The causes and prevention of wildfire on heathlands and peatlands in England (NEER014)

Appendix 2: Natural England and submitted English wildfire data

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Appendix 2. Natural England and submitted English wildfire data

Introduction

The English wildfire data presented in this appendix can be split into three sources. The first includes data submitted to the review for a range of geographical areas by: Lancashire Fire Rescue Service, Moors for the Future Partnership, Pennine Prospects, Peak District National Park, Dorset County Council, Exmoor National Park and the Calderdale Fire Operations Group. The second is information compiled by Natural England on wildfire occurrences that took place on an area that that was either a designated site or within an agri-environment agreement. The majority of this information can be classed as new in that it has not been compiled and presented in this way before. The final source of information comes from the analysis of Home Office wildfire data carried out by Forestry Commission (2019) which includes the published national statistics on wildfire (Forestry Commission England 2019) along with an additional, new specific re-analysis of an upland subset of the data. We are grateful to all of these organisations for allowing us access to this information.

There is some duplication of recording of events, but every attempt has been made to ensure that only one record is included where an event was recorded by more than one organisation. For some of the older records, particularly within the Natural England data, some of the detail of fire events was not always recorded. As a result, the number of fires recorded is larger than the number of fires where the date/day of the week was recorded. Where an analysis is dependent upon a specific incident date, only records where the full data were recorded have been used.

The Lancashire Fire Rescue Service and Natural England data has been split by upland and lowland areas. The data supplied by the other organisations is treated as all upland (e.g. Moors for the Future) or all lowland (e.g. Dorset County Council) depending upon the geographic location. Most of the data used in the review runs from 2009 when new wildfire recording practices were put in place. The data from Dorset runs from 2002.

National wildfire statistics for England 2009–10 to 2016–17

These statistics (of which only a subset are included within this review) are produced by Forestry Commission using data from the Home Office's online Incident Recording System (IRS), that Fire and Rescue Services populate to provide records about wildfire incidents that they attend (Forestry Commission England 2019).

Summary of IRS findings

Fire and Rescue Services attended almost 260,000 wildfire incidents in England in this eight-year IRS period (an average of about 32,000 incidents per annum) (Table A2.1). This involved around 37,000 ha of land being burnt in the eight years (an average of about 4,600 ha per annum), and the incidents had a total duration of just over 300,000 hours (an average of about 38,000 hours per annum). The greatest number of incidents, area burnt and duration were each in 2011–12 (almost 50,000 incidents, over 14,000 ha burnt and a total duration of 60,000 hours). The smallest number of incidents, area burnt and duration was in 2016–17 (about 21,000 incidents, 2,200 ha burnt and a total duration of 25,000 hours).

Table A2.1. All wildfire incidents summary by financial year in England 2009–10 to 2016–17.

	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	Total
Wildfire incidents (number)	46340	47718	49847	17099	30657	22178	24393	20635	**258867**
Area burnt (ha)	4827	8281	14043	1095	2226	1970	2246	2228	**36916**
Wildfire Duration (hours)	55224	51480	60201	20369	33834	26178	30671	25224	**303181**

Data from IRS from England (Forestry Commission England 2019).

Weather conditions are likely to have had a significant impact on wildfire incidents in England. The higher number of wildfires and area burnt in 2010, 2011 and 2012 (Table A2.1) correlates with the drought of the same period in central, eastern and southern England and Wales as well as heat wave alerts.

Primary fires are potentially more serious fires that harm people or cause damage to property and meet at least one of the following conditions:

a) any fire that occurred in a (non-derelict) building, vehicle or (some) outdoor structures;

b) any fire involving fatalities, casualties or rescues; and

c) any fire attended by five or more pumping appliances).

Primary wildfires took place on a wide range of land cover classes (Tables A2.2 & A2.3) in this eight-year period. Woodland fires and those on arable land accounted for more primary wildfires than any of the other land cover types (about 2,500 and 4,800 primary wildfire incidents respectively out of a total of about 15,000). This meant woodland fires accounted for between 11% and 25% (2011–12) of primary wildfires per annum in this period, and wildfires on arable land accounted for between 28% and 41% (2012–13) of primary wildfires per annum in the period.

Table **A2.2.** Numbers of primary wildfires by land cover class per year in England 2009/10–2016/17.

Land Cover type	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17
Woodland (all categories)	6637	7988	9137	2272	4980	3123	4412	3368
Arable	5952	5995	6168	2437	4396	3140	2093	1967
Improved grassland	8129	8116	8255	2775	5396	3708	3956	3528
Semi-natural grassland	1394	1701	1596	506	1164	722	400	250
Mountain, heath & bog	392	547	506	142	283	181	201	145
Built-up areas & gardens	23455	22892	23750	8833	14170	11083	13115	11199
Other*	347	450	404	134	267	218	204	161
No classification	34	29	31	0	1	3	12	17
Total	**46340**	**47718**	**49847**	**17099**	**30657**	**22178**	**24393**	**20635**

Data from IRS for England (Forestry Commission England 2019).

*Other = coastal, freshwater and saltwater land cover classes aggregated.

Table A2.3. Area of primary wildfires (area burnt) by land cover class by year 2009/10–2016/17.

Land cover type	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17
Woodland (all categories)	152.7	1662.5	519	66.3	177.2	183.3	434.3	109.1
Arable	278.4	1223	230	300.9	461.7	818.8	426.4	343.1
Improved grassland	3698.9	1505.3	731	48.9	116.8	75.6	140.3	173.3
Semi-natural grassland	336.1	883.9	872	298.2	657.6	53.6	211.5	655.5
Mountain, heath & bog	202.3	2823.9	11481	318.4	654.2	769.4	823.3	537.6
Built-up areas & gardens	148.3	173.4	203	59.4	123.9	67.3	208.2	382.6
Other*	10.8	9.5	8	2.9	34.1	1.7	1.2	35.3
Total	**4827**	**8282**	**14043**	**1095**	**2226**	**1970**	**2246**	**2236**

Data from IRS for England (Forestry Commission England 2019).

*Other = coastal, freshwater and saltwater land cover classes aggregated.

