

Pilley Bridge Nature Reserve, Cheltenham
Community Orchard Draft Management Plan

Produced for: The Friends of Pilley Bridge Nature Reserve

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Summary

The purpose of this report is to outline the plant diversity observed at the Pilley Bridge Community Orchard. Then, using literature reviews and current theory, address important issues with regards to managing the plant diversity of this site. A number of potential management strategies are suggested for the Friends of Pilley Bridge Nature Reserve (FPBNR), should they wish to take them on. However, the schemes here are not guaranteed to provide the desired results nor whether they can be applied in practice. Some management suggestions maybe applied elsewhere within the reserve if they are not feasible within the orchard. Overall, this report provides a starting point for the FPBNR's aim of increasing plant diversity within the community orchard. This plan has also been designed to work alongside other ecological management reports for the nature reserve and acts as a foundation of scientific knowledge for the site. There is much scope for further ecological investigation and repetitions of surveys within the community orchard.

The author

This draft report has been written by H. Dennish, an undergraduate biology student of the University of Gloucestershire with a strong interest in ecology and botany.

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1. Introduction

- 1.1 The community orchard is located within the western corner of the Pilley Bridge Nature Reserve. This site was opened to the public in October 2013 following a change in land use from an overgrown garden and allotment. It is now a refuge for plant and animal life and still hosts a number of fruit tree varieties dated from its time as an allotment. Before the site was opened, many Ash and Sycamore trees were cleared, making the orchard one of the few open spaces within the reserve that receives maximum sunlight; a necessity for the growth and diversity of wildflower species. An overview of the orchard is displayed in figure 1.
- 1.2 The orchard also provides an area for community events to be held, organised by the FPBNR. Thereby helping to connect people to their local nature reserve for leisure and educational purposes. It is already used by a number of children's groups including Woodcraft Folk, Nature Explorers, Scouts and Naunton Park Primary school.
- 1.3 As a fairly new site, little is known of the community orchard's biological diversity. This report presents the results of an initial plant diversity survey of the orchard, which was carried out from 14th May to 17th June 2014. The study has provided a foundation of ecological knowledge for the site.

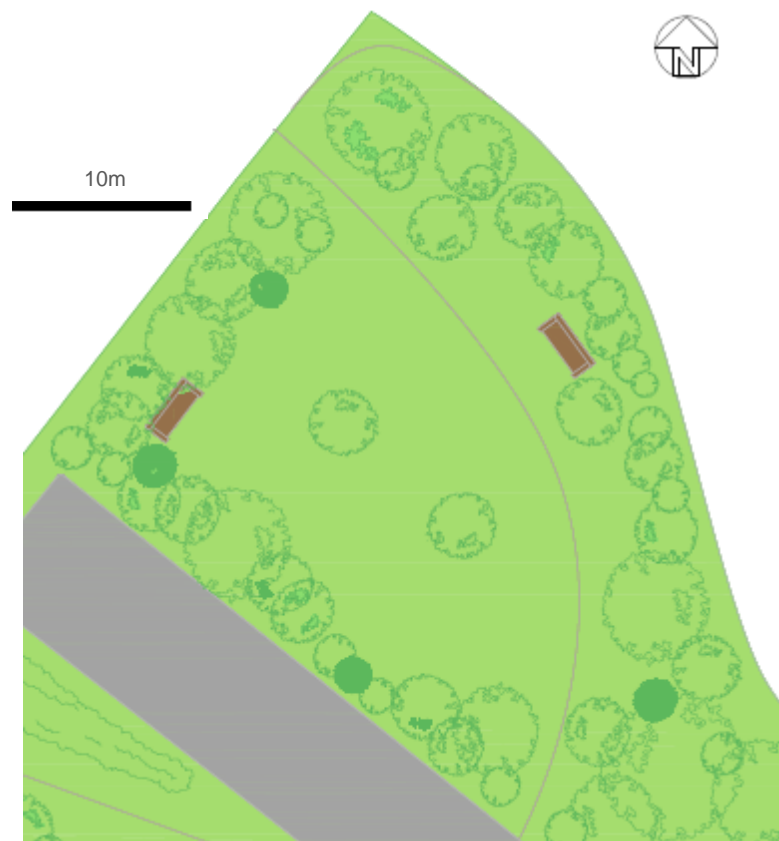


Figure 1. Aerial view of the Pilley Bridge community orchard (Provided by SK Drawing Services Ltd).

