AFRICA WORKS! 2022
Innovation for Resilient Growth

GROUND WATER MANAGEMENT FOR AGRICULTURAL PURPOSES

ROYAL Eijkelkamp
Meet the difference

The Salt Doctors

ACACIA WATER

TNO innovation for life

NL.IN. BUSINESS

NABC
Confidence in African Business

Government of the Netherlands

MODERATOR

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MR. FRANS VERBERNE

Senior Coalition Builder

Netherlands Food Partnership

PRESENTATION 1

MS. TINE TE WINKEL

Expert Water Resources Sustainability

Acacia Water

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Groundwater and Agriculture

Africa Works

June 28th, 2022

Tine te Winkel

ACACIAWATER

Acacia Water

- Highly specialized groundwater consultancy
- Global operations
- Over 30 academically trained water specialists
- Professional yet practical




Groundwater & agriculture

- Approximately 70% of the global groundwater withdrawals are used for agricultural production;
- 80% in Africa;
- Groundwater withdrawals played a major role in accelerating food production and economic development.

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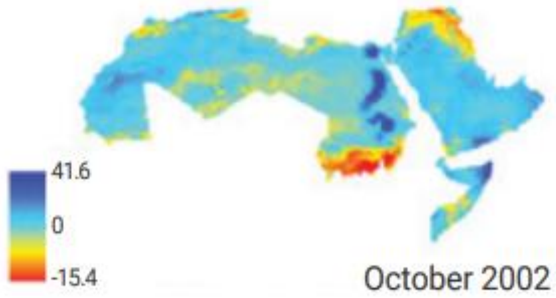

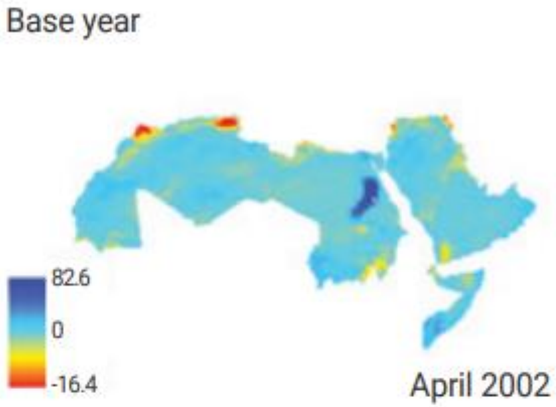

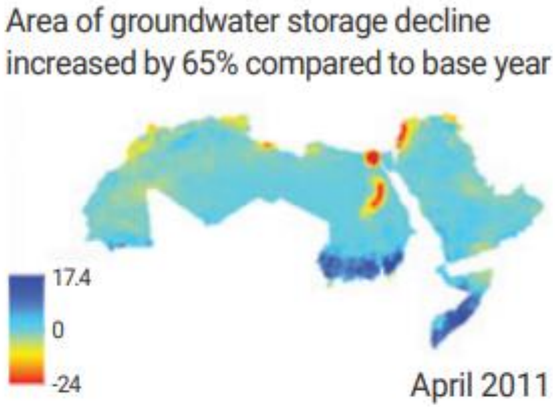

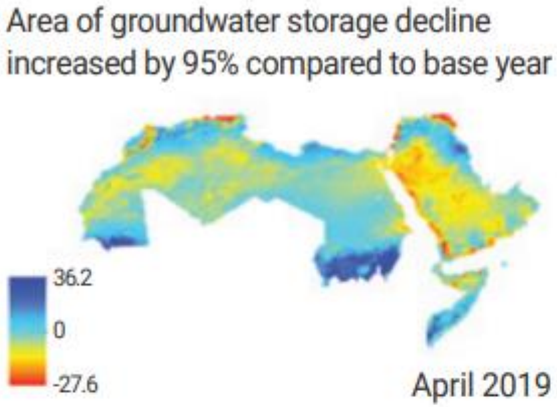

United Nations, The United Nations World Water Development Report 2022: Groundwater: Making the invisible visible. UNESCO, Paris. Compiled by UNESCWA, based on McStraw (2020) and on GRACE 2.0 (n.d.).

Moving forward

- Profitable and sustainable groundwater use;
- Fact based baselines;
- Practical solutions:
  - Working boreholes;
  - Recharge systems
  - Efficient groundwater use

How do we solve this in NL?

- Salinization and drought;
- Seed potato industr
- Aquifer Storage anc Recovery
- €300 - 450,-/ha/yr
- Decennia of potato cultivation in water scarce areas

FOTO EWIJLEN WETERINGS

Mark Slot bekijkt zijn suikerbieten, die waarschijnlijk nooit meer hoeven te slapen op peilgestuurde drainage.

Application in Africa

- Groundwater development in Africa is challenging;
- Will not improve in future;
- Agricultural development and overall water security depends on groundwater;
- Financial resources often considered difficult;
- ***Fact based and solutions***

Application in Africa

- Potential borehole investment maps;
- Mapping investment risks;
- Scaling groundwater storage;
- Together with the local experts to build capacity and secure investments

What’s next?

- In NL the investment for sustainable gw in agriculture is about €300/400 / ha
- We need to work towards this in Africa as well;
- With the right partners and investors;
- Acacia Water is your practical knowledge partner;
- Regenerate and develop sustainable agriculture based on GW;
- But, investment is needed!


CLEAN
SAFE
WATER

Global Head Office
Gouda - The Netherlands

Regional Office Northeast Africa
Addis Ababa – Ethiopia

Regional Office Northern Netherlands
Leeuwarden – The Netherlands

www.acaciawater.com
info@acaciawater.com

ACACIAWATER

PRESENTATION 2

MR. RASOUL D. MIKKELSEN

Director for Strategic Business Development

Royal Eijkelkamp

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ROYAL Eijkelkamp
Meet the difference

GroundWater Management for Agricultural Purposes

Meet the difference

ROYAL Eijkelkamp
Meet the difference

Company history and values

- Started in 1911, Royal since 2011
- Family owned
- Represented by specially selected partners on **5 continents** and in more than **90+ countries**
- Own offices in US and UK

Sustainable Development Goals

With our integrated solutions for water and agriculture challenges we embrace UN's Sustainable Development Goals.

Perfect Storm: Too much water | No water | Poor quality water

- FAO estimates that high or very high-water shortage or scarcity currently impacts around 3.2 billion rural people.
- More than 170 million hectares - that is over 60 percent of irrigated croplands - are subject to high water stress.
- At least 155 million people are facing acute hunger because of conflict, economic shocks and extreme weather. *Over half of the population in Africa are food insecure*
- Currently, agriculture accounts (on average) for 70 percent of all freshwater withdrawals globally . Access to fresh water due to Climate impact decreases dramatically.
- Increased saltwater intrusion to groundwater and freshwater discharge into the oceans.

Holistic and Value Chain Approach

Integrated Solutions

- Smart Water Resource Management (making water cloud
- And invisible more visible)
- Remote quantity and quality monitoring of water resources
- Smart Agricultural – Remote Soil monitoring, smart irrigation based on data
- Soil health
- Smart Geotechnical survey and monitoring
- Rainwater harvesting (Managed Aquifer Recharge)

Pollution | Urbanisation | Land development | Natural Resources | Food Security | Land Degradation

Case study | Water Quantity and Quality monitoring – Sri Lanka

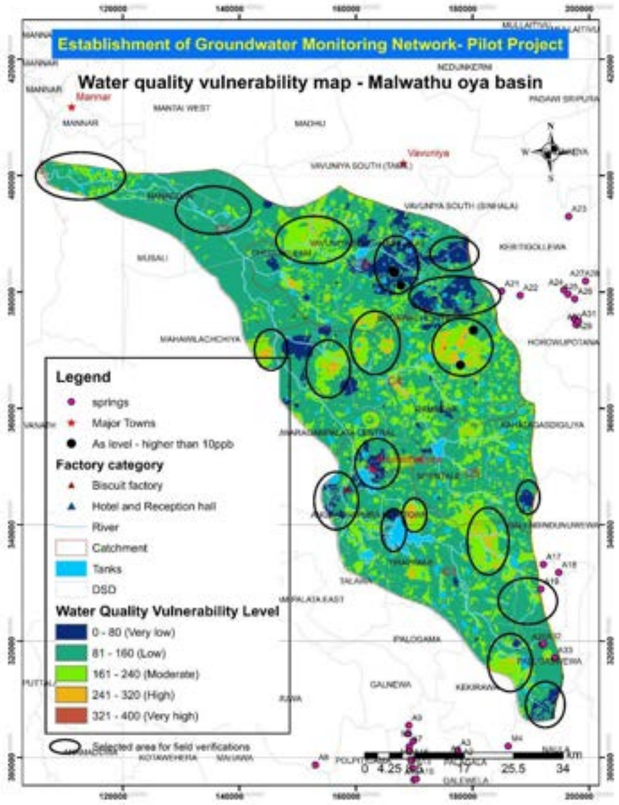
In assignment of Ministry of Irrigation & Water Resources Management

