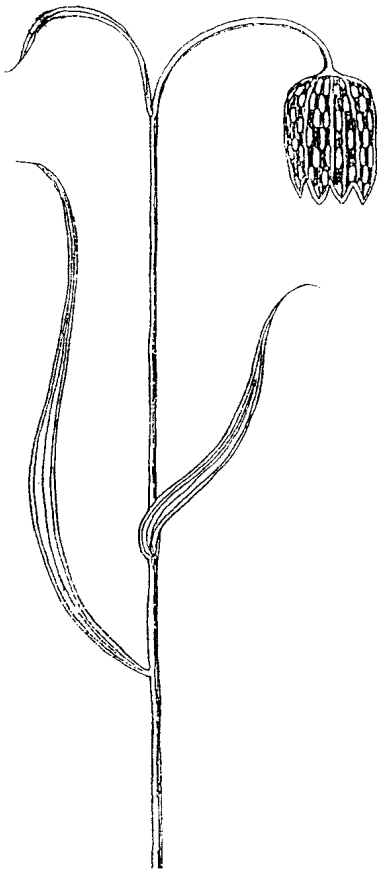
WILTSHIRE BOTANY



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WESTONBIRT'S *CAMPANULA PATULA*

Rosemary Westgate

Fig 1. Campanula patula plant

***Campanula patula* - a Wiltshire and Gloucestershire Plant**

My fascination with wildflowers has been well known at Westonbirt Arboretum, just outside the north-eastern boundary of Wiltshire for many years. Back in 2005 one of the guides spoke to me about a very elusive wildflower that appeared occasionally in Silk Wood, at the Arboretum site. This was *Campanula patula* or the Spreading Bellflower (Fig 1). *Campanula patula* was recorded at Silkwood in 1939 by A.B. Jackson of Kew in *Wiltshire Plant Notes* (Grose 1957) and a reference in *The Flowering Plants of Wiltshire* (Preston 1888) may be to this plant. Silkwood was in Wiltshire at these times before the county boundary changes and most of it is still within the North Wiltshire botanical vice-county (VC 7). This is now the only known site in botanical Wiltshire (Gillam, Green and Hutchison 1993; Pilkington 2007) but, historically, it was more widespread, with records also in or near Westbury, Malmesbury, Whetham, the Vale of Pewsey, Landford, West Wellow, Bulford, Longbridge Deverill, Warminster and Alderbury (Grose 1957). Since it can reappear from dormant seed after absences of many years, it could be seen elsewhere in Wiltshire in the future.

Campanula patula is a slender biennial herb up to 60 centimetres high, with leaves longer than broad and stalkless or almost so and loose clusters of pinkish-blue flowers in summer and autumn. The flowers are up to two and a half centimetres in diameter and have a typical structure for the family Campanulaceae, with five each of sepals, petals and stamens and a single ovary surmounted by three styles. The fruit is a capsule opening by holes near the top. Its general appearance depends on where it grows - tending to erect in open habitats, but spreading in more shady conditions. The main difference between this and other bellflowers is that the petals in the bell are spread out and pointed. It is classed as **endangered** in the *Vascular Plant Red Data List for Great Britain* (Cheffings and Farrell 2005). The definition of endangered is "A taxon is Endangered when it is not Critically Endangered but it is facing a very high risk of extinction in the wild in the near future". It is also classified as **Nationally Scarce**, which means that it has been recorded in 16-100 km squares in the British Isles. It thus features in the *Wiltshire Rare Plants Register* (WRPR) (Pilkington 2007).

Early exploration

Throughout the summer of 2005 I searched and searched for *Campanula patula* to no avail - I suppose basically because I really did not know what I was looking for or the correct habitat in which to search.

I needed to know more. The next step was a field trip in 2006 to the Forest of Dean organised by the BSBI. Although we had a very pleasant day and saw the sites where *Campanula patula* had been recorded the previous year, yet none were to be found. The day did give me more information as to the likely habitat and the knowledge that ground disturbance was a help.

I continued searching at Westonbirt, particularly in the areas that I felt supplied a suitable habitat, focusing my attention on Sand Earth and Concord Glade. It was not until the last week of August 2006, that I had an excited telephone call from Hugh Angus, Head of Collections at the Arboretum. He had found what he thought might be our campanula!

Fig 2. *Campanula patula* first found in 2006

On examination, he had found two plants of *Campanula patula* growing through the tree cage surrounding a tree, *Picea pungens* (Fig 2). Descriptions of *Campanula patula* in shady conditions are of a scrambling lax plant. This proved to be the case. The plants were intertwined through the cage, long grass and nettles as the accompanying photograph shows. These plants continued to produce flowers into December.

Systematic study

Campanula patula was the spark behind the formation of the Westonbirt Wildflower Group which was formed in 2007. The main driving force however, was the Forestry Commission's desire to know more about the wild flowers at the Arboretum and how best to encourage their presence whilst compiling and applying the Sward Management Plan for the benefit of the tree collection which is the main feature of the site. The Wildflower Group supplied many more eyes and to our delight *Campanula patula* was again sighted under the *Picea pungens* but also other plants nearby in early July 2007.

Fig 3. Single blue flower

It appeared again in 2008, but in totally different areas as well as under the same *Picea pungens*. We were beginning to feel that we needed some help and advice as to how to conserve this plant so we contacted Tim Wilkins at Plantlife. Tim duly visited on 25 July 2008, and was very impressed with our plants and made some suggestions on how we might proceed.

Experimental propagation

Though the plant is described as a biennial or a short lived perennial, no one was able to supply us with a photograph of a first year rosette. Tim Wilkins suggested that the Westonbirt Propagation Unit might try to germinate some of our seed. He also suggested that we prepare trial plots replicating as nearly as possible habitats where it is known to grow and monitor progress. With his help we selected two areas within an area that had previously been coppiced for our trial plots. We did not sow seeds but monitored the areas to see whether any plants grew spontaneously.

In February 2009, with the aid of the Volunteer Work Parties, two sites were prepared (Fig 4). Both sites were marked out and cleared to bare earth then divided in half, one half was lightly raked, while in the other the soil was disturbed to a depth of 20cms. Early July brought a magnificent display of *Campanula patula*, not in the prepared areas but around the edges which had been heavily trampled during the preparation of the sites.

Fig 4. Prepared plot February 2009

Natasha de Vere, Head of Conservation and Research at the National Botanic Garden of Wales had undertaken a survey to assess the distribution and abundance of *Campanula patula* in Wales, so we invited her to Westonbirt. She came on 10th August 2009 and was stunned by our display from our eight plants, particularly as she had seen only a few examples in three of the 16 sites in Wales. She and I collaborated on an article for *Plantlife* (De Vere 2009).

July 2010 brought even more plants, again not in the prepared sites but as before around the edges and a totally different site in an area that had been cleared the previous year. Here we marked the plants with blue stakes so that we could monitor the progress during the Winter, 2010 and Spring, 2011. Plants continued to flower into December - we even had one frozen blue flower on 19th just before Christmas.

On the propagation front we had supplied small quantities of harvested seed to our propagation unit in both 2008 and 2009. However hard they tried nothing had germinated, although some seed in the soil bank must have been viable as we continued to find *Campanula patula* plants flowering. In 2010 one of our Wildflower Group, Jo Newbould, purchased some *Campanula patula* seeds from a commercial source and was able to germinate them in her greenhouse after giving them six weeks cold treatment in her refrigerator. We were able to see what the germinating plants looked like but unfortunately they damped off and did not prosper. This February after our snow and hard frosts, I harvested two dry stems of *Campanula patula* with several unopened seed capsules and passed them to

Fig 5. Campanula patula on log in Silk Wood

Jo. Jo split the seeds into two groups, the first group was planted straight away and the second group was put in the fridge for six weeks. Both groups germinated, one six weeks ahead of the other. Fig 6 shows her results, so we now know what the first year rosette looks like, although finding examples in the Arboretum is almost impossible because of the dense vegetation.

Fig 6. Seedlings from wild seed in a pot, July 2011

Also in February 2011, two larger sites were prepared within the coppiced areas. We were assuming that the seeds being so very fine and light were wind distributed, so the two sites were down wind of previous sites. At least this year we knew what the first year rosettes look like but we did not find any plants until the flowers appeared in July. Again we had no luck in the prepared sites but plants were widely distributed and abundant close by.

The present and the future

This summer, we were contacted by the National Botanic Garden of Wales who are undertaking further study of *Campanula patula.* Some of their team visited the Arboretum in early August to sample our plants. They wanted to obtain environmental information at each site, such as light levels, as well as a small (0.5 x 0.5 cm) sample of leaf tissue from each plant. They definitely found 60 plants, sampling 48. Probably, many more were hidden within the brambles. They will be using the leaf material to further study the DNA of *Campanula patula*. We are assured this information will be invaluable in studying intraspecific variation within an area. We have subsequently found a pale flowered specimen (Fig 7) and have forwarded a sample of leaf tissue to the National Botanic Garden of Wales. We hope this will add some variation to their results.

Fig 7. Pale flowers (compare Fig 3)

We have also recorded an interesting phenomenon. *Campanula patula* has migrated into an area in the Old Arboretum a long way from previous populations It is now growing in the staff and volunteers' car park so can be recorded for BSBI purposes as being in Vice County 34, Gloucestershire. What is also interesting is that Corn mint *Mentha arvensis*, previously absent from the Old Arboretum, is growing alongside the Campanula. It has previously been recorded as growing only in Silk Wood in a position fairly close to some of the *Campanula patula* plants. The best explanation we can come up with at this stage is that the large mower used for grass cutting is brushed off in the car park before it is garaged and the site used is within five feet of the occurrence of *Campanula patula* and *Mentha arvensis.*

At our wildflower meeting on 4th September 2011, we found and photographed first year rosettes growing in one of our previous sites (Fig 8). *Campanula patula* is still growing and blooming at the Arboretum and hopefully will be for many years to come. We await the publication of results of the National Botanic Garden of Wales survey and are anxious to explore any possible new ways of conserving this fascinating plant.

Fig 8. Wild seedlings growing in Silk Wood September 2011

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All photographs are by Michael Westgate.

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IDENTIFYING WILTSHIRE WATER-STARWORTS

(*Callitriche* species)

Ken Adams

The water starworts are a group of aquatic plants, mostly having a rosette of leaves on the water surface and also underwater leaves. *Callitriche* species are commonly thought difficult to distinguish from each other, and we cannot be sure exactly how many species occur in Wiltshire. Any of those in the following key might be found. It would be particularly helpful to hear of any sighting of *Callitriche palustris*, which may be more widespread than currently realised.

