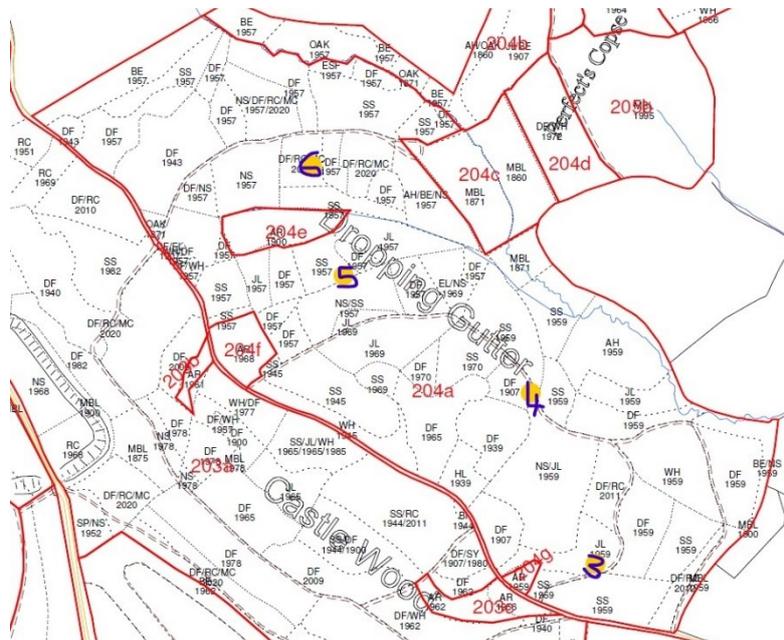
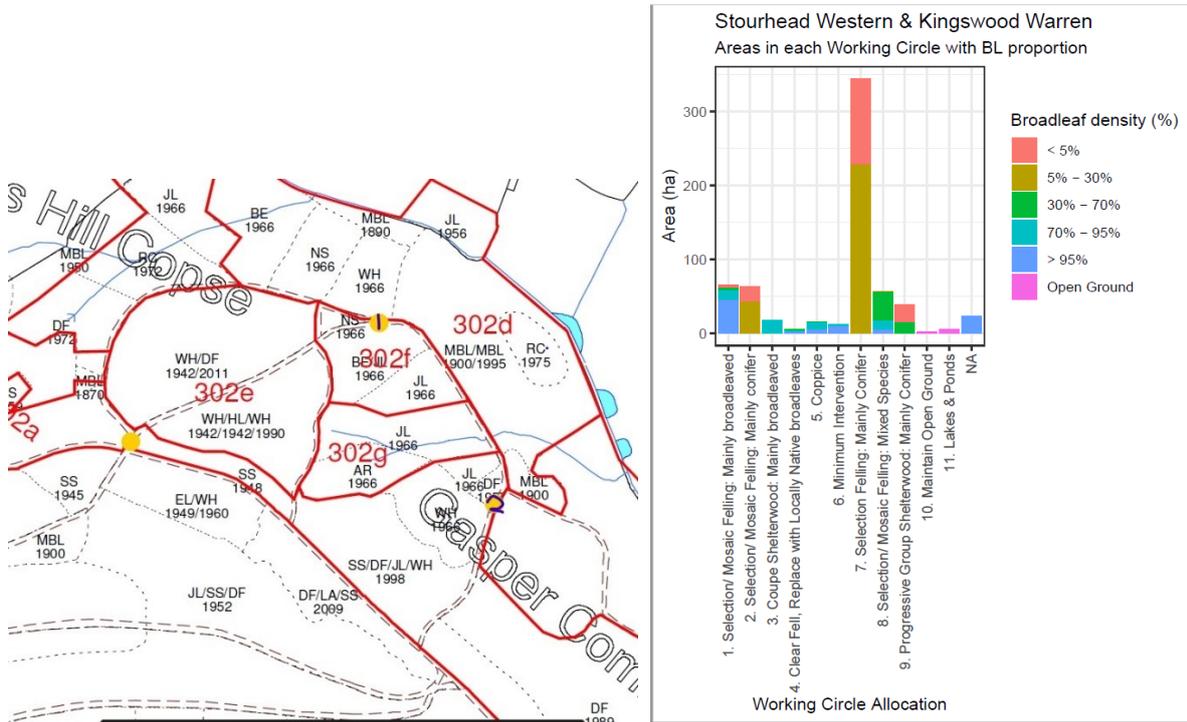


Visit to Stourhead (Western) Estate
 By kind permission of Nick C Hoare (Owner)
 Led by David Pengelly & Rob Coventry (Consultant foresters)
 Guests: Phil Sterling, Dan Alder & Simon Nash
 Audience – Wessex Silvicultural Group

Theme for the day: Biodiversity in irregular conifer dominated stands and the relationship between habitat features and biodiversity output

