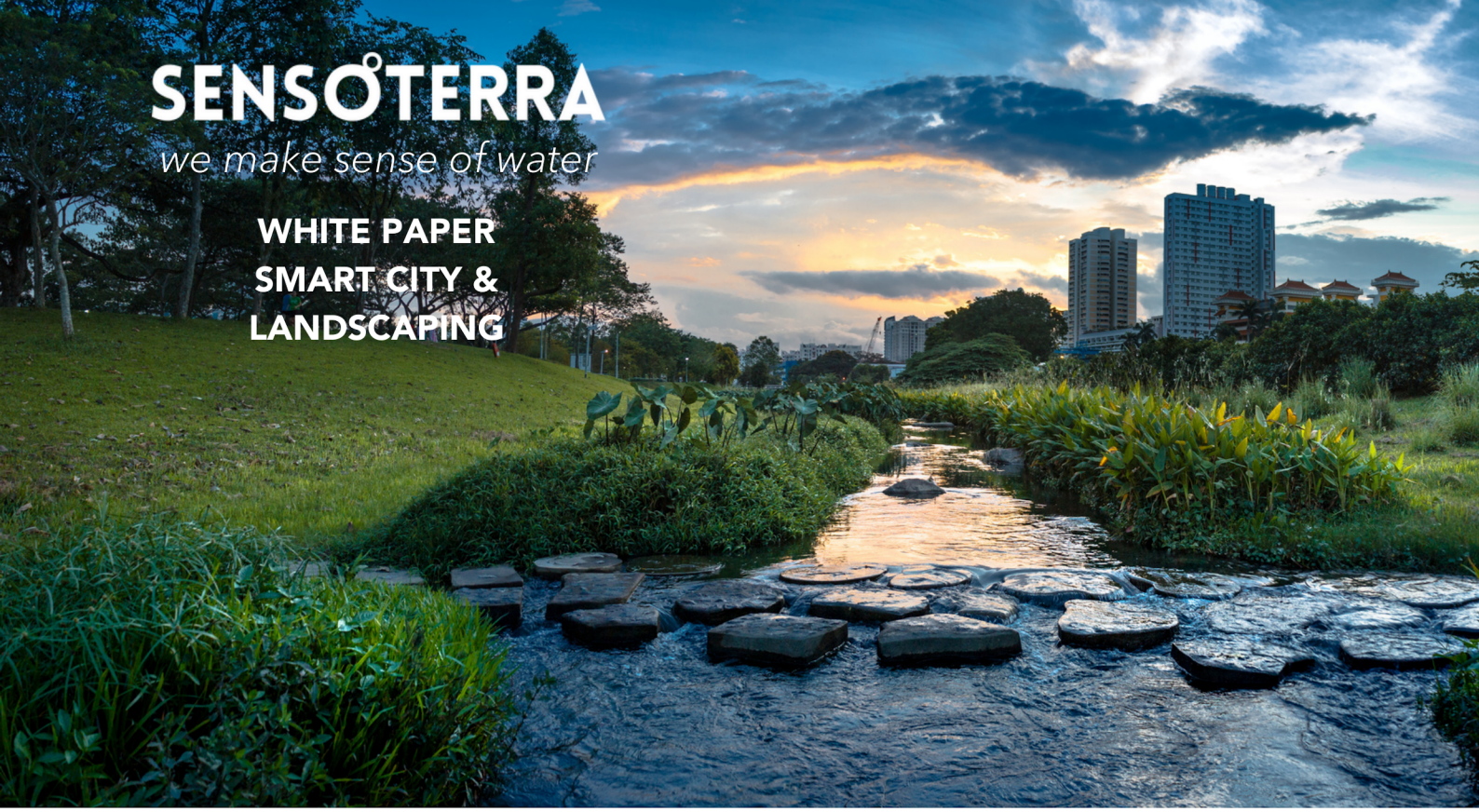


SENSOTERRA

we make sense of water

WHITE PAPER
SMART CITY & LANDSCAPING

Smart city landscaping & urban green

Urbanization is accelerating. It's projected that more than two-thirds of the world population will live in urban areas by 2050 – which equals around 7 billion people.

While cities keep growing, climate change makes it challenging to keep cities livable and be resilient against higher temperatures, more drought, and more intense rainfall. Factors like climate adaptation, reduction of air pollution are all contributing to an increasing appreciation and expansion of nature based solutions.

The challenge is, that nature based solutions need water to stay healthy, provide ecosystem services and sustain their cooling effect. A complication is that built-up areas (roofs, walls, planters, city centers) are not the natural habitat for plants and trees to grow, and to hold water like natural systems do. That is why the right conditions will have to be created – and monitored.

