USE OF DRONES IN MONITORING OF (MICRO)CLIMATE CRISIS

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WATER AND PLANT MANAGEMENT

- We know, that not only the “greenhouse effect” is responsible for climate change. Although it is mentioned in this context very often and nearly often exclusively.

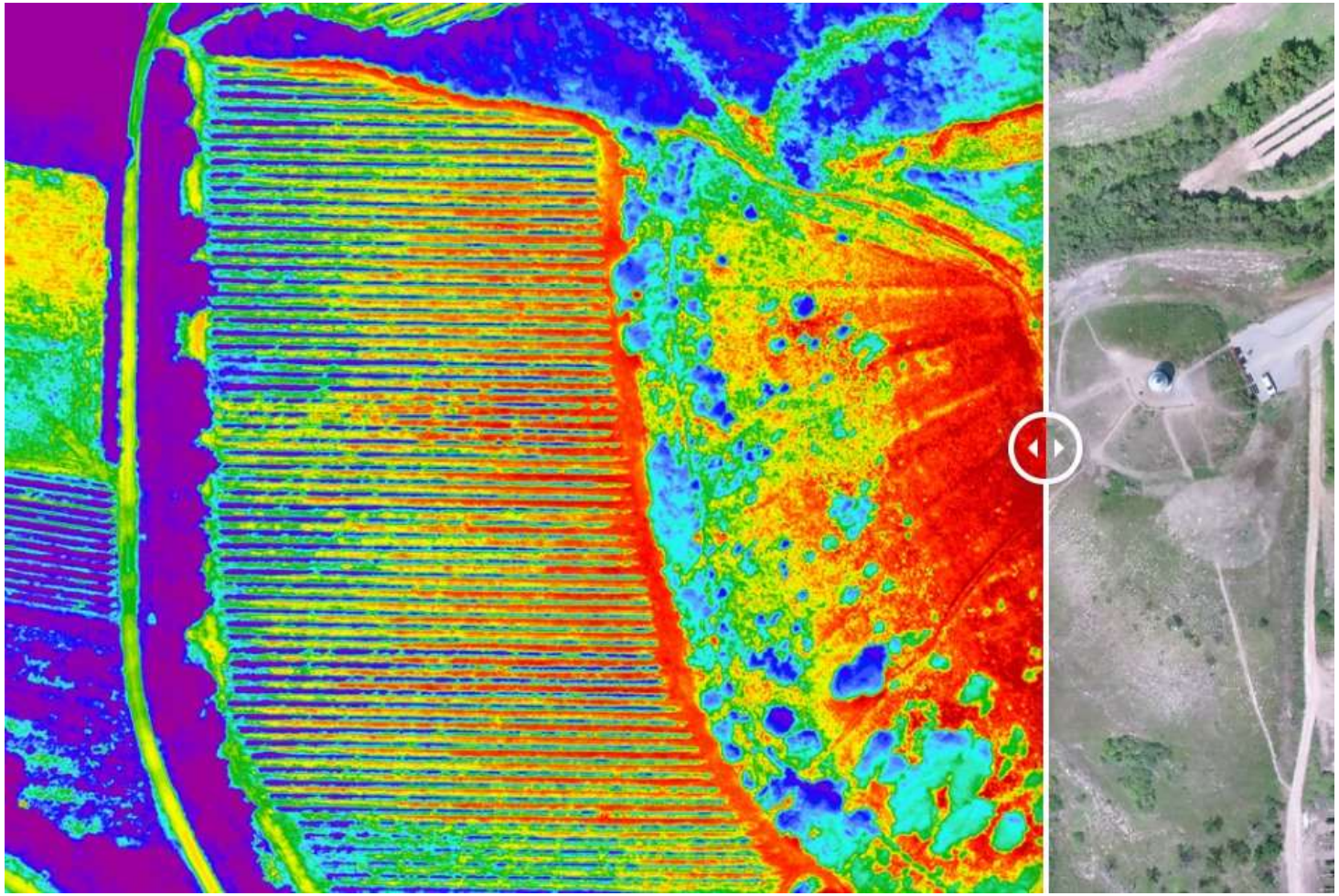
- But warming due to land cover (vegetation) change may explain as much as 18% of current global warming trends.

