Green Water

The Cinderella Resource

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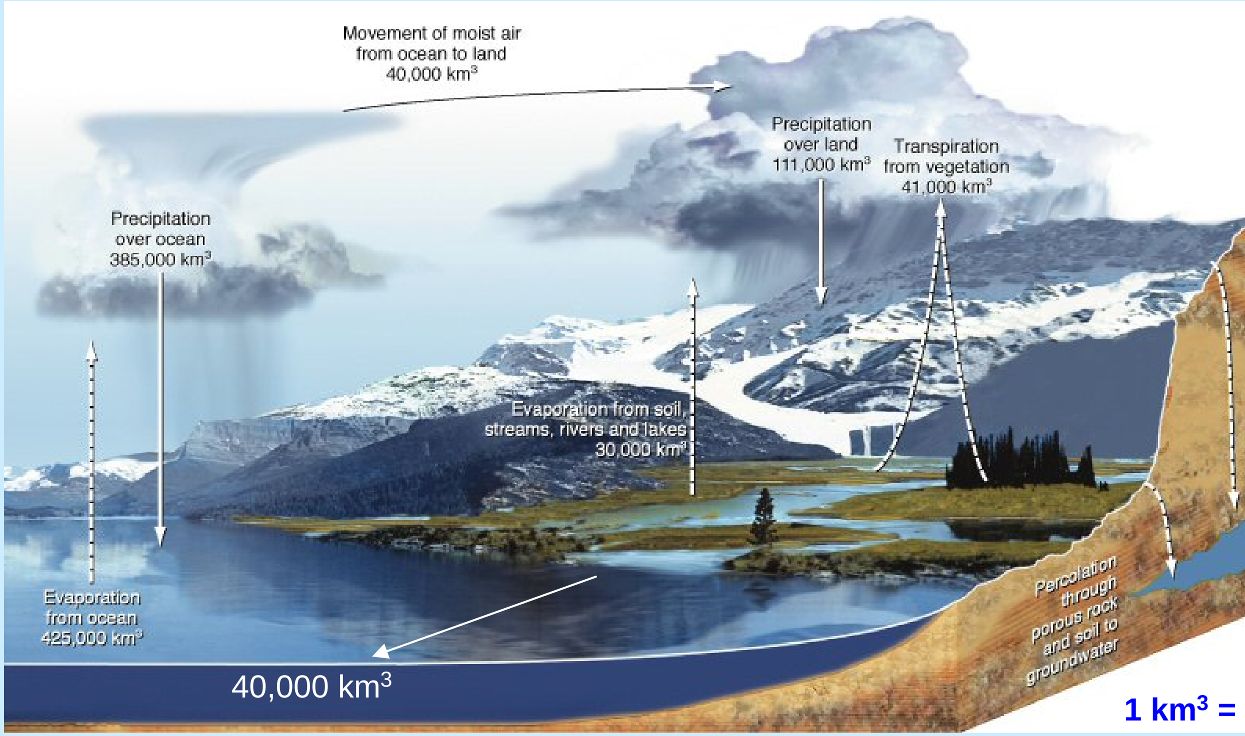
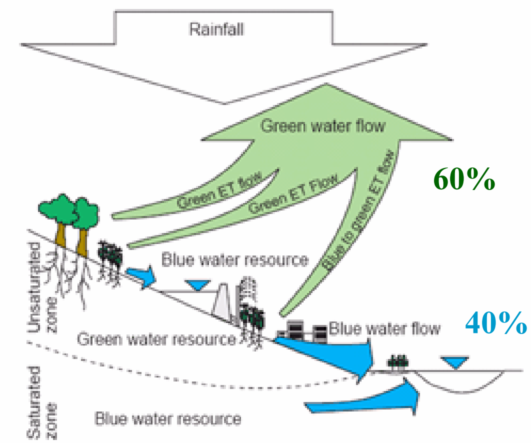
The Global Water Cycle



