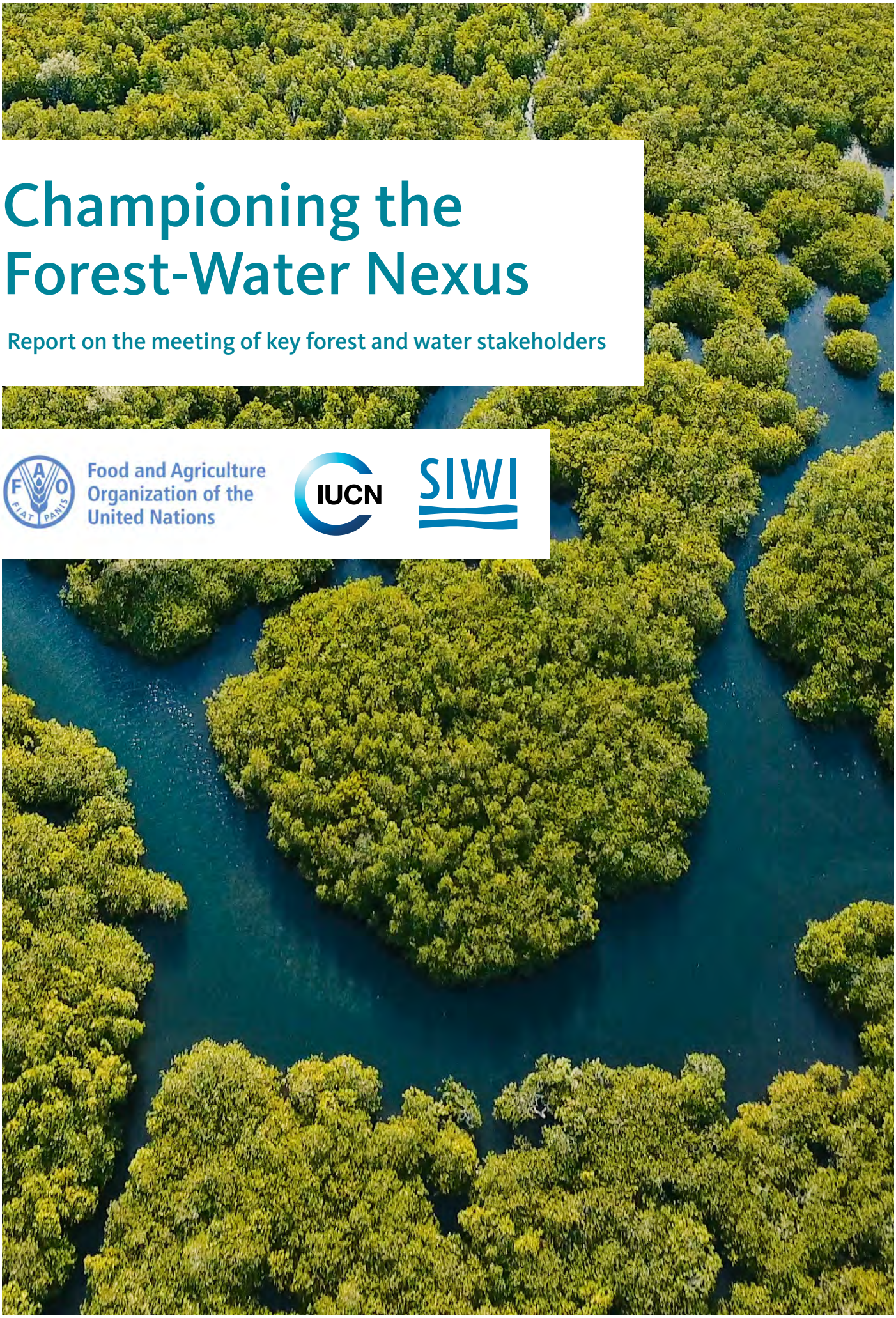
Championing the Forest-Water Nexus

Report on the meeting of key forest and water stakeholders



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Summary

In August 2017, parallel to World Water Week, the Food and Agriculture Organization of the United Nations (FAO), the International Union for the Conservation of Nature (IUCN) and the Stockholm International Water Institute (SIWI) hosted a meeting with 12 experts from the forest and water sectors. The meeting aimed to establish consensus on (i) issues and messages, (ii) develop key communication messages and strategies; and, (iii) develop joint activities for 2018-19 that promote the forest-water nexus. The successful meeting concluded by producing a joint statement on forests and water, as well as a list of suggested collaborative activities.