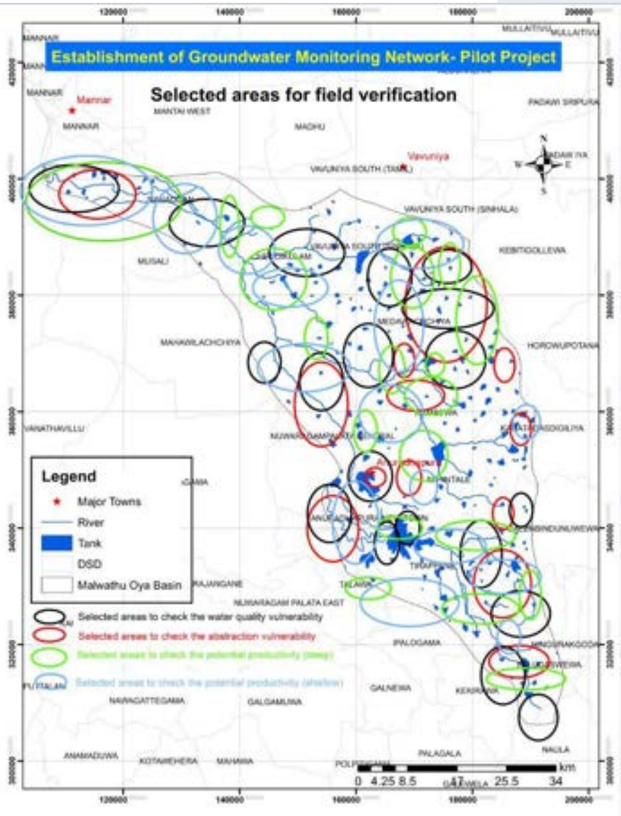
Scope

Establishment of Groundwater Monitoring Network – Pilot Project, covering Malwathu Oya, Maduru Oya and Kumbukkan Oya River Basins in Sri Lanka, completely financed by The Netherlands (Rabobank).

Project activities (1)

- Field and Desk Research
- Collecting data in GIS: e.g. land use, topography, geology, rain fall, water quality / level, wells for agriculture, drinking water, industry, etc.
- Criteria for selection of monitoring points: water level (deep and shallow), water quality, water use, productivity.





Project activities (3)

Installation of the monitoring wells

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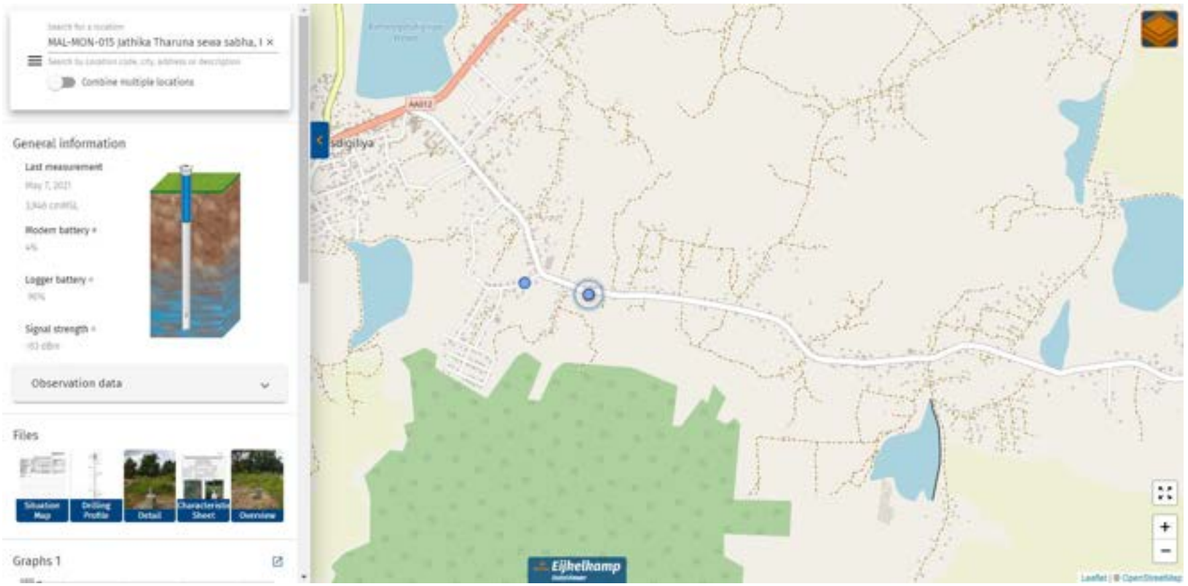
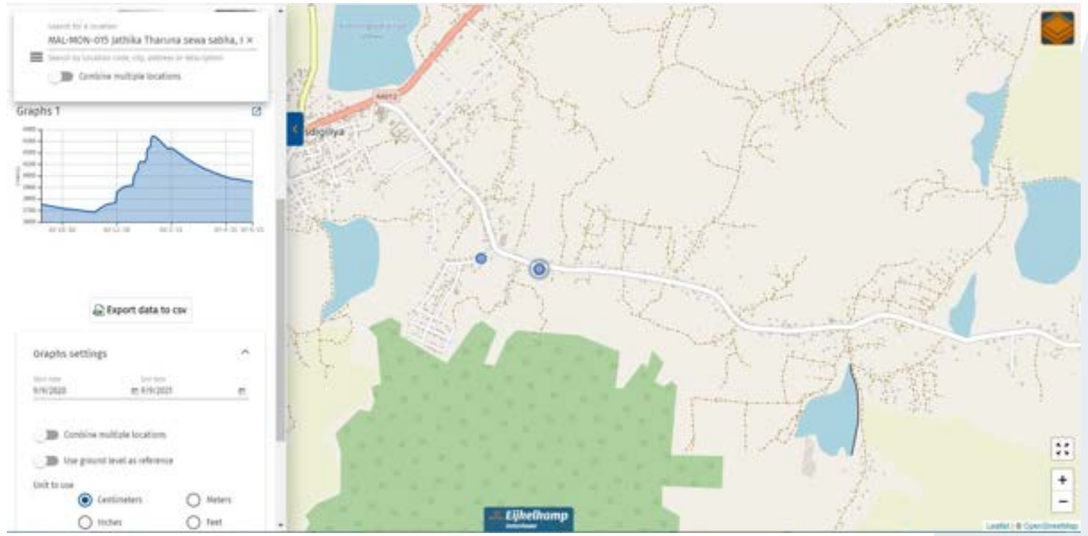
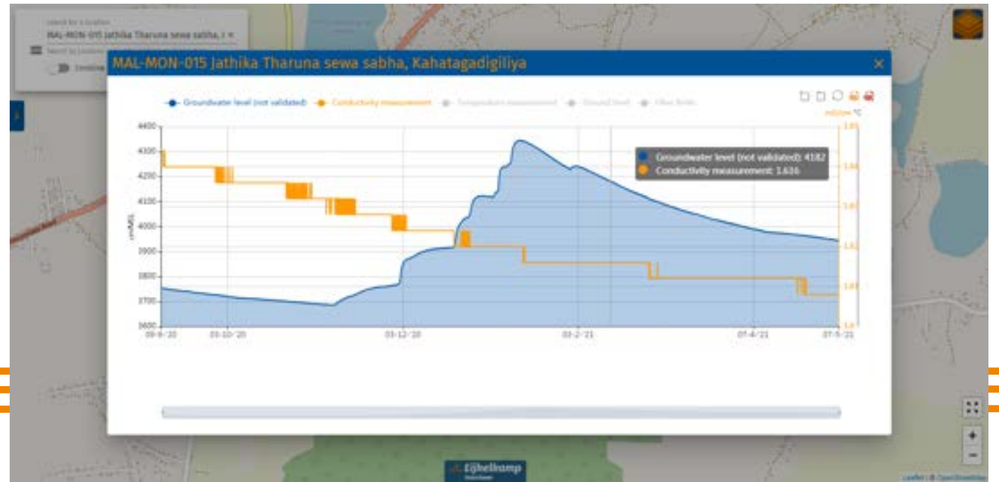
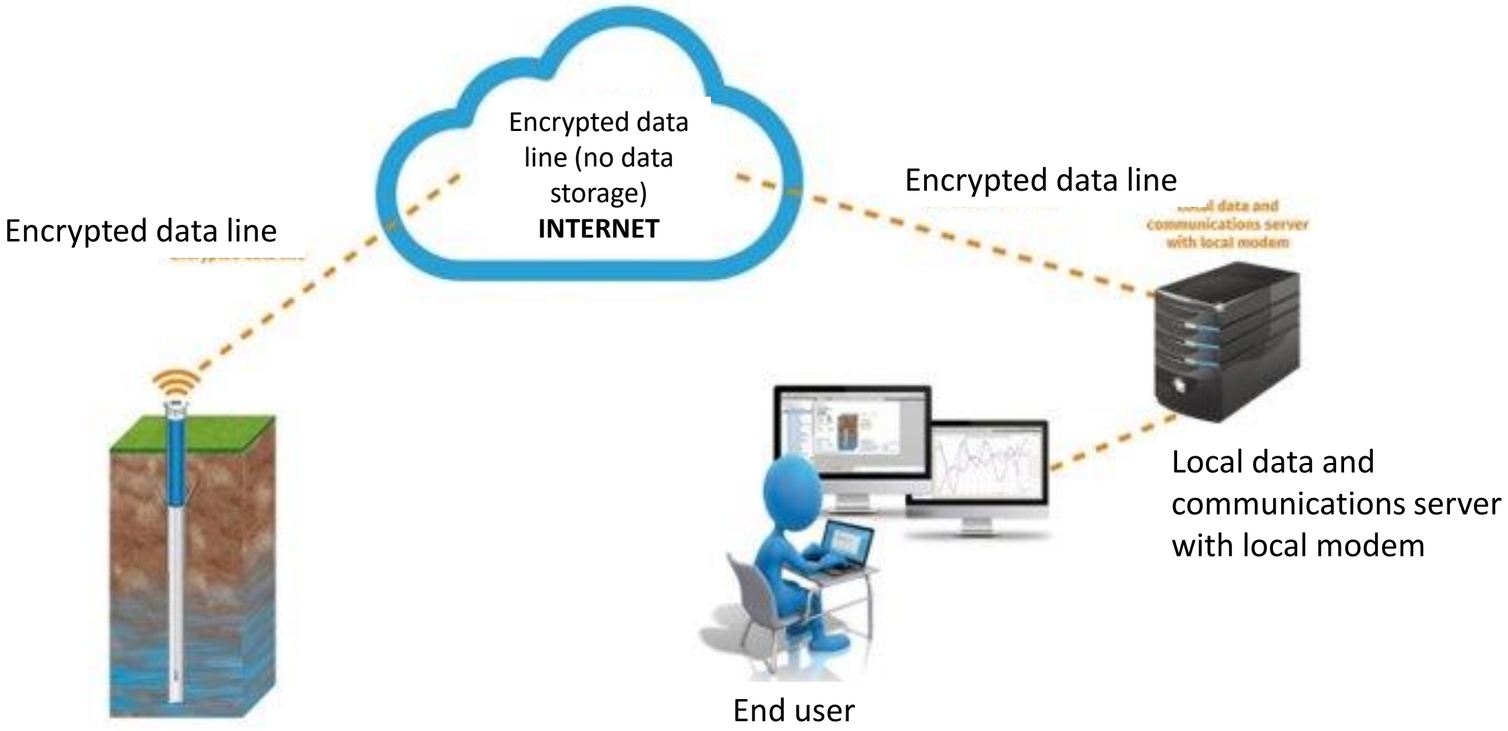
DataViewer by Royal Eijkelkamp