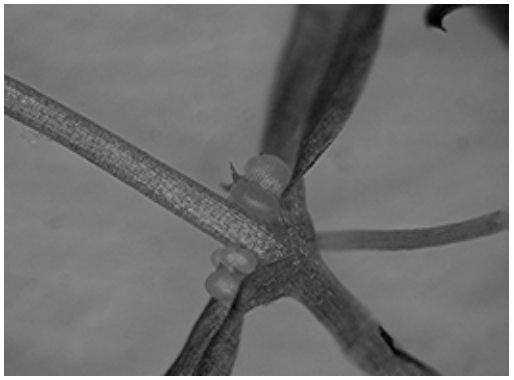
Callitriche flowers do not have perianths (petals and sepals) and are wind-pollinated in taxa with yellow pollen, the anthers being borne in rosettes above the water surface. Those species with colourless pollen produce their flowers under water and are pollinated by water currents.

Mature fruits are often needed for certainty of identification. Where the flowers are aerial, fruiting is usually abundant, but where they are underwater, fruits may often be absent. Attempts at identification have commonly been abandoned because of this difficulty, but it is usually possible to find fruits if a sufficient number of plants is examined.

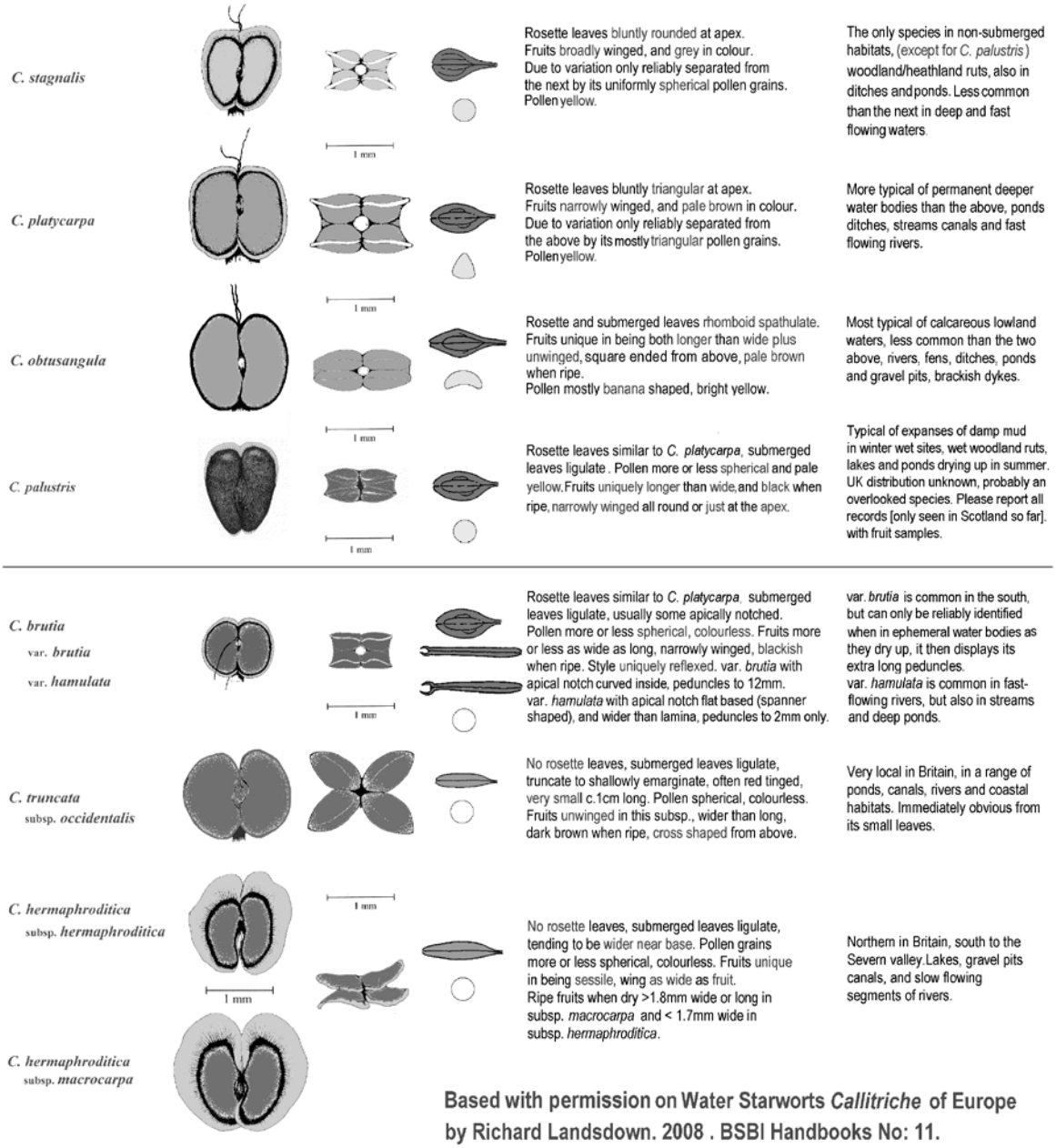
Callitriche stagnalis **rosette, submerged leaves and fruit**

Callitriche stagnalis

Fruit of *Callitriche truncata*. Photo Ken Adams



The Key


C. stagnalis
Rosette leaves bluntly rounded at apex. Fruits broadly winged, and grey in colour. Due to variation only reliably separated from the next by its uniformly spherical pollen grains. Pollen yellow.
The only species in non-submerged habitats, (except for C. palustris) woodland/heathland ruts, also in ditches and ponds. Less common than the next in deep and fast flowing waters.
1 mm
C. platycarpa
Rosette leaves bluntly triangular at apex. Fruits narrowly winged, and pale brown in colour. Due to variation only reliably separated from the above by its mostly triangular pollen grains. Pollen yellow.
More typical of permanent deeper water bodies than the above, ponds ditches, streams canals and fast flowing rivers.
1 mm
C. obtusangula
Rosette and submerged leaves rhomboid spathulate. Fruits unique in being both longer than wide plus unwinged, square ended from above, pale brown when ripe. Pollen mostly banana shaped, bright yellow.
Most typical of calcareous lowland waters, less common than the two above, rivers, fens, ditches, ponds and gravel pits, brackish dykes.
1 mm
C. palustris
Rosette leaves similar to C. platycarpa, submerged leaves ligulate. Pollen more or less spherical and pale yellow. Fruits uniquely longer than wide, and black when ripe, narrowly winged all round or just at the apex.
Typical of expanses of damp mud in winter wet sites, wet woodland ruts, lakes and ponds drying up in summer. UK distribution unknown, probably an overlooked species. Please report all records [only seen in Scotland so far]. with fruit samples.
1 mm
C. brutia
var. brutia
var. hamulata
Rosette leaves similar to C. platycarpa. submerged leaves ligulate, usually some apically notched. Pollen more or less spherical, colourless. Fruits more or less as wide as long, narrowly winged, blackish when ripe. Style uniquely reflexed. var. brutia with apical notch curved inside, peduncles to 12mm. var. hamulata with apical notch flat based (spanner shaped), and wider than lamina, peduncles to 2mm only.
var. brutia is common in the south, but can only be reliably identified when in ephemeral water bodies as they dry up, it then displays its extra long peduncles. var. hamulata is common in fast-flowing rivers, but also in streams and deep ponds.
1 mm
C. truncata
subsp. occidentalis
No rosette leaves, submerged leaves ligulate, truncate to shallowly emarginate, often red tinged, very small c.1cm long. Pollen spherical, colourless. Fruits unwinged in this subsp., wider than long, dark brown when ripe, cross shaped from above.
Very local in Britain, in a range of ponds, canals, rivers and coastal habitats. Immediately obvious from its small leaves.
C. hermaphroditica
subsp. hermaphroditica
1 mm
1 mm
C. hermaphroditica
subsp. macrocarpa
No rosette leaves, submerged leaves ligulate, tending to be wider near base. Pollen grains more or less spherical, colourless. Fruits unique in being sessile, wing as wide as fruit. Ripe fruits when dry >1.8mm wide or long in subsp. macrocarpa and < 1.7mm wide in subsp. hermaphroditica.
Northern in Britain, south to the Severn valley. Lakes, gravel pits canals, and slow flowing segments of rivers.
Based with permission on Water Starworts Callitriche of Europe by Richard Landsdown. 2008 . BSBI Handbooks No: 11.

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THE ANCIENT SAVERNAKE FOREST AREA: PART 2

The 41 commonest tree species and some important disease interactions

Jack Oliver

Introduction

One hundred and forty-three walks were made between September 2004 and August 2005 within the ancient Savernake Forest area to ascertain the number and diversity of the trees and other larger woody plants (Oliver 2011a). The grand total surpassed 235. Fifty-seven out of the 166 tree taxa were self-reproducing. These numbers were far in excess of those outlined for the whole county in the last Wiltshire flora.

This study is a continuation of the one published in *Wiltshire Botany* 12 (Oliver 2011a), covering the same wide area from West Woods to Froxfield in the east. Apart from West Woods and the current Savernake Forest and woods around the Bedwyns, most of the area is now open. The area did not encompass the River Kennet to the north.

The findings here are in eight sections, based around the table on the following pages which summarises the data on the 41 commonest tree taxa, which dominate the area landscape at the start of the new millennium. Below is a general discussion of the results and then an introduction and six sections relating what is happening locally to our larger tree species in relation to national and international trends, focussing on the most menacing threats from pests and pathogens (disease-producing agents).

Results

The table on the next few pages gives outline sketches of the 41 most important large free-standing woody plants for the area, with brief ecological notes but a strong emphasis on self-reproducing cap-abilities. Since the River Kennet was not in the study

Part of Savernake Forest

The 41 commonest tree taxa within the core area, in order. Nov. 04 – Aug. 05.

