

## The decline of Lady's-mantles (*Alchemilla vulgaris* L. agg.) and other hay-meadow species in Northern England since the 1950s

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### ABSTRACT

In Teesdale (v.cc. 65, 66 & 70) and Weardale (v.c. 66), a considerable decline in the status of five species of the *Alchemilla vulgaris* L. aggregate, together with three other species of herbs characteristic of northern England hay-meadows, has been revealed by repeat surveys of meadows, and road and rail verges first visited between 1950 and 1967. As a consequence, these five *Alchemilla* species and the three herbs should be considered threatened and in urgent need of conservation action.

KEYWORDS: Teesdale, meadows, conservation, agricultural changes, grassland management.

### INTRODUCTION

Max Walters (Walters 1949), in his paper 'Alchemilla vulgaris L. agg. in Britain', clarified the identity of the various British species within the aggregate, thereby establishing some order out of the chaos created during the last century by the Swiss botanist, Firmin Jaquet. In 1951, Walters suggested that the author might like to look for them in Teesdale (v.cc. 65, 66 & 70) where he had seen several interesting species himself. It soon became clear that in Northern England there were eleven native agamospecies of the *Alchemilla vulgaris* aggregate (Lady's-mantles) and nine of these were subsequently found in the north Pennine valleys of Teesdale and Weardale (lat. 54° 40' N, long. 2° 15' W). It is now known that three: *A. acutiloba* Opiz (<sup>1</sup>Starry Lady's-mantle), *A. monticola* Opiz (Velvet Lady's-mantle) and *A. subcrenata* Buser (Large-toothed Lady's-mantle) are almost restricted to these two dales and that two more – *A. glomerulans* Buser (Clustered Lady's-mantle) and *A. wichurae* (Buser) Stefansson (Rock Lady's-mantle) are here at the southern fringe

of their distribution and known to be centred in Scotland (Preston *et al.* 2002).

The North Pennines is considered to contain approximately 40% of the surviving upland herb-rich hay meadows (National Vegetation Classification MG3 *Anthoxanthum odoratum*-*Geranium sylvaticum* grassland) in the U.K. These grasslands are characterised by boreal species such as *Trollius europaeus* L. (Globeflower), *Geranium sylvaticum* L. (Wood Crane's-bill) and *Cirsium heterophyllum* (L.) Hill (Melancholy Thistle) as well as more typical grassland species such as *Alchemilla* spp., *Rhinanthus minor* L. (Yellow-rattle), *Conopodium majus* (Gouan) Loret (Pignut), *Sanguisorba officinalis* L. (Great Burnet) and *Leontodon hispidus* L. (Rough Hawkbit).

It was fortuitous that the survey of the *Alchemilla* spp. took place in the early 1950s, shortly after the Second World War and about the time that farming in the dales was becoming mechanised and with artificial fertilisers readily available. In 1967 the author directed a survey of three other characteristic northern hay-meadow species, namely *Trollius europaeus*, *Geranium sylvaticum* and *Cirsium heterophyllum* in Teesdale. By this time, restriction to field margins and riversides of species such as *Trollius europaeus* indicated that a change in the diversity of the meadow flora had already begun. On the author's return to Teesdale, a survey was carried out in the year 2000 to determine the status of these *Alchemilla* species after a fifty-year period, whilst in 2003 and 2004 the Upper Teesdale Botany Group searched the original fields for the three meadow species. This paper now describes the results of these two surveys, the causes of the observed declines, and the prospects for the future conservation of northern hay-meadow species.

<sup>1</sup>See APPENDIX p. 321 for Vernacular names

## METHOD

The five species of the *Alchemilla vulgaris* aggregate originally surveyed were the northern-montane meadow species: *A. acutiloba*, *A. monticola* and *A. subcrenata* together with the arctic-alpine species *A. glomerulans* and the arctic-subarctic species *A. wichurae*. The fine-scale distributions of these five species were mapped in the early 1950s as 'dots' on the Ordnance Survey 1: 25,000 maps, with a 'dot' representing one or more plants (Bradshaw 1962). Where a species was abundant the whole field was coloured-in on the maps and any contiguous presence on road verges was marked as a solid line. In the year 2000, approximately 80% of these sites were re-visited and the findings marked on similar maps and in a similar way. Since then, many of the remaining 20% of sites have also been inspected. A summary of these results is given in Table 1.

