RURAL SOLUTIONS SA

Agribusiness

Environment

Biochar
Current Knowledge and Opportunities

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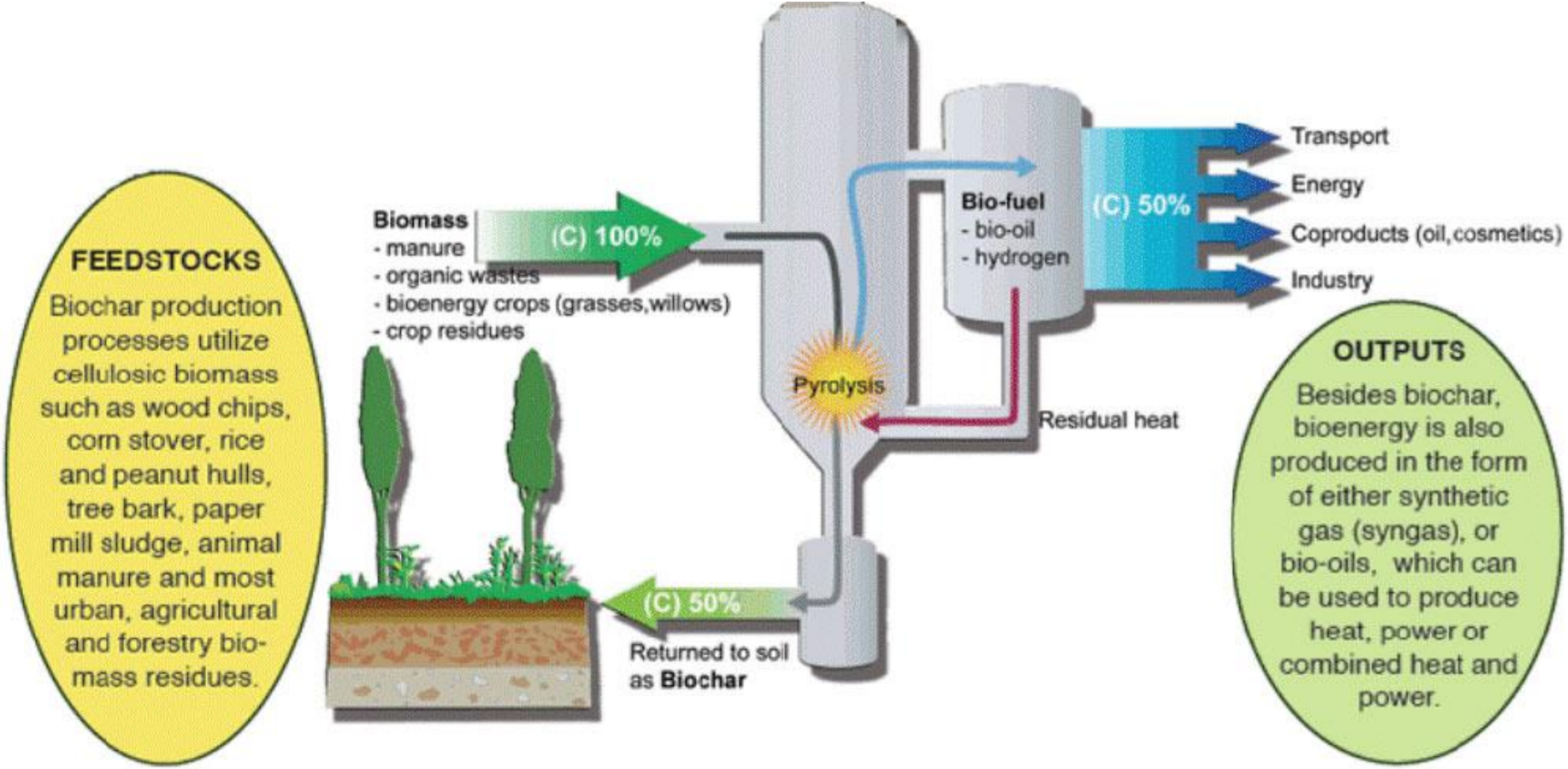
Government of South Australia

Amazon black earth Terra Preta soils

- Higher in pH
- Higher in Phosphorus
- Higher CEC
- Higher Calcium, Magnesium


FEEDSTOCKS
Biochar production processes utilize cellulosic biomass such as wood chips, corn stover, rice and peanut hulls, tree bark, paper mill sludge, animal manure and most urban, agricultural and forestry bio-mass residues.
Biomass
- manure
- organic wastes
- bioenergy crops (grasses,willows)
- crop residues
(C) 100%
Pyrolysis
Bio-fuel
- bio-oil
- hydrogen
(C) 50%
Transport
Energy
Coproducts (oil,cosmetics)
Industry
Residual heat
(C) 50%
Returned to soil
as Biochar
OUTPUTS
Besides biochar, bioenergy is also produced in the form of either synthetic gas (syngas), or bio-oils, which can be used to produce heat, power or combined heat and power.