Prevalence scores	Walks/ sites, (out of 143)	Species / Taxa	Status & Regeneration	Notes
1060 1st	136 1st	*Crataegus monogyna* Hawthorn	Native. Seedlings and saplings very common and widely dispersed.	Ubiquitous. Trees, scrub, hedgerows (much the commonest hedgerow species); farmland. All soils, all situations from dark forest woodland to sundried stonework; edges, grassland, watersides, road and tracksides; waste ground.
951 2nd	127 3rd	*Sambucus nigra* Elder	Native. Seedlings and young plants very common and widely dispersed. Many areas had plants of all ages.	Ubiquitous in all open and semishaded areas in farmland or near human activity. A few twisted or angled trees, but mostly shrubs, scrub, seedlings, or as a common component of agricultural hedging and woodland edges.
912 3rd	125 4th	*Fraxinus excelsior* Ash	Native. Swathes of densely massed seedlings, and often of densely massed saplings of all ages. Widespread dispersal.	Almost as widely distributed as the 2 preceding: hedges; edges; road, track & field sides; plantations and woods. Not competing so well with dense Oak, Beech, Lime or conifer concentrations, but rapid colonization of some areas cleared of these.
900 4th	117 5th	*Fagus sylvatica* Beech, & Copper Beech	Native. Seedlings and saplings common in woodland but seedlings never as dense or as widely dispersed as the 3 preceding. Farmland and roadside seedlings infrequent.	Ancient specimens of 6m or more in girth, but also more recent plantations. Savernake Forest has been described as an Oak & Beech Forest (Cairns 1983). Saplings common in forested areas. Also common as avenue and specimen and estate fringe trees, with fine Beech hedges frequent at property boundaries.
819 5th	113 6th	*Prunus spinosa (*incl. *P. x fruticans).* Sloe, Blackthorn (incl. Hybrid Sloe).	Native. Seedlings and young plants widely dispersed. Also extensive vigorous root suckering by both taxa.	Substantial trees occasional, more especially for the ferociously thorny *P. x fruticans.* Much commoner as scrub, thorny irregular shrubs, hedges, thickets, interrupted fringe lines, and in woodland edges.
785 6th	102 7th	*Corylus avellana* Hazel	Native. Nuts moved by rodents and corvines. Wide dispersal of seedlings and young plants.	Usually a large or very large multi-stemmed shrub, or grown as coppiced plantation specimens which were sometimes long neglected, often with huge bases. Also common as trimmed or uncut hedgerow plants. Of 1000s of plants seen, only 3 were tree-shaped; but large-girth splayed multiple trunks were very common.
686 7th	131 2nd	*Quercus robur* Pedunculate/ English Oak	Native. Apart from Hawthorn, the most widely dispersed tree, perhaps reflecting acorn-planting by jays, other corvines and squirrels.	Huge, ancient trees common but sometimes staghorned. Young and old trees both more subject to Oak Die-back Disease than the 2 other native oak taxa (*Q. petraea* & *Q. x rosacea*), but *Q, robur* acorns from

				alien sources have been used for the plantations for 60 years or longer.
661 8th	96 8th	*Acer pseudoplatanus* Sycamore	The commonest non-native tree, but thoroughly naturalized throughout much of the area. Some recent research suggests it could be native. Seedlings often abundant, also widely dispersed.	Any habitat, as trees of all ages, sometimes as densely invasive as Ash (see preceding). Woodland, hedges, roadsides, clearings, waste ground. Forestry controls in plantation areas evidenced by numerous Sycamore stumps. Re-sproutings from these, and re-branching from lower trunks after ring barkings by squirrels.
485 9th	91 9th	*Ilex aquifolium (including 2 variants and one Ilex x altaclar-ensis)* Holly	Native. Widely dispersed, but patchy dense colonizations. Young plants common, and layering of some old specimens.	Most common as rounded topiary from winter cropping by the Forest deer; but also as dense thickets, often encircling Oaks & Beeches. Most large trees are outside the current Forest woodlands, in old hedgerows. Hollies are cleared in forestry and plantation control management.
424 10th	84 10th	*Betula pendula* Silver Birch	Native. Pioneer colonizer by profuse wind-dispersal of the winged seeds.	Patchy colonies of densely massed trees of all ages, especially after plantation tree fellings. Also edges, fringes and some gardens.
299 11th	60 12th	*Betula pubescens, B. x aurata* &/or intermediates	Native. Pioneer colonizer by profuse wind-dispersal of the winged seeds.	Patchy colonies of densely massed trees of all ages, especially after plantation tree fellings. Also edges, fringes' and some plantation and track borders.
251 12th	53 13th	*Acer campestre* Field Maple	Native. Spread of winged seeds “samaras” by wind dispersal, but seedlings infrequent.	Predominantly a tree of fringes, field and tracksides, but occasionally in woodland, and sometimes used in mixed hedging.
222 13th	68 11th	*Salix caprea* (incl. *S. x reich-ardii)* Great Sallow, Goat or Pussy Willow	Native. Few seedlings seen, but juveniles and small groups with sap-lings of difference ages fairly common. Parent species graded into the hybrid on many sites.	Woodland margins, tracksides and clearings. Trees larger than the flora maxima in deeper woodland, but shrubby low-branching forms more usual. Sometimes a hedging component.
155 14th	32 =17th	*Euonymus europaeus* Spindle	Native. Widely dispersed on chalk. Young plants fairly common.	Mainly hedges, scrub and open wood. Mostly shrubby, but some substantial trees to 8 or more metres high by ancient tracks.
147 15th	28 =17th	*Sorbus aucuparia* Rowan	Native. Main dispersal of fruit and seed by birds; but see right hand column for root-sucker spread.	Mainly found in quantity in Savern-ake Forest woodland. Some trees show an undescribed feature in this species, spread by root suckers, sometimes extensive, or even turf-forming following cropping by deer and rabbits.
140 16th	25 20th	*Quercus petraea* (incl. *Q. x ros-acea*) Durmast/Sessile Oak & hybrid	Native. Young trees less widely dispersed than *Q. robur* in the survey area, but acorns probably spread by similar agents. Notwithstanding the relentless repeated	Many of the largest and most ancient trees are Durmast Oaks or hybrids, especially in the depths of the Forest. Also occur on occasion in north Bedwyn Brail and West Mud Lane, with other outliers. These Oaks are largely resistant to Oak Die-back

			swamping of the Forest with armies of 1000s of disease-prone *Q. robur* (young plantation) trees from alien sources, over 60 years or more, there are young Durmast Oaks and healthy hybrids growing well in several places.	Disease.
126 17th	24 =22nd	*Ulmus procera* English Elm	Native. Spread by root suckers. No seedling trees seen, see right hand column.	No mature trees. Field, road and tracksides; and some woodland edges. Usually conspicuous by dead 2-12m verticals indicating a previous wave of Dutch Elm Disease; so this tree species only now survives as a suckering straggling non-flowering shrub.
125 18th	23 =24th	*Picea abies* Norway Spruce	Non-native. Very occasionally self-seeded at plantation margins. Infrequent natural spread.	A common plantation tree, but sometimes also as a rooted Christmas tree replanted at perimeters and in gardens.
117 19th	28 =17th	*Pinus sylvestris* Scots Pine	Probably non-native in Wiltshire. Self-seeding patchy but sometimes extensive. See right hand column.	Plantations, woodlands and perim-eters. Occasionally seen as seedlings, saplings and trees of different ages at the margins of plantations.
109 20th	32 =14th	*Prunus avium* Wild Cherry / Gean	Native. Spread by seed (bird sown) but mainly by local root-suckerings.	Hedges, edges and woodland. Sometimes as irregular suckering strips of trees of different ages along woodland margins.
107 21st	23 24th	*Tilia x europaea / vulgaris* Common Lime, Linden	Native. Partially fertile hybrid. Some years, certain trees produce carpets of late spring seedlings which are (nearly) all eaten by voles by midsummer (Pigott 1985).	Huge tall trees with dense masses of trunk and basal burrs and stem shoots. Mainly seen as avenues, but also in forest depths.
97 22nd	24 22nd	*Salix cinerea* ssp *oleifolia* Grey Willow / Sallow	Native. Seedlings progressing to saplings in damp, open or lightly shaded areas.	Mostly as small trees or untidy spindly shrubs on poorly-drained and wet clayey sites in open glades or lightly shaded areas. Occasionally densely packed thin young trees of different ages.
94 23rd	17 29th	*Larix kaemferi* (incl. *L. x mar-schlinsii*) Japanese & Hybrid Larch	Non-native. Seedlings and saplings of different ages sometimes seen at margins, or within cleared plantations.	Usually plantations, but some estates also, usually as maturing trees.
91 24th	15 =32nd	*Pseudotsuga menziesii* Douglas Fir	Non-native. Scatters of naturally-seeded saplings of different ages sometimes seen at the margins of plantations and in some cleared	Plantation and estate trees.

			(non-chalky) sites.	
85 25th	25 =20th	*Cornus sanguinea* Dogwood	Native. Bird-sown seed, and root suckerings which can form thickets.	Usually a head-high shrub of hedges and woodland edges on chalk, but a small number of tree-size (6m+) plants with hefty trunks noted by ancient lanes (Oliver 2006).
75 26th	29 16th	*Ulmus glabra* Wych Elm	Native. Wych Elms can seed before being struck down occasionally by Dutch elm Disease. Wind dispersed seed. Some saplings seen.	Dutch Elm Disease affects this species, as with English Elm (see above). Forest and woodland depths Wych Elms less susceptible to D.E.D. than hedgerow trees, which can be easily infected from nearby stricken roadside English Elms.
70 27th	26 19th	*Larix decidua* (incl. var *polonica*) European (& Polish) Larch	Non-native. Very occasional seedlings progressing to saplings seen.	Most often seen as mature trees on the perimeters of estates, or roadsides. Older plantation trees also common.
60 28th	20 =26th	*Taxus baccata* Yew (incl. Golden & Columnar cultivars)	Native. Wide dispersal of seeds, with isolated bird-sown young trees.	Churchyards, where the cultivars are seen. Wild plants of different ages in groups of 1-5. Widely distributed, usually in woodland depths. Also used in hedging.
57 =29th	20 =26th	*Aesculus hippocastanum* Horse -chestnut / Conker	Semi-naturalized in Wiltshire with conkers occasionally dispersed by corvines, boys and grey squirrels. Seedlings and saplings mainly near avenues or human habitation.	Usually originally planted for ornament, but some trees in woodlands and waysides. Blights in 2009 and 2010 - see the special Horse-chestnut section in the text.
57 =29th	11 36th	*Thuja plicata* Western Red-cedar	Non-native, but seedlings progressing to saplings occur. Some naturally originating young trees seen.	Sometimes a constituent of mixed plantations (as in parts of West Woods); and in big gardens and estates. Also used in hedging.
57 =29th	20 =26th	*Acer platanoides* Norway Maple	Non-native, but naturalizing in Wiltshire in recent years. Seedlings, saplings and trees of different ages. See right hand column.	Single roadside trees, or a constituent of some mixed plantations: and some parts of Savernake Forest showing vigorous natural regeneration, where sometimes massed saplings.
43 =32nd	17 =29th	*Castanea Sativa* Sweet/Spanish Chestnut	Non-native. Signalled as <u>not</u> regenerating naturally in the recent Wilts Flora (Gillam 1993): but erratic patchy regeneration apparent over the last 15 years. See right hand column.	Great trees (girths at 1.5m of 5-6m+; coppice base circumferences of 9-10m+) are common in the Forest depths, with even larger ones at Brimslade Park. Seedlings progress to saplings near some (5%) of parent trees, not necessarily the largest.
43 =32nd	6 41st	*Tsuga heterophylla* Western Hemlock-spruce	Non-native. Dense regeneration occasional. Can need control in forestry areas. Some epiphytic seedlings seen.	Few sites noted, all in forestry plantation areas. In 3 of these, there was vigorous natural seeding progressing to saplings.
42 34th	15 =32nd	*Chamaecyparis lawsoniana*	Non-native. Hardly mentioned in the 1993	3 distinct categories. (1) Mixed forestry plantations, where natural