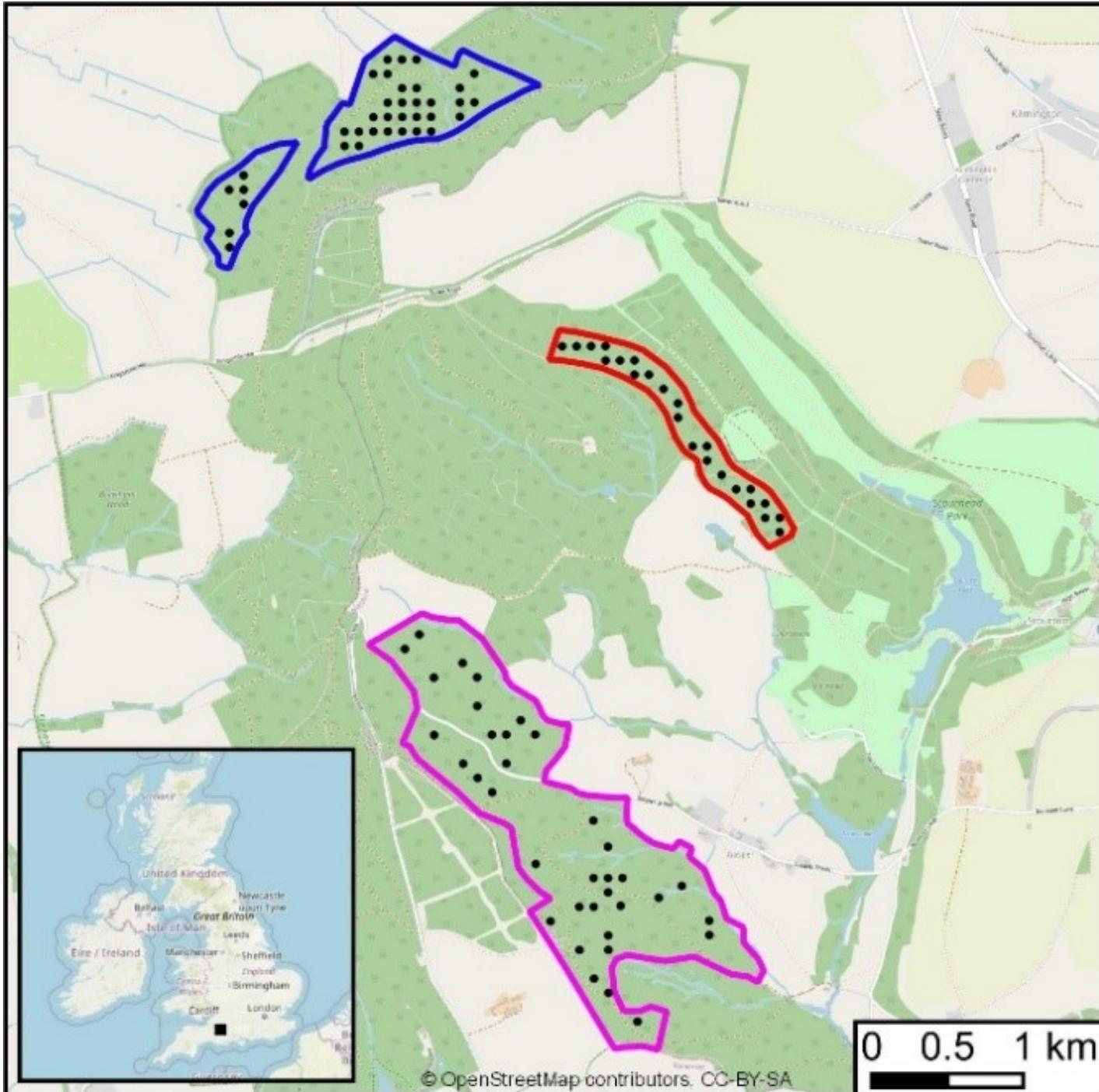
10.30 hours, Tuesday 17th May 2022



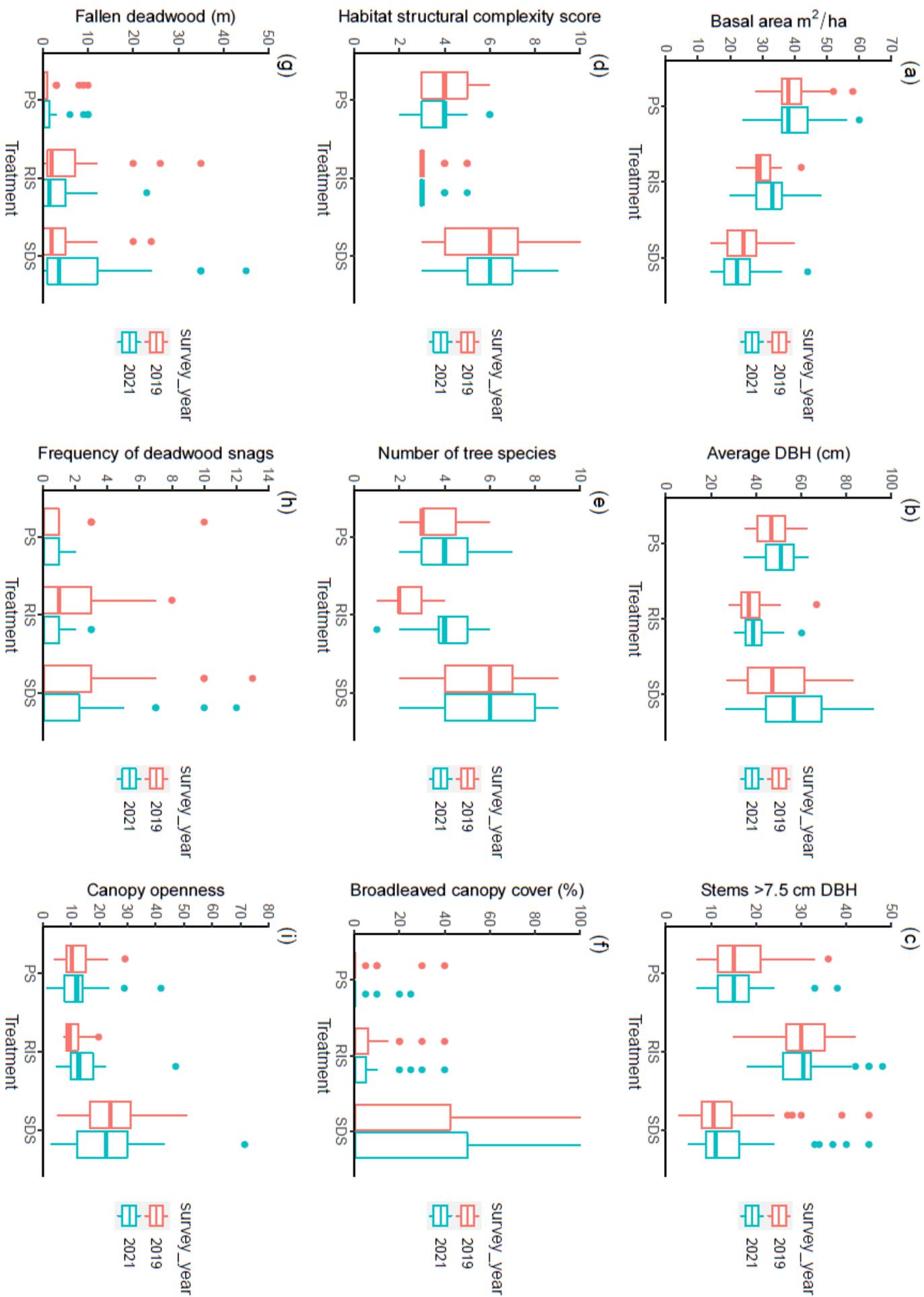
Stop 1. Stourhead Biodiversity Study

Theme for the day: Biodiversity in irregular conifer dominated stands and the relationship between habitat features and biodiversity output

Study area: Stourhead (Western) Estate and National Trust Stourhead Estate



Trophic levels studied: plants, spiders, moths, bats, birds



Stop 2.

Stourhead Surveys

Results – part 1

Taxonomic Group	Stage 1	Stage 2	Stage 3	All Stand Stages
Plants	52	86	109	128
Moths	171 (2867)	184 (3722)	175 (3575)	248 (10164)
Bats	11 (878)	12 (1344)	13 (3718)	13 (5940)
Birds	N/A	22 (125)	25 (278)	26 (403)

- 248 moths species – 27% of larger (macro) moths associated with woodland;
- 13 bats species – 76% of all UK resident species. Both Lesser and Greater Horseshoe bat at Stourhead (though just 6 registrations). Barbastelle was 5th most active bat (IUCN Red List);
- 26 birds species – including 2 Red Listed Birds of Conservation Concern, present at Stourhead – Marsh tit & Spotted flycatcher (low numbers);
- 128 plant species – 94 vascular plants, no outstanding rarities*

* <https://www.nature.scot/doc/naturescot-research-report-1211-establishing-woodland-plants-broadleaved-woods-interim-best-practice>

How does this compare with other sites? Rushmore Estate

486 moth species (30,757 individuals)

11 bat species

20 woodland bird species – note woodland only

91 vascular plant species – diverse ancient woodland flora – 31 ancient woodland indicators



Stop 3.

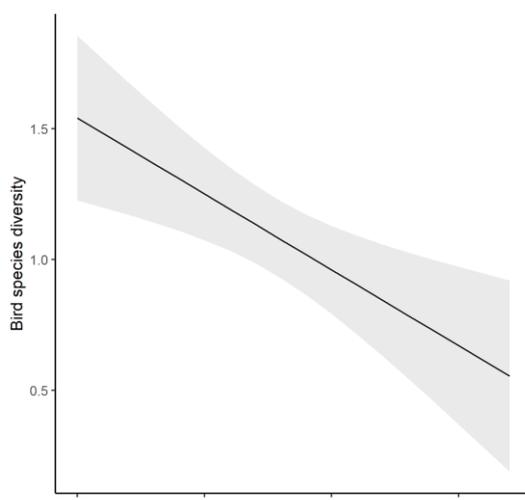
Stourhead Surveys Results – part 2

Habitat structural features particularly important for increasing biodiversity:

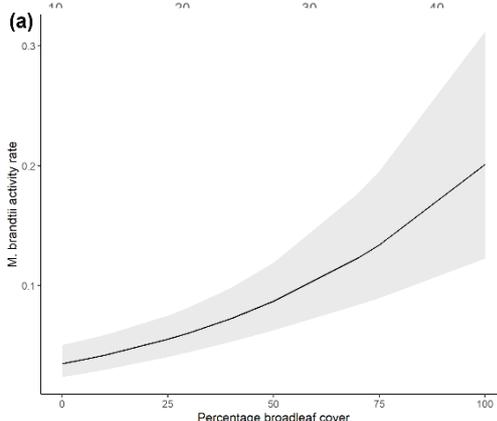
- Higher canopy cover of broadleaved trees was an important habitat feature particularly for broadleaved tree feeding moths and one bat species
- Lower basal area, promoting higher habitat complexity, an important factor influencing biodiversity, particularly higher plant and bird diversity.
- Maintaining a variable canopy with patchy openness is important. Certain groups like bats responded to more open conditions whereas moths were associated with more closed conditions
