



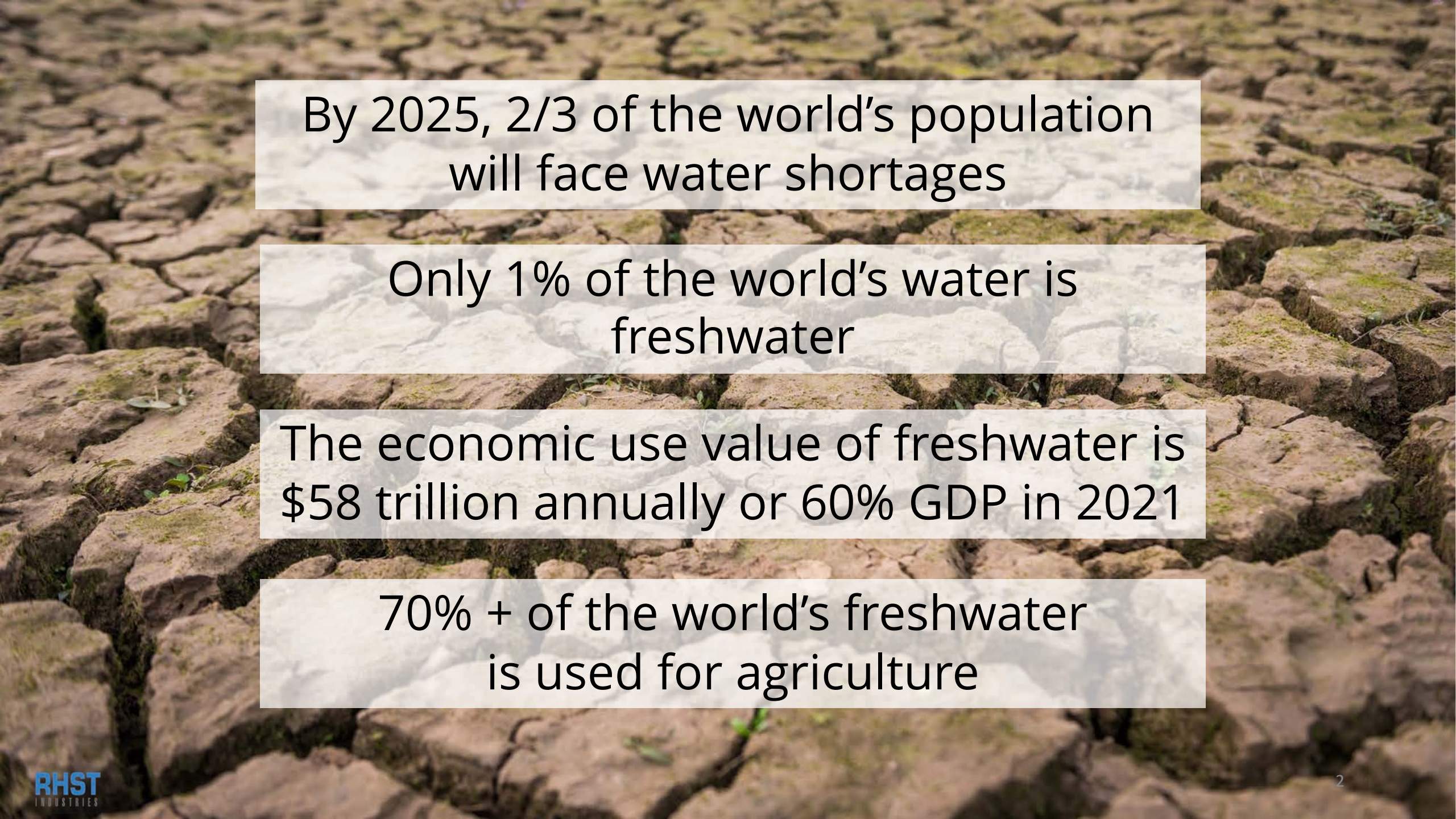
EVAPORATION CONTROL SOLUTION

**REDUCE EVAPORATION
LOSS BY MORE THAN 80%**

**ORGANIC, INERT
NATURE-BASED SOLUTION**

**ECONOMICAL
LONG TERM**

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By 2025, 2/3 of the world's population
will face water shortages

Only 1% of the world's water is
freshwater

The economic use value of freshwater is
\$58 trillion annually or 60% GDP in 2021

70% + of the world's freshwater
is used for agriculture

The Problem

WATER is at the heart of food production

Climate change & food autonomy needs are leading to:

- 80% of global cropland are currently under threat of water scarcity
- Worsening global water availability is **further** degrading future water scarcity scenarios
- Needs for food production in water scarce regions, like arid lands are growing
- Arid and semi-arid regions needs to change the export of virtual water in the form of agricultural products.
- Water use efficiency in agriculture, needs to improve if we are to survive.

