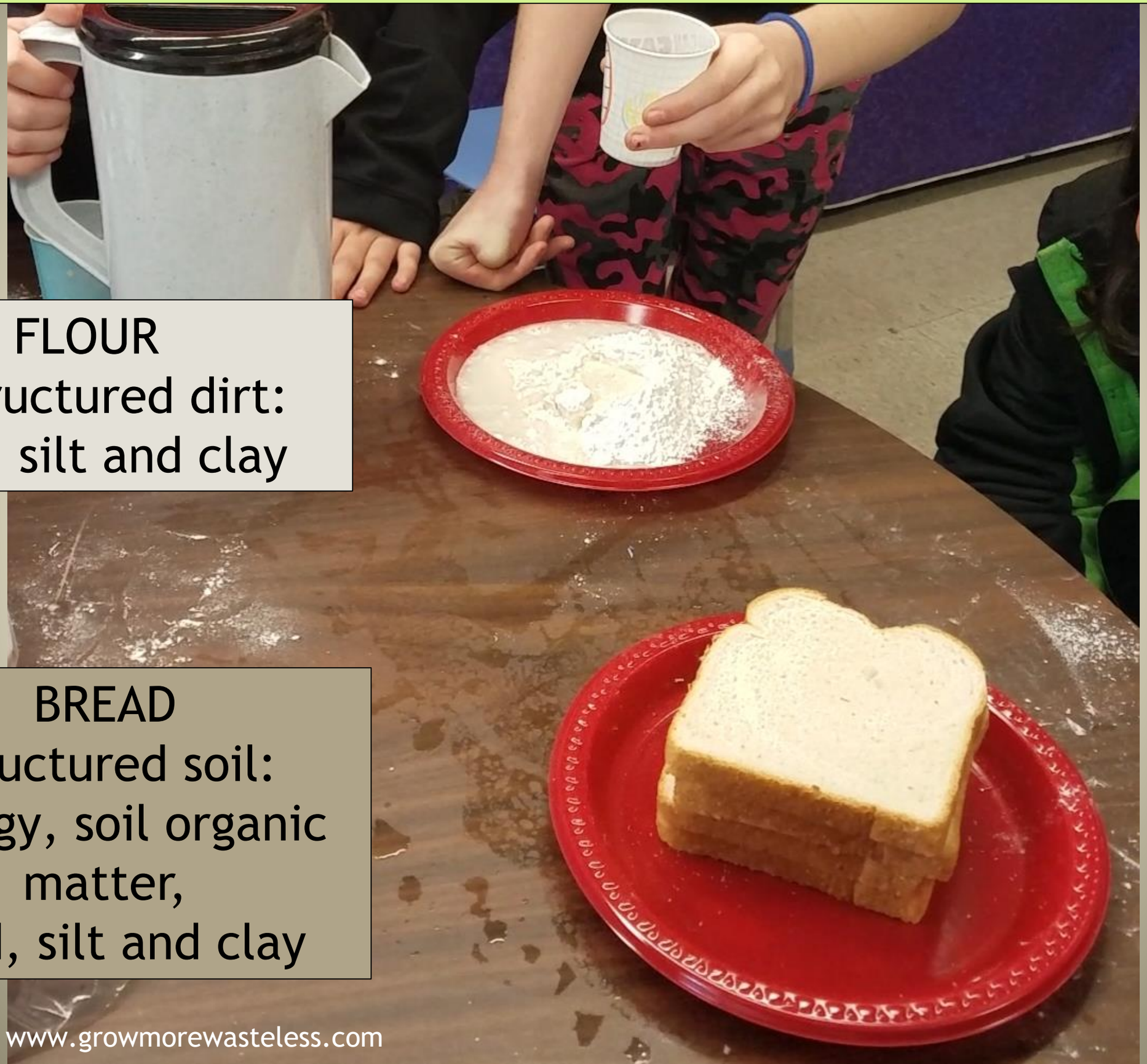
Soil Sponge: healthy soils for better infiltration and retention

Harvesting Water and Growing Soil To Keep Our Landscapes in Place



FLOUR
Unstructured dirt:
sand, silt and clay

BREAD
Structured soil:
biology, soil organic matter,
sand, silt and clay

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The world has 60 years of topsoil left?!

If present rates of degradation continue, all of the world's topsoil could be lost by 2075.

~ Senior UN official. Dec 12, 2014

<u>Average soil loss</u>

1 bushel corn = 1 bushel soil

1 bushel soy = 1.2 bushels soil

<u>Loss per acre, per year</u>

5.8 tons

~15 bushels of lost yield $ potential.

<u>Loss per 10 years</u>

(given 5.8 tons/year average).

~ 1/3 inches topsoil per 10 years

~ $12,225 in lost yield and nutrients on 40 acres

~ Corn and soybean digest 2017

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Is New England any better at holding onto soil than Iowa?

