
Forests and Water – a five-year action plan

Increasing international action to address forest-water interactions in science, policy, economics and forest practices. An action plan of the International Forests and Water Agenda



Acknowledgements

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Introduction

The *Forests and Water: a Five-year Action Plan* calls for the tangible integration of science, policy and practice related to forest-water interactions. It emerged from the discussions and recommendations of the Forests and Water Agenda (Annex 1), which would like to encourage greater engagement of stakeholders from around the world in the topic of forests and water.

The Forests and Water Agenda

Since the 3rd World Water Forum and the Shiga Declaration in 2002, it has been widely acknowledged that forests play a crucial role in the hydrological cycle (Figure 1) both at local and global levels. An increased international understanding of forest-water interactions, and the importance of trees and forests for the regulation and supply of high quality water, is largely a result of the Forests and Water Agenda (Agenda) – coined for the ongoing process of discourse and engagement on forests and water. For over twelve years, the Forests and Water Agenda has gained considerable momentum and now includes over 20 partners (Annex 2), representing international organizations, academia, civil society, non-government organizations and the private sector. These partners are committed to advocate for a better understanding of forest-water interactions and the incorporation of this knowledge in practice and policy.

The Forests and Water Agenda evolved to bring issues related to forest-water interactions to the forefront of the international sustainable development agenda in terms of landscape and natural resource management; to encourage multi-sectoral collaboration; and to bridge the gaps between scientific knowledge, policy and practice. Thus far the Agenda has involved numerous international fora, including congresses, conferences and seminars discussing the relationships between forests and water. However, the Agenda has progressed to the point where discourse must be translated into action. The *Forests and Water: a Five-year Action Plan* (Action Plan) aims to implement the recommendations of the Forests and Water Agenda and to consolidate informal partnerships established as a result of a common interest: to improve our understanding of forest-water interactions and apply this understanding to policy and practice.

From 2016-2020 and beyond, partners of the Forests and Water Agenda will be aligning with the Sustainable Development Goals (Annex 3) and engaged in forests and water research, policy advocacy and forest management activities – some of which are listed in Annex 4. As the momentum of the forests and water topic continues to grow, the Forests and Water Agenda welcomes other stakeholders to join the Agenda and incorporate their forest and water-related projects within the Action Plan. This enables members of the Agenda to share knowledge, experiences and lessons learned, as well as to highlight the importance of forest management for water and other ecosystem services; thus, contributing to resilient landscapes and communities.

Forests and Water

Forest¹ ecosystems are fundamental to maintaining the water cycle.

¹ Forest is defined according to the FAO definition: “Land spanning more than 0.5 hectares with trees higher than 5 meters and a canopy cover of more than 10 percent, or trees able to reach these thresholds in situ. It does not include land that is predominantly under agricultural or urban land use.” For further explanation,

Forested areas provide environmental stability and supply a high proportion of the world's accessible fresh water for domestic, agricultural, industrial and ecological needs. Forests are also major water users, utilizing water for the generation of biomass, storing water in soils and displacing water from one location to another through evapotranspiration and subsequent precipitation. The ratio of water used versus water conserved, purified and delivered downstream by forests varies over time and is influenced by climate, topography, soil, forest structure (age, density, leaf area index (LAI), species composition, etc.) and forest management practices.

Controversies over the role of forests in the hydrological cycle have been debated among scientists and policy-makers around the world. In general, there is poor recognition in policy that trees and forests play a role in water recycling and as such are seen as an end user, not as part of a greater system that redistributes water. A key challenge is how to optimize the trade-offs between water use, water yield, forest products and the wide range of water-related ecosystem services provided by forests. This challenge is further complicated by the fact that forest-water interactions fluctuate in non-linear ways over time, particularly in the context of climate change. There are also often conflicts between different users, particularly upstream versus downstream and downwind and upwind users. For example, urban and agricultural demands for water and land resources downstream influence land management upstream; or conversely, poor forest management in upland areas impact water quality and quantity in lowland areas. Similarly at a continental scale, mass deforestation in one region can have a negative impact on precipitation in another region.

