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SOME EFFECTS OF GRAZING ON THE VEGETATION OF STREAMSIDE LAWNS IN THE NEW FOREST

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ABSTRACT

Small grassy mounds are abundant on many streamside lawns in the New Forest. The vegetation and soil of these mounds is described and evidence is presented to show that they have developed from tussocks of purple moor grass (*Molinia caerulea*) in response to increased grazing.

INTRODUCTION

Among the most diverse and interesting plant communities in the New Forest are those of low lying ground beside streams and rivers. Many of these areas are flooded in winter when swollen streams burst their banks. As the waters spread out over the flood plain they deposit a layer of fine silt which is rich in plant nutrients and adds to the fertility of the heavy alluvial soils. Many factors affect the kind of vegetation which develops on flood plains, including the nutrient quality of the flood waters, speed of drainage, and the intensity of grazing (Atkinson 1978).

On well-drained, fertile sites the vegetation is usually a thick, springy turf dominated by grasses such as common bent (*Agrostis tenuis*), brown bent (*Agrostis canina* ssp *canina*) and red fescue (*Festuca rubra*). These areas are highly favoured by cattle and ponies, and usually closely grazed. On peaty soils where drainage is poor a different sward develops, often dominated by sedges such as carnation grass (*Carex panicea*) and common yellow sedge (*Carex demissa*). Permanently wet depressions provide the habitat for a wide range of species including marsh foxtail (*Alopecurus geniculatus*), flote-grass (*Glyceria declinata*), water purslane (*Peplis portula*) and marsh St John's Wort (*Hypericum elodes*).

A feature of many streamside 'lawns' are the numerous grassy mounds, which occur especially in low lying areas close to the stream. These mounds are about the size of large mole hills (30–70 cm in diameter and 10–20 cm high) and in some places are closely packed and very abundant, *eg* Balmer Lawn SU 305035), Alum Green (SU 278074), Warwickslade (SU 272066). Their origin has been something of a mystery; the aim of this article is to present evidence that they have developed from tussocks of purple moor grass (*Molinia caerulea*), a common plant of wet places which often grows in pure stands. The significance of their formation in relation to changes in grazing pressure is discussed.

METHODS

The main study area was the broad flood plain of Oberwater at Markway Bridge (SU 255038) which has a rich flora and exhibits a wide range of wetland plant communities. In places the flood plain is occupied by grassy mounds; in others there is vegetation dominated by tussocks of *Molinia caerulea* (Fig 1). Grazing pressure varies considerably over the flood plain area, partly because of differences in the accessibility of the vegetation, but also because of the way that ponies use different areas for feeding and excretion (Edwards and Hollis 1982). Most of the study area was closely grazed, but the margins of the flood plain and parts of the stream banks were used by ponies for dunging and urination and grazing pressure was low.

Eight sites occupied either by mounds or by *Molinia* tussocks were chosen for detailed study, representing a range of grazing pressures and drainage conditions. At each site the numbers and dimensions of the mounds or tussocks within a 2 x 2 m^2 quadrat were

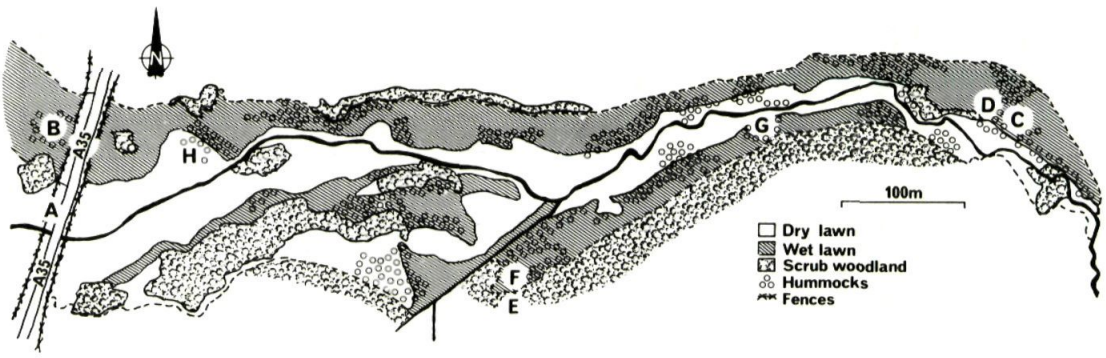

Fig 1. Sketch map of the flood plain of Oberwater below Markway Bridge, showing the distribution of grassy mounds and the location of study sites.