LEFT
Crops and fields destroyed by TS Irene in Waitsfield, VT.

BOTTOM LEFT
Standing floodwater after TS Irene in Pittsford, VT

BOTTOM RIGHT
Schoolyard flooding on July 1 2017 Thetford VT

Soil Loss (runoff) from Tropical Storm Irene, 2011

Holding Landscapes AND Water in Place

Creating conditions for healthy soil will decrease flooding and drought and increase transpiration and global cooling.

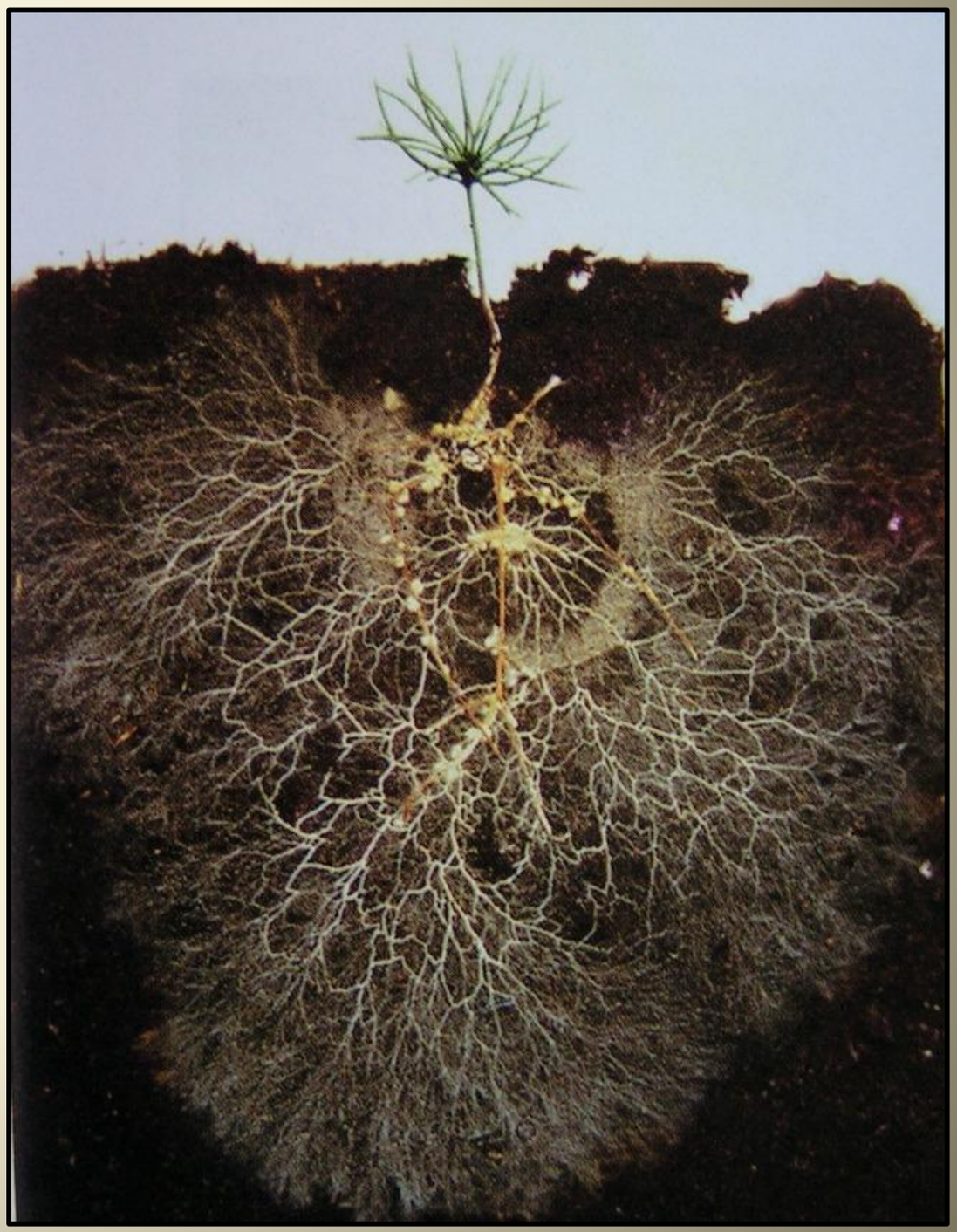
Soil carbon is the living (soil organic matter [SOM] including plants & animals), **the dead** (decaying SOM) **and the very dead** (stable humus, glomalin, fossil fuels, coal).

SOM holds 18-20 times its weight in water and recycles nutrients for plants to use.

The first meter of soil contains three times as much carbon (in SOM) as is found in either the atmosphere or in living plants.