The National Operational Guidance Programme differentiates incidents from smaller wildfires if they meet one or more of the following criteria:

a) It involves a geographical area of at least one hectare (10,000 square metres).

b) It has a sustained flame length of more than 1.5 metres.

c) It requires a committed resource of four or more fire rescue service appliances.

d) It requires resources to be committed for six or more hours.

e) It presents a serious threat to life, environment, property and infrastructure.

National Operational Guidance Programme (NOGP)-defined wildfire incidents totalled 7,141 in these eight years (Table A2.4). The majority of NOGP wildfire incidents (Table A2.4), and wildfire incidents as a whole (Table A2.5), were categorised as ‘small’ (under 1 hectare) on the UK Vegetation Fire Size categorisation, with nearly all the rest medium sized (under 50 hectares). There were fewer large and very large incidents. There were five ‘landscape scale’ (greater than 1,000 hectare) wildfire incidents in the 3-year period 2009–10 to 2011–12 period, but none in the other years.

Table A2.4. National Operational Guidance Programme (NOGP) definition wildfire incidents in England by year 2009/10–2016/17.

	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	Total
Wildfire incidents (number)	1168	1075	1175	447	918	743	867	748	**7141**
Area burnt (ha)	4587	7990	13774	1001	2025	1854	2108	2131	**35, 470**
Wildfire duration (hours)	21752	17587	22716	8382	11516	8907	10, 998	9641	**111499**

Data from IRS for England (Forestry Commission England 2019).

Table A2.5. All wildfire incidents by UK Vegetation Fire Standard (UKVFS) size category in England, 2009/10–2016/17.

UKVFS fire size category	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17
Landscape scale (>= 1,000 ha)	2	1	2	0	0	0	0	0
Very large (100 to 999 ha)	1	15	9	2	4	5	3	6
Large (50 to 99 ha)	1	2	7	1	4	1	5	3
Medium (1–49 ha)	110	179	133	57	92	93	114	116
Small (<1 ha)	44301	45474	47606	15931	29131	20751	22787	18988
No classification	1925	2047	2090	1108	1426	1328	1484	1522
All categories	**46340**	**47718**	**49847**	**17099**	**30657**	**22178**	**24393**	**20635**

Data from IRS for England (Forestry Commission England 2019).

Wildfire incidents took place on sites with a natural environment designation in every year in this eight-year period. The largest number of incidents were on Sites of Special Scientific Interest (SSSIs, an average of 880 per annum), but there were also many in National Parks (an average of 370 per annum), Special Protection Areas (SPAs, an average of 360 per annum), Special Areas of Conservation (SACs, an average of 330 per annum) and Ramsar sites (an average of 150 per annum). FRS attended over 7,000 wildfire incidents in this eight-year period on SSSI accounting for around 10,000 ha of land burnt, with a duration of about 19,000 hours in total.

Wildfires as a whole (including both woodland fires, and non-woodland fires – on other land cover types) took place on a wide range of land cover types. The type with the most incidents was built-up areas and gardens with around half the total number of incidents each year (128,000 incidents in total over the eight years).

Woodland fires accounted for 11 to 15% of the number of incidents in this eight-year period (about 34,000 incidents in total). Improved grassland (16 to 17 % per annum, 44,000 incidents in total)) and arable land (9 to 14%, 32,000 incidents in total) also accounted for relatively large percentages of the number of wildfire incidents each year.

The great majority of land area burnt by wildfire incidents was i) arable, ii) improved grassland, iii) semi-natural grassland, or iv) mountain, heath and bog (open habitats); accounting for over 70% of the burnt area each year. In 2011–12 these four land cover categories accounted for 95% of the burnt area equating to over 12,000 ha of land (and mainly on mountain, heath and bog), out of a total area burnt by wildfire of 14,043 ha that year.

Woodland fires typically accounted for between 1% and 5% of land area burnt by wildfires in England in most of years in this period, equating to a range from 33 ha in 2016–17 to about 105 hectares in each of 2013–14 and 2014–15. In 2010–11, however, woodland fires accounted for much more of the total; namely 12% of the area of land burnt by wildlife in England, equating to 1,107 ha out of the total of 8,281 ha that year.

Uplands

An analysis (Table A2.6) of a subset of fires within the uplands between 2009/10–2016/17, using the Moorland Line and above 250 metres to define uplands, reported 382 fires on the land class category of ‘mountain, heath and bog’, of which 20 were in the large to landscape category. Between them, these 20 fires covered 6,614 ha of the total of 7,011 ha burnt within the time period. Over the same period, 275 fires on ‘semi-natural grassland’ were reported, covering an area of 2,512 ha. The period

2009–2012 accounts for 64 and 60% of all wildfires respectively on mountain, heath and bog and semi-natural grassland for the period 2009/10–2016/17 (Table A2.7).

Table A2.6. Wildfire incidents in upland areas in England by UK Vegetation Fire Standard (UKVFS) size categories, 2009/10–2016/17.

Land cover type	UKVFS Fire Size Category	Number	Area burnt (ha)	Wildfire duration (hours)	Within National Park (no.)
Mountain, Heath, Bog	Landscape	1	1,555.00	8.12	1
	Very Large	17	4,919.00	558.29	4
	Large	2	140.00	7.57	0
	Medium	36	371.00	412.73	24
	Small	326	25.47	1,071.28	98
	Total	**382**	**7,010.5**	**2,058.0**	**127**
Semi-natural Grassland	Landscape	0	0.00	0.00	0
	Very Large	7	2,013.00	205.12	3
	Large	3	213.00	18.79	3
	Medium	26	265.00	167.85	17
	Small	239	21.14	550.57	122
	Total	**275**	**2,512.1**	**942.3**	**145**

Data from Forestry Commission analysis submitted to this review of a subset of IRS data for upland areas, defined as above 250 m *and* within the Defra Moorland Line.

Table A2.7. Numbers of upland wildfires by year, 2009/10–2016/17.