Real time monitoring | Control Room



Monitoring groundwater quality and quantity | DataViewer

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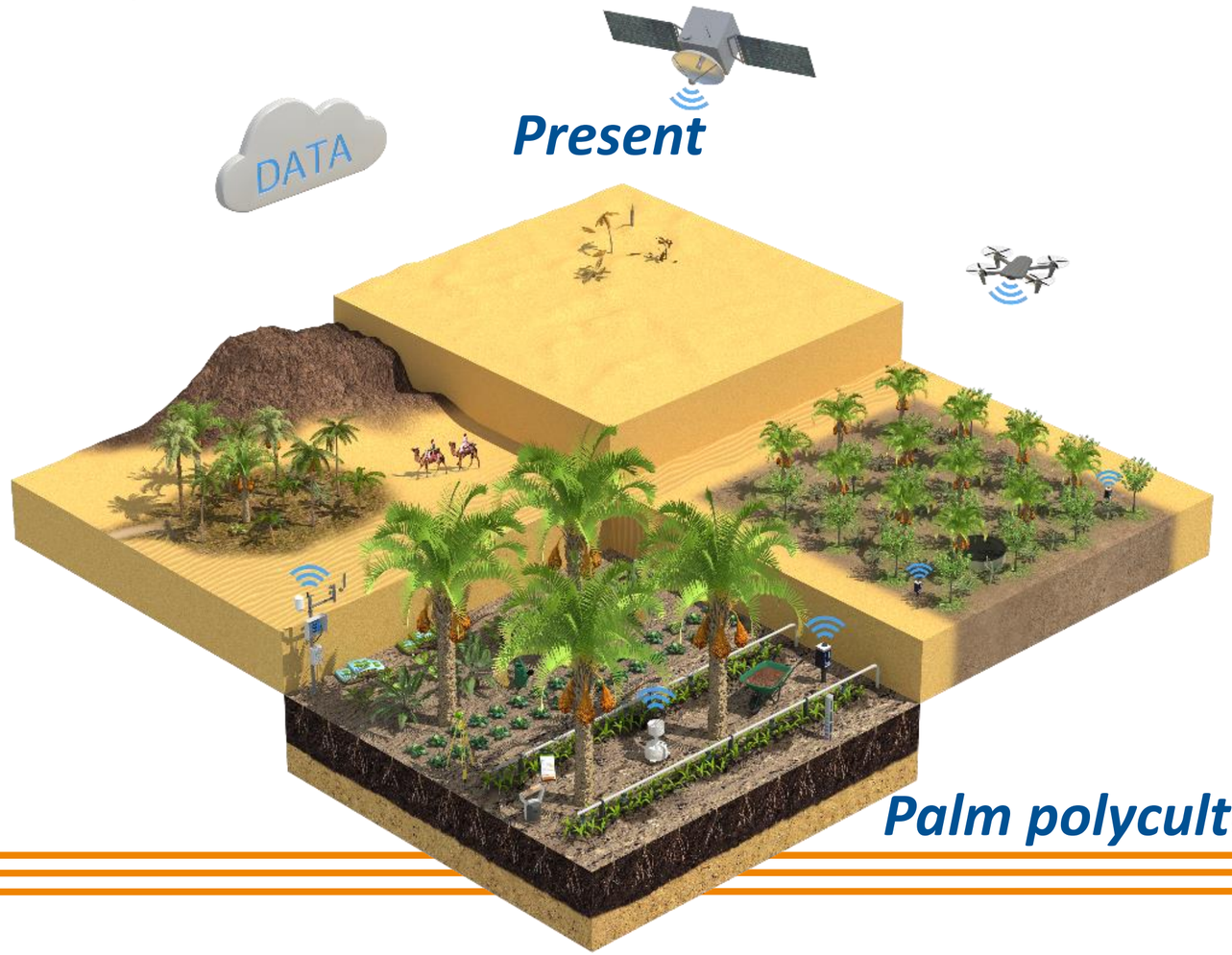
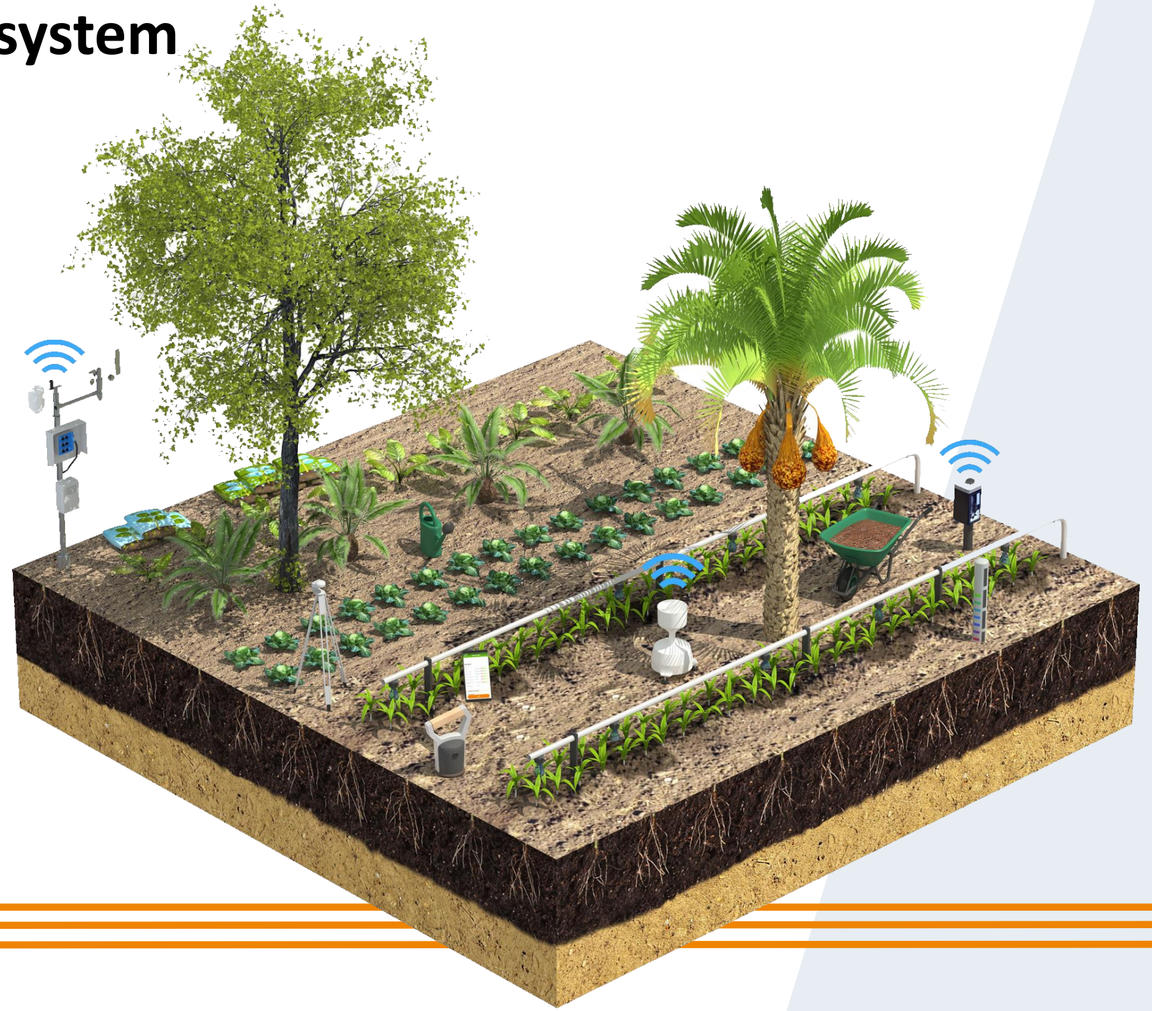
Integrated approach to climate resilient agriculture, food & water nexus, Case Middle East



Case

Gulf region: Integrated approach to climate resilient agriculture and food production built on a comprehensive data management system