Green & Blue Water Flows

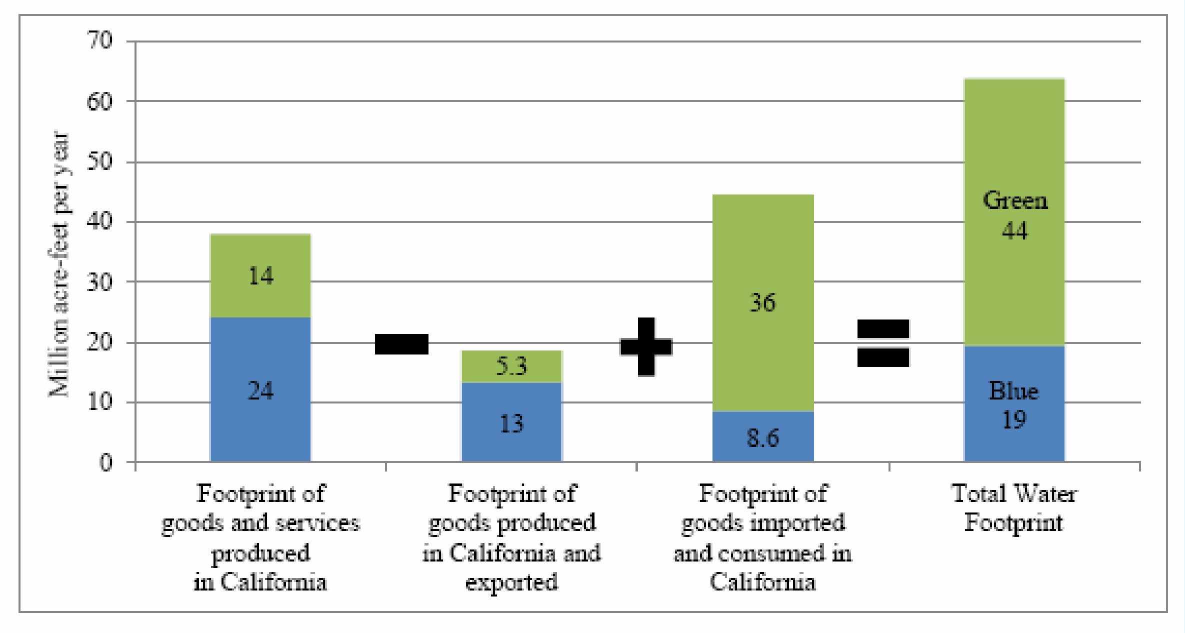


1 km³ = 810, 713 AF

Blue Water **refers to groundwater plus water in rivers, streams, and lakes. Global Flow (rivers into oceans): 33,000 MAF/yr**
Global Cropland Consumption: 486 – 730 MAF/yr

Green Water **refers to water infiltrated into soil rooting zones.**
Global Flow (evapotranspiration): 49,281 MAF/yr
Global Cropland Consumption: 4,680 –5,900 MAF/yr

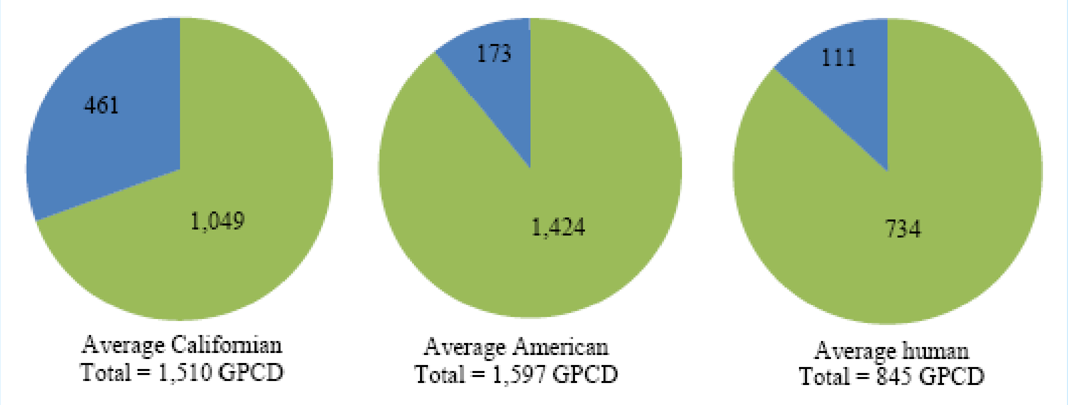
Blue and Green Water Consumption ("Footprint") in California



