Green Infrastructure Action Plan for Pollinators

In South-east Wales

Blaenau Gwent

Caerphilly

Monmouthshire

Torfaen

TACP

December 2015

Front/back cover

Photographs: Andrew Nevill (TCBC)/Katie Partington (BGCBC)/Tim Rich (TACP)

GREEN INFRASTRUCTURE ACTION PLAN FOR POLLINATORS IN SOUTH-EAST WALES

Client: Monmouthshire County Council on behalf of Monmouthshire County Council and Blaenau Gwent, Caerphilly and Torfaen County Borough Councils

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Project Number: **2178**

Revision: **Rev 5**

Revision No.	Date of Revision	Prepared by	Date	Approved by	Date
0	**22.07.2015**	**SF TR TW**	**22.07.2015**	**JW**	**22.07.2015**
1	**30.07.2015**	**SF TR TW**	**30.07.2015**	**JW**	**30.07.2015**
2	**21.09.2015**	**SF TR TW JW**	**21.09.2015**	**JW**	**21.09.2015**
3	**22.09.2015**	**SF TR TW JW**	**22.09.2015**	**JW**	**22.09.2015**
4	**18.11.2015**	**SF TR TW JW**	**18.11.2015**	**JW**	**18.11.2015**
5	**11.12.2015**	**TR TW**	**11.12.2015**	**JW**	**11.12.2015**

Suggested citation:

TACP (2015). *Green infrastructure action plan for pollinators in South-east Wales.* Report to Monmouthshire County Council on behalf of Monmouthshire County Council and Blaenau Gwent, Caerphilly and Torfaen County Borough Councils December 2015. TACP UK Ltd.

CONTENTS

LIST OF FIGURES

LIST OF TABLES

ABBREVIATIONS

BGCBC	Blaenau Gwent County Borough Council
CBC	County Borough Council
CCBC	Caerphilly County Borough Council
CCW	Countryside Council for Wales
GI	Green Infrastructure
GIS	Geographic Information System
KWT	Keep Wales Tidy
LA	Local Authority
LBAP	Local Biodiversity Action Plan
LNR	Local Nature Reserve
MCC	Monmouthshire County Council
NERC	Natural Environment and Rural Communities
NNRs	National Nature Reserves
NRW	Natural Resources Wales
PRoW	Public Right of Way
SAC	Special Area of Conservation
SEWBReC	South-east Wales Biodiversity Records Centre
SEWDER	South-east Wales Directors of Environmental Regeneration
SINC	Site of Importance for Nature Conservation
SPAs	Special Protected Areas
SSSI	Site of Special Scientific Interest
SWTRA	South Wales Trunk Road Agency
TCBC	Torfaen County Borough Council

ACKNOWLEDGEMENTS

The *Green Infrastructure Action Plan for Pollinators in South-east Wales* was produced under the guidance of a steering group comprising Officers from Blaenau Gwent County Borough Council (BGCBC), Caerphilly County Borough Council (CCBC), Monmouthshire County Council (MCC) and Torfaen County Borough Council (TCBC):

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The following individuals/organisations were also consulted with during the process:

Alex Van der Nelson, Alison Jones, Amelia Collins, Andrew Davies, Anthony Crewe, BBCT, Benjamin Terry, Bron Afon, C Pinnel, Caroline Keay, Chris Latham, Claire Gardner, Dave Sagan, David Clements, David Roberts, Derek Elliot, Derek Price, Dewi Thomas, Elaine Wright, Fiona Ford, Frances Williams, Francis Ratnieks, Gerwyn Tumelty, Glynis Williams, Gwent Bee Keepers Association, Gwyn Bradley, Gwynfor Evans, Jaime Bohata, JE Lawrence & Son Ltd, Jemma Hall, Joe Hendy, John Byrne, Keith Jones, Keith Rogers, Keri Jones, Leanne Connor, Lee Pinney, M Evans-Jones, Michael Howe, Neil Jones, Nicola Davies, Nigel Leaworth, Nigel Leaworthy, P Gent, Paul Gray, Peter Frost, Phil Mountain, Rachael O'Shaughnessy, Richard Comont, Richard Healy, Sara Larman, Shelley Shears, Simon Jennings, Simon Morgan, Steve Hodges, Steve Horsham, Steve Williams, Steven Rogers, Tai Calon, Tim Bradfield, Timothy Farewell, Tony Corfield, Tracey Lovering, Vanessa Waddon, Veronika Brannovic, Welsh Bee Keepers Association.

Photographs were kindly provided by Andrew Neville (TCBC) and Katie Partington (BGCBC).

The project was managed by Gill Mackley of Mackley Davies Associates Ltd.

FRONTISPIECE

Wasting honey

'Wasting honey' conveys the struggle that bees are having because of the decline in flowers from which they gather nectar and pollen for making honey.

Medium: Honey on paper.

Shelley Shears BA Hons Art Practice 2015 Graduate Show Exhibition.

https://www.facebook.com/shelleytheworm

EXECUTIVE SUMMARY

Introduction

The *Green Infrastructure Action Plan for Pollinators in SE Wales* is part of the wider *Pollinators for Life* project which is funded through the Welsh Government's Nature Fund. This fund was established to try to address the decline in Welsh biodiversity through landscape-scale projects, recognising the interdependency of maintaining biodiversity with socio-economic factors.

The study area comprises Caerphilly, Blaenau Gwent, Monmouthshire and Torfaen Local Authority areas. However, the *Action Plan* has been developed in such a way that is applicable to other Local Authority areas and hence it could be applied throughout Wales.

Local authorities and the Welsh Government have legal and moral responsibilities for biodiversity, health and well-being for the future. The *Action Plan* forms an important component for delivering on these duties, providing specific actions for pollinators and is closely aligned with relevant Welsh Government and Local Authority policies including:

- Action Plan for Pollinators in Wales (July 2013);
- Well-being of Future Generations (Wales) Act (2015);
- Environment (Wales) Bill (Consultation draft May 2015);
- Natural Environment and Rural Communities Act (2006)(NERC Act); and
- Monmouthshire Pollinator Policy (January 2014).

Implementing the *Action Plan* will directly help the four local authorities to implement policy at four strategic levels: Local Authorities, Wales, the United Kingdom and International.

Local authorities own about 13-18% of the land in SE Wales and can lead by example by managing some of this land, providing multiple benefits for the community and pollinators.

The Importance of Pollinators

In Wales the main groups of pollinators are bees and wasps, flies (including hoverflies), butterflies and moths and beetles. Collectively these are responsible for pollinating approximately 75% of temperate flowering plant species and are hence critical to maintaining human life.

In Britain about 70 crops are dependent on bees, the production being valued at over £430 million per year. Within Wales these crops include hard fruit (apples, pears), soft fruit (e.g. strawberries,

raspberries), oil-seed crops, and peas and beans. They are also important to horticultural businesses, and to the public for fruit and vegetable production in allotments and gardens.

Pollinators are essential for the maintenance of biodiversity and the wider ecosystem through pollination of the wild plants which form the basis of most habitats. They are of intrinsic value in their own right as part of our natural heritage, and some, such as bees and butterflies, are widely appreciated by the public.