Financial Year	Mountain, heath and bog	Semi-natural grassland
2009/10	44	37
2010/11	87	64
2011/12	112	64
2012/13	18	17
2013/14	32	29
2014/15	30	19
2015/16	33	29
2016/17	26	16
Total	**382**	**275**

Data from Forestry Commission analysis submitted to this review of a subset of IRS data for upland areas, defined as above 250 m *and* within the Defra Moorland Line.

Wildfire data compiled by Natural England or submitted to the review

There is evidence from recent (mostly 2011–2018) English wildfire data from 3,127 fires held by and submitted to Natural England (Figure A2.1.), of strong seasonal patterns in wildfire, with peaks in spring (48% of fires) and summer (34%), and fewer in autumn (14%) and winter (5%) (see also later sections).

Seasonal and monthly distribution

There is evidence from recent English wildfire data from 3,127 fires (Figure A2.1 and A2.2) of a difference in the seasonal pattern of wildfires between lowland and upland areas, with a more even spread over spring (44% of fires) and summer (35%) and more in autumn (15%) and winter (6%) in the lowlands, compared with a marked spring peak (67%), with fewer in summer (25%), autumn (6%) and winter (2%) in the uplands, though more fires occurred in the lowlands (2,643 fires, 85%).

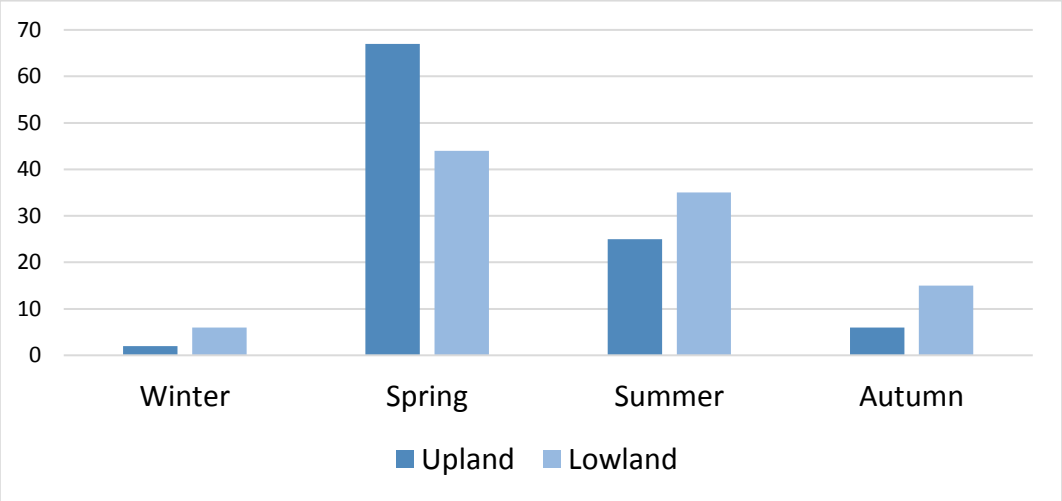

Figure A2.1. Percentage of wildfires by season for the English uplands (*n* = 484) and lowlands (*n* = 2,643) mostly from 2011–2018. Data from Dorset County Council, Lancashire Fire & Rescue Service, Moors for the Future, Peak District National Park and Natural England.

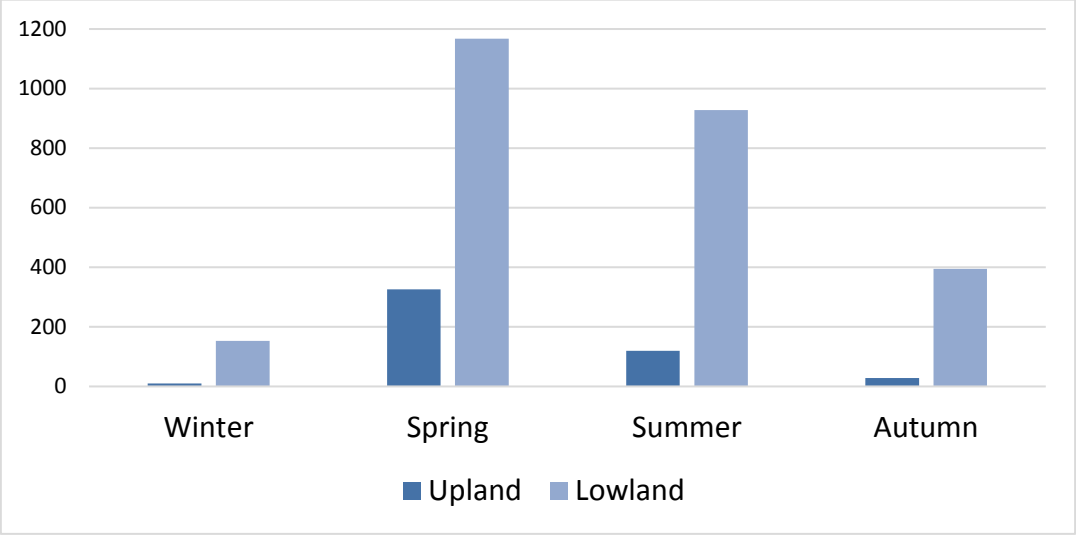

Figure A2.2. Number of wildfires by season for the English uplands (*n* = 484) and lowlands (*n* = 2,643) mostly from 2011–2018. Data from Dorset County Council, Lancashire Fire & Rescue Service, Moors for the Future, Natural England, Peak District National Park.

There is evidence from recent English wildfire data from 3,047 fires with accurate dates (Figure A2.3) that, within the seasonal pattern, higher numbers of fires occur between March and September (>8% of fires in all months c.f. mean only 2% October-February) and especially from April to June (all months >13%). The spring peak is particularly pronounced in April (21% of fires), especially in the uplands (32% c.f. 19% in the lowlands) where a high percentage also occur in May (20% c.f. 15% in the lowlands). Thus, in the lowlands, fires are much more evenly spread over the spring and summer months with, apart from the April peak, between 11 and 15% in all months from March to August.

