

Understanding Evapotranspiration

A Practical Guide to Smarter Irrigation





Irrigation Based on Real Use

For years, irrigation decisions have been based on averages, models, or soil moisture alone. While these methods provide useful information, they don't capture the real water demand of your crops on any given day. **Actual evapotranspiration (ETa)** measurement changes that, by tracking how much water your plants are truly using in real time.

Evapotranspiration (ET) is a critical measurement for managing irrigation efficiently. It represents **how much water a field loses** through evaporation (from the soil) and transpiration (from plants).

This shift from estimates to direct measurement helps you irrigate precisely when and how much your crops need, avoiding overwatering and water stress. It's a new way to **farm smarter, save water, and protect yields** in an uncertain climate.



Why Measuring ET Helps You Farm Smarter



ET tells you how much water to replace

When your field loses water through evapotranspiration, ET helps you know exactly how much to put back. It's like tracking your crop's daily water budget.



ET is measured at the scale you manage

Surface Renewal measures the ET of a whole field, not just a single point in the soil. That gives you data that matches how you make irrigation decisions, by block, by zone, or by crop stage.



ET helps you decide when to irrigate

If ET starts to drop, it's a sign the plants are stressed and closing their stomata - time to irrigate. If ET is steady, the plants are still getting what they need.



ET makes your irrigation data-driven

Instead of guessing based on the calendar, tradition, or gut feel, ET shows you exactly how much water your crop used, so you can replace it with confidence.



METHODS FOR MEASURING EVAPOTRANSPIRATION

MOST ACCURATE ★★★★★

Actual ET (ETa)

The actual water use of a specific field, measured directly in real-time.

FAIRLY ACCURATE ★★★★☆

Model ET

Uses satellite-based infrared sensing methods to approximate actual ET (ETa) by relating air temperature changes to canopy temperatures. These methods are only accurate when continuously calibrated with Actual ET sensors.

LESS ACCURATE ★★★☆☆

Crop ET (ETc)

ETa multiplied by a crop coefficient (Kc). Used to estimate the water use of a specific crop type that has no water stress.

LEAST ACCURATE ★★☆☆☆

Reference ET (ETo)

The total water use of a well-watered lawn. This information is available through many weather service websites, apps, and radio reports.



Know What Your Crop Uses, Not Just What's in the Soil

Soil moisture probes are great at telling you how much water is in the ground. But they don't tell you how much water your crop is actually using. That's where ET comes in:



Soil probes measure availability:

