POLICY BRIEF

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Learning from research on water governance: Priorities for One CGIAR

Facilitators showing cards for alternative crop choices as part of experiential groundwater games, India *(photo: Foundation for Ecological Security)*

Water is an essential resource for all life, but is extremely difficult to manage productively, sustainably and equitably. Good water governance has been a major theme of multiple international conferences for at least two decades (Woodhouse and Muller 2017). Without good governance, we cannot achieve poverty reduction, food security, environmental sustainability, equity and other global development goals or respond effectively to the ravages of climate change.

Achieving many of the Sustainable Development Goals (SDGs) depends on the availability of water to users. However, while there are some local success stories, progress on improving water management has been poor. By many measures, we are moving in the wrong direction: access to water, water scarcity, water pollution and food insecurity are getting worse in many parts of the world. Further, the rapid loss of biodiversity and ecosystem services threatens humanity's future (Bradshaw et al. 2021). There is strong evidence and broad agreement that this is fundamentally a governance failure (e.g., Pahl-Wostl 2017). If we do not succeed in governing water more effectively, we cannot achieve the SDGs. Getting the governance of natural resources right is also a pre-requisite for achieving CGIAR's ambitious 2030 goals (CGIAR n.d.).

In this brief, we have adopted a broad definition of 'water governance' as *the set of formal and informal institutions which define the roles of stakeholders in making decisions affecting water and related resources (who can make what decisions), and how decisions are made and enforced.* Water governance does not include routine implementation functions, such as construction, maintenance, scheduling, financing and staffing: these are essentially management functions whose implementation is incentivized, or disincentivized, by governance arrangements. Because water is inextricably integrated with land and ecosystems, water governance cannot be separated from governance of these resources. Many observers suggest that the hallmark of 'good water governance' includes such characteristics as openness and transparency, broad

KEY MESSAGES

- Dramatically improving the governance of water resources is a pre-requisite for achieving the SDGs and the goals of One CGIAR. CGIAR should therefore place governance at the center of its new program.
- Research on the governance of water resources should be integrated with biophysical, digital and genomic research as they are mutually supportive.
- CGIAR has focused its governance research on generating benefits from water resources and landscapes for poor communities. This contributes to understanding the critical importance of local perceptions and power inequities. Achieving gender equality has been central to CGIAR's water governance research.
- CGIAR's theories of change on how its research leads to development outcomes could be strengthened by incorporating insights from research on water and other natural resource governance that reflect local perceptions and power inequities. CGIAR research should also consider power dynamics and politics.
- CGIAR should invest in improving, adapting and scaling up learning tools, such as experiential games, on water resources. These can help to identify ways to increase the participation of marginalized people; build trust by understanding others' perspectives and the value of collaboration; support conflict resolution; and foster social learning through self-assessment and reflection. Understanding and shaping peoples' mental models is critical for successful experimentation with rules and governance arrangements, and for achieving shared understandings and action in governance.
- For areas without formal governance arrangements, such as the transboundary Salween River Basin, CGIAR researchers have proposed hybrid networks of state and non-state actors to connect parallel and fragmented decision-making landscapes.
- Combining formal and informal governance mechanisms, and training women as well as men to manage water resources reduced conflict and increased scheme coordination in a Central Asian irrigation system.
- CGIAR should invest in identifying more effective ways to improve the governance of multiple but integrated systems, such as water–food–energy–ecosystems.

participation, rule of law (predictability) and ethics.[1]

Over the past decade, the CGIAR Research Program on Water, Land and Ecosystems (WLE) has carried out research on how water is currently governed and how its governance can be improved. We have reviewed this research to identify the most pressing governance challenges and how to improve governance effectiveness. These issues must be addressed in order to transform water governance into a positive force for the future.

WLE's research has focused on governance of watersheds, wetlands, surface irrigation schemes at all scales, aquifers and transboundary river basins. The research ranges across continents and scales, from small communities to major international river basins. It includes empirical as well as conceptual contributions. Although led by social scientists, most of the work is interdisciplinary. Different types of water-based resources present their own governance challenges, but the research has produced insights common to all types of water resources.

