Natural Basingstoke

Natural Basingstoke

Flora Surveying, Seed Collecting & Sowing

Course Overview (1)

- Course Lead: Marion Wolstencroft (Natural Basingstoke, Advisor Board member for Flora)

- This course assumes no previous knowledge!

- Aim: Participants become confident in basic knowledge of flora on their sites:
  - what flora population to expect/ how to assess what you have
  - annual growing cycle & monitoring actions
  - detailed practical steps for seed collection & storage
  - biodiversity improvement by seed sowing – what, when & how.

Course Overview (2)

- Course is delivered in 3 steps :
  - **Step 1 – Theory and background (late spring/ early summer) – site surveying, flora Id, biodiversity assessment, seed collecting & storage, creating seed mixes and sowing them.**
  - Step 2 – Field practice (July) – Surveying, seed collecting and storage (opportunities to continue practice in July – September)
  - Step 3 – Practice (September/October) - Seed mix preparation & seed sowing
- This course covers Step 1!

Course Structure

1. Conservation context
2. Flora Surveying
3. Habitats
4. Seed harvesting & storage
5. Seed sowing

Conservation Context (1)

Why is everyone talking about biodiversity?
For 40+ years we have been curating green spaces for quality, rarity, priorities for action, etc. Suddenly everyone is talking about biodiversity and using the term Biodiversity Net Gain * – why?

Environment Act (2021)
This legislation introduces new UK long term environmental quality strategies – for air, water, green space etc. and mandates actions to achieve them.

For biodiversity, the legal obligation on planning authorities and developers to define and deliver 10% biodiversity net gain (BNG) on new developments has provided legal backing and a source of funding for action – at this early stage the impact seems to be positive.

To work, both the developer (who pays to deliver BNG) and the Local Planning Authority (who can get some of the funding) need baseline data on biodiversity.

[*Biodiversity Net Gain – Term used to describe an increase in biodiversity in a particular area – increase and improvement, in resident constituent species, sustained in the long term]

Conservation Context (2)

- Whatever interests you regarding seed collecting and sowing – the first step is to get to know your patch
- What have you got, floristically and why, what else might you have?
- To answer those questions we will talk about habitats and their management (section 3).
- To identify individual floral species, you will need a source of reference – we use to use a field guide but you now have the option of using an app like Seek. See Appendix A for a list of Reference Material

Flora surveying

2.1 Why, what, how?

2.2 Where to start

2.3 HBIC site surveys

2.4 NB site surveys

Flora surveying
2.1 Why, what, how?

Biodiversity baselines - ‘to know where you are going you need to know where you are coming from’:

- biodiversity baselines, monitoring, & trend data, where are we winning/losing biodiversity,
- assessing & understanding the impact of climate change

Completing the cycle of conservation for flowering plants – ‘everything is connected to everything else’

- role of flora in the ecosystem – food plant, habitat for breeding etc.
- management cycle – locating, harvesting, storing, reintroducing to expand biodiversity
- citizen science – an opportunity for new skill and understanding for volunteers.

Flora surveying:
2.2 Where to start

So where do we start with surveying and Biodiversity data collection:

- HBIC site surveys – and how to read them
    - Most significant sites in Basingstoke have an HBIC site survey on which their original Management Plan was based

- NB Site surveys
    - flora (trees, grasses, flowering plants, fungi & lichens)
    - fauna (butterflies, insects, birds, amphibians, small mammals)

Where is all that data going ? iRecord

Flora surveying
2.3 HBIC Site Surveys (1)

HBIC Survey Summary [HBIC=Hampshire Biodiversity Information Centre]

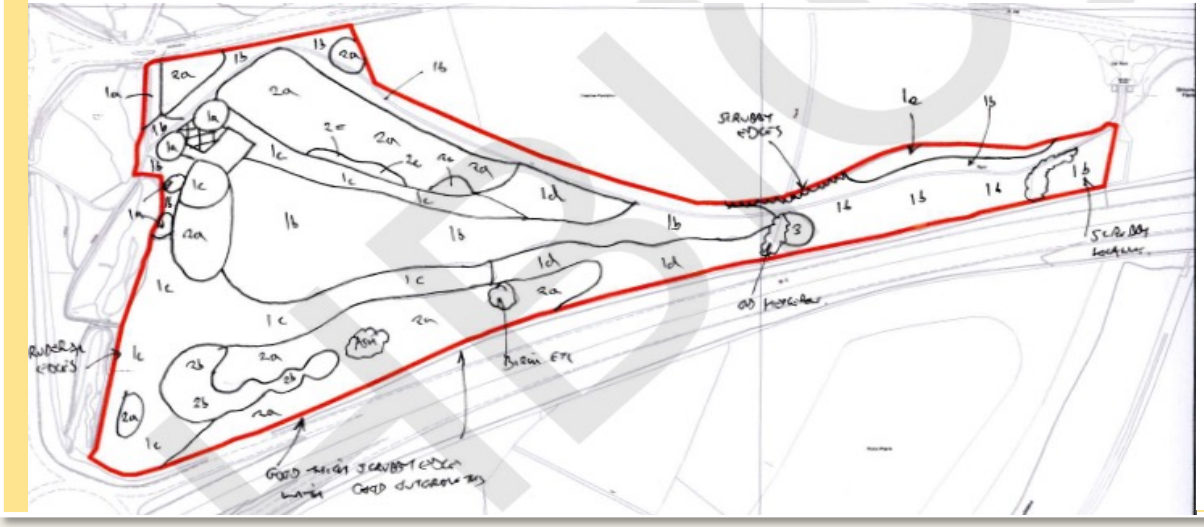
Crabtree Grassland
21/06/2016

Site Details

Grid Reference :	SU65605170	File Reference :	65-0095
Total Area :	18.8 ha		
Civil Parish :	Old Basing		
District :	Basingstoke and Deane		
Vice-County :	12, North Hampshire		

Survey Details

Survey Type :	Phase II
Survey Date :	21/06/2016
Survey Time on Site :	8 (hrs)
Data Owned By :	Hampshire Biodiversity Information Centre Partnership
Data Recorded By :	Ian Ralphs, HBIC



Site Summary

Crabtree Grassland is a large public open space, situated on the south-eastern edges of Basingstoke, between Crabtree Plantation and the M3.

The grassland here is all improved in origin, having originally been arable farmland that was taken out of production after the building of the M3 motorway. However, the grassland with long term sensitive management, is beginning to revert to a more unimproved semi-natural grassland type in character and is beginning to acquire an impressive range of species.

Flora surveying
2.3 HBIC Site Surveys (2)

During the current survey 143 species, of which 9 are regarded as notable were recorded from the site, this included an impressive number of bird and butterfly species, which are taking advantage of the site for both foraging and breeding habitat.

