

The Soil Series: Grassroots for the Climate Emergency
Part 4: Building Soil from the Ground Up
Speakers: Cat Buxton, Juan Alvez, Jess Ruben
March 27, 2019

Contents

- Living Notes FROM THE WALL: Actions; People; and information to connect with (from this Series session and links to past sessions)
- Events (upcoming, collected from all Series so far)
- Group Discussion - *statements and questions from this Series session*
- Presentation notes (link to the slides from Cat, Jess and Juan included below)

Soil Series Hosts

- [Building A Local Economy \(BALE\)](#) - South Royalton, VT. BALE is a community resource center for local economy initiatives in the White River Valley of Vermont, intentionally multi-issue in focused and multi-dimensional in their programmatic work. Check out the [documentary film](#) Dancing With the Cannibal Giant: Five New Stories for the Great Transition.
- [Vermont Healthy Soils Coalition](#) - To join the Vermont Healthy Soils Coalition Email Listserv, fill out this [quick survey](#). Then, follow the instructions in the email confirmations that you'll receive to join the listserv. Join the [VHSC Facebook group](#).

With deep gratitude for support from the [New England Grassroots Environmental Fund](#) and our long (and growing) list of sponsors. *Contact Cat Buxton to become a sponsor: cat@growmorewasteless.com.*

*When you're out in the world, please thank these **Soil Series sponsors!***

[NOFA-VT](#), [Upper Valley Food Coop](#), [Gardener's Supply Garden Centers](#), [Soil4Climate](#), [Vermont Compost Company](#), [UVM Center for Sustainable Agriculture](#), [Clean Yield Assets Management](#), [Rural Vermont](#), [Cedar Circle Farm](#), [350-VT](#), [Vermont Land Trust](#), [Community Resilience Organizations](#), [Long Wind Farm](#), [Community Resilience Organization of Hartford](#), [Orcamedia](#), [Earthwise Farm & Forest](#), [Sowing Peace Farm](#), [the Center for Transformational Practice](#), [MycoEvolve](#), [Voices of Water for Climate](#), [Building A Local Economy \(BALE\)](#), [Vermont Healthy Soil Coalition](#), [Black Krim](#), [Two Rivers-Ottawaquechee Regional Commission](#), [Ben and Jerry's Foundation](#), and [Grow More, Waste Less](#).

Living Notes FROM THE WALL

This is not complete list of resources by any means The lists below were compiled from the collective voices throughout the event. All this in just 2 hours!

ACTIONS (people are already doing these things in our region)

Repair degraded soil

Dont:

- Rototill (broad form, keyline plow)
- Compact Soil
- Over Fertilize

Do:

- Enrich with quality compost
- etc.

Bioremediation

Nematodes and other biopesticides. Avoid pesticides. Promote diversity.

Mycoremediation for watershed restoration - decrease in e. coli

- Fungal mats work

- Stormwater, design, innovation, education

Inoculate

- waterway edge buffers with corresponding species

- riparian plantings with mycorrhizae fungi

- mulch in pathways

- Add mycorrhizal inoculants to rec fields, golf courses, lawns, farm fields (less phosphorus addition required), roots of trees and plants, degraded landscapes

- root dips

- seed soaks

- charge biochar in compost

Install

- myco filters at industrial & agricultural point sources

- mycofiltration systems in stormwater runoff locations

- mycorrhizae inoculum throughout large scale farms

- Hugelkultur - in swales on contour on sloping terrain

Educate

- Youth & public in fungi ecology, food, medicine, & restoration

- Research: infinite potential

- Partner with fungi

- Citizen science

- Sharing books and information (pass it on!)

Legislative

- Write the governor/legislators

- Reporting on pesticides (push for compliance)

- Go to public meetings and committee meeting at the statehouse

- Vandana Shiva May 6th - 11 am - State House

Vote with your dollars

- Buy from farmer you know

- Buy grass-fed meats and dairy

- avoid Neonics, glyphosate

Culture/behavior change

- Buy less

- Compost

- Waste less food

- Producer responsibility

EVENTS

PAST SOIL SERIES EVENTS

Part 1 Ground to Body Soil Health and Human Health: [VIDEO](#), [NOTES/RESOURCES](#)

Part 2 Shielding Soil with Plants & Animals (VIDEO *coming soon*) [NOTES/RESOURCES](#)

Part 3 Connection Through Stories (VIDEO *coming soon*) [NOTES/RESOURCES](#)

Part 4 Building the Soil From the Ground Up (VIDEO *coming soon*) Notes are below.