Pollinators are in decline across Wales, Britain and Europe and have been for many years. There are a variety of factors contributing to this decline which include:

- habitat loss;
- use of pesticides;
- changes in farming practices;
- pests and diseases; and
- urban development.

To reverse this decline, the following methods have been identified:

- increasing diversity of flower-rich resources;
- increasing abundance of food resource; and
- extending the availability of flower-rich resources throughout the life cycle of pollinators.

Green Infrastructure Action Plan

The *Action Plan* seeks to address the decline of pollinators throughout the study area by identifying baseline conditions, measures to benefit pollinators and the preparation of a series of management action plans. These are focused towards implementation on publicly owned areas of green infrastructure in order to encourage the spread of and raise awareness of the importance of pollinators for our health and wellbeing. Stakeholders from within local authorities, housing associations, statutory and non-statutory bodies were consulted during the process of producing the *Action Plan* and a review of good practice has been carried out in order to guide and inform the development of these actions.

The *Action Plan* is underpinned by relevant baseline Geographic Information System (GIS) data. These data help those responsible for delivering the *Action Plan* to identify candidate sites for further investigation and provide them with an objective evidence base for supporting the actions they choose to implement. In the future it is envisaged that these data will be hosted online in order to better facilitate their use by both stakeholders and where appropriate, the public.

The *Action Plan* is designed to be an easy-to-use set of management actions with two primary approaches; a bottom-up and a top-down approach. The top-down approach is most useful for those wishing to develop resources for pollinators at a strategic level; it allows for the identification of a suitable site or series of sites which could add most value to the pollinator resource without any prior bias as to site location. The bottom-up approach is more suited to those who are already managing one or more specific parcels/areas of land and who wish to identify what actions would bring about an increase in resources for pollinators.

The *Action Plan* is process driven requiring the identification of both the green infrastructure type and land type at a chosen site. There are 18 green infrastructure types which include school grounds; roadside verges; civic spaces; allotments and community gardens; and public parks and gardens. Land type is derived from the All-Wales landscape assessment tool LANDMAP. The land type categories include built land; coastal; and upland. With these two parameters defined the number of management actions are reduced to those that are most suitable to a given combination of green infrastructure and land type. The *Action Plan* is therefore highly scalable having the capacity to be relevant to the whole of Wales whilst still being applicable on a site-specific level.

Many actions presented in the *Action Plan* relate to changes to management regimes such as cutting grass to different heights and/or at different times of the year. Some actions require more extensive changes and include the development of wild flower meadows or formal planting areas. Where these are suggested opportunities have been identified to attract additional funding.

Case studies are included with the *Action Plan* to underpin and explain the process with real examples of how it may be used, what changes could be made and the potential benefits these may bring about. These case studies are distributed across the four Local Authorities and cover heritage sites, schools, general amenity land and office grounds.

Monitoring

Monitoring the delivery of the *Action Plan* is necessary to ensure its successful implementation and for changes and refinements to be made. Both scientifically recognised methods and citizen science approaches are proposed. Scientifically recognised methods are important to objectively rate the performance of the *Action Plan*, and developing citizen science is critical if the public is to be successfully engaged. Adopting a citizen science approach would lead to better public perception of the actions implemented and further promote the benefits associated with reversing the decline in pollinators. This is important for attracting additional funding which in turn will lead to more robust science-based approaches being carried out.

Public Engagement

Addressing issues of public perception is essential to the successful implementation of the *Action Plan* as publicly owned land is a) just that, owned by the public and b) very much in the public eye. Where suitable it is recommended that local communities are involved throughout the development of new, or improvement of, existing green infrastructure. With schools, sports pitches and play areas forming a significant component of publicly owned land the *Action Plan* represents a great opportunity to engage with young people on this important issue.

Guidance booklets have also been prepared to engage and explain the *Action Plan* to the key groups and individuals responsible at different stages of implementing it to help encourage active participation of everyone. These groups include Local Authority staff, local authority planning teams, community groups and the education sector.

Future for Pollinators

Implementation of the *Action Plan* would not only increase pollinator provision but it will also help develop multi-functional spaces bringing social and health benefits and support greater ecosystem resilience to issues such as climate change and disease.

For the *Action Plan* to be successful it should be adopted across the entire study area. Habitat connectivity is an important consideration when developing a useful resource for pollinators. Pollinators do not confine themselves within the borders defined by humans. Therefore, cross-border working and policy development is identified as a priority.

To embed the delivery of the *Action Plan* into the day-to-day working of the Local Authorities it is recommended that each Local Authority develops a Pollinator Policy and sets targets for implementation and monitoring.

In order to drive forward the implementation of the *Action Plan* key roles are required which include:

- championing the future for pollinators to encourage cross-border working and preparation of funding bids etc.;
- specialist pollinator technical expertise;
- community engagement and outreach;
- liaison with schools and education authorities; and
- liaison with managers and operatives

1 INTRODUCTION

1.1 Background

The Welsh Government's Nature Fund seeks to address the decline in Welsh biodiversity through landscape-scale projects, recognising the interdependency of maintaining biodiversity with socio-economic factors. Two of the Nature Fund projects are specifically targeting the decline in pollinators; the *Pollinators for Life* project (lead Organisation: Torfaen County Borough Council) and *Natural Buzz* (lead Organisation: Keep Wales Tidy). Pollinators are essential for ensuring our future food security and for the well-being of the countryside in general.

The *Pollinators for Life* project is an ambitious, innovative suite of projects to promote long term, sustainable management and to improve habitats for all pollinating species across the four local authority areas of Blaenau-Gwent, Caerphilly, Monmouthshire and Torfaen. Local authorities and other public bodies are major land owners and can significantly influence the opportunities for providing better conditions for pollinators on its land and lead by example by improving management of its parks, roadsides, school grounds, playing fields, woodlands and urban trees. The Local Authorities have a pivotal role in terms of policy provision and implementation, decision making through the planning process and cross boundary/strategic thinking in terms of delivery of green infrastructure and the landscape scale provision for pollinators, long term monitoring and dissemination of best practice.

The *Pollinators for Life* project includes both direct ground habitat improvements and planning for the future. As part of the *Pollinators for Life*, this ***Green Infrastructure Action Plan*** is a long term plan for land owned by the public sector and key stakeholders. It is specifically designed to consider how public organisations can embed sustainable management principles in their day to day activities.

Local authorities and the Welsh Government have legal and moral duties in terms of biodiversity, health and wellbeing: the *Green Infrastructure Action Plan for Pollinators* forms an important component for delivering on these duties.

1.2 Policy context

The *Green Infrastructure Action Plan* supports both Welsh Government and the four local authority area plans and policies, which have been considered when drawing up the *Action Plan*. Five key relevant plans and policies are outlined below and are included in more detail and with other relevant polices in Appendix 1.