Biochar – What is it?

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- Stable form of charcoal produced using pyrolysis – high temp / low or no O_2 conditions- may last 100's or 1000's of years
- Also produces SynGas (synthetic gas) and bio-oil which needs capture for bio-fuel. Diff to normal fire charcoal- higher C, less GHG produced due to low O_2

Syngas – What is it?

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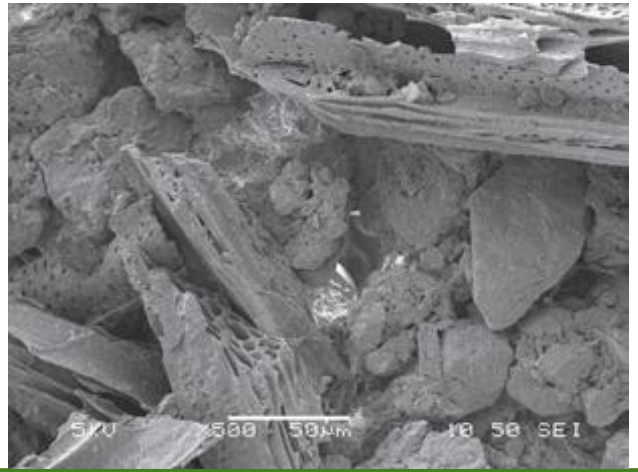
- Syngas includes a variety of gases inc carbon monoxide, hydrogen and methane
- Bio-oil can be used to heat the system or for fuel for heaters or biolers.
- Electron microscope showing porous nature of biochar (Krull, CSIRO)



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Biochar plants - big and small

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- Possible to have portable on-farm Bio-char pyrolysis system
- Or Large capacity slow pyrolysis industrial system
- Both now exist in Australia- not aware of them in SA
- Aware of some smaller furnace types- gas capture?/

Variations to Biochar

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- Variable product based on source material, temperature and time
- Source Carbon - wood>chicken manure> straw
- Higher temp biochars more stabile, better for toxin absorption but less agricultural value
- Lower temp less stable but more fertile, better for production
- If temperature too low can create toxic compounds – as per India

Variations to Biochar - cont

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- Mostly alkaline and have a Neutralising Value unless using wet pyrolysis
- Higher levels of N and P in source can result in more in the biochar but not always available
- CEC biochars vary from 15-300
- CEC soil charcoal vary from 300-500
- Research to see if new biochar CEC will increase over time

Biochar – Potential Benefits

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Carbon Farming

- Increases Soil Carbon
  - But who gets the credits?
- Could help mitigate greenhouse gas emissions
  - Some reductions in Nitrous oxide emissions reported

Summary of N_2O emission

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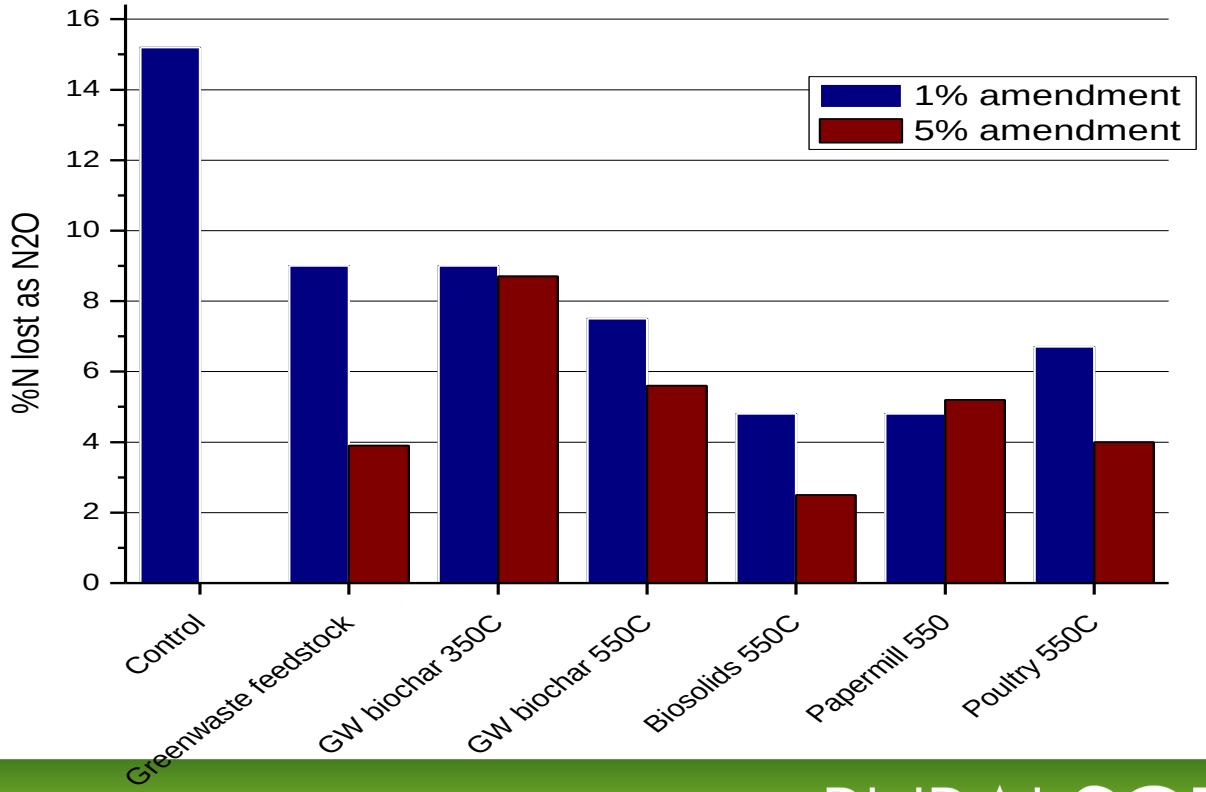