2. Management objectives and ecological importance

- 2.1 As set out by the FPBNR, the ongoing aim for the community orchard is to maximise and maintain its biological interest by increasing biodiversity and habitat heterogeneity; with particular focus on increasing plant species diversity.
- 2.2 The plant diversity survey discussed earlier has taken the first step in achieving this aim. This recent survey assessed the number of different species and their characteristics, what habitats they occupy and what faunal species might benefit from them; thus providing a foundation of biodiversity knowledge for the site to be built upon and a record of species that could be increased through effective site management.
- 2.3 Biodiversity is a measure of ecosystem health and longevity and its resilience to disease, stress and disturbance. Fragmentation and loss of habitats through urbanisation are drivers of biodiversity loss. Thus making urban nature reserves like Pilley Bridge havens for a variety of species. Increasing the biodiversity of nature reserves like Pilley Bridge is a method of conserving what natural habitats are left in otherwise urban environments; providing niches for plant, animal and fungal species alike.

3. Plant diversity of the community orchard

- 3.1 84 plant species have been recorded within the orchard (including 16 species from the adjacent footpath that runs behind Mead road towards Old Bath road, Cheltenham). See Appendix for a full list of species.
- 3.2 Species' families, flowering periods and life cycles (herbaceous - perennial, annual, biannual; woody – evergreen, deciduous) have also been researched. In total, 73% of species flowered only between April and September. In addition, only 18 woody species were recorded, mostly within the hedgerows enveloping the orchard. This research has provided essential information for the management of the site and has helped develop ideas of how to increase plant species richness; including direct introduction of species of different flowering times and life cycles to provide variation in the plant community.
- 3.3 Additionally, the plant families that had the highest species richness were Poaceae (grass), Rosaceae (rose) and Asteraceae (daisy) which had 10, 9 and 7 species respectively. The variety of grass species acts as a bio-indicator of a variety of habitats present within the orchard site.

4. Management proposals

4.1 Current management of the community orchard

There is a voluntary work party that generally maintains the orchard site on a monthly basis but there are currently no methods proposed to increase the site's plant diversity.

4.2 Methodology

Following data collection and research from the plant survey and research of management methods, the aim of increasing plant diversity can be met through three primary initiatives: Introduction of species based on flowering period, life cycle and faunal species interactions; maintaining species already present and physical management methods that increase species richness through ecological disturbance:

4.3 Introduction of species

4.3.1. Based on flowering period

Only 23 species flowered into or solely within the autumn and winter months, including Common Ivy (*Hedera helix*). To increase the plant diversity of the site, it would be advisable to introduce more flowering species within this period, thus creating year-round flowering and provide early or late sources of nectar for pollinators. This may include the Common Snowdrop (*Galanthus nivalis*) which flowers January to March; Colt's-foot (*Tussilago farfara*) which flowers February to April, Cowslip (*Primula veris*) which flowers April to May, Butterbur (*Petasites hybridus*) which flowers early March to May, Daffodil (*Narcissus pseudonarcissus*) which flowers February to April, Meadow Saffron (*Colchicum autumnale*) which flowers from August through to November; Shepherd's purse (*Capsella bursa-pastoris*), Chickweed (*Stellaria media*), Common Groundsel (*Senecio vulgaris*) and Field Speedwell (*Veronica persica*) can all flower all year round and finally Oxford Ragwort (*Senecio squalidus*) which flowers May through to December. Most of these species are common, local and likely to be successful within the orchard habitat.

4.3.2. Based on life cycle

The majority of species recorded were herbaceous perennial species. Introducing species that range in life cycle will provide a varied composition of plant life year after year. More importantly, an increase in the number of woody species would be invaluable within the hedgerows surrounding the orchard, adding to species including English Elm (*Ulmus procera*) and Holly (*Ilex aquifolium*) to create a balance of evergreen and deciduous species and to enhance the biological value of these hedgerows as priority conservation habitats within the UK¹.