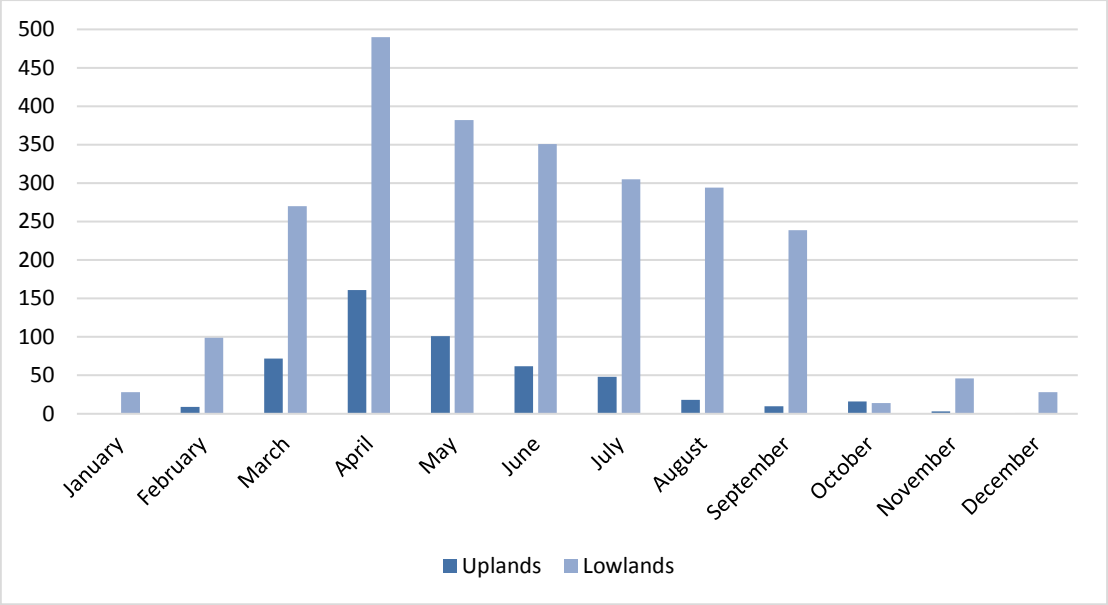

Figure A2.3. Number of wildfires in England by month (*n* = 3,047) mostly from 2011–2018. Data from: Dorset County Council, Lancashire Fire Rescue Service, Moors for the Future, Peak District National Park and Natural England.

There is evidence from recent English wildfire data from 3,127 fires (Table A2.8) of a relatively even distribution of fires by day of the week, but with a slight increase at weekends and on Mondays (16% on Saturday, 18% on Sunday and 16% on Monday, compared with a mean of 13% on other days) perhaps reflecting increased public access.

Table A2.8. Fires by day of the week. Number of wildfires in England by day of the week (*n* = 3,047) mostly from 2011–2018.

Day	Winter	Spring	Summer	Autumn	Total	%
Monday	26	237	181	61	505	16.1
Tuesday	28	196	157	62	443	14.2
Wednesday	14	182	119	53	368	11.8
Thursday	22	175	132	44	373	11.9
Friday	16	202	140	46	404	12.9
Saturday	24	248	143	73	488	15.6
Sunday	33	253	176	84	546	17.5
Total	**163**	**1493**	**1048**	**423**	**3127**	**100.0**

Data source: Lancashire FRS, Moors for the Future, Peak District NP and Natural England.

There is evidence from recent English wildfire data from the period 2009–2018, that of 128 upland wildfires, 78% (100) occurred in the years 2010, 2013 and 2018 and that 43% (55) of the total fires (128), occurred within 2018 (Figure A2.4).

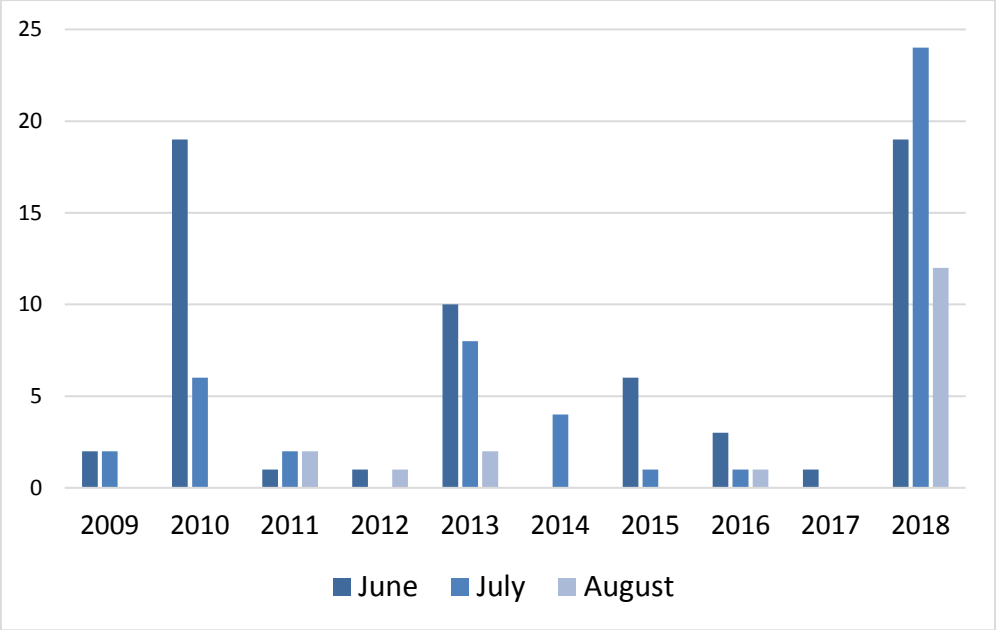

Figure A2.4. Upland wildfire occurrences in England in summer (*n* = 128), 2009–2018**.** Data from Lancashire Fire Rescue Service, Moors for the Future, Peak District National Park and Natural England.

Fire size

There is evidence that all categories of wildfire in terms of size, occur in both lowland and upland environments (Figure A2.9).