		Lawson's Cypress	Wilts Flora, but Stace's (1997) Flora says "…commonly self-sown". Seedlings progressing to saplings occasionally seen.	seeding sometimes progressed to saplings. (2) Property perimeters and short shelter belts where blue, golden and juvenile-foliaged cultivars were common, but seedlings less so. (3) Hedging.
40 =35th	16 31st	*Malus domestica* Apple	Semi-naturalized with self-sown plants as small linear concentrations where pips from voided apple cores had germinated alongside roads and disused old railway cuttings.	Scattered distribution, gardens and waysides.
40 =35th	15 =32nd	*Malus sylvestris* Crab Apple	Native. Patchy, scattered regeneration. Dispersal by badgers in Savernake Forest.	Woodland fringes, and less dense areas (away from Beeches and conifers); and ancient lanes. The Savernake trees densely covered in thorns, with tiny pea to cherry-sized fruits.
38 37th	15 =32nd	*Carpinus betulus* Hornbeam	Native, but also much introduced in Wiltshire. Vigorous seeding in recent years.	3 distinct categories: (1) Single trees. (2) Hedging. (3) Mixed forestry plantations, where natural regeneration was often vigorous.
36 38th	8 =39th	*Prunus laurocerasus* Cherry Laurel	Seedlings occasional. Main spread by vigorous layering.	Woods, shrubberies and pheasant cover. Within these dense jungles 3-10m high, occasional upright trees could sometimes be found with trunks over 1m in girth (at 1.5m).
30 39th	10 =37th	*x Cupresso-cyparis leylandii* Leyland Cypress	Arose originally at 4 separate sites in the British Isles by natural crosses between the Nootka Cypress (now Xanthocyparis) and the Monterey Cypress (Cupressus macrocarpa) Seeding propensities not yet known.	Only 2 (roadside) clumps of impressively large trees; at all the other sites only as vigorous hedging which included the golden forms 'Castlewellan' and 'Robinson's Gold'.
27 40th	10 =37th	*Quercus rubra/borealis* American Red Oak	Non-native. Often self-sowing, on sandy soils especially (Stace 1997). Little evidence to date of numerous acorns or self-seeding in Savernake Forest.	Scattered in various parts of Savernake Forest woodland as past plantings. Trees of similar ages.
24 41st	8 =39th	*Populus tremula* Aspen	Native. Can form suckering thickets.	Mostly seen as a plantation margin trees in damp areas.

area, no Alders or waterside Willows or Sallows appear, although two *Salix* species are represented. Ivy *(Hedera helix)* came 9th in the original 2011 study, but is not included in this table. I have been studying Ivy since, and now think it deserves a higher placement. Scoring in the table is the same as in the first paper, relating to overall commonness (left hand column) and number of sites (walks) on which the tree species was noted (second column).

What the table shows

Ecology textbooks and floras emphasise Birches as the colonizing trees par excellence (Grime et al 1988), but in this part of Wiltshire Ash, Elder, Hawthorn, Hazel and Sycamore seedlings are all more successful in a variety of habitats. I've seen birches in quantity only as young saplings in cleared, and even those become outstripped by Ash,

Sycamore (despite controls) and even Norway Maple.

Finally, ubiquity may match commonness (eg Hawthorn, No. 1 on both), or not (eg English Oak, 2nd and 7th). Likewise size and conspicuousness could have influenced the ordering. Oak and Beech saplings and seedlings are obvious. Dogwood (25th) suckers and seedlings are much less so!

Any of the first 20 tree species in the table would have a good chance of being seen on a walk in the area. It would be unusual not to see a Hawthorn! The English (Pedunculate) Oaks comes second for widespread occurrence, but often as a single tree and well behind Elder, Ash, Beech, Blackthorn (Sloe) and Hazel for quantity.

The table contains 14 strictly non-native trees, although several of these have been well naturalized for centuries. Aside from forestry plantations, Norway Maple may be the most recent generally widely seeding naturalized immigrant.

Trees and pathogens

The six sections below relate what is happening locally to our larger tree species in relation to national and international trends, focussing on the most menacing threats from pests and pathogens. The commonest British broadleaved trees are attacked by over 180 different species of insect pest; common conifers suffer 150+; tree seedlings and saplings a further 25+. Six of the 24 insect orders are involved (see Bevan 1987). Other invertebrates, fungi, bacteria and viruses are even more varied and cause more tree deaths.

Five of the 6 subheaded outlines concern serious threats of damage to the future of one or several species of tree, including Elms decimated by Dutch Elm Disease, various afflictions of Horse-chestnuts, attacks on various tree species by species of *Phytopthora*, and destruction of Larches by Sudden Oak Death and of Oaks by Oak Die-back Disease. The final section provides an optimistic contrast, detailing the greater resistance found in Beech and Ash, with Ash in particular overcoming threats by its great genetic variability and profuse seeding.

Selection is made from some large tree species which have succumbed, some highly successfully resistant, and some for which the disease processes are patchy, uncertain or largely unexplained. The contrast is made between English Elm (one clone, seldom seeding) and Ash which has great genetic variability and seeds profusely. The more that tree diseases are studied, the more webs of interacting and enhancing separate adversities are uncovered, often producing an effect greater than their separate contributions. As well as climatic, soil type and silvicultural restraints, there are numerous other influences both from other living things (biotic) and other sources (abiotic).

Dutch Elm Disease (DED)

DED (Bean 1989, Brasier 1998, Gibbs et al 1994) involves three fungi, *Ophiostoma* (previously *Ceratocystis*) *ulmi, O. novo-ulmi* and *O. himal-ulmi*. There are two beetle vectors, *Scolytus scolytus* and *S. multistriatus*. Humans have brought together pathogenic strains from three continents, and also inadvertently spread the beetles. The English Elm (17th on the table) is a single clone seldom producing seedlings, and therefore highly vulnerable to wholesale elimination of the mature trees. This can be summarised as four main causations (fungi, beetles, genetic vulnerability and human trafficking), involving two insect pest species and three pathogenic fungi.

Within the fungal cytoplasm there may lurk any one or more of at least 13 or more strains of mycovirus known as D-factors which exert varying degrees of natural biological control over the fungal pathogen (Sutherland & Brasier 1997). There is also another fungus (*Phomopsis oblonga*) a secondary invader which discourages the Scolytus beetle by inhibiting its feeding and breeding (Gibbs et al 1994).

In the study area, all fully-grown English Elms have succumbed, although there survives one huge healthy tree, girth 445cm (15ft), height over 30m, spread 29m at Beckhampton. Nevertheless the species persists as extensive lines and patches of root-suckers 1-12m high, up to 60m from the original parent tree (compare Greig 1988). Apart from the Beckhampton tree just to the NW of the study area, none of the suckers reach the flowering/fruiting stage before succumbing to a new wave of DED.

Wych Elms (26th on the table) are also highly vulnerable to DED, the roadside and fieldside trees more so than the occasional trees in wooded areas. No really big specimens were noted, but a small proportion achieves flowering and fruiting despite waves of DED.

Horse-chestnut Blights 2008-2011

Horse-chestnut appears as 29th on the table, but had been slowly increasing in numbers within the study area by conker seedlings – until 2008. Six conditions commonly afflict the *Aesculus* genus locally (Oliver 2011b) but three of these became very serious in

2009, 2010 and 2011. In order of importance, these conditions are as follow:-

1. Bacterial Bleeding Canker (Mabbett 2009)
2. Horse-chestnut Leaf Miner Moth (Tilbury & Evans 2003; Mabbett 2009; Pocock et al 2011)
3. Phytophthora Bleeding Cankers and Trunk Rots (Forestry Commission 2010a & b;Mabbett 2009; Mackinlay & McIntosh 2010)

These are described more fully below.

1) Bacterial Bleeding (Trunk) Cankers are caused by a rod-shaped bacterium, *Pseudomonas syringae pv aesculi*, new to Europe from Asia. Waterlogging, timber cracks, mechanical or frost damage and close planting all contribute to the spread of the disease.
2) Horse-chestnut Leaf Miner Disease is caused by the moth *Cameraria ohridella*, first reported from Macedonia in 1985. It is one of the most conspicuous of tree diseases, causing mid-summer browning of the leaves, as shown in Figure 1 (Oliver 2011b). Drought and long or short distance transport of the leaves by lorries originally contributed to the spread of the blight, but once established the moths need no help – especially where Horse-chestnuts are in lines, clumps or avenues. *C. ohridella* has 15 or so natural enemies, mainly parasitic wasps, but so far these account for only 1-6% of the moth larvae and pupae. A full account, with excellent illustrations of the parasitoids is provide by Pocock et al (2011).
3) *Phytophthora cactorum* and *P. citricola*, like *Pseudomonas*, cause bleeding trunk cankers and trunk rots. However other *Phytophthora* species also can weaken the trees via the roots (see *Phytophthora* section).

There are probably important interactions between these 3 conditions. Number 2 severely weakens the trees by halving the photosynthetic period. Within the study area, occasional bark-stripping of Horse-chestnuts by grey squirrels (see Oliver 2009) allows ingress of pathogens in conditions 1 and 3. Again human trafficking has introduced and mixed in together pathogens made more dangerous by close plantings of one tree species. Drought and flooding influence all three conditions. Fortunately the genetic diversity of *A. hippocastanum* (and *A. carnea* and *A. indica*) means that they may survive the blights. I have seen local trees badly afflicted by number 2 and almost ring barked by numbers 1 or 3 make good recoveries: but some others were killed. Fig 3 shows bark healing on a Horse-chestnut following Bleeding Canker affecting four fifths of the circumference, almost ringbarking the tree at 1.5m in 2009. In 2008, this tree suffered some squirrel-stripping at higher levels. It was also subject to severe Cameraria (Leaf Miner) infestations in 2009 and 2010. Apart from one dead limb, the tree appears to be thriving despite these three conditions.