measured. The plant species composition of two mounds or tussocks was recorded (as percentage cover), and also the species composition of equivalent areas between the mounds. Soil samples were taken from the top of two mounds, and from between the mounds (0–5 cm depth) to measure their pH and organic content (measured as loss on ignition at 350°C for 24 hours). The vegetation data were analysed using a computer program called TWINSPAN (Hill 1979) which arranged the plant species into groups behaving in a similar way.

RESULTS

Table 1 presents information on the size and abundance of mounds and *Molinia* tussocks, and on soil conditions at the various sites. Sites A and B, C and D, and E and F were pairs of adjacent sites, chosen because the first of each pair was less heavily grazed than the second (site A was protected by a fence and completely ungrazed). The less grazed sites were all dominated by tall tussocks of *Molinia*, whereas the adjacent grazed sites had similar numbers of small mounds. As Table 1 shows, the dimensions of mounds and tussocks were also similar, but whereas the tussocks were more or less circular in outline, many of the mounds were elongated, especially at site G (Fig 2). The mounds at site F were rather larger than average and occupied by colonies of yellow wood ants (*Lasius flavus*).

The tussocks were composed chiefly of the dead remains of *Molinia*, but also contained some inorganic material. In contrast the mounds were of silt and clay, although those at site B also contained peat with identifiable remains of *Molinia* and bog moss (*Sphagnum*). There was generally less organic material in the mounds than in the surrounding surface soil (0–5 cm) which in most areas was a thin layer of peat or mor humus. The pH of soil samples ranged between 3.8 in a *Molinia* tussock at site E, to 5.1 in mounds containing a large proportion of inorganic sediment.

The ungrazed site (A) was an almost pure stand of very vigorous *Molinia*, and the spreading leaves of the tussocks filled the gaps between them. There were few other plant species, and these were chiefly tall herbs such as marsh thistle (*Cirsium palustre*) and wild angelica (*Angelica sylvestris*). There was evidence of some grazing at the other tussock sites (C and E) and the *Molinia* was less vigorous and had been invaded by heather (*Calluna vulgaris*), cross-leaved heath (*Erica tetralix*), and several other species. The gaps between the tussocks were not filled with the leaves and litter of *Molinia* and species such as sharp-flowered rush, *Juncus acutiflorus* (site C), and common bent, *Agrostis tenuis* (site E), were able to grow up between them.

The mounds at three of the more heavily grazed sites (B, D and F), contained rather

Table 1. The size and abundance of grassy mounds, and of tussocks of Molinia caerulea *on the flood plain of Oberwater. The pH and organic content of soil samples taken from mounds and tussocks and from the soil between them are also shown.*

Site code and description	Number of mounds per 2 x 2 m²	Mean dimensions (cm)			% cover of *Molinia* in mounds	Soil pH		Soil organic matter in	
		Length	Breadth	Height		Mound	Gap	Mound	Gap
A Fenced roadside, ungrazed. *Molinia* tussocks	16	57	50	–	95	4.6	4.4	34	54
B Close to A, grazed. Mounds	7	54	41	16	10	4.5	4.6	54	56
C Dunging area, little grazed. *Molinia* tussocks	8	56	53	–	95	4.9	4.3	40	58
D Close to C, closely grazed. Mounds	6	56	51	17	30	–	–	–	–
E Margin of flood plain, dunging area, little grazed. *Molinia* tussocks	5	60	52	–	75	3.8	–	23	–
F Close to E, grazed. Mounds occupied by ants	4	75	65	25	35	4.8	5.0	29	53
G Very wet and regularly flooded, grazed. Mounds	11	55	37	20	0	5.1	4.5	26	41
H Well drained, closely grazed. Mounds	5	59	48	11	0	5.1	4.9	16	17

