SENSOTERRA

we make sense of water

WHITE PAPER
WATER GOVERNANCE

Rising expectations for sustainable water management

The global freshwater resources are facing an unprecedented level of strain, eliciting a sense of urgency and concern. Numerous water reserves are confronted with the imminent threats of depletion and pollution, which means theres more pressure from both established and emerging stakeholders. This challenge is further compounded by the scarcity of water, as there simply isn't enough to meet the demands of all.

Climate change compounds this, leading to increasing temperatures, prolonged dry spells, and sporadic, intense rainfall events. As a consequence, our lands are increasingly parched, and when precipitation does occur, it often wreaks havoc. Following a prolonged period of drought, heavy rainfall fails to permeate the soil, flowing towards the lowest points and giving rise to flooding.

To tackle this multifaceted problem, it becomes imperative to empower stakeholders with the tools and knowledge to utilize water as efficiently and effectively as possible. An illustrative example of this approach is the promotion of pollution prevention measures, helping farmers in reducing over-irrigation. Furthermore, during periods of drought, water conservation measures must be implemented, imposing their own set of consequences on the various stakeholders involved.

The management of water resources encompasses a complex process wherein decisions must be carefully weighed against a plethora of competing interests, including agriculture and horticulture production, the preservation of natural ecosystems, energy generation, industrial requirements, safety considerations, quality of life, and financial implications. Moreover, the intricate nature of groundwater and surface water bodies knows no regional or national boundaries, further augmenting the intricacy of water governance.

Given these challenges, how do we ascertain the most suitable course of action for water management? Where do we derive the necessary information from, and what is the level of detail and quality of the underlying data?

Adopting a data-driven approach is critical, aimed at understanding the available water supply and the genuine demands placed upon it. Accurate and reliable data is paramount in informing effective water governance policies and decisions.

However, before anything can be managed, it must be effectively measured. In this regard, soil moisture, in conjunction with other relevant parameters, assumes a pivotal role in addressing the aforementioned challenges. Both excessively wet and excessively dry soil conditions pose significant problems, highlighting the importance of maintaining a balanced soil moisture profile.

"Green water management increases productive transpiration, reduces soil surface evaporation, controls runoff, encourages groundwater recharge, and decreases flooding."

ISRIC World Soil Information

Soil management & Green-water

Green-water refers to the water present in the upper layers of the soil that is accessible for uptake by plants. While it represents the largest freshwater resource, its availability is limited to plant and soil life. The management of green-water primarily falls under the purview of agricultural, forestry, and rangeland practices.

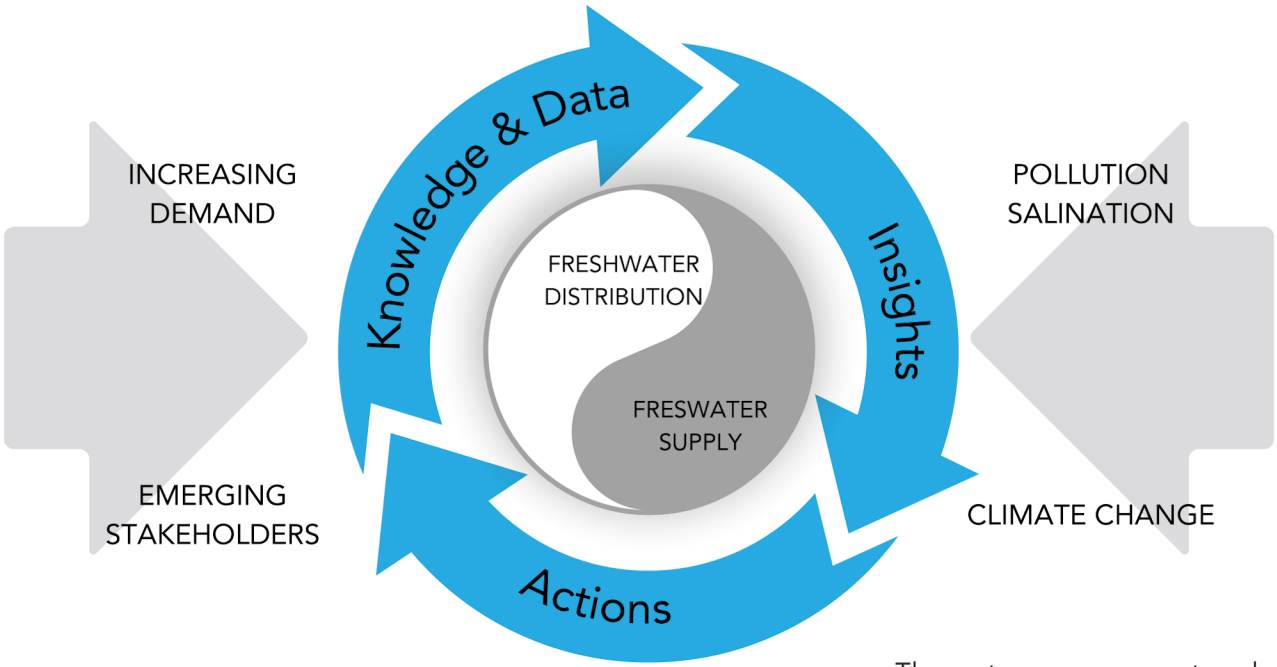
On the other hand, blue-water encompasses groundwater, including aquifers, as well as surface water. It serves as a vital source for sustaining aquatic ecosystems and caters to human, livestock, irrigation, and industrial needs. The management and dynamics of blue-water are closely intertwined with the practices of upstream stakeholders.