1.2.1 Action Plan for Pollinators in Wales (July 2013)

The Welsh Government Action Plan for Pollinators in Wales (July 2013) identified areas where action for pollinators was needed, its vision for pollinators in Wales and also laid out an agenda for action. Four main outcomes for pollinators were identified:

- Wales has joined up policy, governance and a sound evidence base for action for pollinators.
- Wales provides diverse and connected flower rich habitats to support pollinators.
- Wales' pollinator populations are healthy.

- Wales' citizens are better informed and aware of the importance and management of pollinators.

1.2.2 Well-being of Future Generations (Wales) Act 2015 (April 2015)

This Welsh Government Act provided governance arrangements for improving the well-being of Wales to ensure that present needs are met without compromising the ability of future generations to meet their own needs. The key components of the Act, relevant to ensuring sufficient long term provision of pollinators are:

- To set a framework within which specified Welsh public authorities will seek to ensure the needs of the present are met without compromising the ability of future generations to meet their own needs (the sustainable development principle).
- To put into place well-being goals which those authorities are to seek to achieve in order to improve wellbeing both now and in the future.

Evidence needs to be provided to show how sustainable development and long-term thinking have been considered in decision making processes. It also ensures that the measures taken, targets and progress towards them can be easily tracked.

1.2.3 Environment (Wales) Bill (Consultation draft May 2015)

The Welsh Government bill will create the legislation needed to plan and manage Wales' natural resources in a more sustainable and joined-up way. The key components of the Bill relevant to pollinators include provisions to help tackle the environmental challenges Wales faces and focus on the opportunities the existing resources provide.

The bill also places an enhanced duty on public authorities (when compared to the Natural Environment and Rural Communities (NERC) Act 2006) to seek to maintain and enhance biodiversity and promote the resilience of ecosystems.

1.2.4 Monmouthshire Pollinator policy (January 2014)

Monmouthshire's Pollinator policy takes into account the NERC Act 2006 and its Local Biodiversity Action Plan (LBAP) and recognises the importance of pollinators in the agricultural industry, local biodiversity and food chain. Monmouthshire will, wherever possible and reasonable to do so, actively promote the development of pollinator habitats by implementing planting and maintenance regimes designed to support and enhance these habitats and encourage pollinators.

1.2.5 Climate change provision

Climate science predicts that, without immediate, radical and sustained reductions in global greenhouse gas emissions, there will be severe consequences for human society, as well as the biodiversity and ecosystems that provide essential services for human livelihood, including pollinators. The action plan will contribute to resilience of pollinators to climate change.

Predictions on how pollinators may be affected by climate change in the study area are outlined in Appendix 2.

1.2.6 Compliance with policy

Implementing the action plan will directly contribute to implementation of policy and commitments at four levels:

- Local Authorities (Local Biodiversity Action Plans, the Natural Environment and Rural Communities Act (2006);
- Wales (the forth-coming Nature Recovery Plan for Wales and Environment (Wales) Bill, the Well-being of Future Generations (Wales) Act (2015), the Action Plan for Pollinators in Wales (2013));
- United Kingdom (UK Post-2010 Biodiversity Framework (2012)); and
- International (Rio Convention on Biological Diversity (1992) and the European Union Biodiversity Strategy (2012)).

1.3 Aims of the action plan

The *Action Plan* is designed to function on several different levels and offer useful and accessible content for a number of different users. It can be used as a tool for developing specific approaches for pollinators by staff at various levels within local authorities and partner organisations, for guiding decision making regarding individual sites and for prioritising resource allocation. The following are the key aims:

- Increase awareness and understanding;
- Create a framework to secure high level support for action;
- Give guidance to choosing appropriate actions; and
- Assist in prioritising actions.

1.3.1 Increase awareness and understanding

Although it is now widely accepted that pollinators face a number of pressures within our modern landscapes, the relative importance of these pressures and what needs to be done to mitigate them are still being researched. The *Action Plan* sets the scene regarding the current situation, explains the importance of pollinators to food production and outlines the key requirements of pollinators in general terms (Section 2). It then goes into more specific detail and explores, partly through the use of specific case study sites, what can be done to improve the existing pollinator provision. It recognises that pollinators do not exist in isolation and are a key part of a healthy functioning ecosystem.

The guidebooks (Section 10) are targeted at key groups to help develop an understanding of the issues facing pollinators and to generate enthusiasm by empowering people and groups to take action.

1.3.2 Create a framework to secure high level support for action

By adopting or signing up to a policy or a specific plan, local authorities and other organisations can make a formal commitment to implement or carry out certain actions. This provides support to individuals making the decisions and ensures relevant priorities when funding and other resources are limited. If Local Service Boards sign up to particular actions through their Single Integrated Plan process, then they would have a statutory requirement to record and report on progress towards achieving these targets.

1.3.3 Give guidance to choosing appropriate actions

Guidance on choosing appropriate actions for public land is provided within the *Action Plan* by categorising the major land type and the green infrastructure within it, and then indicating a 'shopping list' of appropriate management action plans (Section 5). For each individual green infrastructure type the aims, options and risks are highlighted. Other land not in public ownership can be classified in the same manner, giving a wider application for the *Action Plan*.

Each site will have its own unique combination of factors influencing the potential actions for pollinators which can be undertaken. The intention is that a site manager with local knowledge should make the final decision from this 'shopping list' of actions with consideration of the wider context and overall aims to be achieved.

Local Authority users will also be able to interrogate the GIS information which accompanies the *Action Plan* for additional site specific details, such as elevation, aspect, drainage, soil fertility, etc. By looking beyond the site boundaries, the GIS database provides further information on ecological connectivity, protected areas, population density etc. which may all influence the choices made. This system covers the entire study area so any land identified in future can be added in easily and it will still provide the same level of detailed information.

1.3.4 Assist with prioritising actions

At a site level, actions identified in the *Action Plan* to benefit pollinators are rated in terms of their potential to bring benefits to pollinators (✓ low - ✓✓✓ high) with an indication of their relative cost (£ low - £££ high) and likelihood of success (+ low - +++ high). This can help to prioritise actions for any given site in combination with other factors, such as existing good relationships with local communities which will increase the likelihood of securing external grant funding; this is best assessed at the time by staff involved.

At a more strategic level, prioritisation can be achieved by using the GIS system to assess where current pollinator provision is low or high set against where pollinators are most needed (e.g. to pollinate commercial crops, allotments, plants in gardens, etc.).

1.4 Introduction to pollinators

1.4.1 What are pollinators?

Pollinators are animals which transfer the male pollen from one flower to different flowers of the same species to enable the female ovules to be fertilised and to develop into seeds. In Wales, all pollinators are insects but elsewhere in the world other animals such as birds, bats, monkeys and mice may also be pollinators.

Pollinators are essential for seed-set in about three quarters of species of temperate flowering plants and are critical for maintenance of human life on earth. To attract pollinating insects, flowers may have colour, visual signals and/or scent, and offer rewards of sugar-rich nectar and/or pollen for the pollinators to feed from. Not all plants require pollinators, some may be pollinated by the wind (such as grasses) or water, or routinely pollinate themselves (for example Shepherd's purse). The relationship between plants and pollinators is mutually beneficial; without the pollinators, the plants cannot reproduce and without the flowers, the pollinators cannot reproduce.