Because of the growing number of nature based solutions in cities, the demand for water from cities will increase – while the use of water should be reduced, as other stakeholders see an increasing need as well.

Wireless soil moisture sensors help to make sure that plants and trees have enough water to grow and be healthy. By optimizing irrigation, water use is minimized and CO2 emissions are reduced. Not to mention, fewer man-hours are required for site visits, as soil health can be monitored remotely.

Another key advantage: by preventing soils from becoming too dry, flood resilience is increased by the prevention of erosion/runoff from dried compacted soil – soil that is too dry becomes water repellent and does not absorb or retain water in intense rainfall.

“Because of the growing number of nature based solutions in cities, the demand for water from cities will increase – while the use of water should be reduced, as other stakeholders see an increasing need as well.”

TOO DRY SOIL

Lower yields of crops in agriculture & horticulture

Low quality nature and green spaces do not help to reduce heat stress

Rainwater runs off because soil becomes hydrophobic

HEALTHY SOIL MOISTURE CONTENT

Crops in agriculture & horticulture provide the highest yields

Nature & green spaces are of high quality and reduce heat stress

Rainwater is better absorbed by the soil

TOO WET SOIL

Reduced yields of crops in agriculture & horticulture

Nature and greenery can suffer root damage due to lack of oxygen

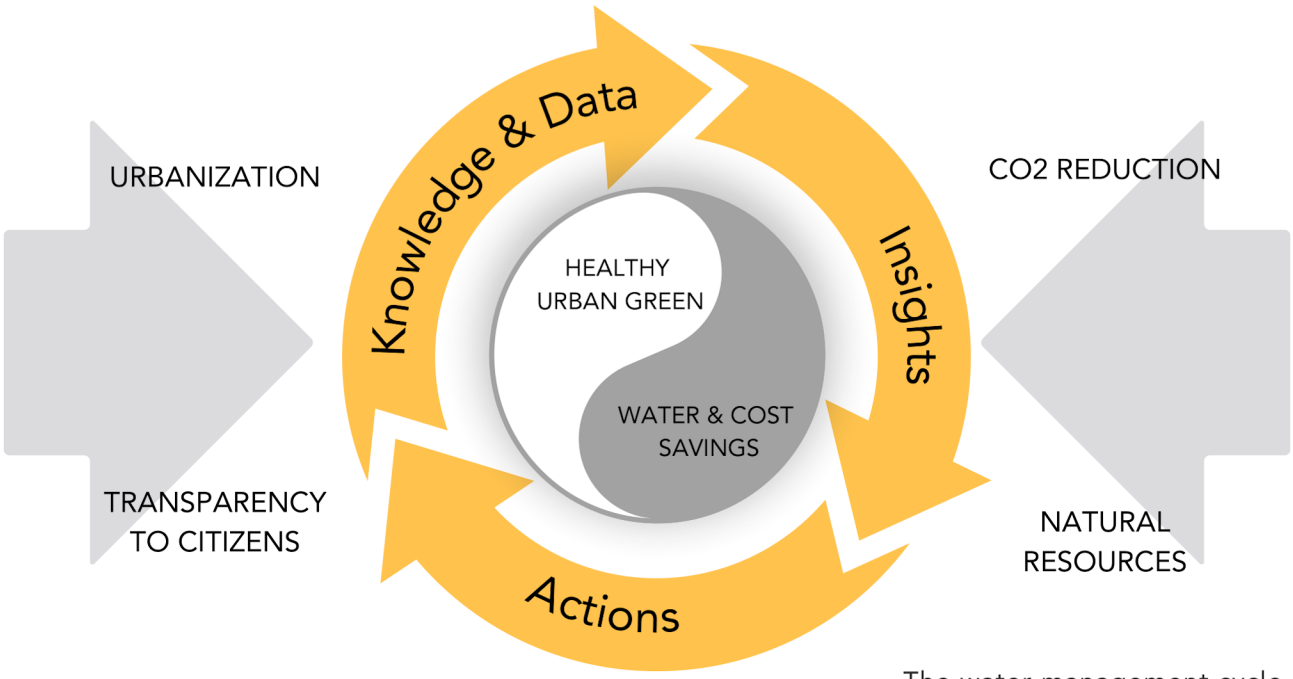
Extreme rainfall is no longer absorbed by the soil

Plant available water has a direct relation to the growth and health of plants and soil functionality. Too much water and plants undergo hypoxic stress, are waterlogged, and unable to uptake air and nutrients. Too little water and plants are susceptible to wilting (stress) and permanent wilting (death).