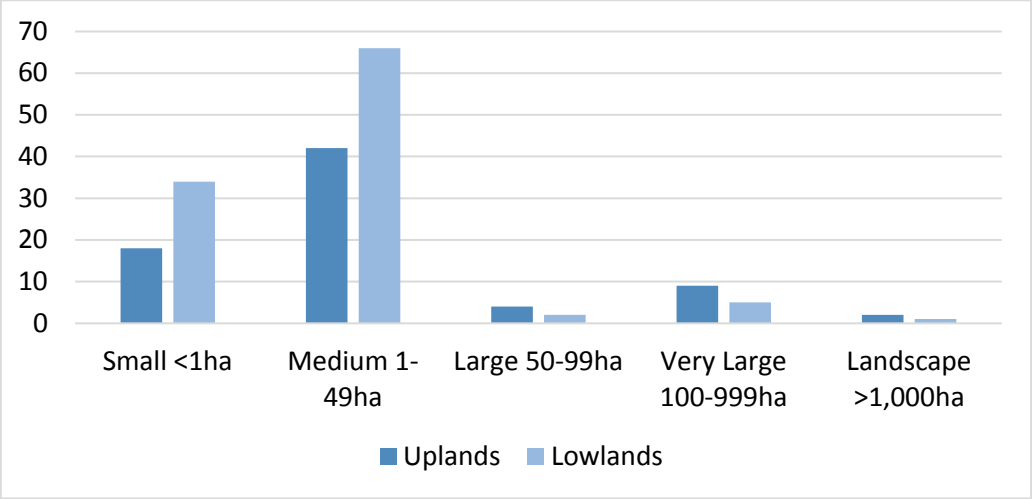

Figure A2.9. Number of fires by wildfire size categories in England 2011–2018 (*n* = 183). Data from Natural England.

There is evidence from recent Natural England wildfire data from 2011–18, from 183 fires on open, semi-natural habitats (Figure A2.9), that such fires are larger on average than in the more comprehensive national FC-analysed IRS dataset across all habitats/land uses, with most falling into ‘medium’ (1–49 ha, 59% of fires) or ‘small’ (<1 ha, 28%) UKVFS fire size categories (Gazzard 2009), but, as with the national dataset, far fewer ‘large’ (50–99 ha, 3%), ‘very large’ (100–999 ha, 8%) or ‘landscape-scale’ (≥1,000 ha, 2%) incidents. Larger fires can, of course, cover much larger areas

when they occur, but tend to be episodic; although ‘very large’ and ‘landscape-scale’ fires occurred in four of the eight years, there was more than one in only two years: 2011 (9 fires) and 2018 (6), corresponding with peak wildfire years (Forestry Commission 2019).

Dorset heaths

There is evidence from wildfire data in Dorset that the number of wildfires and area burnt does not follow a linear relationship (Figures A2.5–8). For the period 2009–18, the average number of fires per annum on the Dorset heaths was 109, with a similar total of 111 in 2018, which was considered a peak wildfire year at least is some other areas (Table A2.9.).

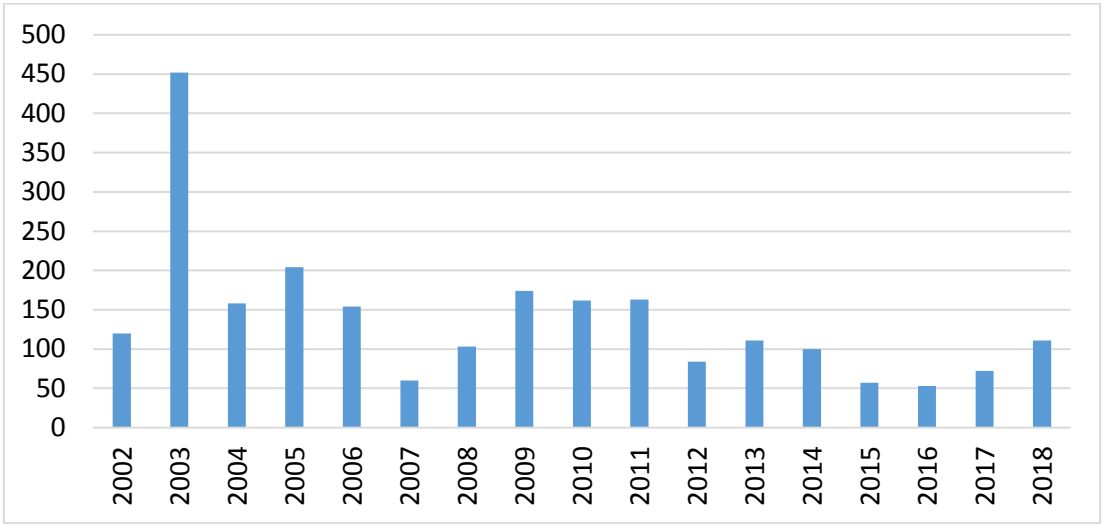

Figure A2.5. Number of wildfires on the Dorset heaths per year 2002–2018 (*n* = 2,338). Data from Dorset County Council.

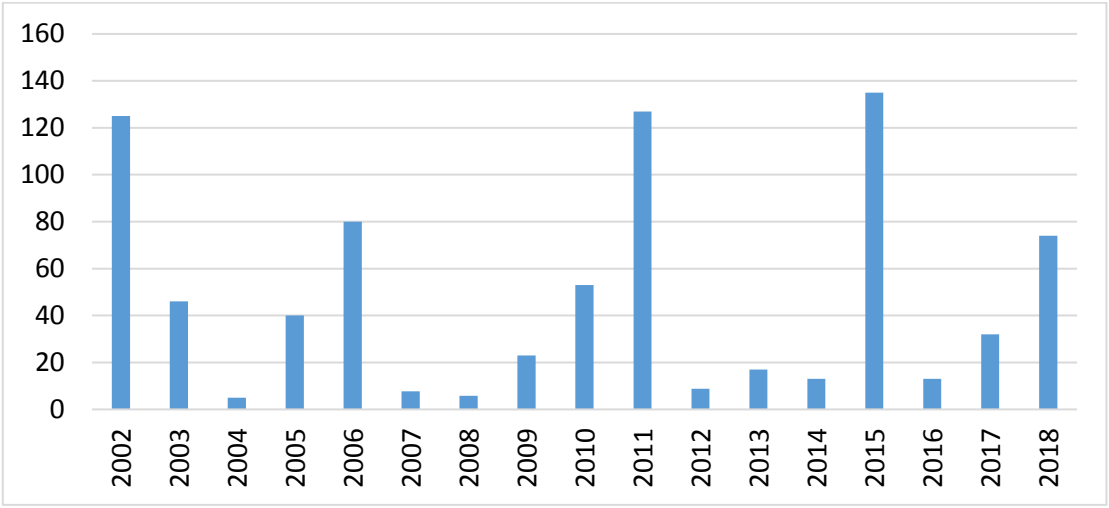

Figure A2.6. Area burnt by wildfires on the Dorset heaths per year, 2002–2018 (*n* = 2,338). Data from Dorset County Council.