Site Designations

Designation

Site of Importance for Nature Conservation

Site Features

Type	Description
Geology	Clay-with-flints
Geology	Upper Chalk
Management	Mowing
Management	Unmanaged
Usage	Amenity
Usage	Dog Walking
Usage	Managed For Wildlife
Usage	Public Access

Priority Habitats

None

Priority Species

Taxon Name	Common Name	Status
Alauda arvensis	Skylark	Hampshire BAP Species NERC Act 2006, Sect 41 Birds of Conservation Concern: Red List
Ardea cinerea	Grey Heron	County Scarce
Fragaria vesca	Wild Strawberry	IUCN (EN2014) - Near Threatened
Milvus milvus	Red Kite	Hampshire BAP Species EU Birds Directive Annex 1 WACA Sch 1, Part 1 County Rare

Species Recorded

Taxon Name	Taxon Common Name	Frequency	Notable
Acer campestre	Field Maple	R	
Achillea millefolium	Yarrow	R/O	
Agrimonia eupatoria	Agrimony	O	
Agrostis capillaris	Common Bent	OLF	
Agrostis stolonifera	Creeping Bent	R/O	

Etc. for 143 species found on site….

Followed by 8 pages of notes on the habitat areas identified, their past management, possible opportunities for improvement etc.

Flora surveying
2.4 NB site surveys – Citizen science in action! (1)

1. Objective

- produce useful data to be shared with others and inform the site management actions of the team

2. Method

- establish standard format for data capture over time
- repeated data capture at intervals to form trend data

Flora surveying
2.4 NB site surveys – Citizen science in action! (2)

- **Preparation**

D – dominant	>75%
A – abundant	51 – 75%
F – frequent	26 – 50%
O – occasional	11 – 25%
R – rare	<11%

Short Ref	Grid ref
1	SU600488
2	SU599488
3	SU598488
4	SU597488
5	SU596488
6	SU595488
7	SU595489
8	SU594488
9	SU594487
10	SU595487
11	SU596487
12	SU597487

- **Data collection**: walk the site several times per year logging flora by species, by location code (Grid ref), by abundance (DAFOR code)
- **Data sharing**
  - with others through iRecord
  - with volunteers, NB, Rangers, BDBC, HBIC etc.

Habitats

3.1 Basic botany for seed collectors

3.2 Habitats & wildflowers to be found in each:

- 8 local habitat types and their characteristics
- basic flowering plant sets for each habitat

3.3 Grassland Habits - Grass control for biodiversity enhancement

3.4 Woodland habitats - Ancient Woodland Indicators

Habitats
3.1 Basic botany for seed collectors

Flowering plants have been around for 130 million years (since the Cretaceous) the most successful group of plants on earth.

Understanding plant lifecycle :

- Annual - flowering and setting seed annually, the plant dies over winter
- Biennial - the plant flowers in its second year, setting seed and then dying
- Perennial - lasting for several years at least, flowering and setting seed in most years while the plant continues to grow

Why does this matter to the seed collector? Because it will influence the seed harvesting strategy applied for each species

Understanding seed distribution strategy: Strategies are many (gravity, wind, ballistics, water, animals...) which determine for how long they are available to harvest, how the seeds are packaged and how successfully collected

Habitats
3.2 Habitats & wildflowers to be found in each (1)

HABITAT: "The combination of climate, soil chemistry, moisture, light level and living organisms which determine what species can live and thrive there".

UK has 20 defined habitat types and 852 sub-groups (inc marine habitats) – we are only concerned with 4 types and specific sub-groups - we will focus on 8 habitats in total.

Basingstoke accommodates 4 important and quite different terrain groups within 5 miles of the town centre

- Chalk and alkaline clay grassland (e.g. our Downland sites)
- Lowland heath on neutral/acid gravels (e.g. Wigmore Heath)
- Clays/neutral soil grassland
- Alluvium associated with water features (e.g.: Millfield)

Added to these are the habitat types created by human adaptation of the land:

- Woodland and Woodland Edge
- Hedgerow and Waste

Habitats

3.2 Habitats & wildflowers to be found in each (2)

- Most of us in Basingstoke work on sites where alkaline soils are the main influence – there are exceptions (e.g. Wigmore Heath has acid heathland).
- Most of us have dry sites – some groups curate sites with streams and ponds (wetland habitats) – with water tolerant species on the intersection.

Local Geology (meadow sites):

- **Chalk downland** – (most of) Old Down, Beggarwood &, Crabtree. Overton Hill.
- **Alkaline soil (clay on top of the chalk subsoil)** - lower slopes of Old Down, Beggarwood & Crabtree. Down Grange.
- **Rich Neutral riverine soil** - most of Millfield, meadow areas in Chineham.

Code	Category	Description of usual plant characteristics	Soil type	Moisture level
W	Woodland-mixed deciduous	Early flowering or tolerates deep shade, often corms or bulbs	any draining soil	
E	Woodland edge	May flower early or tolerate semi shade	any draining soil	
M-c	Meadow - Chalk	Alkaline tolerant, well drained, summer flowering, seed disseminated by wind or disturbance	chalk & limestone	dry
M -w	Meadow - Water	Water tolerant specialists, summer flowering	loam or clay	wet
M-a	Meadow - Acidic/neutral	Acid/neutral soils, summer flowering	loam/sand/clay	
H	Hedgerow	Summer flowering but semi shade tolerant, often tall	any draining soil	
P	Poor Wastes	Tolerant of dry conditions & very poor soil	neutral poor soil	dry
Hth	Heaths	Acid/neutral, poor soil, dry conditions but often mosaic of micro conditions	neutral/acidic sand or clay	dry but water logging in places

Habitats
3.2 Habitats & wildflowers to be found in each (3)

- 8 local habitat types and the core populations of flowering plants for each habitat
- JNCC lists flora for each of these 8 habitat types.
- Typically, 20–30 species in each habitat type, core species are highlighted (none of these species are considered rare and most are on our sites).
- Some species appear on several lists – common, robust and adaptable species which can usually survive on most sites.
- Probably a further 20 species which you <u>might</u> find (if lucky) – this is where a field guide is helpful.

See Appendix B for Species Lists by habitat type

[JNCC = Joint Nature Conservation Committee, Dept of Environment]

Habitats
3.3 Grassland Habitats (1)

Grass control for biodiversity enhancement:

- Historically, temperate grassland developed as a highly successful biome from the late Cretaceous period.
- In the wild it includes two control mechanisms – fire and grazing. Large conservation bodies (e.g.: Wildlife Trusts), where public access can be controlled, have always used grazing as it provides:
    - low impact, low energy grass control without soil compaction or degradation of valuable features like ant hills
    - automatic recycling of nutrients at existing levels
    - automatic control of scrub species when young,
- This type of management is not without effort, in boundary control and cattle husbandry, but where it can be applied it has proved very successful.