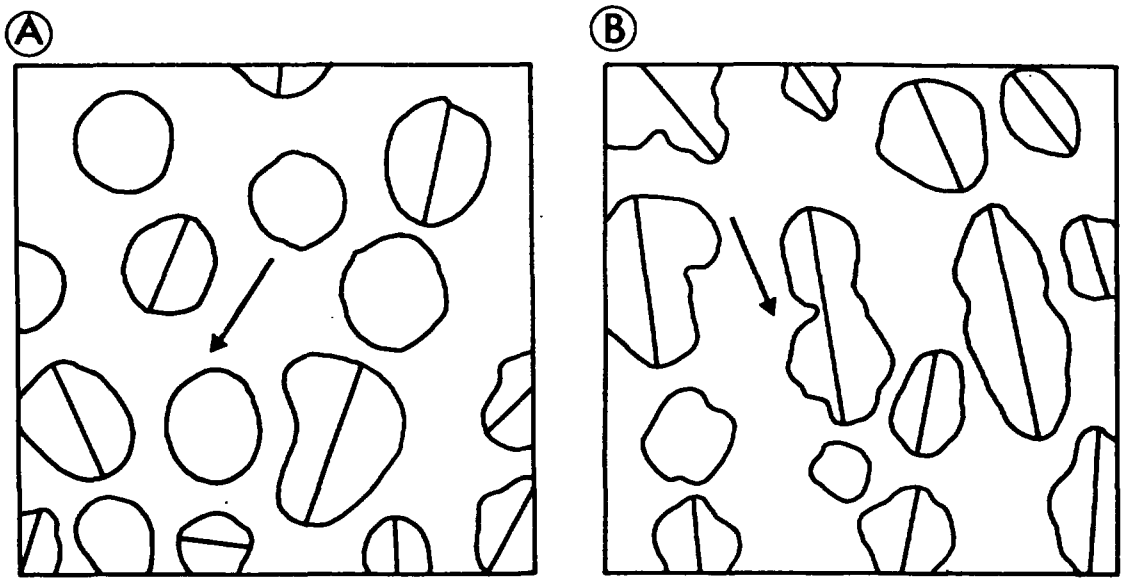

Fig 2. Sketch plans of 2 × 2m² quadrats at (A) a site on Balmer Lawn, and (B) site G on Oberwater, showing the long axis of the mounds and the direction of flow of flood water (arrow).

little *Molinia*, which was closely cropped and only grew in a fringe around the base. However, some of them (*eg* at site B) also contained the dead remains of *Molinia*, proving beyond doubt that formerly they had been tussocks. The vegetation covering the mounds contained a high proportion of bog moss (*Sphagnum auriculatum* var *auriculatum*), together with many other species including heather (*Calluna vulgaris*), cross-leaved heath (*Erica tetralix*), brown bent (*Agrostis canina*) and bog pimpernel (*Anagallis tenella*). The vegetation in the gaps between the mounds was a closely bitten sward, usually dominated by carnation grass (*Carex panicea*) and brown bent (*Agrostis canina*).

The mounds at sites G and H were heavily grazed and contained no *Molinia*. However from the similarities in their size and distribution to those containing *Molinia*, it is fair to assume that they also were formerly tussocks. Site G was a marshy area, regularly flooded in winter, and the mounds had a diverse flora of wet meadow species including marsh ragwort (*Senecio aquaticus*), sharp flowered rush (*Juncus acutiflorus*), and large birdsfoot-trefoil (*Lotus uliginosus*). The most abundant species in the gaps between the mounds were the marsh foxtail (*Alopecurus geniculatus*) and flote grass (*Glyceria declinata*), both of which are characteristic of soft mud in the New Forest. Site H was much dryer grassland, and was dominated by common bent (*Agrostis tenuis*) and white clover (*Trifolium repens*), with several other species typical of well drained streamside lawns.