The significance of effective green-water management cannot be overstated, as it impacts soil and water conservation efforts. When green-water is managed efficiently, it results in improved availability and quality of blue-water resources.

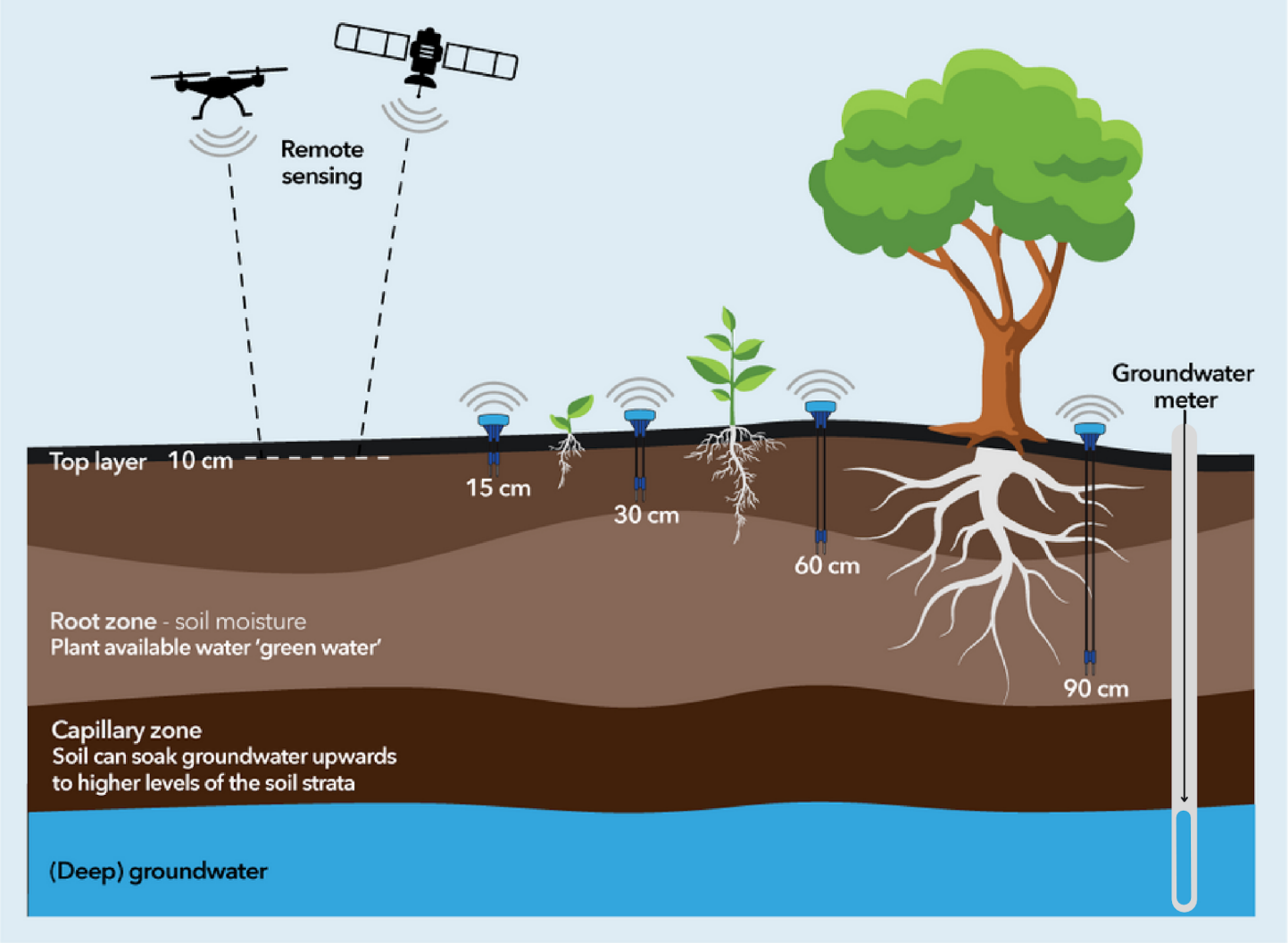
Optimizing the allocation and utilization of both green- and blue-water resources can yield substantial benefits in terms of water availability and usage. By strategically dividing these resources, we can strike a balance that maximizes their respective advantages.