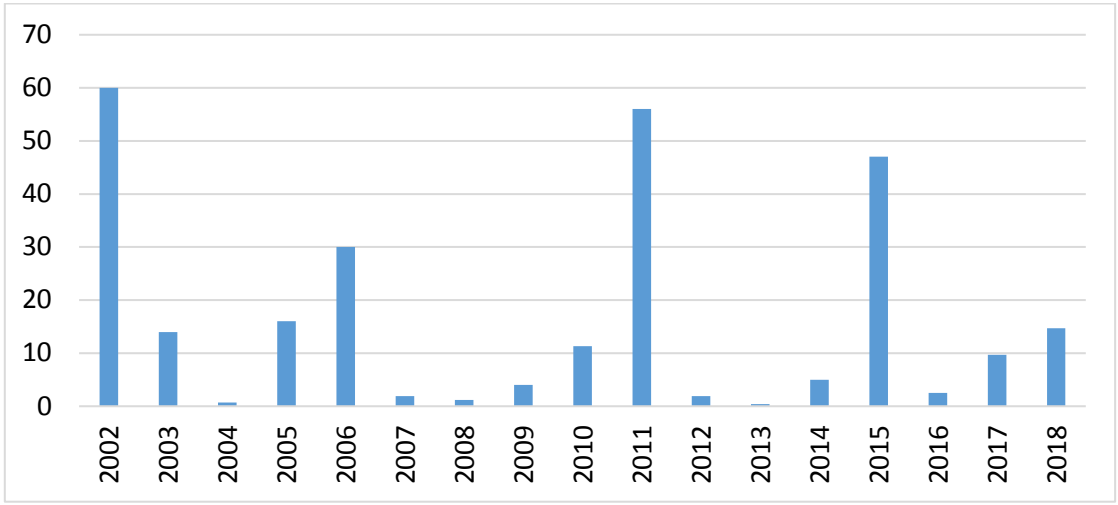

Figure A2.7. Largest individual fire (ha) each year on the Dorset heaths, 2002–2018 (from 2,338 fires). Data from Dorset County Council.

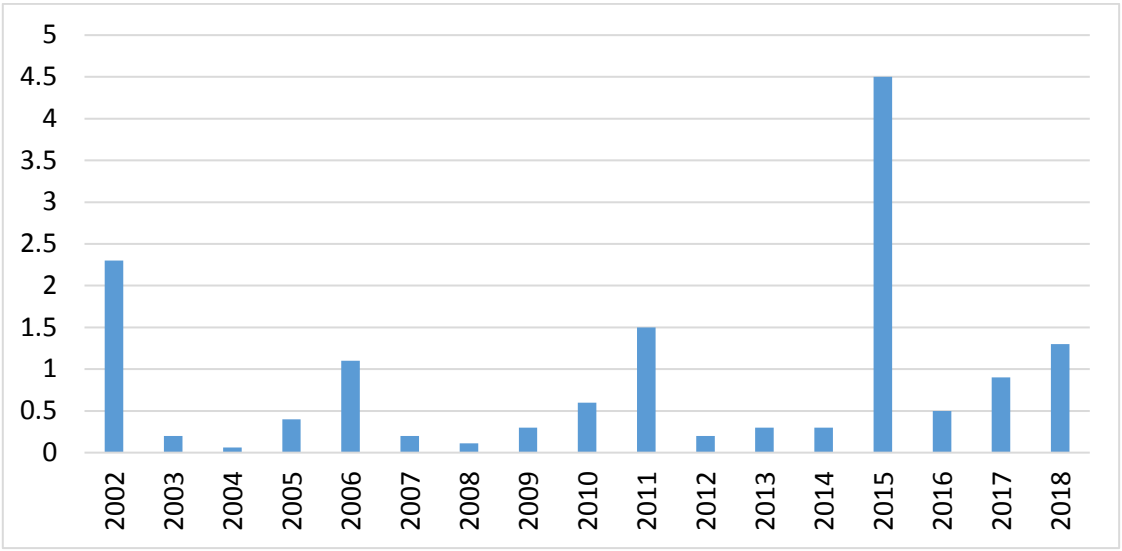

Figure A2.8. Mean wildfire size (ha) on the Dorset heaths, 2002–2018 (*n* = 2,338 fires). Data from Dorset County Council.

Table A2.9. Number of wildfires on the Dorset heaths per year, 2009–2018.

2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	Average
174	162	163	84	111	100	57	53	72	111	109

Data Source Dorset County Council.

Ignition causes in England

There is evidence from 603 upland wildfires that 22% were the result of accidents, 38% were deliberate (started by persons unknown) and 35% were not assigned an ignition cause/category (Figure A2.10). There is evidence from 2,666 lowland fires that 6% were the result of accidents, 71% were deliberate and 11% were not assigned to a cause/category (Figure A2.11).