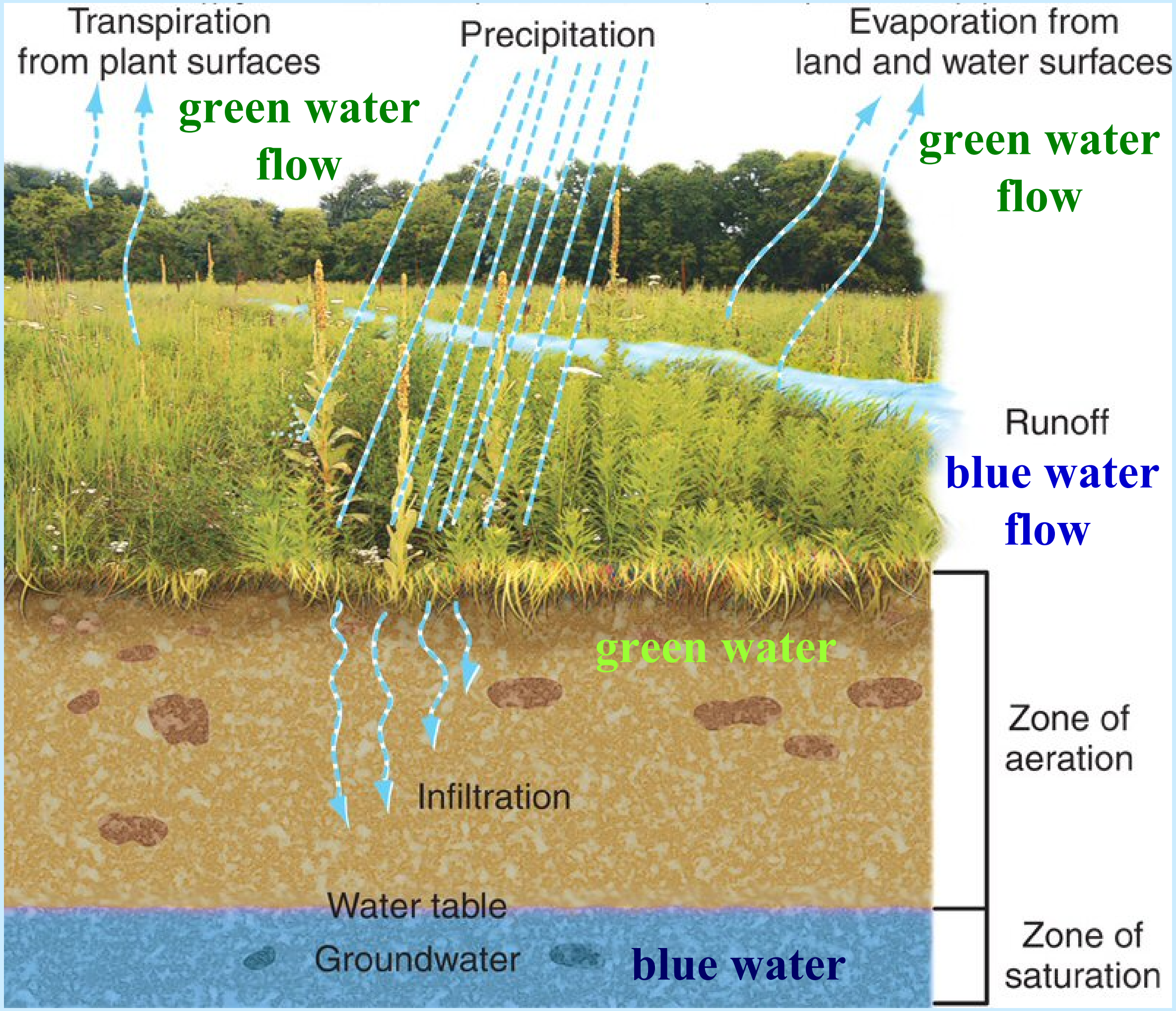
Mostly blue water is consumed to produce goods & services in-state. Mostly green water is consumed to produce imported goods & services.

California's Water Footprint
Pacific Institute (2012)

On a per-capita basis, Californians consume 300 % more blue water and 40 % more green water than the world average.