- Greater quantities of deadwood promoted activity of Common and Soprano Pipistrelle
- Understorey positively associated with the number of spider webs

Note no consistent differences between the biodiversity in the three stand development stages:

- Overlapping habitat structures found across the stand stages
- The most developed stand needs 20+ years to reach equilibrium following transformation
- External factors to each stand / area such as surrounding landscape habitats influencing what was recorded within a stand



Relationship between bird diversity and basal area. Bird diversity was higher when basal area was lower



Positive relationship between activity of Brandt's / Whiskered bats and broadleaved canopy cover

Group	Habitat Feature	Relationship	Significance
Plants			
Plant species diversity	Basal area	Negative	**
Woodland generalist species richness	Percentage broadleaf canopy	Positive	***
Moths			
Total moth species richness	Canopy openness	Negative	**
Total moth abundance	Canopy openness	Negative	*
Total moth species diversity	Canopy openness	Negative	***
Woodland moth species richness	Canopy openness	Negative	**
Woodland moth abundance	Canopy openness	Negative	**
Broadleaved feeding moth species richness	Complexity score	Positive	**
Broadleaved feeding moth abundance	Distance to broadleaf	Positive	***
Broadleaved feeding moth abundance	Percentage broadleaf canopy	Positive	***
Conifer feeding moth species richness	Basal area	Positive	**
Conifer feeding moth abundance	Distance to broadleaf	Positive	***
Spiders			
Number of spider webs	Bramble	Positive	**
Number of spider webs	Brash	Positive	**
Bats			
Soprano Pipistrelle	Average DBH	Positive	**
Soprano Pipistrelle	Canopy openness	Positive	***
Common Pipistrelle	Canopy openness	Positive	***
Serotine	Canopy openness	Positive	*
Soprano Pipistrelle	Deadwood snags	Positive	*
Common Pipistrelle	Fallen deadwood	Positive	**
Brandt's/Whiskered	Percentage broadleaf canopy	Positive	***
Birds			
Bird species diversity	Basal area	Negative	**

How does this compare with Rushmore Estate?

