



# Water for productive and multifunctional landscapes

How do hydrological flows affect the productivity of landscapes and what hydrological aspects need to be considered when restoring landscapes for sustainable production? Through numerous examples, the SIWI Swedish Water House Cluster Group on Water in the Landscape analysed the governance arrangements and management approaches, practices and technologies that would enable long-term sustainable landscapes.

The world's population is growing rapidly, and living standards are improving. These positive developments have a drawback: they also increase competition for water. The demand for water for increased manufacturing, food and energy production is growing. Climate change intensifies these water challenges through changed precipitation patterns, resulting in too much or too little water, or water of poor quality. Productive, multifunctional landscapes – where a mix of trees, forests and agricultural land uses support the livelihoods of people, produce economic goods and wellbeing, strengthen biodiversity and sustain the water cycle – are a prerequisite for sustainable development. Restoring degraded landscapes is therefore becoming increasingly important.

Against this background, Stockholm International Water Institute (SIWI) and the Swedish Water House (SWH) took the initiative to bring together Swedish expertise and stakeholders in Swedish and global/international landscape management and restoration with the objective to identify key knowledge and experiences on sustainable water resources management in landscapes, which could be shared with a larger audience both nationally and internationally. This brief provides a summary of the main findings of the multistakeholder consultation process held during 2017 and 2018. It highlights the urgent need for landscape restoration from the local to global scale and the importance of careful consideration of water resources, water recharge and water management when managing natural resources available in the landscape. It draws on Swedish and international landscape management and governance experiences.

Our ambition is to:

1. inspire Swedish stakeholders to engage increasingly in international water and landscape dialogues and processes; and
2. initiate bilateral and multilateral activities to build resilient landscapes, with resulting benefits for water resources and productive landscapes.

## Landscape restoration and water flows

Water flows and storages are intrinsically connected to both challenges and benefits in landscapes for people, economies and environment, as they form a complex system. By changing landscapes through development and altered land use, the water flows and their benefits are altered too. These interactions are particularly challenging when landscapes and their water resources are in a degraded state. Hence, addressing water management is often a key entry point to restore degraded lands and to enhance landscape resilience for the benefit of local people. Moreover, degraded landscapes result in costs, and negative impacts for people, economies and for ecosystem services. There are both global and local challenges, including current state of environment, use of water and land resources, population increase and changes in diet, as well as in climate that put specific landscapes at risk for becoming more degraded, or remaining in degraded states, unless proactive management is done.



Photo: istock

Water-related considerations should be better integrated into landscape management and vice versa, and there is a need to regulate and manage our use of water much more than we are doing today, especially when it comes to degraded landscapes. Water is fundamental to food production systems and the achievement of the UN Sustainable Development Goal (SDG) 2 on food security for all. In terms of water use for diets, there is a challenge related to total demand due to population growth as well as an increase in more water intensive crops and livestock produce. Management strategies are knowledge and capacity intensive, and context specific, but good experiences from Sweden and elsewhere 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 SDG15 on life on land.

## Forests, agriculture and water

Conversion of forests into agricultural land leads to changes in water flows and increase in land degradation; reforestation or integration of trees in agricultural land can be beneficial to regain ecological functionality. 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, their impacts on the hydrological cycle at different scales is still poorly understood. Stocktaking of recent research findings from international and Sweden-based institutions highlight the following challenges and opportunities:

- There is a need to widen the geographical perspective from watersheds to whole continents and cross-regional perspectives to understand where precipitation originates from to better integrate forest-driven water and energy cycles into regional, national, continental and global decision-making, as trees and forests could be used to improve sustainability, and support climate change adaptation and mitigation efforts and achievement of SDG13 on climate action.

- For water flows, it is sometimes better to focus on density and types of trees than forests as such, taking into consideration different species, age of trees, spacing/density, etc. The specific tree density that maximizes groundwater recharge will depend on several factors, but it is now clear that increasing tree cover does not always lead to reduced groundwater recharge.
- Local-level forest management initiatives often face a mix of problems and issues ranging from governance challenges at national level to technical issues and problems at local level. A key- success factor is to work with participatory processes and partnerships. A forum which offers neutral arenas for dialogue between different interests seems to be an important tool to be able to move forward and see results. Challenges include financial sustainability and to build a resilient social network, which includes the gender aspect.

Agricultural lands can be restored to improve livelihoods, ensure food production and better water flows also using other management techniques. 'Greppa Näringen', a Swedish success story of farm management in the landscape has focused on reducing eutrophication through improved advice to farmers on nutrient management contributing to reducing nutrient flows into the Baltic Sea and achievement of SDG 6 on clean water and sanitation. Preventive measures to reduce soil erosion has involved identification of 'erosion wounds' in the landscape where tailored protection zones have been established to reduce gully erosion. Other preventive measures include avoiding soil compaction. In addition, Västra Götaland, one of Sweden's most important agricultural regions is testing nature-based solutions (NBS) to reduce flood risk in the landscape, which also includes promoting practices, such as no-till agriculture, use of cover crops, etc. that can also improve agricultural productivity and sustainability.

## Impacts of climate change on landscapes

One of the major challenges to sustaining multifunctional and productive landscapes is rapid climate change and the pressures it exerts on ecosystems and water resources. This calls for measures to adapt to climate change that are easy to implement and cost effective. To adapt to climate change, it is also necessary

**Figure 1: How to manage water for productive and multifunctional landscapes**



to monitor, report and model changes of availability to water resources in the landscape. In many countries, there is limited availability 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 provide a strengthened evidence base for design of NBS and other measures that would safeguard the hydrological functioning of landscapes and their resilience to climate change. NBS measures are tested at different scales in Västra Götaland, Sweden, from soil management at field level, establishment of river bank buffer strips, planting of trees to enhance infiltration and slowing of water flows, improvement of drainage involving ditches, to creation of dams and wetlands at the landscape scale. Based on these experiences we conclude that NBS for managing climate risks are promising and could be cost effective solutions, but that there is a need to consider the economic feasibility of implementing NBS when there are potential conflicts of interests with agriculture.