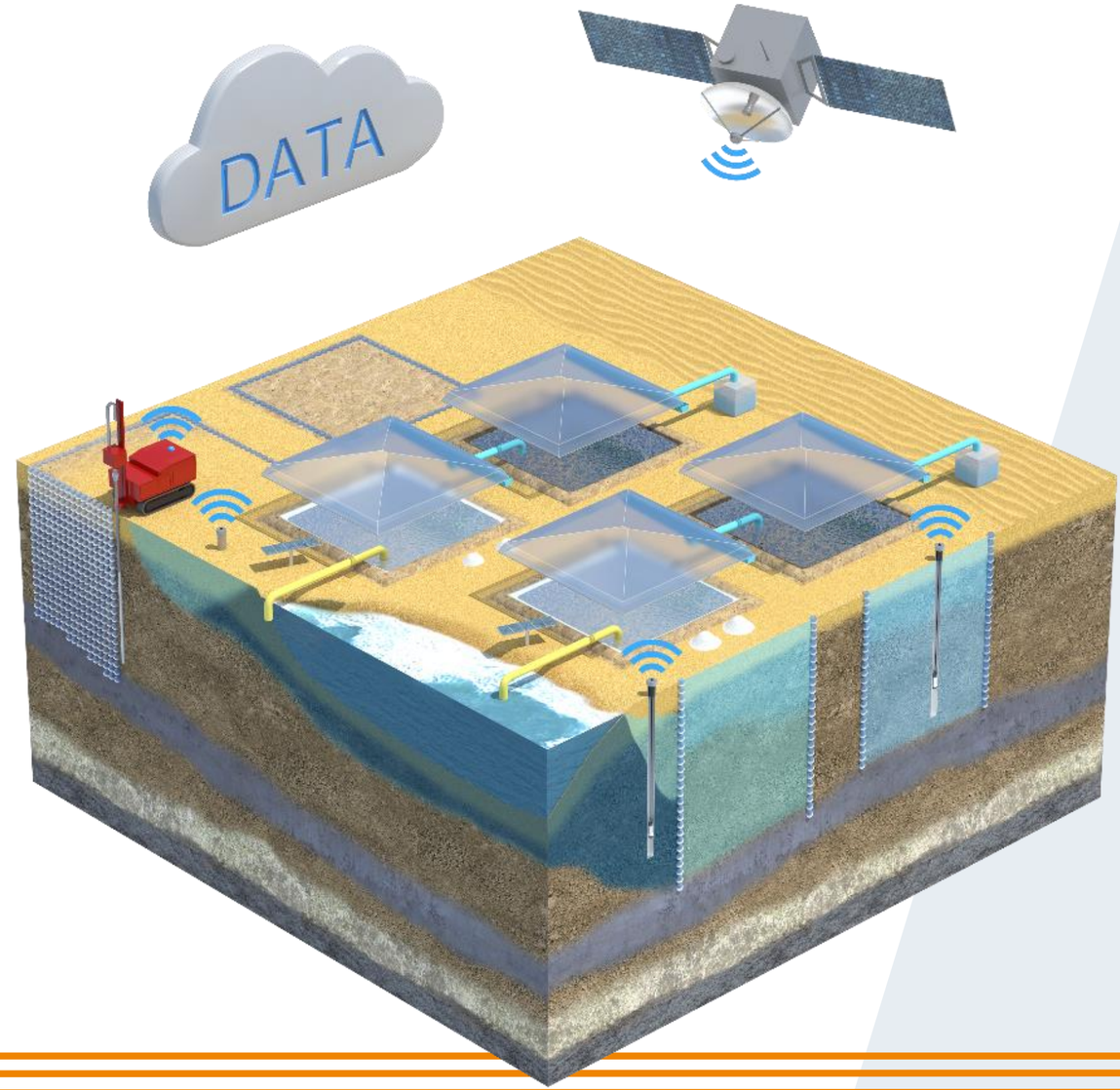
- Soil Health: Endemic trees and restoration of the micro-biology results in re-generated soil structure and fertility without use of chemicals.
- Water Resource Management-Effecient Irrigation System
- In the long term, the area will not only become climate resilient, but has also positive impact on climate change and healthy soil and freshwater balance.