UPCOMING SOIL SERIES EVENTS

[The Soil Series: Grassroots for the Climate Emergency](#)

April 10 Part 5 Social Mycelium: the Fiber of Community Resilience

April 24 Part 6 A Soil Sponge to Cool the Planet

May 8 Session 7 - Next Steps: Growing Grassroots Agency & Action for the Climate Emergency

ONGOING CALENDAR OF EVENTS collected the from Soil Series (April through June.)

[Full calendar HERE](#)

CONNECTIONS *(from this session)*

- VT Myconode; [fb group](#) & [page](#)
- [MycoEvolve](#); www.mycoevolve.net & [fb page](#)
- Mycelium (social too)
- Relationship with abenaki - connection to soil
- [Montpelier Tree Board](#)
- Elaine Ingham - [soilfoodweb.org](#) Soil Food Web, the cakes and cookies
- [Peter Donovan](#) - Soil Carbon Coalition

INFORMATION *(from this session)*

- [NDVI maps](#) - (normalized difference vegetation index) Measuring sunlight by mapping 3 years worth of photosynthesis at a time. Drafts by Peter Donovan. Map of the Champlain Basin (and others).
- Radical Mycology; <https://radicalmycology.com>
- Corenewal: <https://www.amazonmycorenewal.org>
- Mushroom supplies
 - [Mushroom Mountain](#).
 - Fungi Perfecti; <https://fungi.com>
 - North Spore; <https://northspore.com>
- Tradd Cotter - [Mushroom Mountain](#). North Carolina. 2014. [Book](#): Organic mushroom farming and mycoremediation: simple to advanced and experimental techniques for indoor and outdoor cultivation. White River Junction (VT): Chelsea Green Publishing
- Darwish, Leila. 2013. [Book](#): Earth repair: a grassroots guide to healing toxic and damaged landscapes. Gabriola Island (BC): New Society Publishers.

- Lowenfels, Jeff. 2017. [Book](#): Teaming with Fungi; The Organic Grower's Guide to Mycorrhizae. Portland (OR): Timber Press
- McCoy, Peter. 2016. [Book](#): Radical Mycology, A treatise on Seeing & Working with Fungi. Portland (OR): Chthaeus Press.
- Phillips, Michael. 2017. [Book](#): Mycorrhizal Planet; How Symbiotic Fungi Work with Roots to Support Plant Health & Build Soil Fertility. White River Junction (VT); Chelsea Green.
- Stamets PE. 2005. [Book](#): Mycelium running: how mushrooms can help save the world. Berkeley (CA): Ten Speed Press
- [Book](#): Biological Transmutations by C. Louis Kervran
- [Book](#) Healthy Crops: A New Agricultural Revolution. Francis Chaboussou

We've moved these two important sections to separate pages.

- 1) [PEOPLE \(alphabetical\) \(from ALL Soil Series sessions so far\)](#)
[also a list recurring topics of interest on this page]
- 2) [GROUPS/INITIATIVES \(from all Soil Series so far, broken down into lists of Local and not-so-local, with links\)](#)

Group Discussion

Note: these discussion rounds will directly inform the May 8 event.

Pose a question that won't be answered; State a comment or how you're feeling; Question(s) you're left with.

Below are your questions and statements as best as we could capture them

Questions:

- How can we continue to manage land and perennial food production to maximize partnership with soil and carbon sequestration?
- How to share information with people who aren't into the science; do simple things?
- What drives land management decisions - how to get there from here?
- How to convince condo association/neighbors to grown plants not managed lawn?
- [Montpelier Tree Board](#) - focus on invasives (Norway Maple and Crazy Snake Worms, Emerald Ash Borer) - If we were so focused on regenerative soils, would we really need to deal with invasives?
- How to garden without tilling?
- How do we get people to not be afraid of microbes?
- How to handle/get rid of invasives?
- How can we reach those who are working three jobs, who don't have a lot of time, how to make it accessible?
- What actions can we take?
- Where can I get Juan's presentation/references?