Outcomes

The workshop was appreciated and motivated follow-up discussions concerning the joint statement (page 5-6), which is planned for official release at the World Water Forum in Brasilia, Brazil in March 2018. The 12 Champions' participants unanimously expressed the need for further inquiry into the relationships of forests and water and were motivated to participate in future projects.

The workshop was organized into 4 activities: a tour de table for introductions and to understand the background of the participants; a discussion on the relationships between forests and water (see table 1); an exercise to form the structure of a joint statement on forests and water (page 5-6) and a brainstorming on the potential areas of collaboration.

A main outcome of the meeting, and a major influencer in the development of a joint statement on forest and water relationships, were the themes of the discussion exercise, compiled below. Table 1 was produced with the results of a brainstorming activity where participants discussed topics of agreements and disagreements within mainstream forest-water narratives. The chart shows there are certain topics that appeared as both issues of agreement and disagreement, suggesting that there is a need for further discussion. Due to time constraints, we were unable to address specific issues within the topics requiring further discussion or where there was no consensus. This table however, provides a foundation to the practice and discourse of integrating forest and water management.

Table 1. *Discussion Activity*

Theme	Areas of agreement	Areas of further discussion
Water Quantity	Trees and forests influence the hydrological cycle, by regulating and affecting basin flows through interception, uptake, evapotranspiration, reducing run-off and improving soil infiltration and groundwater recharge.	Forests (positively or negatively) impact on downstream water flow and groundwater levels.
	Forests do not always improve water yield; this is dependent on location, forest type and age, scale (physical and temporal).	What types of trees/forest most efficiently support, water supply/security and which deplete water yield? Where in the landscape should trees be located?
	Fire is a normal and healthy aspect of many forests, correlating with precipitation regimes and also influencing hydrology.	
	Forests can reduce the risk of flooding, but the parameters for reduced flood risk are complex, site-specific, influenced by many other factors, and are often not well-known.	The parameters related to the potential of forests to mitigate floods need to be more clearly defined for different contexts and variables.
	Evapotranspiration from forests can have a positive effect on downwind precipitation.	The extent of the effect and implications of forests, evapotranspiration and precipitation recycling are still unknown and require further research.
	There is a need to define the parameters of forest-water relationships, such as scale-related benefits and negative impacts, flooding, precipitation, groundwater, etc.	Issues related to the relationship between forests and precipitation and flood control, as well as the positive and negative impacts of reforestation on water yield; benefits and impacts of forests at different scales require further research to improve understanding.

Theme	Areas of agreement	Areas of further discussion
Water Quality	Forests generally improve water quality through their root systems and stable soil profiles which can act as a natural filter, reducing soil erosion and sedimentation.	
	Forests are critical to aquatic ecosystems.	The extent of the contribution of riparian zones and floodplains for fish communities (and forest/ fish dependent communities).
Policy and practice	The SDGs provide an opportunity to bring related scientific knowledge to the attention of policy and decision makers, and areas where the science is not yet comprehensive enough or overly-simplistic. Also to highlight the need for integrated approaches across sectors and disciplines.	
	Forests are communities of living organisms that are adapted to environmental conditions, including water. Similarly, scale and context matter for forest-water relationships and therefore forest and land management activities impact water and water users in different ways depending on local conditions, forest ecology, management regime, scale, etc.	What are the benefits related to forests and water interactions, when they occur and what are the trade-offs? Of particular interest is carbon storage, climate change mitigation and adaptation, extreme events. Research, methods and decision-making tools need to be developed and properly communicated.
	To improve management of the forest-water interface a combination of technical and policy measures are needed and should be summarized in a theory of change. Similarly, a scientific, conceptual framework is needed that shows the main linkages and interactions between forests and water. This should integrate existing tools to manage for uncertainty/risk in Sustainable Forest Management, Sustainable Landscape Management and Integrated Water Resource Management. It should be communicated across disciplines and sectors in order to reach consensus.	How to achieve these and by whom requires further discussion.
Socio-economics	Trees/forests have multiple purposes; however, managing forests is managing water, and both resources are part of deeply intertwined socio-ecological systems. The socio-economic dimension and implications for governance policies need to be better addressed, with specific attention to climate change, reduced forest functions and increased demand for water for human well-being.	How to best approach and manage a mosaic of land uses and other interventions, including natural ecosystems and managed systems in order to maximize overall benefits, keeping in mind equitable distribution of benefits.
	Ecosystem services from the forest-water nexus need to be better documented and accredited and used to develop funding schemes for overall landscape development.	Whether water accounting needs to re-prioritize ecosystems and look at a water "net balance." This can contribute to a cost-benefit analysis of forests as natural capital in place of or to complement grey infrastructure.