In 1967 the three hay-meadow species, *Trollius europaeus*, *Geranium sylvaticum* and *Cirsium heterophyllum*, were surveyed in the hay-fields, roadsides, and river margins in two main areas: (i) the Newbiggin-in-Teesdale and Holwick area (altitude c. 260 m) to the west of Middleton-in-Teesdale, and (ii) Forest-in-Teesdale (altitude c. 380 m) to the west of the High Force Hotel (Bradshaw 2001). These sites were then re-surveyed in 2003 and 2004 (Bradshaw 2006).

## RESULTS

## ALCHEMILLA SPECIES

In the fifty-five year period since the first survey, the status of each of the five species of the *A. vulgaris* aggregate was found to have changed from being apparently stable (although in some species rare) to endangered, even in the most abundant species, *A. monticola* and *A. acutiloba*. A detailed assessment of each species is given below, see also Table 1.

*Alchemilla subcrenata*

*A. subcrenata* is the scarcest of the four Northern Montane Lady's-mantles in Britain. It was first collected in 1951 by the author near Newbiggin-in-Teesdale and identified by Walters (1952). Its main area of distribution is restricted to the Newbiggin-Holwick area but in 2007/2008 a few plants were also found in each of three meadows near Allendale, in Northumberland (v.c. 67), a considerable distance from its centre in Teesdale.

Since the first survey, the number of fields in which *A. subcrenata* has been recorded in Teesdale has fallen from 22 to 10 (49 to 25 dots) and now there is only a single road verge site. Most populations are confined to meadows where it is a scarce species and to two pastures. Plants found in the 1950s in two fields in Weardale, north of Stanhope, were not re-found in 2000 nor in 2002, both fields having been agriculturally 'improved'.

TABLE 1. CHANGES IN THE FREQUENCY OF THE 'DOT' RECORDS FOR FIVE SPECIES OF THE *ALCHEMILLA VULGARIS* AGGREGATE IN TEESDALE AND WEARDALE MADE IN THE 1950s AND BETWEEN 2000 AND 2007

Species	Area	'Dots' in 1950s	'Dots' visited 2000-2007	'Dots' found 2000-2007	% lost	Comment
<i>A. acutiloba</i>	Teesdale	27	20	16	20	
	Weardale	195*	164*	82	50	plus 10 fields*
<i>A. monticola</i>	Teesdale	498*	380*	56	85	plus 33 fields*
	Weardale	36	36	1	97	
<i>A. subcrenata</i>	Teesdale	49	49	25	49	
	Weardale	4	4	0	100	
<i>A. glomerulans</i>	Teesdale	81	74	14	81	
	Weardale	2	2	1	50	
<i>A. wichurae</i>	Teesdale	34	27	15	44	

\* In the 2000–2007 survey neither species was found to be as frequent in any of the fields as they were in the original survey, nor were either of them frequent along contiguous lengths of road-verge. Finds in these places were recorded as 'dots'.

Only one site, a pasture, occurs within the perimeter of the Moor House-Upper Teesdale National Nature Reserve although several populations in fields on the south side of the River Tees are under 'agri-environment' agreements. On the north side of the Tees, the field where the species was discovered is not currently under any conservation management scheme, another field has a non-statutory agreement between the landlord and the tenant, whilst a third is in the Higher Level Stewardship Scheme (Natural England). *A. subcrenata* is classified as 'endangered' in the new Red List (Table 3) (Cheffings & Farrell 2005). The current population probably comprises no more than 300 plants.

#### *Alchemilla acutiloba* and *A. monticola*

*A. acutiloba* has been known from Teesdale since 1946, but was not collected in Weardale until 1951 when the author found a dense colony on disturbed ground near the new Burnhope Reservoir dam. In the 1950s it was found to be very frequent in meadows and on road- and rail-verges in Weardale but not as common in similar habitats in Teesdale. It has also been recorded from a scattering of sites, mostly on roadsides, to the east and north of the area. It was only in 2006 that it was found to occur south of the Tees with the location re-confirmed in 2008.