- Why is soil degraded in a place where no one lived or disturbed the soil? (besides Irene)
- How to increase access to this type of knowledge and experience? Vermont is a pocket; think up to cities.
- Why would your first step in management to grow things be to add toxins?
- Why do Vermonters burn 40,000 piles of unwanted vegetation per year?
- How do we stop the "machine"; do we need to fight directly?
- Can we think about buying one farm product per week?

Statements:

- Inspired by turnout - great energy
- Interested in learning more about fungi
- Inspired by all of the people in the room and by the feeling that I don't have to figure this out alone
- Hopeful about the speed that we can turn around the degradation of the land is possible
- Excited about having conversations with own plant lady about improving their yard
- Integrating new information with old
- Gabe Brown - [Book](#): Dirt to Soil - introduction to regenerative agriculture
- Impressed by the distance people travelled for this event
- Appreciate the upbeat nature of these events; hopeful
- Maybe soil can make some positive change, relationship to climate change
- Inspired by how quickly we can get culture back
- Hospital context: Sanitizing; getting rid of bugs vs talking about how awesome they are
- Excited to get a broad-toothed fork
- Curious about transmutation
- Emerging Plants/Invasives book
- Didn't realize what I was doing tilling in the midwest - driving the honey wagon
- Overwhelmed by the magnitude of the problem we face
- Extremely concerned with glyphosate products in the state; we're owed reports; governor needs to give us those reports - mandated by legislature; don't know the scope of the problem
- Glyphosate - Monsanto - patent for antibacterial - kills everything
- Call your governor for the report
- Stop using RoundUp - court cases in the process
- Excited that the science is so in depth
- Impressed by knowledge of the presenters
- See magnitude of problem, but hopeful because of the work that is being done
- Final quote really hit home- what we know already keeps us from learning
- Experimenting with nematodes to target a "bad" soil organism
- UVM Center for Sustainable Agriculture
- Buy from farmers who are treating the soil the way you want them to
- Howling Wolf Farm
- Tunbridge Hill Farm
- Interest in growing fruit and nut trees
- Swales and hugelkultur interest
- Randolph Community Orchard (and in Bethel)
- Mushroom forager - excited by Jess's presentation

- We can all spend more time getting to know our fungal ancestors
- Shocked by how much we need science to tell us how vulnerable life is
- Come back to value-based systems to bring climate deniers, etc. in
- Wendel Berry
- Not everybody knows that this is a huge problem
- Soil health was being worked on in Montana too!
- Invasive species management without chemical methods - inspiration from MA
- Pesticide Advisory Council - where are the reports!?
- Share books and information with one another
- Learn more every week; hopeful at turnout
- Experiential approach to gardening, intuitive, think more about how to tie it all back together
- This is a lot of information to digest
- Can't believe we're still farming this way
- Invasives are a symptom of industrial agriculture system
- Swedemitch - invasive
- 350VT - Climate Walk
- Theory that all insects are beneficial, remove non-nutritional plants
- Biomimicing socially
- The other side is very organized - how to stop the "machine"
- Quote: If you screw it up, it's your responsibility to fix it
- Need to know more not to screw it up
- Interested in mycoremediation
- Relationship between scientific knowledge and other ways of knowing - how to include and speak across differences
- Invasives need to be thought about differently - it's not their fault
- Tao Orion - [Book](#): Beyond the War on Invasive Species
- Sheep were able to get rid of poison parsnip - anecdote
- First time that I really feel that I can get into my garden and not dig
- Biotransmutation discussed by a university professor
- Airplants - interest
- Take responsibility for what we do
- Crisis can bring opportunity
- Conventional agriculture has to evolve
- [Tunbridge Hill Farm](#), a small-scale, diversified ecological farm run by Jean and Wendy Palthey in Tunbridge, VT
- [Howling Wolf Farm](#), a small-scale, grass-fed livestock operation in Randolph VT run by Jenn Colby and Chris Sargent
- Randolph Community Orchard [Pruning, Grafting, and Planting Workshop](#) April 13
- [BALE Resilience University](#)
- [Got Weeds?](#) - Mike Bald
- [350VT Climate Walk](#) and other events coming up
- Soil4Climate - Facebook group
- John Kemp - [Advancing ecoagriculture](#)
- [Mothers Out Front](#)
- [Rich Earth Institute](#)
- Cows Save the Planet - Book, Judith Schwartz (Judith will speak at the 4/24 Soil Series)

Presentations

Cat Buxton

Presentation Overview [\[SLIDES\]](#)