STATEMENT

Forests and water: managing our connected natural capital

Sustainable development is dependent on the forest-water nexus.

To achieve SDG 15, water and food security should be at the heart of forest management and the restoration of multi-functional landscapes. Similarly, water management should incorporate appropriate forest management as a natural infrastructure solution to achieve SDG 6.

Landscape restoration and forest activities should extend priorities beyond the conventional forest product, biodiversity and carbon storage focus, and more centrally include water impacts and opportunities to better contribute to a range of the sustainable development goals.

Only by recognizing the interlinkages of forests and water, and how the management of these resources influences productive multi-functional landscapes can appropriate agricultural, environmental, and carbon-reducing actions be designed for long-term benefits.

There are trade-offs; understanding and managing for these are paramount.

The relationships between forests and water are complex and context-specific.

Research and knowledge exist that can help to prioritize how forests should be managed within our landscapes in symbiotic relationships with water-related ecosystem services, such as soil erosion control, flood reduction and groundwater recharge. The same research can help us to identify trade-offs where forests may be counter-productive to water needs.

There is general agreement on the physical processes that are influenced by forests that change the water cycle, but less agreement on the effects of their interactions, and their impacts.

One key challenge is the range of forest-water interactions, and how different processes and effects occur at different spatial and temporal scales. For example, forests may cause a net loss in downstream water availability in some river basins, but may contribute to precipitation in other river basins due to the recycling of evapotranspired[1] water. Effects and impacts may therefore require further understanding across a range of scales.

[1] Evapotranspiration (ET) - evaporation from soil and plant surfaces and transpiration of water by plants.

Changing the landscape changes water: forest and landscape restoration will affect water supply.

Where forest and landscape restoration activities are planned, care must be taken to ensure that any impacts on water under current and future climate predictions are taken into account. Equally, the length of time it takes for forests to restore landscape functions needs to be recognized, as hydrological processes in forests change over time.

We urge caution with generalized assumptions due to the highly contextual nature of forest-water relationships. What is true for one geography, altitude, forest type, management regime, scale and season, may not be true for another. More research and monitoring on forest-water interactions in multi-functional landscapes is therefore required, and should be a requirement of restoration and landscape initiatives.

To achieve the SDGs, the forest-water nexus needs to be included in management, supported in policies and effectively monitored.[2]

Simply recognizing the forest-water nexus is not enough. We must improve our ability to design, implement, and learn from landscape approaches that both rely on the relationships between forests and water, and impact them.

This is necessary if we are to achieve the Sustainable Development Goals, including those related to hunger (SDG 2), poverty (SDG 1), water (SDG 6), climate (SDG 13), energy (SDG 7), economic growth (SDG 8), sustainable cities (SDG 11) and life on land (SDG 15); the Aichi targets on biodiversity; as well as store the carbon needed to achieve the temperature targets in the Paris Agreement.

This statement is the result of a meeting with forest and water experts co-organized by FAO, IUCN and SIWI with contributions from Elaine Springgay, FAO; James Dalton, IUCN; Lotta Samuelson, SIWI Swedish Water House; Angela Bernard, FAO; Alexander Buck, IUFRO; Jan Cassin, Forest Trends; Nathaniel Matthews, Global Resilience Partnership; John Matthews, Alliance for Global Water Adaptation; Anna Tengberg, SIWI Swedish Water House; Jacob Bourgeois, First Climate Markets AG; Mike Acreman, IUCN; Ingrid Öborn, ICRAF; and James Reed, CIFOR.