Fig. 1: Horse-chestnut leaves attacked by leaf miners

Fig. 2: Horse-chestnut bark healing from Bleeding Canker (Photo Jack Oliver)

Phytophthora

This fungus-like pathogen, in one of the most profound taxonomic changes, has recently been taken out of the fungal kingdom and transferred to the new kingdom of *Chromeoalveolata* (previously *Chromista*). Its chemistry is much closer to that of the algae; the old A-level botany syllabus needs revision!

There are more than 50 *Phytophthora* species, and many further strains and new hybrids, some of immense economic importance. *P. infestans* was responsible for the failure of the potato crop in Ireland in 1845 causing the great famine and subsequent mass emigrations. There are currently fears concerning the mass deaths of trees attributable to new virulent *Phytophthora* epidemics, worsened by unrestricted imports of timber from the EU and other countries. Some of the titles of articles, reports and editorials illustrate the anxieties for the future

(Editorials, Forestry Journal 2010b; 2011a, b; Locher 2010; Mabbett 2010, 2011a).

The scientists are hardly keeping up with the new fast-moving epidemics, but *Phytophthora* has long been known to afflict a wide range of trees and shrubs. It seems necessary to try to differentiate occasional pathogenicity triggered by other (often complex) factors from epidemics of sudden unexpected onset, and then to relate these considerations to the study area. More than 30 years ago, the three main *Phytophthora* diseases (Phytophthora Root/Foot rot, Bleeding Canker, and Beech Seedling Blight) were known to have the capacity to seriously damage or kill woody species of 11 tree and 9 shrub genera (Strouts 1981). More recently, I have collated from publications in 2010 and 2011 the following count of vulnerable woody plants in Britain (Oliver 2011b):-

- Broadleaved trees 14 genera 17+ species
- Broadleaved shrubs 11 genera 15+ species
- Conifers 4 genera 4+ species
- Woody climbers 1 genus 1 species

Individual and wholesale deaths blamed on virulent strains of Honey Fungus are usually caused by *Phytophthora*, with the Honey Fungus as a mere secondary invader (Strouts 1989).

Phytophthora cactorum and *P. citricola* have been known for decades (see Horse-chestnut subheading). The highly virulent *P. lateralis* (Editorial Forestry Journal 2011b) is thought to be a threat to Yew (also vulnerable to new strains of *P. ramorum*) and Lawson's Cypress (28th and 34th respectively on the table). However most alarm is created by *P. ramorum* (identified first in 2001) and *P. kernowii* (identified in 2004, Kernow=Cornwall). Warnings about these two organisms "...introduced to the UK from as yet unknown ecosystems" and their main host *Rhododendron ponticum* have been given by the National Trust (Wright 2011). Pain (2005) reviewed the threat, mentioning four severely affected major shrub and eight tree genera (*Camellia, Rhododendron, Vaccinium, Viburnum; Aesculus, Alnus, Castanea, Fagus, Fraxinus, Nothofagus* and *Quercus*). Pain emphasised the increased virulence following transcontinental shipments of infected plant material, spread between nurseries, and hybridization between introduced *Phytophthora* strains and species. Further information on *P. ramorum* and *P. kernoviae* is given in the Forestry Commission printouts (2010 a & b), and there is an excellent review on *Phytophthora* in general and *P. ramorum* in particular by Mabbett (2011b) derived largely from work by Webber et al (2010). *Betula, Pseudotsuga* and *Tsuga* were three further tree genera identified as vulnerable to *P. ramorum.*

Based on preceding publications, potentially vulnerable species shown on the table include Nos (left hand column) 3,4,7,8,10,(?11),13,14, 21, 23, 27,28,=29 (all 3), =32 (both) and 40. It is difficult to know which of these tree species might be most at risk, but from this seemingly gloomy catalogue, our local Ash, Beech, Sycamore, Birch, Goat Willow, Common (Hybrid) Lime, Yew and Norway Maple representatives in particular, have such large, diverse, healthy reproducing populations that it is hard to envisage them succumbing. At the time of writing, nearly all are in good health and reproductive vigour, excepting the *Aesculus, Qercus* and *Ulmus* genera.

Larch and other conifers

The four taxa shown for Nos 23 and 27 on the table are *Larix decidua, L. decidua* var. *polonica, L. kaemferi* (Japanese Larch) and *L. x marschlinsii* (Dunkeld Larch, the previously highly successful hybrid between Japanese and European, much used in Forestry). Seedlings occur locally, but are infrequent and never dispersed beyond the immediate vicinity of the parent trees.

Phytophthora ramosa plague was first known as "Sudden Oak Death" because of its devastation of North American Tan Oaks (*Lithocarpus densiflora*). This disease name is inappropriate in the British Isles because larches have so far been the main target (Editorials, Forestry Journal 2010a,b, 2011a; Locher 2010; Mabbett 2010, 2011b; Webber et al 2010). By the end of 2010 there were over 100 severely afflicted Japanese larch plantation sites in Wales, Scotland, Northern Ireland, Eire and England – but not yet in Wiltshire (April 2011).

Mabbett (2011b) raises "The appalling possibility of many other conifer species being struck down by spread of P. ramorum from Japanese Larch to other conifers "on a large scale". Apart from the presumed vulnerability of Dunkeld and European Larch, conifers so far known to be infected by the *P. ramorum* inoculums from adjacent infected Japanese Larches include Noble Fir (*Abies procera*), Douglas Fir (No 24), Western Hemlock-spruce (=32) and Yew (28). "Infection of Japanese Larch is the first instance of widespread and terminal damage caused to a conifer, and the very first to a commercial plantation by *P. ramorum*." (Mabbett 2011b).

Oaks

Four Oak taxa are represented on the table, Nos 7, 16 (including hybrid) and 40. As under the last section "Sudden Oak Death" from the Pacific Northwest (*Phytophthora ramorum*) strikes down Larch, not

Oak in the UK, although there have been some examples of *Quercus* infections by *P. ramorum* in England (Pain 2005) and Scotland (Mackinlay and McIntosh 2010). Three of those possibly potentially vulnerable species, Turkey, Holm and Durmast Oak (*Q. cerris, Q. ilex* and *Q. petraea* (No 16)) occur in this study area, the first two in very small numbers.
Oak Die-back disease (ODBD, also known as "Oak Decline") mainly afflicts English Oak (No 7), but Durmast Oak and its hybrid (both No 16) much less often within the Savernake area. Waves of public concern tend to be over this "disease", which is more likely a symptom of a complex of a variety of infections and adversities. A parallel in human medicine would be the inadequate diagnoses made on ill soldiers in the Crimean war, such as "Anaemia" or "Diarrhoea".

The staff at Westonbirt Arboretum raised headline public concern in response to the 1990s waves of virulent ODBD leading to the drawn-out deaths of Gloucestershire's and Wiltshire's oaks, or their stunted survival as "Staghorn Oaks". They recommended pollarding as the treatment for cherished veterans (Standard Times 1992; Marlborough Times 1992). Research studies then suggested a cocktail of causations, with hints that root *Phytophthora* species could be very important – but no confirmation (Gibbs & Greig 1997). A subsequent Forestry Commission alert on Sudden Oak Death (2006) said that if British oaks were to become subject to trunk infections from the Californian *Phytophthora ramorum*, sap ooze, trunk bleeding cankers or tarry spots would appear. By contrast Oak Decline (ODBD) could be caused by recurrent droughts, root disease fungi (especially *Collybia*), severe invertebrate infestation and root-infecting (rather that trunk or foliage infecting) *Phytophthora* species.

Within the study area in the year 2000, Lord Cardigan asked us to look at Staghorn Oaks (all *Q. Robur*, 150-300 years old) which were continuing to die back, with patches of discoloured foliage. Dr David Rose of the Alice Holt Research Station confirmed ODBD, with a variety of contributory weakening causations. These included Oak leaf mildews and altered weather and water table patterns, and possible invertebrate depredations and new pathogenic strains of *Phytophthora*. There were no confirmations of any primary pathogens from twig and leaf samples. Dr Rose also said that many of the close-grown young *Q. robur* plantation saplings and trees within Savernake forest were unhealthy, very probably with the same condition ("Oak Decline" in young oaks can be caused by comparable factors as those caused by ODBD). Root *Phytophthoras* could be secondary debilitating aggravants or weakeners as well as primary pathogens.

A recent BSBI Oak referee, Dr Allen Coombes commented on the exceptional genetic diversity between and within the 3 main native oak taxa in Savernake Forest, but not in the newer oak plantations (see table Nos 7 & 16). This same diversity is apparent in the field-side open-grown English Oaks north of West Woods, which I have observed for 40 years. In some, for instance, the unrestricted canopy is three times as high as wide: for others it is one third as high as wide. This genetic diversity may explain why some trees are unaffected by ODBD, others succumb and others become partly staghorn but recover subsequently.

Fig 3 on the next page illustrates three themes from this study. The Staghorn Oak took 15 years to die. It never suffered severe invertebrate infestations, but was subject to Oak Mildew. The ivied diagonal is an English Elm killed by Dutch Elm Disease. The main ivy colonization occurred after the debilitation and deaths of both trees. Indistinctly shown in the photo are foreground young Ash, Sycamore, and Norway maple with new Hawthorn, Holly and Hazel behind (Nos 3, 8, 29, 1, 9 and 6 respectively). Fig. 4 shows an English Oak fully recovered from ODBD about 25 years previously, the ivy colonizing rapidly when the tree was debilitated, but the tree now with a complete canopy.

Ivy is an important weakener of local trees (shading and wind throw). Contrary to some accepted dogmas, it finishes off oaks weakened by ODBD. A local tree surgeon said he'd hardly ever seen a wind thrown oak which was not heavily ivied. Neither have I. The spread of Ivy in recent centuries may be one factor in the near extinction of tall, straight-trunk veteran oaks (Oliver & Davies 2009).