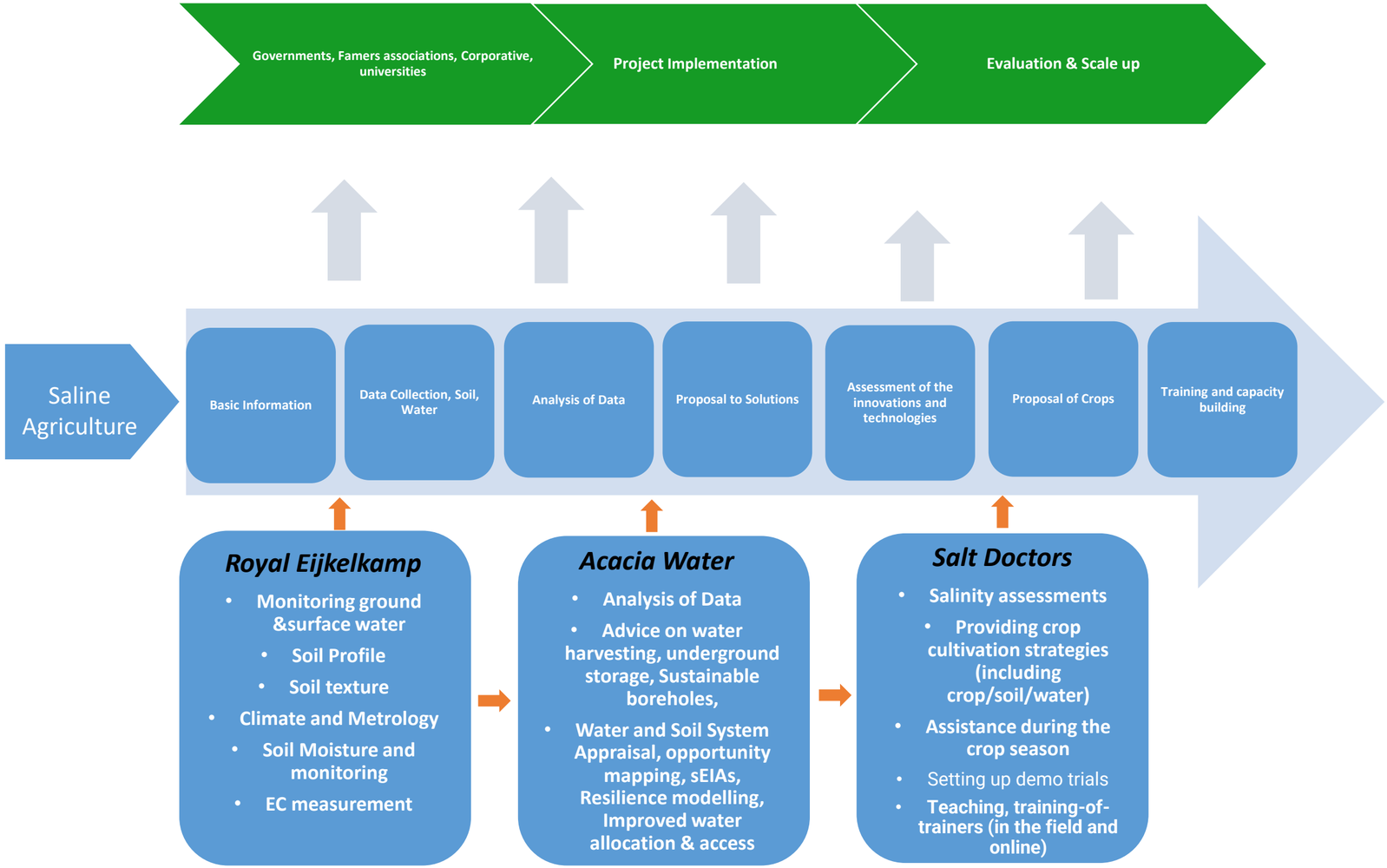
Water Production

Desalination and freshwater storage

- Conversion of seawater into fresh irrigation water through condensation
- Use of ecologically clean waterglass basins, also used for water storage of precipitation
- Restoration of coastal life (e.g. mangroves) will improve biodiversity and water quality



Holistic Value Chain Approach



Conclusions/recommendations: (Business As Usual Is Not An Option)

- Value Chain Approach.
- Food, Water, Job Security nexus.
- Silo thinking is not an option. We can only solve the global water & food challenges in collaboration and partnerships
- We need to translate various studies to concrete projects, solutions and actions. Less talk more actions
- Stop talking about the private sector but engage the privates more
- Scale up the solutions that works and move from pilot to scale

UN 2023 Water Conference

“Uniting the world for water”

The Netherlands and Tajikistan, as co-hosts, and UNDESA with the support of UN-Water as Secretariat of the Conference will strive to make the Conference ***a watershed moment for the world.***

Three Principles:

- **Inclusive**: both in terms of (a) the Conference process (ensure vertical and horizontal inclusiveness) and in terms of (b) the results (leaving no-one behind)

UN accreditation process **deadline** 15 July ’22

- **Action-oriented**: the Conference aims to lead to concrete results through concrete actions and plans on the ground

Water Action Agenda

- **Cross-sectoral**: the Conference should mobilise all other sectors to improve the way they manage and utilize water resources. These sectors need to bring their plans and actions to the Conference.