How much water is stored in the soil



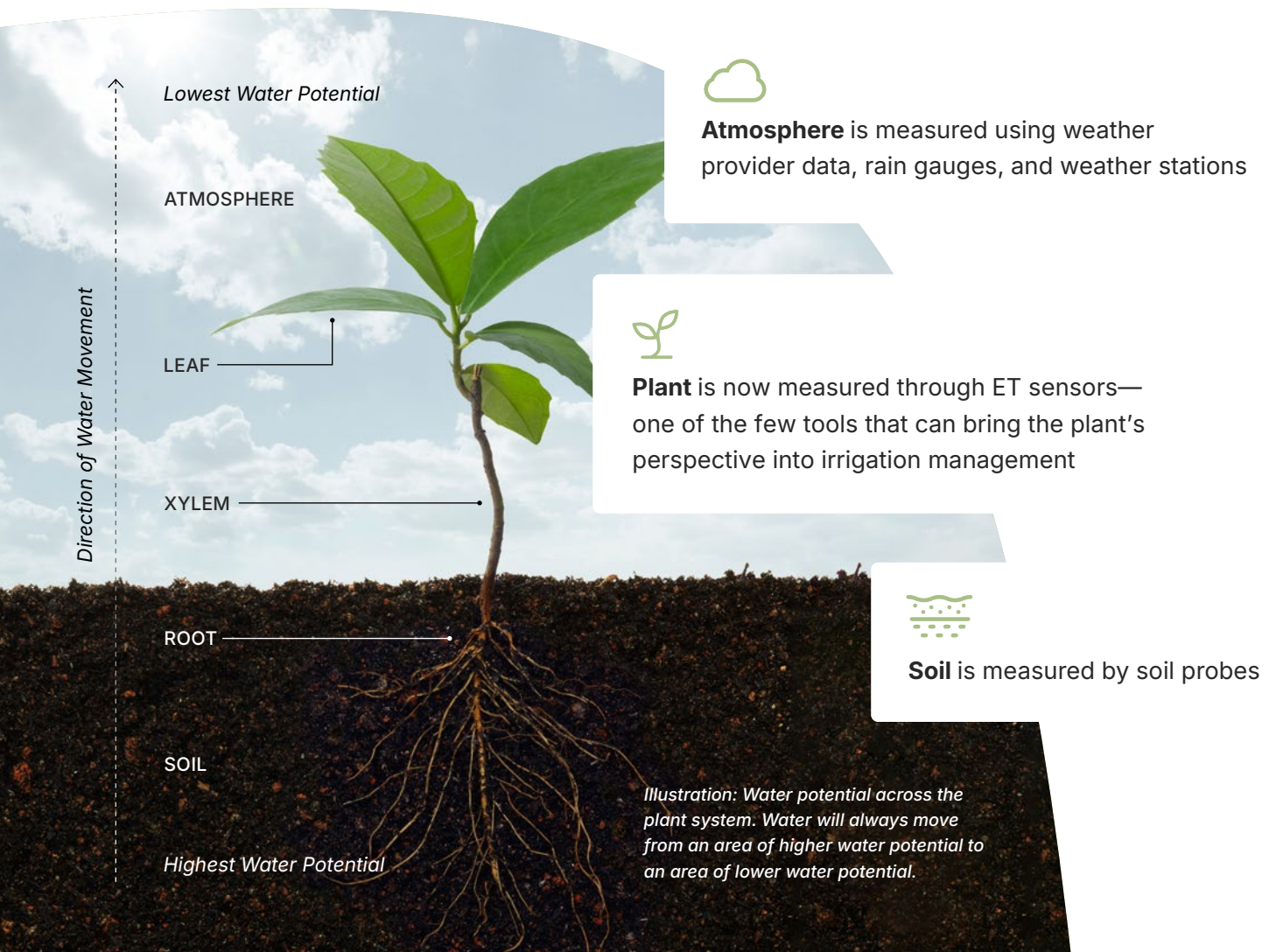
ET sensors measure demand:

How much water the crop pulled out of the soil today

When you use both together, you get the full picture: Is there water available? Is the plant actually using it? This combination makes irrigation timing more precise and removes a lot of the guesswork.

It's important to note that ETa trends should be considered in context, as daily changes can be driven by weather. Pairing ETa with Canopy or Water Stress graphs ensures irrigation timing reflects plant needs, not just environmental shifts.

This approach reflects the **SPAC (Soil-Plant-Atmosphere Continuum)**. By capturing all three parts of the continuum, irrigation decisions can better match real crop needs.



Validating Surface Renewal as a Tool for Measuring ET

What Is Surface Renewal?

The Surface Renewal method is a reliable and field-proven way to measure ET, offering growers and advisors a practical tool for water management without needing complex, high-maintenance systems.

How It Works

CropX measures ET using the Surface Renewal method, a proven technique that's been around for decades and has been adapted for agriculture by leading researchers. Recent improvements have made it more accurate and easier to use, with no need for field-by-field calibration. Surface Renewal measures ET by analyzing the energy moving between the soil, plants, and the air above a field. When the sun shines on a crop, energy flows into the system. Some of that energy warms the soil and the air, and some of it goes into evaporating water, which is what we care about when measuring ET.

Surface Renewal works by:

1. **Measuring incoming energy** from the sun (radiation),
2. Tracking **how much energy goes into the soil and the air**, and
3. **Calculating the remainder** – which is the energy used to vaporize water (i.e., ET).

One of the more complex parts of this equation is estimating how much energy is used to heat the air, especially because that transfer is driven by tiny, constantly shifting puffs of warm air (called eddies).