Satellite imaging and historical GIS data is often employed to acquire snapshots of the condition of the top 10 cm of soil at a specific point in time. These systems offer valuable insights into changes in water availability over time. However, they are not practical for daily management practices that require real-time information.

Therefore, it becomes imperative to complement satellite data with in-situ measurements of soil moisture, specifically at the root-zone where plants use green-water. Such data provides invaluable insights into soil and plant health, and the behavior of water within the soil.



The water management cycle



"Importance of measuring green-water with a combination of in-situ sensors, satellite, drone, weather data, and ground water information."

Key elements of a monitoring system

When considering a monitoring system, several key elements come into play. While technology plays a crucial role, simply installing sensors is insufficient. A comprehensive monitoring platform, enriched with domain knowledge, user management, and sensor management, is vital for success.

The monitoring platform
The monitoring platform serves as the central hub where all components converge. It should offer configurability for different sensors and online data sources. Additionally, the platform should incorporate domain knowledge, enabling the establishment of thresholds and other relevant indicators.

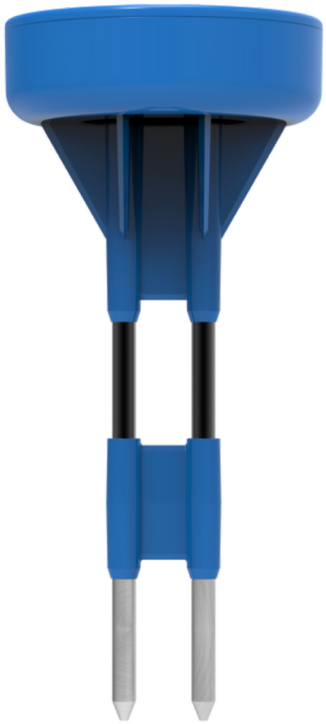
Sensors
When it comes to sensors, it is crucial that they can be discreetly installed in both public spaces and open fields. Once installed, the sensors should require minimal maintenance throughout their operational lifespan. To achieve this, the sensors must be equipped with long-lasting batteries capable of providing power for extended periods (typically 6 to 10 years with hourly measurements). Leveraging the LoRaWAN communication protocol, which is widely available in many countries and regions, allows for the use of a single sensor in multiple projects and locations over an extended duration.

Flexible placement
Measuring green water necessitates positioning sensors within the root zone of plants, trees, or crops. Various sensor lengths are available, including a Multi Depth version to cater to different needs. Hiding sensors can be done by using drainpipe covers, mulch, coco mats, or wooden covers, and will work as long as the sensors are not obstructed by metal objects.

Considering the rapid hardware advancements and the multitude of suppliers in the market, managing different dashboards for each sensor type can become cumbersome. Thus, it is crucial for a monitoring system to be hardware agnostic, allowing for easy integration of devices without being tied to a specific platform. This approach enhances flexibility, enabling the system to adapt to different scenarios by combining various sensor types, thereby maximizing its capabilities.

Integrated data provides value add to stakeholders - supporting actionable water management decisions

Sensoterra soil moisture sensors
Sensoterra's wireless soil moisture sensors are designed to set up a high density network of soil moisture measurements:



- Very fast installation (<1 minute) and relocation
- Easy to hide, theft free, mower friendly Maintenance free for 6 to 10 years, with 1 measurement per hour
- Multiple depths available (Single Depth) and Multi Depth for 6 depths at once
- Super high accuracy with more than 45 standard calibrations
- Low TCO (Total Cost of Ownership) per sensor
- Long range, cost efficient wireless connectivity via LoRaWAN
- Built to integrate (API-first philosophy)

To learn more, visit www.sensoterra.com or contact us at sales@sensoterra.com.

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