND MANAGEMENT INITIATIVES WORLDWIDE RELATED TO FORESTS AND WATER.

Convened jointly by FAO, the International Tropical Timber Organization (ITTO), the United Nations Educational, Scientific and Cultural Organization (UNESCO) and the Forestry Agency of Japan, the expert meeting focused on new challenges and perspectives concerning forest and water interactions, such as the need for better understanding of the hydrological and ecosystem services provided by forests, more effective management tools integrating forest and water resources, and clearer national strategies and policies to guide stakeholders in the field. The meeting also raised questions on the role and services of forests in the global freshwater crisis which threatens livelihoods – including health and food security – and biodiversity conservation. The main outcome of the meeting was the Shiga Declaration on Forests and Water, which is presented in Annex 1. Highlighting the need for a more holistic consideration of the interactions between water, forests, other land uses and socio-economic factors in complex watershed ecosystems, the Shiga Declaration has become a key reference for the development of a new generation of forest and water policies over the past few years.

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Warsaw Resolution 2 on Forests and Water of the Ministerial Conference on the Protection of Forests in Europe (FOREST EUROPE) was another milestone marking the path for the development of an international process focusing on this topic. The resolution was adopted on the occasion of the 5th Ministerial Conference held 5-7 November 2007 in Warsaw, Poland. Recognizing the close interrelation between forests and water, the signatory states and the European community committed themselves to undertake consistent action in order to address four main areas of concern:

- sustainable management of forests in relation to water;
- coordinating policies on forests and water;
- forests, water and climate change;
- economic valuation of water-related forest services.

The resolution text is presented in Annex 2.

Warsaw Resolution 2 has significantly boosted the international momentum with regard to forests and water. As part of the follow-up to the endorsement of Resolution 2, many events on forests and water were organized by FAO and key partners between 2008 and 2011, each of them looking at the issues from a slightly different perspective:

- the 26th Session of the European Forestry Commission Working Party on the Management of Mountain Watersheds, 19-22 August 2008 in Oulu, Finland, with the thematic focus on forests, water and climate change in high altitude and high latitude watersheds;
- the III International Conference on Forest and Water, 14-17 September 2008, Mrągowo, Poland;
- the Plenary Session on Forests and Water held during the European Forest Week, 20-24 October 2008, FAO Headquarters, Rome, Italy;
- the international conference Water and Forests: A Convenient Truth?, 30-31 October 2008, Barcelona, Spain;
- the Workshop on Forests and Water organized by FOREST EUROPE and partners, 12-14 May 2009, Antalya, Turkey;

- the Forests and Water Technical Sessions and Side Event at the XIII World Forestry Congress, 18-25 October 2009, Buenos Aires, Argentina;
- the Forests and Water Segment at the 35th European Forestry Commission Session, Lisbon, Portugal, 27-30 April 2010;
- the Plenary Session on Forests and Water in the Context of Climate Change held during the 20th Session of the Committee on Forestry (COFO), 4-8 October 2010, FAO Headquarters, Rome, Italy;
- the Workshop on Forests and Water in Drylands: A Virtuous Cycle – Information exchange from the Mediterranean to Central Asia, 7-8 July 2011, Geneva, Switzerland.

The next section will present summaries of these events in chronological order and according to a standardized structure:

a. purpose of the event;
b. sponsors and organizers;
c. main themes, questions and ideas discussed;
d. key messages and recommendations.

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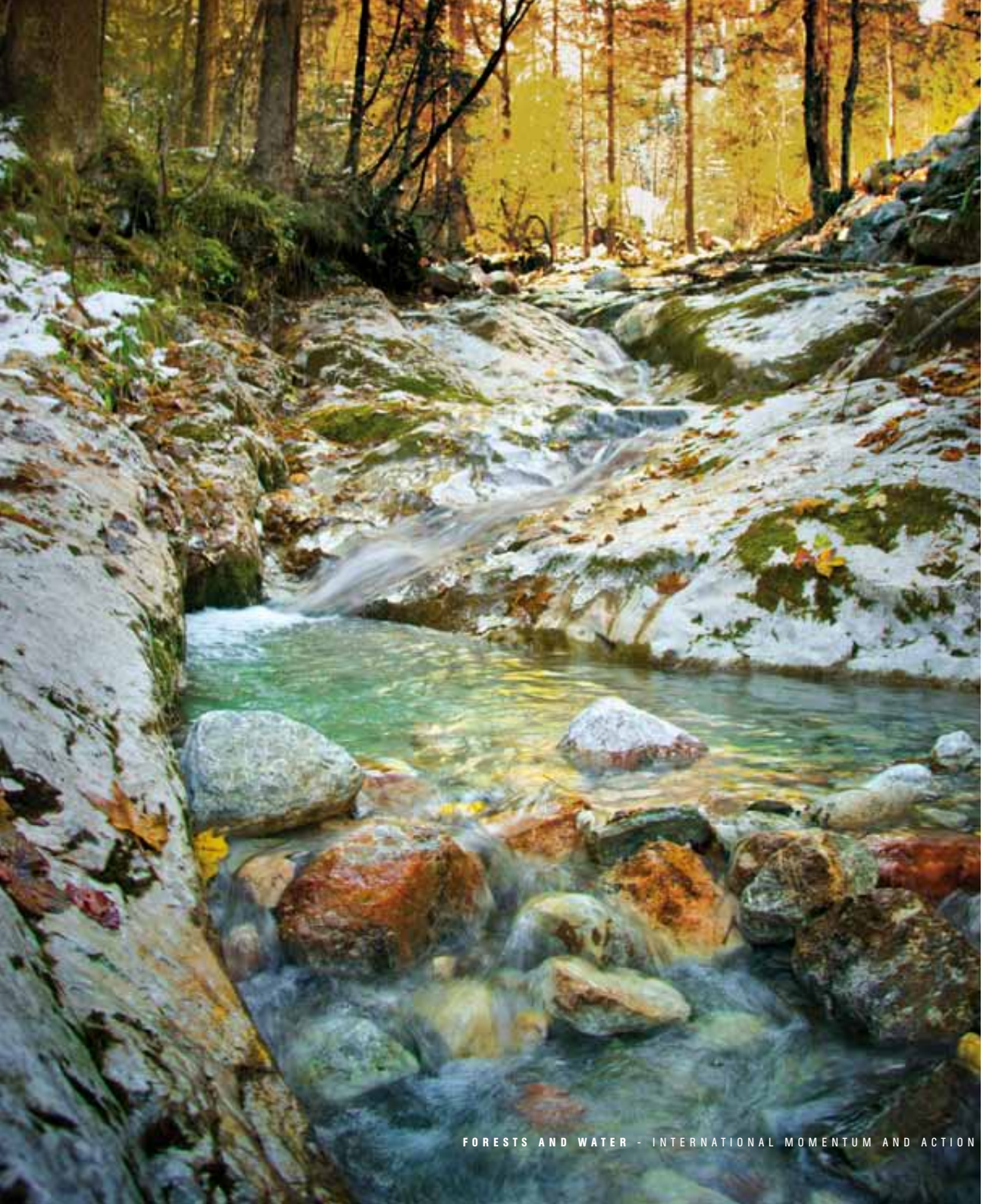


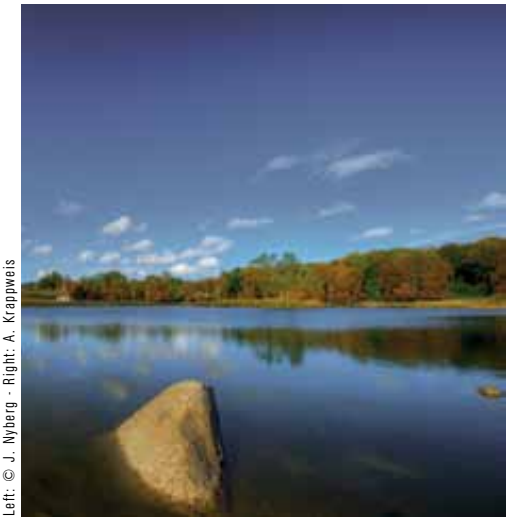

CFM 2009
XIII Congreso Forestal Mundial
XIII World Forestry Congress - XIII Congrès forestier mondial
18 - 23 OCTUBRE 2009


CFM 2009
XIII Congreso Forestal Mundial


ALBANIA

KEY FEATURES OF FOREST AND WATER-RELATED EVENTS 2008–2011

26th SESSION OF THE EUROPEAN FORESTRY COMMISSION WORKING PARTY ON THE MANAGEMENT OF MOUNTAIN WATERSHEDS



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THE 26th SESSION OF THE EUROPEAN FORESTRY COMMISSION WORKING PARTY WAS HELD IN OULU, FINLAND, 19-22 AUGUST 2008. THE SESSION WAS JOINTLY ORGANIZED BY METLA OF THE MINISTRY OF AGRICULTURE AND FORESTRY, THE FINNISH ENVIRONMENT INSTITUTE (SYKE) OF THE MINISTRY OF ENVIRONMENT AND FAO. THE MAIN TOPIC UNDER DISCUSSION WAS "FORESTS, WATER AND CLIMATE CHANGE IN HIGH ALTITUDE AND HIGH LATITUDE WATERSHEDS".