An aerial photograph of a large-scale palm tree plantation in a desert environment. The palm trees are densely packed in rows, stretching towards the horizon. The ground is sandy and light-colored. In the far distance, a flat desert landscape with some low-lying vegetation and a few small structures is visible under a clear sky.

Challenges

Freshwater Cost & Supply
Water Resilient Agriculture
Evaporation Loss
Salt Intrusion



WaterPearls, a Breakthrough Innovation in Water Conservation

In agriculture, WaterPearls™ :

- Create a barrier that restricts moisture evaporation from the soil **by up to 80%**
- Create a moisture-filled and healthy environment for plant roots
- Provides a permeable barrier for air and water to flow into the soil, improving soil health and nutrient use efficiency while avoiding weed growth

Environmental and economic benefits include:

- Reduce volume of freshwater required for irrigation by **up to 60% instantly**
- Reduce energy consumed for desalination and pumping
- Improve yield thanks to reduced plant stress
- Inert and 100% UV biodegradable



How does it work

Date palm trees

WaterPearls nature-based solution is specifically designed to reduce the loss of water due to evaporation.

1. WaterPearlstm are inserted in 45cm x 100cm mesh mats
2. WaterPearlstm mats are installed directly on the soil
3. Drip irrigation system is installed over it
4. Workers can walk on it with no problems

Almost maintenance-free:

- only need to flip the mats every 12 years
- Replace mats' mesh every 25 years
- WaterPearls lifespan is 50 years



1



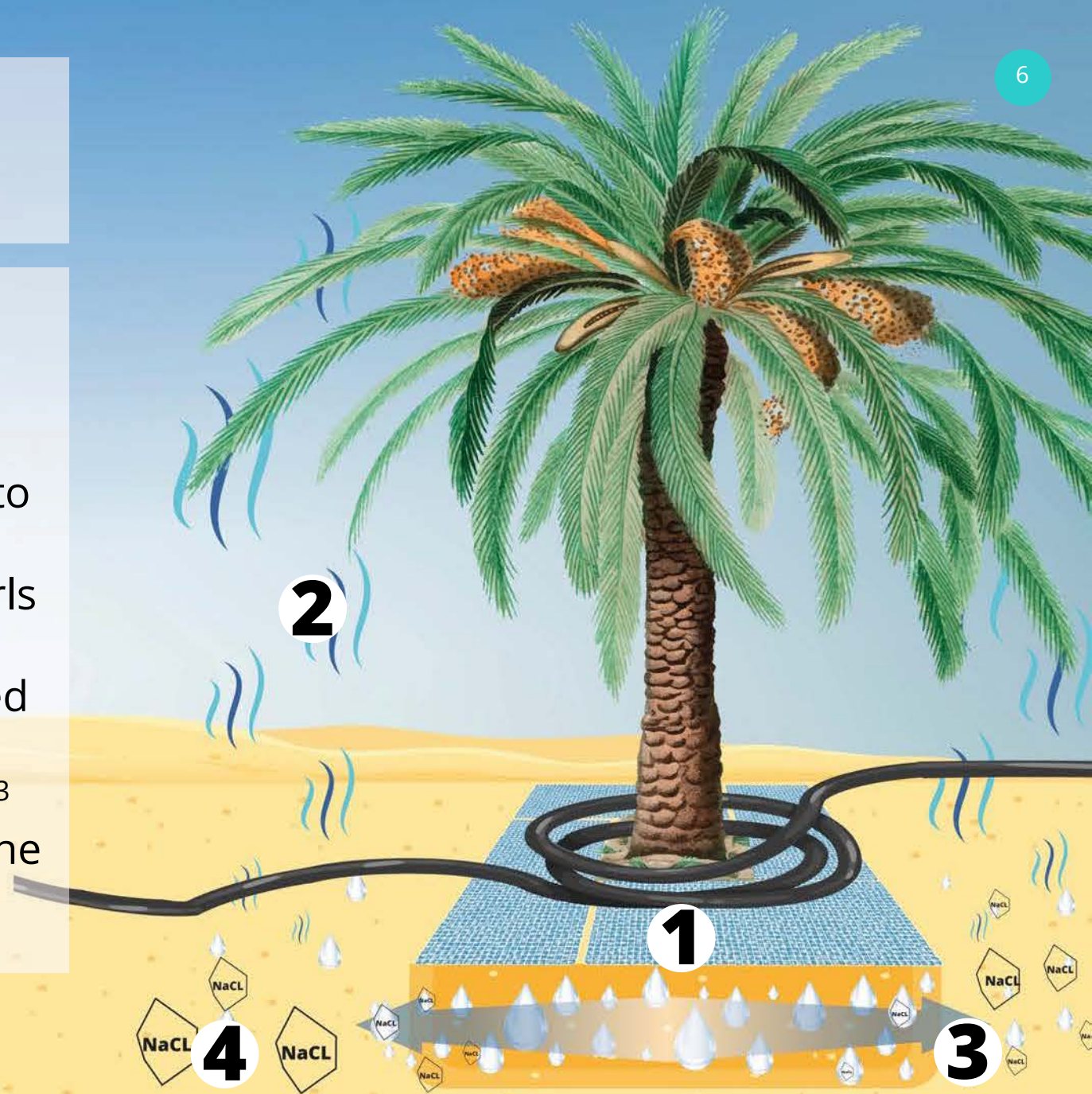
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3