Habitats
3.3 Grassland Habitats (2)

Grass control for biodiversity enhancement:

- On modern day urban and ex-urban conservation areas neither grazing nor burning is currently available for controlling the vigour and density of grass - but control is necessary if the aim is increased biodiversity because the soil is generally rich, after centuries of agricultural use and soil improvement.

< Yellow Rattle
– Rhinanthus Minor

Red Bartsia
– Odontites verna

are annual flowering plant species which are semi-parasitic on grass and highly effective in reducing the vigour and density of existing grasses and are important elements in achieving biodiversity enhancement.

Habitats
4 Woodland Habitat – Ancient Woodland Indicators (AWI)

Woodland habitats are primarily categorised as:

Terrain:	X	Genus:
• Lowland • Upland • Wetland		• Conifer (pine) • Deciduous (oak, ash...)

- In north Hampshire our woodland habitat is predominantly oak, or ash based mixed broadleaf woodland – either ancient woodland or later plantation woodland.
- Much attention is given to **Ancient Woodlands** – primarily because the amount of this habitat is constantly shrinking and once lost is gone forever.
- The AWI definition ("woods over 300 years old never clear felled") is a demanding yardstick, dependent on soil and climate conditions, so is broken into several lists, depending on geography.
- Ancient Woodlands will support a range of flowering plant species rarely found today (see Appendix C for AWI list).
- **Why are AWIs so uncommon?** The rarer plants are more specialised, less vigorous, slow to spread so now cannot compete with some common species – they are isolated in their current niche. For Hampshire this is a list of 55 species (see Appendix B)
- Typically, a mature wood (150 or so years old) may well have 10–20 AWI species.

Natural Basingstoke

Coffee break!

4. Seed harvesting, & storage

4.1 Planning & wider context

4.2 Mechanical and single species harvesting

4.3 Seed collecting ‘Rules’

4.4 When to harvest & harvesting routines

4.5 Grassland control

4.6 NB Seed Inventory

Seed harvesting, & storage
4.1 Planning & wider context

- Old Down Park has taken 20 years of good management to reach its current condition.
- An enrichment project can take 2–5 years to show results.
- Seed collecting team need to be involved from early stages of an upgrade project, to advise on seed availability, anticipate needs and build stocks.
- Not only do groups need to have a good knowledge of the habitats on their site; those engaged in seed collecting need to be aware of the flora on the sites within which they collect to be able to expand the seed stocks available to all groups.

Seed harvesting, & storage
4.2 Mechanical & single species harvesting

Ranger Team have a mechanical seed harvester for seed collecting on meadow areas without seriously damaging the plants. It can be passed over an area to collect the ripe seed several times (from July to September). Collected seed is laid out to dry for 2 weeks, then sent to a seed company for winnowing and bagging

Pros	Cons
Quick collection on multiple site visits	**Non-selective harvesting includes weeds and grass**
Easy and effective seed release from chaft/pods	**While seed is 'clean', chaff still in the mix as winnowing ineffective on non-selective harvesting**

Manual harvesting of individual species will still be vital – but mechanical winnowing is being investigated.

Seed harvesting, & storage
4.3 Seed collecting 'rules' (1)

Annuals

- Chalk downland annuals [examples: Common Centaury – *Centaurreum erithraeus,* Eyebright – *Euphrasis ,* Field Poppy – *Papaver Rhoeas*]
- Do not harvest and remove all the seed presented to you, leave sufficient to ensure the species thrives in situ where it is obviously growing successfully.
- Apply rule of harvesting no more than 30 % of the seed set, leaving the other 70 % on site, even when you visit the site several times during mid-July to mid-September
- To avoid over collecting, keep notes of each season's collection dates and results.
- Good practice to spread ripe seed around within the general area you are visiting.

Biennials

- Flowering in 2nd year [examples: Foxgloves -*Digitalis purporea*, Teasel -*Dipsacus fullonum*] .
- Good reason to 'know your patch', note where plants are in years 1 so you can return ready to harvest the seed in year 2.
- Like annuals , leave some seed at harvest site to repeat the life cycle.

Seed harvesting, & storage
4.3 Seed collecting 'rules' (2)

Perennials

- The majority of species
- Ensure seed is mature and ready for collection, collected too soon and it will not keep and germinate,
- Visit to harvest too late and it has dispersed.

Keep in mind - distribution and rarity of species: ensure that while you are harvesting you are also spreading some seed around locally.

Seed harvesting, & storage
4.4 When to harvest & harvesting routines (1)

- Harvest mature seed on dry days, preferably when the previous day was also dry.
- Climate change is making forecasting ripening difficult – on 1 May 2025 plant growth was up to 2 weeks ahead of normal.
- Learning to recognise seed heads by species takes time – they are usually dissimilar to their flowering selves!
- The **NB Seed Inventory list** (Appendix C) includes clues from their flowering stages
- **The Seed Site** http://theseedsite.co.uk/ holds details of most species seed pods and seeds.

Seed harvesting, & storage
4.4 When to harvest & harvesting routines (2)

Is it collectable?

You learn by experience….when the seedhead is brown not green, when the stem has gone brown or partially brown. The trickiest are the wind distributed seeds – they can go from attached to the flower head to blown away in half a day. The exploders can be collected when fat and full (and still partly green) but not yet split open.

When is it dried out?

What you have collected MUST be laid out to complete drying – 1-2 weeks exposure to air to avoid mould growing – a dry green house for example. A moisture absorbing surface - several sheets of newspaper at base help.

Releasing seed from pod and husk

After drying, the stalks, leaflets and pod sheaths should snap off or opened. The material can be passed through a series of sieves – the seed is dry and will not be harmed by this process. Finally, when there is just seed and fine chaff left, the seed can be winnowed (best done outside). Whatever weight the seed is it will be heavier than the chaff – July demonstration and practice.

ALWAYS remember to weigh the container of seed , label with Name and Year of production and log it!

