INITIATIVE ON
Transforming Agrifood Systems in South Asia

INITIATIVE ON
National Policies and Strategies

Bringing new focus on groundwater irrigation in Nepal's irrigation policy

Potential policy opportunities and pathways

Policy Note 3

December 2023

WHY IT IS TIME FOR A STRONGER FOCUS FOR GROUNDWATER IN NEPAL'S IRRIGATION POLICY

The last irrigation policy of Nepal (2003) acknowledged that the traditional focus of irrigation development in Nepal has been on run-off river-based surface water irrigation. To counter the problems of seasonal low flows of rivers, groundwater resources were regarded mostly as a *supplementary or conjunctive* irrigation source that could extend irrigation year-round. However, there have been several new developments in the irrigation sector and water systems of Nepal that now call for a new focus and approach to groundwater irrigation.

Climate change led uncertainties have created new barriers to surface water irrigation with recorded greater fluctuations expected in surface water flows and growing insecurity in availability of and access to surface water irrigation (Dahal et.al 2020, Maharjan et.al 2021, Risal et.al 2022, Prajapati et.al 2023)

Additionally, ***migration, urbanization, and emergence of new markets*** have shifted the focus from farming to non-farm activities, resulting in a decline in collective action within farmer managed irrigation systems (FMIS). This has led to barriers in operation and the upkeep of community-managed surface water irrigation systems (Khadka et.al 2021).

At the same time as the government has undertaken community tubewell projects to provide supplementary or conjunctive irrigation within several surface water irrigation projects, little focus has been given to the private development of groundwater irrigation. Recent data from the National Agriculture Census of Nepal 2021 shows a significant increase in the area under groundwater irrigation and much of this comes from ***sole use of groundwater irrigation sources and not as mixed/ conjunctive irrigation.***

While much of this development has come from diesel pumps (Foster et.al 2021), the ***recent expansion of grid coverage in Nepal*** is leading to increased role of electricity in agriculture (from providing 6.15% of all agricultural energy use in 2019 to 14.37% in 2022) giving rise to an energy-irrigation nexus in rural areas with higher role of electricity subsidy, pricing and metering, as well as farmer's private investments and access to credits. The potential implication is that this could open up a new cross-sectoral dynamic between food-water-energy in irrigation policy and implementation.

At the same time, groundwater needs careful governance. It is not inexhaustible. There have been several recent news reports of drying up of shallow groundwater sources such as village handpumps and shallow irrigation tubewells, especially under drought conditions in Nepal's Terai. Given these ***early indications of uncertainties in groundwater availability*** in many regions, there is a need to monitor and implement initiatives that can ensure sustainable groundwater management..

Experience from two decades of groundwater research in South Asia – including contiguous regions in India with the terai —demonstrate that groundwater irrigation development has considerable implications for equity in resource access, cropping pattern shifts, resource depletion and long-term sustainability (Shah 2010). Integrating timely recognition of these challenges and dedicated efforts towards groundwater resource monitoring, data, and governance is key. This will help support equitable access and use, as well as long-term resource sustainability, which is of critical importance in Nepal's context where groundwater irrigation is becoming increasingly dominant.

As Nepal recently approved its new irrigation policy, the time is ripe to discuss a greater focus on groundwater irrigation with regard to its monitoring systems, institutions, deeper understanding of its access and socioeconomic dynamics, and implications for equity, resource sustainability and commercialization of agriculture.

Photo Credit: Abdul Momin

THE TRENDS THAT COUNT IN NEPAL'S GROUNDWATER DEVELOPMENT:

Increasing use of groundwater irrigation and declining extent of surface water irrigation:

In comparing the 2011 and 2021 National Agriculture census data, the percentage of irrigated area under land parcels reporting groundwater (GW) use for irrigation has increased substantially in a decade (Figure 1) from 29.8% to 41.7%, while for surface water (SW) use it has fallen from 63.6% to 48.6% of total irrigated area. At the same time, despite its predominance in (existing) policy narratives, mixed source irrigation (conjunctive irrigation land area), covers just 3.4% of the total irrigated area in 2021. Not only has groundwater irrigation become substantially more significant, clearly the policy environment needs to go beyond its currently limited policy recognition of groundwater as merely a supplementary conjunctive resource.