*A. monticola* was first recorded in Teesdale in 1922. Walters (1949) found it to be frequent in meadows and on roadsides in 1947 and this was also the case in the 1950s. It is rare in upper Weardale where the author found only one colony on a verge in a side valley. Many plants were also found to the east of this site growing around Hamsterley village green on the south side of the valley.

Since the 1950s both species have become much scarcer in both dales. In Teesdale the number of meadow populations of *A. acutiloba* has fallen by 20% from 20 visited-sites (of the 27 originally identified) to 16; in Weardale the decline has been much greater (50%) from 164 (of the 195 originally identified) to 82. In Teesdale the number of *A. monticola* populations has fallen by 80% from 330 (of the 448 originally identified) to 63 and in Weardale all the 35 'records' at Hamsterley have been destroyed due to the 'tidying-up' of the village green. However, the very small colony of roadside plants in the upper Dale was still present in 2008.

There have been even greater losses of both species from road- and rail-side habitats and from certain meadows. No longer are there long stretches of verge where one or both species are frequent as they were in the 1950s<sup>2</sup>. *A. acutiloba* has been lost from a 2.9 km length of verge in Teesdale and from a 2.1 km length in Weardale, whilst *A. monticola* has disappeared from a 4.8 km length of verge in Teesdale; this is a total length of 9.7 km (i.e. almost 6 miles). Of the thirty-three small fields<sup>2</sup> near Middleton where *A. monticola* was formerly very frequent, about half of them are now built on with houses and a school whilst, in the remainder, the species have been reduced to individual 'dots'. Similarly, *A. acutiloba* is now scarce in the fields in Weardale where it was formerly very frequent.

#### *Alchemilla glomerulans* and *A. wichurae*

*Alchemilla glomerulans* and *A. wichurae* are respectively arctic-alpine and arctic-subarctic species which, in the UK, occur mainly above 615 m in Scotland. Populations of *A. wichurae* in northern England are at the southern limit of their UK distribution and also of their world distribution (Kurtto *et al.* 2007) and are unusual in occurring at the relatively low altitude of 250 m. Walters (1949) discovered *A. glomerulans* when visiting Teesdale in 1947 and it is now known to occur in meadows, meadow-type vegetation near the Tees, and in well-drained and flushed hill grasslands extending up to 676 m on the Pennine escarpment in v.c. 69 (Westmorland). It has also been recorded on a road verge and a bank in a meadow in v.c. 70 (Cumberland). In Weardale it was discovered by the author in the 1950s growing in a single meadow and in a nearby railway cutting. *A. wichurae* was collected by Walters in 1946 on Ingleborough (v.c. 64) and in Teesdale in 1947 (v.c.c. 66 & 69). It has been found to be very thinly scattered, usually occurring as single plants, in a few meadows, upland pastures, and on limestone outcrops. Several records occur by waterfalls over the whinsill (dolerite) rock.

In Teesdale, by 2007, the number of *A. glomerulans* populations has declined by 82% from 74 (of the original 81) 'dots' in the 1950s to 14 (including 4 recent finds). Some of the losses have been from meadows; one of these was due to ploughing but the majority have been of isolated single plants in close-grazed hill pastures. In Weardale it has been lost from its meadow site leaving just one plant by 2007.

In Teesdale, the number of 'dots' for *A. wichurae* has declined by 44% from 27 (of the original 34) to 15, most losses having been from meadow sites. In hill pastures, *A. wichurae* has survived better than *A. glomerulans* but is still vulnerable to extinction where only single plants remain. Nowadays, the only concentration of plants of *A. glomerulans* is in four meadows near Middleton-in-Teesdale.