DISCUSSION

From the evidence presented here it seems clear that the grassy mounds characteristic of many streamside lawns in the New Forest represent former tussocks of purple moor-grass (*Molinia caerulea*). On Oberwater we can see all stages in a sequence of change from large tussocks of *Molinia* growing in pure stands, to small, rounded mounds of silt and clay with no *Molinia*. The change is apparently a result of increased grazing; the results of this study show that even light grazing (as in pony latrine areas) is sufficient to reduce the vigour of *Molinia* and allow other species, notably *Sphagnum* spp, pennywort (*Hydrocotyle vulgaris*) and heather (*Calluna vulgaris*) to invade the tussock. Further vegetational change may follow: the mounds are better drained than the surrounding soil, and in the absence of a dense cover of *Molinia*, provide a suitable seed bed for trees species. Seedlings of oak and birch were found growing in several mounds on Oberwater and in others there were well established Scots pine trees up to 5 m tall and 25 years old. The dryer, unshaded conditions of a heavily grazed tussock may also provide suitable sites for ants. Many of the mounds on Oberwater were occupied by yellow wood ants (*Lasius flavus*) and some of those at the edge of the flood plain were well developed ant hills (*eg* site F).

The implications of these observations is that many streamside lawns in the New Forest were formerly dominated by *Molinia*. Their transformation has been due to increased grazing pressure, and also to some extent to drainage of wet areas. Only in places largely inaccessible to cattle and ponies, such as the centres of large bogs (*eg* Shatterford Bottom), do we find *Molinia* growing as a vigorous dominant. There are also extensive tracts of pure *Molinia* within some inclosures (*eg* Fletchers Hill Inclosure SU 267042), giving us some idea of the kind of vegetation which would occur if grazing in the open forest were reduced. Some of the streamside lawns were probably formed following drainage in the nineteenth century, which improved access to these areas and thus increased grazing pressure (*eg* Balmer Lawn, Warwickslade). However some of the changes from *Molinia* to 'lawn' are more recent. For example, the mounds on Oberwater which contain recognisable remains of tussocks have probably been formed in the past forty years during which there has been a very considerable increase in numbers of ponies.

The mounds are chiefly composed of inorganic material – silt and clay – whereas tussocks are formed from the living and dead

Table 2. The percentage cover of plant species in tussocks of Molinia caerulea *(T) in grassy mounds (M), and in the gaps between mounds or tussocks (G) at 8 sites on the flood plain of Oberwater.*