Bees, wasps, hoverflies, flies, beetles, butterflies and moths are the major groups of insects which are pollinators in Wales, but not every species in every group may be a pollinator. Pollinators do not just need flowers to feed from, they also require habitats to live in and places to lay eggs and for young to feed and develop. Each pollinator will have its own specific requirements to complete its life cycle.

1.4.2 Why do we need Pollinators?

Pollinators are essential for maintenance of human life on earth as they enable crops to be produced for food and other materials. Worldwide, about 1,000 plants need to be pollinated to provide the food, drinks, fibres and medicines on which we depend. In Europe, there are about 150 crops which require pollination. In Britain about 70 crops are dependent on bees, the production being valued at over £430 million per year. Pollinators also pollinate many wild flowering plants which form the basis of wider ecosystems.

Pollinators are essential for the production of a range of different agricultural crops in Wales, for example hard fruit (apples, pears), soft fruit (e.g. strawberries, raspberries), oil-seed rape, flax, lupins, peas and beans, for horticultural businesses, and for fruit and vegetable production in allotments and gardens. Honeybees are the main pollinator of crops but wild pollinators, such as bumblebees and butterflies, are also important. Within Wales, the total area of crops requiring pollinators from Welsh Government agriculture statistics 1998-2014 is relatively small (oilseed rape and horticulture; c. 0.3% of the total agricultural area of Wales). Figure 1 shows that the area of crops requiring pollinators in Wales is slowly increasing, though it does vary from year to year.

Maintenance of all biodiversity is ultimately down to the plants which form the habitat and the basis of food chains and natural ecosystems also rely on pollinators. In the long term, maintaining the diversity of plants will also maintain the diversity of other groups of organisms such as birds, and to maintain plant populations they must reproduce for which many require pollination. Not only do the wild plants themselves need pollinators to reproduce, but other biodiversity may also depend on fruit and seed-set, resulting from pollination, to survive. For example, the only food of gorse weevil larvae (*Exapion ulicis*) is the developing seed inside the fruit pods of gorse, and without gorse seeds it cannot reproduce. Blackberries provide food for birds and small mammals, which in their turn may also provide food for predators.

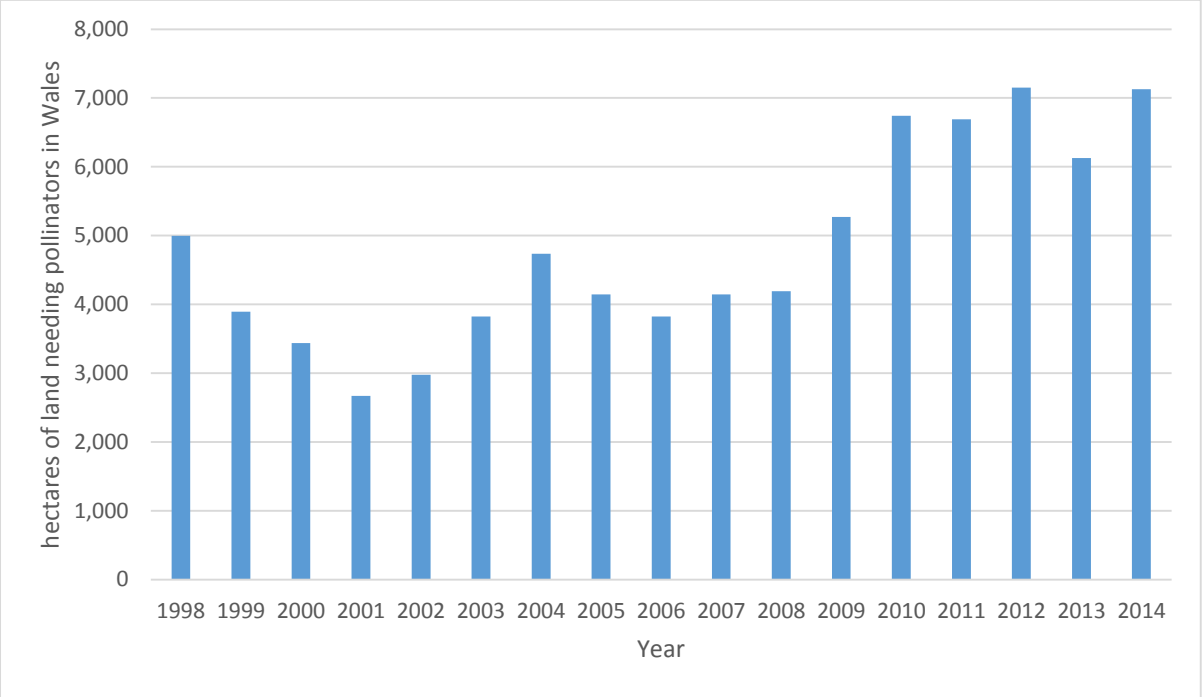


Figure 1 - Hectares of main crops in Wales which require pollinators (derived from Welsh Government agricultural statistics 1998-2014)

1.4.3 What Problems are pollinators facing?

It is widely accepted that pollinators are declining in Wales, Britain and Europe, and have been for many years. There are multiple causes which probably act in combination (e.g. Vanbergen et al. 2014) and these are now discussed in relation to the study area.

1.4.3.1 *Habitat loss*

Loss of habitat is a primary cause of decline in pollinators. Habitats have been lost for a range of reasons including agricultural intensification, especially from the post-war agricultural revolution which saw widespread improvement to land through use of fertilisers, herbicides, ploughing and drainage. The often-quoted figure that there has been loss of 97 % of wild flower meadows gives some indications of the loss of species-rich meadows. In 2008, the author of the *Flora of Monmouthshire*, Trevor Evans regretted the 90 % loss of the flower-rich Monmouthshire meadows of his youth (Western Mail, 1st April 2008, Farming Supplement, page 5). There has also been a widespread loss of arable weeds through control with herbicides, again reducing wild flower resources for pollinators. These scales of losses will have reduced the availability of flowers for pollinators proportionally.

As the scale of habitat loss has increased, the remaining good areas have become more fragmented resulting in isolation of populations. Isolated, smaller populations are more vulnerable to extinction through lower resilience to environmental change and random catastrophic events, inbreeding and disease. These indirect effects of habitat fragmentation are probably also significant factors in pollinator decline.

1.4.3.2 *Use of pesticides*

The second major cause of pollinator decline is the widespread use of pesticides to protect crops from being consumed by insects. After World War 2, pesticides such as dichlorodiphenyltrichloroethane

(DDT) and organophosphates were applied in quantity until their cumulative and non-selective environmental impacts began to be realised. These have been replaced by systemic pesticides such as neonicotinoids, whose indirect effects are now also being questioned. Inevitably pesticides have affected pollinators as well as the insects eating the crops, both directly and indirectly through persistence in the environment, with the greatest declines in areas where they are intensively used. Within the study area, widespread pesticide use will have been associated with the intensive agriculture in the Monmouthshire lowlands, whilst large areas of the uplands may never have been affected at all.