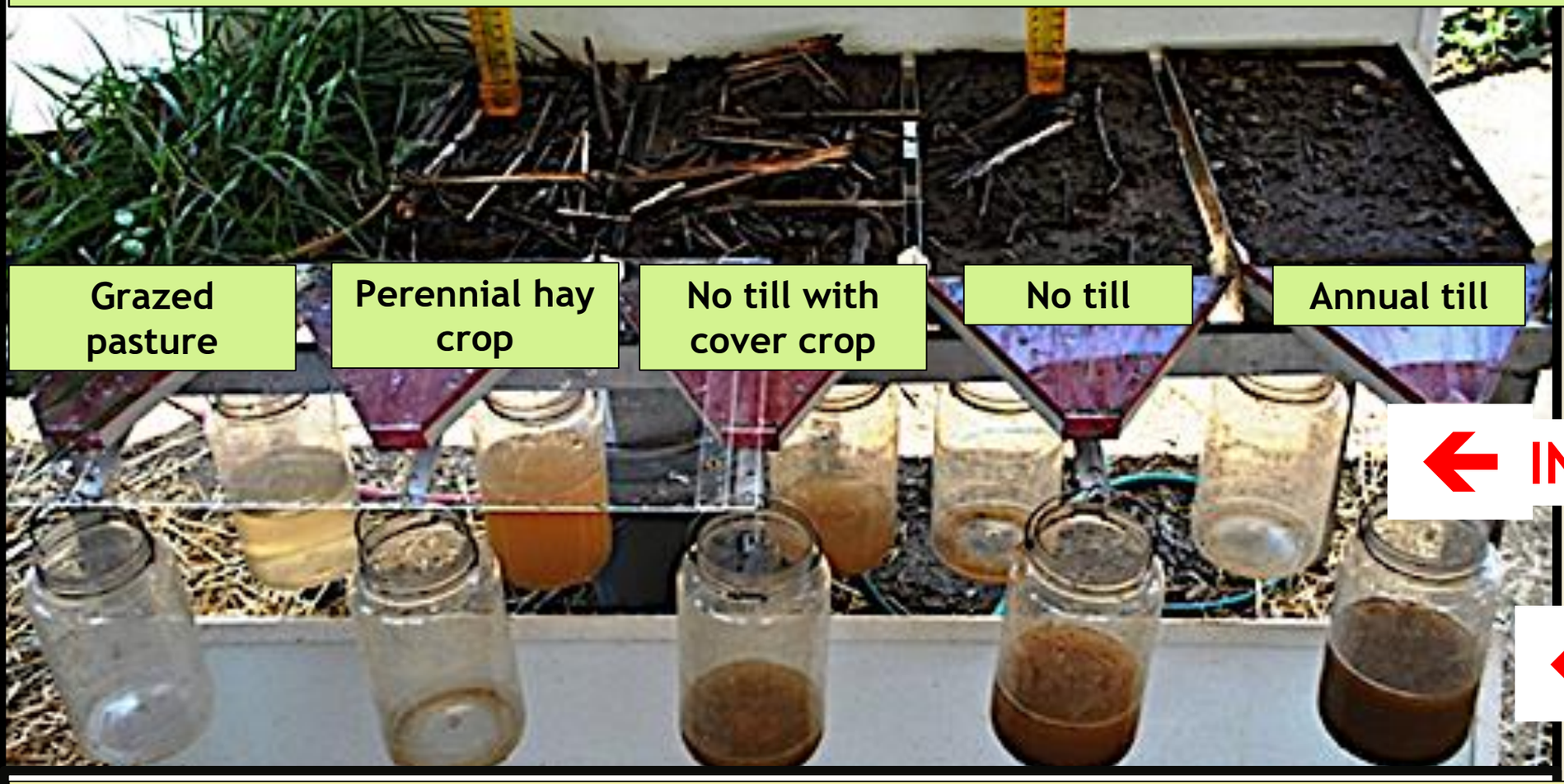
Living soil can absorb and store greenhouse gases AND retain and cycle water.

A 1% increase of organic matter in the top 6 inches of soil per acre can hold over 20,000 gallons of water.