From the perspective of adaptation to climate change, the session was an occasion to gather and discuss contributions from researchers, and to share approaches from national experiences as well as international organizations (projects, policies and relevant outcomes) related to forest, water and risk management. Besides offering a full insight into the topic at stake, it allowed for a comparison of problems experienced and coping strategies put in place by specialists working in either high altitude or high latitude areas. The northern venue of the session further fostered this comparison exercise. It made clear that a deeper understanding of the interactions between forests and water is a common concern throughout Europe and that these interactions need to be differentiated according to altitude and latitude.

The session was attended by 36 lecturers, delegates and observers from the following countries and international organizations: Austria, the Czech Republic, Finland, France, Hungary, Poland, Romania, Slovakia, Sweden, Switzerland, Turkey, FAO, the International Centre for Integrated Mountain Development (ICIMOD), the International Union of Forest Research Organizations (IUFRO), FOREST EUROPE, UNESCO and the European Science Foundation.

Member countries were requested to report on the following issues related to the main topic of the seminar:

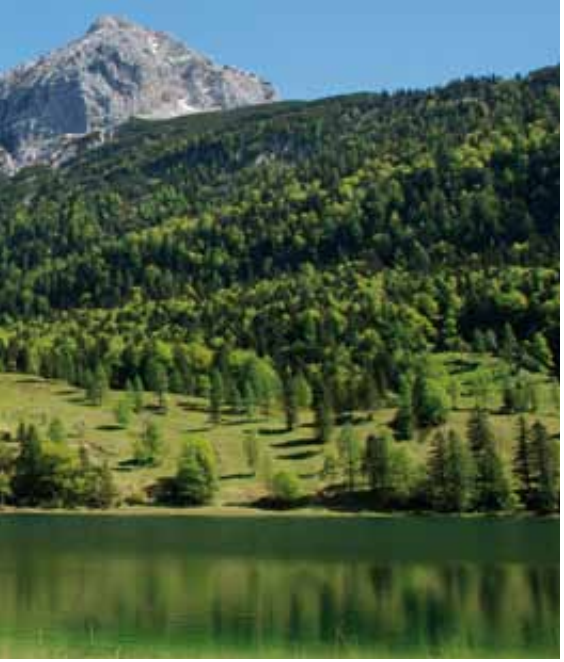
- trends and threats to water, forests and soils, including evidence of increasing hazards;
- projects to address these threats and trends;
- research results, experiences and case studies;
- policy attention and case studies.

Key points discussed:

- The climate of high altitude and high latitude watersheds is characterized by seasonal cycles, and the hydrometeorology is controlled largely by processes involving snow and ice.
- The impacts of climate change are easier to predict in high latitude than in high altitude watersheds where topography and microclimate are very complex and highly differentiated.

THE IMPACTS OF CLIMATE CHANGE CAN RESULT IN CONSIDERABLE HUMAN AND ECONOMIC LOSSES. THE ABILITY FOR MITIGATION AND ADAPTATION LARGELY DEPENDS ON THE LEVEL OF SUSTAINABILITY OF NATURAL RESOURCES MANAGEMENT

- The overall predicted trends through climate change are the same: more precipitation during the winter months, drier summers, more extreme weather events and increased unpredictability, and upward/northward movement of treelines. In terms of impacts on biodiversity, climate change particularly threatens high altitude species because of the limited space for horizontal moves.
- In high latitudes, the predicted hydro-meteorological trends can cause floods, droughts, more storms and pest diseases to trees. In high altitudes, climate change may lead to glacial lake outbursts and permafrost hazards with disastrous consequences both in the mountain areas as well as downstream.
- The impacts of climate change can result in considerable human and economic losses. The ability for mitigation and adaptation largely depends on the level of sustainability of natural resources management. The strongest negative impacts of climate change on local livelihoods are expected to occur in mountain regions of developing countries which are particularly vulnerable.



Left and right: © A. Borchard

Main recommendations:

- There is a need to improve our understanding of snow, ice and hydro meteorological processes; to strengthen good monitoring systems; to develop better and more reliable climate and climate change impact models; to develop more elaborated disaster risk management tools, including on a transnational basis.
- There is a need for concrete examples or case studies which are able to identify, monitor and document impacts of climate change on the environment, the economy and the livelihoods in high altitude and high latitude watersheds.
- In both high altitude and high latitude watersheds integrated watershed management is a sound strategy for the adaptation to climate change. Improved techniques for natural resources management and the provision of alternative livelihood options to reduce pressure on natural resources are important elements. Socio-economic interventions require awareness-raising and capacity-building at all levels.

III INTERNATIONAL CONFERENCE ON FOREST AND WATER

THE III INTERNATIONAL CONFERENCE ON FOREST AND WATER WAS HELD IN MRĄGOWO, POLAND, 14-17 SEPTEMBER 2008. THE CONFERENCE WAS ORGANIZED BY THE POLISH IBL AND THE NORWEGIAN FOREST AND LANDSCAPE INSTITUTE, IN COLLABORATION WITH THE GENERAL DIRECTORATE OF THE STATE FORESTS IN WARSAW AND THE REGIONAL DIRECTORATE OF THE STATE FORESTS IN OLSZTYN.

The main objective of the conference was to allow scientists and practitioners to present and discuss research results, views and experiences related to forest and water issues. It aimed to bring relevant researchers, technicians and policy-makers closer to the commitments adopted in Resolution 2 and to consider options and ways for their implementation.

The conference was organized in the context of the follow-up to the endorsement of the Warsaw Resolution 2 on Forests and Water by the Ministerial Conference on the Protection of Forests in Europe in November 2007. The conference was attended by 80 participants from the following countries and organizations: the Czech Republic, Germany, Latvia, Norway, Poland, Ukraine, FAO and FOREST EUROPE.

Left: © P. Ceci - Right: A. Krappweis

Structure of the conference and main themes:

The sessions of the conference were structured according to the four main areas of concern addressed by the Warsaw Resolution 2:

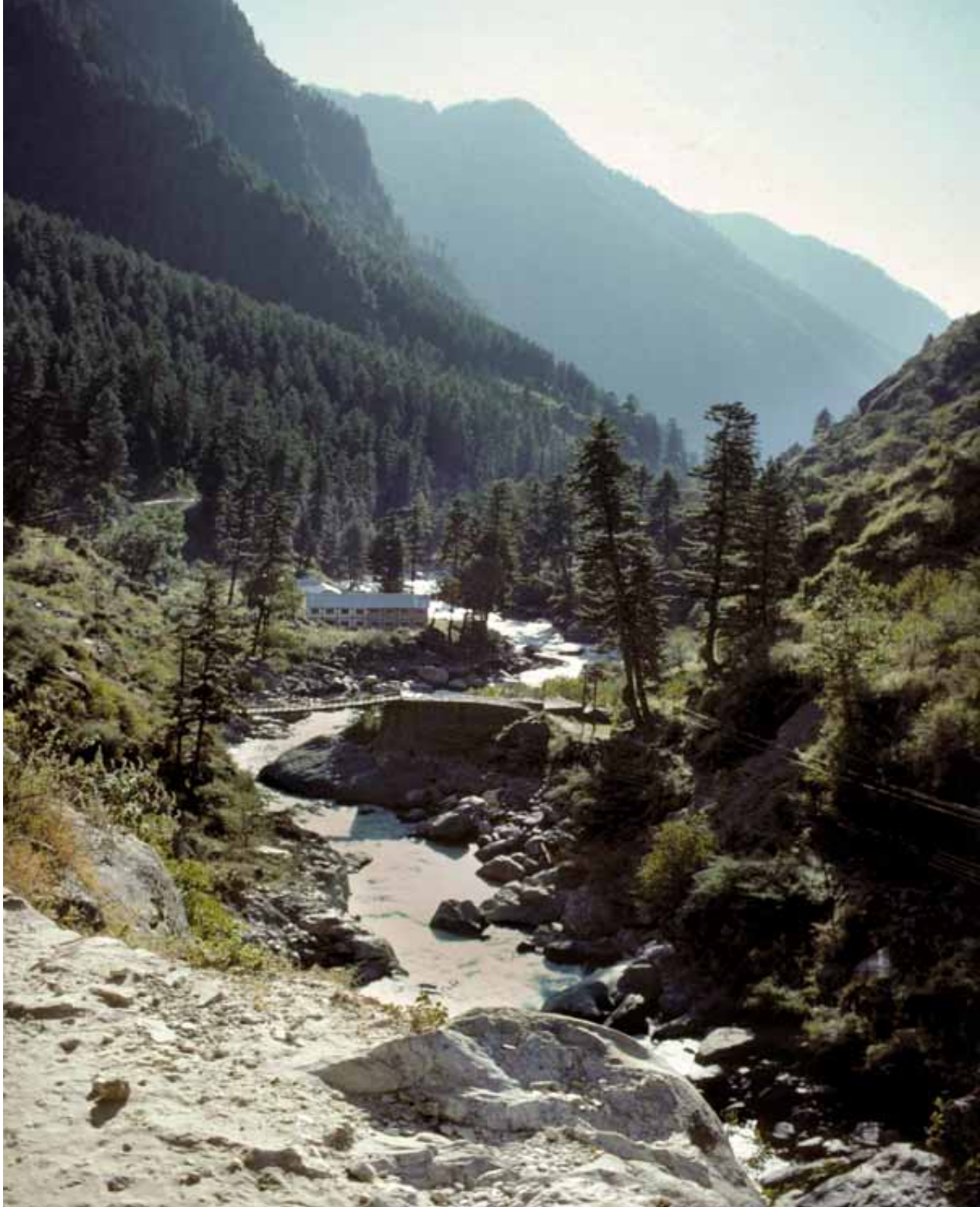
- sustainable management of forests in relation to water;
- coordinating policies on forests and water;
- forests, water and climate change;
- economic valuation of water-related forest services.