Seed harvesting, & storage
4.4 When to harvest/ harvesting routines (3)

The NB Seed Inventory :

List of common locally found species and habitats they are found in -	Woodland: decid.	Woodland edge	Hedgerow	Meadow - Chalk	Meadow - Wetter	Meadow - Acid/neut	Meadow - poor	Wastes	Heaths	A/B/P	Flower Colour	Max Stalk Height	Flower Period	Seed Stock Ref
	W	E	H	M-c	M -w	M-a	P		Hth					
Agrimony - Agrimonia eupatoria		X	X		X	X				P		50 cms	Jun - Sept	11
Barren Strawberry - Potentilla sterilis	X		X				X		X	P				100
Bell Heather - Erica cinerea									X	P				101
Betony - Betonica officinalis					X	X				P		50cms	Jun - Sept	1
Birdsfoot trefoil - Lotus corniculatus				X	X	X			X	P		35cms	May - Aug	2
Black Medick -Medicago lupulina				X	X					A		40cms	May - Aug	3
Black Mullein - Verbascum nigram				x						P		120cms	Jun - Oct	4
Bladder Campion - Silene vulgaris				X	X					P		80cms	May - Aug	5
Blue Fleabane - Erigeron acer (annual)				X						P		35cms	Jul - Sept	6
Bugle - Ajuga repans	x	x				x				P		30cms	May - Jul	7
Bulbous Buttercup - Ranunculus bulbosus				X		X				P				102
Bush Vetch - Vicia sepium		x	x	x			x			P		>60cms	Apr - Sept	8
Clustered Bellflower - Campanula glomerata				x						P		15cms	May - Sept	10
Common Cats ear - Hypochaeris radicata				X						P		50cms	May - Oct	9
Common Centaury - Centaurrium erythraea(annual)				X						A		15 cms	Jun - Aug	12
Common Figwort - Scrofularia nodosa	X	X					x			P				104
Common Fleabane - Pulicaria dysenterica		X		X						P		40cms	Jul - Sept	13
Common Hemp Nettle -Galeopsis tetrahit			X				X			A		80cms	Jul - Sept	14
Common Knapweed - Centaurea nigra		X	X	X	X	X				P				40
Common Mallow - Malva Sylvestris			X							P		75cms	Jun - Sept	15
Common St John's Wort - Hypericum perforatum										P		50cms	Jul - Sept	16
Common Valerian - Valeriana officinalis				x	X		x			P				105
Common Vetch - Vicia sativa				X						P		>150cms	Apr - Sept	17
Corky-fruited Water-dropwort - Oenanthe pimpinelloides					X					P				106
Cow Parsley -Anthriscus sylvestris	X	X	X							P				107
Yellow Rattle - Rhinanthus minor				X	X	X				A		40cms	Apr - Sept	73
Counts	25	33	39	54	44	23	19	17						128

- NB seed stock will be moving to Wade Rd by the end of 2025. Held at normal temperatures – shelf life of 3-4 years. Containers are not vacuum sealed but shaded from sunlight and ingress of bacteria is minimised.
- Inventory list holds useful information on species features, habitats where each could be found, flowering period and seed weight code (see section 5).
- The inventory will be updated after the end of the collecting season (August-December) and issued for reference in in seeding projects. This gives an opportunity for groups to plan forward their seeding needs.

Seed harvesting, & storage
4.5 Grassland control (by semi-parasitic species)

Yellow Rattle – *Rhinanthus minor*

- **Annual – so leave some seed where you find it / in surrounding area**
  Early seed setter – harvested July-August
- **Chalk soil specialist prefers alkaline soil**
- **Does not tolerate foot fall well**

Red Bartsia – *Odontites verna*

- **Annual – so leave some seed where you find it**
- **Late seed setter – harvested Sept-Oct**
- **Tolerant of neutral soils**
- **Tolerant of foot fall areas & being crushed**

- These species are not listed on the Habitat type lists or seed mix lists as can be required before, during or independently of wildflower seed application.
- Use rate – depends on grass sward (0.5gms – 1.5 gms /m^2).
- Sow in prepared grassland in Autumn, needs to overwinter in the ground.

Seed harvesting, & storage
4.6 NB Seed inventory

List of common locally found species and habitats they are found in -	Woodland-decid.	Woodland edge	Hedgerow	Meadow - Chalk	Meadow - Water	Meadow - Acid/ neut	Poor Wastey	Heaths	A/B/P	Flower Colour	Max Stalk Height	Flower Period	Seed Stock Ref
	W	E	H	M-c	M -w	M-a	P	Hth					
Agrimony - Agrimonia eupatoria		X	X		X	X			P		50 cms	Jun - Sept	11
Barren Strawberry - Potentilla sterilis	X		X				X	X	P				100
Bell Heather - Erica cinerea								X	P				101
Betony - Betonica officinalis					X	X			P		50cms	Jun - Sept	1
Birdsfoot trefoil - Lotus corniculatus				X	X	X		X	P		35cms	May - Aug	2
Black Medick -Medicago lupulina				X	X				A		40cms	May - Aug	3
Black Mullein - Verbascum nigram				x					P		120cms	Jun - Oct	4
Bladder Campion - Silene vulgaris				X	X				P		80cms	May - Aug	5
Blue Fleabane - Erigeron acer (annual)				X					P		35cms	Jul - Sept	6
Bugle - Ajuga repans	x	x				x			P		30cms	May - Jul	7
Bulbous Buttercup - Ranunculus bulbosus				X		X			P				102
Bush Vetch - Vicia sepium		x	x	x			x		P		> 60cms	Apr - Sept	8
Clustered Bellflower - Campanula glomerata				x					P		15cms	May - Sept	10
Common Cats ear - Hypochaeris radicata				X					P		50cms	May - Oct	9
Common Centaury - Centaurrium erythraea(annual)				X					A		15 cms	Jun - Aug	12
Common Figwort - Scrofularia nodosa	X	X					x		P				104
Common Fleabane - Pulicaria dysenterica		X		X					P		40cms	Jul - Sept	13
Common Hemp Nettle -Galeopsis tetrahit			X				X		A		80cms	Jul - Sept	14
Common Knapweed - Centaurea nigra		X	X	X	X	X			P				40
Common Mallow - Malva Sylvestris			X						P		75cms	Jun - Sept	15
Common St John's Wort - Hypericum perforatum									P		50cms	Jul - Sept	16
Common Valerian - Valeriana officinalis				x	X		x		P				105
Common Vetch - Vicia sativa				X					P		>150cms	Apr - Sept	17
Corky-fruited Water-dropwort - Oenanthe pimpinelloides					X				P				106
Cow Parsley -Anthriscus sylvestris	X	X	X						P				107
Yellow Rattle - Rhinanthus minor				X	X	X			A		40cms	Apr - Sept	73
Counts	25	33	39	54	44	23	19	17					128

5. Seed Sowing

5.1 Building up a Natural Basingstoke wildflower seed bank

5.2 Plan ahead for biodiversity upgrades

5.3 Ground preparation, timing and sowing density

5.4 Creating sowing mixes

5.5 Rarer species

5.6 Non-native species

Seed Sowing
5.1 Building up NB wildflower seed bank (1)

Seed can be sourced reliably in the marketplace BUT there is no seed better than that sourced locally from sites we know intimately, and its FREE!