GPCD = gallons per capita per day



The Field-Scale Water Cycle

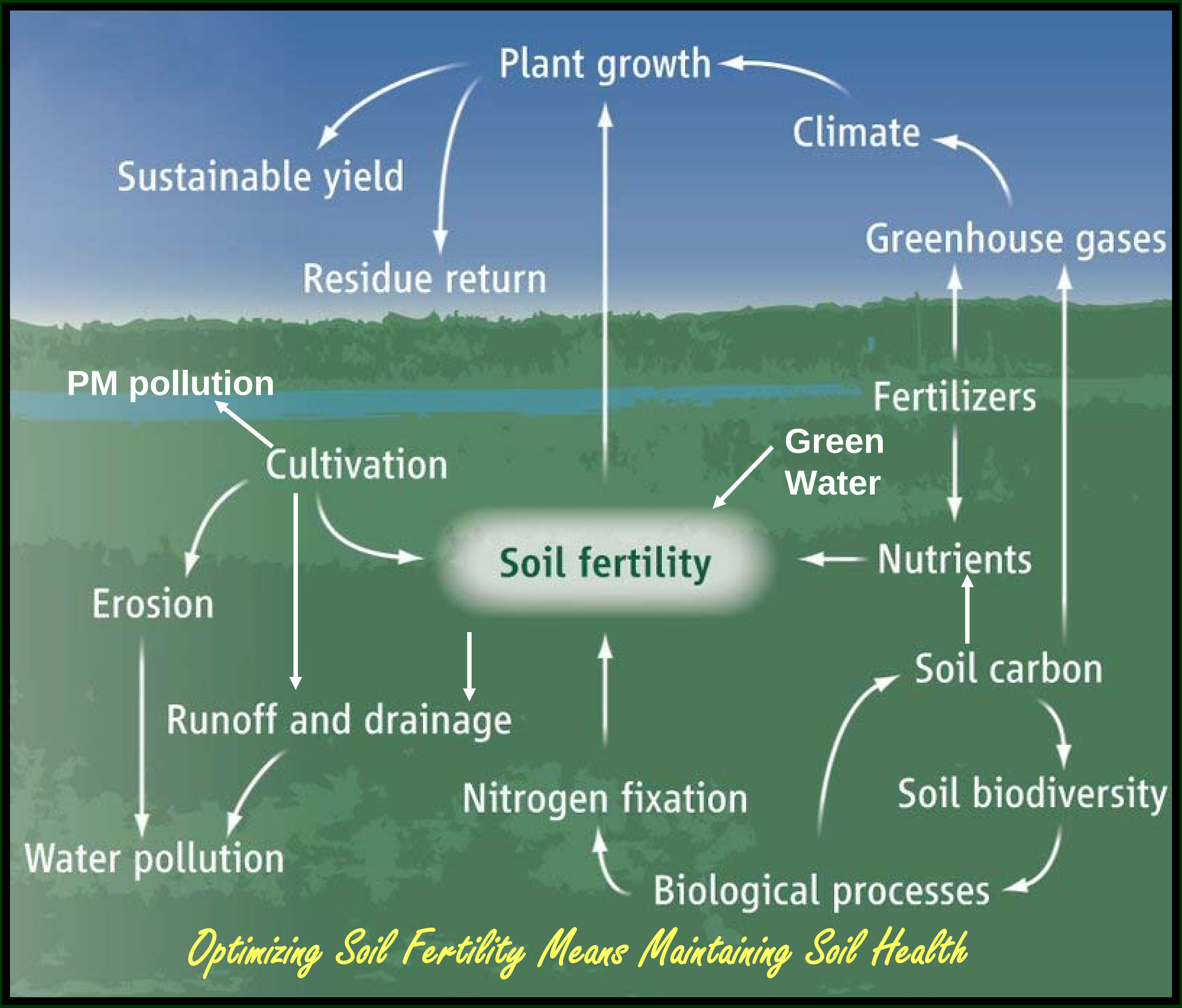
***Crop Yield* =**
Genetics × Environment × Management

***The Management Challenge*: Optimize green water availability & green water productive flow (transpiration) in croplands.**

"The green water transpired determines crop yield."
B. A. Stewart (2013)

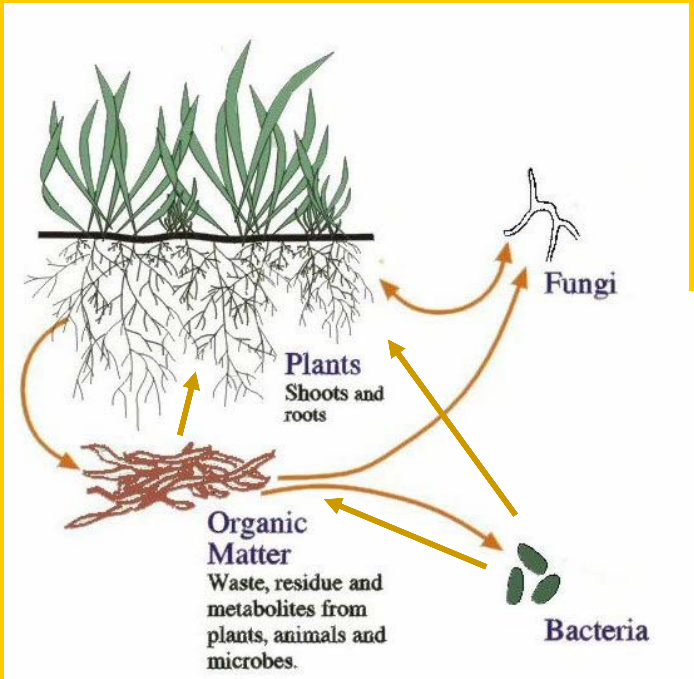
"*Soil quality* determines water use efficiency."
R. Lal (2013)