1.4.3.3 *Change in farming practices*

Another factor causing decline in Southern Britain but probably less so in South-east Wales, is the change in agricultural practice to producing large areas of one type of crop (monocultures). Although crops grown in monocultures such oilseed rape can provide abundant nectar, they do so in a short, sharp burst and then nothing for the remainder of the season. Large areas of monoculture have the potential to draw pollinators away from other habitats which may affect pollination of wild plants, as well as increase rates of transmission of pests and diseases.

1.4.3.4 *Pests and diseases*

Some pollinators are declining due to pests and diseases. For example, the verroa mite has spread viruses such as Deformed Wing Virus to honeybees which have caused colonies to collapse and die. These effects may devastate individual species, which can have knock-on effects when they are key pollinating species in the environment such as honeybees.

1.4.3.5 *Urban development*

Urban development has resulted in habitat loss, but also in resource creation. Whilst there is obvious direct loss of pollinator habitat when green field sites are built on, many urban areas have mosaics of habitats such as gardens, parks, cemeteries, road verges and railways, all of which have potential to provide numerous nesting and floral resources for pollinators. These areas may have a more diverse range of floral resources for longer periods during the year than the wider countryside, as well as lower pesticide use than farmland. Studies show that urban areas are as good, in many respects for pollinators, as nature reserves and the wider countryside, though differing in the suite of species they support (Baldock et al. 2015). Hence within the study area the urban developments in the valleys have probably resulted in changes to the composition of the pollinator community rather than caused significant overall decline.

1.4.3.6 *Other factors*

Other factors attributed to causing pollinator decline are of probably relatively minor importance in the study area. Alien plants have probably provided as much pollinator resource as native plants, and alien animals, such as the Asian hornet (*Vespa velutina),* which is a significant predator of bees and other pollinators, could have an impact in the future. Climate change could have an impact in the future but it is difficult to prove current cause and effect on pollinator decline (Appendix 2).

1.4.3.7 *Key factors*

Thus the key factors in causing pollinator decline in the study area are likely to be loss of flower-rich habitats and use of pesticides in agriculture. It is hard to control the use of pesticides on private agricultural land except through national policy, but it is possible to provide some replacement habitats at a local level. Land owned and managed by Local Authorities can provide a perfect opportunity to provide some replacement habitat.

1.5 Objectives of the study

The project brief set out 14 objectives as follows:

- Based on data and consultation outcomes from the linked Torfaen County Borough Council (CBC) data collation project, undertake analysis and any further work to understand the existing and potential resource for pollinators on public sector and partner land.
- Identify how policies and processes can be influenced to promote improved management for pollinators.
- Identify potential areas for enhancement for pollinators including physical improvements, management techniques, and any new machinery that may be required to make managing land more economically viable in the long term.
- Identify what the barriers are to introducing conservation management techniques in publically owned land and seek to identify solutions.
- Identify potential areas for joint working and new partnerships particularly in reducing management costs, sharing machinery, joint purchasing etc.
- Identify the role of communities in delivering practical actions and monitoring.
- Identify suitable monitoring methods.
- Identify areas and examples of good practice such as Bee Friendly Monmouthshire that can be shared, including any relevant research projects such as the Insect Pollinators Initiative.
- Consult with land managers and other key staff within the local authorities and partner organisations to understand their views on opportunities, constraints, joint working, monitoring, and data presentation needs.
- Consult with key external biodiversity stakeholders to better understand their views.
- Consult with Geographical Information System (GIS) staff within the local authorities to identify issues around data capture, how data can be published to meet end user requirements, and how data maintenance can be achieved post-project.
- Produce an Action Plan for managing green infrastructure (GI) on public and partner land, summarising the above findings and consultation responses.
- Produce guidance booklets tailored for each key local authority section (e.g. Education, Highways, Street Scene), for partners e.g. social housing associations, and for community groups. Guidance is to be specific rather than generic, and will include common issues and opportunities found from sampling, examples of good practice, benefits and barriers, and where to access further support.
- Provide presentations at the end of the project to council members and to Gwent Association of Voluntary Organisations (GAVO).

These were rationalised into 11 related packages of work which are dealt with in the chapters below.

- Baseline information (Section 2)
- Measures to benefit pollinators (Section 3)
- Stakeholder consultation (Section 4)
- Action Plan (Section 5)
- Case studies (Section 6)
- Community involvement (Section 7)
- Monitoring methods (Section 8)
- GIS Strategy (Section 9)
- Guidance Booklets (Section 10)
- Presentations
- Data handover, sharing and training

2 BASELINE INFORMATION

2.1 The Study Area

Figure 2 shows the study area which covers the Local Authorities of Blaenau Gwent, Caerphilly, Torfaen and Monmouthshire.