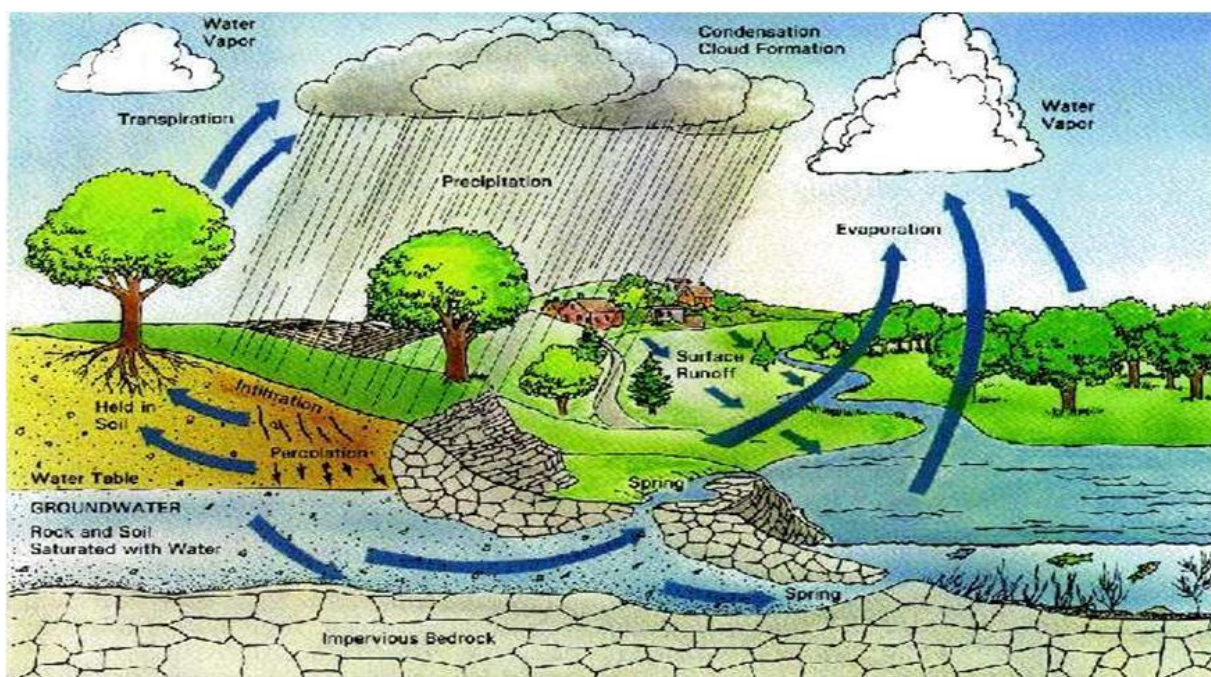


Figure 1. <http://www.ldeo.columbia.edu>

Gaps often arise between science, policy and practice, resulting in misconceptions about forest-water interactions and misguided forest and/or water management and policy. For instance, it is a common misconception that forests prevent floods. However, increasing scientific evidence suggests that the

Please refer to the *Forest Resources Assessment Working Paper 180* (<http://www.fao.org/docrep/017/ap862e/ap862e00.pdf>).

role of forests in flood mitigation is a question of scale: forests can minimize the effects of or prevent small, frequent floods; they do not have any significant moderating impact on large-scale, less frequent or catastrophic floods. Moreover, with growing populations and climate change, there are increasing pressures on forest and water resources. There is also mounting evidence that natural hazards, such as floods, drought and wildfires, are becoming more frequent and intense; therefore, impacting forest-water interactions. For example, forest fires reduce groundcover and the water infiltration capacity of soils, resulting in increased run-off and sedimentation of waterways. In addition, forest management decisions, in particular large-scale land-use conversion, are proving to have even larger-scale impacts; for example, there is evidence to support that large-scale deforestation in the Amazon and Congo basins has affected regional and continental precipitation.

Yet, there is also evidence that forests contribute to more resilient landscapes and can mitigate the negative impacts of climate change, such as natural hazards. For example, mangroves can reduce sedimentation of rivers and oceans, maintain local fish populations and provide protection from cyclones and tsunamis.

Vision

The vision is to integrate forest and water management to provide a safe and sustained supply of both water and forest-related ecosystem services for people and the planet, while ensuring the resilience of forests to global changes. The Action Plan aims to balance trade-offs and maximize synergies between forests and water resources management.

Trees, forests and forested watersheds should be managed to ensure environmental flows that supply a sufficient amount of accessible and well-distributed fresh water throughout the year. This water supply should be for the domestic, agricultural, industrial and ecological needs of local upstream and downstream communities, upwind and downwind communities, as well as society at large.

Mission

The mission is to establish a network committed to integrated landscape management and to address the forest-water interactions in science, policy, forest practices and economics.

Goals & Objectives

The primary objective of the *Forests and Water: a Five-year Action Plan* is to understand and link the diverse roles of forests with the needs of supplying water for humanity and the planet by ensuring that forest-water interactions are considered and integrated into science, policy formulation and management practices at all levels (from tree, stand and watershed levels to regional, national and even global scales). These goals and objectives were derived from the FAO publication “Forests and Water – International Momentum and Action”², which provided 20 points for future action covering seven thematic areas:

1. Process understanding and research
2. Cooperation, policy and institutional development
3. Economic incentives and mechanisms

² “Forests and Water – International Momentum and Action” (Synthesis report, FAO 2013, www.fao.org/docrep/017/i3129e/i3129e.pdf)

4. Climate change mitigation and adaptation
5. International dimension(s)?
6. Awareness-raising, capacity development and communication
7. Forests and water management

For the purposes of this Action Plan, the goals and objectives have been consolidated into three forest-water goals: Science, Policy, Practices and Economics; and one cross-cutting goal of Capacity Building and Communication.

Science Goal: Promote and intensify international research on forest-water interactions, addressing knowledge gaps.

1. Deepen the understanding of forest-water interactions under multiple climate change scenarios and at all scales, including tree, stand, catchment, watershed, biome and precipitation shed scales.
2. Pilot cost-effective, reliable and replicable research methodologies to assess forest-water interactions and assess delivery of a broad range of ecosystem services across the globe.
3. Develop mechanisms for sharing forest-water interactions research among concerned stakeholders including participating countries, organizations, institutions and individuals.
4. Identify key areas of concern not currently addressed by important actors (governments, transboundary actors, sectors).

Policy Goal: Support forest-water policies, governance institutions and mechanisms.

1. Increase the recognition by all levels of governments and other non-state actors of the water services provided by forests.
2. Support policy makers in developing and implementing policies and institutional mechanisms that safeguard forest and water resources through sustainable forest management.
3. Increase collaboration and coordination between all sectors relevant to forest and water management, including forestry, water, agriculture, rural and urban development, energy, etc. in order to improve policy integration.
4. Improve transboundary cooperation between countries.

Practices and Economics Goal: Integrate scientifically based understanding of forest-water interactions in the management of diverse landscapes.