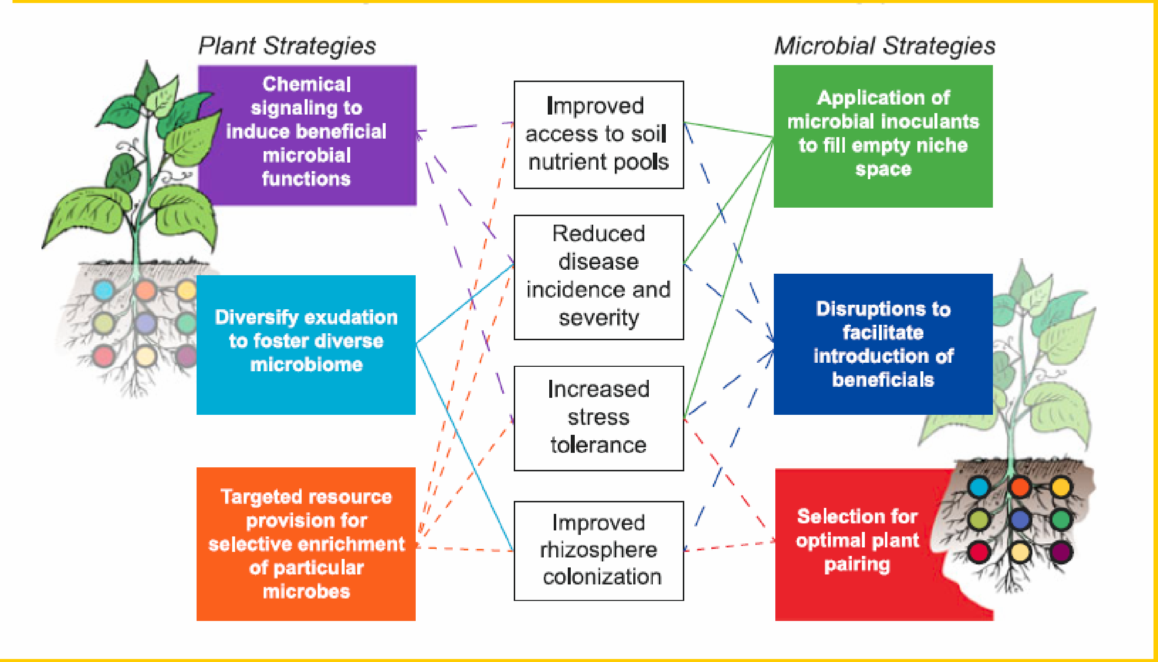
"Three Shades of Water," *CSA News*, October 2013.


Plant growth
Sustainable yield
Residue return
Climate
Greenhouse gases
PM pollution
Fertilizers
Green Water
Cultivation
Soil fertility
Nutrients
Erosion
Soil carbon
Runoff and drainage
Soil biodiversity
Nitrogen fixation
Water pollution
Biological processes
Optimizing Soil Fertility Means Maintaining Soil Health

Introducing the Soil Microbiome

The microbial organisms, mainly bacteria and fungi, that inhabit soil ecosystems are a major contributor to global biodiversity, influencing key soil processes occurring very close to plant roots in a zone known as the *rhizosphere*. It is through the rhizosphere that all productive green water flows must pass.