Salt exfiltration

Salt is extracted from the root zone, in a process which is called ex-filtration. The process operates by the movement of concentrations from higher concentrations to lower concentrations which is the result of a humid root zone¹ covered by the water pearls which prevents evaporation and the sand external to the root zone which is being dried because of the evaporation at the surface² which is drawing water and salt via capillary³ suction to end up with a deposit of salt⁴ at the perimeter of the water pearl covered zone.



Livestock integration

SUB-SURFACE INSTALLATION

1- Installed under a layer of sand, WaterPearl mats create a moist substrate allowing for the germination of grass

2- Animals like sheep and goats can graze In the date farm

3- Animal manure fertilizes the soil to increase organic matter in the soil and improve date production capacity



Practical Application in Date Palm Trees

From Seedling to Sapling to Farm

Date Palm seedlings
with Water Pearls



Date Palm Saplings
with Water Pearls



Date Palm Saplings in Nursery ready
for transplanting in farm

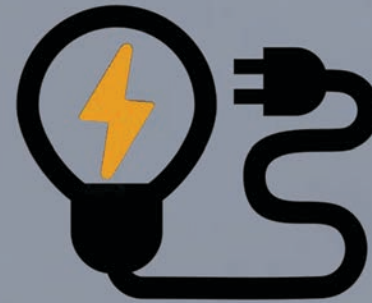


Yearly Impacts

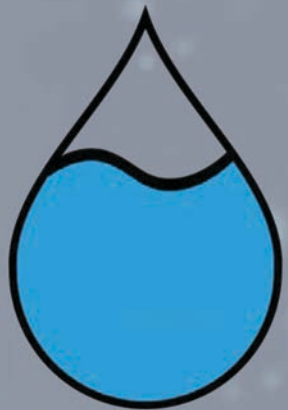
on 50 acres (typical farm)



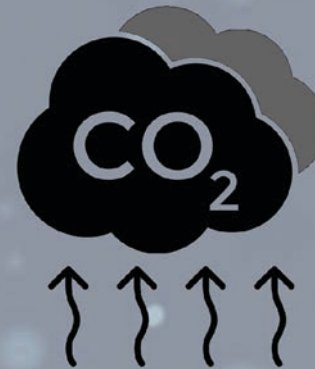
10 tons



100,000 kwh



216K tons



41 ton CO₂e

Impacts

on 50 acres (typical farm)

	WaterPearls
Investment	2 700 000\$
Gross Benefit post Payback Over 50 years period	18 000 000\$ - 35 000 000\$
ROI	10% - 16%