Key points discussed:

- While forest ecosystems are important water users, they also play an important role in the conservation of water resources. Silviculture practices need to be extended to take into account water management requirements.
- There is a need to develop and implement long-term monitoring systems on quantitative and qualitative changes of water resources within and from forested catchment areas in order to assess state threats and action needed to reverse unfavourable trends.
- There is a need to review national legislation related to forest and water management in order to harmonize the provisions, fine-tune the terminology and update contents according to the most recent research findings and management experiences.
- Projected climate change and associated disturbances in the water cycle are expected to have a strong influence on water resources resulting in extreme events such as floods and droughts. Public awareness needs to be raised on the potential of forests to mitigate the impact of these extreme events.
- There is a need to develop tools to estimate the value of water-related ecosystem services ensured by well-managed forests and to put in place financial schemes to compensate the providers of such services.

SILVICULTURE PRACTICES NEED TO BE EXTENDED TO TAKE INTO ACCOUNT WATER MANAGEMENT

PROJECTED CLIMATE CHANGE AND ASSOCIATED DISTURBANCES IN THE WATER CYCLE ARE EXPECTED TO HAVE A STRONG INFLUENCE ON WATER RESOURCES RESULTING IN EXTREME EVENTS SUCH AS FLOODS AND DROUGHTS



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Main recommendations:

- More research should be conducted to deepen the knowledge of forest and water interactions at different stand development stages and under changing climatic scenarios.
- Countries should urge the implementation of provisions endorsed in the Warsaw Resolution 2 on Forests and Water.
- Institutional obstacles hindering joint forest and water management should be overcome and cooperation between the two sectors should be strengthened by redefining competences and the roles of respective institutions.
- Specialists in relevant ministries and line agencies should be trained in interdisciplinary approaches including hydrology, water management, environmental engineering and forestry.
- Forest management practices should aim at maximizing the benefits of forests for water quantity and quality. Forest functions such as water retention and groundwater recharge should be optimized through sound management. Additionally, forest management measures have to be put in place for adapting to climate change and minimizing its impact on water resources.

FORESTS AND WATER PLENARY SESSION AT EUROPEAN FOREST WEEK

EUROPEAN FOREST WEEK WAS CO-ORGANIZED BY THE EUROPEAN COMMISSION, FAO, FOREST EUROPE AND UNECE, AND TOOK PLACE AT FAO HEADQUARTERS IN ROME, ITALY, 20-24 OCTOBER 2008.

The plenary on forests and water, which took place on 23 October, aimed to promote the implementation of the FOREST EUROPE Warsaw Resolution 2 on Forests and Water and to contribute to a closer interaction between the forest and water sectors. Topics covered ranged from financial instruments and economic incentives, especially payments for ecosystem services, to forests and water-related risk management in the context of climate change and transboundary cooperation.

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The session was chaired by Sibylle Vermont, Swiss Federal Office for the Environment (FOEN), Switzerland. The opening of the session by Paolo Garonna, Deputy Executive Secretary, UNECE, and the keynote address by Christian Küchli, FOEN, were followed by a panel discussion with the following participants: Gerald Steinndlegger, WWF; Hillevi Eriksson, Swedish Forest Agency; Edward Pierzgalski, IBL; Eric Toppan, French Private Forestry Federation; and Pier Carlo Zingari, European Landowners' Organization (ELO).

The panellists and participants reflected on the following questions concerning the collaboration between the forest and water sectors:

- What are the benefits of cooperation?
- Are national strategies integrative enough?
- What are the major obstacles and how to overcome them?
- How to foster collaboration?
- What are the areas for collaboration?
- How can the Warsaw Resolution 2 be promoted?
- What are the lessons learned and experiences on cross-sectoral cooperation, payments for ecosystem services and others?

Key points discussed:

- The plenary session was the first policy level meeting between the forest and water sectors. Such dialogue and cooperation can bring many benefits to both sectors and needs to be strengthened.
- As a basis for such cooperation, improved knowledge on forest hydrology and forest and water interactions, enhanced information exchange, communication and cross-fertilization are required.

Left and Right: © P. Caci

- Payments for ecosystem services are a key tool which requires more consideration, practical implementation and learning from experience.
- A number of countries have developed policy tools for the integrated management of forests and water. It is important to exchange existing experience and evaluate the needs for additional guidance at the regional and national levels.
- Global drivers of change such as climate change, energy crisis and changes in production and consumption patterns call for coherent and integrated responses from the water and forest sectors that need to be developed jointly.

GLOBAL DRIVERS OF CHANGE SUCH AS CLIMATE CHANGE, ENERGY CRISIS AND CHANGES IN PRODUCTION AND CONSUMPTION PATTERNS CALL FOR COHERENT AND INTEGRATED RESPONSES FROM THE WATER AND FOREST SECTORS THAT NEED TO BE DEVELOPED JOINTLY

Main recommendations:

- Forests and water should be considered in the broad landscape context and an integrated approach should be applied at the local, national and transboundary levels.
- National and transboundary institutions and mechanisms (such as water councils or national forest programmes) should make efforts to bring all concerned actors together.
- The European Forestry Commission (EFC), the UNECE Timber Committee, the UNECE Working Group on Integrated Water Resources Management, FOREST EUROPE and FAO should continue working together on forest and water-related issues.
- Existing experiences on collaboration between forest and water sectors and the need for joint development of guidelines have to be assessed.
- The joint development of projects on payment for ecosystem services has to be considered.

WATER AND FORESTS: A CONVENIENT TRUTH?

THE CONFERENCE WATER AND FORESTS: A CONVENIENT TRUTH? TOOK PLACE IN BARCELONA, SPAIN, 30-31 OCTOBER 2008. IT WAS CO-ORGANIZED BY: EFIMED, IUFRO, CENTRE DE RECERCA ECOLÒGICA I APLICACIONS FORESTALS (CREAF), UNIVERSITAT DE BARCELONA, CENTRE TECNOLÒGIC FORESTAL DE CATALUNYA, FUNDACIÓ TERRITORI I PAISATGE DE CAIXA CATALUNYA, FAO AND FOREST EUROPE. THE EVENT WAS SPONSORED BY THE DEPARTAMENT DE MEDI AMBIENT I HABITATGE DE LA GENERALITAT DE CATALUNYA.

The event aimed at contributing to (i) a better understanding of the bio-physical interactions between forests and water in different geographic situations and contexts; (ii) the development of effective and efficient models for managing forest and water resources with an integrated approach; (iii) a more comprehensive knowledge on forest/water interface addressing policy-makers in the framework of different policy initiatives (e.g. the European Union Water Framework Directive and the Ministerial Conference on the Protection of Forests in Europe).

The conference brought together decision makers, managers, scientists and stakeholders from the forest and water sectors in order to discuss new approaches and challenges from the perspective of different disciplines: meteorology, eco-physiology, forestry, hydrology and economics. The structure of the conference allowed for the provision of a global perspective as well as a specific focus on the Mediterranean region. It was divided into four sessions with high-level keynote presentations and invited statements: Session I. Rainfall: what prospect?; Session II. Water for Trees; Session III. Forests: sinks or sources for water?; Session IV. Water for people.

Participants reflected on the following questions concerning forest and water sectors:

- Can General Circulation Models predict future precipitation patterns?
- How does water stress affect growth of Mediterranean trees?
- What are the trade-offs between water use and carbon fixation in forest ecosystems?
- Adapting forestry to limited water availability: towards a water saving silviculture?
- Plantations versus natural forests, and forests versus other vegetation covers: what are the differences regarding the water balance?
- Use of water resources and future availability: how to manage water resources in a context of increasing water scarcity?
- Why is it important to invest in watershed management?

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Key points discussed:

- Global climate models predict, with more uncertainties than for temperature, marked changes in seasonal snow and rainfall. They forecast significant rainfall decrease in the Mediterranean basin and increase of winter precipitation in central and northern Europe. Climate change in the Mediterranean basin is expected i) to increase water scarcity (less rainfall and more evaporation); ii) to impact, through higher aridity and more frequent extreme events (heat wave, dry spells, floods), the vitality, resilience and even survival of trees and forest ecosystems.
- Forests have lower input of nutrients, pesticides and other chemicals into water bodies than more intensive land use systems such as agriculture and, accordingly, they play an important role in ensuring the delivery of high quality water. On the other hand, forests can consume greater amounts of water than other natural vegetation covers.
- In arid or semi-arid ecosystems, forests can evapo-transpire up to 90 percent of the rainfall. However, by avoiding erosion, forests play a key role in the protection of soil resources. Accordingly, the challenge in arid zone forests is to optimize the trade-offs between water yield and soil protection.

Main recommendations:

- The interactions between forest cover and water are complex with regard to different variables such as low flow, high flow, water yield and water quality. They depend on many parameters which often have a site-specific nature. The present scientific knowledge on forest and water interactions needsw to be efficiently and effectively communicated to policy-makers and society at large.
- The components of the water cycle and the water budget should be considered in an integrated manner, taking into account both the Blue Water (water in liquid form, used for the human needs or flowing to the oceans) and the Green Water (water in vapour form, resulting from evaporation and transpiration processes).

