

Releasing the Pressure

Water Resource Efficiencies and
Gains for Ecosystem Services



Policy Brief



Key Findings:

- **Water productivity analyses need to consider the multiple benefits generated by ecosystem services for human well-being and for nature.**
- **Water productivity gains have often been achieved out of balance with landscape ecosystem services.**
- **Balancing the goals of agricultural ecosystems with landscape ecosystem services can produce synergies and improve overall water productivity.**
- **Water management that mimics natural water storage can improve agro-ecosystem water use while maintaining hydrological links with the surrounding landscape, which preserves water needed for additional ecosystem services.**
- **Integrated water resource management approaches need further development to ensure they can maximise water productivity across multiple uses, including landscape ecosystem services.**

Water resources increasingly face competing demands because they must support a wide range of human activities whilst also sustaining healthy ecosystem services in landscapes. This competition, often in the context of scarce or limited resources, can affect human well-being, and thus there is a growing need to make the most efficient possible use of water in society and in nature. In this context, the concept of ‘water productivity’ has been developed as a way to assess water resource use efficiency, often from the perspective of a single sector. However, given the mul-



iple uses of water by humans and ecosystems, it is not evident that one measure of efficiency can capture the multi-faceted and multi-sectorial benefits that water provides. ‘Productive’ use of water in one realm may have negative effects on other realms due to the dynamics of water supply and demand. Societal disparities may also result in unequal benefits from water for men versus women, or for the wealthy versus the poor.

The focus of this policy brief – and of the underlying report – is a specific shortcoming of commonly used definitions of ‘water productivity’: their narrow scope, which ignores many important benefits from water use. Taking such an approach can result in water productivity gains in a single sector – usually agriculture – that are out of balance with landscape ecosystem services.

Still, increasing water productivity has been at the center of water management efforts over the last decades, in particular in agricultural sectors. Much focus has been on more ‘crop per drop’ or irrigation and more ‘crop per \$’ – with little regard for the water needed to sustain non-agricultural ecosystem services in landscapes. This has been detrimental to the production of ecosystem services in all types of landscapes.

Key terms

Water productivity: The amount of benefits (material and nonmaterial) generated by a given volume of water. Several variations of the concept exist, notably crop water productivity, livestock water productivity, and monetary efficiency (benefits relative to the opportunity cost of water).

Benefits: Material and nonmaterial produce that contributes to human well-being and livelihoods; this includes the results of human activities – such as crops, livestock or industrial products – as well as ecosystem services.

Human well-being: The freedom of choice and action to achieve basic material for a good life, health, good social relations, and security. Well-being is at the opposite end of a continuum from poverty, a pronounced deprivation of well-being. (UNEP Ecosystem Management Programme, 2008).

Ecosystem services: The material and nonmaterial produce that people obtain from ecosystems and that contribute to human well-being and livelihoods – from forest products, to wild fish, to nutrient cycles.

Landscape ecosystem services: Services provided by ecosystems at the landscape scale (1- 100,000 km²) that are not actively managed by humans, but are influenced by human activities.



Recognising the value of ecosystem services for human well-being

It has become clear that agricultural production is not the only important use of water, and that many other ecosystem services that underlie complimentary livelihood strategies make use of the same water resources needed for agriculture. Examples of important ecosystems that provide useful products for livelihoods are wetlands (e.g. reeds, fish, rice) and forests (e.g. timber, charcoal, wild game, fibre). In addition, water cycles

underlie several supporting and regulating functions within ecosystems, including nutrient transport, vapour flow and sediment flows. Improving water management to reflect multiple needs and multiple uses of water is crucial to sustaining multiple benefits to human well-being, societies and economies.

Water resource management activities that balance agricultural and other landscape ecosystem services will identify which services are vitally important and can produce positive synergies with one another.

The benefits of such synergies are particularly important for rural communities, especially those relying on local ecosystem services for income and well-being. For example, a community may rely on a mix of small-scale agriculture and livestock, fishing and gathering of forest products, and thus will benefit from water resource management that maximises benefits to all types of ecosystem services, and not just to agriculture. Thus identifying the role of water for ecosystem services synergies can increase productivity on multiple fronts, and do so with long-term sustainability.

