UNDERSTANDING THE FOREST-WATER NEXUS

Monitoring Framework Expert Workshop Summary

ABSTRACT

Workshop summary and background information on the "Understanding the Forest-Water Nexus: monitoring framework" expert workshop 27-30 September 2016.

Food and Agriculture Organization of the United Nations

Prepared for the FAO Forest and Water Programme by Angela Bernard with supervision by Elaine Springgay.

We would like to acknowledge the efforts of SIWI Swedish Water House, especially Lotta Samuelson, in the co-coordination of the workshop. It was a highly successful collaborative endeavour. We would also like to acknowledge all the workshop participants whose expertise and cooperative engagement were instrumental in the success of the workshop, and the process to develop a forest-water monitoring framework.

Food and Agriculture Organization of the United Nations

SIWI SWEDISH WATER HOUSE

Executive Summary

An intense three-day workshop from 27-30 September 2016 was organized with the theme “Understanding the Forest-water Nexus” as the latest phase of the development of the FAO Forest-Water Monitoring Framework. Hosted at SIWI headquarters in Stockholm, approximately twenty participants convened to brainstorm indicators that would encourage data sourcing and enhance the observation for and understanding of forest-water relationships. With participants spanning the globe, and coming from various disciplines, sectors and levels of exposure to the Forest and Water Agenda, the workshop was highly interactive and packed with presentations, breakout groups, and plenary discussions. Presentations from participants confirmed a growing awareness and the importance of forest-water interactions, yet expressed continued knowledge gaps and a lack of coordination. Informal assessments from the participating practitioners reported that forests are rarely included in the indicators for water and vice-versa.

In response to a repeated call to improve forest-water monitoring and evaluation, the participants presented their own projects and mapped out the variables that they felt should be observed. The proposal of a number of indicators and variables to be included in the framework led to four themes: water quantity, water quality, agents of change and socio-economic. Output from breakout groups were further discussed and modified in plenary sessions. The workshop concluded with the proposal of three new indicators for inclusion in the Forest-Water Monitoring Framework and Online Tool. These were refined into three to four sub-indicators following a similar format to that of the Montreal Criteria and Indicators for the Conservation and Sustainable Management of Temperate and Boreal Forests. In addition, attendees were urged to share tools from their work to aid implementation of the indicators, which offered the proposal of a riparian tool to be adapted for this purpose. A post-workshop survey was later conducted to gather feedback that might not have been expressed during workshop. The concluding sentiment was positive with an overall wish to continue collaboration and contribute to the advancement of the monitoring framework.

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1. Outcomes of Workshop

Criterion: Conservation and maintenance of water-related ecosystem services from forests

Indicators

Indicator 1: The status of water supply (quantity and quality) within and from forested areas in comparison to reference conditions.

- ***Sub-indicator 1.1: The status of forest water quantity***
  - Area and percent of water bodies in forest areas with significant changes in area (length and width) or volume from reference conditions
    - 1.1.1: Ratios of area and percent of forest cover and area and percent of water bodies in forests
    - 1.1.2: Surface, base flow and infiltration capacity
    - 1.1.3: Effect of forest cover, management and conversion on components of ET
    - 1.1.4: Soil water and groundwater recharge
- ***Sub-indicator 1.2: The status of forest water quality***
  - Area and percent of water bodies in forest areas with significant change in physical, chemical and/or biological properties from reference conditions
    - 1.2.1: Chemical status
    - 1.2.2: Pollutant status
    - 1.2.3: Biological status
    - 1.2.4: Hydromorphological status
- ***Sub-indicator 1.3: Effects of integrated forest and water management on water-related ecosystems services***
    - 1.3.1: Flood regulation
    - 1.3.2: Habitat for aquatic biodiversity
    - 1.3.3: Biomass production
    - 1.3.4: Effects of forest and land management on water balance
- ***Sub-indicator 1.4: Effects of changes in water supply (quantity and/or quality) on forest condition***

Indicator 2: The recognition of forests and water within practice, as well as legal, institutional and economic frameworks.

- ***Sub-indicator 2.1: Conservation and sustainable forest management for water-related ecosystem services***
  - Extent to which forest and land management enhance and maintain the water-related ecosystem services of forests
    - 2.1.1: Proportion of forest area protected or managed for soil and water conservation (disaggregate riparian forest)
    - 2.1.2: Proportion of forest management activities that meet best management practices, or other relevant legislation, to protect water related resources
- ***Sub-indicator 2.2: Legal frameworks***
  - Extent to which legal frameworks support the conservation and sustainable management of water-related ecosystem services of forests
    - 2.2.1: Existence of legal frameworks
    - 2.2.2: Effectiveness of legal frameworks
    - 2.2.3: Availability and invocation of mechanism to manage institutional conflict
- ***Sub-indicator 2.3: Institutional frameworks***
  - Extent to which institutional frameworks support the conservation and sustainable management of water-related ecosystem services of forests
    - 2.3.1: Existence of institutional frameworks
    - 2.3.2: Effectiveness of institutional frameworks
    - 2.3.3: Availability and invocation of mechanism to manage institutional conflict
- ***Sub-indicator 2.4: Economic frameworks***
  - Extent to which economic frameworks support the conservation and sustainable management of water-related ecosystem services of forests
    - 2.4.1: Existence of economic frameworks
    - 2.4.2: Effectiveness of economic frameworks

Indicator 3: Maintenance and enhancement of long-term socio-economic benefits from sustainable forest and land management for water-related ecosystem services

- ***Sub-indicator 3.1: Social and cultural***
  - Social benefits/costs of enhancing and maintaining the conservation and sustainable management of forests for water-related ecosystem services
    - 3.1.1: Perception and value of relationship between forests and water
    - 3.1.2: Inclusion of downstream and upstream communities/stakeholders
- ***Sub-indicator 3.2: Economic benefits***
  - Economic benefits of enhancing and maintaining the conservation and sustainable management of forests for water-related ecosystem services
    - 3.2.1: Percentage of households electing to participate in PES
    - 3.2.2: Proportional increase in household income from PES
    - 3.2.3: Opportunity cost
- ***Sub-indicator 3.3: Equity and access***
  - Status of equity and access resulting from enhancing and maintaining the conservation and sustainable management of forests for water-related ecosystem services
    - 3.3.1: Change in distance to water resources forest and forest-adjacent communities
    - 3.3.2: Extent of downstream impacts, leakage and displacement

Analysis of process

The three-day workshop produced **three forest-water indicators**. This framework is intended to create a better understanding of forest-water interactions and draws from four main themes which emerged from an initial brainstorming: quantity, quality, drivers of change, and socio-economic. Breakout groups based on these themes presented proposed sub-indicators and variables, in a final plenary discussion. The details of the groups are provided in following sections.

It was acknowledged that while the forest-water topic is complex, attempts to mainstream the issue and overcome complexity have not advanced the topic far enough. The development of a monitoring framework is welcomed and ambitious, and perhaps the urgent need for such a framework and tool has led to a rushed process. The preceding global survey garnered a lot of results, but many were not relevant. There was also limited time to review the survey responses, or to ensure the right combination of experts and sectoral/regional representation were able to attend the workshop. That said, the workshop had a great array of participants and it was refreshing to expand the existing forest-water network with newcomers.

A key takeaway from the workshop was the clear potential for forest-water indicators to further our knowledge. Participants where enthusiastic to contribute to the development of the monitoring framework in order to share and learn from experience and data collected globally. Following this, a desire to continue collaborating on the finer details of the above indicators and implementation of the monitoring framework was widely expressed. For example, issues of scale and methodology requires further discussion, as there was insufficient time.

Practical tools were suggested such as an existing **riparian tool**[1] developed and used in Sweden that could be adapted to these indicators. Along with the development of the indicators and suggestions on implementation, attendees were enthusiastic to participate in the next steps and offered their availability to contribute to capacity building and module development, training sessions and participate in pilot studies and projects. To keep up the momentum, they requested a **forest-water pamphlet** in order to share information and grow the forest-water network.

[1] Annex 5: Riparian Tool Example

Post Workshop Survey

A survey sent one week after the workshop concluded, showed unanimous benefit of the workshop for respondents, with each stating the monitoring framework would influence their current work. For the purpose of preparing the monitoring framework, a series of questions were asked to gauge enthusiasm and technical needs to continue contributions. Nearly all that answered stated the need for a support in order to incorporate the forest-water nexus in their work. Many had suggestions on how they could potentially collaborate to create training modules, facilitate trainings or get involved in pilots and projects. The survey response mirrored previous discussions during the process: that it was time to take action; and while many have experience in one or more elements to close knowledge gaps in the forest-water relationship, there needs to be a tool to implement. One respondent stated that we should not wait for the perfect monitoring tool but rather let data improve the tool with time.