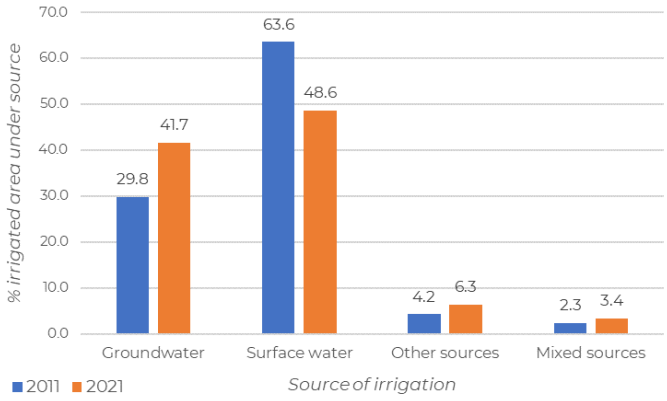

Figure 1: Change in area under irrigation in Nepal by source (2011-2021). Source: computed based on National Agriculture census of Nepal (2011 and 2021)

Increase in dependence on deep tubewells

Data (Figure 2) also shows that within groundwater use, the dependence of households (HH) on deep tubewells (DTWs) has shown a rise (23.8% to 31.5% of groundwater irrigating households) whereas use of shallow tubewells (STWs) has shown a decline (54.8% to 46.45 of groundwater irrigating households).

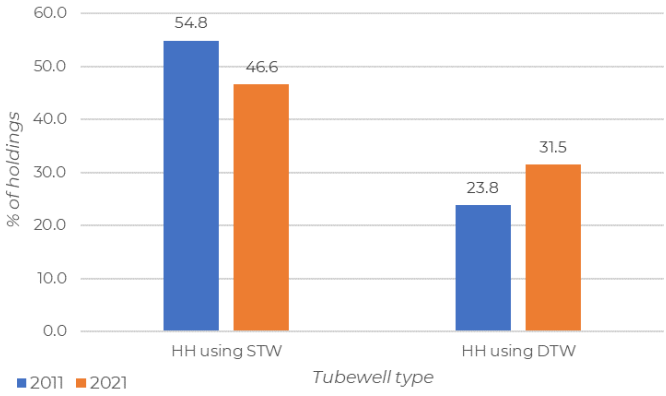

Figure 2: Change in use of shallow and deep tubewells in Nepal (2011-2021). Source: computed based on National Agriculture census of Nepal (2011 and 2021)

This indicates the intensification of groundwater extraction in Nepal and increasing deepening of tubewells (providing some indications towards potentially precarious groundwater levels although there is no systematic long-term groundwater monitoring data yet capturing decline in groundwater levels in Nepal). And/or it could mean a greater access to cheap energy. Even in terms of actual number of STWs and DTWs, we find a 178% increase in the number of DTWs between 2011 and 2021 compared to only a 59.9% increase in number of STWs.

Expansion in the western region, intensification in the eastern region

A regional picture is emerging. Much of this rise and intensification in groundwater use has come from the provinces comprising the Terai of Nepal, which is also closer to major markets in India. The increase in area under groundwater irrigation (Figure 3) is highest in the western region in Sudhurpaschim province (28% to 57.5% of total irrigated area under GW irrigation). But the highest increase in use of DTWs (Figure 4), is seen in the extreme eastern province of Koshi (2% to 48.1% of GW irrigating households), which imply an intensification of groundwater use. It may also possibly indicate declining groundwater levels, although more long-term data on water levels would be needed to confirm this trend.

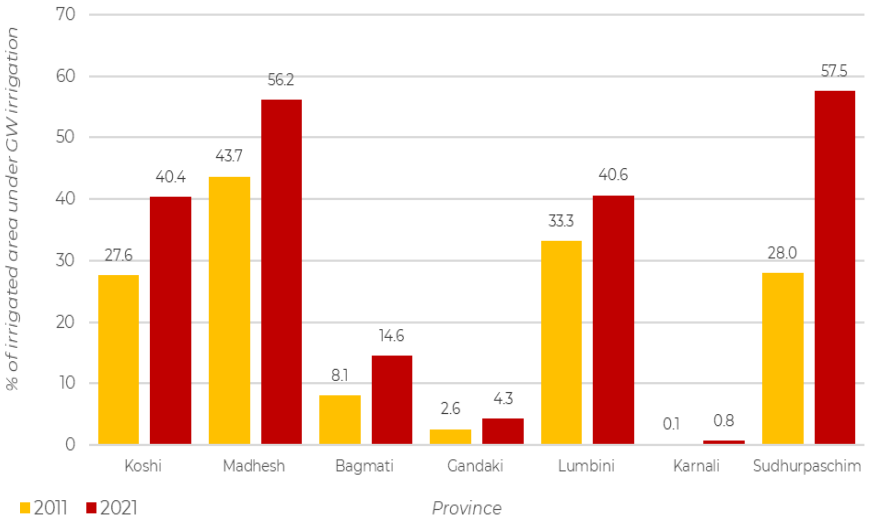

Figure 3: Change in area under irrigation by source in Nepal at Province level (2011-2021). Source: computed based on National Agriculture census of Nepal (2011 and 2021)