- Thermal imaging camera **Workswell WIRIS Pro^{SC}** allows to measure surface temperature over large areas very accurately, with high sensitivity and stability.

WATER AND PLANT MANAGEMENT

- Well recognized as stores of carbon, vegetation also provide a broad range of less recognized benefits that are equally, if not more, important. Indeed, carbon sequestration can, and perhaps should, be viewed as one co-benefit of reforestation strategies designed to protect and intensify the hydrologic cycle and very important associated cooling.
- By transpiring, trees recharge atmospheric moisture, contributing to rainfall locally and in distant locations. Cooling is explicitly embedded in the capacity of trees to capture and redistribute the sun's energy.

WATER AND PLANT MANAGEMENT



see in full resolution: http://bit.ly/2ywUyfC

WATER AND PLANT MANAGEMENT

- Orthothermogram is composed of 1500 separate thermograms, which were acquired by thermal camera **Workswell WIRIS Pro^{SC}** and composed in Pix4Dmapper software. Orthothermogram map an area of approximately 5 hectares (50,000 m^2) and were taken by a drone during two separate flights (flight time 50 min) from a height of 70 m.
- Water and plant management influence the local microclimate. By draining and removing greenery on large areas, we induce a desert climate, especially in cities or fields, that does not solve any technical equipment. Thanks to this image, it is clear from which places in the landscape drought and loss of vegetation coming from. We can see that the naked hill (affected by deadly soil erosion) on the right above the vineyard warms its surroundings and reaches through the vineyard.

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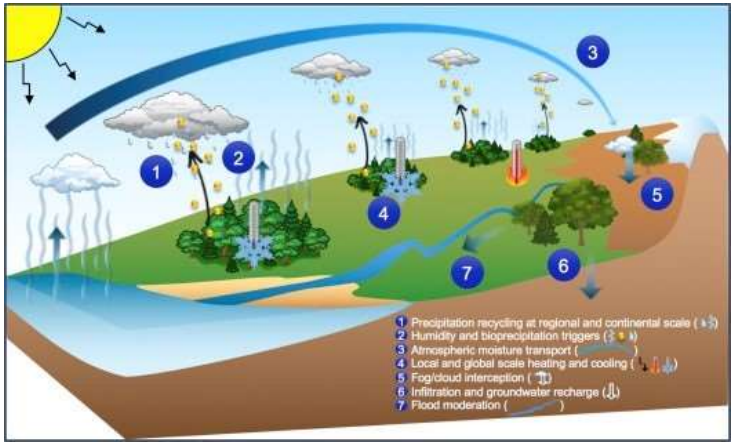
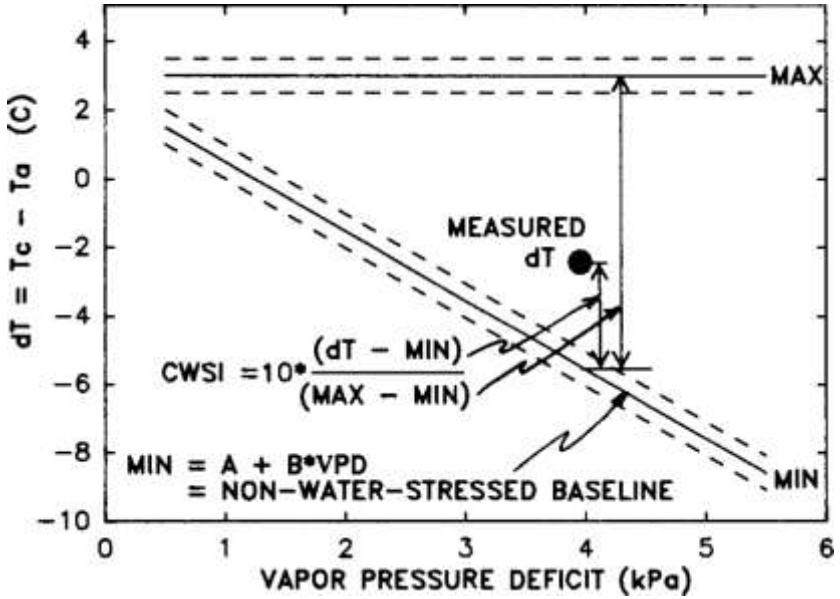
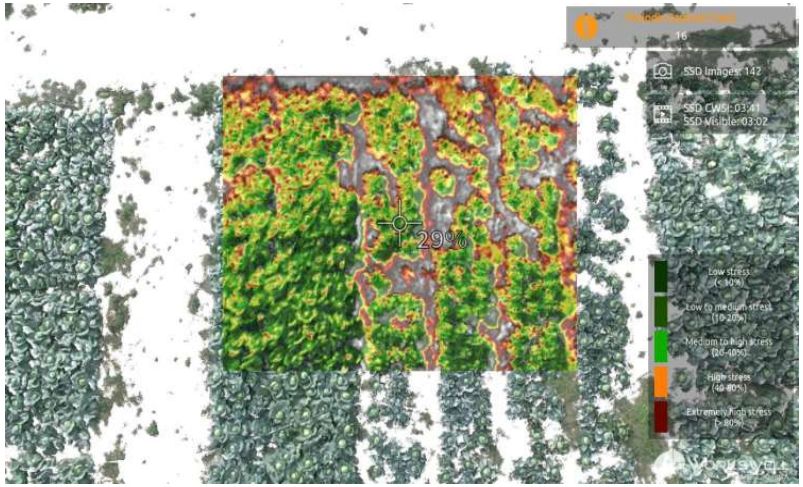


