

Feed Avalon Soil summer School June 2015
Biochar Stoves in Agroecology and Permaculture
Ed Revill

1. Intro and Background

Climate Change and Resource Depletion;

Fracking to produce nitrate fertilisers which release soil carbon?! We can do better than that.

How did we get here? The Green Revolution!

Fritz Haber to Norman Borlaug to industrialised agriculture.

A way out of this mess;

Understanding and acting on soil carbon influencing factors.

e.g. Biochar heat sources in closed loop systems (agroforestry).

Hurdles;

Food and fossil fuel subsidies and corporate control.

Ignorance, laziness, resistance to change and failure to take responsibility.

2. Soil Carbon Management

‘Rich’ soil means carbon rich.

Soil erosion and degradation rate and causes;

Soil carbon release causes aggregate destruction. (White mans footsteps.) This is the biggest of our environmental failings.

24bn tonnes soil lost each year..

i, Factors and practices which release soil carbon

Weather

rainfall, UV/sunlight, wind, temp (microbes)

man made climate change (vicious cycle)

Fertilisers and biocides

Deforestation

plant roots, soil biota including AMF

Inappropriate grazing.

Cultivation, compaction, poaching, smearing.

Temperature and humidity; microbial influences.

Bare soil.

Fungae vs bacterial decomposition

ii, Factors and practices which stabilise soil carbon.

R strategist microbes vs k-strategists

Amino acids vs Humic acids

Earthworms.

(Human survival depends on understanding and acting on this one!)

i, various forms of carbon (labile to stable)

ii, external factors; Air, Water, Temperature, Radiation, UV, CEC, microbiology, Biochar,

Soil erosion and degradation effects

Pollution, Climate change

Resource depletion, Peak food, food security and food sovereignty

Toxic food, Nutrient poor food

Dust bowls / flooding

Need for ever increasing fertiliser quantities

Peak water

Soil erosion solutions

1. Stop the causes
2. Optimise primary producers carbon draw down
3. Stabilising carbon in soil to create **soil aggregates**.

3. Soil Aggregation

1. Optimising carbon draw down and 2, locking it in.

Water Stable Aggregates

Pores and micropores

Exercise;

How to measure soil aggregates

slake test, infiltration test

rain test

Soil Aggregate Building Principles

1. Stop Destroying Aggregates (above)
2. Optimise carbon draw down
3. Stabilise carbon in soil

1. Stop Destroying Aggregates

No walk raised beds

Cultivation

Mulch (armour)

Plant roots

Don't kill microbes; biocides and fertilisers

2. Optimising carbon drawdown

photosynthesis, primary producers

trees, coppice pollard, green manures/cover crops, wholistic farm management,

3. Stabilising Carbon in Soil

Amazon forest and many woodland soils demo need to do more than just draw down tons of carbon.

Ferralsols vs anthrosols

Glomus AMF and Glomalin

Bacterial polysaccharides

Terra Preta

9% biochar, no metal, no draught animals

The remaining organic matter in TP is stable

4. Biochar Stove Tech.

Stovaholics Anonymous

Peak oil, Extreme energy; aim to come off oil and stay within biocapacity.

Wood burning stoves, Rayburns, open fires inefficiency

Appropriate Scale

Corporate control, energy sovereignty

Charcoal kilns too wasteful and polluting

Re-inventing Fire

Combustion vs Pyrolysis

Retort vs kiln

The key: The smoke you see coming out of a charcoal kiln is flammable.

Majority World

CO and PAH poisoning, saving trees, disaster relief , CO2 negative, Soil building.

TLUD Stoves

Paul Anderson

Anila Stoves

Prof. Ravikumar

Rocket Stove

Larry Winiarski

Insulation and elbow

Thermal Mass Rocket Heaters

Ianto Evans

Slow burn vs hot burn with heat capture and slow release of heat

Indoor Biochar Heat Sources

Bringing biochar heat sources to the minority world.

Biochar Rocket Stove Hybrid

Anila Flue Riser

Pit Biochar

Outdoor fires will never be the same again

All of these appropriate technologies are Open Source.

Optimum Retort Shape

Using Biochar Stoves

Aim to reverse ecological footprint with regard to food and fuel.

Staying within 2.1gha

Use within systems of fuel and food production which include need for heat

Use within systems which build soil.

Trees, primary producers

Stoves stabilise the carbon

5, Using Biochar

Soil/mulch Respiration,

Fixed vs labile carbon. Using biochar to fix other organic carbon

To dig or to mulch?

Using biochar to stabilise mulches

Transported vs Cover crop mulches.

Use Within Closed Loop Systems (agroecology)

Use in conjunction with the above soil carbon optimising factors.

e.g. no walk min dig raised beds in an alley cropping system.

Optimise conditions for AMF proliferation

Create a biochar rich stabilised surface soil ammendment.

Biochar to replicate terra preta in stabilising mulch materials

(risk of biochar being washed out, it floats, unless locked into soil ammendment.)

Using biochar in forest gardens and perennials; digging it in.

Natural forest soil is very shallow; add biochar to mimic terra preta forest soil

Replicating anthropogenic not natural forest soil

Dig once to incorporate (with organic matter)

Biochar in different composting systems.

Other uses

tree bogs, propogating composts, hugel beds, tattoos, vertical growing systems, water filters, bioremediation substrates, medicinal

6. Biochar Stoves in Alley Cropping

My Growing System.

3 new practices;

1, Bringing biochar stoves indoors. (CO issues)

2, Combining alley cropping with biochar stoves; more than the sum of the parts.

3, Using biochar in a mulch (not soil) to crate a stable surface ammendment

Combine with all possible soil carbon stabilising practices.

7.. Reverse Systems

Using biochar heat sources in closed loop systems to reverse eco and carbon footprint.

1. *Kitchen Garden*, links garden and kitchen.

2. *Market Garden*

Inc ovens for adding value to crops

3. *Bakery*

Grow grain in alley cropping, use conservation tillage and cover crops.

Bake wheat in biochar ovens.

5. *Tree Bogs*

Jay Abrahams.

Biochar Heat Sources in Landscape Designs

Efficient vs Reverse

No austerity regarding this food and domestic energy.

Reverse life style rather than polute then offset.

Depression, Anxiety and Panic attacks.

These are a perfectly normal response to modern capitalist, corporation dependent, life destroying lifestyles.

You have a tool to help you return to living in harmony with life on Earth; knowledge that the way back needs an understanding of soil carbon influencing factors.