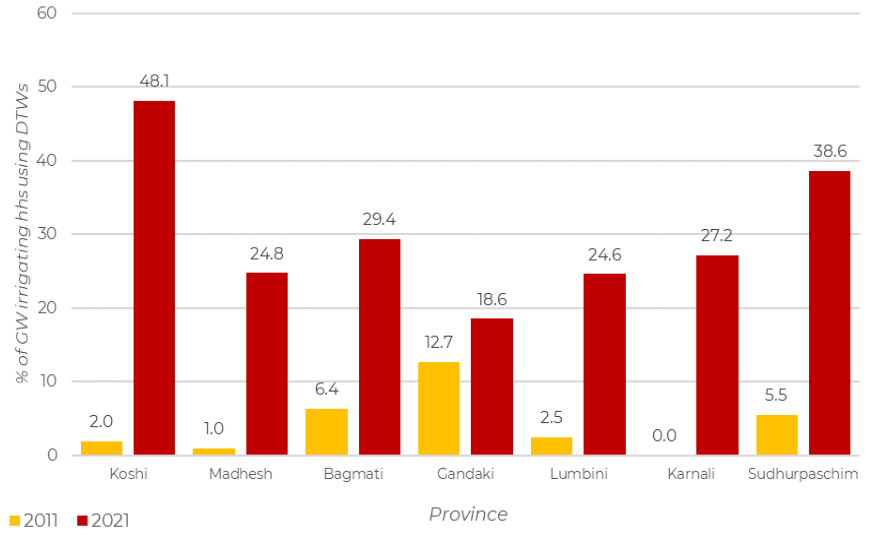

Figure 4: Change in use of shallow and deep tubewells in Nepal by Province (2011-2021). Source: computed based on National Agriculture census of Nepal (2011 and 2021)

EMERGING OPPORTUNITIES FOR STRONGER POLICY PATHWAYS:

A new irrigation policy is an opportunity for change

A new irrigation policy provides an opportunity to call for stronger focus on groundwater irrigation, beyond its current limited role as a supplementary source. This would entail recognition and dedicated efforts towards groundwater resource monitoring, data availability, aquifer mapping, groundwater use, access to tubewells and pumps, source of energy, pricing and affordability, and resource sustainability. Furthermore, it is an opportunity for provisioning closer collaboration of the water sector policy with agriculture to maximize water use efficiency and increasing production in a sustainable and equitable manner thus promoting an integrated approach to food security, water access, and groundwater sustainability. It is also an opportunity for promoting multiple uses of water for drinking, aquaculture-fish ponds, and irrigation to incorporate the essential linkages between different water uses and encourage their integrated management. At the same time, an integrated approach would also enable balancing the needs of different competing water uses to ensure groundwater resources are not depleted while fulfilling multiple water demands. For instance, urban water demand have significant impacts on groundwater levels (Lamichhane and Shakya, 2020, Shrestha et.al., 2018), and compete with agricultural water uses particularly in periurban areas, which would require not only an integrated approach across sectors but also between rural and urban governance.

Frameworks for decentralised groundwater governance

The current institutional system for groundwater development was partially centralised within the Groundwater Resources Development Board (GWRDB), which is now in the process of dissolution with its key mandates on groundwater research and implementation will be redistributed hereafter among the Water and Energy Commission (WEC) and Department of Water Resources and Irrigation respectively. This institutional change creates an approach to groundwater resource development and management that can span the irrigation-energy nexus, rather than a more siloed approach.

However, since groundwater irrigation is dependent on smaller and more atomised privatized pumping locations and individual service providers, its monitoring, regulation and support for access would likely benefit from an accompanying more decentralised institutional structure. The new federal governance system in Nepal offers an opportunity for this decentralisation to province levels.

Moreover, the FMIS has long existed as an institutionalized community-based irrigation management approach (Water User Associations) for surface water irrigation canals. Expanding the scope of these community-based institutions to include groundwater irrigation management could provide pathways for more decentralised management of groundwater in the future.