SPECIES CHARACTERISTIC OF NORTHERN  
HAY-MEADOW

The survey of three hay-meadow species, *Cirsium heterophyllum*, *Geranium sylvaticum* and *Trollius europaeus*, has revealed a decrease in the numbers of fields in which each species can now be found (the slight increase of *Geranium sylvaticum* in Forest-in-Teesdale is very likely due to the more thorough search made in 2004) (Table 2). In the Newbiggin-Holwick area, *Trollius europaeus* is now almost exclusively confined to the banks of the Tees. *Geranium sylvaticum* is the only species that is widely dispersed throughout any individual fields and is most frequent in Forest-in-Teesdale. It is clear that these characteristic and conspicuous species are less common than they once were and that there has been a general decrease in the species diversity of the hay meadows. This is supported by an observable change in general colour of most dales meadows which at one time were mauve, white and shades of yellow to nowadays being only buttercup-yellow, white and brown. In 2006–2007, John O'Reilly searching for herb-rich meadows in the North Pennines Area of Outstanding Natural Beauty found that only 8% of the 388 fields examined could be classified as species-rich and that even this figure might be an over-estimate when considering the total number of meadows in existence (pers. comm., J. O'Reilly, 2008).

CAUSES OF DECLINES

The decline of the five species of *Alchemilla* and the other meadow species probably began in the 1960s and, based on the author's experience, most had occurred by the 1980s. The primary causes in meadow habitats have been due to changes in farm management and animal stocking. Heavy continental-cross suckler cows have replaced the dairy cows and larger numbers of sheep are being 'wintered' in the meadows. Artificial fertilisers have supplemented farmyard manure, which itself has changed from a sweet-smelling dung to an acrid, ammonia-laden, semi-raw compost created from bought-in straw used for bedding; this most probably has had a significant effect on the soil micro-flora and fauna as well. At the same time, there has been a decrease in the application of lime and/or basic-slag. Some hill farms stocked with fell-sheep continue to make small bales of hay, but large-bale silage and haylage has generally become the norm and a surer way of conserving the grass for winter feed.

Although during the second half of the last century, a few fields had been ploughed and re-seeded or slot-seeded with more productive rye-grass/clover (*Lolium/Trifolium*) mixtures, the recent relaxation of Environmental Impact Assessment (Agriculture) (England) Regulations 2006 has resulted in several herb-rich meadows being destroyed. The sum of all these developments has been a marked loss in species-diversity formerly evident in herb-rich meadows.

Road verge habitats have also been affected. There has been a great increase in the amount and weight of motorised traffic which has necessitated strengthening the road-edges by the addition of imported ballast. As a result, seeds and parts of weedy plants have accidentally been introduced onto the verges and become established. Eutrophication,

TABLE 2. NUMBER OF FIELDS CONTAINING THE THREE MEADOW SPECIES IN THE SURVEYS OF 1967 AND 2003–2004

	Nos. fields resurveyed	Nos. fields with		Nos. of fields with		Nos. of fields with	
		<i>Trollius europaeus</i>		<i>Geranium sylvaticum</i>		<i>Cirsium heterophyllum</i>	
	in 2003/2004	1967	2003/2004	1967	2003/2004	1967	2003/2004
Newbiggin / Holwick	80	26	12	52	44	22	15
Forest in Teesdale	59	36	15	28	36	26	25

TABLE 3. CONSERVATION STATUS OF THE RARE *ALCHEMILLA VULGARIS* AGGREGATE SPECIES IN TEESDALE

Species	(1) Red List GB	(2) Scarce	(3) DRPR	(4) BAP
<i>Alchemilla acutiloba</i>	VU A2c	RD	V	+
<i>Alchemilla monticola</i>	EN A2c	RD	E	+
<i>Alchemilla subcrenata</i>	EN A2c B1ab(v) + 2ab(v) C2a(I) 4 <800 individuals	RD	E	+
<i>Alchemilla glomerulans</i> *	VU A2c		E	
<i>Alchemilla wichurae</i> *	EN A2c	SPIB	E	

(1) *Vascular Plant Red Data List for Great Britain*. (Cheffings & Farrell 2005).

(2) *Scarce Plants in Britain*. (Stewart *et al.* 1994).

(3) *Durham Rare Plant Register* (Durkin, unpublished) (pers. comm. 2008).

(4) *Biodiversity Action Plan UK BAP List 2007*

\* Natural England Common Standards Monitoring of Rare Plant Species, Local Distinctiveness Attributes (LDA), e.g. scarce in England but frequent in Scotland or at edge of the species range.

caused by exhaust fumes, spray and salt from the roads, and seepage of nutrients from adjacent fields, have also had an adverse effect. Successive changes in road verge management have involved the use of herbicides; mowing by County Council machines with wide flails which create a heavy mulch has favoured the stronger, coarser grasses, broad-leaved plants and imported weeds. In addition, re-alignment of, and other work on, many minor roads has added to the toll. Collectively these changes have decimated the colourful meadow plant community.