Not all species can be relied on to seed well each year – Birds' Foot Trefoil is a chalk downland staple – but the harvest in 20023 & 24 was very poor – we have no stock!

Not all species can be harvested mechanically and some need manual harvesting.

Biodiversity improvements may be planned several years out and want a tailored seed mix

Seed Sowing
5.1 Building up NB wildflower seed bank (2)

We assume average seed viability at 3-4 years. Stocks were run down in 2020-22 and are still being rebuilt.

Habitat type	Past number of species stocked	Future target number of species stocked
Woodland	5	14
Woodland edge	15	17
Hedgerow	22	22
Meadow	43*	50*

- Some species listed here can be found in other habitat types as well.

We saw in Section 3 approximately 20–30 species represent the basic flora of each habitat type, while listing some species in two or more habitat types.

What species do you have in your habitats? What is missing and could be added?

Seed Sowing
5.2 Plan ahead for biodiversity updates (1)

- Plan ahead for biodiversity upgrades – very little in nature is instant!
- All meadow enrichment projects should review the existing grass population and apply grass control mechanism where appropriate (yellow rattle and red bartsia) before adding flowering plant mixes or specific flowering species.

Project type	Timeframe
Large area of ex-agricutural land or building site	1yr clear and remove , 1 year fallow then plow and seed, 2 years fresh growth = 4 +years
Smaller green spaces for upgrading areas	1 year clear and late autumn reseed 2 years fresh gowth = 3 years
Small or medium areas of meadow grass	1 year scarify and prep + control seed 1 year grass management 1-2 years biodiversity seed mix 2-3 years fresh gowth = 3-4 years
Cleared bare earth	1 year clear and late autumn reseed 1- 2 years fresh gowth = 2- 3 years

Seed Sowing
5.2 Plan ahead for biodiversity updates (2)

- If possible, use Natural Basingstoke sourced seed – check seed stocks well in advance
- Other reputable and useful suppliers of seed and seed mixes:
  - Emorsgate Seeds (https://wildseed.co.uk/) and
  - British Wildflower Meadow Seeds (https://britishwildflowermeadowseeds.co.uk)

[Their websites are useful databases on all things wildflower seed related and their seed is UK propagated].

Seed Sowing
5.3 Ground preparation, timing & sowing density (1)

When to sow – aim to sow in late Autumn (October /November)

- Autumn sowing allows a 'winterizing' process to settle the seed in the ground with a cold spell of weather.

Ground preparation is worth the effort

- Cutting grass as short and as close to the ground as possible with all arisings removed
- Scarifying the area to be seeded robustly or harrowing:
    - to break the surface and expose a proportion of bare earth
    - to ensure the seed, when sown, is in contact with the soil almost immediately and not held up in the stalks of the grass

De-turfing (removing the top 5-10cm of grass sward and root) is an effective way of reducing fertility and preparing ground for seeding. BUT - labour intensive and only practical when dealing with very small areas - less than 10 m^2.

Seed Sowing
5.3 Ground preparation, timing & sowing density (2)

Sowing Density

- You only need to prepare 1.5 gms per m^2 of flower seed mix (excluding grass seed, yellow rattle or sand) for bare soil sowing - in some circumstances you may want to increase that quantity to 2 grams.

With Yellow Rattle or without?

- Ideally include yellow rattle every time (1 - 1.5 grams/m^2 yellow rattle) – but you may already have treated the area with yellow rattle before sowing seed or you may have removed the turf beforehand and only need to sow yellow rattle round the edge of the seeding area.

Sowing

- Seed sowing is by hand broadcast, with the seed well mixed with dry sand to ensure a fine distribution rather than clumped. For any larger areas of seeding, break the area down into sections and apport the mixed seed into those sections then mixing with the sand to ensure even spread.

Seed Sowing
5.4 Creating seed mixes

Wildflower seed is mostly extremely fine and is measured in grams (a gram is 1/28th of an ounce). For example, Musk Mallow weighs in at 500 seeds per gram while Toadflax weighs in at 7,000 seeds per gram.

How to judge how much seed you need? Not an exact science but relatively easy to calculate.

Introducing the concept of YRE- Yellow rattle equivalent:

Yellow Rattle (one of the heavier seeds) weighs 300 seeds to the gram and is usually spread at a rate of between 0.5 and 1.5 grams per square metre – usually 1.0grm/m^2.

Almost all wildflower seed weighs significantly less than Yellow Rattle, so we have developed the concept of Yellow Rattle Equivalent (YRE).

- If all the seed being used weighed the same as Yellow Rattle how much by weight would you need of each species to sow at the rate of 1.5 -2.0 grams combined weight per square meter – excluding the carrying sand?
- Having calculated that figure – the weight of each species in the mix at YRE - you multiply each of those by the relative weight factor to get the actual weight of seed per species you will need.

Confused? Let's look at a worked example….

Seed Sowing
5.4 Creating seed mixes – Worked Example

Seed Mix needed for 250m² of chalk meadow, previously seeded with Yellow Rattle	% of mix	Seed weight as YRE (375gms total)	Seed weight code	Actual weight of seed per species
Birdsfoot trefoil - Lotus corniculatus	10	38	M	**38**
Black medick - Medicago lupilina	5	19	M	**19**
Bladder Campion - Silene vulgaris	5	19	M	**10**
Cowslip - Primula veris	12	45	L	**90**
Hoary plantain - Plantago	7	26	VS	**3**
Horseshoe Vetch - Hippocrepis comosa	2	8	VS	**1**
Kidney vetch -Anthyllis vulneraria	5	19	M	**19**
Lady's bedstraw -Galium verum	5	19	M	**19**
Musk Mallow - Malva moschata	10	38	M	**38**
Oxeye daisy -Leucanthemum vulgare	15	56	M	**56**
Salad burnet - Poterium sanguisorba	2	8	L	**16**
Self-heal -Prunella vulgaris	2	8	S	**4**
Small Sabious - Scabiosa columbaria	10	38	M	**38**
Blue Fleabane - Erigeron acer	5	19	D	**1**
Common centaury - Centaurrium erythraea	5	19	D	**1**
Total	100	375		**357**
Dry sand to assist distribution				1-1.5 kilos

Code	Seed qty/gm	Weight as YRE
D	10,000+	0.05
VS	3,000 - 10,000	0.1
S	1,000-3,000	0.5
M	300-1,000	1
L	<300	2

D= Dust
VS = Very Small
S/M/ L = Small, Medium, Large

Notes: The seed weight code is a simple way of adjusting the weight of each species required for the widely differing seed sizes and can be found on the species inventory schedule. Final required weight of each seed used

= YRE col x value of weight code

Seed Sowing
5.5 Rarer species, Orchid family & problem species (1)

Rarer Species (as defined by JNCC and indicated in any good flowering plant guide) - legitimate aim would be to reintroduce in places where they have been known but the seed bank has been lost,

Options

- *acquire seed from a legitimate source*
- *Raise and plant out as plug plants where you wish to introduce them*
- *Establish a nursery and grow the population for further propagating and seed harvesting*

Seed Sowing
5.5 Rarer species, Orchid family & problem species (2)

Not easy to grow and propagate - seed is as fine as dust and does not contain nutrients needed to start germination & growth process (think of an egg without a yolk).