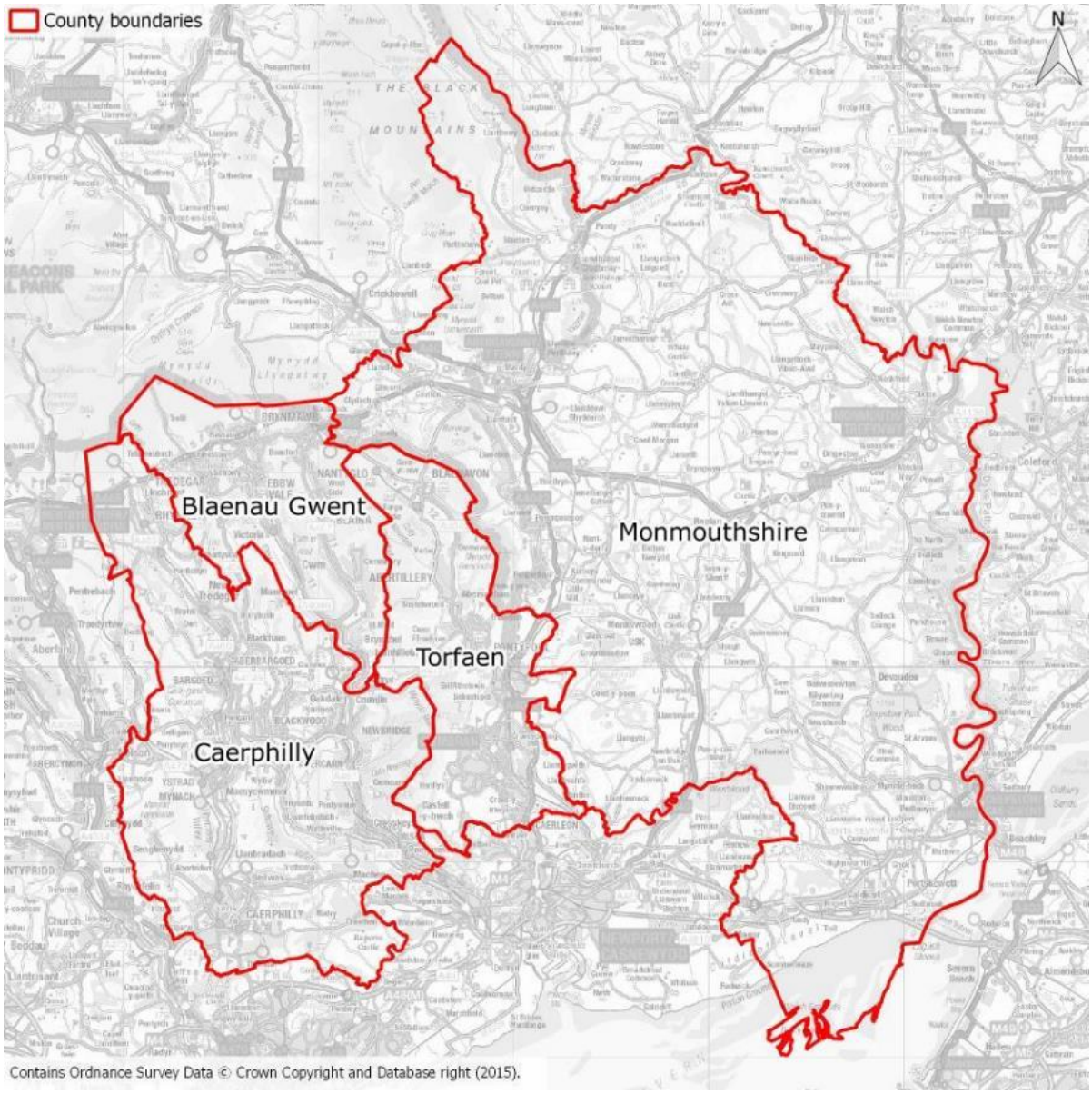


Figure 2 - Map of the study area with four local authority boundaries

The study area is very varied topographically and geologically (Figure 3). Detailed topographical, geological, soil and climate information has been compiled and is available in GIS format, and is very briefly summarised below.

The topography has a large influence on the way the land is managed, which also determines both the pollinator resource and pollinator demand. Along the Severn Estuary there are salt marshes and the wetlands of the coastal grazing marshes such as the Gwent Levels. The east side is marked by the

major valley of the River Wye with extensive woodlands and cliffs. Carboniferous Limestone outcrops west and south-west of Chepstow, provide some diverse woodlands and grasslands, though much is now intensive agriculture. Much of central Monmouthshire is low-lying agricultural land over Devonian and Silurian rocks, with arable and improved pasture and areas of hilly country which are again mainly improved pasture. The west side of the study area is dominated by the South Wales Coalfield and the southern Llanthony Valley which have extensive moorland and heathland in the uplands interspersed with the grazed slopes of valleys and significant urban areas associated with the former coal mining areas.

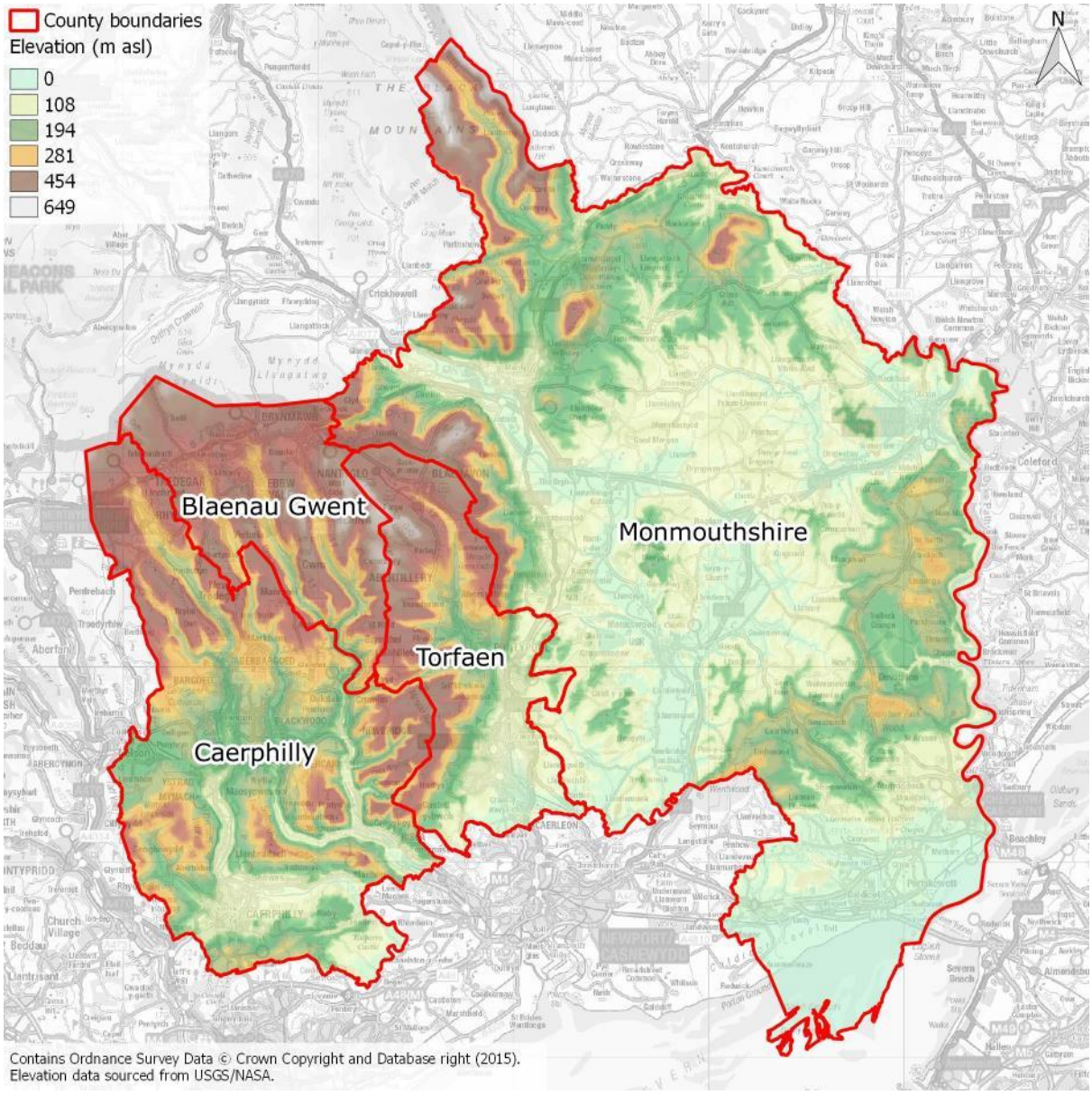


Figure 3 - Topography of the study area

The human population density varies indicating how the demand by the local population for pollinators in gardens and allotments (vegetables, fruit trees, etc.) may be concentrated (Figure 4). Pollinators are needed for agricultural crops in the lowlands such as oil seed rape, but specific data are not readily available to map.