Pacha (2004) found a similar decline over the last two decades in the distribution of *Geranium sylvaticum* in the meadows within the Yorkshire Dales National Park. This species has disappeared from 40% of meadows where it was known to exist in the 1980s with surviving populations having become increasingly isolated over the survey period. Also, even fields managed under agri-environment schemes have become more impoverished with a general decrease in diversity and richness, especially among species characteristic of MG3 *Anthoxanthum-Geranium* meadows. The survey results also highlighted the increasingly important role that road verges and river margins play for the survival of northern hay-meadow species such as *G. sylvaticum*, especially in areas where the species has disappeared from the adjacent meadow habitats.

#### CONSERVATION

All five species of the *Alchemilla vulgaris* aggregate mentioned in this paper are classified as 'endangered' or 'vulnerable' in the new Red

List for Great Britain (Cheffings & Farrell 2005), and the three meadow species (*A. acutiloba*, *A. monticola*, *A. subcrenata*) are included in the new Biodiversity Action Plan (BAP) List of priority species (Table 3). At the time of writing, in 2008, all of these species are very vulnerable to further reductions in their numbers. This is particularly so because of the uncertainties in the future of farming and of the management of the upland meadows and fells for food production, game birds and recreation. Already, more sheep as well as cattle are housed in winter on imported straw, thus producing larger quantities of straw-based manure (see earlier) which will have unknown effects on the meadow biota. Other changes, for example, might include the reduction in the numbers of cattle and hence their availability for the desirable autumn grazing of the meadows; also a possible increase in the number of sheep, including breeds with different fodder requirements, followed by an increase in winter grazing of the meadows; these would all have an effect. On the fells, the reduction in the number of sheep that has already begun might prove beneficial in the short-term by allowing heavily grazed plants to flower (and so be identified) at least in those areas where rabbits are absent or controlled. In the longer term, under-grazing could produce a different threat, especially to light-demanding plants. Of the five *Alchemilla* species, *A. wichurae* would be the most likely to be adversely affected by this.

Finally, it should be remembered that global warming is predicted to affect many more species than the *Alchemilla* species and meadow plants covered in this paper.

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## APPENDIX

VERNACULAR NAMES FOR *ALCHEMILLA VULGARIS* S.L. SPECIES

The following vernacular names are proposed for the agamospecies of the *Alchemilla vulgaris* aggregate found in Britain. In non-scientific papers it is recommended that the English name be followed by the Latin in brackets.

<i>A. glabra</i>	Smooth	Lady's-mantle	(belongs to the 'Sub-glabrae' and can have hairs and so belie the name <i>glabra</i> and confuse learner botanists)
<i>A. acutiloba</i>	Starry	Lady's-mantle	
<i>A. micans</i>	Shining	Lady's-mantle	
<i>A. filicaulis</i> ssp. <i>filicaulis</i>	Slender	Lady's-mantle	as used in Scandinavia
<i>A. filicaulis</i> ssp. <i>vestita</i>	Hairy	Lady's-mantle	
<i>A. wichurae</i>	Rock	Lady's-mantle	as used in Scandinavia, the species frequently grows on rocky outcrops in the UK
<i>A. glaucescens</i>	Silky	Lady's-mantle	
<i>A. xanthochlora</i>	Pale	Lady's-mantle	
<i>A. subcrenata</i>	Large-toothed	Lady's-mantle	
<i>A. glomerulans</i>	Clustered	Lady's-mantle	
<i>A. monticola</i>	Velvet	Lady's-mantle	I frequently describe the upper surface of the leaf as looking like 'velvet'— dense, short erect hairs
<i>A. minima</i>	Least	Lady's-mantle	
<i>A. alpina</i>			Alpine Lady's-mantle is already in use
<i>A. conjuncta</i>			Silver Lady's-mantle is already in Stace (1997)
<i>A. tythantha</i>	Crimean	Lady's-mantle	
<i>A. mollis</i>	Soft	Lady's-mantle	
<i>A. venosa</i>	Crisp	Lady's-mantle	