1. Increase recognition among communities and land management practitioners of the water services provided by forests.
2. Build the capacity of stakeholders in integrated forest-water management.
3. Increase cross sectoral collaboration to promote sustainable water/forest management.
4. Establish synergies with other initiatives targeting specific landscapes.
5. Support committed stakeholders in the development and implementation of pilot projects forest-water management.

Capacity Building and Communications Goal: Build the capacity of network members and the international community at large to address gaps in forest-water science, policy and management.

1. Increase awareness of forest-water interactions and the Forests and Water Agenda.
2. Improve knowledge sharing on forest-water interactions between stakeholders.
3. Support stakeholders in forest-water advocacy in international and national negotiations and processes.

Strategy

The *Forests and Water: a Five-year Action Plan* has strategies for Science, Policy, Practices and Economics, as well as Capacity Building and Communications. Although each area has its own vision, mission, goals and proposed activities, these areas are cross-cutting and activities will not be implemented in isolation.

Science: Promote and intensify international research on forest-water interactions, addressing knowledge gaps.

Vision and mission statements

The vision is that the evidence-based results of international research on forest-water interactions and their implications are effectively communicated to decision-makers and land management practitioners.

The mission is to establish an open network of research and educational institutions, organizations and individual researchers to address knowledge gaps in the understanding of forest-water interactions – including associated soil processes, water use by trees and forests, and the benefits of forests on water resources – and to share this scientific knowledge on forest-water relationships with the wider community interested in forests and water.

Problem diagnosis

The research agenda should help provide evidence for the role of forests and trees in relation to food and water security for upstream, downstream, upwind and downwind beneficiaries. Although significant research has been conducted in this area, the focus has primarily been on paired catchment basin experiments, and on sap flow and eddy covariance studies. As of 2015, the most important knowledge gaps concern variation in forest-water relationships, including the effects of forests on atmospheric moisture, under different and changing forest structures, soils, geology, climates, and spatial and temporal scales, including regional and continental scales. This means that management and policy decisions are often based on forest-water relationships from non-representative conditions and contexts, resulting in inappropriate management and misconceptions of forest-water interactions. Major barriers to addressing this issue are the geographical and temporal scales at which research studies are conducted, as well as the lack of standard research protocols and the cost of instrumentation and monitoring.

A priority for research should be the establishment of a global network for sharing forest-water research. This should enable the research community to extend existing knowledge on forest and water interactions (quantity and quality) and methodology into data and/or resource poor areas. From the social perspective, complementary work is needed to understand the trade-offs across the interests of different user groups (e.g. upper vs. lower watersheds), the effects of changing land use and water distribution patterns, the impacts of forest degradation, and the mechanisms for social protection surrounding the management of forests for water ecosystems services.

Major Objectives

- Deepen the understanding of forest-water interactions for various biomes at all scales, including tree, stand, catchment, watershed, biome, precipitation shed and global scales.

- Provide data to simulate the effects of multiple climate change scenarios at varying scales, from single tree to global scales.
- Pilot cost-effective, reliable and replicable research methodologies to assess forest-water interactions and assess the delivery of a broad range of ecosystem services across the globe.
- Develop mechanisms for sharing forest-water interactions research among interested stakeholders, including participating countries, organizations, institutions and individuals.

Activities

In order to achieve the aforementioned science goals, the following activities will be implemented:

- Collect research on forest-water interactions and documents related to integrated management and develop a forest-water database.
- Synthesize existing research and knowledge and identify knowledge gaps.
- Create a network of multidisciplinary researchers, research organizations and data sources.
- Develop and maintain cost-effective, standard research protocols with standardized indicators.
- Investigate the efficacy of new technologies for data gathering, analysis and the rapid dissemination of information.
- Identify global funding sources.
- Establish a network of resource people across different biomes and regions.
- Implement a standardized monitoring framework, including long-term monitoring.
- Support and produce publications summarizing existing research and its application in integrated forest-water management.
- Develop training materials on piloted methodologies, using existing and innovative approaches.
- Review academic or training curricula on the relationships between forests, water and people.
- Develop guidelines for the analysis of water interception of forest ecosystems.
- Develop data management and knowledge sharing systems and procedures.

Policy: Support forest-water policies, governance institutions and mechanisms.

Vision and mission statements

The vision is that policies and institutional mechanisms recognize watershed ecosystem functions and services and incentivize forest management practices that maximize the provision of these functions and services.

The mission is to support the development of integrated forest and water strategies, policies and institutional mechanisms at multiple levels, and to establish linkages between relevant sectors and stakeholders, including but not limited to forestry, water, agriculture and energy sectors; the private sector; local and national governments; regional governing bodies; non-government organizations; civil society and academia.

Problem diagnosis

Water use by forests can create conflict between different land and water users. At the same time, societies benefit from improved water quality and the protective functions provided by forests. The

environmental services of forests and the conversion of forests to other land uses provide strong opposing financial, social and economic incentives for policy-makers and land-users. Although the positive effects of forest-water interactions are known, it is observed worldwide that land use and water policies do not necessarily recognize healthy forests and trees (either as closed forests, buffer zones, tree lines or single trees) as effective, economically viable, environmentally friendly management options for improved water management within a sustainable landscape. The failure to recognize the full extent to which trees and forests effect water availability and flows also affects how issues of climate change are addressed and allows the role of forests in climate change mitigation and adaptation to be dominated by their role in carbon storage. Although desirable, collaboration between forestry, agriculture, and water sectors – and with rural and urban socio-economic development programs – is often weak or non-existent. In addition, forestry departments and ministries – those mainly responsible for forest-water – often lack the power and capacity to promote sustainable management of forest-water interactions at national and regional levels, which means that land management tends to favour other land uses and forests are unable to contribute to more resilient landscapes in the context of climate change and growing populations.