[2] Although the connection between forests and water are acknowledged in SDG targets 6.6 and 15.1, there is currently no methodology to monitor how changes in the landscape, including forest loss and/or gain, relate to changes in water and vice-versa, and therefore no data to inform management and policy decisions.

Background and rationale

The forest-water topic is a contentious one. There are few universal truths about forest-water relationships that can be applied widely for an array of ecosystems, in different regions, or across various scales. Our accepted wisdom relies on expert judgement and inference. The benefits and/or impacts of forests in relation to water can also be a matter of perspective, such as upstream/downstream, upwind/downwind and can be dependent on scale: time and spatial, including local, national, regional, etc. Seeking consensus within and between the forest and water sectors, and ultimately establishing collaboration, has proven challenging.

With 2018 celebrating the themes "Forests and Sustainable Cities" and "Nature for Water," it is timely to strategize an inter-sectoral approach to advocacy and collaborative engagement, championing the forest-water nexus.

A large proportion of people worldwide have difficulties in accessing and obtaining clean water to meet their basic needs. As the world's population grows, water is expected to become an even more scarce resource in the future. According to estimates, the human demands for water, energy and food are expected to increase 30-50%, and

accompanied with the business-as-usual climate scenario, the world is projected to face a 40% global water deficit by 2030. Water stress is a problem for human health and economic growth. Holistic and integrated water and land management plans are needed in order to tackle the problem of water quality and availability.

Forests and trees play an important role in providing diverse environmental, social, economic and cultural benefits to people in both rural communities and urban areas. The interactions between forests and water influence the provisioning and filtering of water, regulation of floods, the conservation of soils and climate regulation, among others. The Millennium Ecosystem Assessment (2005) estimated that up to 75 percent of the freshwater needed for human and environmental needs is from forested watersheds. It is also estimated a significant proportion of the drinking water required for the world's biggest cities comes from forested catchments and watersheds. So we need to be sure about the role of forests in water provision and manage forests to improve water security.

The linkages between forests, trees and water are diverse and depend on a large number of influencing factors. Forests and trees can contribute to mitigating challenges related to changing climate, including too much, too little or too dirty water, but the relationships between forest, trees and water are not always positive ones. With pressures from land use change and growing populations, exacerbated by climate change, eco-hydrological processes and services are often altered before they can be adequately accounted for in land and water management practices and policies. Integrated management of land and water resources calls for more holistic policy responses. These have to be based on scientific information, acknowledging the different regional scales, natural conditions and trade-offs between the diversified uses of water and objectives for different water users. Intersectoral collaboration and approaches to management and policy are imperative with growing attention on land and forest restoration efforts and large national commitments.

Over the years, the role of the forest-water nexus has gained further political attention at the international level. Various international activities and milestones, such as the activities of the Forests and Water Network, Shiga Declaration (2002), Warsaw Resolution 2 (2007), national and international events and scientific conferences on forests and water interactions, have helped to place more emphasis on the topic worldwide. Most recently, FAO) and other partners launched a "Forests and Water: A Five-Year Action Plan" during the XIV World Forestry Congress in Durban in 2015, paving the way for increased cooperation on the topic. However, recognition of the linkages between forests and water has not necessarily materialized on the ground, or incorporated into policies.

The Forest-Water issues

Forest-water relationships are complex and highly contextual. While the interactions can be generalized, these are not universal truths; there will likely be contrary examples, further supporting that management decisions and policies should be based on science and an understanding of local conditions.

Forests and water quantity | It is generally agreed upon that forests regulate the water cycle by maintaining soil health and moisture, supporting soil infiltration and groundwater recharge, which can reduce floods. Forests also evaporate intercepted precipitation and transpire water from soil and groundwater storages. Whether the net effect is that forests "provide" or "use" water overall is contested, as evidence shows these relationships are site specific and also dependent of tree varieties and species and forest management practices.