"It is very interesting how we are seeking the same thing but using different points of view. This workshop showed me how is important and challenging to converge ideas regarding forest-water relationship."
– Silvio Ferraz

Next Steps

The preliminary list of indicators drafted by the participants established a skeleton framework, to be reviewed by FAO and will require further consultation with various forest, land and water experts. A zero draft of the framework is scheduled for the end of the year with the piloting of indicators and methods aimed for 2017. Planning in 2017 includes the launch of a beta version of forest-water monitoring tool and piloting the indicators.

Timeline	
Nov 2016	Feedback from select experts; Dissemination of workshop outputs
Dec 2016	Zero-draft of indicators finalized
Jan 2017	Wider dissemination of indicators
Feb-Dec 2017	Piloting of indicators; Development of tool
May-Jun 2017	Promotion of framework at World Water Congress
Sep 2017	Promotion of framework at IUFRO Congress
Mar 2018	Launch of beta forest-water monitoring tool

Online Tool and Forest-Water Network

The tool intends to be online and interactive to assist stakeholders in the various stages of the monitoring and evaluation process for on-the-ground projects involving forests and tree management, from strategy planning and the selection of indicators to analysis. The tool will allow stakeholders to easily integrate forest-water interactions in the monitoring of their activities. Users will be able to select from the indicators based on their relevance to the stakeholder and the project.

Based on the discussions during the workshop and the post-workshop survey, all participants welcomed their involvment in a forest-water network. Attendees expressed preference for ongoing e-mail communication with secondary interest in a newsletter or online meetings. Additionally, more workshops involving potentially affected parties (e.g. forest restoration projects that may or may not have considered water-related issues) could be organized to exchange information. Marketing materials, such as the Forest-Water brochure was requested to share at conferences and enlarge the network.

2. Forests and Water: Rationale and History

Forests and Water: a five-year action plan, launched in September 2015 at the XIV World Forestry Congress in Durban, South Africa, emerged from the discussions and recommendations of the Forests and Water Agenda – an international process to include forests and water in international fora and frameworks. It marks a transition from discourse to action. The Plan presents the tangible integration of science, policy and practice of forest-water interactions, and seeks to encourage greater commitment to sustainable forest and water management. Improved monitoring is a key component of the plan, cross-cutting all the goals of the Action Plan, which are related to science, practice, policy and capacity building.

This workshop is part of a process to develop a monitoring framework: preceded by a global stocktaking survey and peer reviews, and followed by additional consultations and the piloting of indicators.

Survey & Peer Review

The process commenced with a global survey, which received over 280 responses from 74 countries. Most of the workshop attendees participated in this survey and were selected based on their contributions, expertise, as well as their regional and sectoral representation. While a number of responses did not entirely address the objective of the survey: to know who is measuring forest-water relationships, where and how, the feedback surpassed expectations. Most importantly, the survey affirmed that the forest-water topic is highly relevant and that there is a lot of knowledge and ongoing activities globally. However, this knowledge is predominantly held within the research community, has a geographic bias and has not been sufficiently integrated into practice and policy. Apreliminary peer review of survey responses[2] provided the foundation for potential indicators to discuss during the workshop.

Developing a Forest-Water Monitoring Framework

The development of this monitoring framework is in an ongoing process of phases:

- ✓ stocktaking exercise to determine what is being measured, where and how (June-July 2016);
- ✓ analysis of survey feedback (August-September 2016);
- ✓ preliminary peer review of indicators and methods (September 2016);
- ✓ **workshop to standardize indicators, protocols and field methods (September 2016);**
- additional consultations to develop framework (2017);
- development of an online tool and guide for users (launch March 2018);
- capacity development program to promote the application of the framework (2017-2018).

One of the key cross-cutting activities identified in the Action Plan is monitoring and evaluation, contributing to improved scientific understanding, as well as better-informed practices, policies and capacity building. Upon launching a new Forest and Water Programme, the development of a forest-water monitoring framework became one of the primary activities of the Programme, thereby addressing one of the key needs of the Forests and Water Agenda and Action Plan, and the groundwork for further capacity building, advocacy and project development.

FAO Forestry Officer, Elaine Springgay, and SIWI's Lotta Samuelson collaborated to conduct a workshop to develop a forest-water monitoring framework. The framework, and future tool, would provide accessibility to peer-reviewed indicators and methods that will enhance projects, as well as create transparency to inform policy and practices for a complex topic. The framework should be implemented with the understanding that forest-water relationships should not be managed in isolation, but in the broader context of landscape management and in consideration of other socio-economic, political and environmental objectives. Ultimately, the monitoring framework will provide the basis for improved forest and water management project development and implementation; capacity building workshops; strategic forest management for water supply; a forest-water module in national forestry assessments; improved analysis for the global forest resources assessment (FRA); cross-sectoral policy and integrated landscape management. Therefore,

[2] See initial survey description in Annex 6: Briefing Note

scientists, researchers, policy and decision-makers as well as practitioners were encouraged to attend the workshop in order to contribute to the development of the indicators.

Online Tool

The resulting indicators are intended to be incorporated into an online, interactive monitoring tool to assist stakeholders in the various stages of the monitoring and evaluation of on-the-ground projects involving forests and trees, from strategy planning and the selection of indicators, to analysis. Each indicator will provide recommended method(s), providing details for the method(s) and justification for their use, including the context for optimal use. Workshop attendees looked positively at this idea, wanting to know more how the tool would work. This opened the opportunity for participants to become involved in the development since there is a great need for a wider-reaching online, open-sourced tool. While eager to contribute participants voiced concerns over intended users and the technical training some variables or methods would require, as well as likelihood of some practitioners having internet access. These aspects are intended to be addressed during the beta-phase of the tool.

"In order to better understand the water-forest nexus, it is important to 1) showcase lessons learned in the field, 2) apply technical and scientific knowledge/know how and 3) foster a knowledge sharing network that enhances research and cooperation." – Laura Valverde

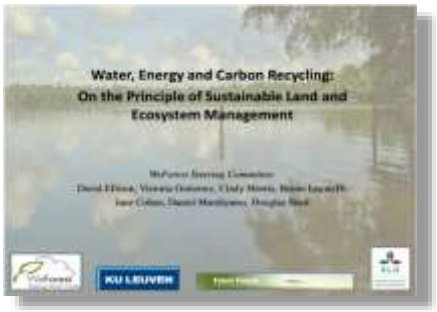
3. Summary of Proceedings

Workshop Programme

The three-day workshop primarily involved small group discussions, and began with introductions from SIWI and FAO to frame the workshop and provide guidance for the development of indicators. The 20 participants represented a variety of forest and/or water experts who work with government, NGOs or academia.

The morning of Day 1 focused on the objectives of the workshop and a series of presentations to provide a background and framework for the rest of the workshop. Elaine Springgay, provided the context for the workshop and introduced the desire of FAO to learn how this monitoring framework could make an impact. A series of presenters showcased how projects and organizations currently look at forests and water; these presentations are summarized below. Most of the presentations focused on challenges experienced and the way they overcome them, as well as how a global monitoring framework/tool for forests and water may assist them in their work.

David Ellison, Ellison Consulting



Discussed defining the concept of hydrological space and natural balance. Suggested practitioners look beyond catchment as to not overlook the cross-continental transport of atmospheric moisture affecting forests. Stressed the importance of water and energy cycles being placed at the core of land use management strategies.

Lotta Samuelson, SIWI

How SIWI uses data as a baseline in dialogue with policy makers as well as build capacity of water users and professionals across boundaries. The various departments at SIWI gather data and evidence to support policy making in their specialty.

Laura Valverde, Fundecor

Costa Rican Foundation aiming to add value to local tropical forests through SFM and ecosystem services. Partners with a public-private and civil society water fund 'AquaTica', to identify watersheds and intervene when necessary. Discussed the challenge to develop a monitoring system.

Victoria Gutierrez, WeForest

Forest landscape restoration where social economics are an important part of the activity. Currently in development of FLR certification framework (having some overlap with water). Managing forest for water and climate cooling. However, unable to succeed in getting data sedimentation load and flow. Addressed how to scale up solutions.

Benedict Omondi, KFS

Described the functions of the Kenyan Forest Service as it monitors various aspects of forestry, weather and water resources. Namely, works to manage forests on water catchment areas through indigenous forest conservation and management. Stated to have capacity gaps where a forest-water monitoring framework would be useful.