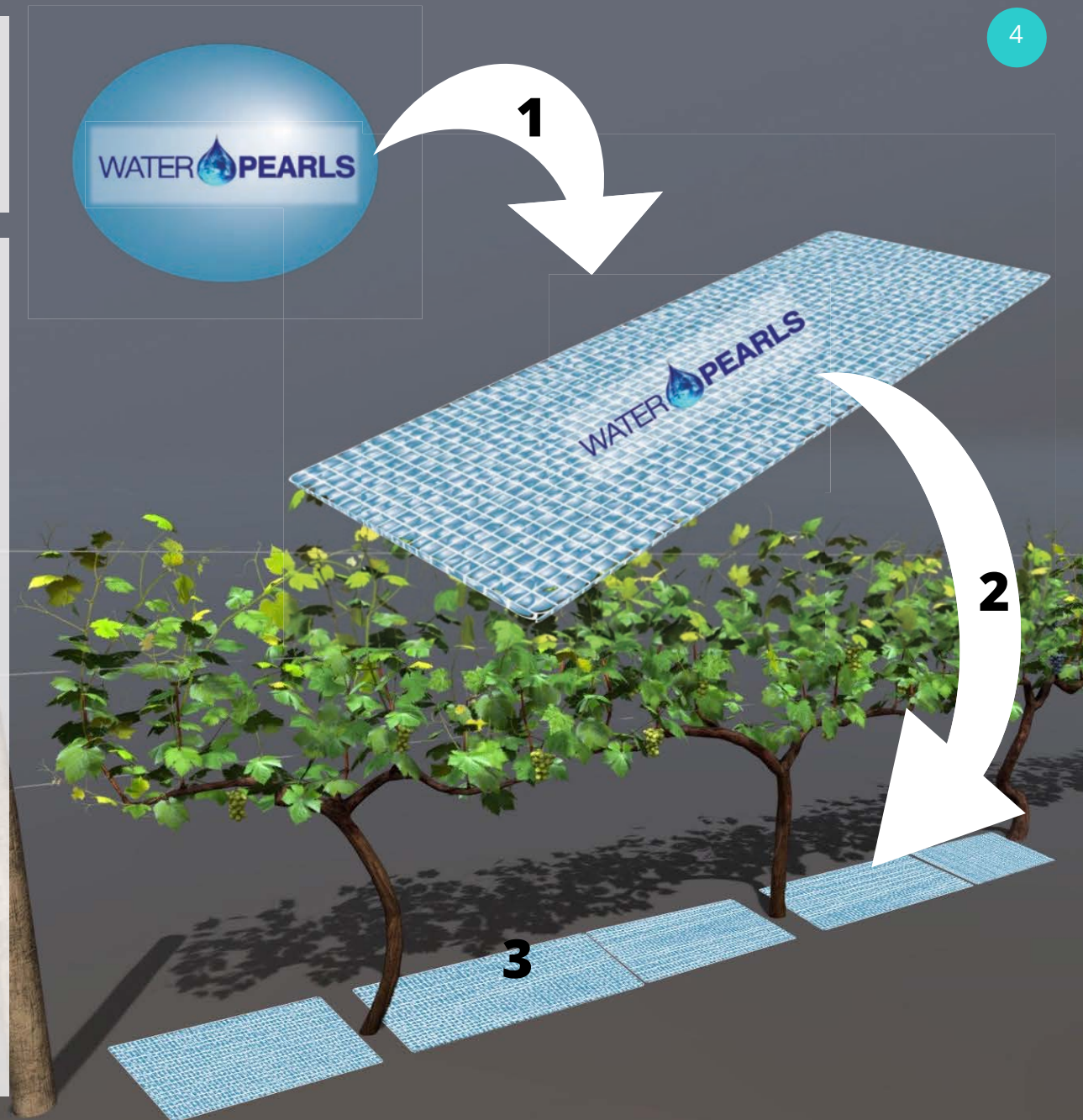
How does it work in a Vineyard

WaterPearls nature-based solution is specifically designed to reduce the loss of water due to evaporation.

1. WaterPearls™ are inserted in 45cm x 100cm mesh mats
2. WaterPearls™ mats are installed directly on the soil
3. Drip irrigation system work as usual
4. Workers can walk on it with no problems

Almost maintenance-free:

