Chronosequence: MOORCO – Moorland colonisation

Chronosequence plots are used to assess long-term changes in biodiversity and ecosystem processes when woodland establishes on moorland

Background

The MOORCO [1] chronosequence plots use sites where birch (*Betula* sp.) has naturally colonised moorland to assess changes in biodiversity and ecosystem services following a change in land use from moorland to birch wood.

In the 1970s John Miles identified 13 sites across Scotland and Northern England where moorland had been colonised by birch trees. At each site he identified plots with different aged birch woodlands that had colonised the moorland and a set of neighbouring moorland plots. John went to considerable lengths to confirm that the sites were first generation birch woodland on moorland and the soils would have been similar to neighbouring moorland soils prior to tree colonisation. Our data has enabled us to identify changes in above and below-ground species and soil properties that occur when birch woodland establishes on moorland.

Key results

The same trends of change in vegetation and soil seem to be occurring at all sites whether under *Betula pendula* or *B. pubescens*, although the extent and rate of the change varies considerably between sites. When moorland was colonised by birch woodland the following changes were shown to occur:

- Increased numbers of earthworms.
- Following the death of heather, a gradual breakdown of surface mor humus and its conversion to a mull like form.
- Increased rates of cellulose decomposition.
- Increased pH, exchangeable Ca and total P.

- Decreased in C:N, C:P and to a lesser extent C:K.
- Increased fertility.
- A change from a heather dominated ground flora to a grass and herb rich flora.
- Nematode abundance and diversity increased.

These chronosequences were used to show that:

- The vegetation composition predicts the soil microbial community at least as well as the soil chemical data. The vegetation composition may represent a more stable 'summary' of the effects of multiple drivers over time and may thus be a better predictor of the soil microbial community than one-off measurements of soil properties.
- Soil chemistry and plant composition are, in substantial amounts, explaining different parts of the variation within the soil microbial community.
- Trees may control soil community structure through the manipulation of resources and the soil physio-chemical environment.

See Publications [2] for further details of results.

Sites

Although John worked at 13 sites at the James Hutton Institute we have only continued the work at three sites:

Site Name	Grid reference
Tulchan	NJ154373
Craggan	NJ190323
Kerrow	NH325295

Treatments

In 1975 each site had an open moorland area and a range of plots with different birches

Age of birch trees at start of work and in 2009; 0 = open moorland

Site	Stand	1975	2099
Craggan	1	6	40
	2	19	53
	3	26	60
	4	52	86
Kerrow	1	0	0
	2	18	52
	3	27	61
	4	70	104
Tulchan	1	0	0
	2	17	51

Site	Stand	1975	2099
	3	25	59
	4	37	71

Replication

Each stand (age of birch/moorland) replicated three times at each site.

Data collected

Data type	Date	Details
Vegetation	1975, 1986, 2006, 2009	Species composition recorded as Domin scores or % cover
Soil chemistry	1975, 1986, 2006	Al, C, C:N, Ca, Ca, Fe, K, LOI, Mg, Mn, moisture, N, Na, N-mineralization, P, pH
Soil microbial	2006	PLFAs and TRFLP's
Soil seedbank data	1975, 1986, 2004	Density of seeds per m^2
Invertebrates	2005	Millipedes and carabids
Soil physical properties	1975, 1986, 2006	Bulk density, depth of O horizon, soil profiles

Contact

MOORCO [3] is a collaborative project across several groups and themes within the James Hutton Institute and with many different staff involved. In the first instance please contact Dr Ruth Mitchell [4] for further details.

Related Staff

Related staff

Ruth Mitchell [5]

Links:
[1] https://www.hutton.ac.uk/research/departments/ecological-sciences/research-facilities/moorco
[2] https://www.hutton.ac.uk/research/departments/ecological-sciences/research-facilities/moorco/publications
[3] http://www.hutton.ac.uk/research/departments/ecological-sciences/community-ecology/moorco
[4] mailto:ruth.mitchell@hutton.ac.uk?subject=Enquiry%20about%20MOORCO
[5] https://www.webarchive.hutton.ac.uk/staff/ruth-mitchell