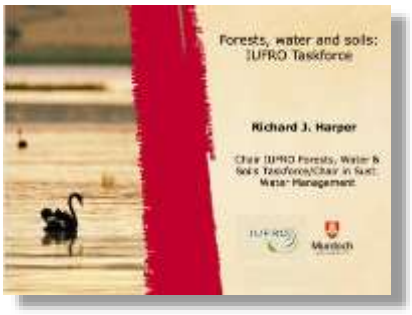
Jacob Bourgeois, Gold Standard

NGO (founded by WWF and others) with aim to address shortfalls of the CDM and help projects along in its certification process. Draft technical documents required for certification. Are in the early phase of a creating a Water Benefit standard with methodology accounting for forest-water impacts from reforestation.

Silvio Ferraz, University of São Paolo

Brazilian Cooperative program in watershed management and modelling where they study this relationship from the hydrological standpoint. For example, answering whether forest plantations are planned and managed in order to avoid hydrological resource degradation.

Richard Harper, Murdoch University

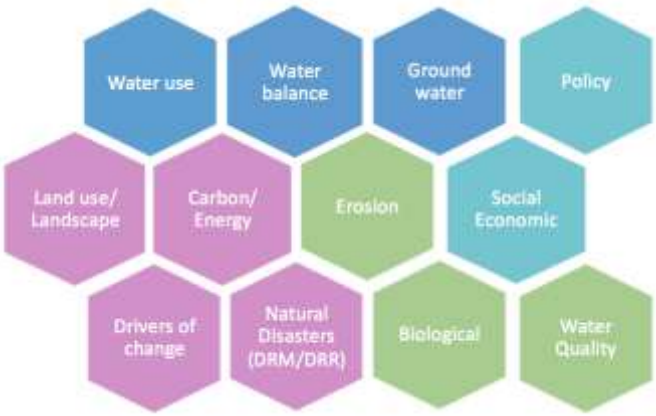


On behalf on the UIFRO Taskforce, one of five research themes in the IUFRO 2015 -2019 Strategy describes several gaps and uncertainties related to forests, water and soils. Climate change will prove to have direct and indirect effects, making the nexus relevant.

In addition, two networking events were incorporated into the schedule: a roundtable and reception hosted by the Royal Swedish Academy of Agriculture and Forestry, FAO, SLU and SIWI where attendees had the opportunity to learn about Swedish scholarly and practical advancements in forests and water; and a post-workshop fieldtrip hosted by the Swedish state-owned forest 'Sveaskog' to 'Torpesta Näs' ended the week. For further information, please refer to the agenda in Annex 1.

Getting to work: developing forest water indicators

The majority of the workshop was spent in breakout groups and plenary discussions focused on developing the monitoring framework. The participants were tasked to propose new indicators to observe forest-water relationships. A number of indicators had been provided by peers through the initial global survey and were presented to the group a week before the workshop[3]. With those suggestions in mind, participants evaluated new indicators that could work for the tool. In order to determine the main issues and breakout group discussions, a beginning brainstorming exercise allowed participants to unload all the variables that should be taken into account when developing indicators. Participants were asked to keep certain factors in mind:



- Are the indicators generic enough to be used in different contexts?
- At which scale does the indicator apply?
- Can the indicators be easily measurable?
- What aspects of forest-water relationship do you currently measure? Or should/would you like to measure?

While approximately fifty variables were provided, they could be clustered into the above groupings, which formed four overarching themes: water balance (quantity), quality, drivers of change and socio-economic factors. Each breakout group had four or more participants.

[3] See 'Proposed Indicators to Initiate Brainstorming' in Annex 6 Briefing Note

Table of variable inclusions to the indicators

Theme	Description	Brainstormed Sub-indicators and variables		Group members
Quantity / Water Balance	Ground water recharge, redistribution of water, water use, forest cover	• Hydraulic conductivity • Soil water holding capacity • Upwind (continental recycling ratio) - ET • Catchment recycling ratio	• Water-use efficiency • Soil degradation • The loss of biological and hydrological productivity in a system or the overall stress • Site description, physical reality	Jacob, David, Benedict, Kevin, Ulrik, Antonio, Jan
Water Quality	Biological, Chemical, and Geomorphic status	• Pesticides • Pharmaceutical waste • Heavy metals	• Solid waste • Other chemicals • Organic pollutants	Linnea, Lotta, Maria, Laura
Land-use and Change	Forest management, condition, regulated/unregulated, water use by wet sectors	• Water quality/quantity • Agricultural chemicals • Salinity (mangrove loss)	• Water consumption per capita • Water management schemes • A/R	Victoria, Angela, Paola, Richard, Sahbi, Bhawani
Social / Economic	Eco-services (and income derived), policy and regulations, access to water, opportunity costs, equity, health of community	• Community perceptions • Economic benefits • Income • Water security • Governance • Anti-corruption • Policy challenges	• Capacity • Representation/participation • Local quality of health • Anti-corruption • Distance/time • Population density	Victoria, Angela, Paola, Jason, Sahbi, Elaine
Parking Lot	Items not discussed in groups above	• Protected areas, ex. National park • Drainage systems • Wetlands • Infrastructure (including hydropower)		

During the breakout groups, participants also considered data sources and whether the data could be reproduced (when to collect and how). During plenary discussion, the groups presented their outputs and discussed higher order indicators and rationales. As seen in the table, an additional 'Parking Lot' list included items that were not necessarily discussed in the breakout sessions, but seen as potentially relevant. Formulating indicators proved challenging due to forest-water relationships involving specific technical requirements due to differences in scale, geographic context, etc. Reviewing indicators for the Quantity and Water Balance group was particularly challenging due to the range of complexity in collecting data for some variables. Some argued that simplicity in data collection and implementation of an indicator should be preferred over accuracy. The preliminary workshop indicators agreed upon by the end of the workshop can be seen in Annex 3, which contributed to the criterion presented previously.

Academy Visit and Field Trip

On Wednesday afternoon all participants were invited to the Royal Academy of Agriculture and Forestry for a round table and short presentations on the Academy, activities at SLU Global and IUFRO. The occasion allowed for exposure to opportunities with Swedish stakeholders and for a more informal exchange between participants. The workshop concluded with a fieldtrip outside of Stockholm to an area where landowners integrate water considerations in agriculture and forestry management plans. The excursion was hosted by Sveaskog, the largest forest owner in Sweden, managing 14% (4.04 million ha in 2015) of the Swedish forests. Guided by Stefan Bleckert in Torpesta Näs, the Conservation Director of Sveaskog, participants were led and guided through a landscape where forests, water and agricultural land is holistically managed based on their potential risk to water quality and quantity. Participants were encouraged by these examples of clear integration of water resources into forest and landscape management.

Annex 1: Workshop Agenda

Day 1 – Tuesday, 27 September 2016

Time	Activity	Description	Responsible
8:30	**Arrival**		
8:40	**Welcome message**	Introduction to the workshop, overview of workshop schedule and logistic information	Lotta
8:45	**Participant introductions**	Participants provide brief introduction to themselves, including name, affiliation, experience in forests and water, and what they hope to get out of the workshop	Lotta
9:30	***Forests and Water: from discourse to action***	Presentation on the background of Forests and Water and rationale for the workshop	Elaine
9:40	**Forests and Water in science**	Presentation on a brief overview of forest-water science and the challenges of incorporating science in practice and policy	David Ellison
9:50	**Q&A**	Opportunity for any questions regarding presentations and discussion	Lotta
10:00	***Coffee Break***		Karin
10:30	**Forests and Water in Policy**	Presentation on the importance of data for policy	Lotta
10:40	**Fundecor**	Presentation on challenges of monitoring / measuring forest-water relationships and how challenges are currently overcoming these challenges. In addition, it would be useful to know how a global monitoring framework/tool for forests and water may assist in practices and policies.	Laura Valverde
10:50	**WeForest**		Victoria Gutierrez
11:00	**KFS**		Benedict Omondi
11:10	**Q&A**	Opportunity for any questions regarding presentations and discussion	Lotta
11:30	**Gold Standard**	Presentation on Gold Standard's methodology development approach and perhaps an overview of the benefits/limitations of standards, including the challenges standards can help address or still need to address	Jacob Bourgeois
11:45	**Q&A**	Opportunity for any questions regarding presentations and discussion	Lotta
12:00	***Lunch Break***		Pernilla
13:00	**Objectives of Workshop / Developing Indicators**	Presentation on the objectives of the workshop and tips for developing indicators	Elaine
13.10	**Documentation**	How is it done and what is the purpose	Angela
13:15	**Forests and Water – what is measured**	A plenary brainstorming discussion to come up with a laundry list of what is measurable. Participants will initially be asked to come up with the 3 most important aspects that should be measured. These can be arranged according to topic and how to approach moving forward.	Elaine/Angela
14:45	**Break out group organization**	Quantity volumes/ Quantity water cycle/ Quality, people in groups, note taker, facilitator	Lotta
15:00	***Coffee Break***		Pernilla
15:30	**Group Discussions – Indicators**	3 Breakout Groups: - Quantity – Balance - Quantity – Hydrology - Quality	Elaine (floating) Lotta Jacob Angela Bernard
17:00	**Wrap-up**	Any announcements for the day and logistics for tomorrow.	Lotta

