Arguments against biochar: True or false?

GECA ENVIRONNEMENT

EXPERT-CONSEIL ENVIRONNEMENT-RÉSIDUS-BIOCHARS

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Delaware, USA

A threat or a saviour?

- Saves the planet from climate change
- Solves larges environmental problems
- Solves all problems related to residues
- Reduces hunger in the world
- Improves soils/water retention
- Improves wealth

Briefly: Black gold for solving food, climate, and environment crisis?

- False hope on climate change
- Long term: bad impact on the environment
- Reduces innovation of new products from residues
- Will increase hunger
- Depletes soil properties
- Not economical

Briefly: Another snake oil?

Note: I'll be using 'biochar' for char and biochar

Climate change: Carbon sequestration

Content in biochar	
Total carbon content:	50-97%
Stable carbon content:	18-90%
Content in volatiles:	7-50%

Therefore,
only a part of the carbon is stable,
sometimes very little
Some biochars will do the job
while others won't

Climate change: GHG emissions

When applied in soil: Often ↑ respiration

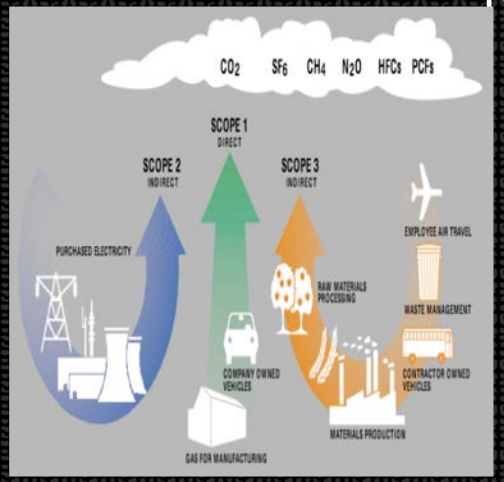
During manufacturing: Always emit CO_2

emit particles when poorly controlled

Feedstock: Emit during transport

emit if grown for biochar

Life cycle budget: usually less emissions than if residues let on ground, composted, burned



For decreasing overall emissions:

Manufacturing should be efficient, recycle its gases,

Control particle emissions

Should use residues rather than crop

not too far from the pyrolysis plant

Environment: Residue routes

Organics

Compost

If good quality

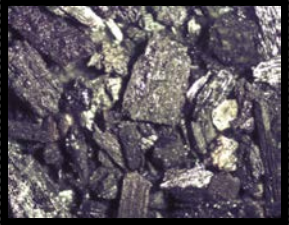
Garden and agriculture

Animal bedding

If not

Landfills

If not,
alternate route



Transformed
into Biochar

New products

Different markets

Transforming into biochar should not be the 1st reflex for residues, but rather to improve life cycle of residues

Environment: Residue routes

Pyrolysis	• Pyrolysis can not transform all residues into biochar
Organics	• When contaminated with organics, better transform residues into biochar at high temp. to destroy them (ex: creosote)
Heavy metals	• The metals concentrate in the biochar, limiting it uses, but still have interesting markets
Mixture	• When several materials are mixed and can't be separated, they go to landfill, can transform them into biochar for improving life cycle

Pyrolysis transformation may eliminate or concentrate contaminants into the biochar,
Then, we have to know its properties to use it correctly

Environment

Some biochars may

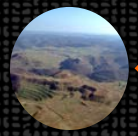
Sorb heavy metals, organics, nutrients to clean the environment

Serve for water filtration, replacing coal based products (AC)

Serve for air filtration, replacing AC and other less renewable products

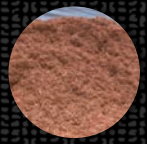
Serve for gas interception, replacing less renewable products