WATER STRESS EVALUATION & CWSI

CWSI – CROP WATER STRESS INDEX

- The crop water stress index (CWSI) was developed as a normalized index to quantify stress and overcome the effects of other environmental parameters affecting the relationship between stress, plant temperature and air temperature. CWSI has been widely used for crop water status monitoring [1].



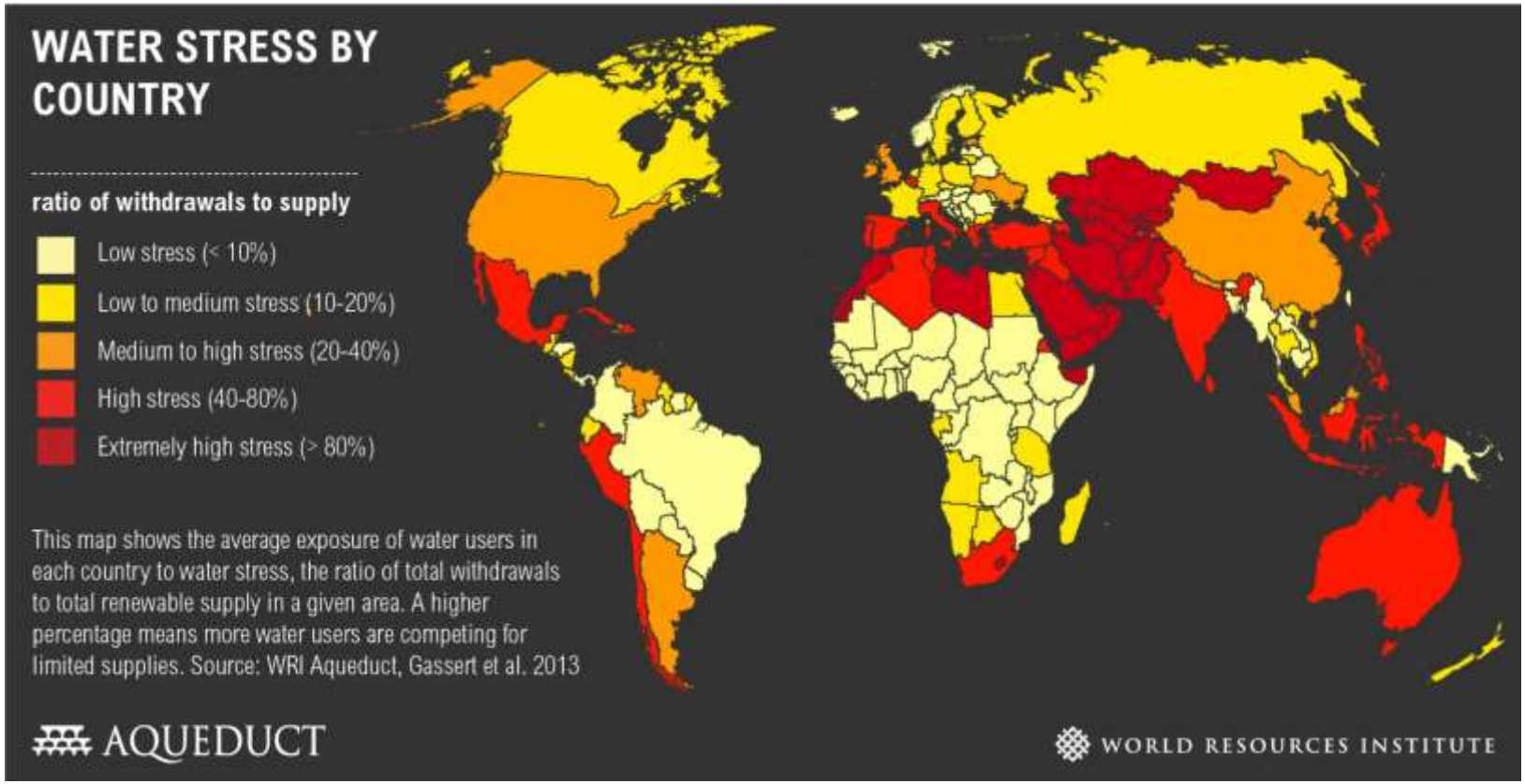


CWSI – CROP WATER STRESS INDEX

- The idea of CWSI is since in the case of absence of water intake from the soil the plant is not able to cool down own body by transpiration. Evapotranspiration is the water loss occurring from the processes of evaporation and transpiration.