Since privately developed groundwater infrastructure tends to be capital intensive for farmers, there may be unequal capacity for different categories of farmers to invest in such systems. This often leads to the development of informal water markets. These market-based institutions also play a significant role in shaping how irrigation supply and access help determine profits from agriculture by different groups. Direct or indirect regulation of these markets to

ensure that they do not lead to concentration of resources and power in the hands of larger farmers, requires strong local governance at the village and province levels. Community-based governance can also prove potent in regulation of such markets.

Strong role and capacities of the civil society

While there has been limited policy focus on groundwater, there has been growing interest among civil society organisations and networks for this resource as climate variability may affect access to household water and urban water supplies traditionally sourced from groundwater. This interest and growing capacity in studying groundwater availability, quality and access can be leveraged for research and monitoring in the groundwater irrigation sector. Civil society engagement and integration can also offer significant buttressing of local groundwater governance. Engaging civil society in the design of policy could therefore be a key to future resource sustainability – and policy impact..

Bridging data gaps

To strengthen policy and institutions for groundwater irrigation there is a need to first develop a firm foundation of evidence and knowledge about the status and dynamics of the resource in the country. This requires significant focus on development and deployment of resources and tools for groundwater monitoring and mapping and creating platforms for data access and dissemination. Digitisation of limited existing monitoring data could offer a first step in this direction (eg. recent initiative of CSISA-TAFSSA dashboard https://gw-nepal.com/).

The developing electric grid and solar energy is enabling easier access to groundwater irrigation

Since groundwater extraction is dependent on pumping equipment, a reliable supply of energy is essential for determining the access to groundwater irrigation. Development of low-cost diesel-based pumping mechanisms led to the initial growth of groundwater irrigation in Nepal (Foster et.al 2021). Diesel imports and prices have been significant drivers determining affordability and ease of access to groundwater. The currently expanding electricity grid in Nepal is bringing in new energy access opportunities for changing the energy-irrigation nexus. Electricity subsidies, metering, licensing and access to electric pumps can therefore affect access to groundwater irrigation. Solar irrigation provides another energy source that is currently being piloted in Nepal through initiatives of the development sector (eg. https://solar.iwmi.org/). Greater integration of the water and energy sector and institutions would thus be increasingly important, beyond the currently siloed approach to irrigation and energy.

Insights and lessons from the region

Data and evidence on groundwater resources and access in Nepal is still nascent. There is, however, significant development in research, monitoring tools, aquifer mapping initiatives, assessments of sustainability and equity outcomes of groundwater development and management in the South Asian region that could offer initial insights on benefits, risks, implications, alternatives and potential directions for groundwater development and governance for Nepal.

INITIATIVE ON
Transforming Agrifood Systems in South Asia

INITIATIVE ON
National Policies and Strategies

AUTHORS

Shreya Chakraborty, Researcher, IWMI
Nilhari Neupane, Researcher, IWMI
Shanta Karki, Department of Agriculture, Government of Nepal
Timothy J. Krupnik, Regional Director, Sustainable Agrifood Systems Program (Asia), CGIAR Country Convener, CIMMYT Country Representative for Bangladesh

SUGGESTED CITATION

Chakraborty, S., Neupane, N., Karki, S., Krupnik, T.J. 2023. Bringing new focus on groundwater irrigation in Nepal's irrigation policy – Policy opportunities and pathways. TAFSSA Policy Note 3. Transforming Agrifood Systems in South Asia (TAFSSA).

ACKNOWLEDGEMENTS

This policy brief is a result of ongoing research of groundwater irrigation in Nepal under the CGIAR Initiative on Transforming Agrifood Systems in South Asia initiative. We are publishing this policy brief in collaboration with the CGIAR Initiative on National Policies and Strategies for Food, Land and Water System Transformation.

We would like to thank all funders who supported this research through their contributions to the CGIAR Trust Fund: https://www.cgiar.org/funders/

To **learn more about TAFSSA, please contact**:
t.krupnik@cgiar.org; p.menon@cgiar.org

ABOUT TAFSSA

TAFSSA (Transforming Agrifood Systems in South Asia) is a CGIAR Regional Integrated Initiative that supports actions improving equitable access to sustainable healthy diets, that boosts farmers' livelihoods and resilience, and that conserves land, air, and water resources in a climate crisis.

ABOUT CGIAR

CGIAR is a global research partnership for a food secure future. Visit https://www.cgiar.org/research/cgiar-portfolio to learn more about the initiatives in the CGIAR research portfolio.

DISCLAIMER

This publication has been prepared TAFSSA Initiative and has not been peer reviewed. Any opinions stated herein are those of the author(s) and do not necessarily reflect the policies or opinions of initiatives, donor agencies, or partners.