

Weather & Climate

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Geographically, the Pennines are unique within England because they are the only significant upland area that is not close to the sea. This fact has implications for the climate of the Pennines and, with the River Tees having its source close to Cross Fell, the highest summit in the Pennine chain, Upper Teesdale has its own climatic conditions.

The Dale is also unique in having more data and long-term weather stations than any other UK upland area. A continuous temperature record is available from 1931 (Holden & Adamson, 2001). Gordon Manley of Durham University began recording at Moor House at 550 m in the 1950s, using a hut close to the summit of Great Dun Fell, the second highest Pennine summit (850 m). Designation of the area as a Site of Special Scientific Interest, in 1948, then National Nature Reserve in 1952, saw Moor House established as a Nature Conservation field station and daily recordings were made for almost 30 years.

Reservoirs built in Selset and Lunedale (1955) and Baldersdale (1960) took advantage of the heavy local rainfall, and despite strong opposition, Cow Green reservoir was built in the late 1960s. Significant funding was provided for research to monitor any changes associated with the reservoir, including the effect such a large body of water may have on micro-climate. A weather station was set up on Widdybank Fell (510 m) for daily recording, data being analysed by local universities and sent to the Met Office that took over the recording in 1974. Records were mostly made by Ian Findlay, until his retirement in 1996 when he relocated the weather station to his home at Hunt Hall Farm, Langdon Beck (370 m). He has continued recording ever since.



Hunt Hall Farm weather station: © Ian Findlay

What are Conditions like?

Gordon Manley summarised the climate at high altitudes in the Pennines as follows; 'We therefore form a conception of excessively windy and pervasively wet autumn, a very variable and stormy winter with long spells of snow cover, high humidity and extremely bitter wind, alternating with brief periods of rain and thaw. April has a mean temperature little above the freezing point and sunny days in May are offset by cold polar air, while the short and cloudy summer is not quite warm enough for the growth of trees. Throughout the year, indeed, the summers are frequently covered in cloud'.



Old weather station at Cow Green reservoir with snow-covered Great Dun Fell, Dun Fell and Cross Fell in the background: © Steve Gater

This cool, wet climate has been central in dictating the range of vegetation and associated fauna in Upper Teesdale. Blanket bog, rare in a global context, is common above 500 m on limestone and other rock types. Climactic conditions allow some plant growth but only partial decomposition of dead material, the latter forming peat to a depth of around 2m.

At the altitudes of 350 – 800 m in the Dale, the growing season is very short, even with 'the best weather', with implications for wildlife and hill farmers.

Manley noted that the mean May temperatures at the summit station were similar to the mean January temperatures in London and he considered the climate in Upper Teesdale similar to that at sea level in Iceland!

And the characteristic weather of uplands is the occurrence of extreme climatic events, such as the severe winters of 1916, 1940, 1947 (all with late winter and heavy snowfall), 1963 (prolonged snow cover and very cold) and 1978/79. Weather dictated the rate of farming practice, particularly up to 1960 when the horse was relied upon rather than the tractor. As late as 1979, the four-wheel drive tractor was a rare vehicle in the Dale!

For the past 25 years the Environment Agency has asked all upland weather stations to record snowfall and to measure the depth and weight of snow, as well as rainfall during the winter. Such data are used in flood forecasting for the lowlands.

Records 1931-1999

Across this period the average temperature was 5.3°C, ranging from –18.5°C (31 January 1972) to 28.0°C (4 August 1990). On 23 August 1976, at Widdybank Fell, the maximum temperature was 23°C, followed by a minimum of –1.5°C, a range of 24.5°C. On average there was some rain on 244 days per year and 45 days per year were considered as foggy. The average days with air frost was 126 per year, with frost in every month.

Extreme Weather Events

1976: A very dry, hot summer reaching 18.6°C mean maximum in July and August. A wet autumn, with a total of 17.9" rain (September 8.6", October 9.3"), followed by low temperatures, high snowfall and heavy drifting in November, December.

1978: Snowfall in late December and two days of blizzards to end the year.

1979: A dreadful winter. Four separate periods of blizzards (severe, very severe, extreme) for two or three days and 129 consecutive days on cross-country skis. Local roads were blocked for long periods, Birkdale Farm was cut off by snow from 28 December to 16 April, local schools were closed and people couldn't get out of the Dale to their jobs. A very difficult time for the farming community.