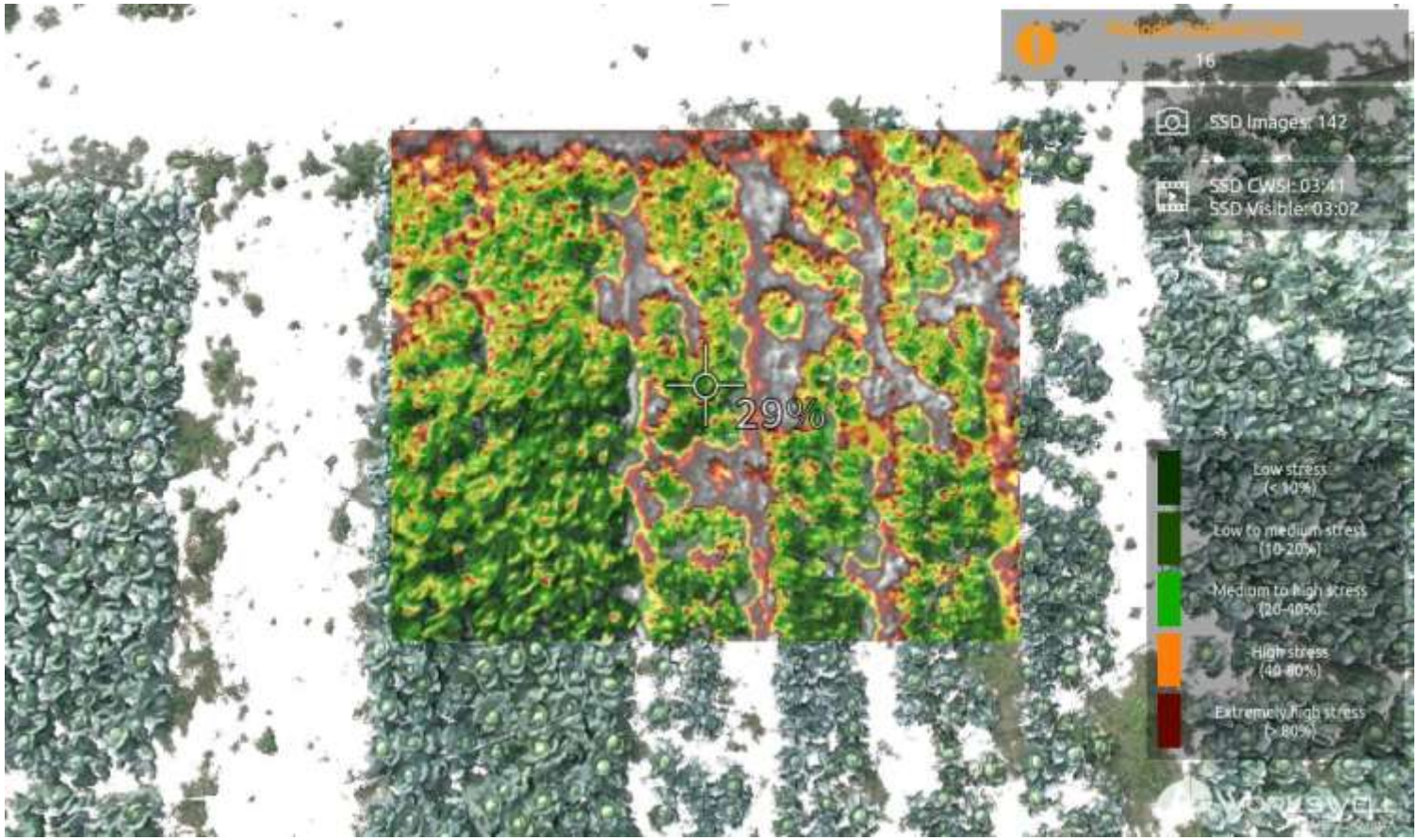
Evaporation occurs when water changes to vapor on either soil or plant surfaces. Transpiration refers to the water lost through the leaves of plants. The cooling of the plant body is thus affected by the evaporation of water from its surface. This water passes through the body of the plant and is released to the surface and then evaporated.

WATER STRESS BY COUNTRY



The World Resources Institute, the nonprofit research organization that conducted the study, classifies “highly” water-stressed countries as those that withdraw between 40% and 80% of their available water each year, while “extremely highly” stressed nations draw down more than 80%. There are 37 countries in the “extreme” category.

CWSI PICTURE TAKEN BY WIRIS AGRO



CWSI
Crop Water Stress Index

VS

NDVI
Normalized Differential Vegetation Index

Situation in a real time
See the current situation! You can se how "it works" and how to "improve it" in a real time. Intervention could be evaluated during a few hours.

Physiological process
You observe the actual crop's physiological process under given conditions at a given time. This is great, for example, for controlling of irrigation systems or locating vegetation infested by pests.

Before it's too late!
You can take actions before the crops die, ie when the stress is already occurring but the process is still reversible. The effectiveness of the intervention can be evaluated immediately after applying it.

Dead or live
NDVI is used to detect live green plant canopies in multispectral remote sensing data. So you can only quantify the photosynthetic capacity of plant canopies in that time.