Beech and Ash

Beech Bark Disease (BBD) is caused by a tiny scale insect, *Cryptococcus fagisuga* which predisposes the tree to invasion by the ascomycete fungus *Nectria coccinea* (Lonsdale &Wainhouse 1987). Drought, nutrient imbalance and root disease contribute tovulnerability. Some crustose lichen species and the fungus *Aschodichaena rugosa* seriously inhibit invasion and colonization by the scale insect. Some Beeches have a relatively strong genetic resistance to *Nectria*. Site factors, soil chemistry, varying silvicultural practices, temperature extremes and other climatic variations all influence susceptibility to BBD and its progression. There are also predatory invertebrates which attack the scale insects, and more fungi parasitic upon or antagonistic towards the *Nectria*. This is an example of at least 9 biotic and 5 abiotic factors influencing the balance between a common disease and a common tree. Within the

Fig 3. Oak affected by Oak Die-back Disease and Elm affected by Dutch Elm Disease (Photo Jack Oliver)

Fig 4. English Oak recovered from Oak Die-back Disease (Photo Jack Oliver)

study area, the Beeches were generally free from BBD or other serious disease. The possibility of Beech falling victim to the new waves of *Phytophthora ramorum* and/or *P. kernowii* seems unlikely at the time of writing. However many veterans from fashionable plantings 150-250 years ago are senescent, with saprophytic fungi as they die. Self-seeding may not be quite so reliable as in most of the other top 12 on the table, but should be sufficient to keep Beeches amongst the front-runners in future. In addition there is plenty of genetic variety (Oliver 2000). Many forestry Beeches are close grown and trimmed for long straight trunks, but came from European mountain stock with a natural tendency towards this snow-shedding design. There are all degrees of anthocyanin ("copper") leaf pigmentation in Beeches in parts of Savernake Forest and elsewhere. Even the seedlings can show 3 main colour cotyledon variants; coppery, glaucous or grass green (compare Oliver 1996).

Within the study area, Ash is the most successful of any of the largest tree species. At the time of writing, I can hardly recall an unhealthy tree in the study area, most local Ashes with remarkable growth rates (compare Oliver 1998). Ash Die-back Disease (Hull & Gibbs 1991) has may parallels with Oak DBD, but we have not been seeing sick or stag-horned Ashes. I have twice been stopped by Irish lorry drivers from different companies, asking for local Ash timber, seeds, seedlings and saplings from within the study area. Genetic variety is considerable, obviously seen in trees with varying numbers of leaflets per mature leaf (7-9 to 13-15), softness versus leatheriness of leaves, and chaotically variable flowering patterns (♂ (male) or ♀ (female) or H (=hermaphrodite), or ♂ +♀, or ♀+ H, or ♂+H, or all three, per tree or per branch or changing with age of tree).

The successful establishment of these Ash trees may be categorized as follows:-

1. Seedlings seen at many varied sites, often well away from parent tree(s).
2. Massed healthy seedlings.
3. Pioneer colonizations overtaking massed *Betula* (Birch) or *Salix* (Sallow) saplings.
4. Seedlings progressing to saplings closely around the bases of other trees (including conifers) to eventually overtake the previously established trees.
5. Ash saplings sometimes treated as invasive weeds, and controlled to give other tree species a better chance.

Concluding Summary

The 41 commonest tree species are tabulated according to their prevalence and occurrence or not at 143 sites. This pattern for 2004 and 2005 is there for comparison with any future trends. One tree genus *Ulmus* (Elms) has been decimated by disease, but hangs on. The *Aesculus* genus (Horse-chestnuts) has been seriously affected by two conspicuous conditions from 2008 onwards.

Waves of new pathogenic species, new hybrids and new strains of *Phytophthora* from three continents could have the potential for changing the scenery again. The *Larix* genus (Larches) could soon be subject to decimation. Half of the other tabulated species and their hybrids are also known to have degrees of susceptibility to the new *Phytophthoras*, but most have considerable genetic variability.

Waves of public concern over other cherished trees, notably the genus *Quercus* (Oaks) could relate to new root *Phytophthoras*, but so far Oak Dieback Disease in the area has been patchy and un-predictable.

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VASCULAR PLANTS IN WILTSHIRE IN 2010

Activities and highlights

Sharon Pilkington
BSBI Recorder for VC7 and VC8

Ivy Broomrape

New and interesting records

Approximately half of the new finds in North Wiltshire this year were the result of one man's quest for botanical excellence. Jack Oliver has been assiduously recording the area around Marlborough for many years but amazingly he still manages to find new things. Unlike many other botanists he is not daunted by hybrids and this year has found two hybrid docks *Rumex x dufftii* and *R. x sagorskii*. Given that the parents of these hybrid docks (Wood Dock *R sanguineus*, Curled Dock *R. crispus* and Broad-leaved Dock *R. obtusifolius*) are widespread in Wiltshire it is likely that the hybrids occur elsewhere. Perhaps another brave local botanist would like to follow Jack's lead?

Rob Large found Ivy Broomrape *Orobanche hederae* flourishing outside the old rectory in Bemerton. This species - mostly native to rocky coastal cliffs and grassland - was historically planted in large gardens and this is the most plausible explanation for it there. On the other side of the county Tim Kaye was most excited to find Flixweed *Descurainia sophia* in a field corner in Bishopstone, the first record in North Wiltshire. This was just one of many exciting arable weeds he found during survey work in the area (more below).

It is sometimes said that plant distribution patterns tend to reflect the location of field botanists rather than the plants themselves. Thus it is that I found two plants new to VC8 in Westbury, my new home town. Green Bristle-grass *Setaria viridis* growing in pavement cracks in the town centre was almost certainly a bird-seed alien, whilst Common Ramping-fumitory *Fumaria muralis* ssp. *muralis* was flourishing as a weed in a garden border. Wiltshire Botanical Society member Rosemary Duckett, who lives in the same part of town, has also reported this fumitory in her garden so it seems plausible as a legitimate inhabitant.

Wiltshire has the only known British chalk grassland site for Marsh Helleborine *Epipactis palustris*. This showy orchid has been known from dry grassland in a disused chalk quarry for many years but it appears to be on the move. A visit to Morgan's Hill SSSI in June by the Wiltshire Botanical Society found possibly hundreds of leaf rosettes of the species. Not only that, Rob Large and S. Payne found 15 flowering plants in early successional set-aside among MGI grassland and ash saplings when they visited the farm just downslope of the quarry later in the summer. Clearly, the population is thriving. See the Editorial for a photo.

Arable plant recording

Wiltshire is a known hot-spot for declining arable weeds and quite a bit of effort has been made by the Wiltshire Botanical Society, FWAG and others to record on a number of farms in the county. The north has been a little neglected, probably because large tracts lack the thin chalky soils that so many of our rare species seem to like. Tim Kaye managed to obtain funding for surveys in the North Wessex Downs AONB and co-ordinated volunteer surveys during the summer. One or two of the farms yielded some excellent records including Night-flowering Catchfly *Silene noctiflora*, Rye Brome *Bromus secalinus*, Corn Knotgrass *Polygonum rurivagum*, Venus's Looking-glass *Legousia hybrida* and Grey Field-speedwell *Veronica polita*. In my opinion the most exciting find of all was two fully flowering plants of Cornflower *Centaurea cyanus* in an unpromising-looking organic turnip field at Bishopstone. Many other rarities were also present in this field and the Cornflower seems likely to be genuinely native there - a rare thing these days. Unfortunately the farmer let pigs into the field before Tim could tell her about the Cornflowers but we hope some plants will grow from the seed-bank in 2011.

The summer of 2010 was also good for arable weed recording in a general sense. Having seen all four of our native poppies flowering together for the first time in arable field margins in two different places (a Stone-curlew plot on Salisbury Plain and at Martin Down NNR) it is tempting to think that the tide may be turning at last for some of our scarce arable flowers.

New datasets

2010 was a superb year for data flow. As some people know, I hold records in a MapMate database which enables efficient data entry and records exchange. Every year I send data to various places including the W&SBRC, BSBI, Defence Estates, the Cotswold Water Park Society and neighbouring BSBI county recorders. In turn, all of this data ends up in places like the NBN Gateway in a publicly accessible format. I strongly believe that biological records are only useful if they are shared and thus encourage submission of reliable records. In Wiltshire I am very fortunate to work closely with a small but knowledgeable and enthusiastic group of amateur botanists who are willing to collect records and send them to me. In addition, last year the late Geoff Goatley of the Westonbirt Wildflower Group sent me more than 600 records collected on the Wiltshire side of the arboretum, including information about the rare Spreading Bellflower *Campanula patula*. Tim Kaye submitted hundreds of records from road verge surveys and Richard Aisbitt sent more than 1500 records from Clouts Wood and Markham Banks alone. There are numerous other botanists who send me occasional records and I am very grateful for their time and enthusiasm.

Green Bristle-grass

Green Bristle-grass close-ups
(Photos Sharon Pilkington)

Wiltshire Botany 13, 2012, pages 35-37

PLANT RECORDS 2010

Knotted Bur-parsley *(Torilis nodosa)*

Explanatory notes

- The following is a selection from WBS records received in 2010. For each species, initials of recorders and names of towns, villages and sites are not repeated. Assume it's the same one until a new one appears.
- Only those new to their 10 km square in the 2010 year are included. This is relative to the period since the flora mapping in the 1980s and 1990s for the 1993 Wiltshire Flora and recorded there.
- Where a record is also a 1st county or vice-county record, an unqualified statement means that it is the first record ever, as far as is known. Where the word "recent" is inserted, it means that it is the first since the flora mapping began, but had been recorded before this period.
- Where a recording square is only partly in Wiltshire, any comment on record status applies only to the part within Wiltshire.

Recorders

ABr - Andrew Branson
BL - Barbara Last
DP - David Pickering
HS - Helen Senior
JBr - Jane Brown
JCl - J Claridge
JEO - Jack Oliver
JFo - Jenny Ford
JN - Joy Newton
JP - John Presland
JRM - John Moon
LBe - Leif Bersweden
PQ - Phil Quinn
PSk - Paul Skelton
RAi - Richard Aisbitt
RL - Rob Large
SFi – Sue Fitzpatrick
SG - Sarah Grinsted
SPi - Sharon Pilkington
TKa - Tim Kaye
VH - Val Hopkinson
WBS - Wiltshire Botanical Society (excursion)

SPTA - Salisbury Plain Training Area

Vc 7

***Alchemilla mollis;* Garden Lady's-mantle;** SPi; Christian Malford; one self-sown in churchyard.
***Angelica archangelica;* Garden Angelica;** TKa; Blundsdon; Stanton Park; 1st county record.
***Anthriscus caucalis;* Bur Chervil;** PQ; Haydon Wick; one in school playground; 1st recent vice-county record.
***Aubrieta deltoidea;* Aubretia;** JP; Winsley; self-seeded on mortared wall.