All data from NRCS Cat Buxton www.growmorewasteless.com

Infiltration and runoff by variety of management on agricultural land

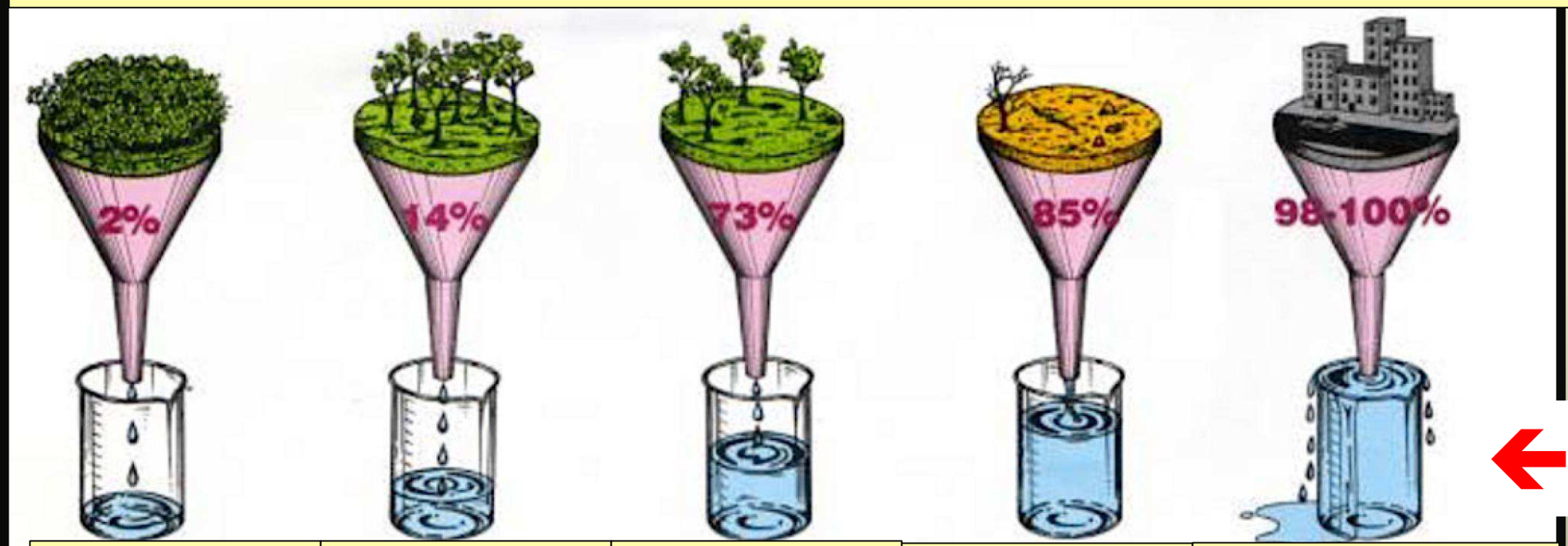


Can we improve land management?

← INFILTRATION

← RUNOFF

Percent of runoff on a variety of environments and surfaces



Can we improve community Planning?

← RUNOFF

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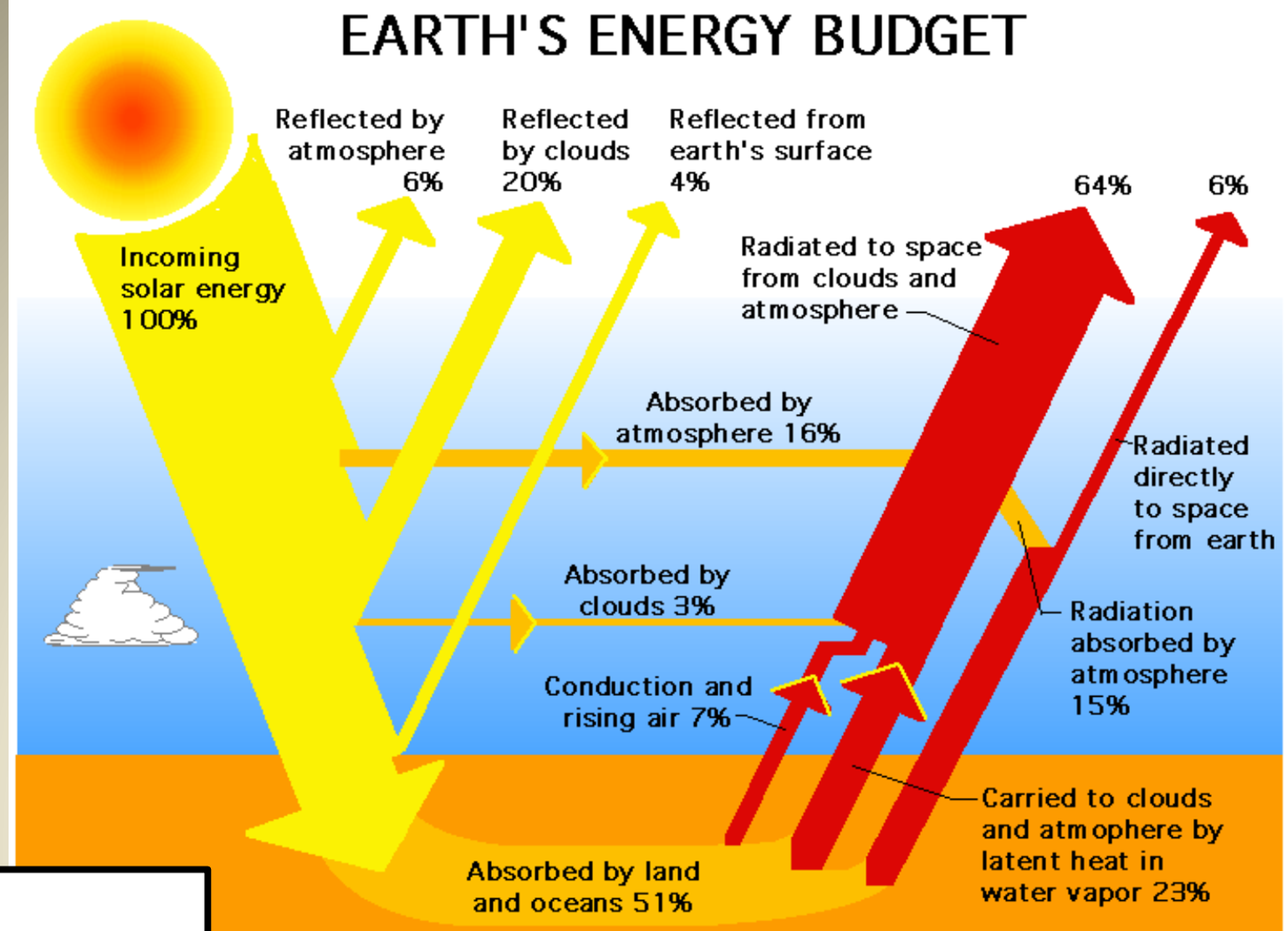
Soil Health Principles