To germinate and grow initially require assistance of a mycorrhizal fungus. The process of getting the orchid to the stage where it can be transplanted into its ultimate habitat can take quite some time.

Not known what determines their flowering propensity. They can appear where they have not been seen before – clearly the seed is in the ground, long term, and the conditions were right for it to grow.

In **2025 we are focusing on surveying Helleborines and Twayblades** and hope to log these 4-5 species across Basingstoke sites – starting in May. Groups are asked to log the presence of these (What3Words) and let us know.
Come June we will be surveying grassland orchids again.

Seed Sowing
5.6 Non-native species (1)

We suffer from the invasion of non-native species which have escaped from gardens.

- Containment is difficult – seed spread by wind, birds, etc has ensured that species like laurel and rhododendron are widespread in woodlands.

- Horticultural variants are often more vigorous than the native species and difficult to eradicate (e.g.: variegated leafed Alexander/Yellow Archangel – invades adjacent woodland)

- Negative influences on the natural environment–
    - not integrated into the system of native plant life checks and balances, have no known predators and thus can take over whole areas – like Japanese Knotweed.
    - ground shading and thus kill off native species which cannot compete, especially on the forest floor,
    - slow to rot down, poisonous, or climbing out of control

Seed Sowing
5.6 Non-native species (2)

Native Invasives

- There are a number of native species which can become a problem as they are difficult to eradicate or contain (shrubs include blackthorn and dogwood which spread by root creep) - but there are also some flowering plants which need to be managed: Wild Parsnip, Wild Chicory and Ragwort**.
- While an integral part of the normal biome, and in some cases a valuable food plant for insects, why are they a potential problem:
    - control mechanism (fire or grazing) may be weak or absent leading to the species becoming dominant
    - species may have been modified or 'improved' for horticultural or agricultural purposes and become almost indistinguishable from the original unmodified species (other than at DNA level) but are much more vigorous.

[**The fact that Ragwort is poisonous to horses and cattle is not usually an issue on conservation sites].

What's next?

- A copy of the slides and associated Manual will be issued after the course.

The Acid Test!!! - July 2025

Site visit to Old Down, to practice:

- using site survey documentation
- seed harvesting & processing

Natural Basingstoke

Flora Surveying, Seed Collecting & Sowing: Appendices

Appendix A: Reference Material

Beginners:

A **photographic flower index, in date sequence of flowering,** is recommended.

Title/ description	Author
Wildflowers of Britain	**Roger Phillips**
Wildflowers of Britain Month by Month	**Erskine Wilson**
SEEK	**App**
	App

Experienced:

A **technical manual, which includes information on habitat, distribution, flowering period** etc., is recommended

Title/ description	Author
The Wild Flower Key	**Rose**
Wild Flower Guide (Collins)	**Streeter, Hart-Davies, Hardcastle, Cole & Harper**

Appendix B – Species List
Calcareous meadow, hedgerow & woodland edge

Calcareous Meadow (34)

Core perennials 15 common & 15 optional

Bulbous Buttercup - Ranunculus bulbosus
Birdsfoot trefoil - Lotus corniculatus
Black medick - Medicago lupilina
Bladder Campion - Silene vulgaris
Common catsear - Hypchoeris radicata
Common knapweed -- Centaurea nigra
Common vetch - Vicia sativa
Cowslip - Primula veris
Dropwort - Filipendula vulgaris
Field scabious - Knautia arvensis
Greater Knapweed - Centaurea scabiosa
Hedge Bedstraw - Galium album
Hoary plantain - Plantago
Horseshoe Vetch - Hippocrepis comosa
Kidney vetch - Anthyllis vulneraria
Lady's bedstraw - Galium verum
Meadow Buttercup - Ranunculus acris
Musk Mallow - Malva moschata
Oxeye daisy - Leucanthemum vulgare
Red clover - Trifolium pratense
Ribwort plantain - Plantago lanceolata
Rough hawkbit - Leontodon hispidus
Sainfoin – Onobrychis viciifolia
Salad burnet - Poterium sanguisorba
Self-heal - Prunella vulgaris
and……
Small Scabious - Scabiosa columbaria
Sorrel - Rumex acetosa
Stocky mouse-ear - Cerastium glomeratum
Yarrow - Achillea millefolium
Wild Carrot - Daucus carota

Annuals – 2 common & 2 optional

Blue Fleabane - Erigeron acer
Common centaury - Centaurrium erythraea
Fairy flax - Linum catharticum
Field Poppy Poppy - Papaver rhoeas

Hedgerow and Woodland edge (26)

Core perennials 12 common &14 optional

Agrimony - Agrimonia eupatoria
Cow Parsley -Anthriscus sylvestris
Crosswort -Cruciata laevipes
Common Knapweed - Centaurea nigra
Field Scabious - Knautia arvensis
Garlic Mustard - Alliaria petiolata
Greater Knapweed - Centaurea scabiosa
Hedge Bedstraw - Galium mollugo
Ladies' Bedstraw - Galium verum
Hedge Crane's-bill - Geranium pyreniacum
Lesser Burdock - Arctium minus
Meadow Crane's bill - Geranium pratense
Musk Mallow - Malva moschata
Oxeye Daisy - Leucanthemum vulgare
Ragged Robin - Silene flos-cuculi
Ribwort Plantain- Plantago lanceolata
Rough Chervil - Chaerophyllum temulum
Red Campion - Silene dioica
Selfheal - Prunella vulgaris
Teasel -Dipsacus fullonum
Upright Hedge-parsley - Torilis japonica
Vipers Bugloss - Echium vulgare
White Campion -Silene latifolia
Wild Carrot- Daucus carota
Wood Avens -Geum urbanum
Yarrow -Achillea millefolium