This is where Surface Renewal comes in. It uses a fast-response temperature sensor placed in the field to observe the pattern of these air eddies. As warm air rises and cooler air takes its place, the sensor picks up a distinctive ramp-like pattern in temperature changes (Figure 1, below). By analyzing the shape of these ramps, we can estimate how much energy is being transferred from the field into the air, a key step in calculating ET.

The result is a full, field-scale measurement of daily ET that reflects how your entire crop is behaving, not just one plant or one soil probe.

Validating the Method: How Accurate Is Surface Renewal?

Surface Renewal has been validated over the past two decades by comparing its results to two well-established scientific methods for measuring ET:

1. **Eddy Covariance (EC):** A research-grade method that tracks changes in wind speed and temperature in real time to estimate water and energy fluxes.
2. **Lysimetry (Lys):** A method that involves placing plants in large, soil-filled containers and measuring the water they lose by weighing the container.

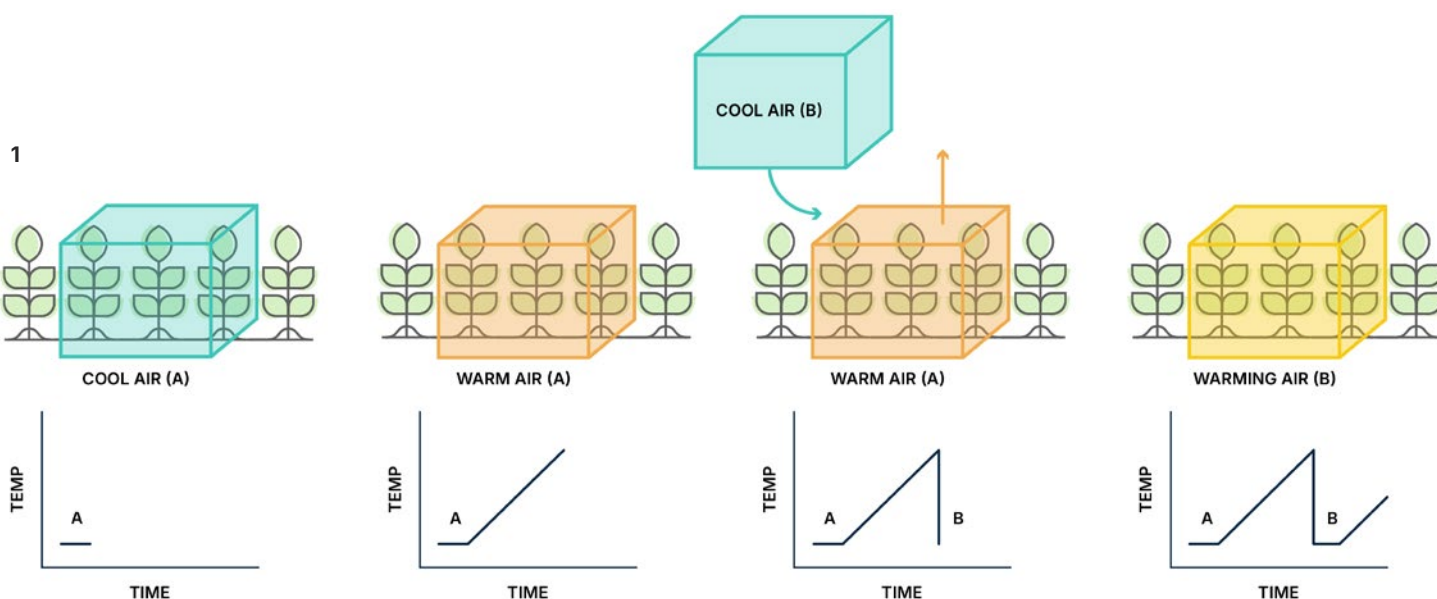
Comparison with Eddy Covariance

In a commercial vineyard in California, ET was measured daily using both Surface Renewal (SR) and Eddy Covariance (EC) in two vineyard blocks. As shown in Figures 2A and 2B, the two methods follow each other closely over time, with Surface Renewal consistently tracking changes in ET as irrigation events and weather conditions changed.

