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A watershed moment for healthy watersheds

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The healthy watersheds concept links ecosystem condition with human benefits and helps decision-makers evaluate trade-offs. Implementation requires letting go of technocratic approaches, accounting for ecosystem services, embracing watersheds' complexity and supporting participatory processes and subsidiarity.

Water has rightly found its place on the global agenda, signalling its foundational importance to food security, economic development, health and well-being. However, the dominant discourse around water is overly simplified and siloed. Framing water issues around water scarcity, for example, can be attention-grabbing, but this leaves out related crises — such as the alarming decline in freshwater biodiversity — and inadvertently marginalizes important issues and stakeholders, particularly in places that may not yet be facing a crisis[1,2]. As a result, proposed solutions are often reductionist, technocratic and ill-suited to the complex realities most watersheds face[3,4]. As an alternative, the healthy watersheds concept is being invoked, acknowledging the need for more complex and holistic approaches to address the suite of challenges facing so many freshwater systems[5,6]. We define a healthy watershed, explain why the concept is both important and timely, and suggest priorities for policymakers and practitioners.

A healthy watershed is one where freshwater ecosystems, their biodiversity and their surrounding watersheds provide an equitable distribution of benefits now and in the future, through collaborative management and governance. Ecosystems are central to healthy watersheds and constitute the first pillar. In addition to providing a habitat for high concentrations of biodiversity, a watershed's ecosystems exercise critical control over the pools and fluxes of water, both above and below the surface. They intercept and transpire moisture, partition the moisture into runoff and infiltration, slow flows, stabilize soils and filter pollutants. These ecosystems are more than just the watershed's relatively pristine or natural areas — agricultural lands, reservoirs and even cities are modified ecosystems, and the balance of natural versus modified ecosystem functions impacts watershed health. As ecosystems become degraded and lose function, this negatively impacts freshwater biodiversity and can impair ecosystem service delivery as well.

Ecosystem services are the second pillar of a healthy watershed and provide a critical complement to the ecosystems pillar, underscoring that services rely on healthy, functional ecosystems. These services include clean and reliable water supplies, as well as protection from floods and disease, food provision via inland fisheries and less tangible benefits such as cultural and spiritual experiences. Explicit recognition of these services and possible trade-offs (for example, a dam that stabilizes water supply but disrupts fish migration) helps people link changes in ecological health to changes in benefits[6]. Science can guide certain thresholds, for example, water quality standards to maintain aquatic life, but other cases are normative decisions requiring deliberation.

Fig. 1 | An example of the characteristic complexity of a watershed (Rhone River near Culoz, France). Water and land use must be managed across industrial, agricultural and domestic demands, and waterways are managed to provide flood protection, navigation and recreation, all while supporting rich biodiversity. Credit: Gregory_DUBUS/E+/Getty.

The third pillar of a healthy watershed — governance — recognizes that many environmental crises are caused by ineffective governance. Key principles of effective governance include cross-sectoral coordination (for example, environment, health, energy and agriculture), managed at the appropriate scale to reflect local conditions, and promotion of robust stakeholder engagement, with particular attention to under-represented groups in the communities impacted by resource-related decisions. Good governance has no blueprint, as context influences interpretation and implementation[7].

The healthy watersheds concept builds on the global experience of water resource management and the recognition that water presents a wicked problem, where simple technical fixes and command-and-control procedures often fail[8]. While the notion of integrated water resources management (IWRM) is not new, it has generally been implemented in a top-down, normative fashion, with ecosystems treated as an afterthought. A healthy watershed perspective requires that decision-makers understand ecological and hydrological limits, so that the multitude of impacts are balanced to maximize service production according to stakeholder preferences. Nexus assessments are similarly designed to analyse interlinkages and trade-offs, but they are difficult to fit to local scales where critical land and water use decisions are made[9]. Watershed health emphasizes that water

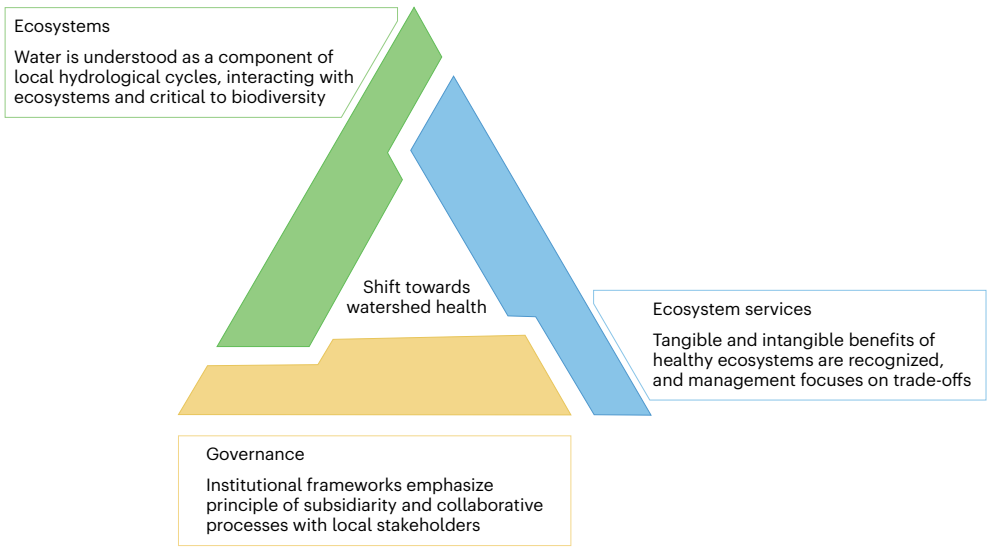

Fig. 2 | A framework for watershed health, illustrating its three pillars and principles. Healthy watersheds require functional ecosystems, a balancing of benefits and trade-offs (for example, between humans and nature), and attention to governance.

issues are often local and connected to place–human communities, the lands and waters surrounding them, and their unique dynamics and interactions (Fig. 1).