Two case studies: India and Zambia

Case studies illustrate the synergies and tradeoffs of real-life water resource management choices. For example, in India, activities in the Kothapally watershed restoration

project nearly doubled groundwater recharge, more than tripled multi-cropped systems, and reduced soil loss more than 75 per cent. However, streamflow out of the watershed was reduced by more than half, so increased benefits to some local ecosystem services came at the expense of others downstream users of water (see Figure 1).

Ecosystem services from wetlands in the Barotse flood plain, Zambia on the other hand, yielded strikingly large benefits to human well-being from the natural habitats. Estimating local livelihood dependencies on ecosystem services showed that crop production only contributed 15% of subsistence income, whereas fish catch and extensive grazing contributed more than 70% of subsistence income. Thus incorporating these benefits in assessing water use and water productivity would result in a value of protecting the wetland functions for the Barotse floodplain (see Figure 2).

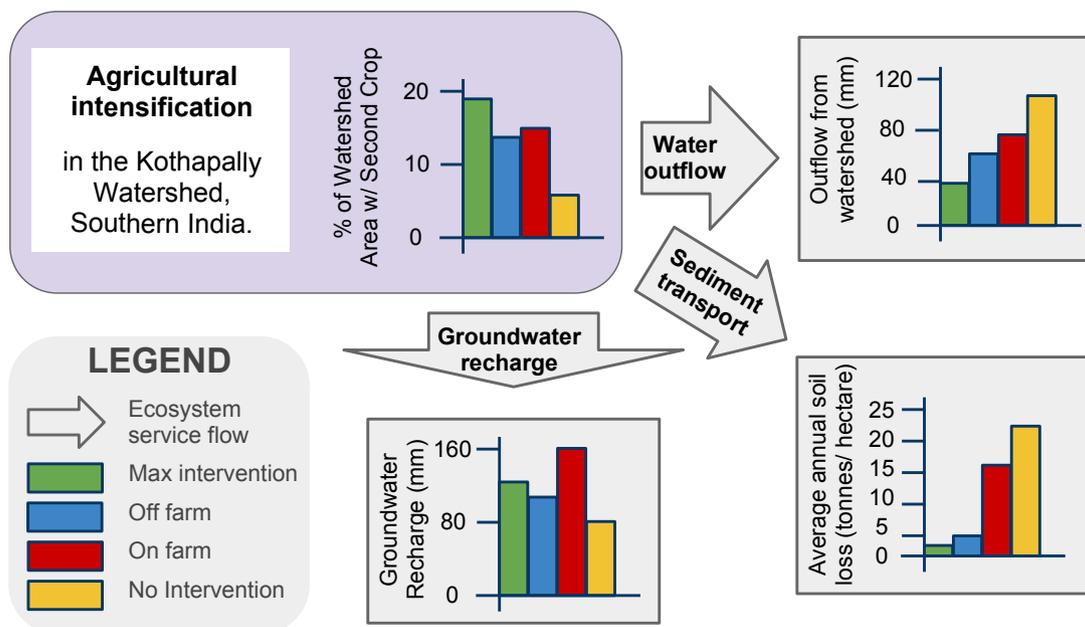


Figure 1: Improvements and deterioration of ecosystem services associated with agricultural water management in Kothapally watershed management, during a 'normal' rainy season (dry and wet seasons were excluded for the sake of simplicity)