- Despite all of our accomplishments we owe our existence to a six-inch layer of topsoil and the fact that it rains
 - Image of corn field in the midwest, completely losing soil on farmland
- Soil Health Principles - NRCS and Gabe Brown
 - Living roots in the ground
 - Maximized diversity
 - Minimized disturbance
 - Minimized bare soil
 - Animals in contact with soil
- The sun has an energy budget
 - Sun is how soil gets its energy and food
 - 50% absorbed
 - 40-60% of this energy is invested by the trees into the root system
 - Maximize: biodiversity, photosynthesis, transpiration
- Making the connection of the circle of life
 - Sunlight; carbon; water
 - Kids are being raised to think that carbon is bad
 - Carbon is life; we are just mismanaging it
- Leaves are the first solar panels
- Billions of organisms eat the sugars made by plants in the soil/roots
- Can we harvest more sunshine
 - Elaine Ingham - soilfoodweb.org Soil Food Web, the cakes and cookies
 - [Peter Donovan](#) - Soil Carbon Coalition
 - [NDVI maps](#) - 3 years worth of photosynthesis maps around the Champlain Basin
 - Conifers photosynthesize year round - great to have
 - Brown spaces on maps indicate cities and farmland
 - Corn - 65 day window of photosynthesizing
- Leaves capture sunlight - turning oxygen and carbon dioxide (4% of Greenhouse Gasses), and water (95% of Greenhouse Gasses)
- Rhizosphere - vast root hairs underground
- Fungal hyphae (when there are lots of hyphae it's called mycellium) and bacteria in rhizosphere
- 1 tsp of healthy soil can have 1 mile of fungal hyphae in it
- What life could be in the soil if we were maximizing soil health?
- Soil food web map - all interconnected, cannot remove any individual
- Dead soil - "dirt" - sand, silt, and clay - not conducive for life
- Fertilizer, tillage can kill the soil food web
- Can we increase living roots in the ground?
 - Standard single species lawn - incredibly short
 - Prairie plants from the West - length of up to 15 feet
 - This holds soil together during rain and deepen watersheds

- Holding landscapes in place
- A 1% increase of organic matter in the top 6 inches of soil per acre can hold over 20,000 gallons of water (figure still under dispute)
 - We can increase water storage by increasing organic matter
- Image of Long Island Sound after Irene - Vermont farm fields ended up there
- Is it important to hang onto soil; what is the economic cost of losing soil?
- We can change the way water moves through our landscape by improving the soil
 - Can we turn cities into greener spaces?
 - Vertical gardening, rooftop gardening, roof catchment, pervious pavement, rain gardens [Green Education Foundation](#)
- July 1, 2017 - Thetford Elementary - 7 inches of rain in a few hours caused 12 feet of water above the drain
- The ocean dead zone in the Gulf of Mexico is now the size of Connecticut
- Humans create crop production at the expense of all other ecosystem services
- Ecosystem services:
 - Pollination - Insect apocalypse - killing off all of the insects that are good in order to kill very few that are detrimental to crop production
 - Clean water
 - Clean Air
 - Surface water temperatures
 - Landscapes that hold themselves in place
- Can we learn to mimic functional natural ecosystems
 - Beavers - Let them manage our water
- Can we shift our systems to provide multiple ecosystem services versus single services
 - Think about how your food is produced. Ask before you buy.
 - Who grew it? How was the land treated?
 - Look for: Organic, grassfed, pasture raised meats and dairy; organic, no-till, nutrient dense, soil stewardship, agroecology, permaculture, small scale, regenerative
- Can we measure impacts and outcomes
 - Can we focus on outcomes/ecosystem services?
- "Principles" not "practices" - practices limit us, they stop us from innovating
- Actions - SLIDE

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

- Buy Read labels: Vote with your food and plant dollars!
- Gardens Less disturbance. Living roots. No bare ground.
- Hire farmers, foresters and land managers to deepen watersheds.
- Compost Aerobically compost all food scraps and yard waste.
- Harvest Water Catch, slow and sink water everywhere.
- Landscapes Swales. More deep-rooted perennials and trees.
- Lawns Mow less. Mow higher. Add more species.
- Community Planning Avoid impervious surfaces. Manage all water. More green spaces with rain gardens, uphill!
- Learn Connect with others. Become a Soil Carbon Coalition Land Listener!

