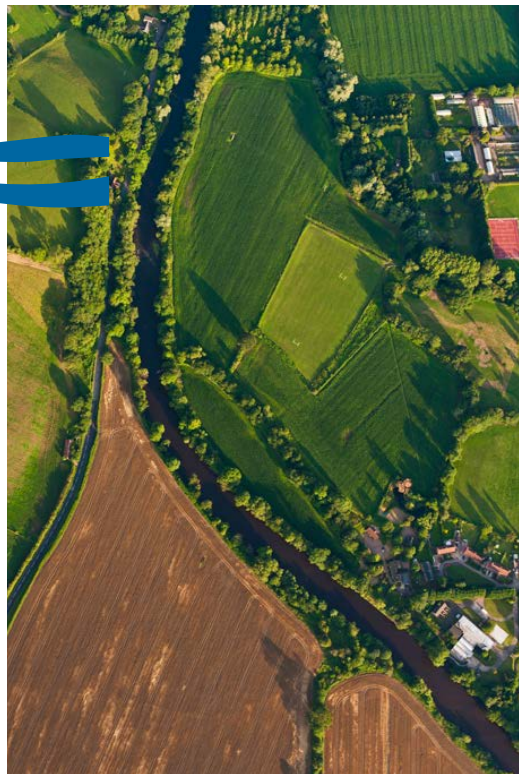

POLICY BRIEF

How landscapes and water mitigate climate change

Trees, forests and agriculture are key to reducing carbon emissions and assisting countries in adapting to the adverse effects of climate change. In addition, sustainable forest and land management provide essential ecosystem services that regulate both surface and groundwater flows. To achieve the Paris Agreement and meet major water challenges, water wise management and productive multifunctional landscapes are crucial.

Recommendations

SIWI welcomes the initiative launched at COP23 by the Subsidiary Body for Implementation (SBI) and the Subsidiary Body for Scientific and Technological Advice (SBSTA), to recall Articles 9 and 10 of the Convention and, in accordance with decision 4/CP.23, initiate the Koronivia joint work on agriculture (KJWA). The KJWA takes into consideration the vulnerabilities of agriculture to climate change and the impacts on food security in the context of improved soil carbon, soil health and soil fertility under grassland and cropland as well as integrated systems, including water management.

Improved integration of land and water considerations and understanding of hydrological processes in landscapes can contribute to both climate change mitigation, through reduction of emissions from land use and land use change, and to adaptation by supporting essential ecosystem services that regulate both surface and groundwater flows. However, landscape management is complex, as it encompasses multiple objectives, stakeholders and governance levels. It is context-specific and it is therefore impossible, even undesirable, to present a unique blueprint for water management in the landscape. We recommend combining the different aspects of management of water in the landscape in a flexible, adaptive and integrated manner.

- Sustainable management of water in the landscape can contribute to both climate change mitigation and adaptation, as it can enhance carbon stocks and sinks as well as support adaptation of forest management and agriculture to more extreme climate conditions.
- The forest-water nexus needs to be considered and integrated into both policy and practice and effectively monitored. Simply recognizing the forest-water nexus is not enough and there is a need to improve the ability to design, implement, and learn from landscape approaches that rely on the relationships between forests and water.
- More research and monitoring of forest-water interactions in multi-functional landscapes are required and should be integrated into forest restoration and landscape initiatives.
- Strengthened multi-level governance arrangements that allow for genuine stakeholder participation is a perquisite for sustainable landscape management.
- Scaling up of best management practices and innovative tools can provide practical on-the-ground solutions to sustainable management and monitoring of the forest-waternexus.

Climate change is water change

The impacts of climate change are most dramatically felt through changes in water – changes that will severely affect humans, economy and the environment. The world's growing population and improved living standards increase the competition for water, as the demand for water for domestic, industrial, agricultural and energy production is growing. Climate change intensifies these water challenges through changed precipitation

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patterns and changes to evapotranspiration (ET) and ultimately the water balance, resulting in too much or too little water. Although the important role of water is not recognized in the Paris Agreement itself, it is included as a central component in many of the Nationally Determined Contributions (NDCs).

UNFCCC acknowledges that change of land use can contribute significantly to mitigation of climate change by reducing carbon emissions, but also by maintaining and improving carbon stocks (also known as carbon sinks). Article 5 in the Paris Agreement addresses the importance of conserving and enhancing sinks and reservoirs of greenhouse gases, including forests. Forests and wetlands also play a central role in the hydrologic cycle, filtering, storing and regulating surface and groundwater flows. Productive, multifunctional landscapes– where a mix of trees, forests and agricultural land uses contribute to mitigation and adaptation – are consequently a prerequisite to achieve the ambitions set out in the Paris Agreement.

Water flows in the landscape

Water flows and storage form a complex system, intrinsically linked with the larger landscape. If the landscape is altered through development and alternative land uses, water flows and their benefits are also impacted. When land is degraded, so too are its water resources, which can negatively impact people, economies, and ecosystem services downstream. Hence, water management is often key to restoring degraded lands and increasing landscape resilience, for the benefit of people and ecosystems.

There are many factors driving land use change across different spatial and temporal scales, including climate change, population growth, soil loss, shifting dietary preferences, and the conversion of forests and wetlands to croplands, pasture or plantations. Without proactive, integrated management of landscapes and their associated hydrologic systems, we risk further degrading these systems and reducing the effectiveness of restoration activities.