In terms of new and innovative technologies, rainfall monitoring can be improved using microwaves from telephone masts, a leapfrog technology that can help inform management of landscapes in a changing climate. Potential users are meteorological agencies, municipalities, insurance companies, energy providers, media and especially developing countries. In addition, geographical water balance models can be very powerful tools to assist in the planning of water adaptation measures and modelling can provide integrated analysis of the efficiency of measures at catchment and landscape scale. New monitoring technologies and computer models could be coupled with bottom-up and participatory approaches to monitoring and modelling, such as citizen science. This could lead to inclusion of more perspectives and scenarios and more informed and comprehensive solutions.

### Good water governance in landscapes

Good governance is characterised as participatory, consensus oriented, accountable, transparent, responsive, effective and efficient, equitable and inclusive, and rule of law following. The principles for the landscape approach are well aligned with these

characteristics with its focus on adaptive management, participation, and rights and responsibilities of different stakeholders. Experiences from Sweden and the global South on how to combine different governance approaches, and public as well as private sector instruments show that landscape approaches need to work with multi-level governance arrangements, from multilateral environmental agreements to local level customary or statutory law and take gender and power relations into consideration. Public participation in landscape governance has evolved over time and more inclusive and participative approaches have been adopted by Swedish institutions and in the EU Water Framework Directive, as well as in many developing countries.

Wetlands are threatened in many parts of the world from changes to flow regimes caused by e.g. drainage and increase in sediment loads where the ultimate drivers 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 reductions under the United Nations Framework Convention on Climate Change (UNFCCC) as well as source-to-sea governance frameworks. Private sector companies are also important actors in landscape approaches 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. The “Greppa Näringen” programme in Sweden is a good example of a Public Private Partnership (PPP), which uses a stakeholder participatory approach to reduce nutrient loads to water bodies in agricultural landscapes.

### Participating institutions in seminars and workshops organized by the Cluster Group:

- Alliance for Global Water Adaptation (AGWA)
- County Board of Västra Götaland
- DHI Group
- Ecoloop
- Federation of Swedish Farmers (LRF)
- Food and Agricultural Organization of the United Nations (FAO)
- Forest, climate and livelihood research network (Focali)
- GeWa Consulting
- Hermanssons & Co
- ICA
- ICRAF – World Agroforestry Centre
- Lund University Centre for Sustainability Studies (LUCSUS)
- NIRAS
- SSC Forestry
- Stockholm Resilience Centre (SRC)
- Stockholm International Water Institute (SIWI)
- Sveaskog AB
- Swedish Environment Protection Agency (SEPA)
- Swedish Environmental Research Institute (IVL)
- Swedish Forestry Agency (SFA)
- Swedish International Agricultural Network Initiative (SIANI)
- Swedish International Development Agency (Sida)
- Swedish Meteorological and Hydrological Institute (SMHI)
- Swedish University of Agricultural Sciences (SLU)
- World Wide Fund for Nature (WWF)

## Recommendations

Landscape management is complex. It needs to deal with multiple objectives, and multiple stakeholders and governance levels. It is context-specific, and it is therefore impossible – even undesirable – to present a blueprint for water management in the landscape. However, good experiences from Sweden and elsewhere exist and can be shared. We recommend combining the different aspects of landscape management discussed above in a flexible and adaptive manner. The following recommendations are especially important to consider for sustainable management and, when necessary, restoration of productive landscapes:

- Improve integration of land and water considerations and understanding of hydrological processes in landscapes, as addressing water management is often a key entry point to restore degraded lands and to enhance landscape resilience for the benefit of local people.
- Continuously support the development of new integrated knowledge for evidence-based management and strengthening of capacity for innovative and integrated solutions for landscape restoration. This should include knowledge on both ecological and social aspects of restoration.

- Strengthen multi-level governance arrangements that allow for genuine stakeholder participation in landscape management and decision-making.
- Identify and apply best management practices and innovative tools that provide practical on-the-ground solutions to sustainable management and monitoring of water in the landscape.
- Ensure adequate and long-term financing from both the public and private sectors to sustain ecosystem services important for the long-term productivity and sustainability of landscapes for the benefit of livelihoods, the environment and the climate.

Operationalizing existing national and intergovernmental governance frameworks and policies, in Sweden and internationally, would provide a good starting point for sustainable management of water in the landscape. Coupled with the recommendations in this report, it could contribute to productive and multifunctional landscapes that contribute to achieving the Sustainable Development Goals (SDGs), notably SDG 2 on Zero Hunger, SDG 6 on Clean Water and Sanitation, SDG 13 on Climate Action, and SDG 15 on Life on Land (see figure 1).

## About the SIWI Swedish Water House Water in the Landscape Cluster Group

A number of thematic cluster group meetings (learning and discussion opportunities) were organised on various aspects of hydrology important for the productivity of the landscape and opportunities for landscape restoration. Representatives from forest, agriculture, environment, water and industry sectors participated, as did civil society, scientific institutions and competent authorities, mainly from Sweden but also from the international organisations (see box p. 3). Inputs and recommendations from the seminars form the basis of this report.

However, the report is the responsibility of the core group alone. This group have planned the meetings, invited speakers and hold the authorship of this report. The full report and information about the expertise that has been involved in the cluster group is available at: <http://www.swedishwaterhouse.se/en/cluster-groups/waterinlandscapes/>.

### Members of the Cluster Group

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