Moths

- Considerable variation in total numbers & species counts between plots
- Overall abundance & species count similar across treatments (all moths and across 335 woodland species)
- Across the 2361 moths of 98 rarer woodland species, the overall abundance of moths was significantly higher in Irregular than either Coppice or Limited intervention; and number of species was significantly higher in Irregular than Limited intervention
- A small study of leaf-mining moths showed that numbers and density were significantly higher in Irregular than Coppice

Bats

- Species richness similar between treatment stages at Stourhead; at Rushmore it was highest in irregular
- Bat activity was highest amongst irregular stands for 9 of 11 species at Rushmore and activity was similarly greatest in the stage 3 stands at Stourhead; i.e. structurally complex and open
- The three commonest bat species, common and soprano pipistrelles followed by Whiskered/Brandt's bats showed strong association with canopy openness
- Barbastelle bat is the UK's most threatened resident species and was found significantly more in irregular stands at Rushmore and was also found at Stourhead. Not able to show statistically any association with a stage or habitat structure here BUT this species ranges over several kilometres from tree roosts and its presence in the summer signals suitable feeding...a moth specialist!

Birds

- A similar bird community to Rushmore shared several specialist woodland birds at Stourhead including a mixture of woodland specialists associated with understorey, e.g. willow warbler and marsh tit, as well as canopy species e.g. treecreeper and great spotted woodpecker
- Lower basal areas found in both irregular and coppice promoted bird species richness; at Stourhead this holds true as species richness for woodland specialists and generalists were both significantly related to lower basal area associated with stand complexity

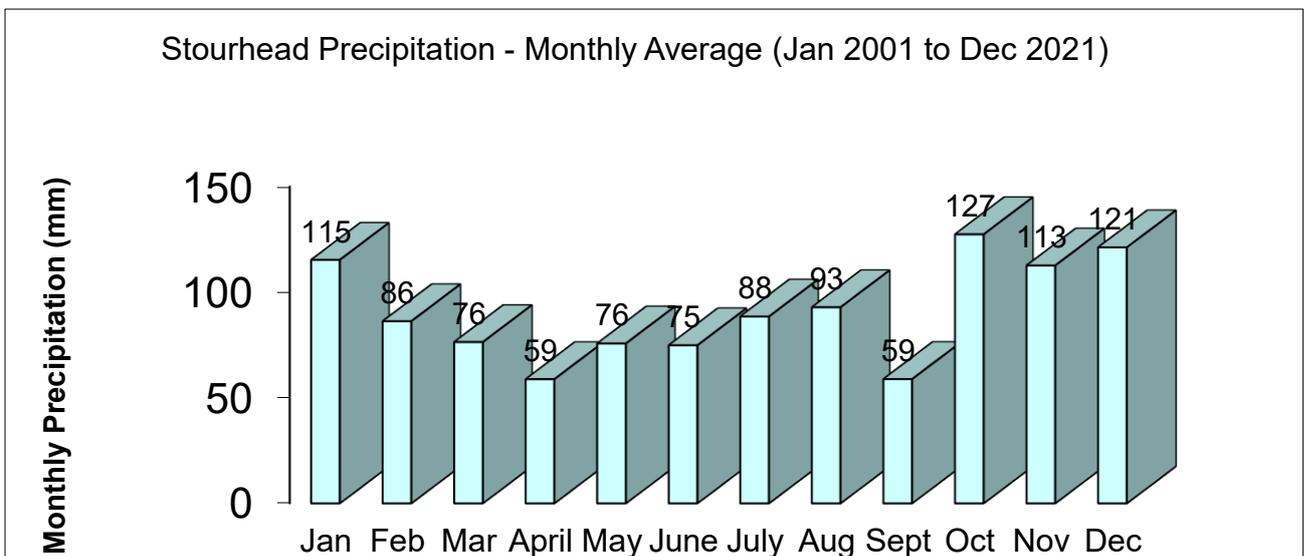
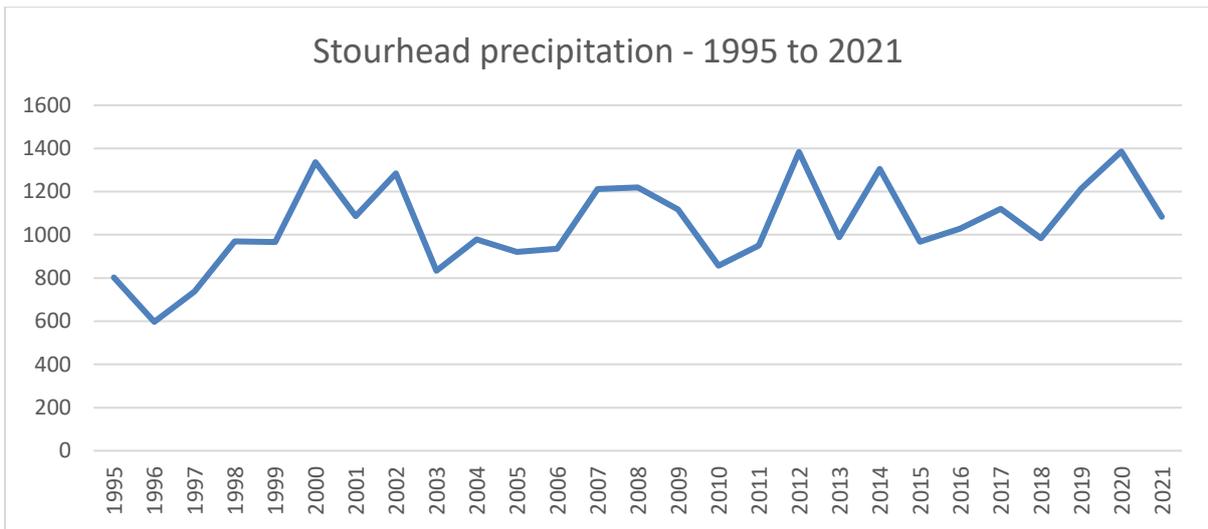
Stop 4.