Cat Buxton www.growmorewasteless.com



Jess Rubin

Presentation Overview [\[SLIDES\]](#)

[Mycoevolve FARMER SURVEY](#) -please share

- Recognition of federally recognized Abenaki land - formerly: "Dawn Land"
 - o These people do not have access due to colonial borders and laws
 - o "There's a lot of pain in the soil here" - how to heal those relationships
- From: MycoEvolve
- Investigating the role of fungi in maintaining health in trophic web
- Regenerative agriculture - shift the burden to the intervenor
 - o You are responsible for what you disturb
- Scientific paradigm of time/creation
 - o Life on planet - 4.6 billion years ago
 - o Microbes - 3-4 billion years ago - made Earth hospitable
 - o Fungi - 2 billion years ago
 - o Plants - 1 billion years ago
 - ecological ancestors
- Fungi bridge microbes and plants - critical in earth repair work

- O-A horizons - 4-16 inches of soil on top
 - Highest density of plant life
- Soil food web
- Hyphae - biggest part of fungi; nutrient exchange networks; nutrient capture, enzyme releasing
 - Mycelium - a lot of hyphae
- Fungi are closer to Humans than plants
 - External digestion system
 - Decompose and recycle
 - Denature toxins and redistribute elements (except heavy metals)
 - Bridge nutrient networks
- Saprophytic Fungi
 - Break down cellulose and lignin in wood
- Mycorrhizae fungi - 90% of plants on earth
 - How fungal cells associate with plant cells:
 - Ectomycorrhizae
 - Arbuscular or Endomycorrhizae
 - Produces glomalin - glycoprotein
 - Helps store carbon
 - Well aggregated soil holds together in wet and dry conditions due to glomalin
 - Glomalin
 - When binds with iron or heavy metals, keeps carbon from decomposing for up to 100 years
 - Sara Wright - [researched and discovered glomalin](#)
- How to add fungi to landscape
 - Hugelkultur - in swales on contour on sloping terrain
 - Inoculate mulch in pathways
 - Add mycorrhizal inoculants to rec fields, golf courses, lawns, farm fields (less phosphorus addition required), roots of trees and plants, degraded landscapes
- To protect and support fungi in soil web
 - Dont:
 - Rototill (broad form, keyline plow)
 - Compact Soil
 - Over Fertilize
 - Do:
 - Enrich with quality compost
 - etc.
- Bioremediation
 - Chemistry - fungi know how to break down pollutants (be careful with heavy metals)
- Mycoremediation for watershed restoration - decrease in e. coli
 - Fungal mats work
 - Stormwater, design, innovation, education
- Inoculate:
 - waterway edge buffers with corresponding species
 - riparian plantings with mycorrhizae fungi
- Install:

- o myco filters at industrial & agricultural point sources
- o mycofiltration systems in storm water runoff locations
- o mycorrhizae inoculum throughout large scale farms
- Educate:
 - o Youth & public in fungi ecology, food, medicine, & restoration
 - o Research: infinite potential
 - o Partner with fungi
 - o Citizen science
- List of resources on slides
 - o Mycorrhizal Applications & Bioorganics
 - o Radical Mycology; <https://radicalmycology.com>
 - o Corenewal: <https://www.amazonmycorenewal.org>
 - o Fungi Perfecti; <https://fungi.com>
 - o North Spore; <https://northspore.com>
 - o VT Myconode; [fb group](#) & [page](#)
 - o [MycoEvolve](http://www.mycoevolve.net); www.mycoevolve.net & [fb page](#)
 - o Cotter T. 2014. Organic mushroom farming and mycoremediation: simple to advanced and experimental techniques for indoor and outdoor cultivation. White River Junction (VT): Chelsea Green Publishing
 - o Darwish L. 2013. Earth repair: a grassroots guide to healing toxic and damaged landscapes. Gabriola Island (BC): New Society Publishers.
 - o Lowenfels, Jeff. 2017. Teaming with Fungi; The Organic Grower's Guide to Mycorrhizae. Portland (OR): Timber Press
 - o McCoy, Peter. 2016. Radical Mycology, A treatise on Seeing & Working with Fungi. Portland (OR): Chthaeus Press.
 - o Phillips, Michael. 2017. Mycorrhizal Planet; How Symbiotic Fungi Work with Roots to Support Plant Health & Build Soil Fertility. White River Junction (VT); Chelsea Green.
 - o Stamets PE. 2005. Mycelium running: how mushrooms can help save the world. Berkeley (CA): Ten Speed Press

Juan Alvez, Ph.D.