Around day 189 of the year, new irrigation treatments were introduced. Both SR and EC captured the change, demonstrating that Surface Renewal is sensitive to management decisions and can provide accurate, responsive ET data at the field level.

Comparison with Lysimetry

In another trial, Surface Renewal was compared to a precision lysimeter measuring the ET of two grapevines (Figure 3). While the two data sets show slightly different values, especially during irrigation cutoffs, this difference is expected. The lysimeter measures ET from just two vines with limited soil volume, while Surface Renewal captures the behavior of the full field, where roots have access to more soil moisture.



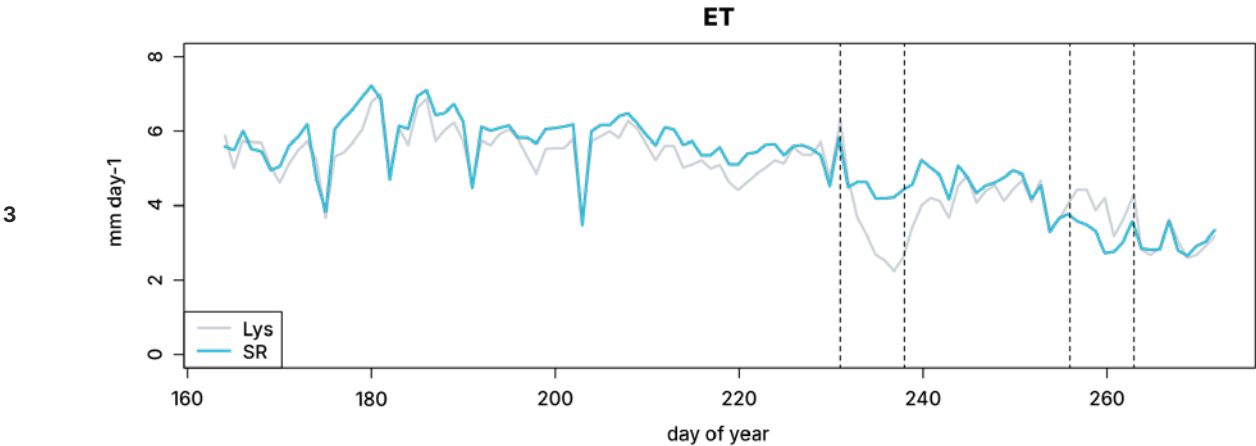
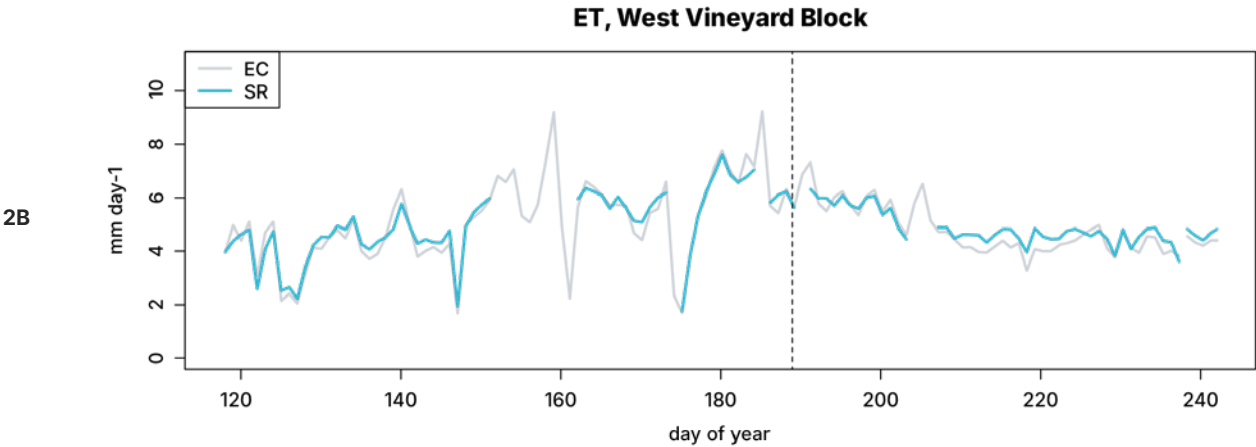
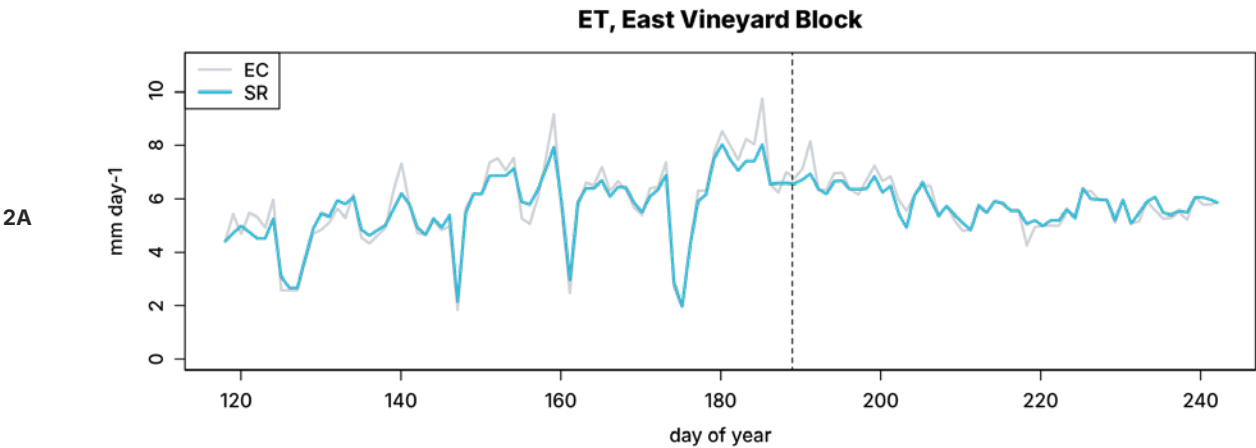
For example, when irrigation was turned off across the vineyard (day 231), the ET measured by the lysimeter dropped rapidly, because the small soil volume dried out quickly. Surface Renewal, measuring across a larger area with deeper rooting, showed a more gradual decline. Similarly, when irrigation was resumed only inside the lysimeter (day 256), it showed a spike in ET that Surface Renewal did not, again, because the broader field was still dry.