4.3.3. Based on faunal species interactions

Wildflowers are major attractions to the local fauna and are essential as both a habitat and a food source. Species interactions can become very intimate, for example, Vetch, Clover and Ivy species (*Vicia*, *Trifolium* and *Helix spp*) are very important to Bumble Bee species (*Bombus spp*) as continuous, early and late sources of nectar. Furthermore, Bramble (*Rubus*) is crucial to butterfly fritillaries (Nymphalidae family) as a source of rich nectar, however, the majority of their food plants (where eggs are laid) exist within the Violet family (*Violaceae*), of which no species have been recorded within the community orchard so far. Therefore, an introduction of Dog violet (*V.riviniana*) and Sweet violet (*V.odorata*) may have a chance of increasing fritillary diversity. Additionally, members of the Pea family (Fabaceae) including Bird's-foot Trefoil (*Lotus corniculatus*), Horseshoe Vetch (*Hippocrepis comosa*) and Kidney Vetch (*Anthyllis vulneraria*) are all important food plants of Blue (Lycaenidae) and Skipper (Hesperiidae) species of butterflies. They are also a source of nectar for other pollinators. As members of the Pea family thrive well in the orchard at present, successful introduction of these species is likely and may aid to increase these butterfly species. It may also be of interest to increase the grass species diversity as grasses are often habitat for Brown (Satyrinae) species of butterfly but also provide habitat for ground invertebrates including beetles. This ultimately supports insectivorous birds and small mammals, having influence upon the entire ecosystem. An increase in fruiting woody species also provides a valuable food source for bird species during winter; an increase in these species is already proposed as a number of fruit trees are being planted for the purpose of the community orchard.

¹ UK Biodiversity Action Plan.

4.4 Maintenance of species

Aside from introducing species directly, natural colonisation and dispersal of plant species are accepted and encouraged by the FPBNR as another method of increasing diversity. For example, notable garden escapees including *Geranium versicolor* (Pencilled Crane's-bill), have colonised both the orchard and its adjacent footpath. The reserve is to be kept semi-domestic so this colonisation method will be invaluable in sustaining species diversity and is recommended to maintain a natural turnover of species over the years. Additionally, a number of species were only recorded in certain areas of the orchard and its adjacent footpath, including Lungwort (*Pulmonaria officinalis*) which was only found within shadier areas of the orchard and Wall Speedwell (*Veronica arvensis*) which was only found along the footpath, exposed to more direct sunlight. Species like these are important as they may reflect a particular habitat that needs maintaining to keep these species present. Any species locally in decline in the reserve or orchard should also be replenished if necessary through direct seeding.

4.5 Physical management methods

The following initiatives aim to increase or maintain plant species richness without introduction or natural colonisation.

- 4.5.1. Firstly, mowing and cutting back vegetation is known to be very effective for increasing plant species richness. This method is known to suppress dominant species, including grasses and even invasive species. This allows fugitive species, including wildflowers, to colonise and coexist. These effects lead to an overall increase in plant species diversity, a similar effect to that of natural grazing. This increase in plant diversity supports a variety of invertebrates, therefore having influence over the entire ecosystem. Mowing supports the 'Intermediate Disturbance Hypothesis', which suggests that species diversity reaches a maximum in an area at an intermediate frequency and intensity of disturbance. From this, a twice-annual mowing of the orchard site is proposed, coinciding with community events (figure 2). Cutting back of shrubbery and trees will also allow a heterogeneous complex of light and shade, enabling a diversity of light and shade-tolerant species to exist. The 84 species recorded within this site suggests the area has potential for revealing a diverse seed bank ready to emerge post-mowing. Mowed clippings, foliage and logs could be left to decompose naturally in a compost heap – providing an ecological niche for detritivores and will create natural fertiliser for the orchard. Additionally, mowing will generally allow access to the orchard within the summer months for the local community to enjoy. Overall, this is an environmentally friendly initiative of managing areas like the community orchard.



Figure 2. The Pilley Bridge Community Orchard. This entire area will be subject to management proposals.