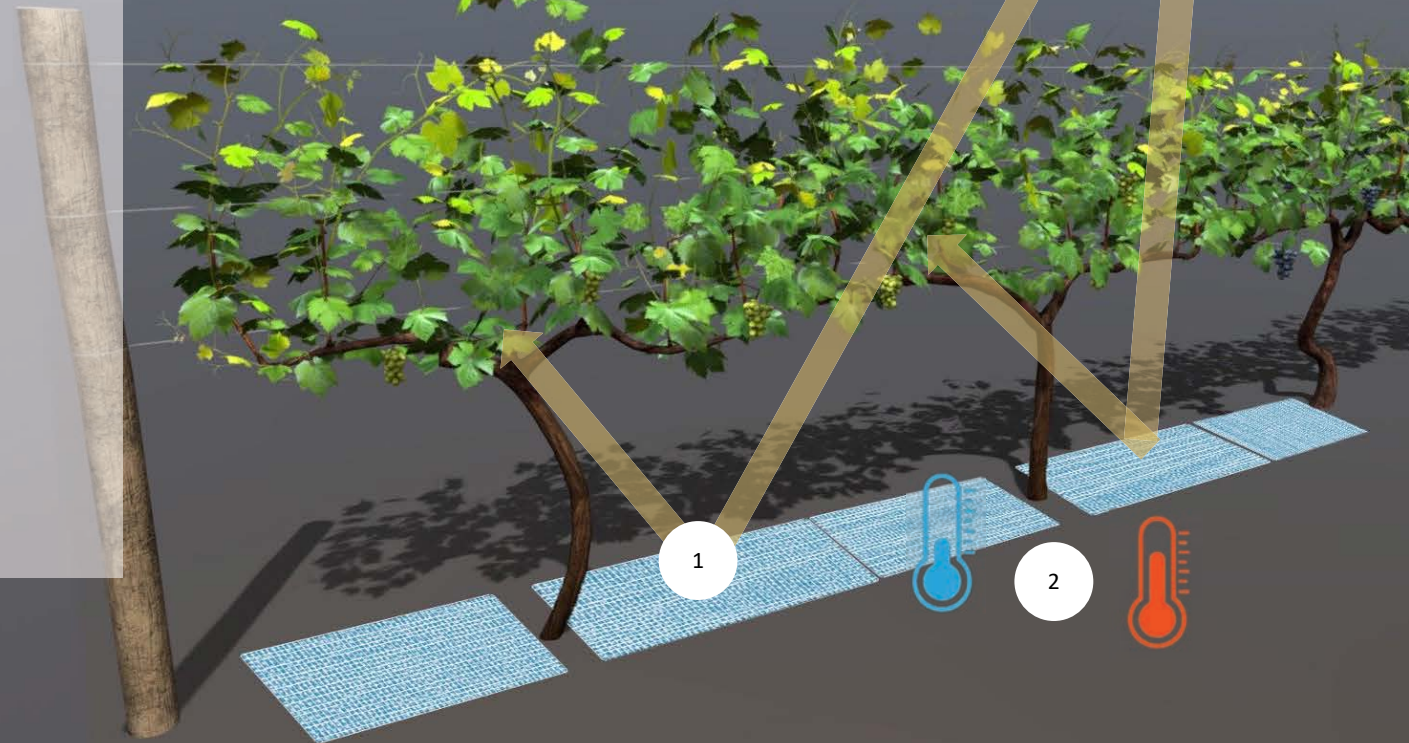
- only need to flip the mats every 12 years
- Replace mats' mesh every 25 years
- WaterPearls lifespan is 50 years



Sun ray reflections

WaterPearl panels increase the surface albedo to reflect sunlight to the leaves under canopy

1. Increases photosynthetic flux density in foliage
 - Increase carbohydrates produced
 - Reduces leaf trimming operations
 - Increases crop yield
2. Reduces soil heat absorption
 - Alters radiative signature of farm





Case Study I – Practical Application in Vineyards

Study done with McGill University, Canada, Mu'tah University, Jordan and Philadelphia University, Jordan

Two crops of grape vines planted: with and without Water Pearls covered with topsoil of sandy gravel for grazing goats



2015

Vine planted with WaterPearls thrive and bear fruit

Vine planted without WaterPearls are alive, but no fruit and minimal growth



2020





Proposed approach for Vineyards

The most cost effective and efficient model reducing marginal cost (cost per unit produced) and achieving maximum productivity with minimum loss of non beneficial water.