LESSONS FROM RESEARCH ON GOVERNANCE OF WATER-BASED RESOURCES

Watersheds are catchment areas for rainfall that often support local multi-use landscapes and also replenish water bodies in downstream areas. Degraded watersheds cause serious damage to both upstream and downstream water users and their livelihoods. Transforming degraded watersheds requires approaches that integrate biophysical, social and political dimensions. The International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) has demonstrated the potential for achieving positive outcomes in a dry watershed in northern India (Bundelkhand). Government departments and research institutions engaged with community organizations to improve and diversify crop productivity and livelihoods (WLE 2019). However, here and elsewhere, strict patriarchal norms restrict communication and the visibility and involvement of women, and limitations in governance directly affect the equity of benefits from watershed improvement (Padmaja et al. 2020). Experiences at this site and in Nepal demonstrate that the imprecise use of terms like 'gender' and 'equality,' and rigid attempts to make existing local governance arrangements fit into institutional straightjackets, result in ineffective governance and continued exclusion of women and other marginalized people. The norms, values and perspectives of officials working in government organizations determine how gender equality is understood and pursued. Their lack of understanding of local values and goals, which are often not aligned with their own assumptions, limits the effectiveness of well-intentioned policies and implementation programs. Unequal power relations between the state and local communities, and within communities, affect how priorities are set, whose knowledge counts, and how rights to resources and benefits are perceived and distributed (Padmaja et al. 2020; Elias et al. 2021).

The solution is to collaborate with local communities to identify and address real-world problems as they perceive them, rather than prescribing a normative approach to water governance. Doing this right is critical: too often, policies call for a

[1] This definition builds on but broadens that proposed by Lautze et al. (2011).

Water governance is the set of formal and informal institutions which define the roles of stakeholders in making decisions affecting water and related resources (who can make what decisions), and how decisions are made and enforced.

bottom-up approach, but implementation is top-down. Success requires integrating the knowledge, perceptions and values of many stakeholders, especially from underrepresented groups (Suhardiman et al. 2015). The greatest challenge is achieving water justice, i.e., fair and equitable distribution of water and its benefits and costs, inclusive participation in decision-making and recognition of marginalized social groups. These are all fundamental governance issues. Achieving this in highly stratified communities or those with relatively rigid gender roles is a major challenge, but not impossible. This highlights the importance of political economy rather than purely technical approaches to reform (Mapedza et al. 2016).

Wetlands are among the world's most valuable ecosystems, supporting rich biodiversity and providing diverse ecosystem services, including food and livelihoods for millions of people. Under WLE, the International Water Management Institute (IWMI) has been collaborating with the Ramsar Convention to support inclusion of sustainable productive use of wetlands by local communities. Researchers have engaged Ramsar Convention stakeholders on the implications of local findings for wetland governance. A project at the Gulf of Mottama Ramsar Site, Myanmar, aims to establish community-based wetland governance arrangements. The research is showing how gender and other social identities and histories have shaped local social structures and power relations and are influencing collective action and wetland development. A major finding is that power imbalances shape values, meanings, experiences and voices in wetland use and governance, especially for the most marginalized wetland users. The exclusion of women from existing governance structures limits access to their unique knowledge of wetland resources.

Findings can be used in Ramsar Convention deliberations, in particular the recognition of local social and cultural complexity of wetland livelihoods, to promote more inclusive wetland governance (Joshi et al. 2021). This observation is consistent with that for watersheds: well-meaning nongovernmental organizations (NGOs) and government officials often seek to impose their perceptions of what is required, limiting the effectiveness of their interventions, and even generating unintended outcomes.

Finding solutions to enhance the performance of **irrigation schemes** is a major theme of WLE research. WLE has examined large-scale irrigation schemes jointly managed by government institutions and farmers in Myanmar and Tajikistan. In Tajikistan, researchers demonstrated that longer training periods improved the functioning of water users' associations (WUAs), and that who is trained matters: the inclusion of female managers led to even better performance, as men tended to migrate after being trained and failed to transfer their skills to women. A combination of formal and informal governance mechanisms also reduced conflict and increased scheme coordination (IWMI 2018; Balasubramanya 2019).

