SOIL & PLANT SENSORS

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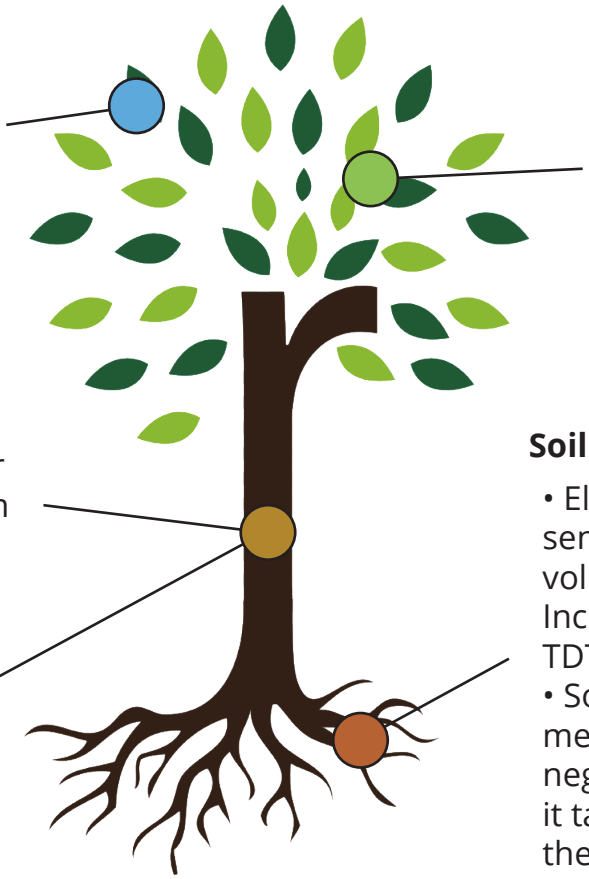
Above Ground ET Sensors

- Aerial Imaging (Satellite or Aircraft) use reflected radiation to estimate crop ET
- Field ET Sensors measure onsite evapo-transpiration



Plant Psychrometers

- In situ measurement of plant water potential (leaf or plant stem) which is the energy required to access water
- Pressure chambers also measure leaf or plant water potential

Sap Flowmeters

- Measure volume of water moving through plant stem

Soil Sensors

- Electronic soil moisture sensors measure the volumetric water content. Include HydraProbe, TDR, TDT and FDR
- Soil matric potential sensors measure the amount of negative pressure or suction it takes to pull water out of the soil. Include tensiometers and gypsum blocks

Dendrometers

- Measure the width of trunks/stems or fruit size as affected by water movement, growth and stress

	Soil Moisture Sensors		Soil Water Potential Sensors	Plant Psychrometers		Aerial Imaging	Onsite ET Sensors
	HydraProbe	TDR and TDT		In situ	Pressure Chambers	Satellite or aircraft	
Method	Measures the dielectric permittivity of the soil by analyzing the propagation of electro-magnetic signals into the soil. From the permittivity one can deduct the water content and the amount of salinity in the soil.		Measures the soil water potential or amount of pressure (suction) necessary to pull water out of the soil	Device installed on and into the plant to measure the amount of force required to extract water from the soil and pull it to leaves (plant water potential)	Instrument carried to the field to measure leaf or stem water potential or amount of force required in a plant to extract water from the soil and pull it to leaves	Measures the reflectance of light radiation by the crop canopy to estimate canopy growth and other factors	Measures actual evapotranspiration where the sensor is located
Options	Stevens HydraProbe	Various	- Gypsum resistance blocks - Tensiometers which measure pressure directly	Various	Soil Moisture SAPS	IrriSat (Satellite) Aircraft(Various)	Various
Sampling area	Volume of soil few inches around the sensor		Volume of soil around the sensor	Single plant	Single plant or part	Option dependent	1 to 10 acres
Benefits	Only commercial sensor measuring the real permittivity, the HydraProbe is less affected by soil salinity, soil variability, temperature and inter-sensor variability than other methods.		Good indicator of how dry is soil and ability of roots to pull water out of the soil	Good indicator of plant water stress		Provides a complete overall view of field with acceptable resolution	Measures ETc directly in the field without need to use local yet offsite data
Challenges	HydraProbe is known to provide accurate measurements of the amount of water in the soil and is a great tool for irrigation scheduling while other Soil moisture methods provide relative measurements which may require calibration for the specific soil type where they are installed.		Tensiometers are best at telling when to irrigate but how much requires additional information from other sources (ETc, soil water content, etc.)	Best at providing information as to when to irrigate but require a trunk large enough to install the device. Monitors one plant at a time.	- Labor intensive measurement - Narrow window of time to take measurement	Time between measurements may far exceed frequency needed during fast water needed growing season	ETc and soil moisture content are key irrigation scheduling components. One tells what the plant needs and the other what the soil water reserve is.