DROPPING GUTTER (Cpt 204) Cpt details	Management history
<p>204a,e,f,g 24.34 ha. – NGR: ST753186</p> <p><u>SITE DESCRIPTION:</u> Soil – Cretaceous Upper Greensand, Gault clay downslope, rotational land slippage; Aspect – Level, dipping NE; Elevation: 175m asl</p> <p><u>WORKING CIRCLE:</u> Selection felling – Mainly conifer</p> <p><u>PLANTATION STATUS: RECENT</u> 33% DF (P.1907, 1939, 1943, 1959); 45% Other conifer SS, NS, WH, RC, JL (P.1945, 1957, 1959); 22% B/l's: SC, AR, BI, BE, POK, AH (1871, 1959, 1968)</p>  <p>January 2016 (per hectare):</p> <ul style="list-style-type: none"> • Total BA = 29.8 • SPH = 167 • Silves = 311m³ <p>BA distribution by diameter group:</p> <ul style="list-style-type: none"> • Small (16-32cm): 9% (Target 22%) • Medium (32-52cm): 27% (Target 32%) • Large (52-72cm): 38% (L & VL Target 46%) • V large (>72cm): 26% <p>Species components (BA):</p> <ul style="list-style-type: none"> • 33% Douglas fir • 37% other evergreen conifer • 8% larch • 22% broadleaves 	<p>Local Research Stand</p> <p><u>Selected Seed Stand</u></p> <ul style="list-style-type: none"> • Stand identity: pmeST40-12SE • Species: Douglas fir • Planted: 1907-1943 • Date registered: 2015 <p><u>Main felling interventions, with some high value timber harvested between:</u></p> <ul style="list-style-type: none"> • 2001, 2007, 2013, 2017 • Diseased larch felling 2018 & 2021 <p><u>Felling intervention summer 2017:</u> Felling focus on those surpassed Target Diameter, with focus on lower quality; Renewal by natural regeneration & enrichment planting of target spp.;</p> <p>Post harvesting tending in 2018</p>  <p><u>Basal Area following 2017 harvesting, PLUS diseased larch & ash removals in 2018 & 2021:</u></p> <p>BA removed = 7.24 (21.3% of pre-felling BA)</p> <p>Size class & spp. component in the removals:</p> <ul style="list-style-type: none"> • Small 4% BA, Medium 29% BA, Large 42% BA, V large 25% BA; • Larch 33.3%, Evergreen conifer 50.3%, Broadleaves 16.5% <p>Current stocking estimate (spring 2022): 27 BA</p>

<p>REGENERATION FOCUS: Natural; Supplemented with Artificial; Diversify species and genetic base of species already thriving;</p>	<p>INCREMENT DATA: Annual Increment 2006–2016 = 11.71 m³ (BA 1.02) Increment contribution by species group:</p> <ul style="list-style-type: none"> • Douglas fir = 25.3% (Increment to GS ratio 0.76) • Other evergreen conifer = 58% (Increment to GS ratio 1.57) • Larch = 6.3% (Increment to GS ratio 0.83) • Broadleaves = 10.1% (Increment to GS ratio 0.45)
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Stourhead Precipitation

Average over 26 yrs (1995 to 2020): 1046mm
 Wettest year in 26 years at Home Farm (2020): 1.4 metres!
 Driest months consistently April & September
 Key is the precipitation from 1 April: 'full tank' from winter



Deadwood volumes in AFI plots 2016 cycle, Dropping Gutter, Stourhead Western Estate