	WaterPearls	Vine coverage	Hectares coverage	Annual water saved Estimated for California
WaterPearl	1	1/8000	1/26670000	0.37 liters
Pilot project	9 tons	10000 vines	3 hectares	29 million liters
Scale up	1000 tons	1 100 000 trees	330 hectares	3,218 million liters

How does it work for nut - fruit trees

1. WaterPearls are inserted in mesh mats
2. WaterPearls mats are installed directly on the soil, allowing air and water to infiltrate the soil
3. Drip - sprinkler irrigation system is installed over it, facilitating maintenance
4. Workers can walk on it with ease
5. Increased surface albedo improves yield
6. Stable nutrient concentration in pore water for ease of uptake by plant roots. No abiotic stress



Almond Farm Trial - Woodland California

- Installation of field sensors with Water Pearls mats
- Water Moisture sensors (GroPoint_{TM} Multi Segment 6" intervals over 48" length)
- Collaborators –





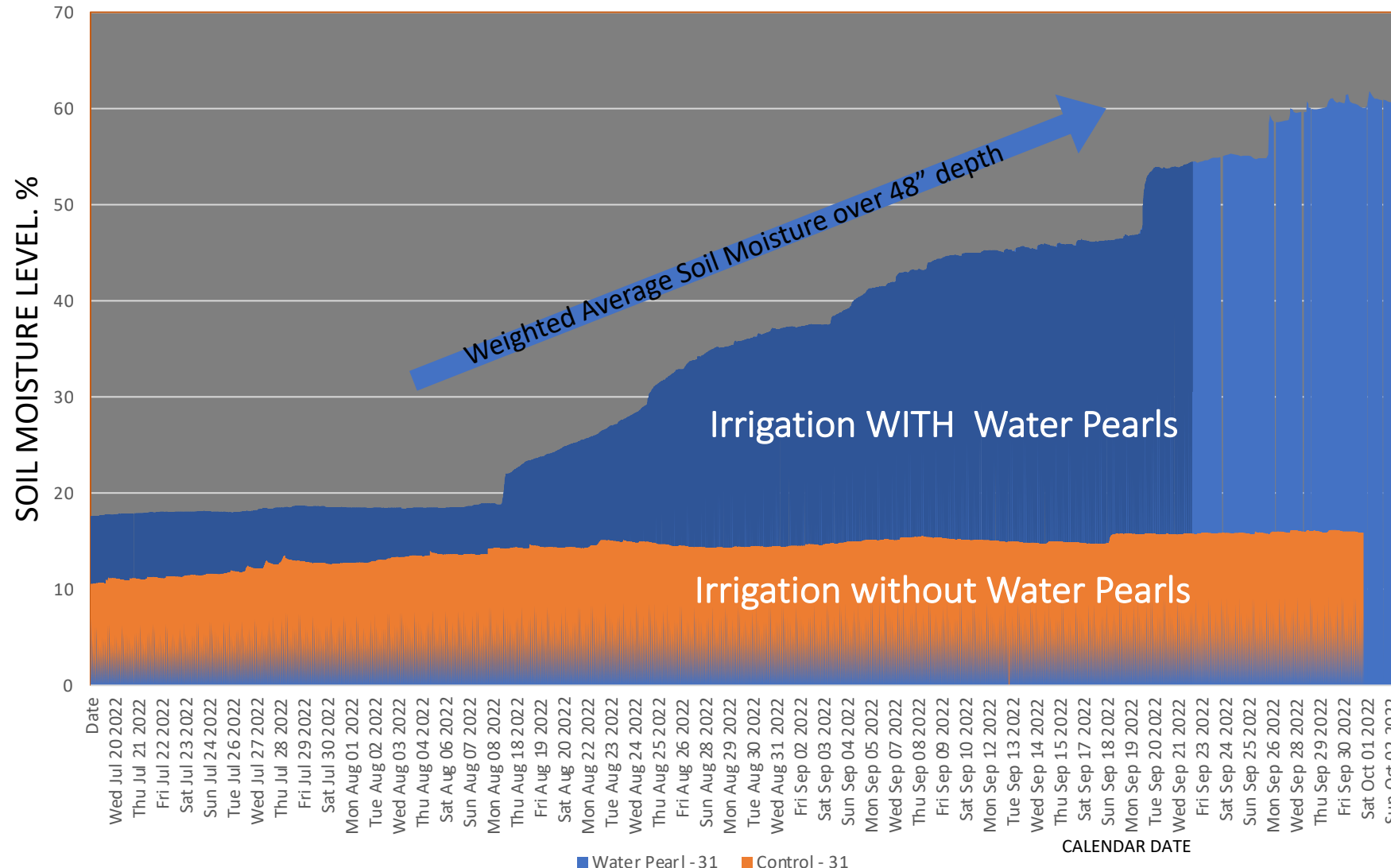
Case Study II – Practical Application in Almond Orchards