© T. Hofer

THE TIME HAS COME FOR DESIGNING INNOVATIVE POLICIES AND STRATEGIES, AIMED AT BALANCING WATER FOR MAN AND WATER FOR NATURAL ECOSYSTEMS THROUGH AN DISCIPLINARY AND INTEGRATED MANAGEMENT APPROACH

- When large-scale forest plantations (for example, for carbon sequestration) are planned, it must be ensured that water shortage will not be accentuated.
- The time has come for designing innovative policies and strategies, aimed at balancing water for man and water for natural ecosystems through an interdisciplinary and integrated management approach. This agenda will require collaboration and increased efforts from the scientific community for structuring the available knowledge in a comprehensive manner and for undertaking new scientific investigations.

SUSTAINABLE FOREST MANAGEMENT AND INFLUENCES ON WATER RESOURCES – COORDINATING POLICIES ON FORESTS AND WATER

THE FOREST EUROPE WORKSHOP ON FORESTS AND WATER ENTITLED SUSTAINABLE FOREST MANAGEMENT AND INFLUENCES ON WATER RESOURCES – COORDINATING POLICIES ON FORESTS AND WATER WAS HELD IN ANTALYA, TURKEY, 12-14 MAY 2009. THE WORKSHOP WAS CO-ORGANIZED BY FOREST EUROPE, THE GOVERNMENT OF TURKEY, THE GOVERNMENT OF SWITZERLAND, UNECE WATER CONVENTION AND FAO.

The aim of the workshop was to examine the interrelations and mutual influences of forests and water, how countries approach these topics, and how they currently are and could be reflected in forest and water policies in the pan-European and UNECE region. A primary objective was to contribute to the development of stronger linkages between the two sectors, thereby facilitating the implementation of the Warsaw Resolution 2 on Forests and Water.

Ninety-five participants from both the forest and water sectors, representing 27 countries and 7 organizations in the pan-European and Central Asian regions and neighbouring countries, took part in the workshop.

Keynote presentations on forest and water relationships were given by Thomas Hofer from FAO's Forestry Department and by Paul Reiter from the International Water Association. An introductory speech was made by Kjersti Bakkebø Fjellstad, FOREST EUROPE, presenting the Warsaw Resolution 2 on Forests and Water and follow-up work. Tomasz Juszczak from the UNECE Water Convention introduced work conducted under the Convention.

The opening session was followed by national presentations and plenary discussions. Presentations were given on country experiences from Austria, the Czech Republic, France, Kyrgyzstan, the Russian Federation, Sweden, Turkey and the United Kingdom of Great Britain and Northern Ireland. The plenary session was chaired by Sibylle Vermont, FOEN, Switzerland and Ísmail Belen, General Directorate of Forestry, Turkey. On the second day of the workshop, participants discussed specific topics related to national and regional level policies in two working groups, chaired by Andrey Filipchuk, the Russian Federation and Tom Nisbet, the United Kingdom of Great Britain and Northern Ireland, respectively.

Participants reflected on the following questions concerning forest and water sectors:

- country experiences in the field of forests and water;
- how to improve coordination of policies on forests and water with regard to benefits, obstacles and solutions;
- exploring the financial basis for water-related forest services, with a focus on payments for ecosystem services: mechanisms, incentives and agreements to promote forest management for water.

Left and Right: © P. Ceci

Key points discussed:

- Closer cooperation between the forest and water sectors would be beneficial for promoting services provided by forests and solving water-related problems in a sustainable way.
- Lack of trust, finances, communication, adequate legislation and political commitment between the forest and water sectors within and among national governments are often serious obstacles to cooperation. Lack of communication between sectors and scientists and policy-makers was also identified as a major barrier to effective forest and water management.
- Payments for ecosystem services is a new concept, which needs to be further developed and communicated within the sectors and to the broad public. Examples of establishing mechanisms and markets for such services are still scarce.

Main recommendations:

A holistic perspective on forests and water can help manage ecosystems and can provide additional economic benefits and employment opportunities. This approach should be achieved through strategic planning, decision-making and implementation.

- To promote cooperation between the forest and water sectors, more efforts should be made in raising awareness among water managers about water-related forest services and in strengthening institutional capacity.
- There is a need to develop cross-sectoral research curricula and to communicate effectively research results to policy-makers and managers. National policies and guidelines on forests and water should be developed based on scientific knowledge.
- Cost/benefit analyses in specific management areas should be conducted to explore the financial viability of PES schemes for water-related forest services.
- Forests provide a wide range of ecosystem services which go beyond water. Financial schemes, particularly PES, in forested areas should be incorporated into policies and strategies, especially those addressing climate change mitigation and adaptation.

FORESTS AND WATER TECHNICAL SESSIONS AND SIDE EVENT AT THE XIII WORLD FORESTRY CONGRESS

THE XIII WORLD FORESTRY CONGRESS TOOK PLACE IN BUENOS AIRES, ARGENTINA, 18-23 OCTOBER 2009.

Due to the large number of abstract submissions by researchers under the topic of forests and water, two technical thematic sessions were implemented at the Congress. In addition, a side event on cooperation between the forest and water sectors was organized.

Left and right: © A. Krappweis

SESSION 1

THE HYDROLOGICAL IMPACTS OF PLANTATIONS IN A CHANGING CLIMATE

In certain geographic areas, tree plantations are expected to cause a reduction in water availability. In drought-prone regions, in particular, where water supply is forecasted to be exacerbated by climate change, the hydrological impacts of tree planting is a controversial issue and, thus, was a very appropriate topic for open debate at the Congress.

THE HYDROLOGICAL IMPACTS OF TREE PLANTING IS A CONTROVERSIAL ISSUE

The session opened with a presentation by Timothy McNaught, Australian forester, who presented a paper entitled "Plantation development, climate change and the great water debate: an Australian perspective".

Key points discussed and recommendations:

- There is a lack of scientific research on the water uptake potential of certain tree species in a landscape context as well as on the predicted impact of plantations on water supply in different landscapes and environmental conditions and under different climate change scenarios.
- In many cases, the lack of information can be attributed to the costliness of data collection methodologies; the tight budgets of state forestry departments are likely to affect the type and quality of projects which can be completed.
- There is a need to develop and adopt alternatives to high density monocultures that do not compromise water consumption taking into account alternative species, methods of harvesting and planting arrangements.
- Sustainable business management approaches that aim at minimizing impacts of plantations on water supply need to be developed.
- Intelligent financing mechanisms need to be developed to increase research activities and to encourage new projects.

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SESSION 2
FORESTS FOR WATER, WATER FOR FORESTS

The session began with a discussion about the relationships between forests and water and how they vary depending on climatic zone, time of year, geology, tree species composition, plant density, plant arrangement and forest management practices.

During the session, the following topics were addressed: the hydrologic impacts of afforestation; water use by forests dominated by native species versus non-native species; bioremediation of ground water using native forests; bioremediation of surface water using leaf litter debris; and appropriate monetary values for water to finance watershed management services.

Thomas Hofer, FAO, set the stage with a presentation on the current state of knowledge about forest and water interactions. Five papers were then presented by researchers covering a broad range of forest and water-related topics:

- "Forests and Water: Securing a Balance in Mountain Ecosystems" by Anita Paul and Kalyan Paul, Pan Himalayan Grassroots Development Foundation, India;
- "The Water Consumption and Productivity Patterns of Exotic versus Native Species Used in Afforestation Projects in Northwest Patagonia: Implications for the Sustainability of Active Production" by Javier E. Gyenge, Instituto Nacional de Tecnología Agropecuaria, Argentina;
- "Quantifying the Hydrologic Impacts of Afforestation in Uruguay: A Paired Watershed Study" by George M. Chescheir, North Carolina State University, United States of America;

- "The Role of Forests in the Bioremediation of Water" by Kamal Melvani, Neo Synthesis Research Centre, Sri Lanka;
- "Economic Valuation of Hydrological Ecosystem Services in Ejido La Victoria, Pueblo Nuevo, Durango" by Ramón Silva-Flores, Centro Interdisciplinario de Investigación para el Desarrollo Integral Regional–Instituto Politécnico Nacional, Unidad Durango, Mexico.

Insights and recommendations:

- There is a lack of long-term monitoring data available to assess the impacts of afforestation projects on water supply. Accordingly, it is difficult to provide the knowledge required for effective long-term management. This deficiency must be considered by REDD-plus policy-makers.
- In agricultural regions, where nitrogen contamination of groundwater poses a health risk, bioremediation alternatives to water treatment technologies should be considered, where feasible, as they offer multiple benefits (i.e. wildlife habitat, nutrient uptake, water purification, increase to native species gene pool).
- There is a lack of information about the water uptake potential of individual tree species throughout the duration of their life span. More research is needed to make adequate assessments of the impact of native versus non-native forests on water uptake. It is important to keep in mind that even if native forests use more water than a non-native stand, the native forest offers other environmental, livelihood and medicinal services to local communities. Trade-offs must be made.

MORE RESEARCH IS NEEDED

SIDE EVENT

The side event was entitled Forests and Water: The Challenges of Cross-sectoral Collaboration and was held with the objective to showcase experiences of institutional collaboration on forests and water amongst different stakeholder groups. The side event was co-organized by FAO, EFIMED, the United Nations University, REDLACH, the General Directorate of Forestry of Turkey and the Austrian Federal Ministry of Agriculture.