On a large government-managed pump irrigation scheme in the dry zone of Myanmar, researchers followed a participatory process for establishing WUAs and transferring responsibilities to them. Creating spaces and processes to empower and support stakeholders to collectively examine the root causes of conflicts and identify ways to operate proved very effective. Encouraging and facilitating local problem-solving processes, often referred to as 'institutional bricolage,' is an underappreciated and underutilized strategy for adapting centrally defined governance arrangements to locally-operated water governance systems such as WUAs (Suhardiman and de Silva n.d.; de Silva et al. 2019). WUA sustainability depends not only on water delivery, but also on how collective action is harnessed to achieve efficiencies along crop value chains. Similarly, work in Myanmar and Cambodia on integrated irrigated rice–fish systems demonstrated that investing in strengthening local social processes is critical to achieving socially inclusive food and livelihood systems (Duncan et al. 2021).

A difficult and complex water governance challenge is the sustainable management of **groundwater** and the aquifers in which groundwater is stored (Villholth et al. 2018). Groundwater is invisible: we cannot see it and it has no clear boundaries, making it difficult to regulate who has access or how much is pumped out. Aquifers are the main source of water for many cities and towns, and for nearly half of all irrigated crops globally. They are critical resources during droughts and support livelihoods, health and prosperity. However, they are being rapidly degraded and depleted by pollution and destruction of their catchment areas, driven by climate change, population growth, increasing food demand and land use changes, and pumping more water than is recharged. WLE has worked on the Ramotswa transboundary aquifer in southern Africa, shared by Botswana and South Africa (Villholth 2021), and aquifers in the Middle East and North Africa, Ethiopia, Laos, India, Vietnam and even Texas, USA.

Following an integrated systemic approach to governance is especially critical as groundwater is intrinsically linked to land, other water resources, and to important environmental and ecosystem functions, as well as to the energy–climate–food systems nexus. A major barrier to sustainable and equitable groundwater use arises from existing governance structures which maintain the status quo of power relations and benefit flows. Prioritizing preservation of the status quo leads to articulation of generalized solutions (e.g., 'accountability') rather than exploration of deeply rooted sociopolitical issues that may be generating groundwater overdraft or pollution (Molle and Closas 2017, 2021; Molle et al. 2018).

The push to expand solar energy for irrigation and other uses is exacerbating weaknesses in groundwater governance, posing a potential major threat to the

TRANSFORMING SMALLHOLDER IRRIGATION SCHEMES IN AFRICA: A SUCCESS STORY

A project in southern Africa implemented by ICRISAT and partners introduced soil monitoring tools to support farmers to learn about soil moisture and nutrient dynamics. Agricultural innovation platforms (AIPs) were established in each of five irrigation schemes. The AIPs enabled farmers and other stakeholders to identify the major barriers to production and learn from experiences. The synergies between these interventions increased both crop yields and profitability. This empowered farmers, improved equity and accelerated social learning and innovation. The resulting iterative cycles of change improved governance, sustainability and socioeconomic outcomes. The researchers do not use the term, but this is an excellent example of institutional bricolage and emphasizes the importance of integrating technical and social innovations.

Source: Pittock et al. (2020).

environment, food security, livelihoods and equality. Degradation of groundwater resources and disruption of linked socioecological systems have thus emerged as a major threat to future food and water security.

There is a serious mismatch between the urgency of the problems and current interventions to address them. Effective water governance cannot be prescribed and implemented in a linear process. Rather, entirely new governance arrangements need to be encouraged. These should build on local arrangements, shifting from government attempts to regulate groundwater use to anchoring transformations in locally-driven collective action in cooperation with state institutions. Technological innovations can help this process (Closas and Villholth 2019; Zwarteveen et al. 2021).