A healthy watershed perspective helps in identifying opportunities for regenerative agriculture practices and nature-based solutions — restoring or mimicking ecosystem functions to enhance water availability, improve water quality, restore biodiversity, and reduce risks associated with floods, droughts and climate change. Water crises may lead to behavioural and policy change, but emergency frames have limitations[1]. A healthy watershed is an inspirational vision for creating value (better health = more benefits), as opposed to relying on the specter of a 'day zero' water emergency to spur action. Using health as a metaphor, we can learn from the experience of public health campaigns, where fear is commonly employed but tends to be ineffective at changing behaviours compared with campaigns designed to promote healthy behaviour[10]. It is important for the public to understand and identify with watershed goals if behavioural change and support for enabling policies are to be achieved.

We offer four principles that can inform a wider, faster and enduring adoption of the healthy watersheds approach. First, it is important to make the benefits of healthy watersheds and their management trade-offs explicit. This requires accounting for ecosystem services, but also educating the public. Second, watershed complexity needs to be better reflected in management, policy and planning. At a minimum, this requires acknowledging watersheds as social–ecological systems and avoiding 'silver bullet' solutions that are based on oversimplified interpretations of water challenges. Third, more attention is needed on watershed governance, following the principle of subsidiarity where decisions and responsibilities rest with the lowest practical level of governance and management. Of course, the appropriate level of governance depends on the issue, but, in general, more local actors need to be involved and their governing capacity strengthened. Finally, more support is needed to foster participatory and collaborative processes that bring multiple stakeholder groups together, focused on attaining agreed targets and objectives. It is critical that stakeholders work towards practical outcomes, rather than being a superficial exercise without a clear purpose. Water resource management needs to be more inclusive and less top-down, technocratic and supply-driven. A healthy watersheds approach can operationalize this and implement it on the ground (Fig. 2).

Human benefits must be made explicit if the concept of watershed health is to gain traction beyond ecologists and environmental managers. Engaging stakeholders like farmers, landowners and community groups requires effort, but it underpins collective action, is an important element of strategic adaptive management and helps identify effective solutions. Climate change has made watershed-centric approaches even more urgent, because navigating this complexity and uncertainty requires bottom-up approaches and stakeholder-driven processes to explore location-specific scenarios and options to build watershed-scale resilience[11].

Governments need to hasten the shift away from state or federal command-and-control approaches and top-down engineering towards truly collaborative partnerships suited to tackle the complexity of watershed issues. These partnerships can take various forms: inter-agency task forces focusing on policy and major technical challenges; cross-sectoral partnerships that convene governments, companies, non-governmental organizations and community members to mobilize implementation; and grassroots partnerships focusing on local issues and influencing behaviour or changes in values[12]. More resources are needed to support stakeholders in determining their goals for watershed health, implementing measures in support of those goals, and then monitoring outcomes and enforcing policies.

Lack of finance is a chronic problem in the management of water resources, which can be solved by diversifying the range of public and private funders and implementing legal, regulatory and economic policy instruments that allow for more flexibility to invest[13]. Government policies and regulations must not only permit but facilitate the cross-sectoral and cross-jurisdictional actions necessary to maintain healthy watersheds, such as fiscal transfers from a city to upstream farmers. This is consistent with the Organisation for Economic

Co-operation and Development's landscape approach to water finance, the pooling of resources to channel investments with multiple objectives, to find synergies and to continually adapt as local conditions change[14]. Monitoring requires increased investment in many parts of the world where basic data on water quantity, quality and biodiversity are lacking. Data collection and monitoring must support management objectives and we encourage the use of promising methods such as remote sensing, environmental DNA and citizen science.

The most challenging element in adopting watershed health is the reluctance to engage in the inevitable politics associated with multiple values, conflicting resource uses and unevenly distributed costs and benefits[15]. This is a primary reason why top-down, command-and-control approaches to the management of water resources were adopted in the first place. Not all management should devolve to local watershed committees, and there remains a need for higher-level (national) governance and participation from global actors. Healthy watersheds are 'nested' into larger river or lake catchments, but are also influenced by supraregional trends and actors. It is important for local watershed stakeholders to recognize how they impact downstream stakeholders, but also when and where there are levers operating at a scale beyond their watershed.

National governments, catchment or basin organizations, and even third-party international organizations need to facilitate information exchange and mediate transboundary conflicts. However, actors at these greater scales should focus less on imposing alternative framings of water crises and more on empowering local solutions that improve watershed health. Concepts like virtual water trade and water footprints leave out too much context to be useful, and global institutional arrangements to govern water have the same limitations. Reconciling multiple levels of governance, negotiating conflicting uses, and recognizing pluralistic values of water, land and biotic resources all have transaction costs, not just for meetings, but also in reaching and enforcing new agreements. However, this presents opportunities for social learning among stakeholders[16], knowledge co-production and comparative analysis to discern factors contributing to the success or failure of watershed health initiatives.

We should not let the challenges and upfront costs of a collaborative approach to watershed health obscure the potential benefits. Localities must continue to experiment with approaches that suit their context, but with more external support (for example, from national governments or philanthropic sources) in designing, implementing and evaluating their efforts. Watershed planning and decision support tools can help to standardize some parts of the process, saving time and money while still ensuring a comprehensive, collaborative approach[17]. Researchers play a valuable role in documenting case studies of watershed health initiatives, particularly to provide practical assistance to other initiatives as they get started. Disciplinary and sectoral knowledge will be as important as ever, but only when freed from typical silos and applied in support of healthy watersheds.

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