

Creating acid grassland by adding sulphur, bracken *Pteridium* litter and heather *Calluna* cuttings at Minsmere RSPB Reserve, Suffolk, England

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SUMMARY

An attempt was made to convert a former arable field to acid grassland. Elemental sulphur, bracken *Pteridium aquilinum* litter and heather *Calluna vulgaris* clippings were added and the area grazed with sheep. Over seven years the target acid grassland species cover increased considerably to 60.7%. Adjacent existing acid grassland had 85.6% cover of these species.

BACKGROUND

This case study describes one of three methods used to try to create acid grassland on former arable land at Minsmere RSPB Reserve in Suffolk, eastern England. The method used in this study is addition of sulphur, bracken *Pteridium aquilinum* litter and heather *Calluna vulgaris* cuttings. The other methods were addition of sulphur plus re-seeding (Ausden & Kemp 2004), and sheep grazing and natural reversion (Ausden & Kemp 2005).

Prior to the current trial, arable cropping had been undertaken on the field every year between 1990 and 1996 inclusive, with the aim of reducing soil fertility, particularly levels of extractable phosphorous (P) and exchangeable calcium (Ca) on the northern reversion block between 1990 and 1996. This period of cropping had no significant effect on soil pH or extractable Ca and P levels (Marrs *et al.* 1998).

ACTION

Study site The current habitat creation took place on 6.1 ha of former arable land on the Typical Brown Sands soil of the Suffolk Sandlings at Minsmere RSPB Reserve (National Grid ref: (TM454686) on the Suffolk coast. The field had been arable for at least the previous 150 years. Soil properties in the field

prior to the start of the current trial were as follows (values are means + one standard error):

Loss on ignition (% of dry weight) 2.1 + 0.1;
pH 6.8 + 0.3; Olsen extractable Phosphorous ($\mu\text{g P/g}$) 3.8 + 0.1

Field treatment: In April 1996 the vegetation was sprayed off with herbicide (Gramoxane) and then ploughed to 15 cm and pressed with a tractor-drawn roller. 2.5 cm of bracken *Pteridium aquilinum* litter and 3.28 tonnes/ha of elemental sulphur were then applied. Five to 10 trailer loads of heather *Calluna vulgaris* clippings and litter were also spread over the field in April 1998 and again in May 1999.

Soil and vegetation monitoring: Soil conditions were determined from 20 randomly located 15 cm deep soil samples. Vegetation composition was monitored in 12 (1999 and 2001) or 15 (1997 and 2003) randomly located 1 x 1 m frame quadrats within the field. The cover of individual plant species within each frame quadrat was determined using 50 'hits' of a point quadrat. The presence of any additional plant species within the frame quadrat not recorded by point sampling was also recorded. Existing acid grassland adjacent to the reversion fields was surveyed (using 15 randomly placed quadrats) in order to define the 'target vegetation community'.

Table 1. Comparison of the vegetation in the field at Minsmere to which sulphur and bracken litter were applied with that of adjacent existing acid grassland. Values are mean percentage cover in 2003 ± one standard error.

	Existing acid grassland	1.7 t S/ha + bracken + heather cuttings	<i>t</i>	<i>P</i>
Target acid grassland species (% cover)	85.6 + 2.5	60.7 + 6.6	2.547	0.017
Target acid grassland species (no. of species/m ²)	5.7 + 0.7	5.2 + 0.5	0.655	0.518

CONSEQUENCES

Soil pH: Addition of the sulphur and bracken litter significantly reduced the pH of the upper 15 cm of soil (Figure 1).

Vegetation composition: Two measures of vegetation composition were used to assess the success of the habitat creation:

a) The percentage of cover of the species that were found in the ‘target acid grassland’. These were defined as all species found in fifteen quadrats recorded on adjacent existing short, rabbit grazed acid grassland excluding bracken *Pteridium aquilinum*, bramble *Rubus fruticosus* agg. and honeysuckle *Lonicera periclymenum*.

b) The species-richness of these ‘target acid grassland communities’.

Changes in the flora of the former arable field are shown in Figure 2 and a comparison of the abundance of the target acid grassland species in Table 1.

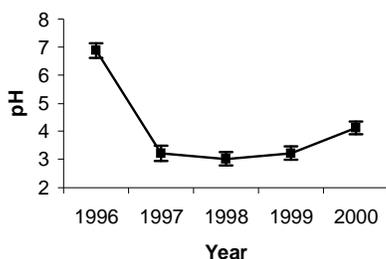
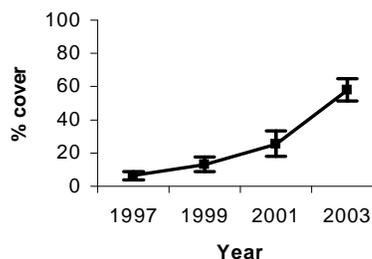


Figure 1. Changes in pH of the upper 15 cm of the soil of the field to which sulphur and bracken litter were applied, Minsmere 1997-2000. Values are means ± one standard error.

The dominant plant species on the field and on adjacent existing acid grassland in 2003, seven years after the start of the trials, are in Table 2. Photo 1 shows the heavily rabbit-grazed end of the field in summer 2004.

a) Target acid grassland species



b) Non-target perennials

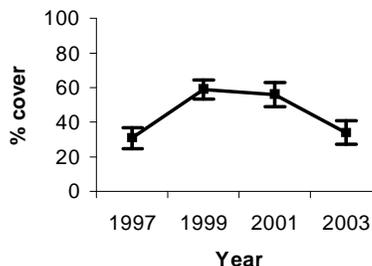


Figure 2a & b. Changes in vegetation cover in the field for target acid grassland spp. and non-target perennial spp. to which sulphur and bracken litter were applied, Minsmere 1997-2003. Values are means ± one standard error.

Table 2. Dominant plant species on the field and on adjacent existing acid grassland in 2003 (values are mean % cover \pm one standard error).

Existing acid grassland:

Sheep's sorrel	<i>Rumex acetosella</i> agg.	49.9 \pm 7.4
Common bent	<i>Agrostis capillaris</i>	11.6 \pm 4.0
Fine-leaved sheep's-fescue	<i>Festuca filiformis</i>	9.0 \pm 3.6
Brown bent	<i>Agrostis vinealis</i>	4.3 \pm 3.6

Field to which sulphur and bracken litter were applied:

Yorkshire-fog	<i>Holcus lanatus</i>	23.5 \pm 5.2
Common bent	<i>Agrostis capillaris</i>	15.9 \pm 5.0
Brown bent	<i>Agrostis vinealis</i>	14.2 \pm 6.0
Sheep's/fine-leaved sheep's-fescue	<i>Festuca ovina/filiformis</i>	7.9 \pm 2.6



Photo 1. Heavily rabbit-grazed end of the field to which sulphur, bracken litter and heather cuttings had been applied, summer 2004.

REFERENCES

Ausden M. & Kemp M. (2004) Creating acid grassland by adding sulphur and re-seeding at Minsmere RSPB Reserve, Suffolk, England. *Conservation Evidence*, 2, 13-15.

Ausden M. & Kemp M. (2005) Creating acid grassland by sheep grazing and natural reversion at Minsmere RSPB Reserve, Suffolk, England. *Conservation Evidence*, 2, 18-20.

Marrs R.H., Snow C.S.R., Owen K.M. & Evans C.E. (1998) Heathland and acid grassland creation on arable soils at Minsmere: identification of potential problems and a test of cropping to impoverish soils. *Biological Conservation*, 85, 69-82.