UN 2023 WATER CONFERENCE
NEW YORK 22-24 MARCH 2023

Ministerie van Buitenlandse Zaken

UN 2023 Water Conference

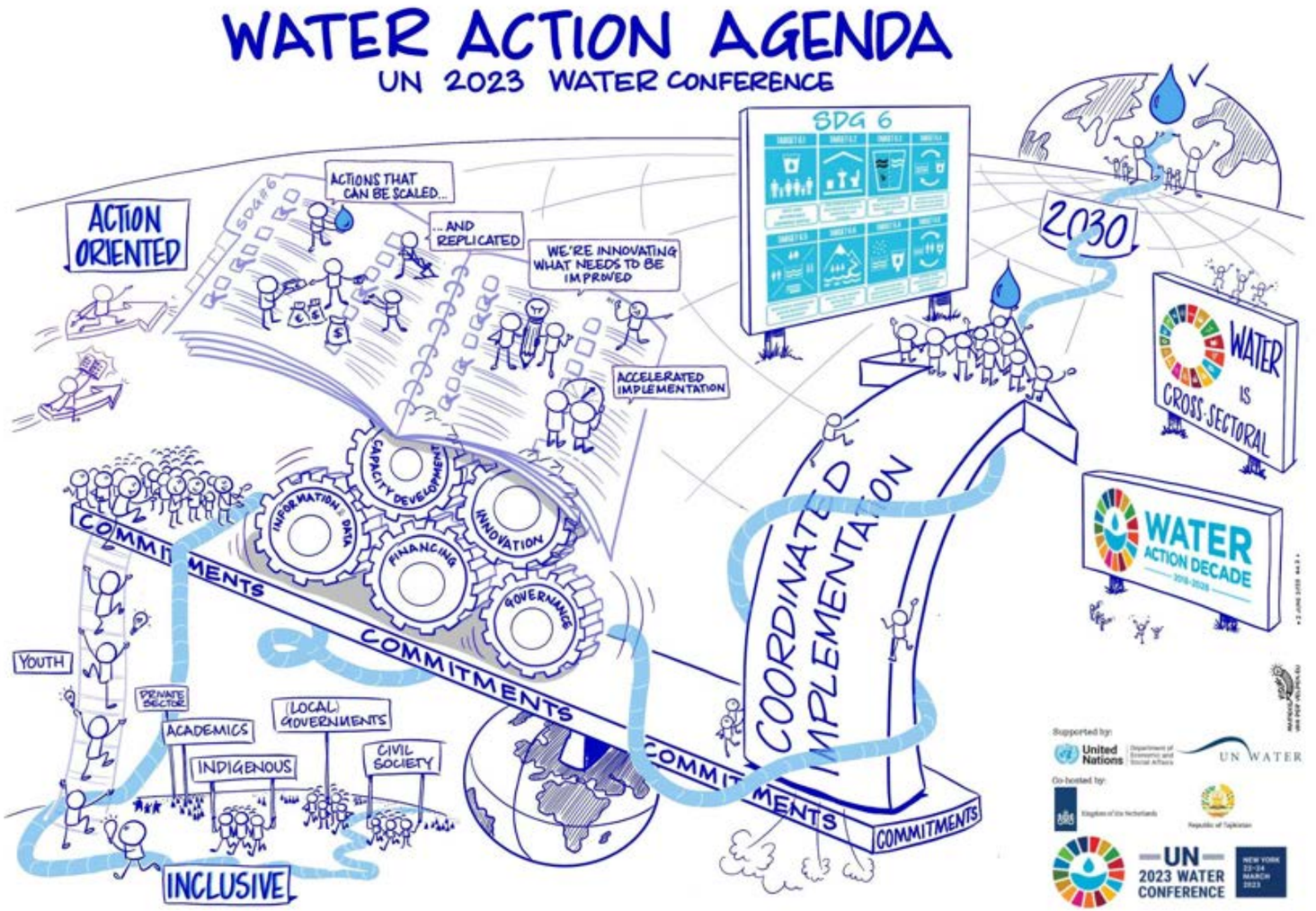
The Conference deliverables

1. **Deliver a summary** of the Conference proceedings
2. **Present a set of voluntary commitments - in a Water Action Agenda -** to get the world back on track:
   - **Scale up and replicate** what works
   - **Discontinue or change** what does not work
   - **Innovate** what needs to be improved
   - **Fund** what merits funding
3. **Roadmap towards 2028 (Decade) and 2030 (SDGs)**
   - Commitments can come through coalitions and partnerships across all of society

UN 2023 WATER CONFERENCE

NEW YORK 22-24 MARCH 2023

Ministerie van Buitenlandse Zaken



UN 2023 WATER CONFERENCE
NEW YORK 22-24 MARCH 2023

Ministerie van Buitenlandse Zaken

Share your stories, ideas and good practices
Commit to water related goals
& **Act** by valuing and managing water better

#UN2023WaterConference

Thank you, let's create a watershed moment by uniting the world for water!

For any questions and follow up please email **UN2023WaterConference @minbuza.nl**

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Any questions?

Thank you for your attention

Rasoul D. Mikkelsen | Director for Strategic Business Development

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PRESENTATION 3

DR. ARJEN DE VOS

Founder and Director

The Salt Doctors

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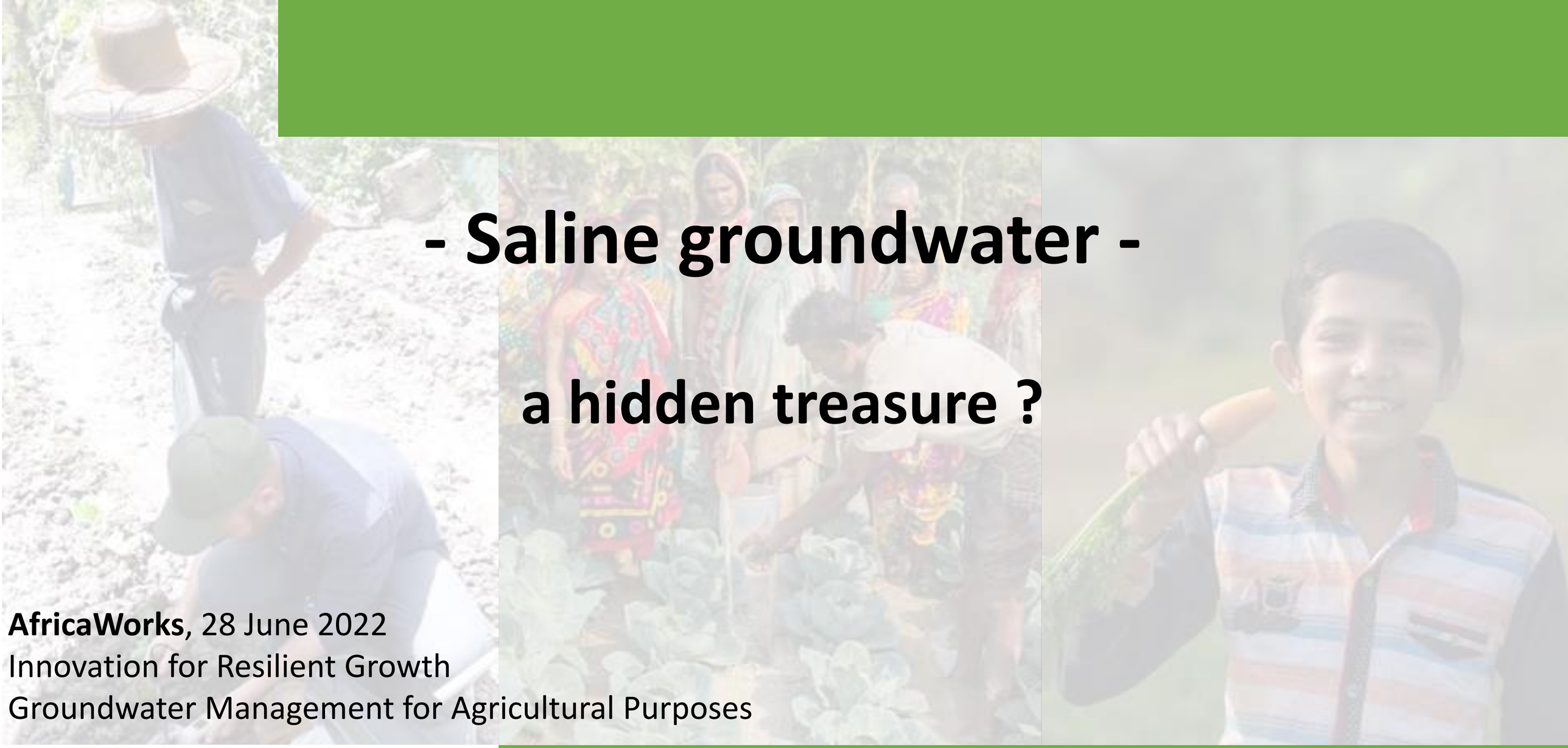


- Saline groundwater -

a hidden treasure ?

AfricaWorks, 28 June 2022
Innovation for Resilient Growth
Groundwater Management for Agricultural Purposes

The Salt Doctors

Dr. Arjen de Vos, Director The Salt Doctors

About us

The Salt Doctors: increase crop yield under saline conditions and put the solutions into the hands of farmers (sustainable solutions, ecological and economic approach)

“knowledge provider”, research and consultancy, independent social enterprise

Key focus:

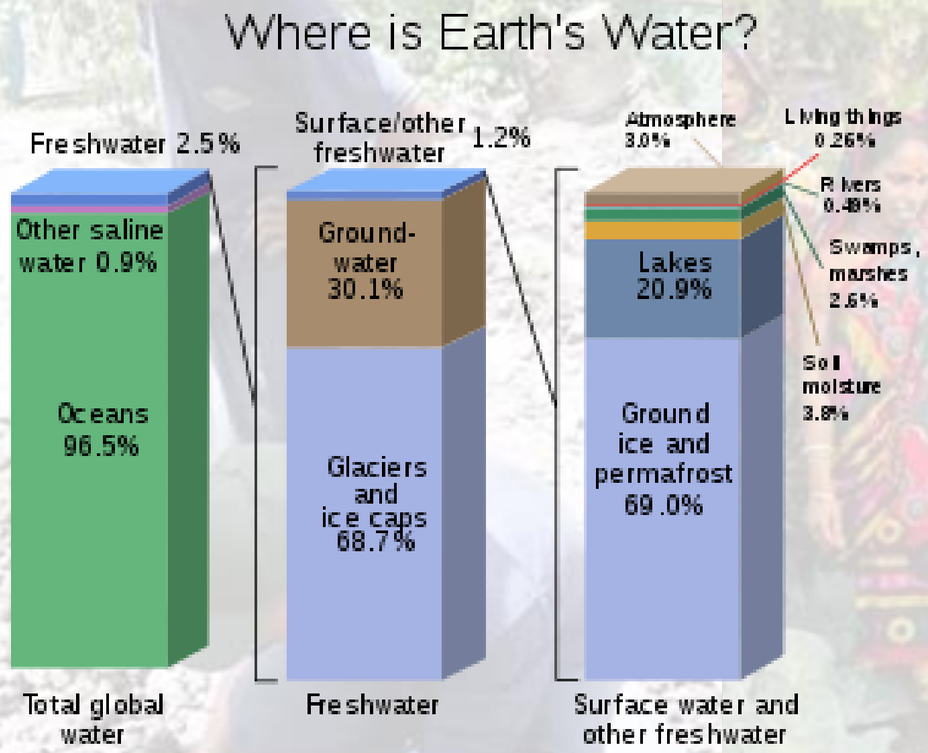
* Salinity assessments and mapping of opportunities
* Research, training (of trainers) and capacity building
* Developing, demonstrating and implementing scalable solutions

The Salt Doctors

“Creating opportunities for salt-affected farmland”

Saline groundwater, a hidden treasure ?