1. **Optimize photosynthesis**

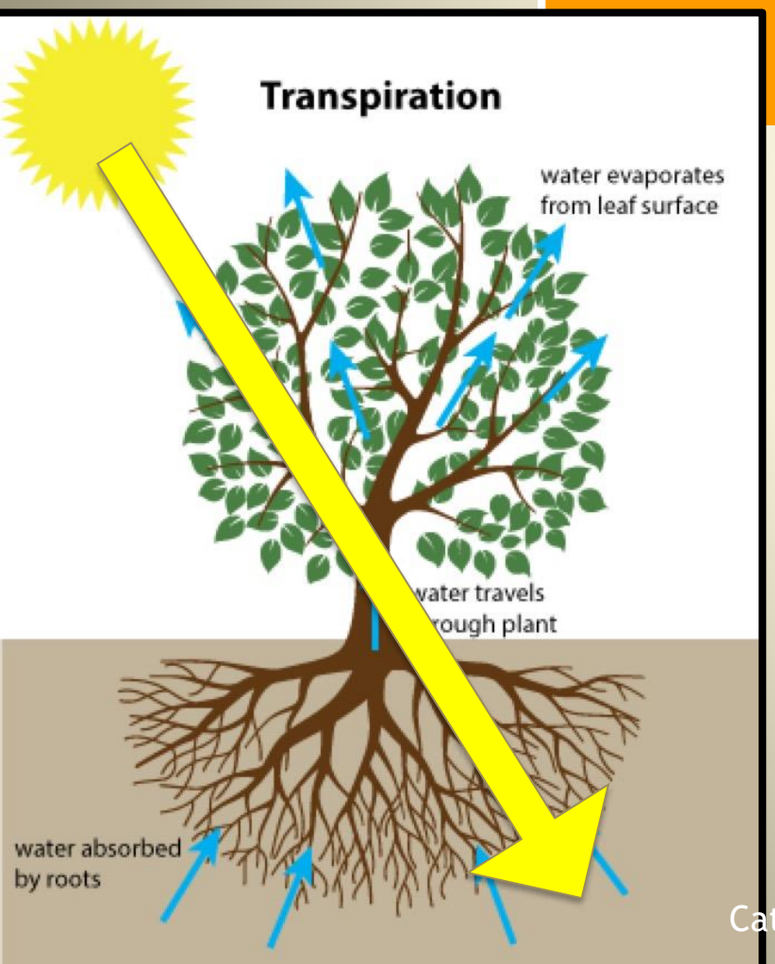
   (Green, growing plants with living roots in the ground)

2. **Maximize diversity**
3. **Minimize disturbance**
4. **No bare soil** *(minimize)*
5. **Animal contact with soil**

   (microbes, beetles, voles, deer, livestock, humans …)