Day 2 – Wednesday, 28 September 2016

Time	Activity	Description	Responsible
8:30	**Arrival**		
8.35	**Todays Agenda** **Plenary Summary Day 1 Break out discussions**		Lotta
8:35	**Group Discussions – Indicators (continued)**	3 Breakout Groups: - Quantity – Balance - Quantity – Hydrology - Quality	Elaine (floating) Lotta Jacob Angela Bernard
10:00	***Coffee Break***		Nicolai
10:30	**Group Discussions – Indicators (continued)**	3 Breakout Groups: - Quantity – Balance - Quantity – Hydrology - Quality	Lotta
12:00	***Lunch Break***		Pernilla
13:00	**Plenary Discussions – Indicators**	Presentation of group indicators and plenary discussions	Elaine
14:50	**Wrap-up**	Any announcements for the day and logistics for next day.	Lotta
15:00	***Coffee Break***		Pernilla
15:30	**Depart for Royal Swedish Academy of Agriculture and Forestry**		Pernilla
16.00	**Round Table**	Welcome - Birgitta Naumburg KLSA Secretary Forestry Section Rational for meeting – Lotta Short presentations, name and organization FAO Forest and Water Action Plan, and Monitoring Framework WS - IUFRO Task Force - Richard Harper – Professor Murdoch University) SLU Global – organisation och activities – Anders Malmer, Director SLU GLobal Q&A - all	
17.30	**Reception**		Lotta/Gun

Day 3 – Thursday, 29 September 2016

Time	Activity	Description	Responsible
8:30	**Arrival**		
8:35	**Summary Day 2 – Break Out Groups**		Lotta
8:45	**Objectives of Methods Session**	Presentation on the objectives of discussions on methods	Elaine
8:40	**Group Discussions – Methods**	3-4 Breakout Groups: - Quantity – Balance - Quantity – Hydrology - Quality	Elaine (floating) Lotta Jacob Angela Bernard
10:00	***Coffee Break***		Nicolai
10:30	**Group Discussions – Methods (continued)**	3-4 Breakout Groups: - Quantity – Balance - Quantity – Hydrology - Quality	Lotta
12:00	***Lunch Break***		Pernilla
13:00	**Plenary Discussions – Methods**	Presentation of group methods and plenary discussions	Elaine
15:00	***Coffee Break***		Pernilla
15:30	**Framework Organization**	Organizing indicators into framework	Elaine
16:30	**Next Steps**	Discussing how to move forward	Elaine
17:00	**Wrap-up**	Any announcements for the day and logistics for next day: field trip.	Lotta

Day 4 – Friday, 30 September 2016

Time	Activity	Description	Responsible
7.00	**Prepare morning picnic**	Coffee, milk, cake	Lotta
8:00	**Departure**		
9:30	***Arrival and Coffee Break, Welcome and outline of the day***		Lotta
	Torpesta Näs and Likstammen	Water Management in different scales High value water –	Lotta
13:00	***Lunch Break; Östermalma***		Pernilla
14:00		Restoration of waterways in forest land; Restoration of wetlands in agricultural land Restoration of waterways in agricultural land	Elaine
15.00	***Coffee Break***		Pernilla
	Baggebol	Adaptations in forestry to integrate water management Targets for high quality forest water	Elaine
16:30	**Departure**		Elaine
18:00	**Arrival Stockholm Central**		Lotta

Annex 2: Participant List

Prefix	First Name	Last Name	Company	Job Title	Email
Ms.	Elaine	Springgay	FAO (Organizer) - Italy	Forestry Officer	elaine.springgay@fao.org
Ms.	Lotta	Samuelson	SIWI Swedish Water House (Organizer) - Sweden	Programme Manager	lotta.samuelson@siwi.org
Ms.	Angela	Bernard	FAO - Sweden	Consultant (Documentation and Facilitation)	angela.bernard8@gmail.com
Prof.	Antonio	del Campo	Universitat Politecnica de Valencia - Spain	Associate Professor	ancamga@upv.es
Mr.	Sahbi	Bedhief	Ministry of Agriculture - Tunisia	Deputy Director	sahbi_ghi@hotmail.com
Mr.	Benedict	Omondi	Kenya Forest Service - Kenya	Head of Watershed Mgt.	bpomondi@gmail.com
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Dr.	David	Ellison	Ellison Consulting - Switzerland	Senior Researcher/Consultant	ellisondl@gmail.com
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Prof.	Silvio	Ferraz	University of São Paulo - Brazil	Professor	silvio.ferraz@usp.br
Dr.	Ulrik	Ilstedt	SLU - Sweden	Associate Professor	ulrik.ilstedt@slu.se
Dr.	Victoria	Gutierrez	WeForest - Belgium	Chief Science Officer	victoria.gutierrez@weforest.org

Annex 3: Preliminary Workshop Indicators

Theme	Indicator	Sub-indicator
Water Quality	Pollutants; concentrations of nutrients and pollutants in the water body in or near forests	Chemicals used in managed forests
	Chemical and physical status; physical characteristics, and concentration of chemicals in water bodies in or near forests	
	Biological status; richness and abundance of biological parameters in water bodies in or near forests	
	Hydromorphologic status; structure and variation of physical elements and components in and adjacent to the water bodies in or near forests	
Agents in Change	Changes in water supply linked to changes in forest cover, land use and management	
	Changes in water linked to forest condition	
	Anthropogenic pressures on forest and water	
	Non-anthropogenic pressures on forest and water	
	The effect of water supply changes on forest condition	
Quantity	Change of water balance of landscape components	Ratio of net forest water balance
	Effect of forest cover, management and land use on surface and ground water yield	Run-off coefficient *tool
	Effect of forest cover, management and land use on components of ET	Baseflow index *tool
		Effects of integrated forest management and water on water-related ecosystems services (quantity, quality, flood regulation, habitat for aquatic biodiversity, recreation, food, timber)
	Surface/Quick flow	Effects of integrated forest management and water on biomass production
	Base/Slow flow	Waterflow regulation
	Ground water depth	Forest water-use efficiencies
	Infiltration capacity	
	Hydraulic conductivity	
	Soil water holding capacity	
	Upwind (continental recycling ratio) - ET	
	Catchment recycling ratio	
	Water-use efficiency	
	Soil degradation	
	The loss of biological and hydrological productivity in a system or the overall stress	
	Site description, physical reality	
Socio-economic	Change in perception of values and relationship between forest-water	Community perceptions, economic benefits, Income, Water Security
	Opportunity cost of forest condition and cover change on water quality and quantity	
	Change in distance to water source in relation to forest cover and condition	
	Incidence of water quality related diseases (e.g. dysentry, typhoid)	
	relative water access in relation to in relation to user groups as a result in changes in forest cover	

Annex 5: Riparian Tool example

NPK+ – Assessment of Conservation values, Impact, Sensitivity and Added value of streams

English version, Translation by Daniel Thorell

Date:	**Name of conducter:**		
Name of stream			
Catchment area	Number:	Name:	
Stretch surveyed (m)			
Coordinates lower	X		Y
Coordinates upper	X		Y
Average width (estimated: <1 m, <3 m, <6 m, > 6 m)		**Dominating ground substrate:**	

