Management practices to grow soil carbon – grazing, cropping and perennial horticulture

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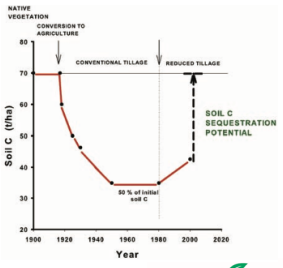
Sequestering soil carbon

- Soil carbon balance: SOC in vs. SOC out
- Loss pathways – principally as CO_2
- 50% of Soil C gone = SOC from 5% to 2.5%
- Increasing SOC by 1% requires about 50t dry matter
- Sequestered C principally humus



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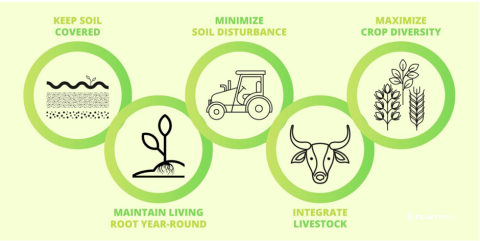
What can we do to sequester SOC?



Principles of regenerative agriculture (Lower Blackwood Catchment).

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Where does sequestered SOC come from?

- The myth of nitrogen fertilising
- Morrow plots: after 40-50 years of synthetic fertiliser, SOC declined despite residue incorporation
- Similar story repeated across geographic regions, soils and tillage practices (incl. no till)
- Mineral N enhances microbial degradation of plant residues, SOC and consequently, reduces organic N

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Where does sequestered SOC come from?

- Coonan et al. (2020)
  - 59-64% of total soil carbon contributed by microbial detritus
  - Total soil N and C were more important than rainfall, acidity and clay contents
  - Nutrient addition to fresh organic matter (e.g. hay or stubble) can increase C sequestration by 6-52%
  - And reduce mineralization of pre-existing SOM by 24-50%
  - Emphasises the need to think about soil agronomy rather than focus on plant agronomy

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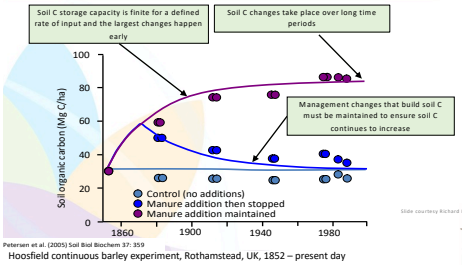
Management of Soil Carbon – saturation and permanence



Petersen et al. (2005) Soil Biol Biochem 37: 359

Hoosfield continuous barley experiment, Rothamstead, UK, 1852 – present day

Slide courtesy Richard Eckard

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So what should I be doing?

Fixing it	**Drainage / ripping** **Keeping water on farm** **Soilkee**
Helping it	**Grazing management** **Compost / SSM** **Intercropping / Cover cropping** **Trees**

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Drainage / ripping

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Keeping water on farms

- Issues:
  - Eroded gullies and tunnel erosion
  - Lack of billabongs
  - Water exiting system too fast
- Solutions:
  - Getting stock out of waterways
  - Where is safe to flood?
  - Leaky weirs
  - Planted and fenced waterways
  - Erosion control plans?

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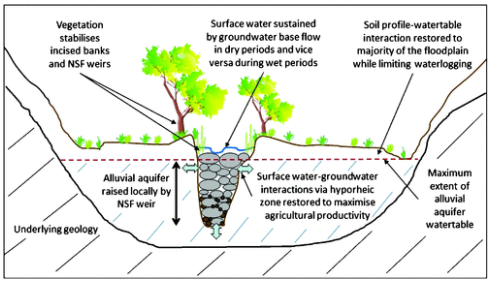
Keeping water on farms



Leaky weir.

Dobes et al, 2013

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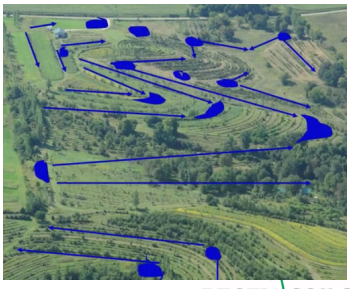
Supporting self-organisation

- Design systems aim to mimic nature or work with nature to meet human goals
- Permaculture zones
- Agroecological principles
- Landscape function
- Keyline



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Soilkee

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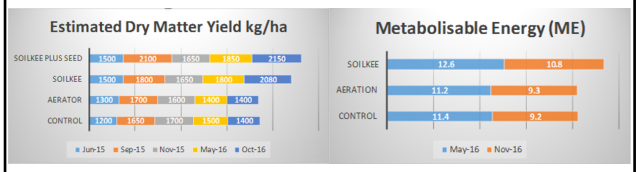
Soilkee



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Grazing management

- Need a system for brittle environments
- Recovery times
- Stock density
- Pasture utilization
- Over grazing
- Diversity
- Weed control
- Mulching the farm

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Compost

- What kind of compost do you need?
  - Soil structure
  - Biological stimulation (fungi / bacteria)
  - Fertiliser contribution
- Customising composts
  - Gypsum / lime
  - Nutrients
- Where to place the compost
  - Surface application – grazing or cropping
  - Subsoil manuring

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Cover cropping / inter-cropping

- Cover cropping
  - Can be part of paddock rehabilitation
  - Can be promoting roots year round
  - Can alternate between cash crops
  - Can complement cash crops
  - Diversity is key
- Inter-cropping
  - Increasing root architectures
  - Deep rooting
  - Increasing diversity
  - Nitrogen fixing

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Inter-cropping

- Corn / Soybean 'Fence Row' farming
- Yielded 2-3 times the county average

(Lazarovits et al., 2013)

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Integrating trees

- Issues:
  - Farm forestry
  - Alley planting
  - Windbreaks
  - Fodder trees
  - Speciality crops (e.g. cut flowers, lavender, pepper berries etc.)
  - Boutique livestock - e.g. Dexters, Lowline etc.
  - Suitability of smaller stock

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Summary

- Soil health is a product of balanced soil chemistry plus management practices
- Focus on organic matter generation and return
- Every farm is different
- Every farm has the potential to sequester more organic carbon
- Every farm has the potential to be better (healthier and more sustainably productive)
- High carbon equals less risk, less stress, and more profit

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Agriprove modules

1. How soil works and how plants grow; the drivers of the case for change (acidification, SOC loss, erosion)
2. Organic matter – the cornerstone of soil health and sustainable production
3. Soil biology – millions of years in the making
4. Mineral management – the role of macro and micro elements
5. Managing fertility to build soil carbon.
6. Management practices to grow soil carbon – grazing, cropping and perennial horticulture
7. Bringing it all together – monitoring and evaluation. Soil and tissue testing – chemistry, physics and biology (and the role of soil health cards)

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THANK YOU

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