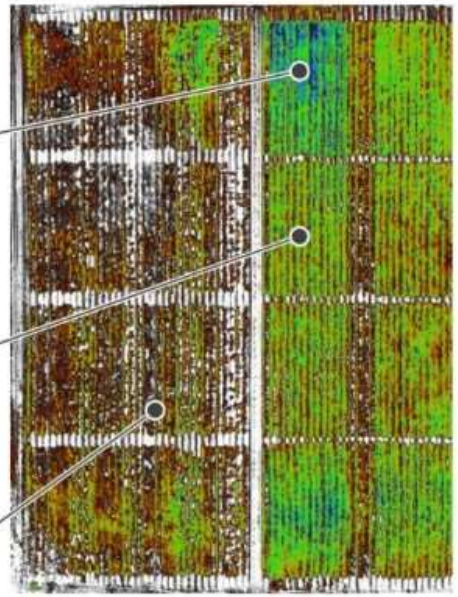
Not the process but the result
You observe the long-term effects of stress factors and environmental conditions on the state of vegetation but it is often very difficult to identify the causes.

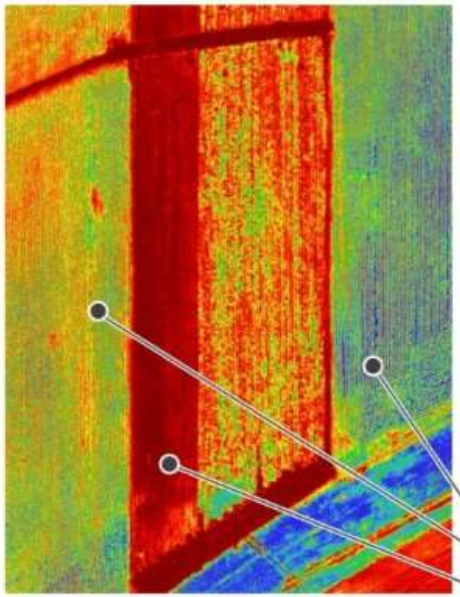
It is too late!
It is very difficult to make the right intervention as you cannot monitor the response quickly enough after applying the intervention. The NDVI shows the impact and result after longer period of time.

Water wasting
CWSI is very low. Water could be better distributed over the land or saved. No drought effect.

Under the correct irrigation
The water stress level corresponds to the current situation (sunny day, no precipitation). Irrigation helps prevent crop damage and works properly.

High level of stress
The irrigation system is not functioning properly and part of the crop is wilting. High level of water stress.





Index range 0.33 - 1
Crops are feeling better or worse, but it is not clear from the NDVI map why and whether they are currently under stress. Any corrective action to improve their condition will not be reflected quickly in the NDVI picture and will be difficult to evaluate.

Index range 0 - 0.33
Crop has already died and it is impossible to tell from the picture how this happened and what intervention would help. Corrective intervention does not exist.

CWSI – STRESS LEVELS

Color	Water stress level description		Level of stress
	Low stress	Crop is practically free of water stress No corrective action is required, a high yield can be expected (unless other problems occur). In the case of water management, it is advisable to consider whether crops are irrigated too much.	<10%
	Low to medium stress	Normal levels of water stress during warmer days - even if the plant is well supplied with water.	10% - 20%
	Medium to high stress	Normal levels of water stress during warmer days - prolonged and persistent exposure to water stress at this level can result in reduced yields or crop damage. Reginato and Howe [2] found that cotton yield showed the first signs of decline when the CWSI average during the season was greater than 0.2*.	20% - 40%
	High stress	Crop is exposed to high level of water stress. With long-term exposure to water stress to a given extent wilting or significantly reduced yield could be expected.	40% - 80%
	Extremely high stress	The yield can be expected to be very low without corrective measures. There is a high probability that without irrigation crops will wilt.	> 80 %

WORKSWELL WIRIS AGRO

- Workswell's WIRIS Agro is the first device of its kind designed to map water stress across large areas in the field of precision agriculture. The aim of this method and device is to determine the value of water stress in the plant stand.

Workswell WIRIS Agro & Gremsy S1

QUESTIONS?

HTTPS://WWW.DRONE-THERMAL-CAMERA.COM/

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- [2] Reginato, R.J., J. Howe, Irrigation scheduling using crop indicators, Journal of Irrigation and Drainage Engineering 111(2): 125-133
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