Major Objectives

- Increase recognition of the water services provided by forests by all levels of government and other non-state actors.
- Support policy makers in developing and implementing policies and institutional mechanisms that safeguard forest and water resources through sustainable forest management.
- Increase collaboration and coordination between all sectors relevant to forest and water management, including forestry, water, agriculture, rural development, urban development, energy, etc.
- Improve transboundary cooperation between countries.

Activities

In order to achieve the aforementioned policy goals, the following activities will be implemented:

- Consult with national governments and/or regional organizations to assess key interests.
- Identify pre-existing structures, strategies, legislation, policies, mechanisms, relationships and demonstrated capacities that facilitate or obstruct the development of forest-water policies.
- Establish institutional mechanisms at local, national and regional levels.
- Develop policies for forest conservation and sustainable forest management to safeguard water resources.
- Improve the coordination of activities and collaboration between forest and water sectors.
- Collaborate with partner countries to develop and implement appropriate forest-water policy institutions and mechanisms.
- Promote and/or facilitate transboundary cooperation between countries.
- Develop a communication strategy to build the capacity of non-specialist decision-makers and other stakeholders on the importance of integrated forest-water management.
- Establish an international standards working group to support national policy discourse.
- Implement pilot projects to scale-up effective policy and practice, and to address policy gaps, including local and national legislation, and local customary laws.
- Develop and implement a monitoring framework with standardized indicators.
- Support and facilitate bilateral cooperation between countries at the transboundary level.

Practices and Economics: Integrate scientifically based understanding of forest-water interactions in the management of diverse landscapes.

Vision and missions statements

The vision is that forest management and economic incentive schemes at international, regional national and local levels are based on an enhanced, scientifically-based understanding of forest-water interactions.

The mission is to integrate an understanding of forest-water relationships and the importance of conserving ecosystem services into forest, water resources, land and urban planning. This includes incorporating compensation for environmental services, such as payment for environmental services (PES) and other incentive schemes, and forest-water relations in forest and water ecosystem management plans.

Problem diagnosis

Forests are both important water users and vital for the sustainable management of water ecosystems and resources, providing multiple benefits including environmental stability. However, the trade-offs and synergies between different forest management regimes, other land-uses and water availability are not completely understood. Despite significant advances in the scientific understanding of forest-water interactions, many different interpretations prevail in both practice and policy, such as the role of forests in reducing floods, which can result in land-use and/or forest management practices that are inappropriate or fail to maximize the win-win scenarios of environmental services for different forest types and at different landscape scales.

Major Objectives

- Increase recognition of the water services provided by forests among communities and land management practitioners.
- Build the capacity of stakeholders in integrated forest-water management.
- Increase multi-sectoral collaboration to promote sustainable water/forest management.
- Establish synergies with other initiatives targeting specific landscapes.
- Support committed stakeholders in the development and implementation of pilot projects in forest-water management.

Activities

In order to achieve the aforementioned practices and goals, the following activities will be implemented:

- Synthesize forest-water related environmental service compensation schemes and economic incentive mechanisms at local, national, regional and international levels, and conduct case study analyses of successful integrated land use management models.
- Conduct a cost-benefit analysis of managing forests for various ecosystem services and production objectives for different forest types, climatic zones and scales.
- Review sustainability criteria of ISO environmental management standards, national legislation, sustainable certification bodies etc., to understand how they (directly or indirectly) link to forests and water.
- Develop pilot projects in different ecological or geographical and political zones to promote integrated management plans at national or local level

- Disseminate information and training material to integrate compensation and/or incentive schemes and forest-water relations in forest management plans.
- Build the capacity of land management practitioners and policymakers in integrated forest-water management.
- Develop a network and/or knowledge management platform to promote the sharing of knowledge and experience.
- Create linkages with policymakers to scale up effective practices.
- Support national legislation processes for inter-sectoral coordination and the implementation of forest and water related activities at landscape scale.
- Establish a global network of project sites and develop guidelines on best forest-water management and economic incentive mechanisms.
- Engage with existing international processes, such as CBD, UNFCCC, IPCC and IPBES, and collaborate with other relevant networks, including the Alliance of Water Stewardship (AWS) to engage the private sector.
- Organize and participate in international events to promote the Forests and Water Agenda and share lessons learned.
- Promote transboundary collaboration and cooperation by mainstreaming forest-water issues in trans-boundary frameworks and initiatives.
- Develop cases for successful compensation and incentive systems in order to share lessons learned.

Capacity Building and Communication: Build the capacity of network members and the international community at large to address gaps in forest-water science, policy and management.

Vision and missions statements

That decision-makers, forest, land and water managers and practitioners should understand forest-water interactions and have the capacity to integrate such knowledge into their activities, while scientists can better help identify knowledge gaps and have the opportunity to effectively improve our understanding of forest-water interactions.

The mission is to establish a communication platform to effectively share knowledge, policy and practices and to build the capacity of decision-makers and land managers to implement this knowledge.

Problem diagnosis

The latest scientific understanding of forest-water interactions is not always reflected in policies and practices. In fact, there are many misconceptions about forests and water that have prevailed, often leading to controversy. One of the main challenges is that there are still many knowledge gaps in both the basic science and in the natural variability of forest-water interactions across geography and climate. Another is that scientific inputs are often not packaged for decision-makers and land managers in a way that facilitate understanding and lead to appropriate actions. Similarly, observations and knowledge gaps in the field or in policy are not effectively communicated to scientists for further exploration. Forest and water interactions change with many factors, including time and weather, and communicated messages must involve information on probability and risk.