PLANT SPECIES	SITE A		SITE B		SITE C		SITE D		SITE E		SITE F		SITE G		SITE H	
	T	G	M	G	T	G	M	G	T	G	M	G	M	G	M	G
Carex demissa	-	-	-	3	-	-	-	-	-	-	-	-	-	-	-	-
Eleocharis palustris	-	-	-	20	-	-	-	10	-	-	-	20	-	-	-	-
Achillea ptarmica	-	-	1	1	-	-	1	-	-	-	-	-	1	-	-	-
Agrostis canina ssp canina	-	-	3	10	-	-	35	10	-	-	-	5	-	-	-	-
Carex panicea	-	-	10	35	-	-	3	70	-	-	5	45	-	-	-	-
Anthoxanthum odoratum	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-
Hydrocotyle vulgaris	3	-	20	10	-	30	5	-	-	-	-	-	-	-	-	-
Salix repens	-	-	5	5	-	-	-	-	5	-	-	-	-	-	-	-
Calluna vulgaris	-	-	-	-	-	-	-	-	5	-	-	-	-	-	-	-
Erica tetralix	-	-	5	-	-	-	-	-	10	-	-	-	-	-	-	-
Festuca ovina	-	-	5	-	-	-	-	-	-	-	-	-	-	-	-	-
Nardus stricta	-	-	3	-	-	-	-	-	-	-	-	-	-	-	-	-
Scutellaria minor	-	-	-	-	-	-	3	-	-	-	-	-	-	-	-	-
Sphagnum auriculatum var auriculatum	-	-	40	-	-	3	20	-	5	-	15	-	-	-	-	-
Potentilla erecta	-	-	5	-	1	-	3	-	-	-	1	-	-	-	-	-
Betula pubescens	-	-	1	-	1	-	-	-	-	-	-	-	-	-	-	-
Angelica sylvestris	1	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-
Pinus sylvestris	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-
Serratula tinctoria	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-
Sieglingia decumbens	-	-	-	-	-	-	-	-	-	-	3	-	-	-	-	-
Cirsium dissectum	3	-	1	3	1	-	-	-	-	10	3	-	-	-	-	-
Galium palustre	-	-	-	-	-	1	-	-	-	-	-	-	5	-	-	-
Lotus uliginosus	-	-	-	-	-	-	3	-	-	-	1	-	5	-	-	-
Juncus acutiflorus	1	-	-	-	1	60	-	1	-	-	-	-	15	10	-	-
Anagallis tenella	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-
Festuca rubra	-	-	-	-	-	-	-	-	-	-	25	-	10	-	15	-
Juncus bulbosus	-	-	-	-	-	-	-	-	-	-	-	1	-	-	25	-
Prunella vulgaris	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5
Ranunculus repens	-	-	-	-	-	-	-	-	-	-	-	-	5	-	5	5
Senecio aquaticus	-	-	-	-	-	-	-	-	-	-	-	-	15	-	-	-
Agrostis tenuis	-	-	1	-	-	-	-	-	-	40	10	-	15	-	20	70
Cynosurus cristatus	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-
Holcus lanatus	-	-	-	-	1	-	-	-	-	25	-	-	10	-	10	-
Juncus articulatus	-	-	-	-	-	-	-	-	-	-	-	-	5	-	5	-
Trifolium repens	-	-	-	-	-	-	-	-	-	-	-	-	3	-	20	20
Carex ovalis	-	-	-	-	-	-	-	-	-	-	-	-	5	1	-	-
Cerastium holosteoides	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-
Plantago lanceolata	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-
Poa trivialis	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-
Potentilla anserina	-	-	-	-	-	-	-	-	-	-	-	-	3	-	-	-
Ranunculus acris	-	-	-	-	-	-	-	-	-	-	-	-	5	-	-	-
Juncus bufonius	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
Alopecurus geniculatus	-	-	-	-	-	-	-	-	-	-	-	-	-	30	-	-
Callitriche stagnalis	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-
Deschampsia caespitosa	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-
Glyceria fluitans	-	-	-	-	-	-	-	-	-	-	-	-	-	25	-	-
Molinia caerulea	95	-	10	-	95	-	30	-	75	-	35	-	-	-	-	-
Bare ground & litter	-	100	-	20	-	-	-	10	-	25	-	30	-	35	-	-

tissues of *Molinia*. The probable origin of the inorganic material is the silt carried by flood waters. Anything which impedes the flow of water, such as a tussock or mound, is likely to promote the deposition of sediment, especially on the downstream side of the obstacle. The formation of mounds of sediment behind tussocks has been described by Brown (1983). The mounds are usually somewhat elongated, with their long axes corresponding to the direction of flow. Figure 2 shows this to be true of mounds in the New Forest; at site G on Oberwater, they were very elongated, while on Balmer Lawn the elongation was slight, perhaps because of the very gentle gradient. The change in vegetation from a pure stand of *Molinia* to a closely cropped lawn represents a very considerable alteration in the roughness of the flood plain. We can speculate that this change may itself affect the pattern of flooding and deposition of sediment since water can spread more rapidly over the flood plain, and perhaps deposit its sediment more evenly. However the importance of such changes for the development of the flood plain remain largely a matter of conjecture.

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