How much is available ?



Source of water	Volume of water in km³ (cu mi)	% total water	% salt water	% fresh water
Oceans	1,338,000,000 (321,000,000)	96.5	99.0	
Ice and snow	24,364,000 (5,845,000)	1.76		69.6
Groundwater	23,400,000 (5,600,000)	1.69		
Saline groundwater	12,870,000 (3,090,000)	0.93	0.95	
Fresh groundwater	10,530,000 (2,530,000)	0.76		30.1
Lakes	176,400 (42,300)	0.013		
Saline lakes	85,400 (20,500)	0.0062	0.0063	
Fresh water lakes	91,000 (22,000)	0.0066		0.26

- there is more saline than fresh groundwater
- saline surface water more or less equal to fresh water

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By using saline (ground) water, it is possible to double the amount of available water for agriculture !

Saline groundwater, a hidden treasure ?

Can you use it ?

Using saline water for irrigation can have a negative effect on:

* soil structure (for soils rich in clay)
    * poor water infiltration
    * poor root development
    * poor workability
* salt concentration of the rootzone (accumulation)
* nutrient availability
* soil microbial community
* crop yield
* ……

The Salt Doctors

using saline (ground) water
only possible with carefull (irrigation) management

Saline groundwater, a hidden treasure ?

Can you use it ?

Using saline water for irrigation can have a negative effect on:

* soil structure (for soils rich in clay)
    * poor water infiltration > use of cover crops, application of gypsum, compost,…
    * poor root development > crop cultivation on raised beds, increase org. matter,…
    * poor workability….> see above, adjusted equipment,…
* salt concentration of the rootzone (accumulation) > controlled leaching and drainage
* nutrient availability > adjusted fertilizer strategy, improve micro-climate
* soil microbial community > compost, manure, biostimulants,…
* crop yield > use of salt tolerant crops
* ……

The Salt Doctors

using saline (ground) water
only possible with carefull (irrigation) management

Saline groundwater, what is “saline” ?

Table 1. General classification of salt-affected soils, based on SAR, EC_e and pH values, and their effect on the soil physical conditions*

Classification	SAR	EC_e (in dS/m)	Soil pH	Soil physical condition
Sodic	> 13	< 4.0	> 8.3	poor
Saline-sodic	> 13	> 4.0	< 8.3	varies
Saline	< 13	> 4.0	< 8.3	normal
High pH	< 13	< 4.0	> 7.8	varies

Table 2. Soil salinity levels and the potential use of various crops

EC_e (dS/m)	Salinity intensity	Potential use of crops
< 4	Slight	Yield of most crops only slightly affected, except for highly sensitive crops
4 - 8	Moderate	Moderate salt tolerant crops are suitable for cultivation
8 - 12	Strong	Salt tolerant varieties of conventional crops still suitable for cultivation
12 -16	Very strong	Limited number of highly tolerant varieties of conventional crops
> 16	Extreme	Only halophytes will produce satisfactorily yields

The Salt Doctors

the actual salinity level and soil conditions also determine the potential use

SaltFarm Texel
Tested on Texel

What can we do with moderate/strong salinity levels?

56 plots: 7 different salt concentrations, 8 repetitions, 1 hectare plot…..

8 years (2012-2019) of **Research and Development** in The Netherlands, 800 varieties of 50 different crops tested, t**olerant varieties found** of potato, carrot, cauliflower, beets, cabbage

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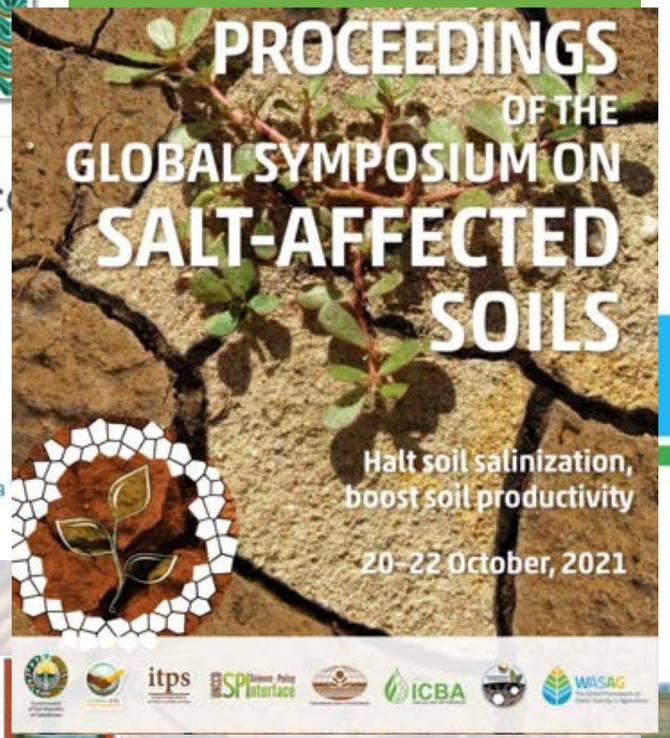
salt tolerant varieties of conventional crops have been identified

Agricultural Water Management
Volume 252, 30 June 2021, 106902

Estimating cultivar-specific salt tolerance model parameters from multi-annual field tests for identification of salt tolerant potato cultivars

G. van Straten [a], B. Bruning [b, 1], A.C. de Vos [b, 1], A. Parra González [b, 2], J. Rozema [c], P.M. van Bodegom [d]



SaltFarm Texel
Tested on Texel

Crop salt tolerance

under controlled field conditions in The Netherlands, based on trials conducted by Salt Farm Texel

Journal of Arid Environments
Volume 203, August 2022, 104775

Saline soils worldwide: Identifying the most promising areas for saline agriculture

Katarzyna Negacz [a], Žiga Malek [a], Arjen de Vos [b], Pier Vellinga [a]

An economic analysis of the yield of eight varieties of potato grown under saline conditions

Bas Bruning[1], Corne Lugtenburg[2], Nada Elbedawy[3], Arjen de Vos[1]

Agricultural Water Management
Volume 213, 1 March 2019, Pages 375-387

An improved methodology to evaluate crop salt tolerance from field trials

G. van Straten [a], A.C. de Vos [b], J. Rozema [c], B. Bruning [d], P.M. van Bodegom [e]

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Implementation

Potato: Implementation **Pakistan** 2016-2017

Result: 42% yield increase under moderate saline conditions, compared to the local variety (ECe around 8 dS/m, 10 ha total)

Egypt 2020-2021

Result: 32 ton/ha,
ECe 5-6 dS/m

SECURING WATER FOR FOOD: A GRAND CHALLENGE FOR DEVELOPMENT

JAFFER

SaltFarm Texel

META META

SEKEM Sustainable Development since 1977

Delphy

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some results

Using saline water, example Kenya

Spinach beet and cabbage cultivation

EC irrigation water 3.8-10.7 dS/m,
drip and flood irrigation,
sandy clay,

EC soil 13.3-7.6 dS/m
(ensure water harvesting during wet season)

yield: 10-13 tons/ha spinach beet
32-50 tons/ha cabbage

October 5, 2020	source	pH	EC	Na	Ca	K	Mg	SAR
			dS/m	ppm	ppm	ppm	ppm	
F1	borehole	6.6	6.9	662	416	21	263	6
F4	river	7.9	10.7	1620	234	28	235	18
F6-R	river	8.1	3.8	518	231	36	116	7
F6-W	shallow well	7.2	8.5	1240	484	58	327	11

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understand the system > work towards solutions

Using saline water, example Iraq

Potato cultivation around Basrah

EC irrigation water 6.3 dS/m,
drip irrigation,
loamy sand,

EC soil 10.9 (start) > 7.3 dS/m (end)
(leaching)

mulch treatment yield +29%
(reduce evaporation…)

yield: 24-60 tons/ha….