Key points discussed and main recommendations:

- A few major bottlenecks to collaboration were identified within the international development cooperation system: i) a segmented distribution of funds at the donor level and a lack of coordination between donor groups; and ii) the pressure for timely completion of activities which does not allow for the establishment of adequate and long-lasting collaborative arrangements.
- Project managers from international development organizations must make efforts to provide capacity-building to local authorities on new methods and approaches that are understood in the global agenda but not yet at the local level.
- Collaboration, mutual trust and understanding between the public and private sectors can be facilitated through workshops and the eventual unification of forest service and water management departments.

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- Collaboration is needed to negotiate the pricing of water for the payment of ecosystem services; consumer education is essential for policy and programme effectiveness.
- More interdisciplinary approaches to education and research are needed to enhance understanding of forest and water relationships and to foster effective land-use management policies.
- Forests serve multiple purposes beyond affecting the availability of fresh water. More scientifically sound strategies are needed to manage these multiple benefits and services.

Five presentations were given by professionals from different geographical regions who discussed specific forest and water-related activities of their organizations that require collaboration between a variety of stakeholder groups:

- Faizul Bari, FAO Emergency Coordinator in Pakistan, discussed the relationships between national authorities and international development organizations;
- Kenan Kılıç, from the General Directorate of Forestry of Turkey, explained how the Directorate collaborates with different agencies, particularly the bottled water sector;
- Marc Palahi, Director EFIMED, discussed the importance of integrating sound scientific knowledge into public policy;
- Fernanda Gaspari, from the Universidad Nacional de La Plata in Argentina, presented the experience of an international watershed management communication network developed with REDLACH;
- Martin Neumann, from the Grand River Conservation Authority in Ontario, Canada, emphasized the effectiveness of watershed management authorities with legally binding mandates to protect water quality.

FORESTS AND WATER SEGMENT AT THE 35th SESSION OF THE EUROPEAN FORESTRY COMMISSION

THE SEGMENT ON FORESTS AND WATER, WHICH TOOK PLACE ON 29 OCTOBER 2010 DURING THE 35TH SESSION OF THE EUROPEAN FORESTRY COMMISSION IN LISBON, PORTUGAL, WAS AN OPPORTUNITY TO TAKE STOCK OF THE CONFERENCES AND WORKSHOPS ON FORESTS AND WATER WHICH WERE HELD IN 2008 AND 2009, AND TO DEVISE A FIRST SET OF RECOMMENDATIONS FOR THE DEVELOPMENT OF AN INTERNATIONAL FORESTS AND WATER AGENDA.

The segment was chaired by Andrey Filipchuk, Director of the International Forest Center of the Russian Federation. Thomas Hofer, FAO, set the stage by giving a presentation on the basics of forest and water interactions and on the recommendations that resulted from previous international events. The segment was organized around panel presentations by five speakers:

- "Policy agenda on forests and water" Christian Küchli, Swiss Federal Office for the Environment;
- "Economy agenda on forests and water" Tomasz Juszczak, UNECE Water Convention Secretariat;
- "Science agenda on forests and water" Eero Kubin, METLA;
- "The role and support by international bodies to countries in the development of harmonized policies and legislations between the forest and water sectors" Kit Prins, UNECE/FAO Forestry and Timber Section;
- "The challenge of integrating the forestry sector into the implementation of the EU Water Framework Directive" Gerben Janse, Swedish Forest Agency.

The panel presentations were followed by discussions and statements from the floor.

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In the discussion, participants reflected on the following core questions:

- How can international bodies such us the UNECE Timber Committee, the EFC, the UNECE Working Group on Integrated Water Resources Management, FOREST EUROPE and FAO better assist countries in developing harmonized policies and legislations between the forest and water sectors?
- What recent cases of success can countries mention in connection to PES and valuation of water-related forest services?

Key points discussed:

- Interactions between the forest and water sectors are complex and extend from legislation and policy to payments for ecosystem services and research.
- Forests have important hydrological functions and contribute to the delivery of ecosystem services. Forest management, when sustainable, can be conducive to enhancing these functions, but, particularly in semi-arid areas, can also adversely impact water supply.
- In some countries the role of forests in ensuring water supply is not fully recognized in existing policy frameworks.
- PES schemes can benefit both the forest and water sectors by supporting the objectives of sustainable forest as well as integrated water resources management. The UNECE Water Convention has developed recommendations on PES based on good practices from different sectors, including forestry.
- The main institutional mechanisms to enhance collaboration between the forest and water sectors in Europe are the UNECE Water Convention (in particular as regards PES), the European Union Water Framework Directive and the FOREST EUROPE Warsaw Resolution 2 on Forests and Water. In particular, the EU Water Framework Directive is an important opportunity for closer collaboration between the two sectors.

IN SOME COUNTRIES THE ROLE OF FORESTS IN ENSURING WATER SUPPLY IS NOT FULLY RECOGNIZED IN EXISTING POLICY FRAMEWORKS

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Main recommendations:

- Adapt national policy and legal frameworks to recognize the role of forests and other land uses for water supply and to overcome institutional barriers. Develop mechanisms to integrate forest owners into the value chain of water provision.
- Conduct further work to raise awareness of the value of forest ecosystems for water supply, to mobilize political support for the development of PES schemes and to enhance institutional capacities for implementing such schemes.
- Promote further scientific work to assess the multiple roles of forests in the water cycle, particularly in the context of climate change. Base increased levels of wood production, e.g. for renewable energy, on thorough research assessing the environmental impact on forests and water.
- Develop long-term monitoring and research tools and programmes on forest and water interactions, building on existing scientific cooperation between member countries.
- International organizations and networks are needed to support countries in their efforts to enhance collaboration between the forest and water sectors.

PLENARY SESSION ON "FORESTS AND WATER IN THE CONTEXT OF CLIMATE CHANGE" AT THE 20th SESSION OF THE COMMITTEE ON FORESTRY

WITHIN THE FRAMEWORK OF THE 20TH SESSION OF THE COMMITTEE ON FORESTRY HELD AT FAO HEADQUARTERS IN ROME, ITALY, 4-8 OCTOBER 2010, A PLENARY SESSION ON "FORESTS AND WATER IN THE CONTEXT OF CLIMATE CHANGE" TOOK PLACE. THE PLENARY TOOK STOCK OF DIFFERENT EXPERIENCES AND LESSONS LEARNED ABOUT FORESTS AND WATER FROM SEVERAL REGIONS AND REFLECTED ON PRACTICAL RECOMMENDATIONS FOR THE NEXT YEARS.

The session was chaired by Anders Lönnblad, Deputy Director-General, Ministry of Agriculture of Sweden. Alexander Müller, Assistant Director General, Natural Resources Department of FAO, acted as moderator. Thomas Hofer, Forestry Department of FAO, set the stage outlining forest and water interactions in the context of climate change and summarizing the outcomes of the relevant international process of which the session represented a culmination.

The panel in the subsequent "Heads of Forest Dialogue" was composed of Moshibudi Rampedi, Deputy Director-General of Forestry, South Africa; Karma Dukpa, Director of the Department of Forestry, Bhutan; Ísmail Belen, Deputy Director General of the General Directorate of Forestry, Turkey; Rolf Manser, Head of Division of Forestry, Switzerland; and Wladimir Tene, Director Nacional Forestal, Ecuador.

Delegates from the following countries and organizations took the floor in the discussion which followed the panel statements: Japan, Afghanistan, Mexico, Economic Community of Central African States (ECCAS), Côte D'Ivoire, Sweden, the United States of America, Switzerland, Bhutan and Burundi.

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The panellists were asked to address the following key questions:

- How is the collaboration between the forest and the water sectors organized in the specific country?
- What are the lessons learned, challenges and opportunities of collaboration between the forest and water sectors in the country?
- How is the country addressing the issue of climate change in relation to forests and water and what are the roles of the forest and water sectors?

Key points discussed:

- Forests strongly influence water resources and accordingly, Heads of Forests have a very important role to play. Institutional settings for forest and water management significantly differ from country to country.
- Countries noted that forest and water management has broad socio-economic implications. Increased attention is to be paid to financing mechanisms such as payments for water-related ecosystem services provided by forests.
- Climate change is a major issue which is expected to bring additional challenges such as changing precipitation patterns, floods and wildfires.
- Because water is often a transboundary issue it requires collaboration at an international level. Exchange of information and experiences on transboundary management of water resources is very important and should be intensified.

FOREST AND WATER MANAGEMENT HAS BROAD SOCIO-ECONOMIC IMPLICATIONS

BECAUSE WATER IS OFTEN A TRANSBOUNDARY ISSUE IT REQUIRES COLLABORATION AT AN INTERNATIONAL LEVEL

Main recommendations:

- Countries officially endorsed the importance of the topic of forests and water and recognized the need to take more concrete action in the next years. In particular, delegates noted the need to improve the coordination among the many governmental and non-governmental agencies involved in forest and water management.
- Countries should intensify work in the area of forests and water, reviewing lessons learned, critical issues and knowledge gaps as well as challenges and opportunities related to cross-sectoral cooperation.
- Countries should consider forest and water issues in climate change negotiations and develop integrated approaches in planning processes at national and regional levels.
- International organizations should provide technical support to countries in the area of forests and water, with particular focus on semi-arid and arid zones, and climate change.
- International organizations should facilitate the exchange of information and experiences on institutional arrangements in relation to forest and water management, including the transboundary dimension.