	Mark with X if present!	
N 1. CONSERVATION VALUES – Stream		
Strong variation in the stream		Stream mostly meandering, large variation in depth and width, and occurrence of sand/gravel and stones/boulders.
Dead wood in water		> 7 pieces per 100 m. Length of pieces ≥ 1 m and 10 cm ∅
Stretch of rapids or swiftly-flowing water		Distance > 10 times the average width.
Stretch with lots of boulders		Boulders >0,5 m ∅, distance more than 10 times the average width.
Credits; 0 - 4		*One X = 1 credit etc.*
N 2. CONSERVATION VALUES – Special biotopes and species		
Natural waterfall		Water falling in 90°, height of falling > 1 m, often forming a natural migration barrier.
Braided channel		The stream splits up in ≥ 3 channels, > 10 m length, with water all year round.
Inlet or outlet of lake		Not regulated. Not deepened. Position of outlet/inlet not changed by digging.
Valuable species		Red-listed species (should normally be know in advance of survey) or occurrence or recruitment of big mussels and salmonids.
Credits; 0 - 4		*One X = 1 credit etc.*
N 3. CONSERVATION VALUES – Riparian zone		
Riparian zone existing for >75%		Riparian zone regarding shading of the stream
Natural composition of tree species		Regarding the actual site, without human disturbance/forestry
Old riparian zone		At the age of normal final felling, producing dead wood etc.
Flooded zone or permanent area of water outflow or spring.		Periodically flooded riparian zone; to be observed on the vegetation, stones, trees and ground (when no snow). One large, or several obvious objects along the stretch.
Credits; 0 - 4		*One X = 1 credit etc.*
TOTAL CONSERVATION VALUES		

P 1. IMPACT – Stream		
Not cleaned, and/or straightened.		Not cleaned: Stream with natural occurrence of boulders, stones and gravel. Not straightened: Natural meandering of stream – not straightened, not lowered
No serious sedimentation of mud		Normal amount of particles of fine material located on bottoms of gravel and sand.
No water regulation and/or extraction of water		No adjustment: No occurrence of one or several dams, often with an arrangement for adjustment of the water level. No removal of water: no hoses, pumps etc. in or along the stream.
No migration barriers		No dams, culverts, or other artificial barriers for fish or benthic fauna.
Credits; 0 - 4		*One X = 1 credit etc.*
P 2. IMPACT – Riparian zone		
Functional riparian zone		Ecologically functional riparian zone. No serious damages on the riparian zone. Negative effect on ≤ 25 % of the distance.

No outflow from ditches		No ditches flowing directly into the stream; without infiltrating through a sediment trap.
No soil damages		No old or new soil damages (caused by heavy vehicles or scarificaion) in or along the stream which might have had a negative effect on the stream (eg. iltation).
No roads		No road crosses the stream, and no road within 10 m along the stream.
Credits; 0 - 4		*One X = 1 credit etc.*
P 3. IMPACT – Water quality		
Clear water		Normal level of turbid and/or coloured water.
No serious acidification		Should normally be known in advance of survey.
No eutrophication		No large amounts of vegetation, for instance green algae and/or reed in the stream.
No point sources		No drainage from farmland, no discharge of wastewater straight out into the stream.
Credits; 0 - 4		*One X = 1 credit etc.*
TOTAL IMPACT		.

K. SENSITIVITY		
Soil types tending to erode		Coarse sand, moraine with fine sand or silt, fine soil types, or peat in the area.
Slope towards the stream		>5 m slope within a distance of 30 m, towards the stream
Wet-moist riparian zones		Heavy vehicles may cause soil damages along the stream and in the stream.
Spring or outflow of water in the area.		Water overflowing the ground and/or shallow ground water in the neighbouring stands
TOTAL SENSITIVITY		*One X = 3 credit, Two X = 6 credits, etc.*

+ ADDED VALUE		
Cultural values and/or ancient remains.		Intact mills, stone foundations, arrangements for driving (floating) of raw timber, stone bridges etc.
Nature protection or Recreational area		Nature reserve etc. Frequently used recreational area, for example foot paths, picnic area, signs, or arrangements for fishing or area often used for fishing.
Actions for restoration		Liming, restoration of migration routes etc.
Interesting species		For example beaver, some particular species of fish, birds and plants.
TOTAL PLUS VALUE		*One X = 3 credit, Two X = 6 credits, etc.*

Point object (connected to water)**:** x: y: Type: Action:

General description and comments

Write a comprehensive description of the stream and note other conditions which might effect N, P, K or +.

Final assessment

	Conservation values			**Impact**			**Sensitivity**	**Plus value**	**NPK+**	**Blue target class (VG, VF, VS, VO)**
	N1	**N2**	**N3**	**P1**	**P2**	**P3**				
RESULT										
TOTAL										
ASSESSMENT*										

***Conservation value**:	Low	0–2	Moderate	3–6	High	7–12
***Impact**:	High	0–2	Moderate	3–6	Low	7–12
***Sensitivity**:	Low	0	Moderate	3–6	High	7–12
***Plus** :	Low	0	Moderate	3–6	High	7–12

Actions according to target class

Propose actions needed to improve N, P, K or +.

UNDERSTANDING THE FOREST-WATER NEXUS

Monitoring Framework Expert Workshop Summary

ABSTRACT

Workshop summary and background information on the "Understanding the Forest-Water Nexus: monitoring framework" expert workshop 27-30 September 2016.

Elaine Springgay
Forestry Officer

Food and Agriculture Organization of the United Nations

Forest and Water Programme, FAO
www.fao.org/2/ForestsAndWater

Workshop Objective

The objective of the workshop is to further develop a monitoring framework for forest-water relationships, more specifically the workshop aims to achieve the following:

1. **Generalized forest-water indicators.** These indicators and sub-indicators/variables should be easily adopted by on-the-ground projects to facilitate the monitoring of the effects of tree/forest management on water. In some cases, sub-indicators may have to take scale into consideration.
2. **Recommended methodology.** Each indicator should have a recommended method for measurement. These methods should have a justification for its use, including appropriate context, limitations, etc. If needed, innovative solutions to addressing monitoring in less than ideal contexts (limited by resources, capacities, etc.) may have to be explored.
3. **Next steps.** Identify next steps in the process, and determine who is responsible and by when.

Forests and Water: from discourse to action

The International Forests and Water Agenda

The 3rd World Water Forum and the adoption of the Shiga Declaration in 2002 marked a significant milestone in coordinated international efforts to acknowledge the extensive role of forests in the hydrological cycle at local and global scales. Current levels of international understanding of forest-water interactions, and of the importance of trees and forests in the regulation and supply of high-quality water, are largely a result of the Forests and Water Agenda – an ongoing international process of discourse and engagement on forests and water led by the Food and Agriculture Organization of the United Nations (FAO), the International Union of Forest Research Organizations (IUFRO), the World Agroforestry Centre (ICRAF), the International Network for Bamboo and Rattan (INBAR), as well as other institutions and forest-water experts.

Over the course of the past twelve years, the Agenda has gained considerable momentum and now includes over 20 partners representing international organizations, academia, civil society, non-governmental organizations and the private sector. These partners are working from a common platform to advocate for a better understanding of forest-water interactions and the incorporation of this knowledge in practice and policy.

An Action Plan for Forests and Water

Forests and Water: a five-year action plan, launched in September 2015 at the XIV World Forestry Congress in Durban, South Africa, emerged from the discussions and recommendations of the Forests and Water Agenda, and represents the transition from discourse to action. The Plan presents the tangible integration of science, policy and practice of forest-water interactions, and seeks to encourage greater commitment to sustainable forest and water management. Scientists, researchers, policy and decision-makers as well as practitioners are all encouraged to contribute to the ongoing process of forging stronger collaboration between these stakeholders and consolidating forest and water-related activities.

This collaboration and related activities are evolving under a common vision: to integrate forest and water management to ensure trees and forests can adapt to global changes and continue to provide a sustainable supply of water and related ecosystem services.

Putting the Plan into action will require the implementation of goals related to science, policy, practice and economics, as well as capacity building and targeted communication and outreach. The Plan aims to:

1) increase international research on forest-water interactions, addressing knowledge gaps;
2) support forest-water policies, governance institutions and mechanisms;
3) integrate scientifically based understanding of forest-water interactions in the management of diverse landscapes; and
4) build the capacity of network members and the international community at large to address gaps in forest-water science, policy and management.

Forests and Water at FAO

Based on the Action Plan, and to reinforce FAO's commitment to the Forests and Water Agenda, the Forest and Water Programme was launched in March 2016 on the International Day of Forests. Recognizing that food security is dependent on water security, which in turn relies on healthy forests and tree ecosystems, the Programme works with governments and other stakeholders to acknowledge the role of trees and forests in maintaining resilient landscapes and water resources by implementing integrated forest-water practices and policies based on a scientific understanding.