These differences illustrate a key strength of Surface Renewal: it reflects real-world conditions across a working field, not just what happens in a controlled environment.

Why This Matters

Surface Renewal offers a robust, research-backed way to measure ET, but without the cost and complexity of scientific equipment. By giving farmers and advisors field-scale, real-time insight into crop water use, it becomes a powerful tool for:

- **Scheduling irrigation more precisely**
- **Detecting water stress before yield is affected**
- **Managing water resources responsibly**
- **Aligning with sustainability and compliance goals**





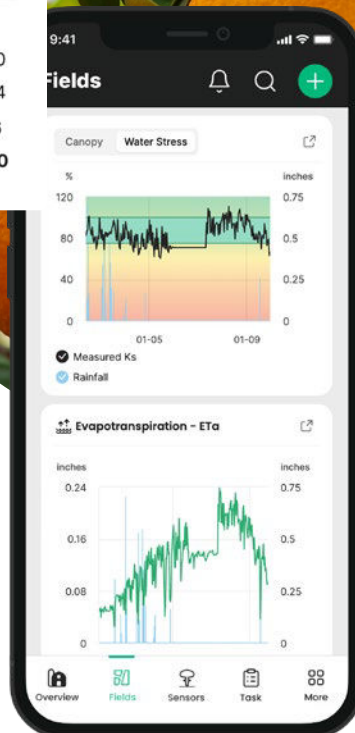
CropX Evato: Field-Scale ET Insights That Drive Smarter Irrigation

The CropX Evato is a direct evapotranspiration (ET) sensor that measures how much water your crops are actually using, not just how much is in the soil or what the weather model predicts. Installed at the pivot, the Evato uses the Surface Renewal method to deliver daily, real-world ETa (actual ET) data over broad field areas, helping growers make confident, data-driven irrigation decisions.

