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SAHEL  
GROUNDWATER



# HARNESSING THE POTENTIAL OF GROUNDWATER TO ENHANCE PASTORAL PRODUCTIVITY IN THE SAHEL

Watering camel herd from Olouma well, Chad ©André Benamour

LEARNING NOTE ONE

APRIL 2023

## POTENTIAL AND BENEFITS

**P**astoralism is a major economic and livelihood pillar in the Sahel region, where more than 20 million people rear livestock to support their families. The livestock sector contributes 15 percent of the region's gross domestic product (GDP), but pastoralists are extremely vulnerable to climate uncertainty and water scarcity because of their itinerant lifestyle and the arid and hyper-arid climate. Groundwater is often the only available water source because rainfall is rare and highly variable, and rivers are concentrated further south in the Sahelian-Sudanian agricultural region.

Groundwater's diffuse yet hidden presence under the ground has left it largely undervalued and untapped despite its huge potential to sustain pastoral livelihoods and provide multiple benefits.

### These include:

- **Year-round availability.** Aquifer formations are extensive, providing a buffer that can be used to mitigate seasonal drought and inter-annual climate variability.

- **Presence virtually everywhere in the Sahel.** Groundwater is ubiquitous, but engineering capacity is needed to address varying depth and flow and changes in both the productivity of wells and the quantity of available groundwater.
- **Higher microbiological and generally higher chemical quality and lower temperature** than surface water.
- **Use by both animals and humans.** Because of groundwater's generally high quality, pastoralists can drink from the same source as their livestock, which is advantageous for pastoralists.

**Water quality** for livestock is often neglected, yet it is critical for **animal health**. While surface water sources are subject to bacteriological or parasitic contamination and heating, groundwater is protected from the same phenomena. Moreover, groundwater can prevent certain mineral deficiencies, including iron deficiencies, which cause anemia in calves. Regular watering with good quality water improves health, animal biomass, and resistance to biotic and abiotic stresses. Since herders can drink groundwater, its higher quality also benefits **human health**.



Extending the network of pastoral groundwater points would also yield important benefits by reducing animal density at each location, which would lessen pressure on grazing areas and the risk of infectious disease transmission. Infectious diseases in livestock can cause significant economic losses through stock reduction, loss of production, treatment costs, and downgrading at slaughter and social losses (e.g., loss of income, poverty, and eventually vulnerability).

Less density would also mean fewer health hazards for herders because it reduces human-animal contact and the probability of animal-to-human transmission of zoonotic diseases prevalent in the Sahel such as brucellosis, tuberculosis, and Q fever. Several zoonotic diseases are water-borne, such as cysticercosis, hydatid disease, and anthrax, and the risk of their spreading to humans is higher around surface water points (e.g., reservoirs and natural depressions) than wells and boreholes.



Shepherd in the Lake Chad area ©LCBC



Vaccination campaign in Burkina Faso ©PADEL-B/World Bank

Addressing water and health needs of both animals and humans lies at the heart of the **One Health approach**. Pastoral communities gather at water points at specific times, presenting an opportunity under One Health to provide integrated health care services, including vaccination campaigns, to both livestock and pastoralists, while optimizing resources and sharing logistics (e.g., vehicles and cold chains).

## ONE HEALTH: A FRAMEWORK FOR INTEGRATED HEALTH SERVICE DELIVERY

Pastoralists in sub-Saharan Africa have limited access to public services because of their mobile lifestyle, economic and political marginalization, and limited health infrastructure that is common to the arid and semi-arid lands where they primarily reside. This often results in poor health outcomes, including increased rates of maternal, neonatal, and under-age-5 mortality. One Health approaches that integrate human and animal health service delivery can improve pastoralists' health through increased vaccine coverage and access to services. One Health, which recognizes the interlinkages between people, animals, and the environment, creates integrated service provision that also fosters economic growth and sustainable use of natural resources. This concept is based on the collaborative efforts of multiple disciplines working together to attain optimal health of people, animals, and the environment.

A study of the status of human and animal vaccination among mobile pastoralists in Chad found that while livestock were vaccinated during mandatory veterinary campaigns, no children in these communities were fully vaccinated. The organization Agronomists and Veterinarians Without Borders organized joint interventions in animal health (vaccination and deworming) and human nutrition (treatment of child malnutrition) in pastoral areas in northern Mali. These actions also raise awareness about health issues such as zoonoses. In Chad, this approach has improved access of pastoral and animal populations to vaccinations and reduced the overall costs of public-health interventions by nearly 15 percent (Zinsstag *et al.*, 2020).

## GAPS AND NEEDS

The first actions in the 1950s to boost pastoral development in the Sahel were followed by major investments in pastoral water infrastructure. However, a recent detailed study by the Permanent Interstate Committee for Drought Control in the Sahel (CILSS) conducted within the Regional Sahel Pastoralism Support Project (PRAPS) in Western and Central Sahel showed that the current network of functional water points is inadequate to meet the needs of pastoral households and their livestock (Toure, 2019). Pastoral water points are still distributed heterogeneously across countries: while some locations have an excessive number (which do not adhere to the optimal density as required by existing legislation for the sustainable use of pasture), there are still vast swaths of land devoid of infrastructure to access groundwater (Toure et al., 2019).

