



Soil carbon sequestration in arable and upland areas: potential and issues

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Outline

- How are GHG inventories currently calculated? Where is soil C within that?
- Why we should encourage soil C sequestration by land managers - the win-win situation
- How could we do this:
 - direct measurement and direct rewards
 - indirect measures and rewards for perceived C sequestration
- Other factors to consider





Accounting for GHG emissions

- Agricultural emissions under National GHG inventory (13% total):
 - enteric fermentation, manure management, agricultural soils
- Other categories related to agriculture (12%):
 - fuel combustion, sewage use, liming
 - land use change (LULUCF) grassland to arable
- Also ammonia and nitric acid production ??
- pesticide production ??

The inventory doesn't account for changes in soil C resulting from improved management practices like.....

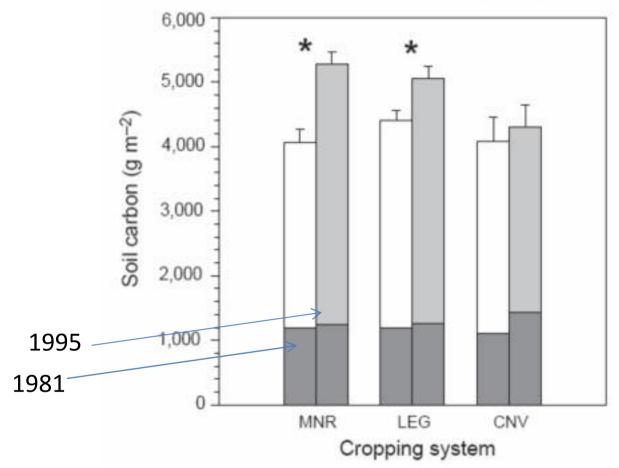
- longer ley periods in arable rotationsreduced tillage practices
- composting of manures to stabilize C
- Could these be included in LULUCF category?







Soil C, N Management and Crop Rotation



- MNR and CNV had similar total organic residue input (43-44 t C/ha over 15 y), but 12 t C/ha accumulated in MNR, versus only 2.2 t C/ha in CNV
- LEG had organic residue inputs of 39 t C/ha, but still accumulated
 6.6 t C/ha over the 15 years

Rodale trial (Drinkwater et al. 1998 Nature)

Soil C and Organic Farming

Treatment	Average annual C application rate (t/ha)	C _{org} relative to NPK fertilizer only
Biodynamic	1.78	26%
Bioorganic	2.24	12%
Conventional	2.18	13%

BIODYN system had stored 16.7 t C/ha more than CONFYM after 20 years

What do these findings tell us?

- Quality of the C added is crucial
- Composting produces stable C more resistant to decomposition, longer residence time
- Differences in microbial metabolism may also be a factor
- Low C:N residues to maintain fertility combined with temporal diversity (rotations) can increase soil C storage

What about C sequestration in upland areas?

- trees versus heather
- grazing management
- heather burning
- grip blocking
- total plant biomass needs to be considered

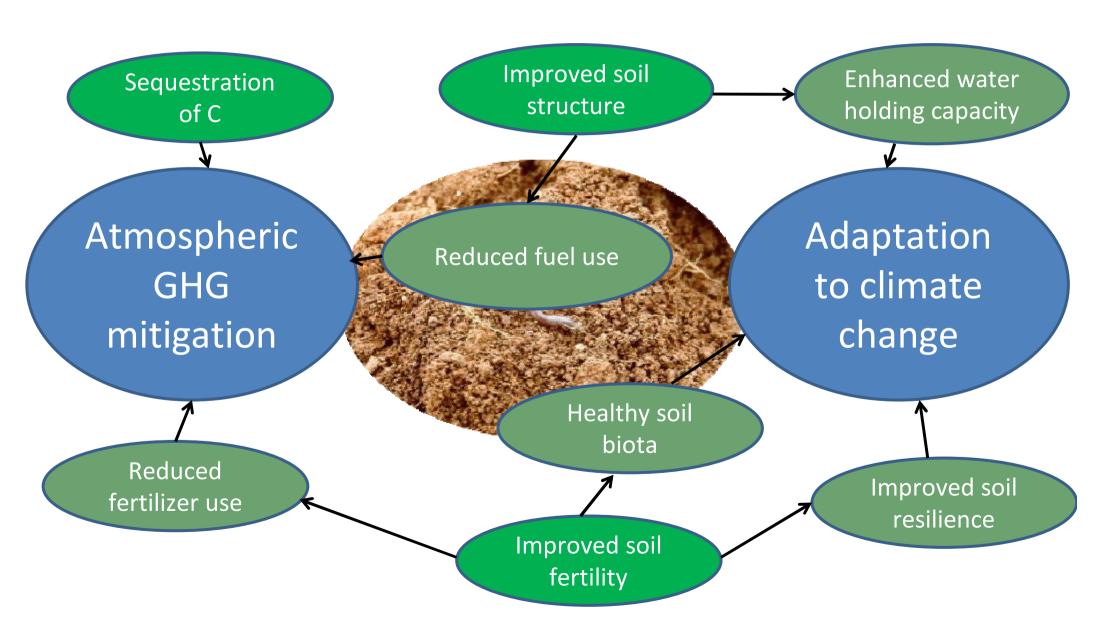








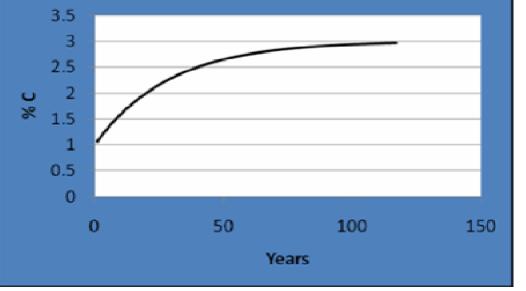
Why promote soil C sequestration? a "win-win" scenario



How to promote soil C sequestration by land managers?

- Direct measurements and rewards based on evidence
- Field by field SOC levels versus an optimum SOC
- Baseline modelled or local optimum





How to promote soil C sequestration by land managers?

- indirect measures and rewards for perceived C sequestration
- using stewardship programmes (ELS, HLS in England or Rural Stewardship Schemes in Scotland)
- should we promote composting of manure? do we have enough evidence?
- moorland management burning? proper grazing management?



Other factors to consider

- trace gas emissions do increases in SOC affect CH₄ and N₂O emissions?
- redistribution of C this is not sequestration where will the C come from?
- important links with other initiatives, especially Water Framework Directive - catchment sensitive farming
- balance food security with emission reductions reducing livestock is an easy way to reduce emissions - but only if diet changes





Questions?