Arctic conditions: © Anne Kelly

1983: 8 July, following a thunderstorm a 1 – 1.5m high roll on Maize Beck, two more later and then a final roll in late July — four rolls within three weeks! Rain fell at the rate of 6" per hour, washing peat off high ground, destroying two bridges and washing away walls.

1985: Very wet (23") in July and August, delaying hay making until September /October (first use of big bales).

1986: Much freezing rain, (11.8") in January with several days of ice (days of blizzards and severe drifting in February, mean maximum temperature

–2.5°C, mean minimum air temperature –6.4°C. Up to 35 cm snow in February/March. Five thermometer readings (maximum, air minimum, grass minimum, wet and dry bulb) were below zero for 31 days — a record. Total rainfall 80.2". One of the coldest months of the century.

1992: Severe gales on 2/3 January, average wind speed 60 mph over 24 hours (gusts 80 – 90 mph) caused severe tree damage at High Force and felled 700+ trees. Yet unbelievably seven days later

in the month were completely calm!

1995: 4" rain fell over 48 hours on 30 January (50.2 mm) and 31 January (47.9 mm). A rapid 7°C rise in temperature triggered a sudden thaw of large amounts of snow on the fells, producing the biggest becks and River Tees since 1968. The Environment Agency issued flood warnings for the lowland areas.



High Force in spate, 1995: © Ian Findlay

Low rainfall totals for June, July, August (only 0.6", the lowest on record), high sunshine totals and high temperatures (August mean maximum temperature 19.9°C). Many areas with shallow soils were burnt out, Cow Green reservoir was so low that the ruins of the mine shop and construction road were exposed in late summer.

1996: The January sunshine total of 6.9 hours was a record (the average is 35.0 hours).

Records in a new Millennium

Weather patterns from 2000 have seen a slight change as the summary on the following pages shows.

The figures on the following tables must be read whole understanding that they reflect the weather patterns only in Upper Teesdale, which covers large areas of the uplands varying in height from 350 m to 700 m. At these altitudes the growing season is very short.

The facts and figures highlight that in any given year farming/wildlife has to cope with complex weather conditions.

Year	Annual rainfall total	Rain days	Sunshine hours	Mean of maximum temperature °C / number of days over 20°C	Mean of minimum temperature °C	Snow days	Diary note
2000	1,841.5mm, 72.5" November 307.3 mm, 12.1"	273 Very high	1,328.7 May 208.4 below average	May 13.3 (2)	May 4.1	January 2	A very wet year
				June 15.0 (3)	June July 7.4	February 9	
				July 15.9 (1)	August 8.1	March 5	
				August 17.1 (1)	8.6	Total 16	
2001	1,181.1mm, 42.5"	241	1,400.6 May 248 Average sunshine total	May 14.5 (3)	May June 4.0	January 9	Average rainfall Very dry summer
				June 14.1 (2)	July 7.1	February 9	
				July 17.1 (9)	August 9.9	March 15	
				August 17.0 (4)	8.2	April 1	
						Total 34	
2002	1,620.5mm, 63.8" February 373.4 mm, 14.7"	230	1,211.5 Very low	May 12.2 (0)	May June 5.8	January 5	February 14.7" rain a record Very low sunshine total
				June 14.7 (0)	July 8.0	February 6	
				July 16.2 (2)	August 8.3	March 15	
				August 18.8 (7)	10.5	December 1	
						Total 27	
2003	998.2 mm, 39.3"	197 Low	1,644.2 June 208.0 August 203.1 Above average sunshine	May 12.9 (2)	May June 5.5	January 12	Low rainfall, high sunshine total, high temperatures
				June 17.3 (3)	July 8.3	February 6	
				July 18.4 (8)	August 10.4	March 11	
				August 19.1 (13)	9.5	Total 29	
2004	1,435.1mm, 56.5" August 274.3 mm, 10.8"	258 High	1,383.0 May 234 Below average sunshine	May 14.3 (0)	May June 4.2	January 10	Below average sunshine Very wet August 10.8"
				June 16.0 (2)	July 7.6	February 8	
				July 16.8 (6)	August 8.8	March 5	
				August 18.0 (7)	10.6	November 1 December 6	
						Total 30	
2005	1,244.6mm, 49.0"	240	1,427.3 May 222.6 Average sunshine total	May 12.2 (0)	May June 4.3	January 5	Average rainfall, sunshine total Low summer months
				June 16.5 (5)	July 8.0	February 9	
				July 17.7 (7)	August 9.5	March 10	
				August 17.1 (3)	8.5	November 4 December 4	
						Total 32	