Recommended Further Reading

- *Forest and Water – a five-year action plan* (Forests and Water Agenda, 2015). Available at www.fao.org/3/a-be803e.pdf
- *Forests and Water: International Momentum* (FAO, 2013). Available at www.fao.org/3/a-i3129e.pdf
- Forest and Water Programme at FAO. Available at www.fao.org/2/ForestsAndWater

Monitoring Forests and Water: bridging gaps

A Gap Equals an Opportunity

The scientific community has led the way in understanding interactions between forests and water, from individual tree and stand to regional and even global scales. However, research is often biased towards particular geographic and social contexts and is often limited in time scale. As a result, there are still knowledge opportunities to be explored in understanding the effects of land use change and forest management on water yields and quality, as well as the protective function of forests.

An informal, preliminary assessment of forest-related development projects has shown that the monitoring of forest-water interactions, including water availability and quality has not been formally included in practice. Despite an increased recognition of the importance of forests for water resources, there is a lack of monitoring of forest-water relationships, especially after changes in forest or land management. Moreover, insufficient data means there has been limited influence over the adoption of integrated forest-water policy and practice.

It is for this reason that a monitoring framework was included as one of the main objectives of the Forests and Water Action Plan. In the past year, interest in monitoring and better understanding forest-water interactions has been expressed by many stakeholders representing institutions, organizations and countries, including the International Model Forest Network, EU, Kenya, Turkey, Tunisia, South Africa and Chile). Regional and global mechanisms, such as the Great Green Wall, Action Against Desertification and the Forest and Landscape Restoration Mechanism are also interested in utilizing the forest-water monitoring framework once developed.

Ideal Timing

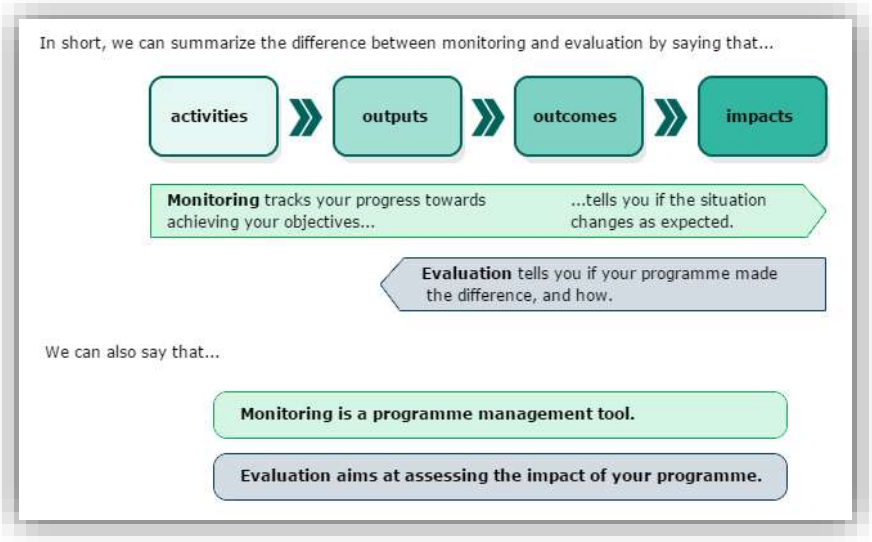
With climate and land use changes impacting environmental processes, it is important to better understand forest ecosystem services under natural conditions and modified or managed landscapes, and how changes in land management impact forest-water relationships. Moreover, water is a fast-emerging cross-cutting issue in climate change discussions; and forests continue to be recognized as a potential solution for climate change. With the next COP in Morocco focusing on forests, water and agriculture, the monitoring framework is timely. The monitoring framework will provide the initial step for project development, improved practices, informed integrated forest-water policies and increased monitoring and reporting (potentially contributing to future Forest Resource Assessments and other publications). Ultimately, the framework and consequent data will assist countries in their activities to meet SDGs 6 and 15.

It is important to note that the monitoring framework is being developed with the understanding that forest-water relationships should not be managed in isolation, but in the broader context of landscape management and in consideration of other socio-economic, political and environmental objectives. However, the framework and tool will provide accessibility to peer-reviewed indicators and methods that will enhance projects, as well as create transparency for a complex topic that can inform policy and practices. If successful, the framework may have the potential to be adapted for other ecosystem services. Ultimately, the monitoring framework will provide the basis for improved forest and/or water management project development and implementation; capacity building workshops; a forest-water module in national forestry assessments; more accurate water accounting; improved analysis for the global forest resources assessment (FRA); cross-sectoral policy and integrated landscape management.

Monitoring Projects: a brief introduction

Monitoring versus Evaluation

Monitoring is a continuous process of collecting data to verify whether the objectives are likely to be attained, and taking corrective actions when needed. It is an effective way to know if interventions are running smoothly and if likely to be successful. Monitoring is also a way to identify any issues that arise, allowing investigation into challenges and further evaluation, so corrective measures can be adopted.



Evaluation is a systematic assessment of a project, programme or policy, its design, implementation and results. It is usually done once or twice during an intervention to ensure the correct directionality and to determine whether or not changes are required. It is also used to assess impact. Evaluation will look at efficiency (cost-effectiveness), external coherence (objectives correspond to other interventions), internal coherence (consistency – different objectives logically contribute to one another), relevance (objectives address the problem) and effectiveness (expected results and objectives have been achieved).

Results-based management

Monitoring and evaluation (M&E) is integral to results-based management (RBM), for which results matrices or logical frameworks (logframes) are developed. These not only provide guidance when assessing the performance and impact of projects, they also assist with project planning. A sample of a logframe is below.

	Details	Indicators	Method (means of verification)	Risks/Assumptions
Impact / Goal				
Outcome				
Output				
Activity				

Components of RBM frameworks include activities (and inputs), outputs, outcomes and impacts; these are further described in the table below.

Step	Description	Example of Monitoring Indicator
Impact Level	The changes that are expected.	National Productivity Rate. (Note: does not measure intervention impact)
Outcome Level	The consequences of the outputs that are expected as a way to obtain the expected impact.	Share of participants who have adopted new practices.
Output Level	The direct results of the activities on its direct targets.	Share of participants who have completed training.
Activity Level	The actions taken that are the actual content of intervention.	Proportion of training sessions completed compared to expected number of training sessions.
Input Level	The resources put into the intervention.	Budget delivery rate.

Recommended Further Reading

- *Developing a Monitoring and Evaluation Plan for Food Security and Agriculture Programmes* (FAO, 2016). Available at www.dropbox.com/sh/m8q2gz4ervhgys9/AAD2OEUChHp6vqwtLxRtqfcma?dl=0
- *How to write a logframe: a beginner's guide* (The Guardian, 2015). Available at www.theguardian.com/global-development-professionals-network/2015/aug/17/how-to-write-a-logframe-a-beginners-guide

Developing Indicators

M&E indicators should help actors to communicate, negotiate and/or make decisions. Most of the time, indicators in an M&E system will focus on numerical (e.g. a share, a number) and categorical (e.g. "traffic lights" or scores) because they are better suited to decision-making. A good indicator must provide simple information that both the supplier and the user can easily communicate and understand.

An indicator is said to be ad hoc or specific when it has been constructed specifically for the M&E of the programme. An indicator is generic when it is recognized as a standard way to measure a given phenomenon.

When developing indicators, the **SMART** criteria are often recommended. A SMART indicator:

- has a **S**pecific purpose: You can make a decision based on it;
- is **M**easurable: It is possible to retrieve the needed data to calculate it;
- is **A**chievable: It has a target value and this target can be attained;
- is **R**elevant: It answers your information needs;
- is **T**ime-phased: The target value evolves depending on the time needed to achieve the expected results.

