UK soil survey to test LTLS terrestrial model outputs

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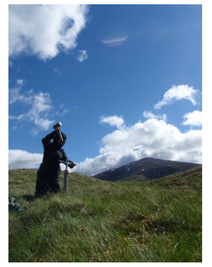
Aim:

Conduct a survey of C, N and P contents and ^{14}C derived soil organic matter residency times of shallow (0 - 15 cm) and deep (15 - 40 cm max.) soils across the UK.

To:

1. Test how closely predictions from the LTLS terrestrial model for soil C:N:P and soil organic matter residency times match measured values for a suite of UK sites.
2. Provide the most comprehensive survey of UK bulk soil ^{14}C values to date.



Site selection:

The survey was awarded sufficient funding for ^{14}C analysis at approx. 85 survey sites.

The LTLS terrestrial model classifies sites by broad vegetation type: herbs, shrubs, trees (defining plant stoichiometries and decomposition rates) & presence/absence of inorganic fertiliser application. Sites for the soil survey were therefore selected using the classification scheme outlined in Table 1.

The majority of the sites were selected from within the Macronutrients Cycles Programme test catchments (Ribble, Conwy and Avon), alongside the Scottish Dee catchment.

It is not our aim to characterise each catchment but to use sites from the catchments to characterise ecosystems across the UK:

- Ribble - urban & agricultural landscape of varying topography
- Conwy - low agricultural & industrial intensity, easier attribution of large-scale drivers of change, e.g. climate & atmospheric pollution
- Avon - provides southerly climatic landscapes
- Dee - extends range of climate and atmospheric deposition northerly.

In addition to sites within these catchments, the arable sites will be selected from specific areas of high arable farming activity in east and southern UK, and a suite of ombrotrophic peat sites will be selected along a S-N UK transect to test a specific peat component of the LTLS model.

Distribution of the sites amongst LTLS soil survey land cover types is based approximately on proportional UK coverage of corresponding 2007 Countryside Survey broad habitats.

Table 1. Site classification scheme for LTLS soil survey

	Site class	Definition
Not inorganically fertilised	**Unimproved grassland**	Grassland with no inorganic fertiliser additions
	Sub-categories:	
	Acid	Acidic soil
	Calcareous	Calcareous soil
	Heathland	Shrub s dominant ; no inorganic fertilisation; not ombrotrophic bog
	Ancient woodland	Woodland since at least 1600s
	Montane	High altitude (> 700m)
	Ombrotrophic bog	Receiving water as precipitation only; peat accumulation
Inorganically fertilised &/or planted	**Improved grassland**	Inorganic fertilised grassland; often also re-seeded
	Arable	Inorganically fertilised crops
	Tree plantation	Forestry plantations

Progress to date:

Sites sampled to date for the LTLS soil survey are shown in Table 2.

Arable and ombrotrophic peat transect sampling to be completed spring 2014.

Lab analysis of total C & N (long-term N pool predominantly organic), total & organic P (ratio of inorganic : organic P variable amongst soils), pH and ^{14}C signature to be completed over the coming months.

Table 2. Sites sampled to date for LTLS soil survey

Site class	Catchment	Sampling sites	Site class	Catchment	Sampling sites
Unimproved grassland – Acid	Ribble	- XXX - Park Fell, Ingleborough NNR	**Forestry plantation**	Ribble	- Sitka spruce stand, Gisbun Forest
	Conwy	- Cwm Clorad, Dyffryn Mymbyr - XXX - Carneddau plateaux		Conwy	- Sitka spruce stand, Glasgwm - Sitka spruce stand, Mynydd Deulyn
	Dee	- Sron na Gaoithe, Glenshee - Meall Gorm, Glenshee		Avon	- Corsican pine stand, Ringwood Forest
Unimproved grassland – Calcareous	Ribble	- Juniper Gill, Ingleborough NNR - Scar Close, Ingleborough NNR		Dee	- Sitka spruce stand, Durris forest - Scot's pine stand, Glen Tanar Estate
	Avon	- Wylye Downs NNR - Pewsey Downs NNR	**Improved grassland**	Ribble	- XXX - XXX - XXX - XXX - XXX
Heathland	Ribble	- Burnrigg Moor, Horton-in-Ribblesdale - Winfold Fell, Trough of Bowland		Conwy	- XXX - XXX - XXX - XXX - XXX
	Conwy	- Foel Lus, Penmaenmawr - Pont ar Gonwy, Migneint		Avon	- XXX - XXX - XXX - XXX - XXX
	Avon	- Holt Heath NNR		Dee	- XXX - XXX - XXX - XXX - XXX
	Dee	- Glen Muick - Glen Tanar Estate			
Ancient woodland	Ribble	- Park Wood, Gisburn Forest			
	Conwy	- Coed Dolgarrog			
	Avon	- Langley Wood NNR - Holt Forest			
	Dee	- Birch woodland, Loch Kinord			
Montane	Conwy	- Carneddau plateaux			
	Dee	- Culardoch			

Soil sampling methods:

6 (improved grassland & arable) or 10 (all other site types) soil cores collected at random from 100m^2 at each site.

Shallow (0-15 cm) and deep core sections taken separately consecutively down the same hole to ensure core depth not affected by compaction.

Deep core sections taken to 40 cm where possible and shallower at sites where impenetrable material hit at < 40 cm depth.

Core sections bulked to give a shallow and deep bulked sample for each site.

For ombrotrophic peat sites, 6 cores to 1.5m depth (or peat base) will be taken from 100m^2 and divided into shallow and deep profile core sections at an approximated mean peatland acrotelm/catotelm boundary (based on peat C contents) that will be used for the modelling.