Serve as slow release fertilizer, reducing the needs for fertilizers



Support good microorganisms for decontamination

However, some biochars may



Contain heavy metals, other contaminants

Release contaminants into the environment

Clog filtration systems

Sorb slower in water and air, than other sorbants at first

Sorb too much nutrients, resulting in less availability

Support undesired microorganisms

Environment

Therefore

Climate change: Partly help, but not all biochars

GHG emissions: Mostly good, but no reduction under certain conditions

Residues: Excellent solution

Should not compete for RRR,

Should complement RRR

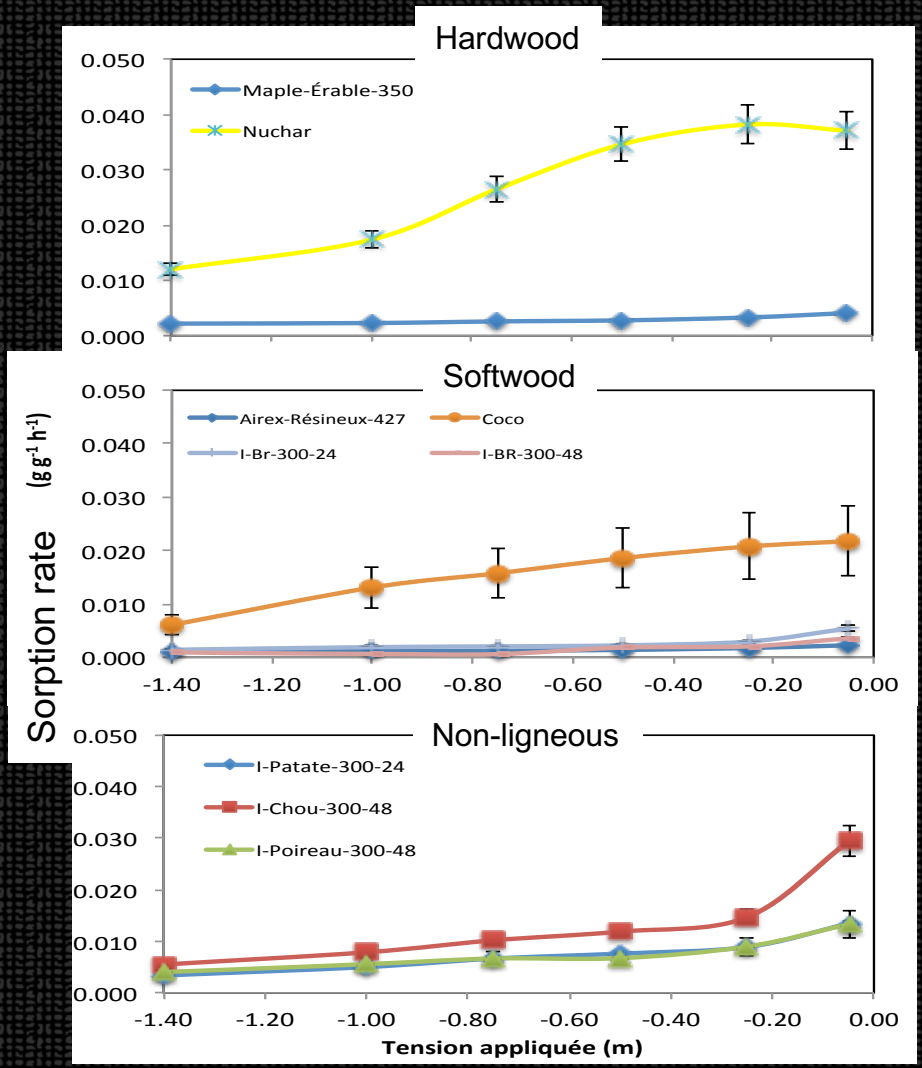
Biochars from contaminated feedstock: Good solution, but Use with care

Avoid most environmental, ag markets and markets for human consumption

Soil amendment

Statements pro	Statements against
Increases water holding capacity	Has not effect on soil water
Improves the structure	Organisms improve structure, not the biochar
Contains nutrients	Does not contain N
Acts as slow release fertilizer	Too slow to be helpful
Increases pH and has buffer capacity	Sometimes too much, burn the soil and not always buffer
Sorbs contaminants	Sorb pesticides, protecting them and decreasing their efficiency