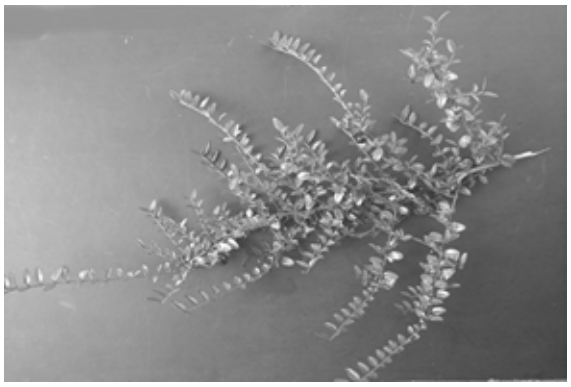
Berberis thunbergii; **Thunberg's Barberry;** JEO; Lockeridge Dene; birdsown shrublet; 1st county record.
Bromus secalinus; **Rye Brome;** SPi/ TKa; Uffcott; a few at arable field edge.
Carex divulsa* ssp. *divulsa; **Grey Sedge;** JEO; Chaddington; Morningside road verge.
Centaurea cyanus; **Cornflower;** WBS; Bishopstone; two in turnip field, probably native.
Deschampsia cespitosa ssp. cespitosa; **Tufted Hair-grass;** ABr/SPi/TKa; Chittoe; Spye Park Estate.
Descurainia sophia; **Flixweed;** TKa; Bishopstone; field corner; 1st recent vice-county record.
Echinochloa crus-galli; **Cockspur;** RAi; Upper Minety; several at Sandpool Farm.
Epilobium ciliatum x obscurum; America x Short-fruited Willowherb; JEO; Marlborough.
Hyacinthoides hispanica; **Spanish Bluebell;** JP; Winsley; 2 on protected verge, ?garden throwout.
Impatiens glandulifera; **Indian Balsam;** JEO; Highworth; roadside.
Kerria japonica; **Kerria;** JP; Winsley; protected verge, ?garden throwout.
Lathyrus latifolius; **Broad-leaved Everlasting-pea;** JEO; Chippenham to Wootton Bassett; M4 embankments; Marlborough; by A345.
Lathyrus nissolia; **Grass Vetchling;** JCl; Lockeridge.
Leucanthemum x superbum (may be *lacustre x maximum* or just *lacustre* itself)*;* **Shasta Daisy;** TKa; Ford to Giddenhall; A420 verge.
Lonicera nitida; **Wilson's Honeysuckle;** JEO; Marlborough.
Medicago arabica; **Spotted Medick;** HS; Broad Hinton; Barbury Castle.
Myosotis sylvatica; **Wood Forget-me-not;** JP; Winsley; protected verge, presumed garden escape or throwout.
Oenanthe crocata; **Hemlock Water-dropwort;** SPi; Luckington.
Oenothera glazioviana; **Large-flowered Evening-primrose;** TKa; Ford to Giddenhall; A420 verge.
Persicaria bistorta; **Common Bistort;** SPi; Shersston; several clumps on a moderately species-rich damp road verge.
Rosa rugosa; **Japanese Rose;** TKa; Ford to Giddenhall; A420 verge.
Rumex x dufftii (obtusifolius x sanguineus); **Broad-leaved x Wood Dock;** JEO; Marlborough; 1st recent county record.
***Rumex x sagorskii* (*crispus x sanguineus*); Curled x Broad-leaved Dock;** JEO; Marlborough; east of Marlborough; Savernake Forest; 1st county record.
Salix alba* ssp. *caerulea; **Cricket-bat Willow;** WBS; Coate Water; 1st vice-county record.
***Salix x reichardtii* (*caprea x cinerea*); Goat x Grey willow;** JEO; Chaddington; Morningside road verge.
Salix x rubens; (alba x fragili); **Hybrid Crack-willow;** WBS; Swindon; Coate Water.
Sanguisorba minor ssp. muricata; **Fodder Burnet;** DP; Cherhill; track, field side; 1st vice-county record.
Sparganium erectum; **Branched Bur-reed;** RAi; Wroughton; Clouts Wood, mud of cress bed; patch in boggy field.
Symphytum tuberosum; **Tuberous Comfrey;** SPi; Christian Malford; naturalised and spreading.
Torilis nodosa; **Knotted Hedge-parsley;** WBS; Bradford-on-Avon; one on canal bank.
Valerianella carinata; **Keeled-fruited Cornsalad;** SPi; Luckington; a few on wall face.
Vicia sativa ssp. sativa; **Common Vetch;** SPi; Luckington.

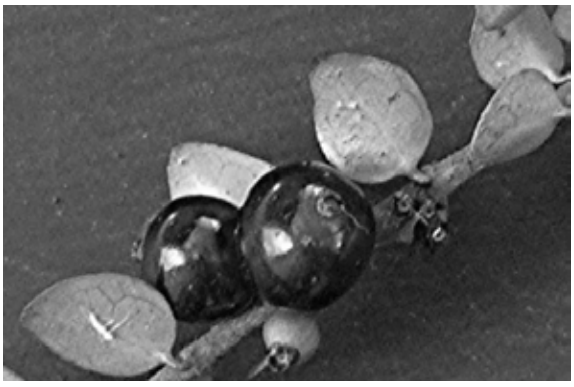
Vc 8

Agrostis gigantea; **Black Bent;** SPi; Martin; Martin Down NNR.
Allium oleraceum; **Field Garlic;** BL; Berwick St John; garden weed.
Allium triquetrum; **Three-cornered Garlic;** BL; Charlton; road verge.
Allium vineale* var. *compactum; SPi; Westbury.
Alopecurus myosuroides; **Black-grass;** SPi; Martin; Toyd Down.
Anagallis arvensis* ssp. *arvensis; **Scarlet Pimpernel;** SPi; Martin; Martin Down NNR.
Anchusa ochroleuca; **Yellow Alkanet;** SPi; Tilshead; several in disturbed ground by roadside; 1st county record;
Anisantha diandra; **Great Brome;** SPi; Westbury; several at arable field edge.
Avena sativa; **Oat;** SPi; Westbury; Martin; Toyd Down.
Brachypodium pinnatum agg; **Tor-grass;** SPi; Martin; Martin Down NNR.
Bromus hordeaceus* ssp. *hordeaceus; **Common Soft-brome;** SPi; Westbury.
Carex humilis; **Dwarf Sedge;** SPi et al; Market Lavington; SPTA, good patch in really rich CG3; JFo/SG/SPi; Between Market Lavington and Larkhill; SPTA Central Impact Area, good patch in really nice CG2.
Carex panicea; **Carnation Sedge;** LBe; West Winterslow.
Carex spicata; **Spiked Sedge;** SPi; Martin; Martin Down NNR.
Ceterach officinarum (now ***Asplenium ceterach);*** **Rustyback;** PSk; Chitterne; dozens on Box trees.
Cuscuta epithymum; **Dodder;** PSk; Bratton; small colony on downland.
Datura stramonium; **Thorn-apple;** SPi; Westbury; one.
Fritillaria meleagris; **Fritillary;** SPi; Bratton; 2, clearly planted.
Fumaria muralis ssp. muralis; **Common Ramping-fumitory**; SPi; Westbury; many in flower border, probably native.
Fumaria officinalis ssp. ***officinalis;*** **Common Fumitory;** SPi; Westbury; SPi/SG; Larkhill; SPTA, game plot full of arable weeds.
Fumaria officinalis ssp. ***wirtgenii;*** **Common Fumitory;** JBr; Pewsey; between path and wall.

***Galeopsis bifida;* Bifid Hemp-nettle;** SPi; Martin; Martin Down, with other interesting arable plants in corner of cornfield.
***Helleborus foetidus;* Stinking Hellebore;** VH; Tisbury; disused quarry overgrown with trees.
***Heracleum mantegazzianum;* Giant Hogweed;** SPi; East Knoyle; 5-10 on verge of A350.
***Hordeum murinum;* Wall Barley;** SPi; Martin; Martin Down NNR.
***Hypericum androsaemum;* Tutsan;** SPi; Westbury; wet willow woodland.
***Juncus tenuis;* Slender Rush;** JFo/SPi; Heywood; woodland ride.
***Lamiastrum galeobdolon ssp. argentatum;* Garden Yellow-archangel;** SPi; Westbury; vigorous colony in old pit by road.
***Lathyrus latifolius;* Broad-leaved Everlasting-pea;** SPi; Martin Down NNR, 1 in scrubby track.
***Leontodon autumnalis;* Autumn Hawkbit;** SPi; Martin; Martin Down NNR.
***Lepidium heterophyllum;* Smith's Pepperwort;** SPi/SG; Shrewton; SPTA, large colony.
***Leucojum aestivum;* Summer Snowflake;** JN; south of Winterbournes; Bentley Wood; SFi; Salisbury; 18 clumps in alder/willow carr.
***Lithospermum officinale;* Common Gromwell;** SPi; Westbury; woodland edge.
***Mentha x villosa;* Apple-mint;** SPi; Westbury; big patch along track. 1st vice-county record.
***Onopordum acanthium;* Cotton Thistle;** SPi; Knook; one beside road.
***Orobanche hederae;* Ivy Broomrape;** RL; Bemerton; 15+ plants in neglected flowerbed.
***Papaver somniferum;* Opium Poppy;** SPi; Westbury.
***Poa humilis;* Spreading Meadow-grass;** JFo/SG/SPi; east of Market Lavington; SPTA Central Impact Area.
***Polygonum arenastrum;* Equal-leaved Knotgrass;** SPi; Martin; Toyd Down.
***Rumex pulcher;* Fiddle Dock;** SPi; Bulford; one plant on road-side bund.
***Sagina nodosa;* Knotted Pearlwort;** SPi/ SG; Shrewton; SPTA, a few in very short, species-rich CG by track.
***Saxifraga granulata;* Meadow Saxifrage;** BL; Charlton; graveyard.
***Sedum spectabile;* Butterfly Stonecrop;** SPi; Westbury; several garden throw-outs; 1st county record.
***Setaria viridis;* Green Bristle-grass;** SPi; Westbury; 2 in wall-pavement crack. 1st recent vice-county record.
***Silaum silaus;* Pepper-saxifrage;** SPi/PSk; Chitterne; SPTA, perhaps hundreds in species-poor winterbourne grassland.
***Spergula arvensis;* Corn Spurrey;** JRM; Collingbourne; edge of arable field.
***Symphytum tuberosum;* Tuberous Comfrey;** SPi; Bradford-on-Avon; naturalised in open ground near woodland track, plentiful.
***Vicia sativa* ssp. *sativa;* Common Vetch;** SPi; Westbury.

Wilson's Honeysuckle *(Lonicera nitida)*





WILTSHIRE BOTANY ELSEWHERE

The "King of Limbs" Oak in Savernake Forest. Photo Joan Davies

While most writing about botany in Wiltshire is found in *Wiltshire Botany* and Wiltshire Botanical Society's Newsletter, relevant articles do occur elsewhere. This section of the journal summarises information of this kind which has not been referred to in publications of Wiltshire Botanical Society. This has become a regular feature, depending on what hase been located. Summaries of further such publications will be most welcome.