Appendix B – Species List
Woodland and heath

Woodland

Core perennials
11common &
7 optional

Cow Parsley - Anthriscus sylvestris
Deadly Nightshade - Atropa belladonna
Dog Violet - Viola riviniana
Dogs Mercury - Mercurialis perennis
Enchanter's nightshade - Circaea lutetiana
Foxglove - Digitalis purpurea
Greater Stichwort - Stellaria holostea
Goldilocks Buttercup - Ranunculus auricomus
Herb Robert - Geranium Robertianum
Lesser Celendine - Ficaria verna
Meadowsweet - Filipendula ulmaria
Primrose - Primula vulgaris
Ragged Robin - Silene flos-cuculi
Red Campion - Silene dioica
Rough Chervil - Chaerophyllum temulum
Sweet Violet - Viola oderata
Wood anemone - Anemone nemerosa
Wood Avens - Geum urbanum

Poor Wastes

This is dry, neutral, very nutrient poor soil In which hardy and adaptable species survive in the absence of competition from more specialised species - 11common & 3 optional

Black Medic – Medicago lupulina
Bladder Campion – Silene vulgaris
Cats ear/hawkbit – Hypochaeris tradicata
Common Agrimony – Agrimonia eupatoria
Common Hemp Nettle -Galeopsis tetrahit
Common St John's Wort – Hypericum perforatum
Foxglove – Digitalis purpurea
Garlick Mustard – Alliaria petiolate
Hedge Woundwort – Stachys silvaticus
Scentless Mayweed – Matricaria maratima
Selfheal – Prunella vulgaris
Teasle – Dipsacus fullonum
Valerian – Valerian officinalis
Yarrow – Achillea millefolium

Lowland Heath

Core perennials
7 common &
10 optional

Barren Strawberry - Potentilla sterilis
Bell Heather - Erica cinerea
Birds foot trefoil - Lotus corniculatus
Common Dog-Violet - Viola riviniana
Cross leaved heather-Erica tetralix
Crowberry - Empetrum nigrum
Devils-bit Scabious - Succisa pratensis
Harebell - Campanula rotundifolia
Hawkbit Species (Miscellaneous) - Leontodon
Heath Bedstraw - Galium saxatile
Heather - Calluna vulgaris
Lousewort - Pedicularis
Meadow Saxifrage -Saxifraga granulata
Meadowsweet - Filipendula ulmaria
Petty whin - Genista anglica
Square Stemmed St Johns Wort - Hypericum tetrapterum
Tormentil - Potentila errecta

Appendix B – Species List
Grassland variants

Grassland Variants

Wet meadow & loamy soil by streams(30)

Core – 16 common & 14 optional

Agrimony - Agrimonia eupatoria
Betony - Betonica officinalis
Common Knapweed - Centaurea nigra
Common Sorrel - Rumex acetosa
Dandelion - Taraxacum officinale
Devil's-bit Scabious - Succisa pratensis
Field Scabious - Knautia arvensis
Great Burnet - Sanguisorba officinalis
Greater Birdsfoot Trefoil - Lotus pedunculatus
Hemp Agrimony - Eupatorium cannabinum
Lady's bedstraw - Galium verum
Musk Mallow - Malva moschata
Meadow Buttercup - Ranunculus acris
Meadow Vetchling - Lathyrus pratensis
Meadowsweet - Filipendula ulmaria
Ragged Robin - Silene flos-cuculi
Red Campion - Silene dioica
Ribwort plantain - Plantago lanceolata
Rough Hawkbit - Leontodon hispidus
Selfheal - Prunella vulgaris
Toadflax - Linarea vulgaris
Tufted Vetch - Vicia cracca
Yarrow - Achillea millefolium
Yellow Loosestrife - Lysimachia vulgaris
and ……..

Clay Soils (19)

Core – 13 common & 6 optional

Agrimony - Agrimonia eupatoria
Betony - Betonica officinalis
Birdsfoot trefoil - Lotus corniculatus
Common knapweed - Centaurea nigra
Common Sorrel -Rumex acetosa
Cowslip - Primula veris
Lady's bedstraw Galium verum
Meadow Buttercup - Ranunculus acris
Meadow Crane's-bill – Geranium pratense
Meadow Vetchling - Lathyrus pratensis
Meadowsweet Filipendula ulmaria
Musk Mallow - Malva moschata
Oxeye daisy - Leucanthemum vulgare
Ragged Robin - Silene flos-cuculi
Ribwort plantain - Plantago lanceolata
Salad burnet - Poterium sanguisorba
Self-heal - Prunella vulgaris
Tufted Vetch - Vicia cracca
Yarrow - Achillea millefolium

Sandy Soils (19)

Core - 12 common & 7 optional

Birdsfoot trefoil - Lotus corniculatus
Black Medick -Medicago lupulina
Bladder Campion - Silene vulgaris
Common knapweed - Centaurea nigra
Crosswort -Cruciata laevipes
Field scabious - Knautia arvensis
Horseshoe Vetch - Hippocrepis comosa
Kidney vetch - Anthyllis vulneraria
Lady's bedstraw - Galium verum
Meadow Buttercup - Ranunculus acris
Musk Mallow - Malva moschata
Oxeye daisy - Leucanthemum vulgare
Ribwort plantain - Plantago lanceolata
Salad burnet - Poterium sanguisorba
Sheeps Sorrel - Rumex acetosella
Viper's-bugloss - Echium vulgare
White Campion - Silene latifolia
Wild Carrot - Daucus carota
Yarrow - Achillea millefolium

……in pond edges and ditches:

Gypsywort - Lycopus europaeus
Corky-fruited Water-dropwort - Oenanthe pimpinelloides
Tufted Vetch - Vicia cracca
Yellow Iris - Iris pseudacorus
Wild Angelica - Angelica sylvestris
Water Avens - Geum rivale

Natural Basingstoke

Appendix C:
Ancient Woodland Indicator Species

Ancient Woodland Indicator species

Of the AWI species listed for Hampshire, the flowering plant species (i.e. excluding trees, shrubs, grasses and ferns) are as follows:
***Species listed in italics are bulbs or corms and are normally propagated from these rather than from their seeds.**