Year	Annual rainfall total	Rain days	Sunshine hours	Mean of maximum temperature °C / number of days over 20°C	Mean of minimum temperature °C	Snow days	Diary note
2006	1,475.7mm, 58.1" December 335.0 mm, 13.2"	224	1,639.4 May 201.0 June 203.1 July 299.6	May 13.4 (2)	May 4.5	January 1	<i>July very warm, 22.0°C highest Sunshine 299.6 hours Also highest record for one month (July)</i>
				June 17.4 (10)	June 7.7	February 6	
				July 22.0 (22)	July 9.4	March 14	
				August 16.2 (3)	August 9.2	April 1	
						Total 22	
2007	1,430.0mm, 56.3"	214	1,513.5 April 214.1	May 12.6 (0)	May 4.4	January 6	<i>Very wet June and July</i>
				June 16.2 (4)	June 8.0	February 4	
				July 16.2 (0)	July 8.9	March 4	
				August 16.2 (2)	August 8.8	December 1	
						Total 15	
2008	1,663.7mm, 65.5"	247	1,327.9 May 209.7	May 14.6 (2)	May June 4.9	January 7	<i>Very wet June, July and September</i>
				June 14.9 (1)	July 6.7	February 1	
				July 17.5 (6)	August 9.7	March 7	
				August 16.2 (0)	10.6	April 3	
						October 1 November 3 December 14 Total 36	
2009	1,524.0mm, 60.0" November 432.5 mm, 17.0"	247	1,501.3 May 232.6	May 13.0 (2)	May June 4.7	January 13	<i>Very wet November, 17.0", highest record for one month</i>
				June 16.4 (7)	July 6.8	February 14	
				July 16.9 (3)	August 9.4	March 1	
				August 17.0 (1)	9.0	November 1 December 15	
						Total 44	
2010	1,074.4mm, 42.3"	224	1,519.5 May 202.2 July 222.8 Average sunshine	May 12.3 (4)	May June 2.8	January 27	<i>High snowfall January, February. December high snowfall, Max 0.9°C Min -5.4°C River Tees frozen 6-8" ice</i>
				June 17.0 (7)	July 7.1	February 17	
				July 16.5 (2)	August 9.9	March 1	
				August 16.1 (1)	8.2	November 6 December 25	
						Total 76	
2011	1,412.2mm, 55.6"	246	1,495.1 April 219.6 May 214.3	May 12.8 (0)	May June 4.9	January 8	<i>Quick thaw early January Below average sunshine in summer months</i>
				June 15.1 (4)	July 6.5	February 6	
				July 16.9 (5)	August 7.1	March 2	
				August 15.5 (1)	8.2	December 13	
						Total 29	