INTERNATIONAL ORGANIZATIONS SHOULD PROVIDE TECHNICAL SUPPORT TO COUNTRIES IN THE AREA OF FORESTS AND WATER, WITH PARTICULAR FOCUS ON SEMI-ARID AND ARID ZONES, AND CLIMATE CHANGE

FORESTS AND WATER IN DRYLANDS: A VIRTUOUS CYCLE – INFORMATION EXCHANGE FROM THE MEDITERRANEAN TO CENTRAL ASIA

THE WORKSHOP FORESTS AND WATER IN DRYLANDS: A VIRTUOUS CYCLE-INFORMATION EXCHANGE FROM THE MEDITERRANEAN TO CENTRAL ASIA WAS JOINTLY ORGANIZED BY THE UNECE CONVENTION ON THE PROTECTION AND USE OF TRANSBOUNDARY WATERCOURSES AND INTERNATIONAL LAKES, THE SWISS FEDERAL OFFICE FOR THE ENVIRONMENT, THE UNECE/FAO FORESTRY AND TIMBER SECTION AND THE UNITED NATIONS CONVENTION TO COMBAT DESERTIFICATION (UNCCD). IT TOOK PLACE 7-8 JULY 2011 IN GENEVA AS ONE OF THE EVENTS OF THE FORESTS AND WATER WEEK.

Participants discussed whether and how forests and afforestation initiatives in drylands can positively influence water availability and water quality. Both the Mediterranean and central Asian regions face similar problems and constraints: climate change impacts, forest ecosystems threatened by heavy anthropogenic pressure and increasing need of freshwater. Managing forests and water in drylands means coping with scarce resources. Forests and water must be considered at the landscape level, taking into account ecological and hydrological aspects as well as land use systems and social issues. Therefore, compensating forest owners for a water-oriented management of their forests can help preserve healthy forest ecosystems.

The workshop brought together countries and stakeholders from the Mediterranean and central Asian regions with the aim to discuss the nexus between forests and water in drylands and the feasibility of establishing working PES schemes. Case studies from Algeria, France, Kyrgyzstan, Tunisia and Turkey were presented.

Key points discussed:

- forest functions in drylands, their specific relationship to water management and relevant challenges;
- challenges and possible solutions, such as trade-offs between water use by trees in drylands, with decreased run-off and water availability for other land uses, and the environmental services and goods provided by forests and other wooded lands;
- experiences on forest and water management policies and tools, also in the framework of climate change adaptation;
- case studies on integrated management of forests and water in drylands;
- potential and challenges of PES schemes in the region; and
- gaps and areas of future work on forests and water in drylands.

Main conclusions and recommendations:

- Dryland forests support the livelihoods of large populations.
- Use of traditional knowledge can be beneficial to sustainable forest management.
- Controlled and rotational grazing in wooded land can positively impact the state of natural resources.
- More research on the influence of forests on microclimates is needed.
- Forests and water should be managed in an integrated way at the landscape level. In order to understand their relationships, hydrogeological phenomena must be monitored.
- Forest and water policies must be considered in connection with climate change and other sectoral issues.
- A dialogue is necessary between actors at all levels and across sectors to harmonize different interests and balance trade-offs. New institutional mechanisms should be developed such as councils of actors at the local level that can negotiate with relevant authorities.
- PES schemes can be useful financial mechanisms and can prevent the construction of expensive infrastructures.

FOREST AND WATER POLICIES MUST BE CONSIDERED IN CONNECTION WITH CLIMATE CHANGE

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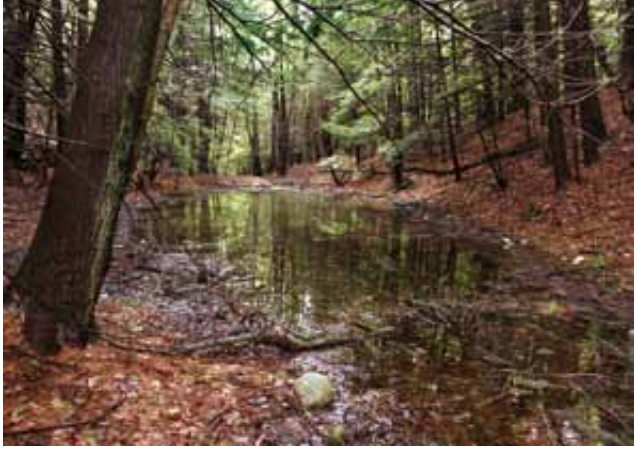
AGENDA ON FORESTS AND WATER: A 20-POINT PROGRAMME

ALL THE EVENTS PRESENTED IN THIS PUBLICATION HIGHLIGHT THE KNOWLEDGE GAPS AND MISCONCEPTIONS WHICH STILL PERSIST WITH REGARD TO FOREST AND WATER INTERACTIONS: THE NEED TO TRANSLATE SCIENTIFIC KNOWLEDGE INTO TOOLS THAT CAN BE USED BY POLICY-MAKERS; THE NEED TO CREATE NATIONAL AND TRANSBOUNDARY INSTITUTIONAL MECHANISMS ABLE TO BRING TOGETHER ALL RELEVANT ACTORS; AS WELL AS THE NEED TO SHARE EXISTING EXPERIENCES RELATED TO JOINT FOREST AND WATER MANAGEMENT.


The various initiatives over the last three years were essential in furthering the dialogue on forests and water. However, in spite of its importance, the topic is still not receiving the deserved attention from the national and international community and there is a need to move from conceptual discussion to concrete action. FAO is fully committed to help move this agenda forward. In close collaboration with key partner institutions,[1] which were the drivers of the different events organized in past years, FAO took the initiative of synthesizing the recommendations from the conferences in order to propose future actions and to develop a comprehensive and practical international forests and water agenda. The analysis revealed that some concerns and recommendations were common to many deliberations and shared by a variety of stakeholders, while others were more site-specific or contentious. The international forest and water agenda, which is presented in this chapter, has been clustered into different thematic areas.

FAO, in a joint effort with key partners, can play the role of facilitator in the deployment and implementation of the forests and water agenda. It can provide an international platform with the aim of bringing together government agencies, research institutions, NGOs, the private sector and international organizations to exchange and disseminate experiences, findings and recommendations related to both the policy and field dimensions. Most importantly, FAO can monitor the progress made and provide guidance and technical advice to member countries and partner institutions for the implementation of the forest and water agenda.

1 Key partners included the Government of Switzerland, the Government of Turkey, METLA, IBL, UNECE, UNECE Water Convention, FOREST EUROPE, EFIMED, REDLACH and the United Nations University.

From left: © A. Movila · © L. Kenney · © V. Puripaisarn

Process understanding and research

Forests have lower input and output of nutrients, pesticides and other chemicals than more intensive land uses such as agriculture. Accordingly, forests play an important role in ensuring the delivery of high quality water. At the same time forests can consume greater amounts of water than other vegetation types. The interactions between forest cover and water are quite complex with regard to variables such as low flow, high flow, water yield and water quality. They depend on many parameters which often have a site-specific nature. Further work is needed to assess the multiple roles of forests in influencing the water cycle and the local microclimates, particularly in the context of climate change. More research will contribute to a better understanding of forest and water interactions at different stand development stages, in different ecological zones and under changing climatic scenarios. It will also help to assess the impact of abiotic factors as well as economic activities on forest and water interactions.

Information is lacking on the water uptake potential of individual tree species throughout the duration of their life span, and of native versus non-native forests. This data is particularly relevant to afforestation and reforestation projects and commercial plantations. More scientific research is needed on the impact of plantations on water supply in different landscapes, environmental conditions and climate change scenarios. These issues imply the development of long-term monitoring systems to detect quantitative and qualitative changes of water resources within and from forested catchment areas.

FORESTS HAVE LOWER INPUT AND OUTPUT OF NUTRIENTS, PESTICIDES AND OTHER CHEMICALS THAN MORE INTENSIVE LAND USES SUCH AS AGRICULTURE. ACCORDINGLY, FORESTS PLAY AN IMPORTANT ROLE IN ENSURING THE DELIVERY OF HIGH QUALITY WATER

RESEARCH AGENDA

1. Develop and implement inter-disciplinary research activities (including field projects) and scientific investigations in order to improve the understanding of the forest and water interactions as a function of the seasons, climatic zones, geological conditions, stand development stages, native versus non-native species, natural versus planted forests and forest management practices. Pay particular attention to hydrological variables such as low flow, high flow, water yield and water quality.
2. Develop long-term monitoring systems and tools on qualitative and quantitative changes of water resources within and from forested catchment areas, in particular, by considering species composition, management practices and different climate change scenarios. Build on existing scientific cooperation between member countries and other partners.

COOPERATION, POLICY AND INSTITUTIONAL DEVELOPMENT

Although some countries have developed policy and tools for the integrated management of forests and water, in many cases the role of forests in ensuring water supply is not fully recognized in existing policy frameworks. The time has come for strengthening existing and designing new innovative policies and strategies, aimed at balancing water for society and for forest ecosystems through a multidisciplinary approach to management. National policies and guidelines on forest and water management should be developed based on sound scientific knowledge.

Closer cooperation between the forest and water sectors is a pre-condition for the development of innovative policies, strategies and legislation. Cooperation is also required for promoting water-related services provided by forests and for solving water-related problems in a sustainable way. For instance, collaboration is needed to negotiate the pricing of water if forest managers have to be compensated for the beneficial water-related services they provide through sound forest management practices. Mechanisms should be

developed to integrate forest owners into the value chain of water provision. A holistic perspective on forests and water would help manage ecosystems and would provide additional economic benefits and employment opportunities. This perspective should be achieved through joint planning, decision-making and implementation.