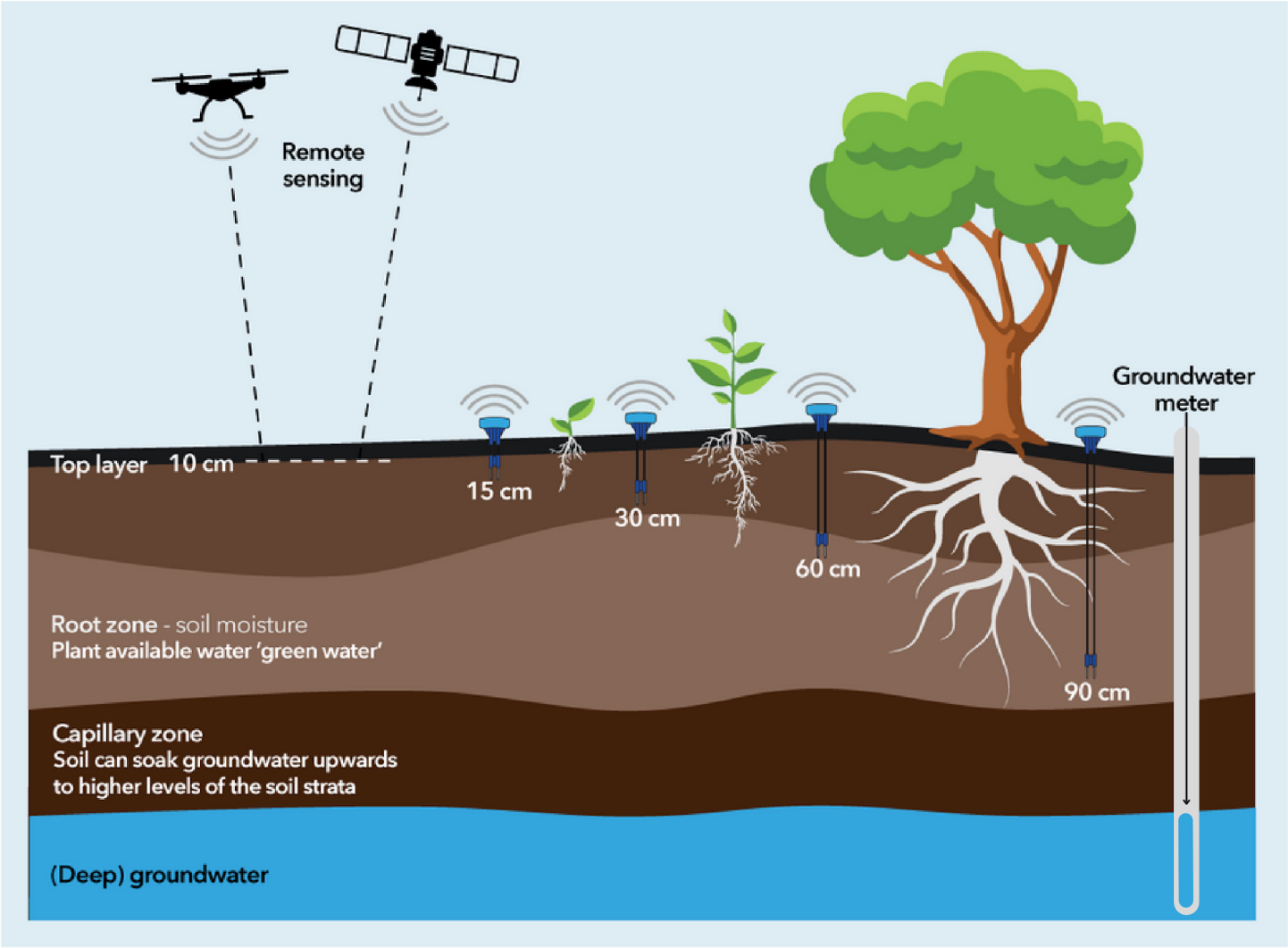
Landscapers use their years of field knowledge and expertise to identify the water related stressors to plants. Keeping plant available water within the 'healthy zone' between these stress related thresholds is key for plant health, and urban green.

Satellite and drone imaging is often used to get snapshots of the state of the top 10 cm of soil at one point in time, or to monitor plant conditions.These systems offer a good indication of the changes in plant/tree health and water availability over time, but are not practical for daily management practices.

Insight in soil moisture levels is needed at the rootzone of the plants, with in-situ measurements, to help substantiate what the landscaper knows – when to irrigate, and when to stop irrigation for plant health.



The water management cycle



Key elements of a monitoring system
There are many sensor systems on the market. Technology is crucial for a monitoring system, but just installing a sensors is not enough. A monitoring platform enriched with domain knowledge, workflow management, automations, as well as user and sensor management are essential.