Research in the Arab world confirms that groundwater governance by state institutions alone is rarely successful. This includes attempts to regulate, license or meter flows from wells. Pure community-centered aquifer governance is rare. More common are various forms of co-management by state institutions and local entities, as reviewed in detail by Molle and Closas (2017) and Molle et al. (2018). There is great variation in joint governance of aquifers, but many of these also fail to achieve long-term sustainable use. For example, the Ogallala aquifer in Texas, USA, is a de facto case of 'managed depletion' of the groundwater, a result of complex and irreconcilable values and goals (Closas and Molle 2018).

Research from Ethiopia and the Ramotswa aquifer demonstrates the continued exclusion of women from participating in groundwater management and policy, and governance of transboundary aquifers. This can deepen inequities (Nigussie et al. 2018; Hawkins et al. 2019). Women could be more effectively engaged in citizen science for sustainable groundwater management, if considered from the outset (Goldin et al. 2021).

If governance of groundwater is problematic, effective governance of **transboundary water resources** – both surface water and aquifers – is even more so. All the challenges of managing within-country water resources are complemented by governing relationships among neighboring countries. In addition to comparative work on river basin management, WLE researchers have worked in several transboundary water resource systems, including the Mekong and Salween river basins and the Limpopo Basin, which includes the Ramotswa aquifer.

A major observation from work in the two Southeast Asian river basins is the serious disconnect or 'institutional dissonance' among local, regional, national and international decision-making bodies. This applies to many other basins. It is reflected in the common assumption by national representatives and donors that the state is the sole or primary actor, obscuring more local sources of conflict and tension, and missing opportunities for progress at local levels (Suhardiman et al. 2012; Suhardiman and Giordano 2012; IWMI 2015).

Unlike the Mekong, the Salween River Basin, shared by China, Myanmar and, peripherally, Thailand, has no intergovernmental agreement. Power relations at all levels are highly asymmetrical, and some parts of the basin experience continuing violence. Nevertheless, dams are being constructed, leading to major transformations in river flows, ecosystems and livelihoods. WLE researchers argue that hybrid networks of state and non-state actors could be strategically engaged to connect fragmented decision-making landscapes. They emphasize the importance of acknowledging the legitimate roles of community-based organizations and civil society in achieving ecological and social justice (Suhardiman and Middleton 2020; Suhardiman et al. 2017).

Governance of transboundary waters occurs at multiple scales. The challenge is to facilitate development of cooperative governance structures that bring practical benefits to people. Locally-focused cooperation tailored to solve specific issues can achieve this, complementing a basin-scale focus (IWMI 2015).

GUIDANCE FOR IMPROVING WATER GOVERNANCE

WLE has produced new tools, handbooks and guides to promote more participatory, effective and equitable governance of water resources. These include handbooks for stakeholder-driven creation of WUAs (e.g., de Silva et al. 2019; Merrey and Lefore 2018), and a guide for supporting community-led multiple-use water systems in South Africa (van Koppen et al. 2020). All three emphasize the need to encourage local creative institution-building processes. The Gender in Irrigation Learning and Improvement Tool supports women's involvement in the

Collective monitoring of groundwater tables, Andhra Pradesh, India (photo: Jake Burke)

governance of larger irrigation schemes or, at least, reduces approaches that discriminate against women (Lefore et al. 2017). Other guidance supports gender equity in smaller-scale systems (Theis et al. 2018). These tools and handbooks complement others developed under WLE, such as those for establishing WUAs in Ethiopia (Lempériere et al. 2014) and a practitioners' guide to community-based management of freshwater resources produced with The Nature Conservancy (Zhang et al. 2020).