Institutional settings related to forest and water management may differ significantly from country to country. To achieve cooperation between the forest and water sectors and to develop and implement innovative policies, institutional mechanisms which cross traditional sectoral administrative boundaries have to be strengthened or put in place. Institutional obstacles hindering joint forest and water management should be overcome and cooperation between the two sectors should be strengthened redefining competences and roles of respective institutions.

In order to enhance cooperation, policy-making and institutional development regarding forests and water, it is important to exchange existing experience and to evaluate the needs for additional guidance at national and regional levels. Existing national legislation and institutional mechanisms relevant to forest and water management should be reviewed to harmonize the provisions, fine-tune the terminology and update contents according to the most recent research findings and practical experiences.

POLICY AND INSTITUTIONAL AGENDA

3. Take stock, particularly at a national level, of existing legislations, policies and institutional mechanisms related to forests and water. Review lessons learned, critical issues and knowledge gaps as well as challenges and opportunities related to cross-sectoral cooperation. Put in evidence bottlenecks hindering effective joint management.
4. Organize national workshops, targeting policy-makers and technicians from the forest and water communities, to present the results of the stock-taking exercises. Develop innovative, cross-sectoral and, if appropriate, transboundary institutional mechanisms and policy proposals in order to enhance the collaboration between the forest and water sectors.
5. At the European level, work for the implementation of the provisions in Warsaw Resolution II.

ECONOMIC INCENTIVES AND MECHANISMS

Forest and water management has very broad socio-economic implications which deserve increased attention. There is a need to develop tools to estimate the value of water-related ecosystem services provided by well managed forests and to put in place financial mechanisms to compensate the providers of such services. In this context, PES have significant potential and should be further explored and communicated within the sectors and to the public at large. Examples related to establishing markets for ecosystem services are still scarce. Payments for ecosystem services are considered by concerned experts to be a key tool which needs more consideration, practical implementation and learning from experience.

By reducing water subsidies and treating water as a commodity rather than as a free good, economic incentives can support better management of forested catchment areas. Ultimately, this is a governance issue, involving development of the necessary institutional arrangements. Bundling of services such as carbon sequestration, biodiversity and recreation also needs to be enhanced.

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ECONOMIC AGENDA

6. Analyse existing experiences and explore the potential for new and innovative economic mechanisms, incentives and benefits with regard to forest and water management.
7. Conduct cost/benefit analyses in specific management areas to explore the financial viability of PES schemes for water-related forest services. Define the legal instruments for the development of such schemes and test them through the implementation of pilot field projects.
8. Develop and foster collaboration with the private sector.

CLIMATE CHANGE MITIGATION AND ADAPTATION

Global climate models predict, with more uncertainties than for temperature, marked changes in seasonal snow and rainfall, with significant rainfall decrease in many areas already under water stress, such as the Mediterranean basin. If large-scale forest plantations are planned, for instance, for carbon sequestration and climate change mitigation within REDD-plus initiatives, it should be ensured that water shortages will not be accentuated. There is a need to develop and adopt alternatives to high density monocultures that do not compromise water consumption, taking into account alternative species, methods of harvesting and planting arrangements.

Projected climate change and associated disturbances in the water cycle are expected to have a strong impact on water resources resulting in extreme events such as floods and droughts. Public awareness should be raised on the potential of forests to mitigate these impacts. In turn, increased water scarcity and more frequent heat waves and resulting wildfires, dry spells and floods can undermine the vitality, resilience and even survival of trees and forest ecosystems.

There is an urgent need to assess the expected impacts of modified stand structures and compositions on local water uptake and the water cycle at larger scales and to put in place forest management practices for minimizing the impacts of climate change and other drivers of change on water resources.

CLIMATE CHANGE AGENDA

9. At the national level, consider forest and water relationships as an integral part of the development of climate change mitigation and adaptation strategies, disaster risk management plans and integrated approaches in planning processes. Develop pilot projects to assess the importance of water-related forest services in climate change mitigation and adaptation.
10. Promote the consideration and incorporation of forest and water issues in international climate change related dialogues and negotiations, with particular reference to UNFCCC and the World Water Forum.
11. Assess the impacts of other drivers of change on forest and water interactions, such as the energy crisis and changes in production and consumption patterns.

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INTERNATIONAL DIMENSION

Forest and water interactions are often of a transboundary nature and, accordingly, collaboration at the international level is very important. This collaboration mainly relates to the strengthening of existing, or the setting up of new, institutional mechanisms as well as the exchange of information and experiences on the transboundary management of natural resources.

International organizations play a very important role in the facilitation of transboundary institutional development and information exchange relevant to forest and water management. International forums and networks are needed to support countries in their efforts to enhance collaboration between the forest and water sectors. International organizations also play a very important role in the coordination of donor groups and in avoiding segmented distribution of financial resources for forest and water-related initiatives and processes.

Additionally, there is a need to improve the coordination among the many governmental and non-governmental agencies involved in forest and water management. National and transboundary institutions, such as water councils or national forest programmes, should ensure the involvement and collaboration of all concerned actors.

INTERNATIONAL AGENDA

12. Designate official, high-level national focal points from concerned ministries to follow and participate in international processes and dialogues of relevance to forest and water interactions.
13. International organizations are encouraged to provide technical support to countries, for example, through the organization of technical workshops and seminars for the exchange of national experiences on joint forest and water management, with particular focus on semi-arid and arid zones and climate change concerns.
14. International organizations are encouraged to facilitate the strengthening of existing or the development of new transboundary institutional mechanisms related to forests and water.

AWARENESS-RAISING, CAPACITY DEVELOPMENT AND COMMUNICATION

For the implementation of the forests and water agenda, particularly as it relates to inter-sectoral collaboration and institutional development, significant efforts have to be put into awareness-raising, capacity development and communication. Increased efforts from the scientific community are required for the structuring of the available knowledge in a comprehensive manner and for the effective communication of research results to policy-makers and managers. Further work is needed to raise awareness about the value and services of forest ecosystems for the hydrological cycle, water supply and food security. That awareness is necessary to mobilize political support for the development of incentive mechanisms such as PES schemes and to enhance institutional capacities.

Specialists in the concerned ministries need to be trained in inter-disciplinary approaches including hydrology, water management, environmental engineering, forestry and institutional development. In order to achieve this goal, cross-sectoral capacity-building and training modules have to be developed.

CAPACITY DEVELOPMENT AND COMMUNICATION AGENDA

15. Develop and implement training programmes on the various aspects of integrated forest and water management that are able to develop capacities of concerned technicians and decision-makers up to the highest levels.
16. Develop and broadly disseminate awareness-raising and communication materials related to forests and water and their link to food security, which are easy to understand and reach out to a broad stakeholder group.
17. Scientists are encouraged to contribute to awareness-raising, capacity development and communication by "translating" research findings into applied and policy-relevant key messages.

FORESTS AND WATER MANAGEMENT

Forest and water interactions need to be taken into account in management practices, which should aim to maximize the benefits of forests for water quantity and quality. Forest functions such as water retention and groundwater recharge should be optimized through sound forest management practices. For instance, in agricultural regions where nitrogen contamination of groundwater is a health risk, bioremediation alternatives to water treatment technologies should be considered, where feasible, as they offer multiple benefits (i.e. wildlife habitat, nutrient uptake, increase to native species gene pool). Forest management, when sustainable, can be conducive to enhancing these benefits, but, particularly in drylands, can also adversely impact water supply. In arid or semi-arid ecosystems, forests can evapo-transpire up to 90 percent of the rainfall. However, forests play a key role in erosion control and soil conservation. In arid zones the challenge is to optimize the trade-offs between water yield and the range of ecosystem services provided by forests.

Forest and water interactions have to be considered in the broad landscape context and an integrated approach should be applied at the local, national and international levels.

MANAGEMENT AGENDA

18. Ensure, in forest and water management, that the benefits of forests for water quantity and quality are maximized.
19. In forest and water management, carefully balance the trade-offs between water consumption by trees and forests and the protection functions, as well as other environmental services, provided by forests and trees.
20. Apply an integrated and landscape approach to forest and water management at the local, national and transboundary levels. Ensure the links to other land use and communicate the important contribution of forest and water management to food security and livelihood improvement.

Annex 1

SHIGA DECLARATION ON FORESTS AND WATER

International Expert Meeting on Forests and Water

20-22 NOVEMBER 2002
SHIGA, JAPAN

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BACKGROUND

Forested catchments supply a high proportion of the water for domestic, agricultural, industrial and ecological needs in both upstream and downstream areas. Forests also provide society with a range of other productive, conservation, amenity, environmental and livelihood benefits. A key challenge faced by land, forest and water managers is to maximize this wide range of multi-sectoral forest benefits without detriment to water resources and ecosystem function.

To contribute to the discussion and outcomes of the 3rd World Water Forum to be held in Japan in March 2003 – about 100 forest and watershed management experts from 18 countries and 16 international organizations/NGOs met in Shiga, Japan under the organization of the Forestry Agency of Japan and the Shiga Prefectural Government.

There is a growing international debate and concern about an impending 'water crisis', and increasing pressures on the land resource to provide food, water and to sustain production, conservation, amenity, recreation and environmental benefits. In this regard, the management of forests in relation to water is a critical issue that must be afforded high priority.