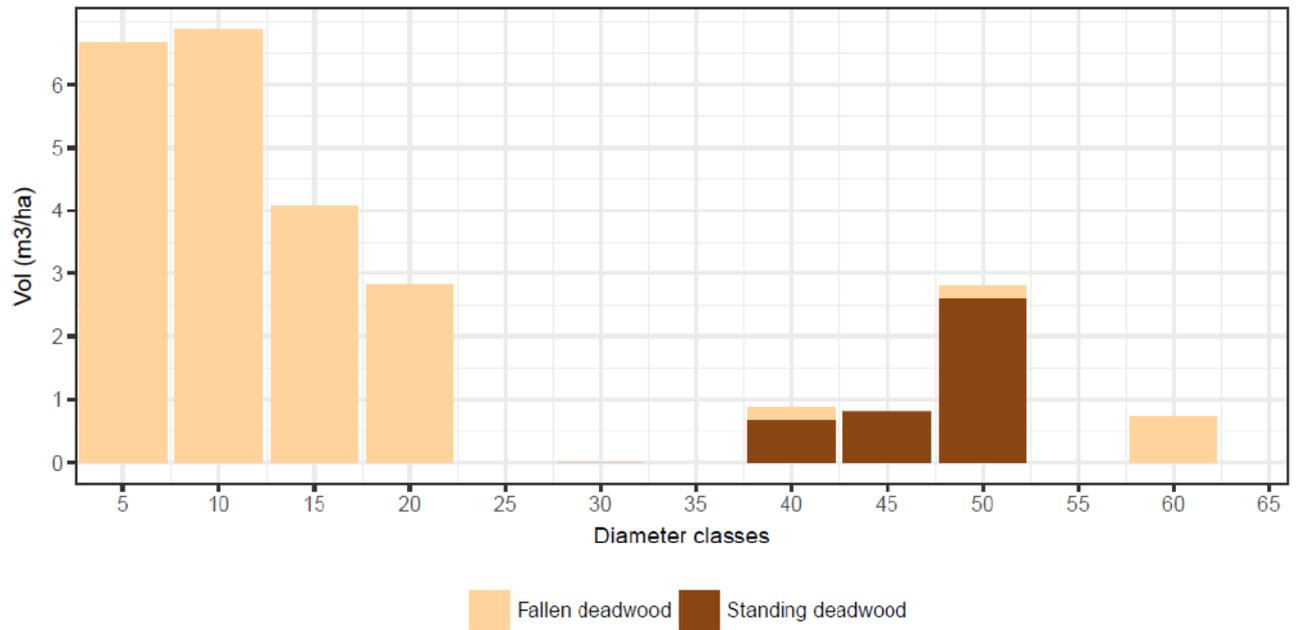


Figure 3.2.1 – Distribution of standing deadwood and fallen deadwood by diameter size

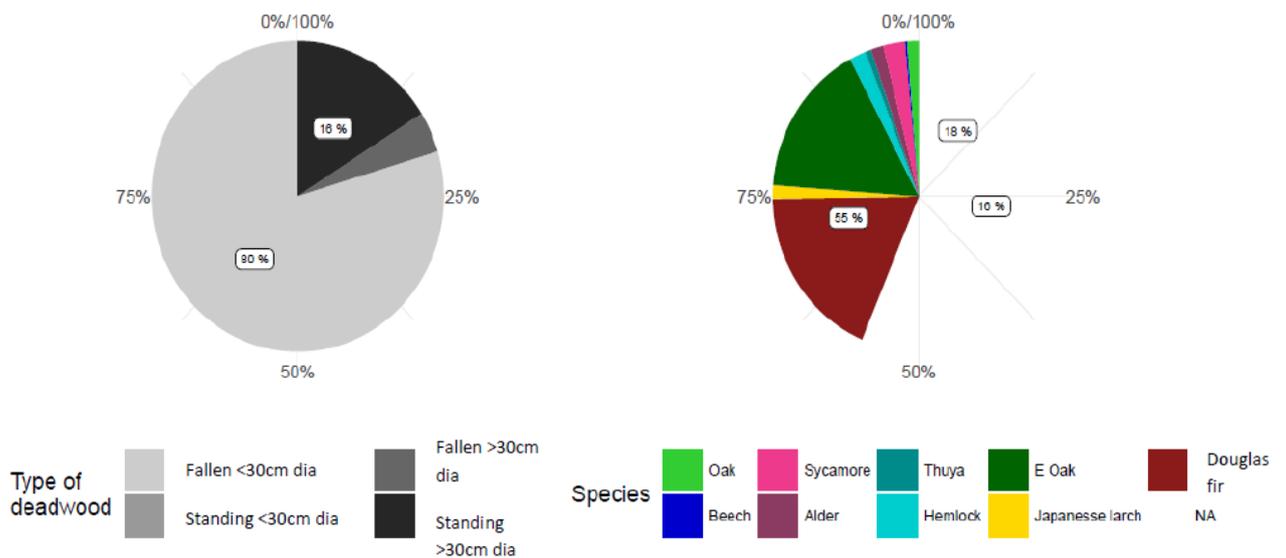


Figure 3.2.2 – Distribution of total deadwood by diameter size and species

Out of the 12 species recorded on this research stand, 11 are found as deadwood. Figure 3.2.3 provides an illustration of the distribution of deadwood by species and by size and position.

Change in deadwood volumes in AFI plots 2006 - 2016, Dropping Gutter, Stourhead Western Estate

Table 3.2.2 and the Figure 3.2.4 show the evolution of volumes of deadwood.

Years	Fallen deadwood		Standing deadwood		Total deadwood
	< 30cm (m ³ /ha)	≥ 30cm (m ³ /ha)	< 30cm (m ³ /ha)	≥ 30cm (m ³ /ha)	
2006	11.5 (61%)	2.6 (14%)	0.1 (1%)	4.7 (25%)	18.9 (100%)
2011				2.9 (100%)	2.9 (100%)
2016	20.5 (80%)	1.1 (4%)		4.1 (16%)	25.7 (100%)