The Salt Doctors

understand the system > work towards solutions

Using saline water, example Morocco

Date palm cultivation around Erfoud

EC irrigation water 14.6 dS/m,
drip irrigation,
loamy soil

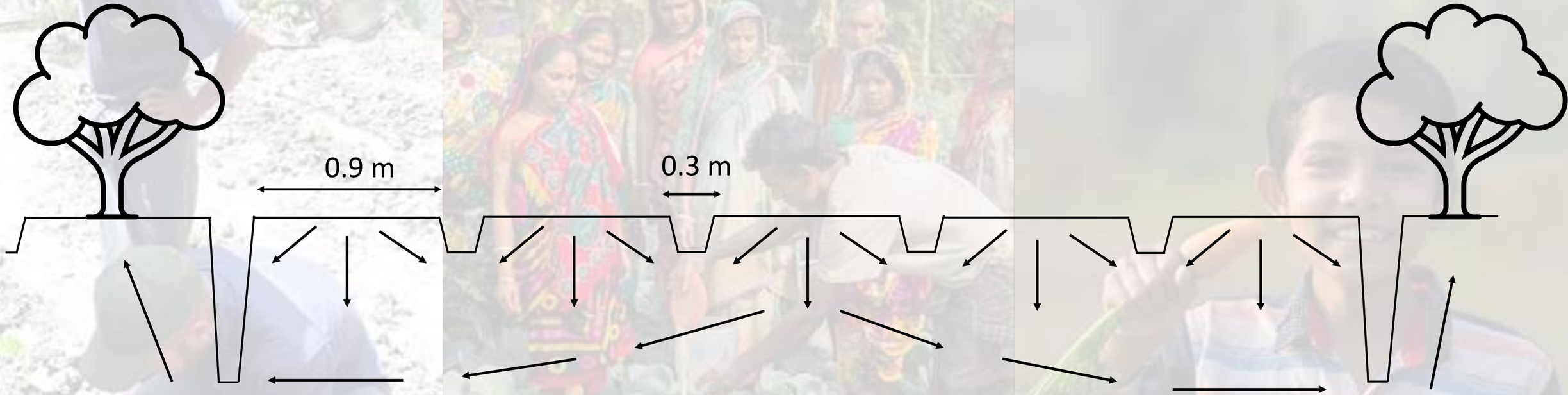
EC irrigation water 9.0 dS/m
flood irrigation
use of intercropping (alfalfa)

intercropping / cover crops > reduced evaporation, improve water infiltration, increase org. matter, extra revenue,…

The Salt Doctors

understand the system > work towards solutions

Controlled leaching and drainage to prevent salt accumultation rootzone



Use deep trenches for drainage (of saline water)

Plant salt tolerant trees and shrubs “to close the cycle”?

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but what about leaching fraction?
prevent (further) salinization of groundwater….

Integrated solutions: agro-forestry > acting as wind breaker (stop sand movement), provide additional income, bio-drainage,…

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Example agro-forestry with Sesbania sesban

(Fayoum, Egypt, soil salinity = 12 dS/m, clay soil)…

Hydroponics
open-field, low-tech, high profit (?)

The Salt Doctors

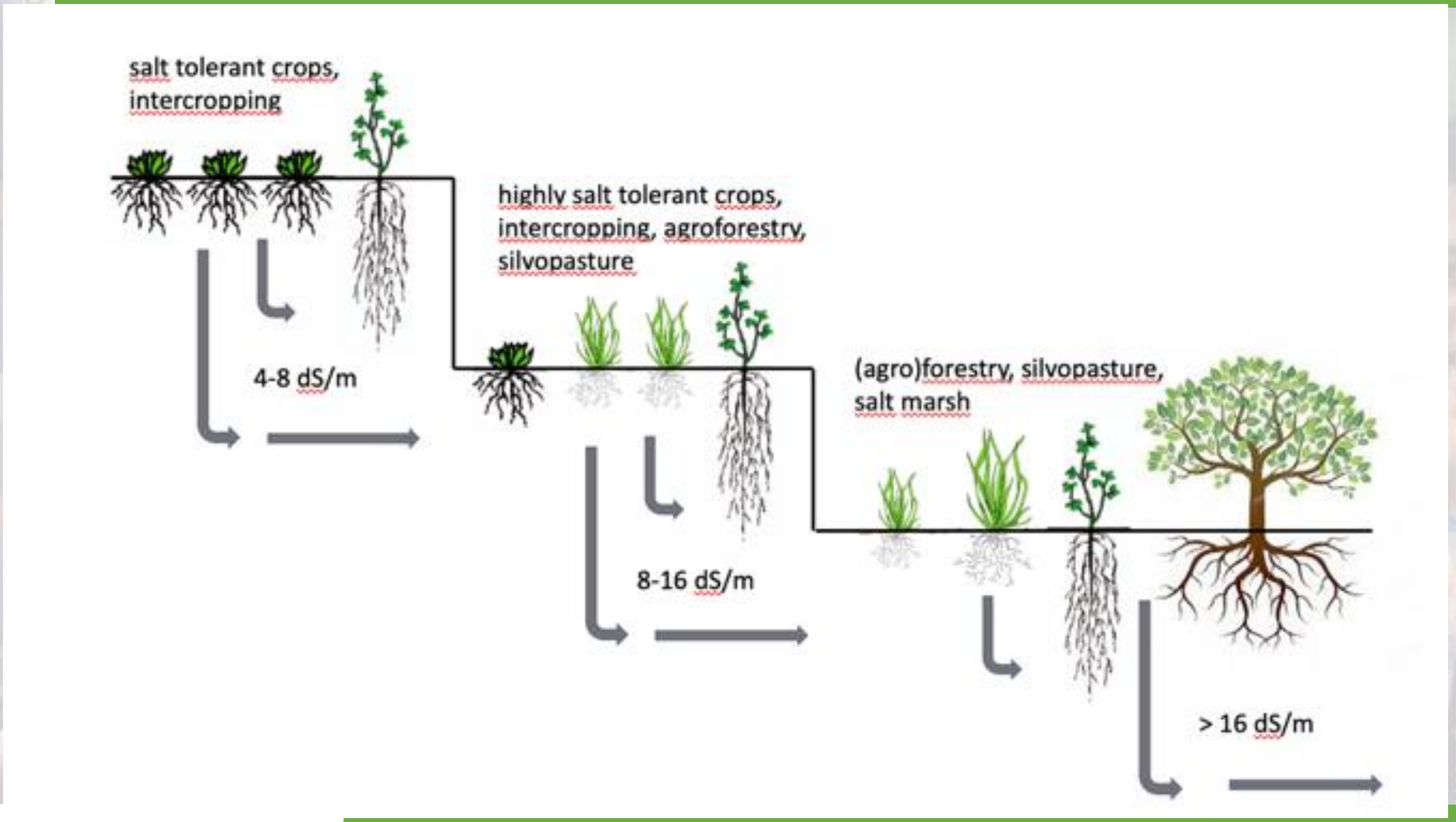
for water-scarce conditions, using saline water
example Tunisia

Hydroponics
open-field, low-tech, high profit (?)

The Salt Doctors

use saline water or reject brine for crop production…

(conventional) salt tolerant crop, new crops, cover crops, intercropping, agro-forestry, fodder/silvopasture, halophytes



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integrated, nature-based solutions for crop/soil/water at field/farm/landscape scale

Summary

- Saline water sources have the potential to double the amount of water available for agriculture
- there are possibilities for using saline resources, but carefull management is needed
- many farmers are already using saline water for irrigation, no other option
- solutions should be tailor-made to the local conditions, needs and (market) opportunities
- ensure a sustainable, integrated approach (soil fertility and salt accumulation topsoil vs deeper layers, farm level – regional level, ecosystem view,…)

The Salt Doctors

For more info:
Arjen de Vos, arjen@thesaltdoctors.com

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THANK YOU FOR YOUR ATTENTION

DO YOU HAVE ANY QUESTIONS?

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