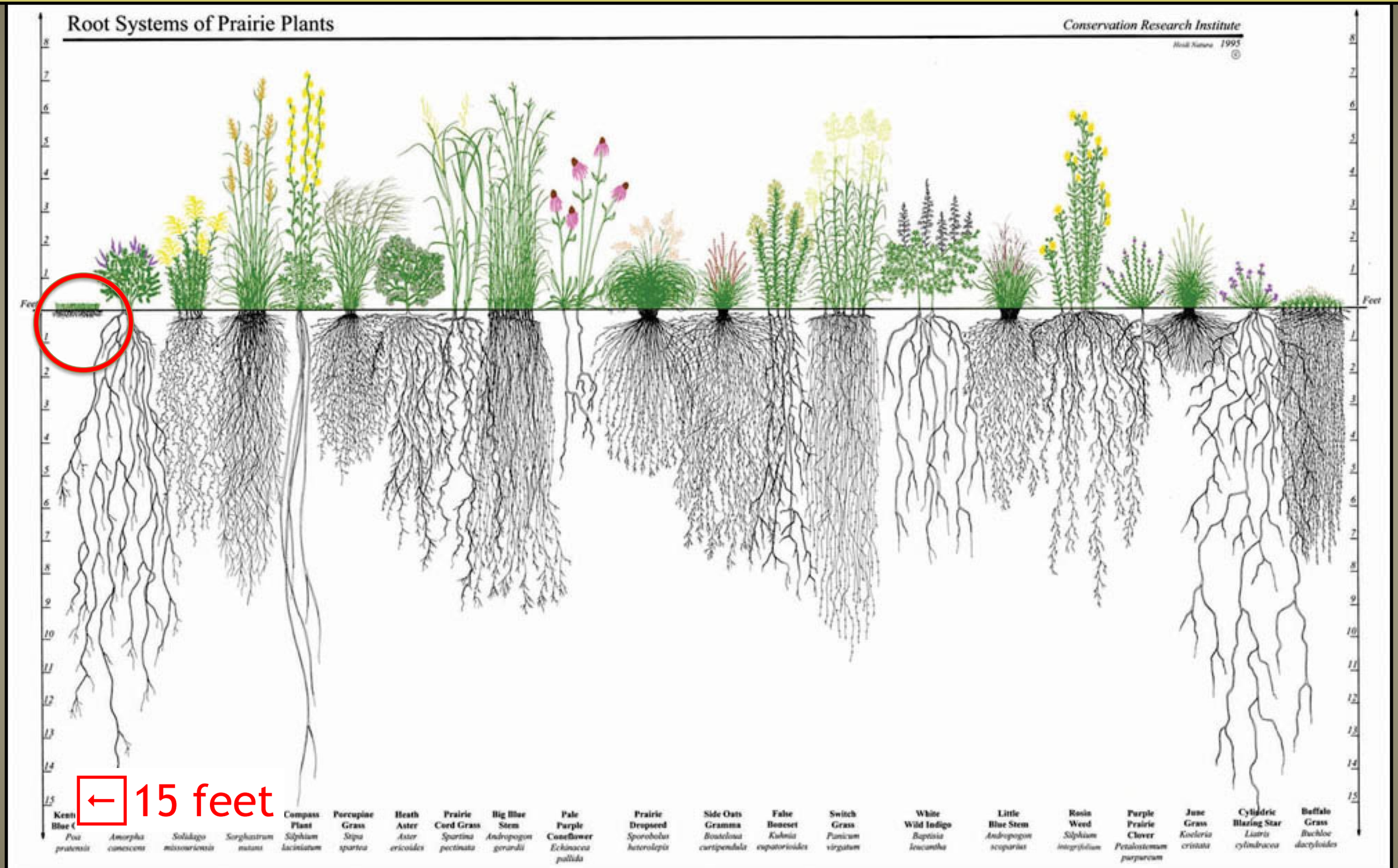


Champlain Basin
average length of green season from 2014 through 2017
Normalized difference vegetation index (NDVI), is an indicator of the work of photosynthesis.



Can we harvest more sunshine?