Table 3.2.2 – Evolution of volume of deadwood

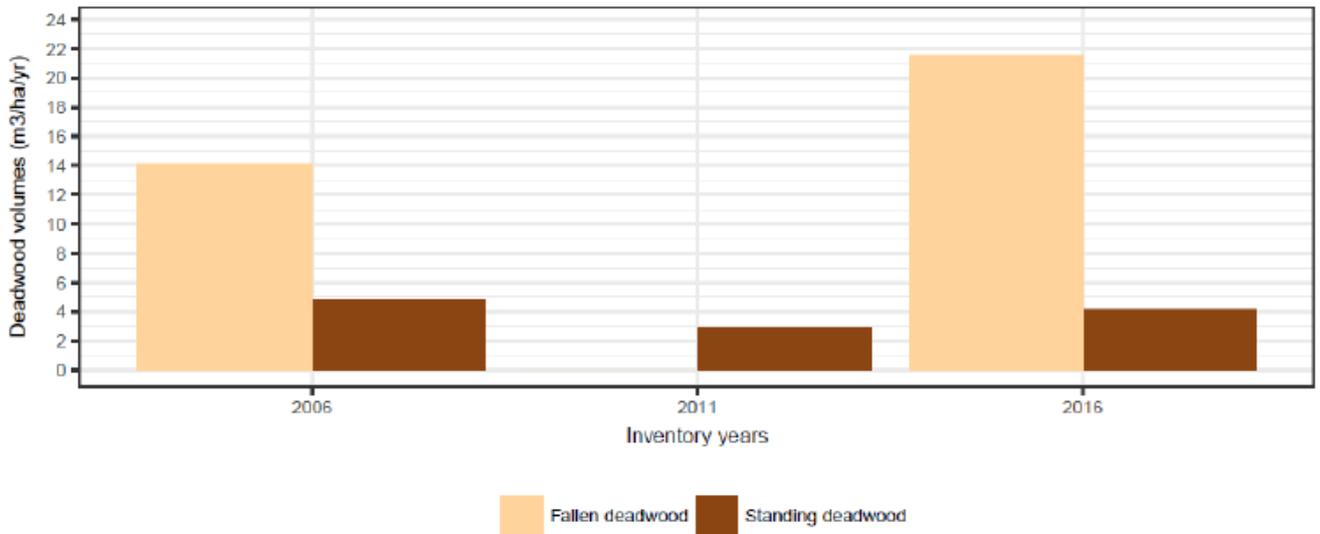


Figure 3.2.4 – Evolution of volumes of deadwood between inventories

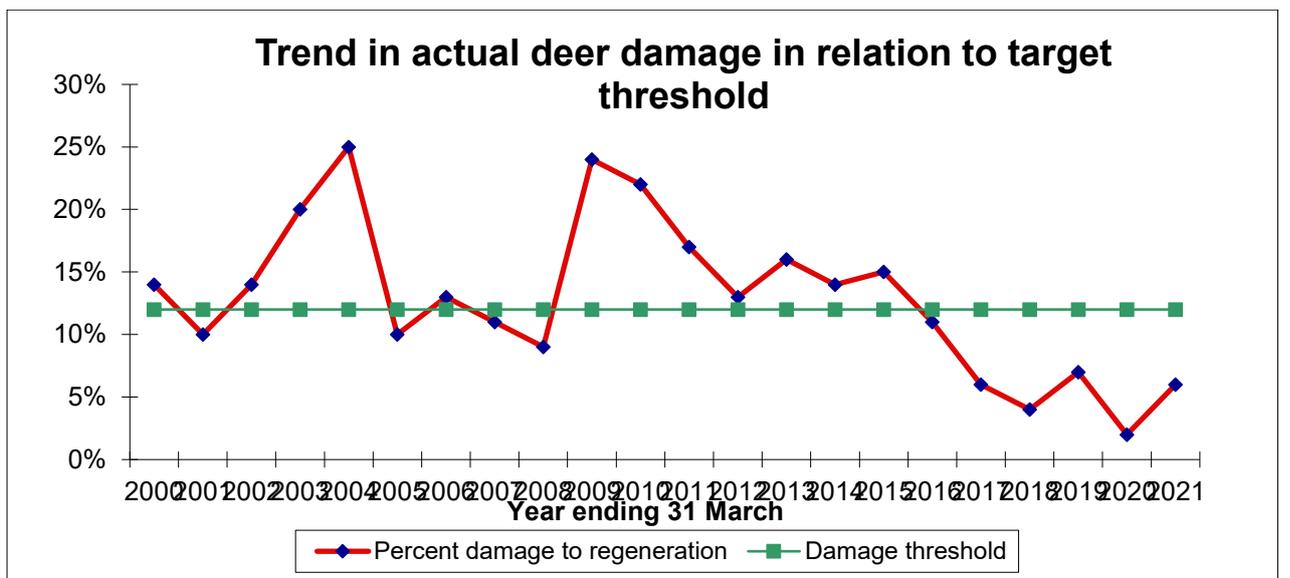
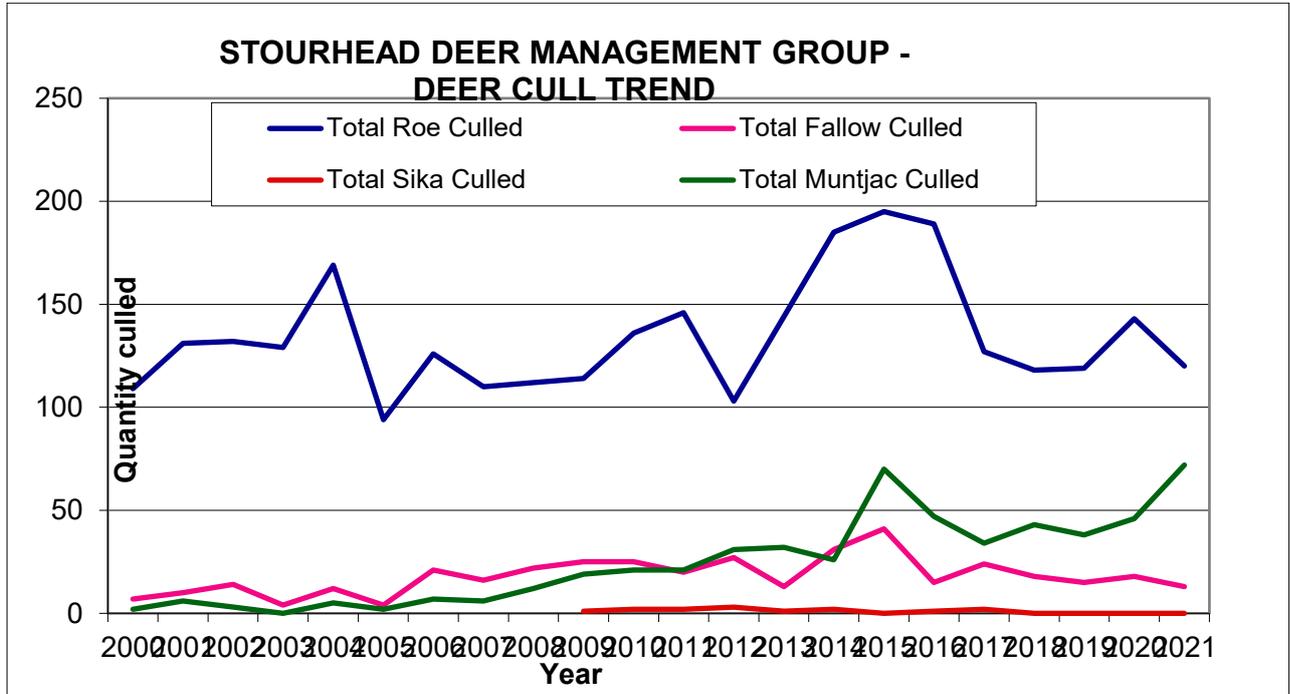
Stop 5. Deer Summary

Deer management group area covers 923 hectares of woodland

Average of 1 deer culled per 5.6 ha of woodland (22 year average); Last 8 years 4.4 ha.