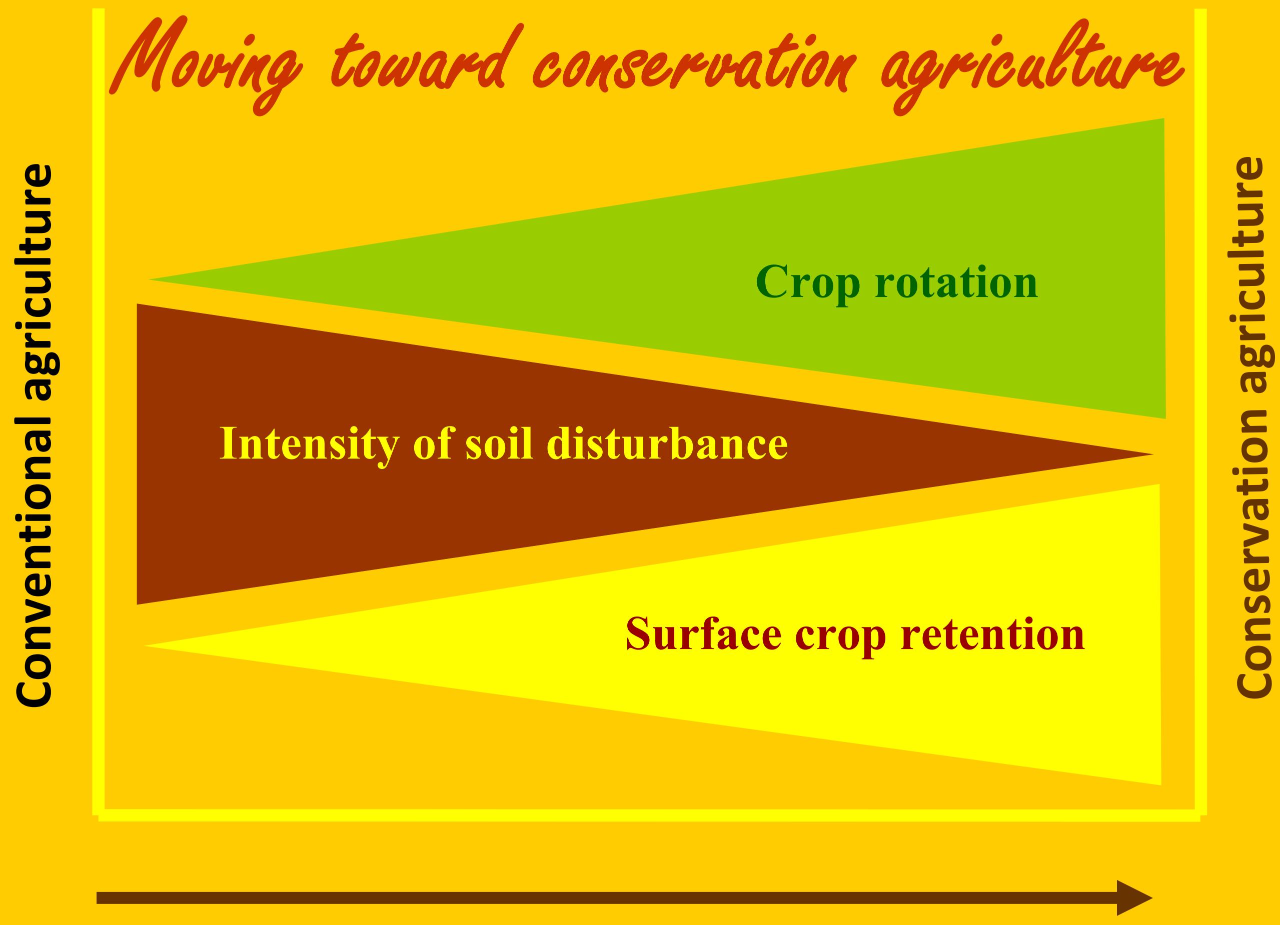


"Unraveling the mechanisms of plant-soil microbiome control will open new avenues to increase crop productivity."

Berendsen, R. L. et al. 2012. The rhizosphere microbiome and plant health. *Trends in Plant Science* 17:478-486.

Bakker, M. G. et al. 2012. Harnessing the rhizosphere microbiome through plant breeding and agricultural management. *Plant and Soil* 360:1-13.

* Minimal soil disturbance
* Diverse crop rotations
* Preservation of residues
* Use of cover crops



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Advanced Conservation Agriculture Benefits

- lower production costs
- reduced pumping time due to increased water use efficiency and reduced soil water evaporation with surface residues
- increased energy and carbon storage with cover crops

- reduced diesel fuel use and PM emissions with conservation agriculture
- lower soil temperatures and fewer weeds with surface residues

http://casi.ucanr.edu/

- increased soil carbon sequestration
- increased soil biodiversity
- reduced NO_3^- leaching with use of crop N management decision support tools and precision irrigation
- increased soil nitrogen provided by cover crops with less fertilizer needed
- increased soil NO_3^- capture and reduced NO_3^- leaching with use of cover crops and precision irrigation

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