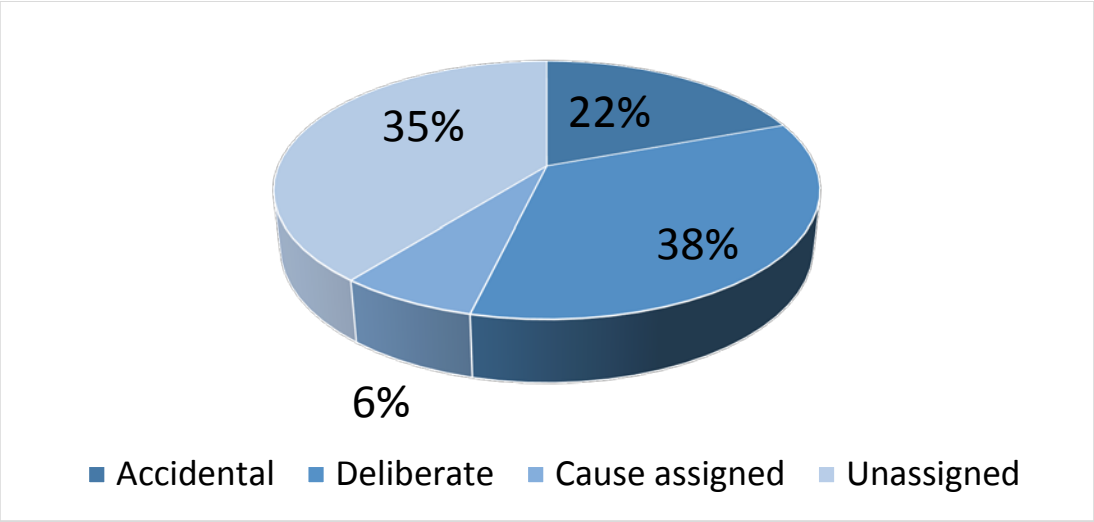

Figure A2.10. Broad causes of wildfire ignition in the English uplands (*n* = 603). Note: "Cause assigned", relates to more specific causes having been identified. Data from Lancashire Fire Rescue Service, Moors for the Future, Natural England, Peak District National Park.

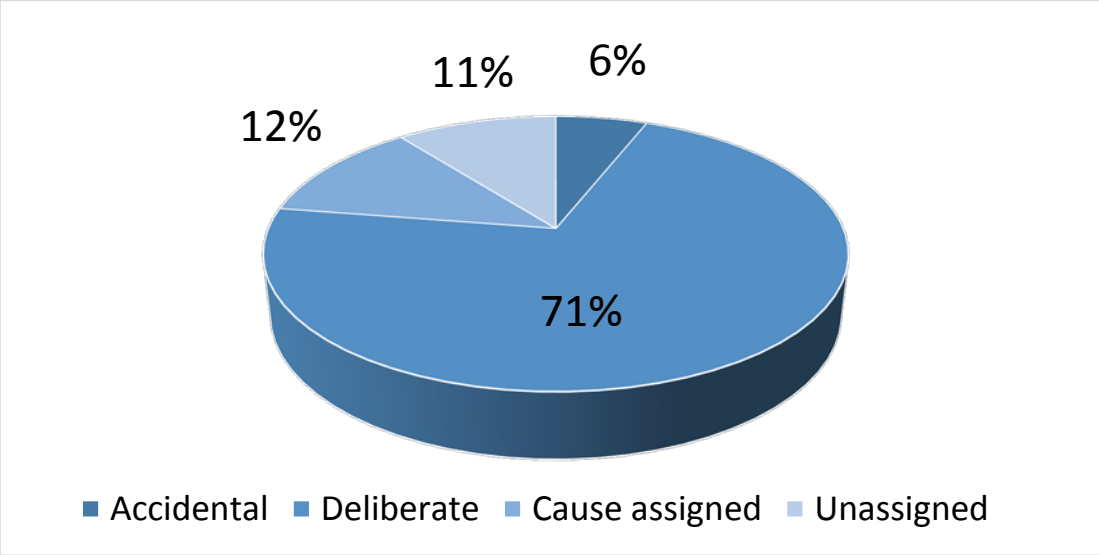

Figure A2.11. Broad causes of wildfires in the English lowlands (*n* = 2,666). Note: "Cause assigned", relates to more specific causes having been identified. Data from Dorset County Council, Lancashire Fire Rescue, Natural England.

There is evidence from the lowlands that, where the cause of ignition was recorded (*n* = 320), 56% (180) originated from camp fires, 11% (35) from BBQs, 7.5% (24) were re-ignited fires, 6% (18) were military training, 5% (15) were land management burns and 3% (11) were caused by children/youths (Figure A2.12). The pattern for the uplands, from fewer fires where a specific source was recorded (*n* = 62) and overall, differs, with 68% (42) originated from a land management burn, 8% (5) were from camp fires, 8% (5) were caused by children/youths, 6% (4) were from BBQs and 5% (3) from military training (Figure A2.12).