Source: LV Zwieten NSW Govt

Biochar – Potential Benefits

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Soil fertility/productivity

- Improves soil structure in **some soil layers** including decreasing bulk density
- **On some soils** increases biological activity, soil fertility, water holding capacity, pH, yield

DAFF/CSIRO Biochar Project Summary

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- Comparing chicken manure and straw biochars
- Soil types – Deep sand WA, Red Brown Earth NSW, Vertisol NSW, Mallee Soil SA
- Found soils responded differently to types of biochar
  - Best yield with chicken manure for Mallee 5t/ha and RBE 10t/ha
  - Best yield with wheat chaff for deep sand 5 t/ha
  - No response on black vertisol

DAFF/CSIRO Biochar Project Summary

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Biochar and effectiveness of herbicides

- Glasshouse experiments have shown;
  - low levels of fresh biochar in the soil rapidly deactivate herbicides = poor weed control
  - also reduced rate of herbicide decay
- herbicide sorption and subsequent deactivation is dependent on type of biochar
- Biochar use will need to be carefully managed in agricultural situations that rely on herbicides applied to the soil

Likley place to apply biochar in MLR

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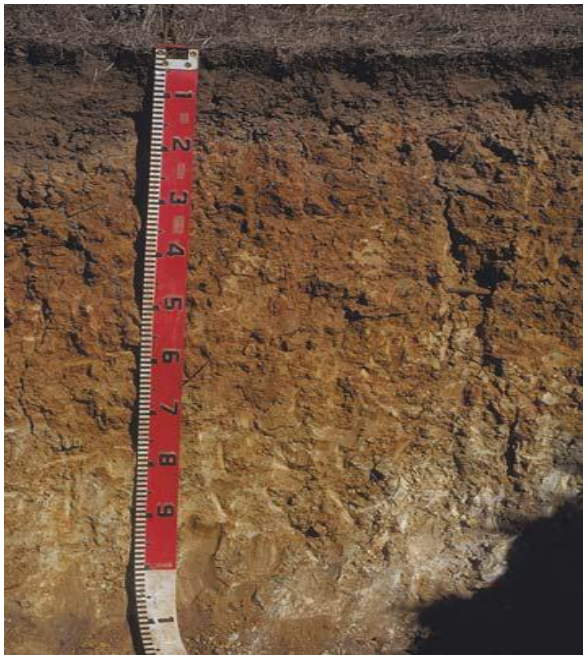
Soils with bleached infertile layers



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Likley place to apply biochar in MLR

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Soil with low organic matter from vegetables or naturally

Likley place to apply biochar in MLR

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- Need waste sources or grow your own
- Waste sources need to be close to sources with biochar plants or manufacture your own
- Waste Sources – periurban Adelaide

Waste sources close to Adelaide

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- Greenwaste - ??
- Grape marc- ??
- Forestry waste - ??
- Biosolids – 80,000t/yr
- Manures- 40,000t/yr

Grow your own from liquid waste or paddock scale

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- SANTFA looking at growing reeds from dairy liquid waste for biochar in the Lower swamps
- SARDI (C Williams) did something similar in the Riverland several years ago with winery waste
- When combined with gas manufacture cereals, straw or pastures maybe source
- 10,000 ha @ 8 t/ha could produce 80,000 tonnes

Where to with Biochar?

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- Better understanding of different products from different sources
- Potential positive effects of biochar for climate change and improving certain soils- needs to be beneficial!
- Negative effects of biochar need to be understood- reduced efficiency and binding of some ag chemicals
- Finally, understanding the economics of production and use of biochar and comparison with other uses of products

Acknowledgements

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- Amanda Schapel, RSSA
- Sparkes, J and Stoutjesdijk, J (2011)Biochar-Implications for Agricultural productivity
- Krull, E CSIRO Biochar Fact sheet and notes from her seminar
- DAFF/CSIRO summary information on website

Do You Have Any Questions?