Moreover, decision-makers who have a good understanding of forest-water interactions are often limited in their capacity to develop and implement policy that translates to actions on the ground.

Major Objectives

- Increase awareness of forest-water interactions and the Forests and Water Agenda.
- Improve knowledge sharing of forest-water interactions amongst stakeholders.
- Support stakeholders in forest-water advocacy in international and national negotiations and processes.

Activities

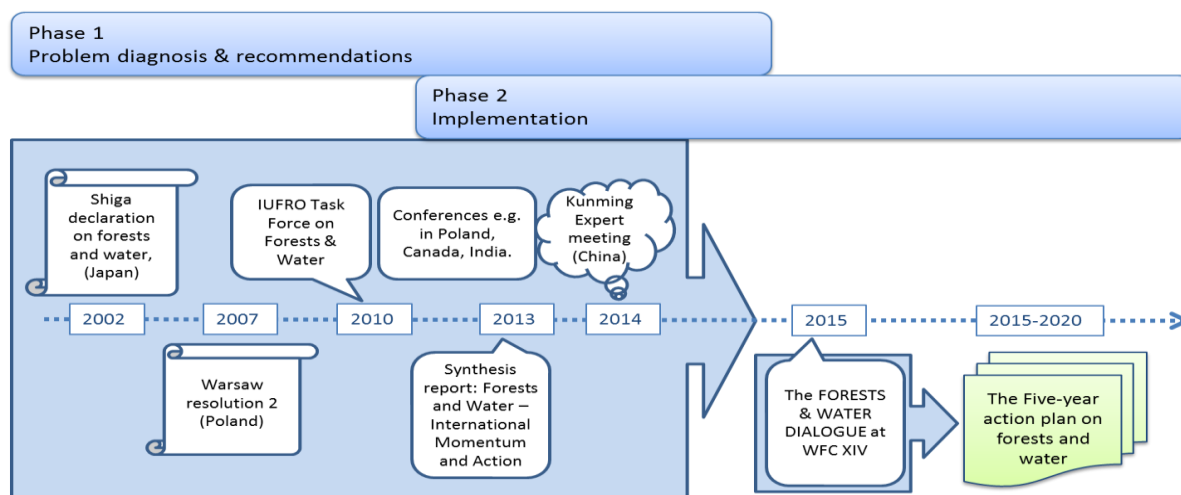
In order to achieve the aforementioned capacity building and communication goals, the following activities are required:

- Develop a communication strategy on forest-water interactions, the Forests and Water Agenda and the Action Plan at all levels with approaches to target specific audiences, particularly the private sector, academia and governments.
- Establish simple, effective messages to increase awareness on forests and water.
- Construct a communication database/platform to share knowledge, experiences and practices related to forests and water.
- Develop and implement workshops to build the capacity of decision-makers to integrate forest-water interactions in policy.
- Create stronger linkages between scientists and practitioners on the ground.
- Increase information sharing between forestry, water, energy and agricultural sectors.
- Coordinate and/or develop a forest-water curriculum.
- Develop and disseminate training materials and information materials to integrate scientifically-based payment for ecosystem services and forest-water relations in forest management plans.
- Create a database for forest-water resources, including research studies, publications and project documents.
- Establish a webpage and other relevant information-sharing platforms for forest-water stakeholders, providing information on news related to the Forests and Water Agenda, updates on forest-water pilot projects, events, resources, etc.

Annex 1. The Forests & Water Agenda

The role of forests towards water has received increasing international attention thanks to the committed individuals and organizations of the Forests and Water Agenda. Since 2002, there have been several milestones, including:

- **2002: Shiga Declaration**, developed in the context of the 3rd World Water Forum
- **2007: Warsaw Resolution 2** of the Ministerial Conference on the Protection of Forests in Europe (FOREST EUROPE)
- **2008 - 2014:** National and international events on forests and water interactions, including conferences in Canada, India and Poland
- **2010: Forests & Water Task Force** established at the 23rd IUFRO World Congress
- **2013: "Forests and Water – International Momentum and Action"** a synthesis report.
- **2014: Kunming Expert Meeting on Forests and Water** on 24-26 March in, Kunming China
- **2015: International Forests and Water Dialogue** 8-9 September at the XIV World Forestry Congress in Durban, South Africa



As the forests and water topic has built momentum, FAO and its partners have taken the initiative to encourage action in addition to furthering discourse, including a publication synthesizing the recommendations of the Shiga Declaration, the Warsaw Resolution 2 and the multitude of other technical meetings and policy events addressing forest-water interactions since 2002.³ To further foster the topic in research, a Forests and Water Task Force was established in 2010 by IUFRO, and was reinstated as the Task Force on Forest, Soil and Water Interactions in 2015. In addition, an expert meeting of forests and water was held in Kunming, China in 2014, with participation from research institutes, the private sector, NGOs and international organizations and political processes to confirm the relevance of the Forests and Water Agenda. At this meeting, it was decided to develop a five-year action plan with the purpose of increasing international action to safeguard forest and water resources worldwide.