Almond farm project in Woodland, California



WaterPearls are inserted into HDPE mesh envelopes (mats) which are then laid on the ground surface. In this fashion, the reflection of the light off the mats, improves the light intensity for photosynthesis under the leaf canopy. It also avoids weed growth, and provides a dry bed for almond husks to dry out at harvest

Weighted Average Soil Moisture Profile - Water Pearls vs Business As Usual



Soil Moisture conserved from avoided evaporation

- Recharges moisture levels to maximum infiltration capacity in 3.5 months

- 3 X times more water stored underground

- Significantly reduces irrigation needs over time

Proposed approach for Almond farms

The most cost effective and efficient model reducing marginal cost (cost per unit produced) and achieving maximum productivity with minimum loss of non beneficial water.

	WaterPearls	Cost	Tree coverage	Hectares coverage	Annual water saved Estimated for California
WaterPearl	1	\$0.01	1/30000	1/8,316,000	1 liters
Pilot project	8 tons	\$289,000	1056 trees	4 hectares	33.3 million liters
Scale up	1000 tons	\$41,255,000	150 850 trees	571 hectares	4,758 million liters

Citrus



Accelerating growth in the nursery
6 month cycle – 3 growth spurts



Reducing
non-beneficial water
lost to evaporation



Healthy & Resilient crops

Improved Berry Production



- Climate Resilient,
- Lower Water Footprint,
- No Weeding, less labour intensive practices
- No Abiotic Stress
- Nutrient Use Efficiency Increased





Impact

Increase water supply by improving the AG water use efficiency

- The simplest and cheapest solution is conservation, to inhibit evaporation with Water Pearls and thereby conserve water in the ground for harvesting

Storage of water in the ground, results in improving soil health.

- To enable immediate ground infiltration for subsurface storage
- Avoid the “Birch Effect” soil respiration emitting CO₂ in cyclical drying-rewetting
- Avoid loss of Soil Organic Carbon

Reservoir surface evaporation reduced

- Eliminate water loss and prevent heat buildup in soil



Why the need to change?

Having water doesn't make you rich if you're giving it away for free to grow food

- California resolution 2024, "Making Conservation the California Way of Life" recognizes the importance in safeguarding water resources.

Water Conservation

- Makes water more affordable by avoiding the need for more expensive supplies
- Central Valley of California grows approximately 50% of U.S. fruits, nuts and vegetables.
- As much as 50% of water applied outdoors is lost due to evaporation and is non-productive.
- Conserving water can reduce energy use, which reduces greenhouse gas emissions and other co-emitted air pollutants.

Sustainability

- Future generations must not be deprived of sufficient water



Valuing water for the economy

- **Water Footprint** of produce is exceedingly high because of unproductive irrigation water that is consumed by evaporation.
- In semi-arid countries, exported produce is the equivalent of **virtual bulk water export**.
- RHST “**WaterPearls**” eliminates water evaporation losses.
- You only need water for plant **leaf transpiration**.

Results

- Reduce evaporation loss by 77% to 98%,
- It increases nutrient use efficiency by retaining dissolved nutrients in the soil pore water, thereby reducing nutrient runoff, enabling farmers to purchase less nutrients,
- Eliminates the use of herbicides which offsets contamination and health issues, as the mats also prevent the proliferation of weeds
- Mats are permeable to water as it flows through interstitial spacing for groundwater infiltration,
- Mats are permeable to air to promote aerobic conditions for a healthy soil biota,
- Mats insulate the soil – reduce temperature fluctuations,
- Mats increase the surface albedo to reflect LWIR outwards, and blue light wavelength
- Overall, an increased resilience to climate change.



Properties

- Super-hydrophobic, stable and 100% organic
- 50+ years lifespan
- The technology functions on the principles of surface morphology, in which the water pearl surface replicates that of the lotus leaf. In addition, it incorporates optimal geometric design for functionality influencing surface wetting behavior. It also integrates quantum mechanics at the atomic level. All of these features result in a stable surface thermodynamic behavior, that will constantly reproduce the same performance levels without any drop in efficiency.
- No leaching migrants above minimum threshold of FAO or Canadian standards for irrigation water.
- pH range: 1.0 – 11.5
- Inert to salts
- UV degradation of 2% / yr - It can be recycled as a polymer for reprocessing.
- Bulk Density :120 kgs/m³



We look forward to solve water scarcity challenges
one pearl at the time

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