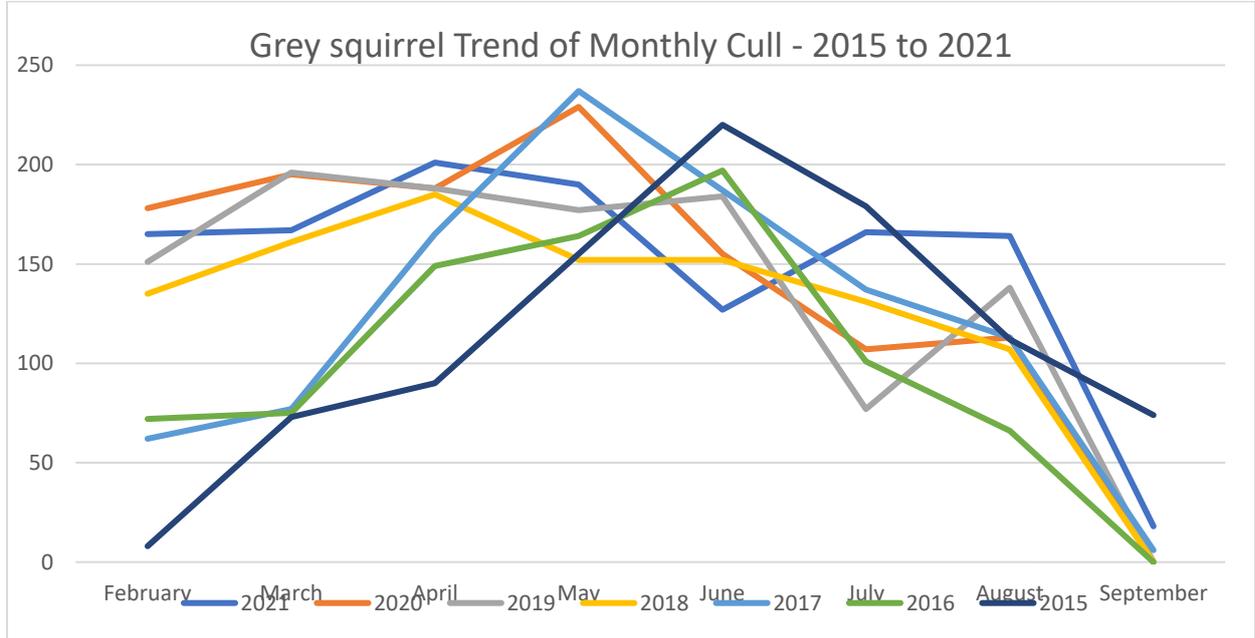
An average of 177 deer culled per annum over last 22 yrs; Last 8 years 219

2021 deer browse / fray damage to vulnerable regeneration: 6% (target <12%). There are localised high levels of damage



Grey Squirrel Summary

Grey squirrel control area covers 756 hectares of woodland
Average of 1.6 grey squirrels culled per hectare of woodland (7 year average);
An average of 1031 culled per annum over last 7 years;



Photos: Dan Alder



Stop 6.

Tree Species group (plus others for comparison)	British moths	
	All moths ²	Micro-moths ³
Date	2020	2018
Willows	267	73
Birches	236	85
Oaks (deciduous)	213	81
Hawthorns	177	61
Poplars	120	45
Apples	113	57
Hazel	104	29
Alders	92	32
Elms	71	25
Pines	67	37
Spruces	63	31
Beech	61	16
Maples (excl Syc.)	60	22
Limes	54	14
Hornbeam	45	23
Sycamore	45	16
Larches	40	12
Lichens	40	21
Ash	37	9
Mosses	34	29
Firs	31	18
Juniper	23	14
Holm Oak	22	7
Algae	21	11
Bracken	17	3
Cypresses	13	2
Holly	6	1
Western Red-cedar	6	1

² Henwood, B.P. & Sterling, P.H (2020) Field Guide to the Caterpillars of Great Britain and Ireland. Bloomsbury Wildlife

³ Sterling, P.H & Parsons, M.S (2012) Field Guide to the Micro-moths of Great Britain and Ireland. British Wildlife Publishing

Tree Species group	Britain	European Russia	British moths	
	All insects ¹	All insects ¹	All moths ²	Micro-moths ³
Date	1961	1961	2020	2018
Oaks (deciduous)	284	150	213	81
Willows	266	147	267	73
Birches	229	101	236	85
Hawthorns	149	59	177	61
Poplars	97	122	120	45
Apples	93	77	113	57
Pines	91	190	67	37
Alders	90	63	92	32
Elms	82	81	71	25
Hazel	73	26	104	29
Beech	64	79	61	16
Ash	41	41	37	9
Spruces	37	117	63	31
Limes	31	37	54	14
Hornbeam	28	53	45	23
Larches	17	44	40	12
Firs	16	42	31	18
Holly	7	8	6	1

¹ Southwood, T. R. E. (1961). The number of species of insect associated with various trees. *Journal of Animal Ecology*, 30, 1-8

(Kennedy, C.E.J. & Southwood, T.R.E (1984). The Number of Species of Insects Associated with British Trees: A Re-Analysis. *Journal of Animal Ecology* 53, 455-478)

² Henwood, B.P. & Sterling, P.H (2020) *Field Guide to the Caterpillars of Great Britain and Ireland*. Bloomsbury Wildlife

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