Monitoring platform
In the monitoring platform, everything comes together. Multiple data sensor types and additional data sources should be configurable. It contains specific domain knowledge for setting thresholds and other settings. It also provides clear dashboards, with at-a-glance information like a map, decision making support, automations, extensive analysis and data export capabilities.

The number of sensors, and sensor placement is based on domain knowledge in the form of project design, plant and tree species, irrigation zones and characteristics of the terrain.

The platform has pre-configured settings for different situations and plant and tree species. Fine-tuning of thresholds is possible by adjusting these manually based on local parameters and experience.

Alerting when soil moisture levels pass beyond the set-thresholds is crucial to ensure good management of water resources.

These alerts can be warnings or critical notifications (alarms), both for (too) dry or (too) wet conditions. All notifications are stored in the log and can (just like the sensor data) be exported for archiving or further analysis.

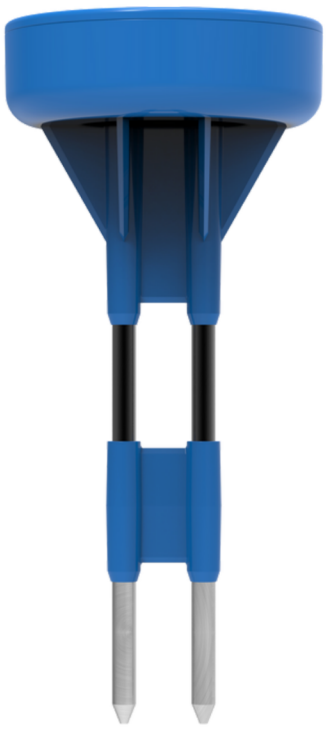
Sensors
Regarding the sensors it is important that these can be installed invisibly in public spaces. If a sensor is hidden or buried, it should not need any maintenance for the period the sensor is operational in that location. This is why the sensors operate on batteries and communicate via LoRaWAN. In many cites, these networks are available.

The batteries need to provide energy for extended periods of time (6 to 10 years with hourly measurements) without having to be replaced. This makes it possible to use a single sensor in multiple projects and locations, over many years.

To optimize growth and tree/plant health, soil moisture must be measured in the root zone. Installing the sensors invisibly can be done by using a drainpipe cover, mulch, coco mat or wooden cover – as long as the sensors are not covered by metal objects.

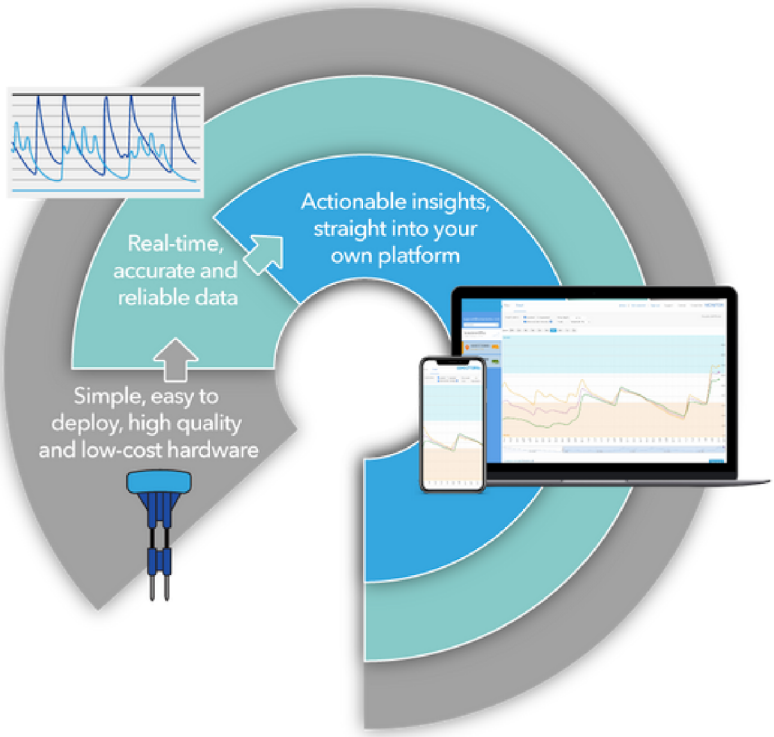
Rapid hardware developments and numerous suppliers exist in the market. Having separate logins and dashboards for each sensor type is impractical. Hence, a monitoring system should be hardware agnostic, allowing seamless integration of various hardware options without relying on mandatory platforms from specific suppliers. This flexibility enables the combination of different sensors based on project requirements and facilitates future integration of new sensor types as they emerge.

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.



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

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NWP | Netherlands Water Partnership