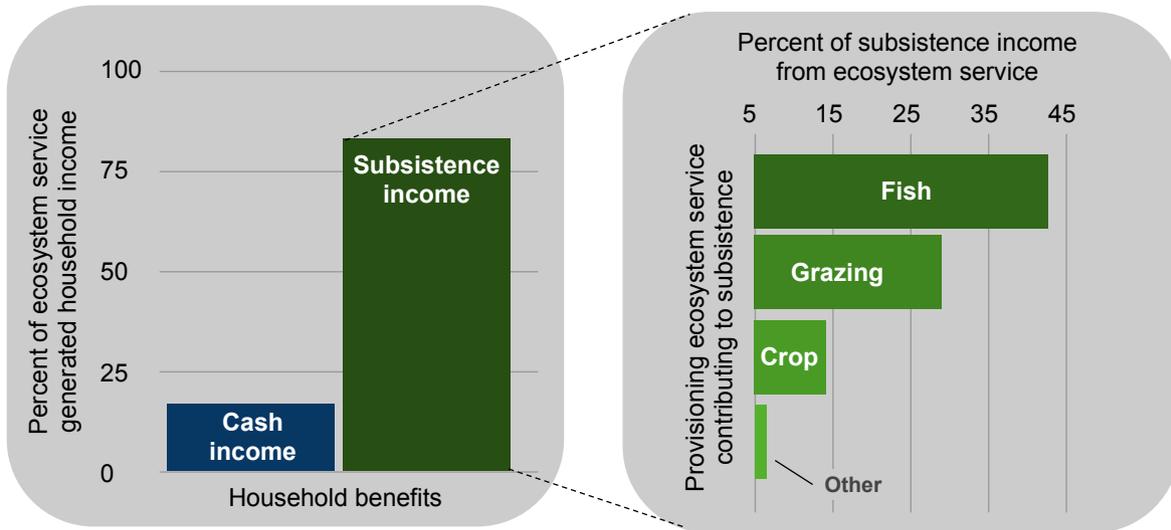


Figure 2: Annual value of ecosystem service-generated income in the Barotse floodplain, Zambia, per household



Taking cues from nature

Water management strategies and structures can mimic natural storage that occurs in the landscape, both on the surface and as underground storage (recharging groundwater). This can be accomplished in many ways, such as actively recharging water into the groundwater table, building small-scale dams in rivers that allow the groundwater table to be artificially raised for dry-season storage, or creating irrigation canals made of local materials that mimic natural infiltration processes.

The value of mimicking natural water storage (rather than hard or 'concrete' storage) is that water is not solely appropriated by agricultural uses, but will continue to sustain ecosystem services in landscapes, particularly downstream and groundwater ecosystems. Surprising consequences can occur if water storage and water use are disconnected from the landscape, including problems related to habitat change (e.g. flooding suppresses pest reproduction, as shown in Figure 3), falling groundwater tables (e.g. appropriation of water flows preventing recharge), and potentially regional conflict (e.g. reduced downstream flow and pitting downstream users against upstream users).



'Bottom-up' support for top-down management

A useful way to ensure that water resource managers understand the full range of ecosystem services in specific landscapes – and which are most crucial to human well-being – is to take a 'bottom-up' approach and solicit input from water users in multiple sectors and on multiple levels.

The ability for local and meso-scale groups to participate effectively in water resource management discussions and perform complex analytical tasks within their own communities is important for self-direction. It also makes it possible for them to coordinate their efforts with larger governance bodies that might manage the same water, land, and ecosystems on a different scale (see Figure 3).