- 4.5.2. Secondly, nutrient management is important. Leaving the site to naturally accumulate and cycle nutrients, such as nitrogen, is advisable to achieve a balanced nutrient base within the orchard, providing coexistence of species. An increase in artificial fertility is known to favour specific, dominant species including grasses, thus reducing species richness. At present, only a small, local amount of compost is used for introducing fruit trees and is recommended not to use at all when seeding introduced wild flowers.
- 4.5.3. Trampling, a high frequency disturbance, is known to have a detrimental effect on species diversity. Species including grasses (Poaceae) and plantains (Plantaginaceae) are more tolerant to this disturbance and begin to dominate in trampled areas, including footpaths, as seen within the orchard. The centre of the orchard suffers trampling on a daily basis and is likely to suffer heavy disturbance during two yearly community events. As this cannot be prevented, it may be a suggestion to create an open and undisturbed habitat elsewhere, to promote growth and diversity of wild flowers away from the orchard, thereby maintaining wildflower development during these periods.

- 4.5.4. Pilley Bridge Nature Reserve is an ecologically isolated habitat, with only neighbouring parks and gardens nearby. The FPBNR are hoping to extend the reserve towards the East, increasing not only the size of the nature reserve but also linking it as a corridor to the grasslands of Leckhampton Hill and Lilley Brook Golf Club, which is home to a population of ancient English Oak trees; thus reducing the reserves isolation. Although a long term initiative, this connectivity may positively impact the floral and faunal diversity within the reserve and the orchard by facilitating dispersal of species. There is also another plan to increase the size of the community orchard, connecting it to the secondary woodland of the reserve. This may help increase plant species diversity, following the species-area relationship.
- 4.5.5. The creation of new habitats by the use of habitat dens is a great attraction to a variety of wildlife including invertebrates, birds and small mammals within the community orchard. The dens consist of logs from trees felled and foliage and branches collected from areas cut back. Linking these habitat dens to the hedgerows of the orchard would provide a habitat corridor for diffusing species. The habitat dens already in place have been naturally covered with Bramble (*Rubus*) which, when flowers, is an important species to pollinators, so the habitat dens are invaluable to the site. Rotting logs and branches of the dens will also provide a suitable habitat for fungi to establish come autumn. Furthermore, common lizards have been known to live within dry stone walls in the east of the reserve. It may be a thought of creating a similar habitat in the community orchard due to the exposure of sun it receives, thus perhaps encouraging reptilian life. An overall promotion of a diverse range of habitats and resources will provide niches for species to coexist, therefore increasing biodiversity.
- 4.5.6. Increasing the diversity of plant species through methods already mentioned can be advantageous in providing natural resistance to dispersing invasive species, similar to disturbance of mowing as it inhibits competitive species. This may be of some importance when considering problem species within the reserve including yellow archangel (*Lamium galeobdolon*). Problem species are to be managed if an impact upon other plant species occurs, for example overhanging trees and shrubs causing excessive shading or invasive species taking dominance.

5. Conclusions

Increasing plant diversity is dependent upon an array of ecological factors; many of which are out of managerial control, such as geology and climate. In addition, each plant species has its own optimum requirements and characteristics. As a result of this, introducing species of local provenance is likely to be the most effective approach. The success of the physical methods proposed will need to be investigated as a developing and ongoing initiative if they are to achieve the aim of increasing plant species diversity. A combination of all three initiatives suggested would be an effective starting point. Overall, further research is required to extend this report and it is recommended to be used in conjunction with the current management plan of the reserve; creating an overall scheme to increase the biodiversity of the community orchard as an ecosystem at the local scale. Follow up studies may include: repeating the plant survey or carrying out; invertebrate, mammal, avian and reptilian surveys. An investigation into plant-invertebrate interactions would also be an invaluable addition to this report (see 4.3.3). Undoubtedly, this site is becoming of great scientific interest to the FPBNR, the local community, children's groups, ecologists and students alike, making the community orchard and the whole nature reserve of importance to conservation.

6. Appendix

Plant species recorded within the orchard, including their flowering period and life cycle researched, and organised into plant families. Abbreviations: agg = aggregate; ssp = subspecies (singular); spp = species (plural); per = perennial; ann = annual; bi = biannual; dec = deciduous; eve = evergreen. Excel versions available.