WLE has collaborated with the CGIAR Research Program on Policies, Institutions, and Markets (PIM) to develop tools for strengthening social inclusion in **multi-stakeholder platforms** (MSPs) and processes. Well-designed MSPs provide structured contexts in which participants can safely discuss inequalities and asymmetrical power. This can build mutual understanding and, in the longer run, encourage changes in behavior. Ideally, MSPs involve a range of resource users (men and women) including government officials, NGO staff and—especially important for driving farmer-led irrigation—the private sector (Minh et al. 2020). These tools can help marginalized peoples' voices to be heard; build trust by understanding others' perspectives and the value of collaboration; support conflict resolution; and foster social learning through self-assessment and reflection.[2]

The use of **experiential games** is a key tool developed and used by CGIAR researchers to improve governance of natural resources. Games offer a structured and replicable approach to facilitate dialogue, influence behavior, improve stakeholders' understanding, influence norms and increase the legitimacy of difficult decisions. The International Food Policy Research Institute (IFPRI) and ICRISAT, with the Foundation for Ecological Security (FES) and other partners, have led the use of experiential games. In Andhra Pradesh, India, these were used to increase awareness among local communities of the relationships between irrigation and the depletion of groundwater, and to promote more effective collective governance (Meinzen-Dick et al. 2016, 2018). Understanding and shaping peoples' mental models is critical for successful experimentation with rules and governance arrangements, and for achieving shared understandings and action in governance.

Games have also been used to support improved governance of other natural resources, such as small reservoirs, rainwater harvesting, forests (Falk et al. 2021) and wetlands, and in land use planning (Suhardiman and Signs 2018; Sindorf et al. 2020; CoRe and FES Forthcoming; Bartels et al. 2020; Evans et al. 2021). However, games alone are not a panacea; they need to be accompanied by technical innovations and external support.

COMMON THEMES EMERGING FROM WLE RESEARCH ON WATER GOVERNANCE

WLE researchers have used a variety of conceptual and theoretical perspectives, including critical institutionalism, feminist political ecology, social ecology and political economy. These all view the complex network of institutions as mediating relationships among people, natural resources and society through a social justice lens. They elucidate how formal and informal institutions are entwined in social life and how asymmetrical power affects outcomes. They emphasize how governance arrangements evolve over time through a creative negotiation process of institutional bricolage, "an active, conscious creative process of adapting norms, values and social arrangements to fit new purposes, while also reflecting and being shaped by deeply embedded unconscious principles" (Merrey and Cook 2012). These processes can result in fit-for-purpose governance arrangements, but can also exacerbate existing inequities, for example, by excluding women from decision-making. Experiential games and MSPs can be used to support and guide these creative processes.

A common theme is how to achieve greater equity, social justice, empowerment and inclusion, particularly by giving an effective voice on governing collective resources to women and others who

[2] This paragraph is based on two PowerPoint presentations by Anne Larson in 2021. These presentations also contain links to a variety of MSP tools developed and tested by PIM, in some cases in collaboration with WLE.

are socially, economically and politically marginalized. This is a major challenge, as water governance is highly contested. A strong emphasis on gender permeates the research, as does the need to understand existing local social systems.

A closely related theme focuses on the relationships between local communities and both government and nongovernment organizations. In river basins, there is a disconnect between higher level official governance arrangements and local arrangements. In irrigation schemes, watersheds and wetlands, the rhetoric of 'participation' and 'bottom-up development' obscures the reality of top-down efforts to impose particular governance structures and particular models of 'gender equity.'

An equally important theme is the failure to effectively integrate biophysical or technical innovations with institutions and governance. Often, technical innovations are introduced without regard to the governance issues they raise. For example, offering low-cost solar pumps to large numbers of farmers sharing an aquifer with limited recharge capacity is a recipe for disaster in several ways: wealthier farmers gain access to pumps disproportionately, making existing inequities worse; and the absence of arrangements for sustainably exploiting the aquifer can lead to its rapid depletion.

NEXT STEPS: PRIORITY WATER RESEARCH CHALLENGES

CGIAR has adopted an ambitious "One CGIAR" program for the period to 2030 with goals that directly support the SDGs (CGIAR n.d.). Thirty-three major research and regional initiatives are being developed into full proposals (CGIAR System Council 2021). Most of these target technological innovations to support food and nutrition security and more effective adaptation to climate change. Targeting investments to support the most disadvantaged and excluded people effectively combined with supporting the creation of equitable and sustainable governance arrangements will be critical to achieving CGIAR's goals. Water is an unconfined, flowing, elusive and increasingly scarce resource that cannot be managed solely through bureaucratic arrangements. Water governance is one of the most complex challenges humanity faces, but it must be addressed to achieve the goals of CGIAR, especially in the context of climate change and the need to transform our food systems. WLE's research, complemented by others' work, has identified some fruitful ways forward.

