

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](#).

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## **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](http://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](http://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](http://www.growmorewasteless.com)



### Jess Rubin

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

[Mycoevolve FARMER SURVEY](#) -please share

- Recognition of federally recognized Abenaki land - formerly: "Dawn Land"
  - These people do not have access due to colonial borders and laws
  - "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
  - You are responsible for what you disturb
- Scientific paradigm of time/creation
  - Life on planet - 4.6 billion years ago
  - Microbes - 3-4 billion years ago - made Earth hospitable
  - Fungi - 2 billion years ago
  - 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](http://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