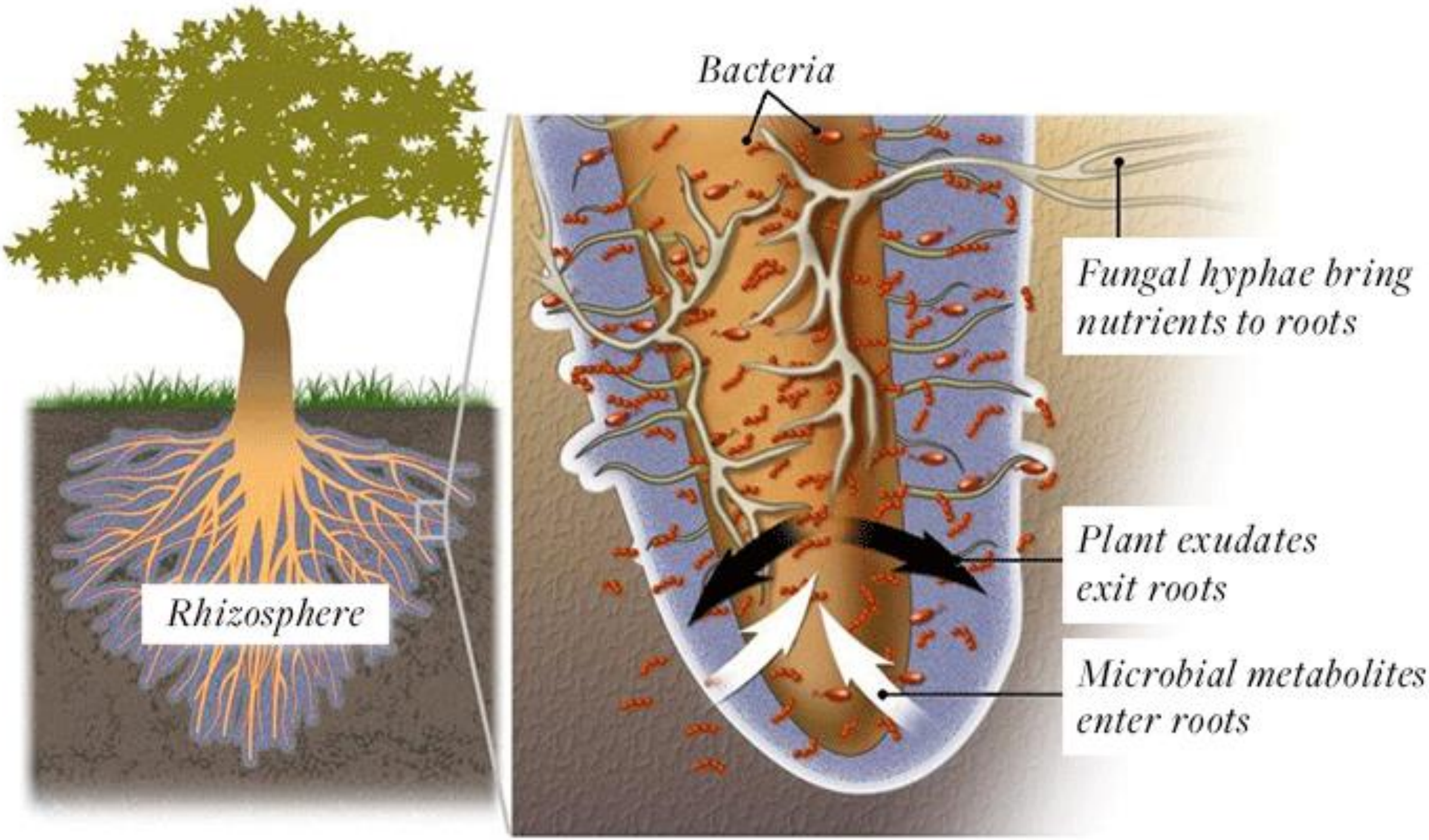
DEEP Living roots in the ground for as long as possible



← 15 feet

Standard lawn

USA: 32 million acres of lawns (residential, commercial, and institutional lawns, parks, golf courses and athletic fields)



The rhizosphere houses billions of microorganisms

Soil Food Web

Nematodes
Root- feeders

Arthropods
Shredders

Arthropods
Predators

Birds

Fungi
Mycorrhizal fungi
Saprophytic fungi

Nematodes
Fungal and
bacterial feeders

Nematodes
Predators

Organic Matter
Waste, residue and
metabolites from plants,
animals and microbes

Bacteria

Protozoa
Amoebae, flagellates
and ciliates

Earthworms

Animals

First trophic level	Second trophic level	Third trophic level	Forth trophic level	Fifth trophic level
Photo synthesisers	Decomposing Mutualists, Pathogens, Parasites, Root-feeders	Shredders Predators Grazers	High level predators	Higher level predators

These underground biological workers are building the glue that holds our landscapes in place.

Glues, snots and slimes are the structure of the Soil Carbon Sponge.

Turn this

To this!

and this!

Jack and Anne Lazor's perennial pasture Butterworks Farm, Westfield VT

and this!

Nicole Masters photo: New Zealand

Can we shift our systems to provide Multiple Ecosystem Services vs. Single Services















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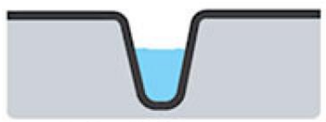
Agroforestry at New Forest Farm in Southwest Wisconsin

Can we learn to mimic functional natural ecosystems?

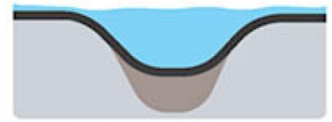
How can we better work WITH nature?