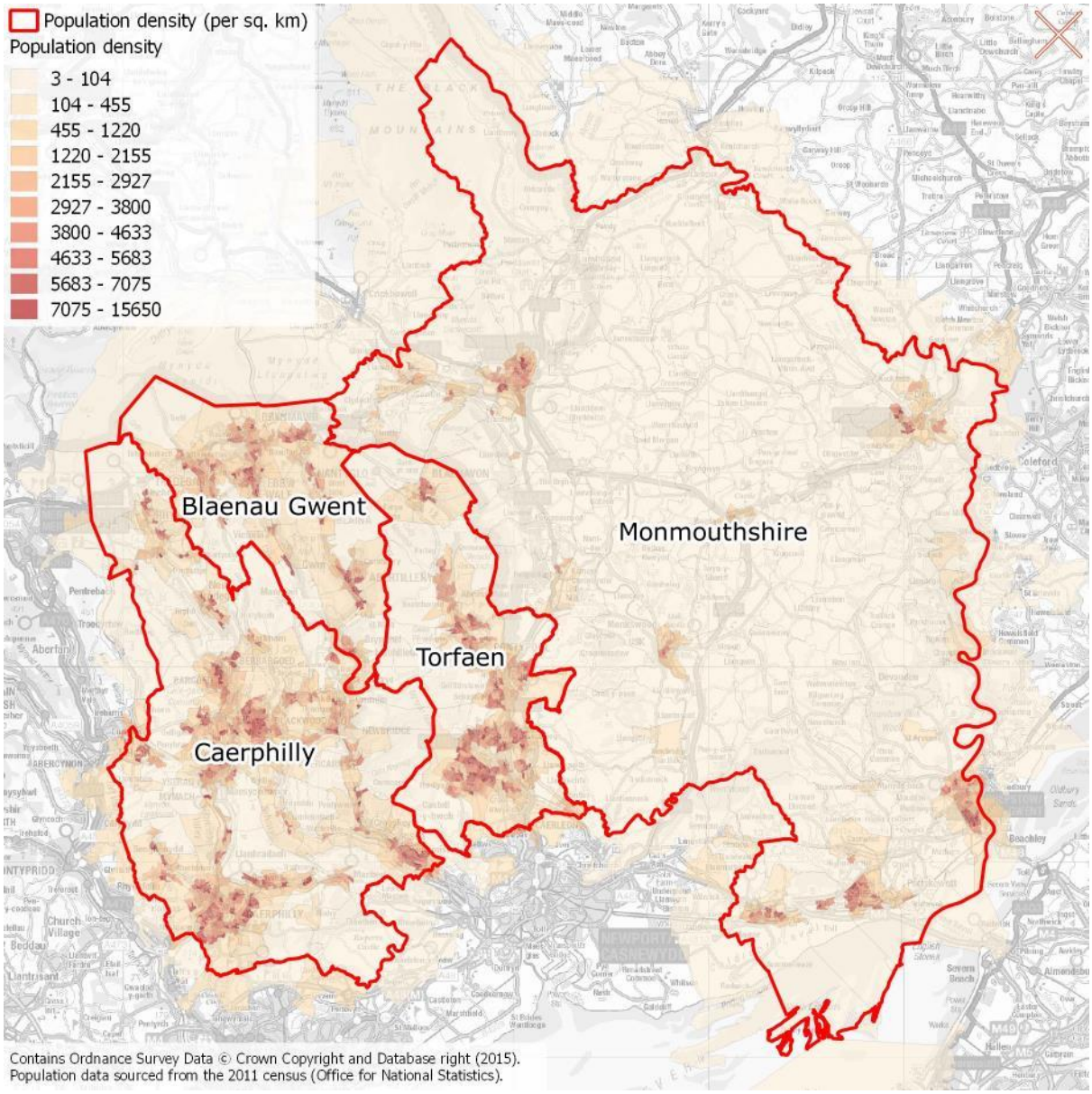


Figure 4 - Population density within the study area

2.2 Pollinators in the study area

The main groups of pollinators are bees and wasps, flies (including hoverflies), butterflies and moths, and beetles. The distributions of these pollinators in the study area illustrated on the maps below is based on records held in the South-east Wales Biodiversity Records Centre (SEWBReC) database; note that these only plot the records held by SEWBReC. There is a strong correlation between the numbers of records and locations of survey effort (compare Figure 4 with Figure 5 below), indicating the records largely reflect where recorders have observed them and that the actual species are probably much more widespread but are not recorded in the database.

2.2.1 All pollinators

A coincidence map of showing where the main groups of pollinating insects are is shown in Figure 5. This shows that there is quite a lot of information for the east of the study area, with very little information from the agricultural areas of lowland Monmouthshire. The numbers of records are significantly correlated with the population density (Figure 4). The patchy, heterogeneous nature of the existing biological records indicate that they will not provide a rigorous scientific baseline against which to assess the existing pollinator resource.