The role of DNA-fingerprinting in the conserveation of Black Poplar - Stuart A'Hara, Sam Samuel and Joan Cottrell, British Wildlife 21, 2, 2009 110-115

A study is reported in which clones of the native Black Poplar (*Populus nigra* ssp. *betulifolia)* are identified by their DNA. A clone is a population derived by asexual reproduction from a single parent. DNA is deoxyribonucleic acid, the material of which genes are made. This has a different unique pattern for each genetically distinct set of organisms.

A sample from a number of different English counties allowed 54 clones to be identified, using 95% similarity as the identifying criterion. Material from only 4 trees was submitted from Wiltshire, and they came from 3 clones:
No. 23, frequent in Suffolk and also in Essex
No. 28, in 7 counties, most frequent in Suffolk and Manchester
No. 49, only in Wiltshire

It is recommended that planting schemes using rooted material should use as many locally sourced clones as possible. Failing that, material of the appropriate clones should be obtained from elsewhere. The identification of clones is of particular importance for this process.

It is also of interest to Wiltshire readers that the native Black Poplar can be distinguished by DNA-fingerprinting from the common hybrid *Populus x canadensis (P. deltoides x P. nigra).* In the research described, only 7 of the total 250 trees involved proved to be the hybrid, showing a high degree of accuracy in identification in the field.

Changes in Upper Kennet Valley *Salix* populations in response to fungal blights - Jack Oliver, BSBI News 114, 2010, 20--24

From observations over the years and reference to historical records, a number of conclusions are derived. The long-standing dominance of Crack Willows has recently given way to flourishing and extensive ribbons of healthy White Willows alongside the River Kennet in the Upper Kennet Valley. This seems to be an accelerating process, not mainly due to intentional human plantings of White (and/or Cricket-bat) Willows. The fungal diseases Willow Scab and Black canker can be intermittent in their virulence, but appear to be having a permanent

weakening effect on all Crack Willows and all their hybrids. Willow Scab causes, in early or mid-season, irregular black spots, blackened and shrivelled leaves, spreading to the shoots, while Black Canker causes, in late season, girdling cankers on woody twigs. All the natural Osiers, Sallows and Purple Willows and their hybrids are so far resistant to the blights, but some exotics, cultivars and complex hybrids are vulnerable. If these observations are correct and are sustained, they are another example of fungi having a sudden and severe influence on tree populations, depressing one or more species in favour of their replacement by others moving in. Fungi may therefore influence the evolution of trees. The article includes a table showing the susceptibility of diff-erent willows to Scab and Black Canker.

The trees of Savernake Forest - Jack Oliver, Wiltshire Archaeological and Natural History Magazine, 96, 2003, 40-46

A complete list of the trees, including hybrids, recorded during 1999 and 2000 is provided with indications of frequency, situation and spread.
They are categorised in four groups

Native species and natural variants.
Forestry plantations.
Naturalised and semi-naturalised species.
Exotics, mainly (but not exclusively) found in the Savernake Forest Arboretum.

Some individual trees of national significance are mentioned. The diversity both of tree types and habitats puts Savernake at least on a par with Stourhead and Longleat.

The King Oak in Savernake Forest and its comparison with the living King of Limbs - Joan Davies and Graham Bathe, Wiltshire Archaeological and Natural History Magazine, 100, 2007, 181-186

Most of the article is historical, concerning the King Oak, a huge and impressive tree which died in the last part of the 19th century. A description is given of the replacement King Oak, planted in the late 1940s, which was grown from an acorn from the original Cluster Oak *Quercus robur L. var cristata* (Henry 1917) in Savernake Forest. However, another giant oak, the King of Limbs (pictured on page 38), can be seen today in Savernake Forest south of Birch Copse at SU 24286601. It is an ancient pollard, with a hollow trunk and many of its branches remaining. It has a girth (circumference) of 10.3m (34 ft), which is the third largest for an oak in Wiltshire. Its estimated height is 27m (88 ft) and the spread is 31m (34 yds). It is a hybrid between Q*uercus robur* (English Oak) and *Quercus petraea* (Sessile Oak), called *Qercus* x *rosacea*.

Trees of Marlborough College and Environs - Jack Oliver, Wiltshire Archaeological and Natural History Magazine, 97, 2004, 15-24.

A complete list (172 trees) of the tree species, including hybrids and distinctive variants, recorded between 2001 and 2002 is provided with indications of frequency, situation and spread. Exotics, semi-naturalised and native species are considered. In the last group, diseases (especially fungal) have changed the balance of dominant species. Girth records are given for some exceptional trees. It seems probable that Marlborough College and its immediate environs have 5 (or more) types of trees which have greater girths than any similar trees elsewhere in Wiltshire. There are 2 likely British Champions and also a Railway Poplar which is the largest yet measured anywhere. Marlborough College grounds carry more tree types than in the combined Savernake Forest, Savernake Forest Arboretum and Tottenham Park areas.

The Duke's Vaunt - Joan Davies & Graham Bathe, Wiltshire Archaeological and Natural History Magazine, 99, 2006, 29-34

The Duke's Vaunt is the name of one of the large, ancient, named oaks in Savernake Forest. Local folklore asserts that the tree was the pride of Edward Seymour, Duke of Somerset, Lord Protector and Hereditary Warden of Savernake Forest who became owner of the Forest in 1548. Pictures show a characteristic massive bulge on the trunk on the left-hand side of an opening into the hollow tree, and were probably drawn from the north-west. Pictures from 1801 to 1893 illustrate the decline of this ancient oak, which is still alive in 2006.

The Duke's Vaunt. Photo Joan Davies

Cluster Oaks Originating from Savernake Forest - Oliver, J.E, Davies J.M. & Titchen, A., Botanical Society of the British Isles (BSBI) News, 92, 2003, 23-24

A description of the known descendants of the original Savernake Forest Cluster Oak and the variations between them.

Quercus x rosacea in Savernake Forest - J.E. Oliver. Botanical Society of the British Isles (BSBI) News, 84, 2000, 31-34
This article describes the different features used to identify the oaks in Savernake Forest and includes diagrams of the variation seen in the hairs on the underside of the leaves.

Remarkable Wiltshire White Willows - Oliver, J.E. The Tree Register Newsletter No. 14, 2004.
Describes with measurements, six White Willows, *Salix alba* on river banks in various parts of Wiltshire.

Dry stone walls - a biological and archaeological treasure? - John Presland, Wiltshire Archaeological and Natural History Magazine, 101, 2008, 8-17.
Is there a limestone dry stone wall community? - John Presland, BSBI News, 108, 2008, 9-12.
The first of these articles gives an overview of investigations and analysis of the flora of walls in Winsley in West Wiltshire. The original survey of the flora of dry stone walls there has already appeared in *Wiltshire Botany* (Presland 2008a), and a comparison with the flora of mortared limestone walls there showing how different it was from that on the dry stone walls (Presland 2008b) was summarized in *Wiltshire Botany* 11 (p 35) The summaries here describe subsequent analyses of the data to investigate whether or not the flora of limestone dry stone walls constitutes a unique community.

Clearly a difference has been demonstrated between dry stone and mortared walls locally (Wiltshire Botany 11). Can this be generalised, or is it due to factors operating only locally? There is evidence that the findings do not apply to walls of acid rocks. However, comparison with the study of largely limestone dry stone walls in the Mendips (Wiltshire Botany 10) shows a high level of agreement with the Winsley findings. It is a reasonable hypothesis that limestone dry stone walls host a flora which is different from that of mortared limestone walls and different from any kind of wall made of acid rocks. But does this mean that the flora of limestone dry stone walls is unique?

It is conceivable that wall vegetation generally is not distinctive, but could be regarded as part of a wider community type not necessarily confined to walls, but including other rocky environments and just reflecting the flora of the areas in which the walls occur. This is certainly not the case in Winsley, where most of the plants described as growing on walls do not occur in other situations - or only in very similar situations, such as a roof accommodating a colony of Biting Stonecrop. The detailed classification of British plants communities accomplished in recent years (Rodwell 2000) has not identified an association for dry stone walls. Is it possible, though, that it could be encompassed by communities or subcommunities identified by Rodwell for rocky environments. There are three possibilities - OV39b, OV41a and OV42, all of which have walls and, at least by implication, mortar mentioned as among their habitats, though there is no reference to dry stone walls. Each possibility is compared in the articles with the Winsley dry stone wall flora. It does not fit the descriptions of any of them. Indeed, some plants characteristic of those communities, such as Ivy-leaved Toadflax, have not colonized Winsley's dry stone walls, even though available in the area to do so. The findings point in the direction of the existence of a distinctive plant community on limestone dry stone walls.

On the basis of the findings, it is a reasonable hypothesis that Cotswold (and may Mendip) limestone dry stone walls have a plant community consisting of crustose lichens, the liverwort *Porella platyphylla,* the mosses *Homalothecium sericeum, Tortula muralis, Grimmia pulvinata, Schistidium apocarpum* and *Bryum capillare, Geranium lucidum* (Shining Cranesbill), *Saxifraga tridactylites (*Rue-leaved Saxifrage), *Sedum acre (*Wall Pepper), and with occasional *Xanthoria parietina* (a more foliose lichen), mosses *Orthotrichum anomalum* and *Rhynchostegium confertum, Polypodium interjectum* (Intermediate polypody) and *Geranium pyrenaicum* (Hedgerow Cranesbill). Other species might be regarded as occurring rarely under particular conditions - such as the moss *Encalypta vulgaris,* the moss-dwelling fungus *Galerina pumila,* the lichen *Cladonia pyxidata, Erophila verna (*Common Whitlow-grass), *Sedum rupestre* (Reflexed Stonecrop), *Ceterach officinarum,* now *Asplenium ceterach* (Rusty-back), *Phyllitis* now *Asplenium) scolopendrium* (Hart's-tongue Fern), and *Umbilicus rupestris* (Wall pennywort).

Conserving dry stone walls

If limestone dry stone walls really are unique, the case for their conservation is very strong. John Presland's 2007 guide *Conserving the Flora of Limestone Dry Stone Walls* (available from Summerfield Books) is based largely on his studies in Winsley. It describes dry stone walls, gives an account of the flora of those built with limestone, describes, with accompanying colour photographs, how to recognise typical plants on limestone dry stone walls, and gives a more systematic account of conservation measures.

Where next?

Investigations and written accounts of the flora are continuing. Progress may be tracked by visiting the website www.dry-stone-wall-flora.co.uk.