A stream comes back to life

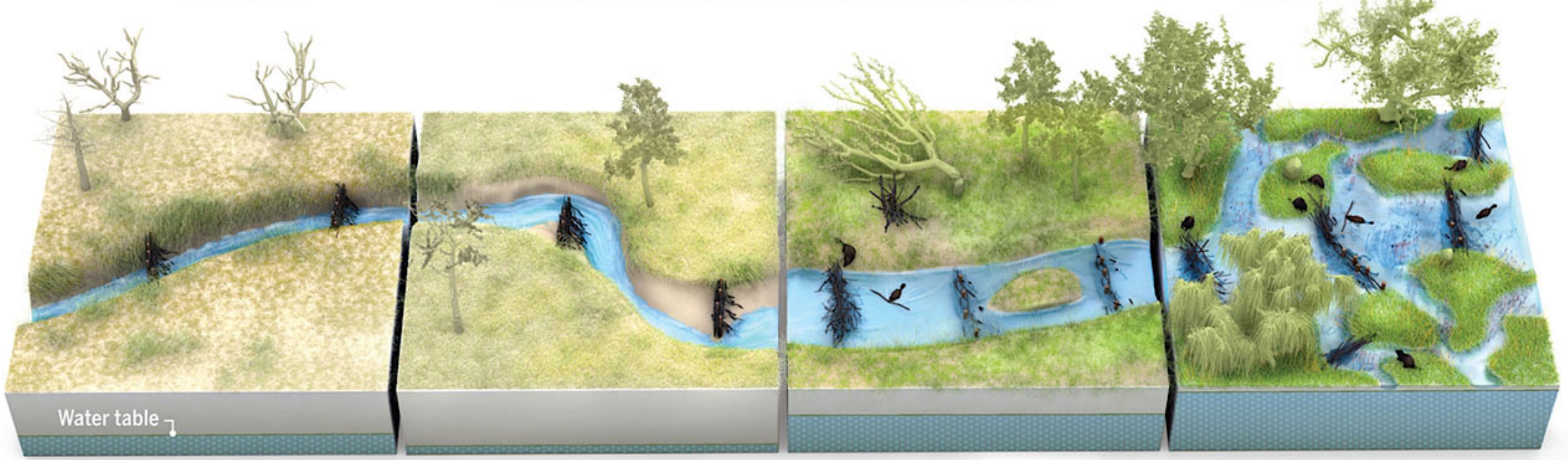
Across the U.S. West, scientists and land managers are using beaver dam analogs (BDAs) to heal damaged streams, re-establish beaver populations, and aid wildlife. In some cases, researchers have seen positive changes in just 1 to 3 years.



Incised stream



Restored stream



Adding dams
Beaver trapping and overgrazing have caused countless creeks to cut deep trenches and water tables to drop, drying floodplains. Installing BDAs can help.

Widening the trench
BDAs divert flows, causing streams to cut into banks, widening the incised channel, and creating a supply of sediment that helps raise the stream bed.

Beavers return
As BDAs trap sediment, the stream bed rebuilds and forces water onto the floodplain, recharging groundwater. Slower flows allow beavers to recolonize.

A complex haven
Re-established beavers raise water tables, irrigate new stands of willow and alder, and create a maze of pools and side channels for fish and wildlife.

Ben Goldfarb, Eager: The Surprising, Secret Life of Beavers and Why They Matter,

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Can we measure impacts and outcomes?

Can we hire land managers to produce the outcomes we want?

How do we create value for ecosystem services?

IMPACTS/loss/liabilities	OUTCOMES/gains/assets
Drought	Plant available water
Flooding	Stream base flow
Erosion	Stream purity
Infrastructure damage	Groundwater quality
Riverbank scouring	Groundwater recharge
Sedimentation	Surface water temperature
Atmospheric carbon	Soil carbon
Nutrient runoff	Soil fertility
Nutrient leaching	Pollination
	Wildlife habitat

The above are a focus of Abe Collins' work with Landstream.

Take Action to Build the Soil Sponge! Grow More, Waste Less!

1. **Buy** Read labels. Know your food. Vote with your food dollars
2. **Gardens** Less disturbance. Living roots. No bare ground.
3. **Hire** farmers, foresters and land managers to deepen watersheds.
4. **Home** Aerobically compost all food scraps and yard waste.
5. **Harvest Water** Catch, slow and sink water everywhere.
6. **Landscapes** Swales. More deep-rooted perennials and trees.
7. **Lawns** Mow less. Mow higher. Add more species.
8. **Community Planning** Avoid impervious surfaces. Manage all water to keep it around; don't waste it! More green spaces with rain gardens, especially uphill!
9. **Learn** Get involved with community resilience initiatives. Become a Soil Carbon Coalition Land Listener and gain skills for monitoring changes over time in landscape function.
10. **Connect** with your community to work together to build our future.

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Connecting communities to affect positive food system change from the ground up.

soil Carbon coalition

Rural Vermont

Northeast Organic
NOFA·VT
Since 1971
Farming Association of Vermont

SOL 4 CLIMATE

building soil, building community
building BALE a local economy

VOICES OF WATER FOR CLIMATE

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