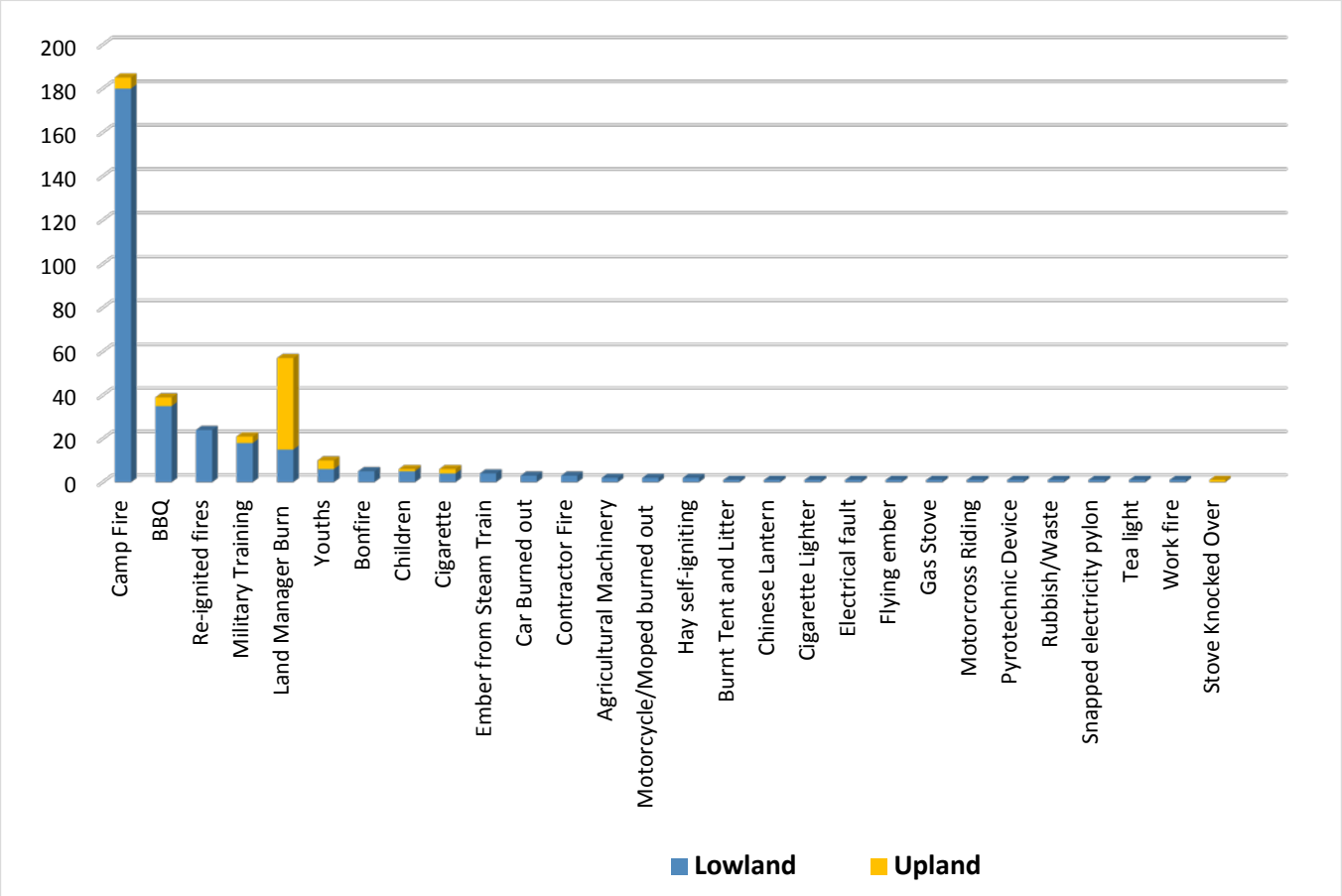

Figure A2.12. Number of wildfires recorded as caused by specific ignitions sources in the English lowlands (*n* = 320) and uplands (*n* = 62), 2009–2018. Data from Dorset County Council, Lancashire Fire Rescue Service, Moors for the Future, Peak District National Park and Natural England.

Geographic variation in wildfire occurrence

National wildfire statistics (Forestry Commission 2019) show the years 2010–12 recorded the largest number of wildfires in England in the period 2009–17 and the largest area effected, and accounted for the longest amount of fire-fighting time in the period. Taking the data submitted to this review for this apparent peak 2010–12 period, there is evidence that the distribution and timing of wildfires varied by area (Tables A2.10 and A2.11). In particular, spring and summer wildfires were more frequent in Dorset in 2010 and 2011 than other areas other than the South Pennines, and similarly in 2011. This apparent variability suggests that drought and heatwaves may be uneven in their occurrence and hence in their influence on the overall number of wildfire events.

Tables A2.10 and **A2.11.** The number of wildfires by month over three years (2010–2012) for two lowland (A2.10) and three upland (A2.11) English geographic areas compared to the average (mean) number for each month over a longer nine year period (2009–2018): green shading indicates lower than average, orange average, and red above average number of wildfires for the month (blank cells indicate no wildfires recorded in an area in the month over the three-year period).

Table A2.10. Lowland wildfire occurrences for Dorset and Lancashire, 2010–2012.

Dorset CC	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2010		2	9	34	27	26	26	24	6	7	1	
2011	2	3	20	36	36	22	13	11	7	13		
2012	1	4	16	10	12	10	11	9	10	1		

Lancs FRS	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2010			15	26	14	12	2		2	1	1	
2011			6	17	4	1	2		1			
2012	1		7	5	4							

Table A2.11. Upland wildfire occurrences for Lancashire, S. Pennines and Peak District, 2010–2012.

Lancs FRS	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2010			1	5	5	6	1					
2011			3	7					1	1		
2012			2	2	1			1				

S. Pennines	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2010			5	10	5	8	4					
2011			6	17	1	1	2	1	1	1		
2012			6		4							

Peak District	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2010			1	10	7	5	1		1			
2011			1	6	3			1				
2012			2	1	3	1						

Managed burning of vegetation in the English uplands

Thacker *et al*. (2014) provide estimates for the extent of managed burning on dwarf-shrub-dominated blanket peat and heath in England (Table A2.12). They reported that an area >33 km^2 is subject to burning on upland deep peat soils annually. This was considered to be an under-estimate of the total area subject to burning as at the time of the work only 80% of the upland dwarf-shrub area had been mapped and assessed, and graminoid-dominated areas were excluded.

The authors reported that 40% of all burning occurred on deep peat with these burning regimes being as intense as those on non-deep peat areas (3.76% yr^{-1} vs 3.99% yr^{-1} respectively). The extent and intensity of moorland burning has increased markedly since the 1940s with the greatest increase being upon deep peat soil types. In the period 1945–1959 around 5.3 km^2 yr^{-1} was burnt annually and by 2010, this had increased to 38.9 km^2 yr^{-1}. Burning has also expanded from more accessible areas of upland heath on moorland fringes up onto blanket bogs, and in places there is evidence that a combination of artificial drainage and burning has contributed to the development of heath-type vegetation on deep peat.

Table A2.12. Summary of managed burning extent in the English uplands.

Soil Type	**Area (km^2)**	
	DS-dominated*	**Burnt year $^{-1}$**
Deep peat	881.31[#]	33.18
Other	1270.47	50.69

Data source: Thacker *et al*. (2014).

*England is incompletely mapped; these figures are based on mapping of approximately 80% of DS-dominated area and only include dwarf- shrub-dominated areas and will therefore represent an underestimate.

[#]1,612km^2 of deep peat has been mapped in total of which 54.7% was dwarf-shrub (DS)-dominated.

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