Soil use: Water holding capacity



Hydrophilic

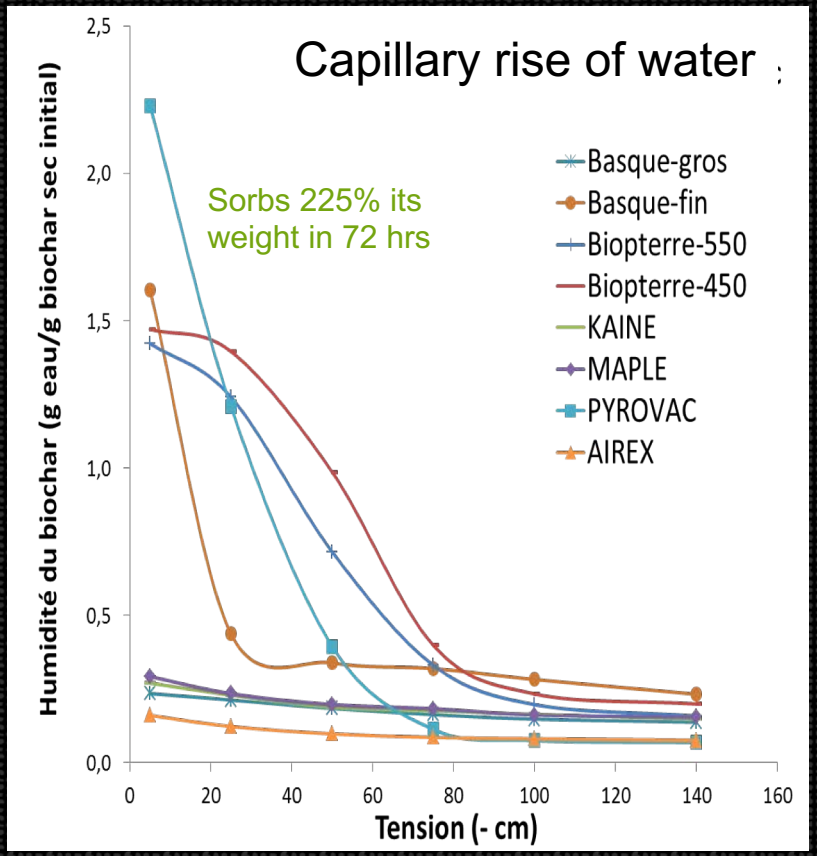
Hydrophobic

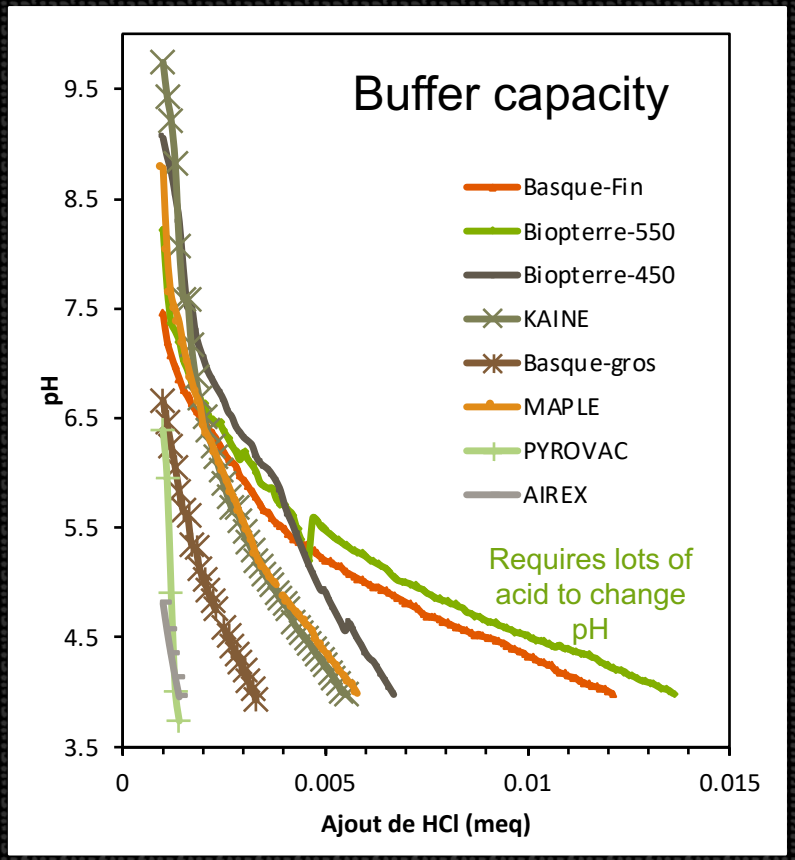
Switch from phobic to philic with its environment

Water sorption rate under different tensions (0=saturated environment)

Therefore, not all biochars can increase soil water sorption rate !

Soil use: Water sorption and pH buffer capacity





Wet ← Humid

Therefore, not all can increase soil water sorption and change soil pH !

Crop production

Our lab tested various biochars with plants conditions in Canada

Species	Conditions	Biochars	Growth	Comment
Picea glauca	Greenhouse, field, mine residues	3 biochars, 3 conc	↑ or ↓	Depends upon biochar conc, better resists to wind, high biochar effect
Alnus rugosa	Greenhouse, field, mine residues	3 biochars, 3 conc	↑ or --	Depends upon soil properties, good with symbiotics
Alnus viridis	Greenhouse, field, mine residues	2 biochars, 3 conc	↑ or --	Better on fine tailing
Alnus crispa	Greenhouse, field, mine residues	3 biochars, 3 conc	↑ or --	Depends upon soil properties,
Populus balsamifera	Greenhouse, field, mine residues	3 biochars, 3 conc	↑ or --	Likes wet conditions
Populus tremuloides	Field, rich soil	1 biochar, 1 conc	↑ or --	↑ C budget, better in waste rock
Salix arbusculoides	Greenhouse and field, mine residues	1 biochar, 2 applicat.	↑ or --	↑ contaminant interception, better on waste rock