Presentation Overview [\[SLIDES\]](#)

- "What does farming with nature mean"
- Compost and fungi connection/study
- Dr. David Johnson and Hui-Chun Su Johnson - Johnson – SU compost bioreactor.
- Difference between two photos:
 - o fundamental differences
 - o animal power vs petroleum power
 - o scale
 - o speed/time to plow the area
 - o manure
 - o energy
- Turning soil - enhances soil respiration
 - o releases excess carbon
 - o disturb carbon, water, nitrogen cycles
- Today's agriculture

- o Reference Jess and Cats info
- o slash and burn
- o clear land
- o commercialize
- o We are not producing food for humans, we are producing food for animals and storage
- o We produce more than double the amount of food the world needs today
- In Brazil - can produce 3 crops a year
 - o Most of the food goes to feeding animals in confinement
 - o Leaves behind polluted food
 - o This model is not sustainable
- Image of sand, silt, and clay - size differences
- Topsoil is full of life
- Rhizosphere can amplify the reaches of the roots and interconnect
- Unprecedented crisis
 - o Less than per person
 - o Losing soil at an unprecedented rate
 - 2,420 tons of erosion per second
 - Desertification - 1,370 hectares per hour
- Relationship between soils and health - microbes rule
 - o Cyanobacteria
 - o Microbes make antioxidants
 - o Mycobacterium vacca
- Soil mining
 - o Learning from Great Depression/Dust Bowl
 - o There are dust bowls all around the world still today - Australia, Africa
 - o We are mining for nutrients
- Since WWII - we have been losing mineral and vitamins at 1% per year in fruits and vegetables
 - o Don't have trace elements for many body elements/functions/processes - hormone formation
- Planetary limits
 - o Biodiversity loss, climate change
- Biodiversity loss crisis
- Comparing world-wide fertilizer and food prices - almost identical over last 50 years
 - o This is a bad habit
- Alegria Farm
 - o Dr. Pinheiro Machado (1966)
 - Started rotational grazing in Brazil (2nd person to do it there)
 - Running animals through fields
 - ghost patches - manure and urine
 - Managed soils and looked at organic matter
 - 1959 - low phosphorus, potassium, soil organic matter
 - 1993 - went up 7.9x, 16x, 33x respectively
 - 1999 - Compared to neighbor who farmed continuously
 - o Land rests dynamically
 - o No fertilizer added, where does extra phosphorus and potassium come from?

- o Everytime we disturb the soil, we are disrupting habitat for micro and macro organisms
- o Nature's secrets - theories
 - Biocenosis (Machado, 2004)
 - Dynamic development of soil life if, and only if, the soils are not disturbed
 - Trophobiosis (Chaboussou, 1980)
 - The development of life via food
 - [Book](#) Healthy Crops: A New Agricultural Revolution. Francis Chaboussou was an agronomist at the French National Institute of Agricultural Research. He introduced the term **trophobiosis** to describe the symbiotic association between organisms where food is to be obtained or provided. The provider of the food is referred to as a trophobiont. The term is also used for a theory of pest resurgence on crops to which pesticides have been applied causing an increasing dependence upon pesticides. This book is a translation from the French edition of 1985.
 - Sap of plants grown in healthy soils, constituted of more complex substances offer a barrier to pathogens because they are unable to fully process these elements
 - Pathogens have insufficient enzymatic capacity - soluble fertilizer connection
 - Ethylene/2 Cycle
 - break down of nutrients
 - Soil needs pores in order to accomplish processes
 - Transmutation of elements with low energy (Kervran, 1901-1983)
 - [Book](#): Biological Transmutations by C. Louis Kervran
 - Low energy nuclear reactions that can transform natural elements into different ones
 - "Biology is not only a chemical process, but also a nuclear one" - Biberian, J.P.
 - Transmutation Examples:
 - o Silica into Calcium
 - Chickens fed oats
 - o Sodium into Potassium
 - Fungi inoculated into sand/clay medium
- Soil health principles
 - o Manage more by disturbing less
 - o Diversify crop diversity
 - o Grow living roots as much as you can
 - o Keep the soil covered as much as possible
 - o "Is it what we know already that often prevents us from learning" - Claude Bernard