Forests and water quality | It is widely accepted that forests contribute to improving water quality through helping to reduce sedimentation into water courses. They may also help reduce pollutants entering water courses through reducing erosion and slowing down surface water run-off, improving natural infiltration into soils and rocks. Yet the amount of forests required in the landscape and where they should be located in order to maximize this benefit is unknown, which also means trade-offs are not known either. The valuation of forests for water quality is an area of interest that may help decision-makers choose between grey and green solutions.

Evapotranspiration, precipitation, and water loss | In water accounting, evapotranspiration (ET) is generally seen as water loss from the system. However, this perception overlooks the important roles of ET in contributing to atmospheric humidity, cloud cover and precipitation down-wind. We now recognise that water cycles operate at many scales: global, regional, local and within catchments and forests; all biophysical processes that contribute to local and larger-scale cooling and water availability. The issue has received increased attention since scientific evidence has suggested large-scale deforestation in the tropics is linked to increases in regional drought frequency and severity.

Forests and erosion/sediment control | Within forests, the complex system of ground cover with shallow roots and organic litter, combined with deep tree roots contribute to forests providing effective erosion and sediment control. This function influences water quality and supports soil protection. Forests may complement grey infrastructure, reducing costs associated with dredging dams or higher levels of water treatment.

Forests and flood control, drought and fire risks | Forests are generally viewed as buffers against natural disasters, such as floods, landslides, storm surges, etc. For example, one prevailing generalization is that forests reduce flooding. While this is true for some contexts there are limitations, dependent on spatial and temporal scales, including the size, duration and intensity of a precipitation event, as well as the geographic area. Generally, forests noticeably reduce the magnitude of small floods. Forests contribute to mitigating climate change by acting as carbon sinks and buffering the effects of extreme events associated with climate change, such as floods and droughts. However, extreme events are also reducing the ability of forests to be effective in this role. Droughts, flooding and forest fires are increasing in occurrence and are affecting hydrology, such as increasing erosion and degradation of soils, and resulting in altered landscapes, sedimentation of water bodies, etc.

Forests and riparian management | There are utilitarian versus conservation priorities and trade-offs regarding forests and riparian management. Riparian zones are multi-functional: reducing floods, erosion and sedimentation of water; regulating water temperature, as well as nutrients and sediments; providing biodiversity corridors that connect upstream and downstream ecosystems, etc. Riparian zones are also important to provide water access to in-land areas and users. Forestry tends to emphasize the protection and conservation of natural vegetation in riparian zones in order to maintain natural water supply. Water management on the other hand, tends to emphasize water-user access, including agricultural, domestic and industrial users, and water-related risks, such as flooding, in order to maintain water supply for all those reliant on the water source. Integrative approaches that allow for both utilitarian and conservation purposes are needed that are in turn supported in legislation.

Forests and groundwater | Inversely correlated to surface flow and erosion, the relationship between forests and groundwater is related to soil health and quality. Forests and their soils slow down water movement, allowing for soil infiltration and improved soil water moisture and groundwater recharge. Organic matter from forest vegetation, above and below ground contribute to this relationship as well. Trees have deeper root systems than other vegetation types and are able to access groundwater even during droughts, influencing water table levels and also providing water closer to the surface. Quantifying the net balance of forests contribution to groundwater versus their use, has proven challenging as it is context-specific and dependent on many factors including forest type (e.g. natural versus planted), species composition, tree density, other land uses, etc.

Socio-economics | Without a firm grounding in the biophysical relationships between forests and water, it is challenging to quantify the potential socio-economic benefits and/or impacts. Case studies are numerous and support both arguments: conserve forests for water and remove forests for water. The conversation should perhaps move towards comparing different management systems, from traditional grey infrastructure to green, as well as the array of integrated systems in between, taking into consideration the short and long-term costs and benefits.

Further reading

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About the Collaboration

In August 2017, parallel to World Water Week, the Food and Agriculture Organization (FAO), the International Union for the Conservation of Nature (IUCN) and the Stockholm International Water Institute (SIWI) hosted a meeting with 12 experts from the forest and water sectors. The meeting aimed to establish consensus on (i) issues and messages, (ii) develop key communication messages and strategies; and, (iii) develop joint activities for 2018-19 that promote the forest-water nexus. The successful meeting concluded by producing a joint statement on forests and water, as well as a list of suggested collaborative activities.

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