Sustainable forest management is a key factor in water resources management in general and upland resources development in particular. Both intact natural forests and well-managed forests generally produce high quality water. In certain circumstances, they can also contribute to reducing storm flow peaks for a given input of precipitation. These forests also play an important role in reducing soil erosion and subsequent downstream sedimentation.

The Expert Meeting reviewed the current state of knowledge and future needs to better understand the hydrological and environmental services of forests, and their role in alleviating poverty, the provision of safe drinking water, food security, conservation and sustainable use of biodiversity, and providing other cultural and socio-economic

benefits, as outlined in the paragraphs 6, 7, 23 and 43 of the World Summit on Sustainable Development (WSSD) Plan of Implementation.

The experts also recognized the need to take actions at all levels with regard to sustainable forest management, as outlined in the paragraph 43 of the WSSD Plan of Implementation, which emphasized the multiple benefits of both natural and planted forests and trees. Such sustainable forest management should be incorporated within the development and implementation of national/regional strategies, plans and programmes with regard to integrated river basin, watershed and groundwater management.

There is also a need to employ the full range of policy instruments, together with regulation, monitoring, voluntary measures, market and information-based tools, land-use management and cost recovery of water services, identified in the paragraph 25 of the WSSD Plan of Implementation. The Expert Meeting also took into account of the Millennium Development Goals and the recommendations and targets set by the WSSD which called for a people-oriented approach towards achieving integrated management of land, water and living resources in fulfilling human needs.

Finally, the Expert Meeting developed recommendations to guide decision-makers, researchers, academics, the public, NGOs, private sector, donors, and implementing agencies in designing and implementing effective policies to achieve multiple objectives for sound forest and water management.

KEY ISSUES

The following key issues were identified:

1. **Promoting the development and the wider adoption of holistic tapproaches to forest and water management that integrate the needs of people and the environment**

   The success of holistic approaches requires the effective involvement of a diversity of stakeholders. As such, there is a critical need to develop cross-sectoral and participatory watershed management frameworks to achieve long-term multiple benefits for a broad range of stakeholders and the environment. This will also require an appropriate policy environment and incentives for stakeholders, including local communities, government agencies, and the private sector, to effectively participate in the development and implementation of management programmes.

   To ensure the long-term sustainability of forest and water resources there is a need to integrate these management programmes into local and national sustainable development. It is also important to monitor and evaluate the full impact of management programmes and to build on lessons learned.

2. **Improving understanding of the bio-physical interaction between forests and water**

   Much is known about hydrological processes in forests at a small catchment scale. However, there is a critical need to initiate and strengthen long-term eco-hydrological monitoring for further research to improve understanding of large-scale interactions and the influence of forests on dry season flows, flood mitigation and groundwater recharge in a range of environments in line with the paragraph 27 of the WSSD Plan of Implementation.

A critical research need is to enhance our understanding of the hydrological impacts arising from the rehabilitation of degraded lands through various afforestation-reforestation strategies. Long-term data sets are also required to better understand the impacts of climate variability from interannual to multidecadal time scales on forest hydrology and the utility of various forest management practices. Such research needs to cover all forest types.

3. Improving understanding of the cultural and socio-economic impacts of different forest and water policies and management practices.

There is a need for better understanding of the economic costs and benefits of forest and watershed services. There is also a need to better understand the impact of different forest/water policies on the livelihoods and interests of both upstream and downstream stakeholders.

4. Developing better mechanisms for managing upstream/downstream linkages and interactions

There is a critical need to develop better understanding of the economic, environmental, and social linkages between the upstream and downstream resource users. Improving the mechanisms for including local communities and other stakeholders in the design and implementation of watershed management policies is also required. More experimentation and further development of equitable and effective compensation mechanisms are crucial.

5. Enhancing knowledge and information sharing

Better dissemination of scientific knowledge to policy-makers, managers, educators, media and the general public is urgently required. To this end, it is necessary to identify the information needs of different stakeholders and to design information and educational products that are easily understood by these groups.

RECOMMENDATIONS

Effective forest and watershed management are valuable for long-term sustainability of water resources. Governments and other stakeholders should develop policies and implement programmes that promote holistic, multidisciplinary and multistakeholder approaches that link forests, water, watersheds, the environment and people.

The Expert Meeting recommends that decision-makers:

1. Move from a sectoral to an integrated and cross-sectoral approach to economic, social and environmental planning at local, national and international levels. This approach would build on and develop the necessary biophysical and socio-economic understanding of forest and water interactions to identify key forest and water issues in the context of the location concerned.
2. Establish the total economic value (capturing all products and services) of forest and water resources, and the economic implications of different policies and management practices. The distribution and the importance of benefits to particular stakeholders should also be established.
3. Put in place appropriate incentives to support the sustainable management of forest and water services to ensure that those who use resources pay the full cost of their exploitation and those who bear the costs of conservation are equitably compensated. In particular, consideration should be given to the provision of secure resource rights, the reform of water pricing policies, the development of market-based or other mechanisms of payments for environmental services, and the removal of undesirable (perverse) subsidies to the agricultural and forestry sectors.

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4. Promote effective and equitable collaborative arrangements and partnerships among governments, local communities, research institutions, civil society, the private sector, forest and water managers, and other stakeholders. These will facilitate knowledge sharing and capacity building, leading to sound science-based policy development and tangible improvements in forest and water management.

5. Address forest and water interactions in forest resources assessments, and request that the international community provides sufficient resources to accomplish this important task.

Annex 2

FOREST EUROPE WARSAW RESOLUTION 2: FORESTS AND WATER

Fifth Ministerial Conference on the Protection of Forest in Europe

5-7 NOVEMBER 2007
WARSAW, POLAND

WARSAW RESOLUTION 2 - FORESTS AND WATER

1. Recognizing the close interrelation between forests and water.
2. Concerned that there is a growing imbalance between freshwater supply and demand.
3. Aware of the need to ensure adequate water quality and quantity.
4. Stressing the need for adequate water conditions in order to sustain European society.
5. Emphasizing the role of forests and forest management for biodiversity of water ecosystems.
6. Concerned that climate change will have severe effects on the frequency, scale and intensity of natural hazards such as floods, debris flow, avalanches, storms, and droughts and will have an impact on forest and water resources and their management.
7. Stressing the role of forests and forest management in protecting water quality, managing water resources for the quantity of all waters, flood alleviation, combating desertification and soil protection as well as the importance of mountain forests in the reduction of land slides, erosion and effects of avalanches.
8. Concerned that the frequency and size of forest fires is increasing and that fires occur more frequently, even at higher latitudes and altitudes, resulting in severe impacts on watersheds, water quality, quantity and soil erosion.
9. Emphasizing that the full economic value of forests has to be adequately recognized and in particular the value of providing ecosystem services.
10. Recognizing that forest owners have rights and responsibilities and noting the importance of prior consultations regarding the provision of water-related services.
    Stressing the need to involve local communities and other relevant stakeholders in planning and implementation of water-related forest policies.
    Building on previous MCPFE commitments and recognizing the ongoing work in the area of forests and water carried out by international conventions, organizations and processes.

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The Signatory States and the European Community, commit themselvest to:

1. sustainable management of forests in relation to water

- maintain and enhance the protective functions of forests for water and soil, as well as for mitigating local water-related natural disasters through sustainable forest management, including through public and private partnerships;
- assess afforestation and reforestation programmes in terms of their effects on quality and quantity of water resources, flood alleviation and soil;
- promote the restoration of degraded forests, particularly in floodplains and upper watershed areas for the benefit of the water environment, flood reduction, conservation of biodiversity and soil protection.

2. coordinating policies on forests and water

- develop and improve policies for forest and water resources management that contribute to the maintenance of ecosystems and the sustainable provision of their services;
- coordinate forest and water resources management policies through national forest programmes or equivalents and integrated water resources management plans and strategies at the appropriate levels;
- develop adequate or improve the existing institutional arrangements to better cooperate in addressing the interrelation between forest and water issues;
- address the management of forests and water at the transboundary watershed level through enhanced international cooperation;
- enhance education, training, research and extension services to promote knowledge and understanding of forest and water interactions;
- increase awareness of the relationship between forests and water as well as the potential of forests and their sustainable management to improve the water environment.

3. forests, water and climate change

- develop a deeper understanding of the potential consequences of climate change on forest and water interactions, including desertification and biodiversity loss as well as the frequency, scale and intensity of floods, storms, droughts, forest fires, pests and diseases;
- develop appropriate policies and strategies for managing forests and water resources sustainably to adapt to climate change and contribute to its mitigation.

4. economic valuation of water-related forest services

- assess the economic value of forest services related to quality and quantity of water resources and flood alleviation from which society benefits;
- incorporate the economic valuation of water-related forest services into relevant policies and strategies on forests and water;
- facilitate the development and implementation of measures, which may include economic tools such as payments for ecosystem services (PES)[1] in order to broaden and diversify the financial basis for sustainable forest management and to maintain the protective functions of forests.

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1 Payments for ecosystem services (PES) – contractual transactions between buyers and sellers for ecosystem services or land use/management practices likely to secure those services. In: "Recommendations on payments for ecosystem services in Integrated Water Resources Management", UNECE Water Convention, 2006.

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FORESTS AND WATER

INTERNATIONAL MOMENTUM AND ACTION

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