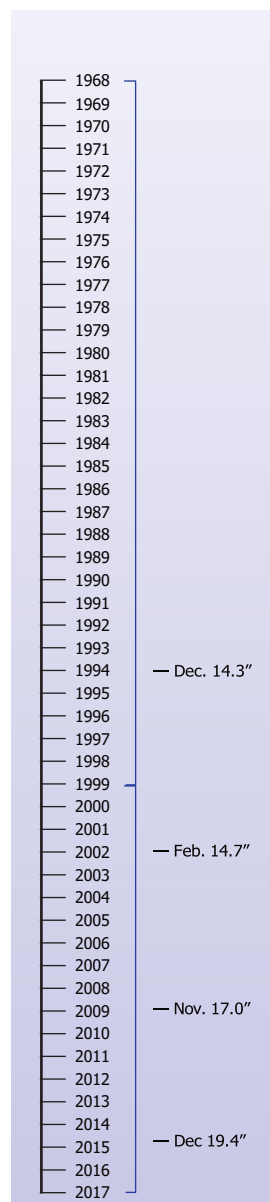
Year	Annual rainfall total	Rain days	Sunshine hours	Mean of maximum temperature °C / number of days over 20°C	Mean of minimum temperature °C	Snow days	Diary note			
2012	1,595.1mm, 62.8"	233	1,383.6 May 218.6 June 94.7 lowest record for June	May	13.1 (6)	May June	3.5	January	4	Low sunshine total Wet summer, autumn and winter
				June	13.4 (0)	July	7.1	February	7	
				July	15.4 (0)	August	9.3	April	3	
				August	17.2 (4)		9.2	December	10	
						Total	24			
2013	1,384.3mm, 54.5"	214 Low	1,433.4 July 269.0 second highest sunshine total	May	12.0 (1)	May June	3.9	January	15	Average rainfall early year Wet backend Very cold March (Max 2.2°C Min -2.8°C) Very warm July
				June	15.6 (0)	July	6.3	February	14	
				July	20.6 (19)	August	10.3	March	22	
				August	17.4 (5)		9.8	April	5	
						Total	57			
2014	1,422.4mm, 56.0"	231	1,375.9 July 247.1	May	13.0 (1)	May	6.0	January	3	Very wet January and February Very dry June (1.3") July (1.5") and September (0.6") Rainfall total 1.5" more than last year
				June	16.7 (1)	June	7.9	February	6	
				July	19.4 (12)	July	19.4	March	1	
				August	15.5 (1)	August	15.5	December	6	
						Total	16			
2015	1,724.7mm, 67.9" December 492.0 mm, 19.4"	237	1,480.5 April 237.5	May	10.9 (0)	May June	3.8	January	12	Second highest rainfall total after 2000 December rainfall total 19.4" highest monthly total since 1968 Higher winter temps! Lower summer temps! Higher number of snow days!
				June	14.7 (3)	July	6.0	February	13	
				July	16.1 (4)	August	7.7	March	1	
				August	16.6 (1)		8.9	November	3	
						Total	32			
2016	1,137 mm, 44.8"	201 Low	1,399.6 2 July 27.2°C	May	13.8 (2)	May June	4.1	January	8	Low rainfall for the year Snow recorded in 5 months but for short periods Average sunshine totals
				June	16.0 (3)	July	7.5	February	4	
				July	16.8 (4)	August	9.4	March	3	
				August	16.9 (4)		9.3	April	3	
						Total	23			
2017	1,155.7mm, 45.5"	235	1,427.8 May 221.5	May	14.8 (4)	May	5.2	January	6	Below average rainfall. Very dry April and May. Wet period June - October Cold December - 14 snow days, 18 days ground frost, 17 days air frost
				June	15.9 (5)	June	8.5	February	5	
				July	16.5 (2)	July	8.5	March	3	
				August	16.0 (1)	August	8.8	November	1	
						Total	29			

The implications of change

Since 2000 the weather pattern has altered, with extremes of rainfall, sunshine and strong winds. Winters have had less snowfall and periods of snow cover measured in weeks, not months. Climate change is not new, but does impact on wildlife and affects the farming year with implications for the farming community, flora and fauna.

Wet open winters with a higher rainfall delay ground warming in the spring affecting invertebrate eggs and overwintering pupae, including those of moths, that are the food for early nesting wader chicks. Slow growth of vegetation delays suckler cows and their calves being turned out into pastures by two or three weeks, at extra feed cost to the farmer.

A surge of bracken growth on the lower fells, especially in juniper woodlands, cannot be managed by chemical treatment and is associated with less snow cover and fewer frost days.



Rush species have spread extensively in pastures and wet ground areas in the Dale due to lower cattle grazing, but open winters and high rainfall do not help.

The rabbit population is higher on the high fells; previously hard winters kept rabbits under control. Fewer sheep graze the upland sites allowing blue moor-grass (*Sesleria caerulea*) to dominate areas to the detriment of rare plants. A similar increase in bog asphodel (*Narthecium ossifragum*) puts sheep, particularly lambs, at risk because of the plant's high toxicity.

Heavy and sudden rainfall has caused damage to road foundations and drains, cutting off the B6277, the only access road running east to west in the Dale. Since the road is built on glacial till and runs close to the Tees, it is at risk from future weather extremes.

The challenge for the future is to reduce atmospheric emissions to minimise the human-induced component of climate change and devise appropriate land management strategy. That would encourage the survival of the highly valued Upper Teesdale flora and fauna.

The timeline shows the occurrence of months with rainfall exceeding 14.0". ***It seems to be getting wetter.*** This view is supported by very recent records of total rainfall and rain days over three consecutive months:

November 2015	11.5"	27 rain days
December 2015	19.4"	30 rain days
January 2016	9.2"	27 rain days
Total 40.2"		84 rain days

References and further reading

- Holden, J & Adamson, J K (2001), Gordon Manley and the North Pennines, *Journal of Meteorology* 26, 329-333.
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