Water-related considerations therefore needs to be better integrated into landscape management and there is a need to regulate and manage our use of water much more than we do today. Water is fundamental to food production systems and the achievement of Sustainable Development Goal (SDG) 2 on food security for all. In terms of water use for diets, there is a challenge in total demand for water due to population growth as well as an increase in water for more water-intensive crops and livestock produce. Management strategies are knowledge and capacity intensive, as well as context-specific, but good experiences exist and can be shared and scaled up. Agricultural landscapes can be regenerated by combining soil and water management across rainfed crops and pastures as well as irrigation development. There are also many opportunities for Forest Landscape Restoration (FLR) linked to international commitments, such as the Bonn Challenge and the New York Declaration on Forests as well as the Land Degradation Neutrality (LDN) target, linked to achievement of SDG 15 on life on land.

The forest-water nexus

Trees and forests have important functions in the landscape as they regulate water flows, clean water, store carbon, enhance biodiversity and reduce erosion and runoff. Yet, this impact on the hydrological cycle at different scales is still poorly understood. Though the negative effects of deforestation and forest degradation on biodiversity and climate change is recognized in the global sustainability discourse, the negative impact on water resources is neither as well understood nor given sufficient consideration, despite the fact that trees and forests are central to managing water resources effectively.

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. Research can help to prioritize how forests should be managed within our landscapes in symbiotic relationships with water-related ecosystem services. It could also identify trade-offs where forests may have negative effects on the water balance and water availability. 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 others, due to the recycling of evapotranspirated water. Effects and impacts must therefore be better understood across a range of scales, and the geographical perspective should be broadened from watersheds to whole continents and cross-regional perspectives.

Agroforestry for groundwater recharge in Burkina Faso

Policy makers are often discouraged from promoting trees in water-limited areas due to the prevailing scientific view that trees reduce water availability. However, the relationships between forests and water are complex and context-specific.

A recent study from the Swedish University of Agricultural Sciences is the first to look at the effect of open forests or scattered trees on ground water recharge in tropical areas.

The study of agroforestry parklands in Burkina Faso shows that when trees improve soil properties, they can be beneficial for groundwater recharge. Over a wide range of intermediate densities, the beneficial effects of trees on soil water infiltration and deep percolation was large enough to override their additional water consumption. The study also pointed to ways that tree management can further improve ground water recharge, including pruning, species selection and spatial configuration.

A collaborative effort between FAO, IUCN, IUFRO and SIWI is advocating for greater recognition of the importance of sustainable management of the water-forest nexus and for its integration into policy, practice and research to achieve the SDGs related to food- and water security, biodiversity and climate change. Within this collaboration, forest and water professionals are invited to exchange knowledge and experiences in order to establish consensus on issues and messages related to the forest-water nexus to inform international processes such as the SDGs, the Paris Agreement and the Sendai Disaster Risk Reduction Framework.

Climate change and water availability in the landscape

One of the major challenges to sustaining multifunctional and productive landscapes is rapid climate change and the pressures it exerts on ecosystems, including water resources. In most parts of the world, seasonal temperatures are increasing, with more heatwaves affecting crop water demand. In parts of Africa, a growing number of examples point to both increasing and decreasing rainfall in many places, and changes in seasonal length. There is a scientific consensus that expected (and confirmed) temperature increases and changes in temperature patterns may already be occurring in some landscapes. Especially in the tropics and semi-arid areas, this may result in lower yields due to heat stress and could require more water for irrigation. The impact of climate change on hydrology at the landscape level is still uncertain and highly unpredictable. In most cases, however, this may already be the new reality; more extreme events, and greater occurrence of drier and wetter conditions. This can impact on multiple landscape features such as erosion, vegetation establishment and water availability (notably scarcity) for many people, with decreased food security as a result.

This calls for climate change adaptation measures that are easy to implement and cost effective It is also necessary to monitor, report and model changes to water resources availability in the landscape. In many countries, there is a lack of hydrological data and information about how water flows in the landscape, and how land uses and/or climate change affect it. However, new and innovative technologies and approaches for monitoring, reporting and modelling are emerging that could strengthen the evidence base for design of nature-based solutions and other measures that would safeguard the hydrological functioning of landscapes and their resilience to climate change.

Good governance for water and landscapes

Good governance is participatory, consensus oriented, and accountable, striving for efficiency while abiding by the rule of law. With its focus on adaptive management and participation, emphasizing rights and responsibilities of different stakeholders, the principles for the landscape approach are well in line with key elements of good governance. Experiences on how to combine different governance approaches, and public as well as private sector instruments, show that landscape approaches need to work with nested governance arrangements, from multilateral environmental agreements to local level customary or statutory law. Gender and power relations should always be taken into account.

Wetlands are threatened in many parts of the world from changes to flow regimes that are linked to poor governance. The Ramsar Convention is important for the governance of wetlands, but its implementation needs to be strengthened through, for example, linking it to emission reduction targets under UNFCCC as well as source-to-sea governance frameworks. Private sector companies are also important actors and can play a positive role through different tools and instruments, including water stewardship to reduce water-related impacts of internal operations and value chains.

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About this publication

This policy brief is mainly based on the SIWI report "Water for productive and multifunctional landscapes" (Report no. 38, 2018), which is the outcome of the Swedish based cluster group Water in the Landscape, gathering Swedish expertise and stakeholders to exchange and develop knowledge in the field of water and landscape management and restoration.

It is also based on the report "Championing the Forest-Water Nexus" (2018), which is a collaboration between FAO, IUCN and SIWI pushing for the inter-linkages between forests and water to be considered in forest management, polices and research for the benefit of food- and water security, biodiversity and climate.

The presented case is based on the study "Intermediate tree cover can maximize groundwater recharge in the seasonally dry tropics" 2016 (Scientific Reports 621930) by Ilstedt U, Bargués Tobella A, Bazié HR, Bayala J, Verbeeten E, Nyberg G, Sanou J, Benegas L, Murdiyarso D, Laudon H, Sheil D, Malmer A.

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