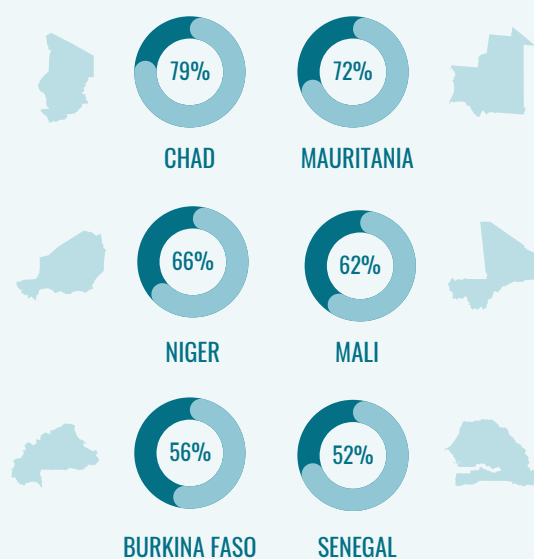
The lack of a sufficient functional network of watering points for livestock along pastoralist routes restricts pastoral mobility, a key strategy of pastoral systems in arid contexts to sustain the productivity of grazing resource. In addition to other factors limiting pastoral mobility, such as agricultural expansion, policies, and plans that neglect or even penalize pastoral livelihoods, and widespread insecurity in the region, the limited availability of perennial water points leads to overgrazing. It also limits access to new grazing lands that could be important fallback sources of feed in lean years. On the other hand, unplanned increases in water points could encourage pastoralists to settle and increase conflicts over access to, and use of, water and degrade vegetation and surrounding land.

“Over 3,000 additional pastoral wells and boreholes are needed in the Sahel”

Prior to new water points, the potential risks of land degradation must be analyzed. Considering an optimal distance between watering points of 12-25 km<sup>2</sup> (Toure et al., 2019), over 3,000 additional wells and boreholes are needed in the Sahel. In Chad for example, the 2015-2030 investment plan estimates that about 1,500 wells and boreholes need rehabilitation (Government of Chad, 2016).

For Western and Central Sahel, the investments for both new and rehabilitated wells and boreholes are estimated to be over US\$225 million. These investments would facilitate the movement of livestock and avoid concentrations of herds in the Sudanian zone; optimize pastoralist corridors in the Sahelian zone; and improve the management of oases, their peripheries, and caravan trails in the Saharan zone.

### PASTORAL AREA UNCOVERED BY WATER POINTS (%)



(Source: Toure et al., 2019)

### THE QUALITY OF WATER WELLS AND BOREHOLES MUST BE IMPROVED

Many factors affect the productivity and lifespan of boreholes and water wells but the siting of infrastructure and the quality of its design and construction are most important. Even though construction costs are often modest compared to other infrastructure programs, technical complexity is high, primarily because the construction is underground and not accessible to visual inspection (only the inner part of wells and boreholes can be seen with video inspection). PRAPS II (2022) highlighted this concern, identifying several siting, design, and construction issues during project implementation, which resulted in a significant proportion of infrastructure being only partially or not operational. The cost of applying international standards for designing, drilling, constructing, and testing water wells and boreholes is a small capital outlay compared with the excess costs incurred by the operation of inefficient water structures or their abandonment when totally unproductive.

## LESSONS LEARNED AND NEXT STEPS

Groundwater plays a key role for pastoral livelihoods, economic productivity, and human and animal health, and there is great potential to develop this resource to sustain both pastoral livelihoods and the ecosystems they depend on. The experience of the World Bank and other financial partners from 20 years of work on pastoral water development in the region highlights several lessons that should guide engagement in groundwater development:

1. Its quality and extensive year-round presence make **groundwater a key, yet untapped, resource** for animal and human health and overall pastoral development.
2. Insufficient consideration of geological risks and the relatively low quality of construction jeopardize the durability of wells and boreholes dedicated to pastoralism. A special effort should be made to **improve the quality of construction** of wells and boreholes in the region.
3. To satisfy the needs for pastoral water in the G5 Sahelian countries and Senegal, more **pastoral wells and boreholes need to be constructed or rehabilitated** to serve the still uncovered pastoral zones (about 1.2 million km<sup>2</sup> or 68 percent of the region's pastoral area), at a minimum investment of US\$225 million.
4. It is crucial to combine the development of watering points with the sustainable management of pastureland. Too often the interconnectedness between these two resources is neglected. The number and distribution of water points and the rules to access and use water should thus be carefully matched to the carrying capacity and natural regeneration of pastures.
5. Local water access and power dynamics must be fully understood when developing new water points to prevent conflict and exclusion. Local water access can be disputed between sedentary (mostly farmers) and mobile (pastoralists) communities and become a magnet for conflict. Moreover, mobility and access to watering points might be constrained by the expansion of farmland and protected areas, which should be considered when developing new water infrastructure.
6. It is important to incorporate the management and maintenance of hydraulic infrastructures into traditional rights and management mechanisms. Local communities have their own set of rules that regulate access to, and management of, resources and assets. Experience has shown that maintenance systems—including institutional and financing arrangements—introduced by projects without integration into existing customary management systems inevitably failed.



Pastoral well in Zinder area, Niger ©André Benamour ©LCBC

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This document has been produced from detailed material prepared by Gabriel Teno, Livestock Specialist, Consultant. This work has been funded by the Cooperation in International Waters in Africa (CIWA), which is a multi-donor partnership administered by the World Bank to support riparian governments in Sub-Saharan Africa and their path toward more sustainable, data-driven, community-focused, and collaborative management of transboundary waters. CIWA is supported with generous contributions from Denmark, the European Commission, the Netherlands, Norway, Sweden, and the United Kingdom.

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### FOR MORE INFORMATION, PLEASE CONTACT

François Bertone [fbertone@worldbank.org](mailto:fbertone@worldbank.org)  
Mariela Varas [mvaras@worldbank.org](mailto:mvaras@worldbank.org)  
Mariam Sou [ydakouresou@worldbank.org](mailto:ydakouresou@worldbank.org)

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