Whether you're managing tight margins, navigating water restrictions, or simply want to irrigate more precisely, the Evato delivers powerful insights without complexity or high maintenance.

Actual ET & irrigation summary

Irrigation calculation	Hours	mm
Last 7 Days Actual ET	--	38.0
Last 7 Days Suggested	43.04	35.4
Last 7 Days Applied	23.87	19.6
Next 7 Days Suggestion	46.15	38.0



Better irrigation timing and amounts

Evato helps you apply water based on what the crop actually used, not just what a soil probe says is available or a model estimates might be needed.



Proven ROI through yield and water efficiency

Customers using Evato have reported up to 15% water savings and measurable yield gains, simply by avoiding over- or under-irrigation.



Cost-effective for scale

For growers with multiple pivots, Evato covers multiple fields from a single installation, making it an affordable way to scale across your whole operation.



Simple Setup, Powerful Insights

JUST SET AND GO:



Direct ETa Measurement

Uses Surface Renewal tech to deliver real, daily crop water use, not just model estimates.



Simple Installation

Install at the pivot, or near the center of the field. Mount above the crop canopy for best accuracy.



Field-Scale Accuracy

Each sensor covers 1–10 acres, depending on crop and conditions, ideal for row crops and pivots.



Low Maintenance

No recalibration or field adjustments required.

FLEXIBLE INSTALLATION OPTIONS:



Install in a Field

Drive a pole deep enough into the ground to stay upright. Attach your Telemetry device to the pole, then install your ET sensor.

Adjust the height of your sensor to ensure it is placed above the canopy of your crop.

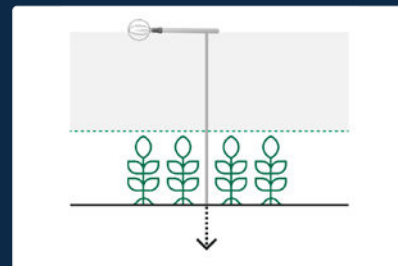


Install on a Pivot

Secure your ET sensor to a lighting pole in the center of your pivot using a U Bolt bracket (provided).

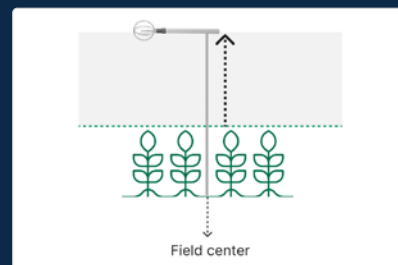
Just remember to leave some slack in the cords so you can easily wire your sensor to your Telemetry device.

INSTALLATION BEST PRACTICES



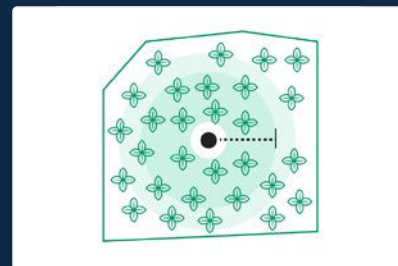
Field Placement

Install the sensor near the center of the field. Ensure at least 330 feet (100m) of canopy surrounds the sensor in all directions to ensure accurate measurements.



Height Above Canopy

Mount the ET sensor 1.5 to 6.5 feet (0.5 to 2 m) above the canopy.



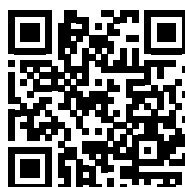
Additional Fetch Per Height

For every 3.28 feet (1m) the sensor is installed above the ground, add an extra 164 feet (50m) of canopy in all directions.

Smarter Irrigation Starts Here

Add Evato ETa to your Lineup – Get a Demo

Scan the QR code or visit cropx.com/contact-us



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