³ "Forests and Water – International Momentum and Action" (Synthesis report, FAO 2013, <http://www.fao.org/docrep/017/i3129e/i3129e.pdf>)

Annex 2. Forests and Water Agenda Partners

Partner	Region	Technical Capacity
Beijing Forestry University	Asia (China)	<ul style="list-style-type: none"> • Science
Chinese Academy of Forestry (CAF)	Asia (China)	<ul style="list-style-type: none"> • Science
Centre for International Forestry Research (CIFOR)	Global	<ul style="list-style-type: none"> • Science • Practice • Capacity Building
Food and Agriculture Organization of the UN (FAO)	Global	<ul style="list-style-type: none"> • Science • Policy • Practice • Capacity Building
FOREST EUROPE Liaison Unit Madrid	Europe	<ul style="list-style-type: none"> • Policy • Practice • Capacity Building
Forest Research Institute, Poland (IBLES)	Europe	<ul style="list-style-type: none"> • Science
Forest Trends	Global	<ul style="list-style-type: none"> • Practice • Capacity Building
FORNESSA Coordinator, Forestry Research Institute of Ghana (FORIG)	Africa (Ghana)	<ul style="list-style-type: none"> • Science
Government of Alberta, Alberta Agriculture and Forestry	North America (Canada)	<ul style="list-style-type: none"> • Science • Policy • Practice
International Centre for Integrated Mountain Development (ICIMOD)	Asia	<ul style="list-style-type: none"> • Policy • Practice • Capacity Building
World Agroforestry Centre (ICRAF)	Global	<ul style="list-style-type: none"> • Science • Policy • Practice • Capacity Building
International Network of Bamboo and Rattan (INBAR)	Global	<ul style="list-style-type: none"> • Policy • Practice • Capacity Building
International Union for Conservation of Nature and Natural Resources (IUCN)	Global	<ul style="list-style-type: none"> • Policy • Practice • Capacity Building
International Union of Forestry Research Organizations (IUFRO) Task Force on Forest, Soil and Water Interactions	Global	<ul style="list-style-type: none"> • Science • Capacity Building

Kenya Forestry Research Institute (KEFRI)	Africa (Kenya)	<ul style="list-style-type: none"> • Science
PlanBleu	Europe	<ul style="list-style-type: none"> • Practice • Capacity Building
Stockholm International Water Institute (SIWI)	Global	<ul style="list-style-type: none"> • Science • Policy • Practice • Capacity Building
Universitat Politècnica de València	Europe (Spain)	<ul style="list-style-type: none"> • Science • Capacity Building
University of Lisbon	Europe (Portugal)	<ul style="list-style-type: none"> • Science
University of Putra Malaysia	Asia (Malaysia)	<ul style="list-style-type: none"> • Science
University of São Paulo	Latin America (Brazil)	<ul style="list-style-type: none"> • Science • Policy • Capacity Building
United Nations University Institute of Water, Environment and Health (UNU-INWEH)	Global	<ul style="list-style-type: none"> • Science • Policy • Capacity Building
WeForest	Global	<ul style="list-style-type: none"> • Practice • Capacity Building
Weyerhaeuser Company	North America	<ul style="list-style-type: none"> • Science • Practice

Annex 3. Forests and Water in the International Development Agenda

The Action Plan contributes to the Sustainable Development Goals (SDGs) for water (SDG6), climate change (SDG13), marine resources (SDG14) and terrestrial ecosystems (SDG15). In order to adequately achieve the SDGs, management for forest-water interactions needs to be mainstreamed on the ground and in policy; this can be achieved through the following:

- **The value of water quality and quantity provided by forests should be included in the total value of forests.** This value should be considered in land-use decisions and the implementation of payment for environmental service (PES) schemes. As a regularly traded commodity and resource, water is one of the easiest environmental services to appraise; however, reliable methodologies and/or models should be developed to measure and cost water from forests to better inform land-use decisions and PES schemes.
- **Forests should be managed as part of the greater landscape, ensuring adequate water availability and quality at different landscape scales.** Forests play a role in the water, energy and food nexus and therefore maintaining, and even restoring, forests to ensure they can provide these environmental services and functions through integrated landscape management, including within changing contexts resulting from climate change and socio-economic drivers, should be a priority in land management and policy.
- **There should be an integration of forest and water policies at local and national levels.** Such policies should recognize that forests regulate water availability and are often sources for high quality water supplies for agriculture, urban areas, fisheries, etc. and should support integrated land management and forest-water interaction research and awareness.

Annex 4. Forests and Water Projects

Project Title	Khasi Hills reforestation project
Location(s)	East Khasi Hills, Meghalaya, Northeast India
Timeline	2013 -2021
Budget	USD 1,200,000
Donor(s)	WeForest
Implementing Partner(s)	Ka Synjuk Ki Hima Arliang Wah Umiam Mawphlang Welfare Society (KSKHAWUMWS), a Federation formed by 10 indigenous councils, involving 62 villages
Main outcomes / objectives	<p>The main objectives are:</p> <ul style="list-style-type: none"> • To reverse deforestation and degradation trends (implement forest reforestation, monitoring and protection activities to facilitate the regeneration of degraded forests; build community capacity to implement resource planning systems and mitigation activities). • Implement soil conservation measures (soil erosion, hydrological function of the Umiam watershed). • Enhance economic conditions of participating and targeted households (sustainable enterprise development through microfinance, ecotourism, sustainable farming and forestry systems). • Protection of endangered flora and fauna species present in the project area.
Brief description (max. 300 words)	<p>WeForest has established a partnership with the federation of indigenous councils in the East Khasi Hills to restore forest cover, improve watershed hydrology, and make a transition to sustainable agricultural systems that are more climate-resilient. The project initially targets 5,000 hectares of degraded community forest, which are restored through enrichment planting, direct sowing and assisted natural regeneration activities.</p> <p>The programme supports the Khasi people, who are coordinated by their own traditional governance institutions, to implement activities that control the drivers of deforestation and land degradation (e.g. mining). In addition, it aims to conserve the old-growth montane cloud forest found in 'sacred groves' (biodiversity islands) that are relevant to Khasi's cultural heritage.</p> <p>A diverse programme of livelihood initiatives provide alternative streams of income and build entrepreneurial capacity (microfinance for women-run self-help groups and home-based nurseries, ecotourism project for the historic David Scott Trail, animal husbandry schemes, and fruit orchards). The implementation of the programme relies heavily on training a wide sector of the community (women groups, farmers clubs, working committees, youth volunteers, and schools).</p>