Work has emphasized policy reform. Without discounting its importance, WLE's research has shown that it may now be more important to focus on how existing, often quite progressive, policies are actually implemented. A basic premise is that neither technological innovations nor governance transformations alone will be successful. Integrating biophysical, digital, genomic and governance innovations so that they are mutually supportive is necessary. Governance is vital to adapting to drought and other climate change impacts and can enable the use of new technologies. A major gap that must be filled is identifying, testing and promoting effective governance arrangements that will enable rapid uptake and use of technological innovations, while drastically reducing inequalities. This is a daunting challenge, but WLE's research provides a good foundation.

RECOMMENDATIONS

1. **Place governance of water and other natural resources at the center of the One CGIAR program.** Effective governance is a pre-requisite for achieving the SDGs and CGIAR goals by 2030. Research on governance must be well integrated with biophysical, digital and genomic research so that they are mutually supportive.

2. **Revise CGIAR theories of change.** CGIAR has pioneered the use of theories of change in designing research and development projects. These need to be reviewed and updated using a sound reflection process and insights from social research to confirm who among the actors needs to do what differently. What is actually required to motivate or enable people to change their behavior? More knowledge and skills alone are not sufficient. This kind of reflexive social network thinking will elucidate governance challenges and opportunities that need to be addressed as an integral part of most projects.

3. **Invest in improving, adapting and scaling out the use of learning tools** such as experiential games in collaboration with interested implementing agencies and local communities. One goal is to identify and document the most effective and scalable modes of cooperative implementation that give marginal groups a strong voice in water governance arrangements of watersheds, wetlands, irrigation schemes, aquifers and river basins.

4. **Highlight how the gender norms, values and perspectives of CGIAR and partners dilute or re-interpret policy aims of gender equality.**

5. Because water governance is highly contested, **understanding political processes, including the politics of knowledge production, and identifying the political spaces for engagement in water governance is critically important to promote transformative change.**

6. **Demonstrate and document the potential long-term benefits of integrating biophysical and institutional interventions** through comparative analysis of water governance interventions. This research could also confirm what intervention strategies are most effective in achieving sustainable and equitable transformation of food, water and land systems.

7. **Identify ways to improve governance of multiple but integrated systems such as water–energy–food–ecosystems to form the basis for post-2030 research for development and investment programs.** Investing in action-oriented research aimed at understanding social and socioecological complexities and their implications for food and water system transformation will facilitate this.

The transition from CGIAR Research Programs to the One CGIAR portfolio offers a unique opportunity. A substantial investment in research on governance of natural resources integrated with cutting-edge biophysical and digital investments will be required to achieve the One CGIAR goals of achieving measurable progress in the SDGs.

Key points

The following recommendations are made based on research conducted by WLE:

- Place governance of water and other natural resources at the heart of the One CGIAR program.
- Revise theories of change to better integrate knowledge from social science research.
- Invest in improving, adapting and scaling out the use of learning tools.
- Highlight how the gender norms, values and perspectives of CGIAR and partners dilute or re-interpret policy aims of gender equality.
- Invest in identifying the political spaces for engagement in water governance based on an understanding of political processes, including the politics of knowledge production.
- Document the potential long-term benefits of integrating biophysical and effective governance interventions versus those programs emphasizing only one dimension.
- Identify ways to improve governance of multiple but integrated systems such as water–energy–food–ecosystems, to form the basis for post-2030 research for development and investment programs.

Experiential groundwater games, Ethiopia (photo: Fekadu Gelaw Mersha)

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Terraced paddy fields, China
(photo: Sasin Tipchai)

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