Species				
Family	Scientific name	Common name	Flowering period**	Life cycle
Aceraceae (Maple)	<i>Acer campestre</i>	Field Maple	5-6	Dec
	<i>Acer pseudoplatanus</i>	Sycamore	4-6	Dec
Apiaceae (Carrot)	<i>Anthriscus sylvestris</i>	Cow Parsley	4-6	Per
	<i>Heracleum sphondylium</i>	Hogweed	6-9	Bi
Aquifoliaceae (Holly)	<i>Ilex aquifolium</i>	Holly	5-8	Eve
Araliaceae (Ivy)	<i>Hedera helix</i>	Common Ivy	9-11	Eve
Araceae (Arum)	<i>Arum maculatum</i>	Lords and Ladies*	4-5	Per
Asteraceae (Daisy)	<i>Bellis perennis</i>	Daisy	3-10	Per
	<i>Cirsium vulgare</i>	Spear Thistle	7-10	Bi
	<i>Leucanthemum vulgare</i>	Ox-eye Daisy	5-9	Per
	<i>Picris echioides</i>	Bristly Ox-tongue	6-10	Ann
	<i>Sonchus asper</i>	Prickly Sow-thistle	6-10	Ann
	<i>Sonchus oleraceus</i>	Smooth Sow-thistle*	6-10	Ann
	<i>Taraxacum officinale</i>	Dandelion	3-10	Per
	<i>Myosotis arvensis</i>	Common Forget-me-not	4-9	Per
Boraginaceae (Borage)	<i>Pentaglottis sempervirens</i>	Green Alkanet	4-7	Per
	<i>Pulmonaria officinalis</i>	Lungwort	4-5	Per
	<i>Symphytum orientale</i>	White Comfrey*	3-5	Per
Brassicaceae (Cabbage)	<i>Alliaria petiolata</i>	Garlic Mustard	4-7	Per
	<i>Sisymbrium officinale</i>	Hedge Mustard*	6-7	Ann
Caprifoliaceae (Honeysuckle)	<i>Sambucus nigra</i>	Elder	6-7	Dec
Caryophyllaceae (Campion)	<i>Silene dioica</i>	Red Campion	3-10	Per
Celastraceae (Spindle)	<i>Euonymus fortunei</i>	Emerald 'n' Gold	5-6	Eve
Clusiaceae (St John's-wort)	<i>Hypericum androsaemum</i>	Tutsan*	6-8	Dec
	<i>Hypericum hirsutum</i>	Hairy St John's-wort	7-8	Per
Convolvulaceae (Bindweed)	<i>Catystegia sepium</i>	Hedge Bindweed	7-9	Per
Comaceae (Dogwood)	<i>Cornus sanguinea</i>	Common Dogwood	5-7	Dec
Cyperaceae (Sedge)	<i>Carex pendula</i>	Pendulous Sedge	5-6	Per
Equisetaceae (Horsetail)	<i>Equisetum arvense</i>	Common Horsetail*	4-10	Per
Fabaceae (Pea)	<i>Trifolium repens</i>	White Clover	6-9	Per
	<i>Ulex europaeus</i>	Gorse	1-12	Eve
	<i>Vicia sativa</i>	Common Vetch	5-9	Ann
	<i>Vicia sepium</i>	Bush Vetch	4-8	Per
	<i>Melilotus altissimus</i>	Tall Melilot	6-8	Bi
Geraniaceae (Geranium)	<i>Geranium endressii</i>	French Crane's-bill*	6-7	Per
	<i>Geranium robertianum</i>	Herb Robert	4-9	Ann
	<i>Geranium versicolor</i>	Pencilled Crane's-bill*	5-9	Per
Grossulariaceae (Currant)	<i>Ribes uva-crispa</i>	Gooseberry	3-5	Dec
Iridaceae (Iris)	<i>Iris pseudacorus</i>	Yellow Iris	5-7	Per
Juncaceae (Rush)	<i>Juncus effusus</i>	Soft Rush	6-8	Per
Lamiaceae (Dead-nettle)	<i>Ajuga reptans</i>	Bugle	4-6	Per