Project Title	South-South Knowledge transfer strategies for scaling up pro-poor bamboo livelihoods income generation and employment creation and environmental management in Africa
Location(s)	India, Ethiopia, Tanzania and Madagascar
Time Period	2014-2017
Budget	USD 1,500,000
Donor(s)	International Fund for Agricultural Development & European Union
Implementing Partner(s)	INBAR, CIBART, PROSPERER, CIBART-Madagascar, TABDEC, CIBINReMP, Amhara Government (BoARD)
Main outcomes / objectives	<p>The main objectives of this project related to forests and water are:</p> <ul style="list-style-type: none"> • To study the hydrological behaviour of commercially important bamboo species (run-off, soil loss, soil moisture). • To study the resource conservation attributes of commercial important bamboo species (nutrient cycling, water use efficiency). • To study the economics of bamboo cultivation of commercial important bamboo species (Quantification of tangible and intangible benefits (PES)).
Brief description (max. 300 words)	<p>INBAR, IFAD and the European Union have joined forces to share bamboo development experiences between India, Ethiopia, Madagascar and Tanzania.</p> <p>In East and Southern Africa, a new programme is stimulating South-South learning on innovative ways to use bamboo to improve the lives of rural communities. Experiences from India are now being tested and applied in Ethiopia, Madagascar and Tanzania. This is a two-way flow of learning, with experience and expertise exchanged between Africa and the Subcontinent. It targets several thousand rural women, men and young people, aiming to bring them new income streams and restore degraded lands by increasing the land coverage of bamboo in villages in the project sites.</p> <p>The South-South bamboo initiative is the next step in a long-term partnership between INBAR and IFAD, the UN agency charged with improving the situation of the world's rural poor, and with significant support from the European Union. It promotes the use of bamboo as a strategic resource that countries can use in their food security and green development action plans.</p> <p>The programme builds on past INBAR-IFAD work with communities in India, and this bamboo-related knowledge is now being transferred to the three African countries. Learning from the African experience will benefit progress of India's bamboo projects. Activities will engage some 7,500 smallholder farmers, 12,500 women and nearly 2,000 young people in the three countries, who will directly benefit from the project through increased income, long-term restoration of their lands for productive use and diversification of their farming activities.</p>

Project Title	Impact of land use on water and nutrient cycling in the South-West Mau, Kenya
Location(s)	South-West Mau, Kenya
Timeline	April 2014 – March 2017
Budget	USD 800,000
Donor(s)	CGIAR programme on Forest Trees and Agroforestry (FTA)
Implementing Partner(s)	CIFOR, Justus-Liebig-Universität Gießen
Main outcomes / objectives	<p>Main objective:</p> <ul style="list-style-type: none"> To quantify the effect of land use on hydrological processes and biogeochemistry in an East African tropical montane forest based on long term field measurements. <p>Outcomes:</p> <ul style="list-style-type: none"> Field data will be used as input for different modelling studies. These models will be used to explore the effect of future land use and climate change through application of different scenarios. The results will form the basis for quantification and valuation of important water related ecosystem services from the forest, which can contribute to the development of Payment for Ecosystem Services (PES) programmes and policy briefs to inform decision-makers about the potential consequences resulting from future land use change in the Mau Forest Complex.
Brief description (max. 300 words)	<p>The Mau Forest is the largest closed canopy forest system and montane forest in Kenya, covering over 400,000 ha. It is one of Kenya's five 'water towers' providing large parts of Kenya with fresh water. Twelve major rivers in the Rift Valley and western Kenya originate in the Mau. However, in the past decades significant deforestation and land use change took place, resulting in a forest loss of approx. 107,000 ha. Although there is much speculation around the consequences of these changes for water supply in areas downstream of the Mau, there is very little scientific evidence to support this.</p> <p>The study area is located in the Sondu river basin, in the South-West Mau, an area that experienced significant forest loss through conversion of natural forest to smallholder agriculture, as well as tea and tree plantations. A nested catchment approach has been applied, where automatic measurement equipment has been set up at the outlet of three sub-catchments within a bigger catchment. The land use in these catchments is natural forest, tea/tree plantations or smallholder agriculture. The equipment measures water level, turbidity, nitrate, dissolved and total organic carbon, electrical conductivity and water temperature at a ten minute interval. A fourth station is placed at the outlet of the larger catchment and data from this site will be used for modelling and upscaling. The resulting high resolution dataset will give a good estimation of the effect land use on stream flow patterns and water quality across seasons.</p> <p>Additional spatial sampling campaigns and stable isotope analysis will provide further information to increase our understanding of hydrological and biogeochemical processes occurring within this area and how these are affected by land use. The study is complemented with an assessment of greenhouse gas emissions from the same land uses: smallholder agriculture, tea plantations, and natural forest.</p>