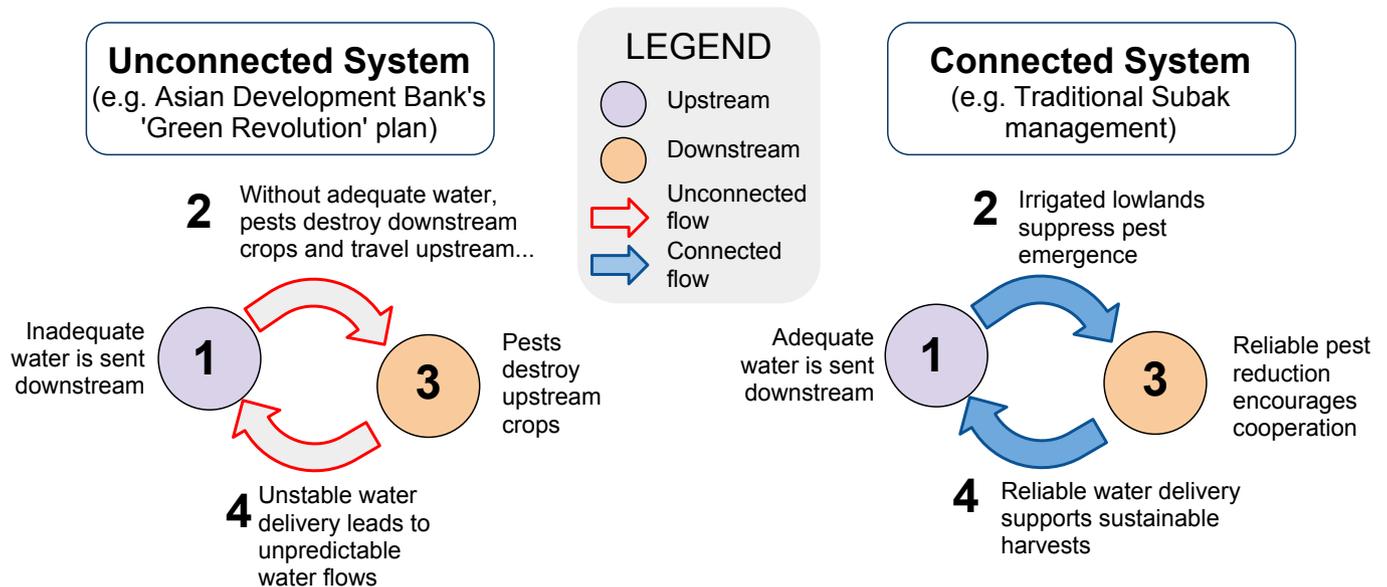


Figure 3: Top-down versus bottom-up management of agriculture and landscape ecosystem services

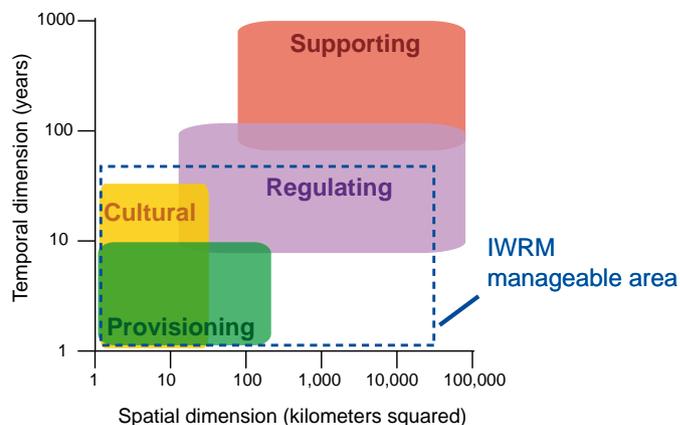


Figure 4: Ecosystem service categories described in terms of the spatial and temporal dimensions at which they occur. The integrated water resource management dimensions are also depicted

Note the log scale used on both axes

Improving integrated water resource management approaches

Integrated water resource management (known as IWRM) is a widely practiced approach to manage water resources from the local to the basin scale, because it effectively brings together water users from various locations and sectors. Therefore, it could be a useful entry point for ecosystem services management:

- By recognising the water requirements of both aquatic and terrestrial ecosystem services;
- By connecting with the entire basin, which allows for local win-win synergies of increased agro-ecosystem output and landscape output to be amplified with regional coordination and planning;
- By improving overall water productivity for ecosystems services, thus increasing the resilience of local and regional livelihoods.

It is important to recognize that IWRM is unlikely to manage some supporting ecosystem services, especially global scale phenomenon because they are outside of the spatial and temporal range of governance (see Figure 4). For example, IWRM would not be able to manage the carbon cycle, since this is a global scale phenomenon. Conversely, ecosystem services related to the quantity, timing, and quality of water flowing in river networks may be directly managed using the IWRM approach.

This policy brief is based on the forthcoming UNEP-SEI publication *“Releasing the pressure: water resource efficiencies and gains for eco-system services”*, by Patrick Keys, Mats Lannerstad, and Jennie Barron, (2012). United Nations Environment Programme (UNEP), Nairobi.

RECOMMENDATIONS

For Research

- Monitoring and evaluation of local water resources and water dependent ecosystem services is key to quantifying water productivity gains and for identifying unexpected impacts due to agricultural intensification (e.g. Figure 1).
- Identifying the value of water-related ecosystem benefits, in terms of both market value and non-market value (e.g. benefits for subsistence), can positively inform discussions of compensation for lost ecosystem services and reasons for preservation of ecosystem services (e.g. Figure 2).

For Management

- Integrated water resource management approaches should be extended to incorporate multiple aquatic and terrestrial ecosystem services, to reflect the unique spatial and temporal scales at which ecosystem services and water resource management overlap (see Figure 4).
- Integrated water resource management approaches should include both upstream and downstream stakeholders in decision-making. Ignoring either can result in negative impacts from development and undermine efforts to increase water productivity.
- It is crucial to build local communities' capacity to participate in water and ecosystem services management decisions. External support in knowledge and awareness may be needed to bridge how local management decisions can impact beyond management location, or affect future resource users of water and ecosystem services.

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