	<i>Lamium album</i>	White Dead-nettle	5-12	Per
	<i>Stachys sylvatica</i>	Hedge Woundwort*	7-9	Per
Liliaceae (Lily)	<i>Allium triquetrum</i>	Three-cornered Garlic*	4-6	Per
	<i>Hyacinthoides hispanica</i>	Spanish Bluebell	4-6	Per
Oleaceae (Olive)	<i>Fraxinus excelsior</i>	Common Ash	4-5	Dec
Onagraceae (Willowherb)	<i>Epilobium hirsutum</i>	Great Willowherb	7-8	Per
	<i>Epilobium lanceolatum</i>	Spear-leaved Willowherb	7-9	Per
Plantaginaceae (Plantain)	<i>Plantago lanceolata</i>	Ribwort Plantain	4-10	Per
	<i>Plantago major</i>	Greater Plantain	6-10	Per
Primulaceae (Primrose)	<i>Anagallis arvensis</i>	Scarlet Pimpernel	6-8	Ann
Poaceae (Grass)	<i>Anisantha sterilis</i>	Barren Brome*	5-7	Ann
	<i>Arrhenatherum elatius</i>	False Oat-grass	6-9	Per
	<i>Brachypodium sylvaticum</i>	False Brome*	7-8	Per
	<i>Cynosurus cristatus</i>	Crested Dog's-tail	6-8	Per
	<i>Dactylis glomerata</i>	Cock's-foot	6-9	Per
	<i>Elymus caninus</i>	Bearded Couch*	6-9	Per
	<i>Lolium perenne</i>	Perennial Rye-grass	5-8	Per
	<i>Poa annua</i>	Annual Meadow-grass	1-12	Ann
	<i>Poa trivialis</i>	Rough Meadow-grass	6-7	Per
	<i>Schedonorus arundinacea</i>	Tall Fescue*	5-7	Per
Polygonaceae (Dock)	<i>Rumex crispus</i>	Curled Dock	6-10	Per
	<i>Rumex obtusifolius</i>	Broad-leaved Dock	6-10	Per
Ranunculaceae (Buttercup)	<i>Aquilegia vulgaris</i>	Common Columbine	5-6	Per
	<i>Ranunculus acris</i>	Meadow Buttercup	5-8	Per
	<i>Ranunculus ficaria</i>	Lesser Celandine	3-5	Per
	<i>Ranunculus repens</i>	Creeping Buttercup	5-8	Per
Rosaceae (Rose)	<i>Crataegus monogyna</i>	Hawthorn	5-6	Dec
	<i>Geum urbanum</i>	Wood Avens	5-8	Per
	<i>Malus spp.</i>	Wild Apple variety	4-5	Dec
	<i>Prunus domestica ssp.</i>	Wild Plum (Damson)	4-5	Dec
	<i>Prunus spinosa</i>	Blackthorn	3-5	Dec
	<i>Prunus spp.</i>	Wild Plum variety	4-5	Dec
	<i>Pyrus spp.</i>	Wild Pear variety	4	Dec
	<i>Rubus fruticosus agg.</i>	Bramble	5-9	Per
Rubiaceae (Bedstraw)	<i>Rubus idaeus</i>	Raspberry	6-8	Per
	<i>Galium aparine</i>	Cleavers	6-8	Ann
Scrophulariaceae (Figwort)	<i>Rhinanthus minor</i>	Yellow Rattle*	5-8	Ann
	<i>Scrophularia auriculata</i>	Water Figwort	6-9	Per
	<i>Veronica arvensis</i>	Wall Speedwell*	3-10	Ann
Solanaceae (Nightshade)	<i>Veronica chamaedrys</i>	Germander Speedwell	3-7	Per
	<i>Solanum dulcamara</i>	Woody Nightshade	6-9	Per
Ulmaceae (Elm)	<i>Ulmus procera</i>	English Elm	2-3	Dec
Urticaceae (Nettle)	<i>Urtica dioica</i>	Common Nettle	6-8	Per

*Species not recorded within the orchard. ** Months recorded as 1 to 12. 1 = January, 12 = December.