Project Title	The Sustainable Land Management Project (SLMP₂)
Location(s)	Ethiopia
Time Period	2015-18
Budget	USD 5,300,000
Donor(s)	The World Bank
Implementing Partner(s)	INBAR, Ministry of Agriculture
Main outcomes / objectives	<p>Main objectives:</p> <ul style="list-style-type: none"> • Introduce an appropriate natural bamboo management system to mitigate the current loss of bamboo and to ensure a long lasting bamboo resource base in 5 target watersheds. • Introduce suitable non-native bamboo species in the selected pilot watersheds so that sufficient bamboo resource base and appropriate varieties will be available for sustainable watershed management. • Train the target communities of pilot watersheds on bamboo cultivation, stand management and sustainable harvesting techniques. • Promote bamboo plantations for sustainable watershed management on selected sites (bamboo culm and mat for soil conservation; bamboo culm for water course/river bank stabilization). • Establish micro and small enterprises.
Brief description (max. 300 words)	<p>The objective of the Second Phase of the Sustainable Land Management Project is to reduce land degradation and improve land productivity in selected watersheds in targeted regions in Ethiopia.</p> <p>There are four components to the project; the first component being integrated watershed and landscape management. The objective of this component is to support scaling up and adoption of appropriate sustainable land and water management technologies and practices by smallholder farmers and communities in the selected watersheds and districts.</p> <p>The second component is the institutional strengthening, capacity development and knowledge generation and management. The objective of this component is to complement the on-the-ground activities to be implemented under component one by strengthening and enhancing capacity at the institutional level, and building relevant skills and knowledge of key stakeholders, including government agencies, research organizations and academia involved in the sustainable management of natural resources, as well as the private sector, community leaders and small holder farmers.</p> <p>The third component is the rural land administration. The objective of this component is to enhance the tenure security of smallholder farmers in the project area in order to increase their motivation to adopt sustainable land and water management practices on communal and individual land. Finally, the fourth component is project management.</p>

Project Title	Concept Development and Criteria for Eco-Hydrological-Based Forest Management as a Measure of Adaptation to Global Change (SILWAMED)
Location(s)	Valencia, Spain
Timeline	2015-2018
Budget	EUR 110,000 (approximately USD 124,500)
Donor(s)	Government of Spain
Implementing Partner(s)	Universitat Politècnica de València
Main outcomes / objectives	<p>The main objective is to improve the understanding and quantification of forest and water relationships affected by forest management. This goal also includes other eco-hydrological elements of the forest following an ecosystem-based approach.</p> <p>Specifically, the project aims to:</p> <ul style="list-style-type: none"> • Improve the water balance of forests. • Improve tree/stand growth and vigor. • Improve tree-climate sensitivity. • Improve stand susceptibility to wildfire risk. • Not harm soil properties or nutrient cycles.
Brief description (max. 300 words)	<p>The research is focused on the need to obtain hydrological and ecological criteria to incorporate into forest management.</p> <p>Under a general scope of precipitation decrease and evapotranspiration increase due to climate change in semiarid regions, proactive adaptive management is becoming a basic strategy to either maintain or to gradually adapt current forest ecosystems. In water-limited regions, adaptive management usually focuses on forest and water relationships based on hydrology-oriented silviculture. Artificial plantations, marginal forests, protected forests, etc. are a special case of forests with low resilience to environmental shifts, and they could greatly benefit from adaptive silviculture.</p> <p>However, this type of silviculture is underdeveloped in many aspects in comparison to traditional silviculture oriented towards timber production. Guidelines for adaptive management must be developed under an integral approach that goes from tree to stand scales. Stand scale is related to the hydrologic performance of the physical structure of forests (density, leaf area index (LAI), canopy storage etc.), where thinning is known to affect water cycle components such as rainfall interception, throughfall, transpiration, soil moisture and deep infiltration. On the other hand, studies at tree-scale provide fundamental information about how changing forest structure and microclimate might lead to modifications in the ecophysiology of photosynthesis, transpiration and tree water relations. In this context, tree climate-growth relations, water use (WU) and water use efficiency (WUE) are central topics to deal with when relating forest management and tree-water interactions.</p> <p>This project aims to provide guidelines dealing on how to maintain site productivity, enhance soil water content (SWC), balance green/blue water, promote tree and stand resilience (most adapted species, proper density, etc.) for specific regions or ecosystem types, etc.</p>

Project Title	Understanding and balancing the forest-water interactions in the dryland regions of China
Location(s)	Liupan Mountains and Jinghe River Basin, Northwest China
Timeline	2015-2020
Budget	USD 1,500,000
Donor(s)	National Natural Science Foundation of China (NSFC), State Forestry Administration of China (SFA), etc.
Implementing Partner(s)	Institute of Forest Ecology, Environment and Protection, Chinese Academy of Forestry (CAF); Long-term Forest ecological Research Station at Liupan Mountains of Ningxia, SFA; Ningxia Academy of Agriculture and Forestry Science; Forest Administration of Liupan Mountains
Main outcomes / objectives	<p>The main objectives are:</p> <ul style="list-style-type: none"> • Understanding and quantifying the forest-water interactions at different spatial scales. • Developing techniques for balancing the forest and water interactions based on the water carrying capacity and the principle of multifunctional land use.
Brief description (max. 300 words)	Through long-term forest eco-hydrological research supported from different donors, the project aims to: 1) understand the forest-water interactions at different spatial scales, especially the impact of forest management on water yield; 2) quantify the forest hydrological impacts and their relations with the structure and distribution pattern of forests; 3) up-scale and evaluate the forest hydrological impacts and other related ecological services from stand scale to watershed scale; 4) quantify the water carrying capacities for forests and vegetation using proper indicators; 5) develop techniques and decision tools for regulating and balancing the forest and water interaction at different spatial scales; 6) promote the application of the techniques of integrated forest-water management and multifunctional forestry; 7) suggest policy improvement for balancing the forestry development and water resources management in dryland regions of China.