Example of Forest-Water Indicators

An example of forest-water indicators can be found in the Montreal Process for Criteria and Indicators for the Conservation and Management of Temperate and Boreal Forests:

- Criterion 1: Conservation of biological diversity
- Criterion 2: Maintenance of productive capacity of forest ecosystems
- Criterion 3: Maintenance of forest ecosystem health and vitality
- **Criterion 4: Conservation and maintenance of soil and water resources**
    - Indicator 4.1: Protective function
    - Indicator 4.2: Soil
    - **Indicator 4.3: Water**
        - 4.3.a: Proportion of forest management activities that meet best management practices, or other relevant legislation, to protect water related resources
        - 4.3.b: Area and percent of water bodies, or stream length, in forest areas with significant change in physical, chemical or biological properties from reference conditions
- Criterion 5: Maintenance of forest contribution to global carbon cycles
- Criterion 6: Maintenance and enhancement of long-term multiple socio-economic benefits to meet the needs of societies
- Criterion 7: Legal, institutional and economic framework for forest conservation and sustainable management

Recommended Further Reading

- *Strengthening Criteria and Indicators (C&I) for Sustainable Forest Management (SFM) in Policy and Practice – Workshop Final Report*. Available at www.fao.org/forestry/42459-08248fccad99fbd1f1795db78417a066b.pdf
- *The Montreal Process*. Available at www.montrealprocess.org/Resources/Criteria_and_Indicators/index.shtml
- *CA Forest & Rangeland Indicators*. Available at indicators.ucdavis.edu/forest/indicators
- *A framework for developing urban forest ecosystem services and goods indicators* (Dobbs et al., 2010). Available at http://bit.ly/2d17xe4

Understanding the Forest-Water Nexus: a monitoring framework

Developing a Forest-Water Monitoring Framework

The development of this monitoring framework will involve multiple phases:

- ✓ stocktaking exercise to determine what is being measured, where and how (June-July 2016);
- ✓ analysis of survey feedback (August-September 2016);
- ✓ preliminary peer review of indicators and methods (September 2016);
- **workshop to standardize indicators, protocols and field methods (September 2016);**
- additional consultations to develop framework (2017);
- development of an online tool and guide for users (launch March 2018);
- capacity development program to promote the application of the framework (2017-2018).

Survey & Peer Review

The global survey received over 280 responses from 74 countries. While a number of responses did not adequately address the objective of the survey: to know who is measuring forest-water relationships, where and how, the feedback surpassed expectations. Most importantly, the survey affirmed that the forest-water topic is highly relevant, there is a lot of knowledge globally, but this knowledge is predominantly held within the research community, has a geographic bias and is not sufficiently integrated into practice and policy.

A preliminary peer review of survey responses was conducted with the purpose of proposing potential indicators to initiate discussions during the workshop.

Expert Workshop

As previously mentioned, the objective of the workshop is to further develop a monitoring framework for forest-water relationships, more specifically the workshop aims to achieve the following:

1. Generalized forest-water indicators.
2. Recommended methodology.
3. Next steps in the process.

Online Tool

The development of a forest-water interactions monitoring framework as an online tool will achieve the following:

- Streamline and further expand data collection and shared knowledge on forest-water interactions globally and for different contexts, in particular the role of forests in regulating water resources and soil health;
- Provide country, regional and global data on forest-water interactions;
- Promote the integration of knowledge on forest-water interactions in projects and practice on the ground, as well as in policy;
- Monitor the impacts of projects on forest-water interactions, in particular the water-related services of forests;
- Increase the number of global sites monitoring forest-water interactions.
- Encourage long-term monitoring of forest-water interactions data.

The online, interactive monitoring tool will assist stakeholders in the various stages of the monitoring and evaluation of on-the-ground projects involving forests and tree management, from strategy planning and the selection of indicators to analysis. The tool will allow stakeholders to easily integrate forest-water interactions in the monitoring of their activities. Users will be able to select standardized indicators based on the topic(s) of interest, e.g. forest management influence on water quantity and/or water quality, or impacts of forest fires on forest hydrology, etc. Each indicator will provide recommended method(s), providing details for the method(s) and justification for using the method(s), including the context for optimal use.

Once indicator(s) are selected, a table will be generated that will allow users to enter their data, providing instant analysis. Over time, data collected in the system can be aggregated to provide data at different scales:

project, national, regional/continental and global. Thus, providing a more accurate picture of forest-water relationships to justify enhanced integrated policies and practices.

Workshop Details

Programme

The three-day workshop, which will primarily involve small group discussions, will commence with a series of short presentations to frame the workshop and provide further guidance. In addition, two networking activities have been incorporated into the schedule: a roundtable and reception hosted by the Royal Swedish Academy of Agriculture and Forestry, FAO, SLU and SIWI, as well as a field trip to a forest managed by Sveaskog. For further information, please refer to proposed schedule below.

<table>
<tr><th></th><th>27 Sept</th><th>28 Sept</th><th>29 Sept</th><th>30 Sept</th></tr>
<tr><td>8:30</td><td>Introduction
Welcome
Participant introductions
Background on Forests and Water
Presentations</td><td>Group Discussions – Indicators (continued)</td><td>Group Discussions – Methods

At least two groups:
Water balance (quantity)
Water quality (chemical & aquatic)</td><td rowspan="8">Field Trip (optional)
*Depart at 8:00 from SIWI office</td></tr>
<tr><td>10:00</td><td>Coffee</td><td>Coffee</td><td>Coffee</td></tr>
<tr><td>10:30</td><td>Group Discussions – Indicators
Workshop Guidance
At least two groups:
Water balance (quantity)
Water quality (chemical & aquatic)</td><td>Group Discussions – Indicators (continued)</td><td>Group Discussions – Methods (continued)</td></tr>
<tr><td>12:00</td><td>Lunch</td><td>Lunch</td><td>Lunch</td></tr>
<tr><td>13:00</td><td>Group Discussions – Indicators (continued)</td><td>Plenary – Indicators
Group Presentations
Discussion</td><td>Plenary – Methods
Group Presentations
Discussion</td></tr>
<tr><td>15:00</td><td>Coffee</td><td>Coffee</td><td>Coffee</td></tr>
<tr><td>15:30</td><td>Group Discussions – Indicators (continued)</td><td rowspan="2">Roundtable and Reception at the Royal Swedish Academy of Agriculture and Forestry</td><td>Organization of Indicators within Framework
Next Steps</td></tr>
<tr><td>17:00</td><td>Wrap-up</td><td>Conclusion</td><td>Return to SIWI 17:00-18:00</td></tr>
</table>

Indicators to Facilitate Discussion

In order to facilitate discussions, a number of indicators have been proposed by peers based on the output from the global survey.

Questions to consider during discussions:

- Are the indicators generic enough to be used in different contexts?
- At which scale does the indicator apply?
- Can the indicators be easily measurable?

There are a number of current trends in the international agenda that may require consideration:

- Sustainable Development Goals, mainly 6 and 15
- Forest and landscape restoration
- Climate change

- Food security
- Water scarcity/security
- Resilience

Proposed Indicators to Initiate Brainstorming

Theme	Topic	Indicator	Sub-indicator
Water Balance (Quantity)	Water Balance	Amount of water flowing within and out of tree covered area	Area and % of water bodies, or stream length, in forest areas with significant change in bio-physical or chemical or properties from reference conditions
	Water-use Efficiency	Average water-use efficiency based on ecosystem type, species, management, age	
	Run-off	Extent area and amount of run-off within forested/tree-covered area	
	Erosion	Extent area and amount of erosion within forested/tree-covered area	
	Soil Moisture	Average soil moisture content based on soil type, ecosystem type, management	Change in soil moisture/water storage capacity
	Groundwater	Proportion of water within a forest area contributing to groundwater recharge	Soil water drainage as % of annual rainfall
	Water Stress	Status of vegetation condition due to water stress	Change in NDVI as indicator of evaporation fluxes
Water Quality	Water Quality	Status of water quality flowing within and out of tree covered area	Area and % of water bodies, or stream length, in forest areas with significant change in bio-physical or chemical or properties from reference conditions
	Sediment	Average sediment load of water bodies in forest areas	
	Chemical	Chemical properties of water bodies in forest areas	
	Stabilization	Status of vegetation to stabilize soil and reduce erosion	
Management	Forest Management	Proportion of forest management activities that meet best management practices, or other relevant legislation, to protect water related resources	
	Conservation / Protection	Adoption of water-related ecosystem services in forest conservation objectives	Area and percent of forest whose designation or land management focus is the protection of soil or water resources
	Forest Fires	Status of forests, soil and water post-forest fire event	Change in bio-physical and chemical properties of forest areas post-fire event a. Change in soil vegetation cover b. Change in soil properties c. Change in run-off and erosion
	Restoration	Status of water resources within and from restored forest area	
	CBFM	Water included as a management consideration for CBFM	Number and area of CBFM areas that include water-related ecosystem services in management consideration
Socio-Economic	Ecosystem Services	Status of water-related ecosystem services from forest	1. Change in extent and proportion of water-related ecosystems over time 2. % change in water-related services
	Income	Extent of benefits from incentives for ecosystem services from forests	3. Number of households benefitting from an incentives for ecosystem services initiative 4. % increase in income from water-related PES (Male/Female)
	Policy	Inclusion of “forests and water” in legislation	1. Regulations, institutions or mechanisms developed to include (or exclude) the forest-water issue 2. Adoption of forest-water legislation 3. # of stakeholders engaged in forest-water advocacy