Local Name	Scientific Name	Woodland Habitats specifics	Flower mnths
Yellow Pimpernel	Lysmacia nemorum	Neutral soil	5-9
Common Cow-wheat	Melampyrum pratensis	Chalk & wet soils	5-9
Three-veined Sandwort	Moehtingia trinervia	Richer soils	5-6
Wild Daffodil	*Narcissus psueonarcissus*	Clay and loam soiil	3-4
Bird 's-nest Orchid	*Neottia nidus-avis*	Chalk beech woods	5-7
Early Purple Orchid	*Orchis maculata*	Chalk & neutral clay soil	4-6
Wood-sorrel	Oxalis acetosella	Dry	4-5
Herb-Paris	Paris quadrifolia	Damp chalky soil	5-7
Greater Butterfly-orchid	*Platanthera chlorantha*	Calcareous & neutral clay	6-7
Solomon's-seal	Polygonatum multiflorum	Dry calcareous or sand soil	5-6
Barren Strawberry	Potnilala sterilis		2-5
Primrose	Primula vulgaris		3-6
Narrow-leaved Lungwort	Pulmonaria longifolia	Clay or loam soil	4-5
Goldilocks Buttercup	Ranucula auricomus	Neutral soil	4-6
Black Currant	Ribes nigrum	Wet woodland	4-5
Red Currant	Ribes rubrum	Wet woodland	4-5
Field-rose	Rosa arvensis	Clay soil	6-7
Butcher's Broom	Ruscus aculeatus	Dry	1-4
Sanicle	Sanicula europaea	Chalk beech woods	5-8
Orpine	Sedum telephium	Dry sand & gravel	3-5
Saw-wort	Serratula tinctoria	Fens	7-9
Golden-rod	Solidago virgaurea	Dry	7-9
Black Bryony	Tamus communis	Chalk or neutral soil	5-7
Wood Speedwell	Veronica montana	Calcarious and neutral soil	4-7
Bush Vetch	Vicia sepium		4-8
Wood Vetch	Vicia syvatica	Open woods	6-8
Marsh Violet	Viola palustris	Acid wet woods	4-7
Early Dog-violet	Viola reichenbachiana	Chalky soil	3-5

	Scientific Name	Habitats	Flower mnths
Moschatel (Townhall Clock)	Adoxa moschealellina	Richer soil	4-5
Ramsons	*Allium ursnium*	Damp chalky or richer soil	4-6
Wood Anemone	Anemone nemorosa	Dry	3-4
Columbine	Aquilegia vulgaris	Calcareous damp soil	5-6
Nettle-leaved Bellflower	Campanula trachelium	Calcareous soil	7-9
Large Bitter-cress	Cardamine amara	Damp	4-6
Sword (Narrow) -leaved Helleborine	*Cephalanthera longifolia*	Chalk beech woods	5-6
Climbing Corydalis	Ceratocapnos claviculata	Dry neutral to acid soil	6-10
Alternate-leaved Golden-saxifrage	Chrysosplenium oppositifolium	Boggy woods	4-5
Meadow Saffron	Colchicum autumnale	Damp	8-10
Pignut	Conopodium majus	Dry neutral to acid woods	5-6
Lily-of-the-valley	*Convalleria majalis*	Dry chalk or sandy soil	5-6
Small Teasel	Dipsacus pilosus	Damp	7-8
Broad-leaved Helleborine	*Epipactis heleborine*		7-9
Narrow-lipped Helleborine	*Epipactis meulleri*	Chalk beech woods	6-7
Violet Helleborine	*Epipactis purpurata*	Calcareous clay & beech woods	8
Wood Spurge	Euphordia amygdalodes	Basic neutral soil	4-5
Sweet Woodruff	Galium odoratum	Richer- calcareous soil	5-6
Water Avens	Geum rivale	Wet wodland	5-9
Green Hellebore	Helleborus viridis	Calcareous soil	1-4
Tutsan	Hypericum androsaemum	Neutral soil	6-8
Slender St John's-wort	Hypericum pulchrum	Dry neutral soil	6-8
Stinking Iris	*Iris foetidissima*	Chalky soil	5-7
Yellow Archangel	Lamiastrum galeobdolon	Chalk or richer soil	5-7
Toothwort	Lathrarea squamaria	Rich or calcareous soil	4-5
Narrow-leaved Everlasting-pea	Lathyrus latifolius	Open woods	6-8
Bitter-vetch	Lathyrus linifolius	Neutral to acid soil	4-7

Appendix D: NB Seed Inventory

List of common locally found species and habitats they are found in -	Woodland- decid.	Woodland edge	Hedgerow	Meadow - Chalk	Meadow - Water	Meadow - Acid/ neut	Poor Wastes	Heaths	A/B/P	Flower Colour	Max Stalk Height	Flower Period	Seed Stock Ref
	W	E	H	M-c	M -w	M-a	P	Hth					
Agrimony - Agrimonia eupatoria		X	X		X	X			P		50 cms	Jun - Sept	11
Barren Strawberry - Potentilla sterilis	X		X				X	X	P				100
Bell Heather - Erica cinerea								X	P				101
Betony - Betonica officinalis					X	X			P		50cms	Jun - Sept	1
Birdsfoot trefoil - Lotus corniculatus				X	X	X		X	P		35cms	May - Aug	2
Black Medick -Medicago lupulina				X	X				A		40cms	May - Aug	3
Black Mullein - Verbascum nigram				x					P		120cms	Jun - Oct	4
Bladder Campion - Silene vulgaris				X	X				P		80cms	May - Aug	5
Blue Fleabane - Erigeron acer (annual)				X					P		35cms	Jul - Sept	6
Bugle - Ajuga repans	x	x				x			P		30cms	May - Jul	7
Bulbous Buttercup - Ranunculus bulbosus				X		X			P				102
Bush Vetch - Vicia sepium		x	x	x			x		P		>60cms	Apr - Sept	8
Clustered Bellflower - Campanula glomerata				x					P		15cms	May - Sept	10
Common Cats ear - Hypochaeris radicata				X					P		50cms	May - Oct	9
Common Centaury - Centaurrium erythraea(annual)				X					A		15 cms	Jun - Aug	12
Common Figwort - Scrofularia nodosa	X	X					x		P				104
Common Fleabane - Pulicaria dysenterica		X		X					P		40cms	Jul - Sept	13
Common Hemp Nettle -Galeopsis tetrahit			X				X		A		80cms	Jul - Sept	14
Common Knapweed - Centaurea nigra		X	X	X	X	X			P				40
Common Mallow - Malva Sylvestris			X						P		75cms	Jun - Sept	15
Common St John's Wort - Hypericum perforatum									P		50cms	Jul - Sept	16
Common Valerian - Valeriana officinalis				x	X		x		P				105
Common Vetch - Vicia sativa				X					P		>150cms	Apr - Sept	17
Corky-fruited Water-dropwort - Oenanthe pimpinelloides					X				P				106
Cow Parsley -Anthriscus sylvestris	X	X	X						P				107
Yellow Rattle - Rhinanthus minor				X	X	X			A		40cms	Apr - Sept	73
Counts	25	33	39	54	44	23	19	17					128