Crop production

Our lab tested various biochars with plants conditions in Canada and Africa

Species	Conditions	Biochars	Growth	Comment
Avena sativa	Greenhouse, mine residues	2 biochars, 3 conc	↑ **or** --	Need fertilizer
Festuca rubra	Greenhouse, mine residues	3 biochars, 3 conc	↑ **or** ↓	Depends upon conc, Good winter survival
Trifolium repens	Field, rich soil and mines residues	1 biochar, 1 conc	↑ **or** --	↑ C budget
Spirea	Greenhouse, potting soil	3 biochars, 4 conc	-- **or** ↓	Needs pH adjustment
Calamagrostis canadensis	Greenhouse, mine residues	3 biochars, 3 conc	↑ **or** --	Depends upon mixture
Calamagrostis overdam	Greenhouse, mine residues	3 biochars, 4 conc	-- **or** ↓	Needs pH adjustment
Switchgrass	Field, rich soil	1 biochar, 1 conc	↑ **or** --	↑ C budget ↑ Microbial activity
Corn in Africa	**Field, rich soil**	**1 biochar, 1 conc**	↑	**2 x the yield!**

Crop production

The impact on crop production depends on

Soil	• Works better on dry, poor or acidic soils
Plants	• Works not as good with competitive plants
Climate	• Impact more impressive in warm country or with lack of water
Management	• Enhanced interactions when managed with microorganisms and N, need to be careful for pH
Biochar	• Biochar properties must match the needs of soil/plant/climate/management scenario

Therefore,
It does not always work !
Need for careful selection and management

Hunger, wealth, and economy

Hunger

- Increase crop production, not always
- Does not displace food crop, unless badly managed
- May help in reclaiming soils, but be careful on biochar choice

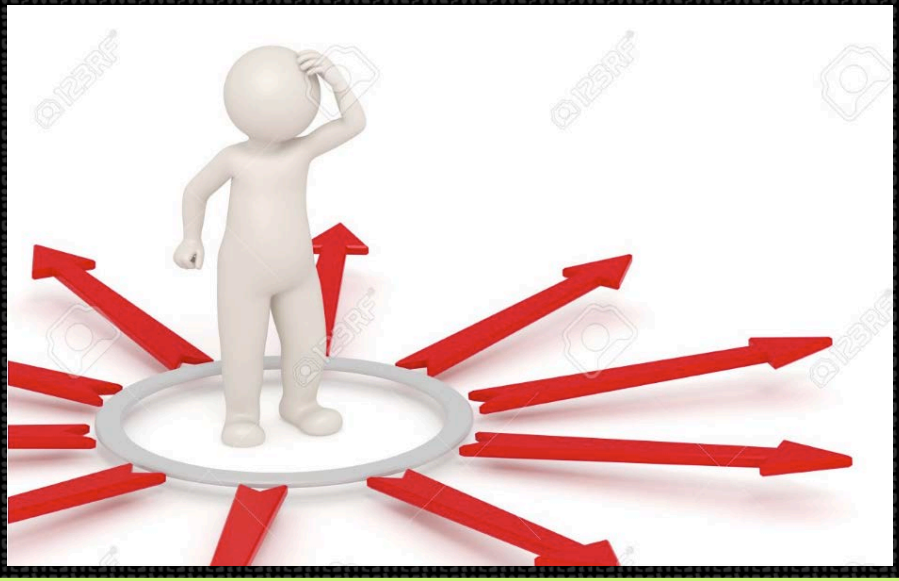
Wealth

- Help in decreasing dependency to imports, affects large number of people, but need to be organized
- Revenues for biochar and residue producers, salesmen
- Lower needs for fertilizers, pesticides, but not always true

Economy

- Favour RRR+new markets, but sometimes displace only
- Favour local, circular and green economy
- Other industries try to protect themselves from being displaced
- Does not help economy as long as too expensive, should become commodity for some markets

What should I believe!



- Arguments against it have a basic and should be considered seriously
- Biochar is not the solution to all problems and is not a snake oil

- ✓ Biochars can solve problems, but each one is different
- ✓ Some solve only one problem, others several
- ✓ The right use of the right biochar at the right place and time is the solution !
- ✓ There us no one recipe fits all!

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Thanks

To the USBI for this event !

To all of you for being here today !