Annex 6: Concept Note

Forests and Water Monitoring Framework Concept Note

Title	***Understanding the Forest-Water Nexus: Monitoring Framework for Forest Landscape and Water-related Ecosystem Services (FL.WES)***
Venue / Time	SIWI, 27-30 September 2016
Collaborators	FAO FOA – Elaine Springgay (Forests and Water) SIWI – Lotta Samuelson FAO AGL
Objective	To develop a monitoring framework and tool to measure, monitor and quantify forest-water interactions. The framework will provide standardized indicators, protocols and field methods that can be adopted by forest, water and other natural resource management projects. An online tool will enable practitioners to customize how they monitor for forest-water interactions, analyse and report on their data. The online tool will eventually provide aggregated and/or synthesised data that can provide local, national, regional and global information, which will be used to inform integrated forest, water and landscape management practices and policies. The development of this monitoring framework will involve multiple phases: 1. stocktaking exercise to determine what is being measured, where and how; 2. analysis of survey feedback; 3. preliminary discussion on indicators and methods based on thematic topics; 4. workshop to standardize indicators, protocols and field methods; 5. development of an online tool and guide for users; 6. capacity development program to promote the application of the framework. The stocktaking exercise will be conducted by survey, first amongst FAO and members of the International Forests and Water Agenda and then disseminated globally using an online survey tool, targeting researchers, practitioners and other experts measuring and/or observing forest-water interactions. A team of experts will assist in the analysis of survey responses and will facilitate preliminary discussions to propose standardized indicators and appropriate methods. The workshop will target key experts, who can further refine the framework, including the standardization of indicators and the adaptation of methods into cost-effective field methods which can be implemented through a user-friendly open source online monitoring tool, and field guide. The monitoring framework and tool will ultimately support the justification of integrated forest-water practices and policies, as well as improve our understanding of forest-water interactions. Thus facilitating natural resources planning, practices and policies to achieve better management of forest ecosystems, soil health and water resources, including water quality, groundwater recharge, and water availability and access.
Tool Description	The online, interactive monitoring tool will assist stakeholders in the various stages of monitoring and evaluation, from strategy planning and the selection of indicators to analysis. The tool will allow stakeholders to easily integrate forest-water interactions in the monitoring of their activities. Users will be able to select standardized (peer-reviewed) indicators based on the topic(s) of interest, e.g. forest management influence on water quantity and/or water quality, or impacts of forest fires on forest hydrology, etc. Each

	indicator will provide recommended method(s), providing details for the method(s) and justification for using the method(s), including the context for optimal use. Once indicator(s) are selected, a table will be generated that will allow users to enter their data, providing instant analysis. Mobile apps and offline options should be developed for later releases/upgrades. Over time, data collected in the system can be aggregated to provide statistics at different scales: project, national, regional and global. Thus, providing a more accurate picture of forest-water relationships to justify enhanced integrated policies and practices. There is potential for such a monitoring tool to be scaled up to other ecosystem services, or topics for forestry and beyond. It can also be incorporated into national forest monitoring assessments, providing information on national forest-water interests and potential collaboration for capacity building. Forest-water topics that will likely be available include: 1. Bio-physical a. Forest hydrology b. Water cycle 2. Management considerations a. Watershed / land-use planning b. Riparian, wetland, coastal management c. Agroforestry d. Storm water e. Forest fires f. Water supply, accounting and budget g. Soil management / restoration 3. Socio-economic a. Incentives for forest ecosystem services b. Livelihood development c. Private-public partnerships d. Integrated forest-water policy
Rationale	***Forests are vital for water and food security*** Forests regulate the quantity and quality of water and influence soil health. It is estimated that approximately 75 percent of our available freshwater for human and environmental needs comes from forested watersheds and wetlands (MEA, 2005). Forests are therefore vital for water and food security, and need to be restored, managed and conserved. As our knowledge on forest-water-land interactions increases, we have become more aware that these interactions are complex and often context specific, dependent on geography, ecosystem (species composition, age dynamics, etc.), time of year, scale, etc. These relationships are made increasingly complex by climate change and drastic changes in land-use and human demands on ecosystem services. ***The time to put discourse into action is now*** Since 2002, there have been over 15 international meetings on forest-water interactions; this ongoing process, called the International Forests and Water Agenda (FAO, 2013), has consistently highlighted the need to improve the monitoring and evaluation of forest-water relationships, and to enhance our knowledge for different biomes, at different spatial and temporal scales, and for varying climate change scenarios. This knowledge also needs to be applied in practice and policy. The scientific community has led the way in understanding interactions between forests and water, from individual tree and stand to regional and even global scales. However,

	research is often biased towards particular geographic and social contexts and is often limited in time scale. As a result, there are still knowledge opportunities to be explored in understanding the effects of land use change and forest management on water yields and quality, as well as the protective function of forests. An informal, preliminary assessment of forest-related projects has shown that the monitoring of forest-water interactions, including water availability, quality and soil health, has not been formally included in practice. Although there is increased recognition of the importance of forests for water resources, the lack of monitoring of forest-water interactions and available data means there has been limited influence over policy and practice. ***Stakeholders are ready*** It is for this reason that a monitoring framework was included as one of the main objectives of the Forests and Water Action Plan, a five-year work plan to improve the integration of forest-water science, policy and practice, which was developed and launched at the World Forestry Congress (September 2015), with endorsement from several international organizations, as well as South Africa (Department of Water and Sanitation). In the past year, interest in forest-water interactions has been expressed by many stakeholders representing institutions, organizations and countries (EU, Kenya, Turkey, Tunisia, South Africa and Chile). Regional and global mechanism, such as the Great Green Wall, Action Against Desertification and Forest Landscape Restoration are also interested in utilizing the forest-water monitoring framework, once developed. With climate and land use changes impacting environmental processes, it is important to better understand ecosystem services under natural conditions and modified or managed landscapes, in order to better understand the impacts of land management, particularly on water and food security. Moreover, water is a fast-emerging cross-cutting issue in climate change discussions; and forests continue to be recognized as a potential solution for climate change. With the next COP in Morocco focusing on forests, water and agriculture, the monitoring framework is timely. The monitoring framework provides the initial step for project development, improved practices, informed integrated forest-water policies and increased monitoring and reporting (potentially contributing to future Forest Resource Assessments and other publications). Ultimately, the framework and consequent data will assist countries in their activities to meet SDGs 6 and 15, specifically targets 6.4, 6.6, 15.1, 15.2 and 15.3. It is important to note that the monitoring framework is being developed with the understanding that forest-water relationships should not be managed in isolation, but in the broader context of landscape management and in consideration of other socio-economic, political and environmental objectives. However, the framework and tool will provide accessibility to peer-reviewed indicators and methods that will enhance projects, as well as create transparency for a complex topic that can inform policy and practices. If successful, the framework may have the potential to be adapted for other ecosystem services. Ultimately, the monitoring framework will provide the basis for improved forest and water management project development and implementation; capacity building workshops; a forest-water module in national forestry assessments; improved analysis for the global forest resources assessment (FRA); cross-sectoral policy and integrated landscape management. **Expected Output:** The development of a forest-water interactions monitoring framework as an online tool will achieve the following:

	• Streamline and further expand data collection and shared knowledge on forest-water interactions globally and for different contexts, in particular the role of forests in regulating water resources and soil health; • Provide country, regional and global data on forest-water interactions; • Promote the integration of knowledge on forest-water interactions in projects and practice on the ground, as well as in policy; • Monitor the impacts of projects on forest-water interactions, in particular the water-related services of forests; • Increase the number of global sites monitoring forest-water interactions. • Encourage long-term monitoring of forest-water interactions data.	
Proposed Workshop Programme		
Day 1 Morning	**Introduction –**	Presentations
		Workshop Logistics: *Participants will be grouped according to expertise*
Day 1 Afternoon	**Group Work – Indicators**	Group Work: Harmonizing indicators *Groups will be determined based on survey feedback and availability of experts.*
Day 2 Morning	**Group Work – Indicators (continued)**	Group Work: Harmonizing indicators
Day 2 Afternoon	**Group Presentations**	*Each group will report on their break-out discussions.*
Day 3 Morning	**Field Methods**	Group Work: Proposing and developing appropriate field methods for monitoring *Groups will be determined based on survey feedback and availability of experts.*
Day 3 Afternoon	**Review of Workshop Outcomes / Follow-up Roles and Responsibilities**	Development and presentation indicators and field methods