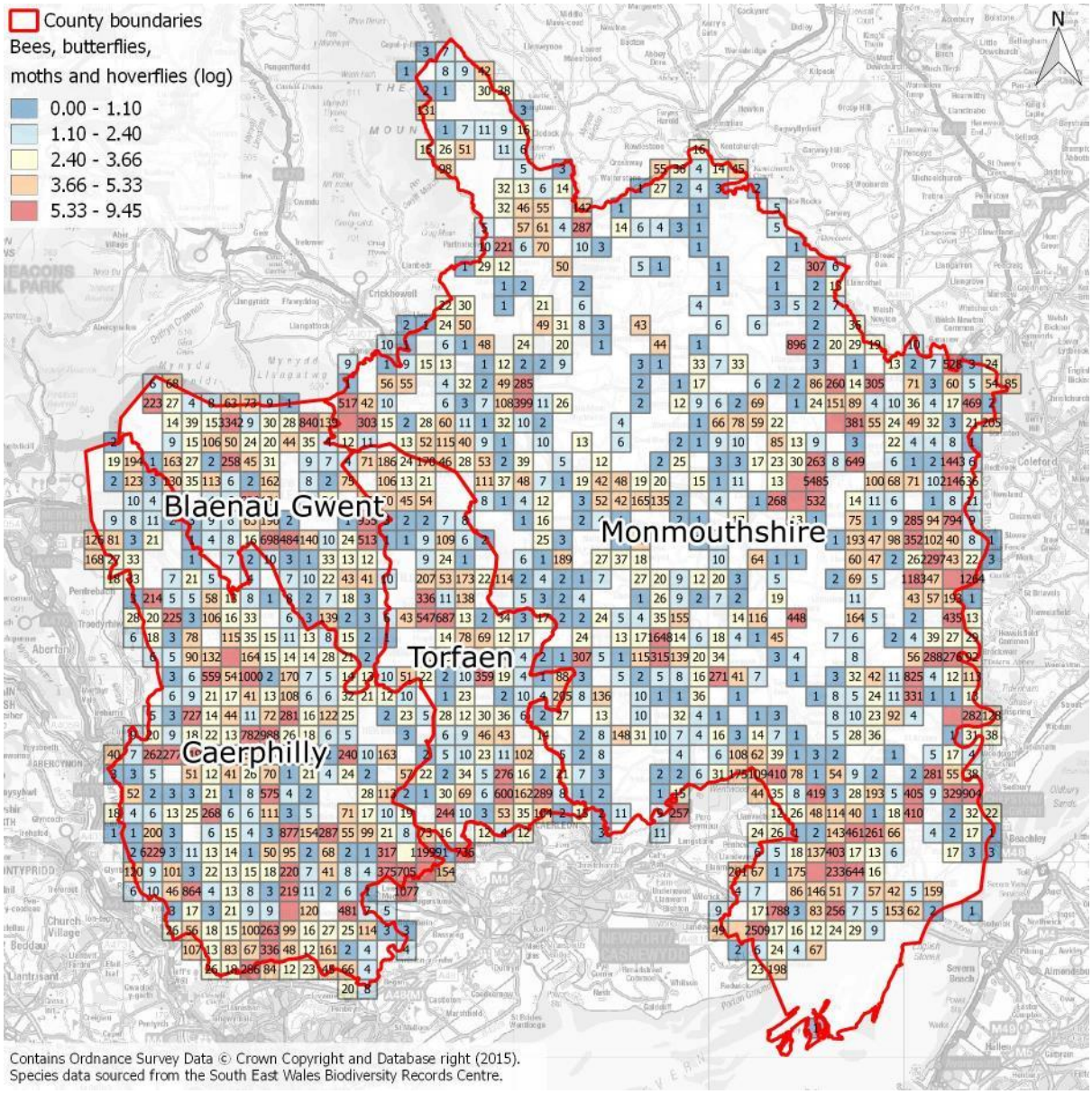


Figure 5 - Coincidence map of the main groups of pollinators from records in SE Wales (SEWBReC data)

2.2.2 Bees and wasps (Hymenoptera)

Hymenoptera are probably the most important group of pollinating insects. They include a range of species from specialist pollinator insects such as bees, to less frequent visitors such as wasps or ants.

Bees, especially honeybees (*Apis mellifera*), are the best-known and most important pollinators for man. They are specialist feeders on both nectar and pollen and visit a wide range of crop species such as clover, beans and sunflowers and wild flowers and are widespread in the study area (Figure 6).

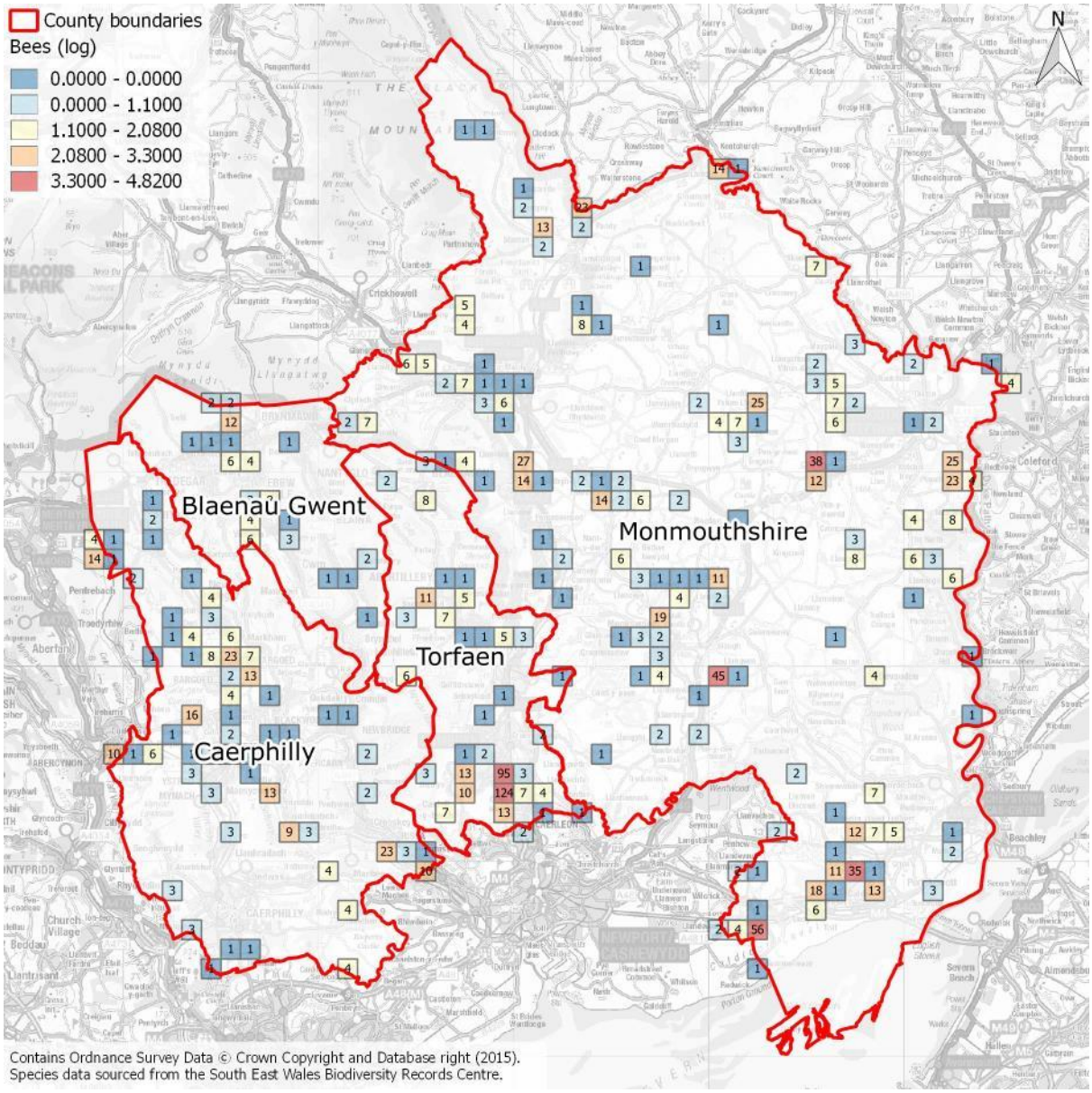


Figure 6 - Number of individual records of bees within the study area (SEWBReC data)

Honeybees are the single most important pollinator species, and are thought to pollinate about a third of the food we eat, as well as wild flowers. Managed honeybees and their hives provide a pollination service and produce honey. The value of the bees' services has been estimated at £200m a year, with a retail value of what they pollinate closer to £1bn. Gwent Beekeepers Association has over 150 members including farmers and volunteers. Wild honey bee colonies also contribute to pollination and ongoing research aims to identify their numbers and importance in Britain.

Bumblebees are very important pollinators. There are 26 species in the UK, of which at least 20 20 occur in Wales. They are social animals which look after their young. Like honeybees they feed exclusively on pollen and nectar, the size of the bee and the length of each species' tongue determining which flowers they can feed from. Long-tongued bees feed mainly on clover.

An example of a pollinating bumblebee is the buff-tailed bumblebee (*Bombus terrestris*) which has a very varied diet from visiting many different flowers. This is a common bee throughout Britain and is the largest bumblebee seen in gardens and parks between March and October. It usually nests below ground, often in disused mouse holes or vole nests, with colonies consisting of upwards of 500 individuals. In SE Wales it is probably more widespread than has been recorded (Figure 7).

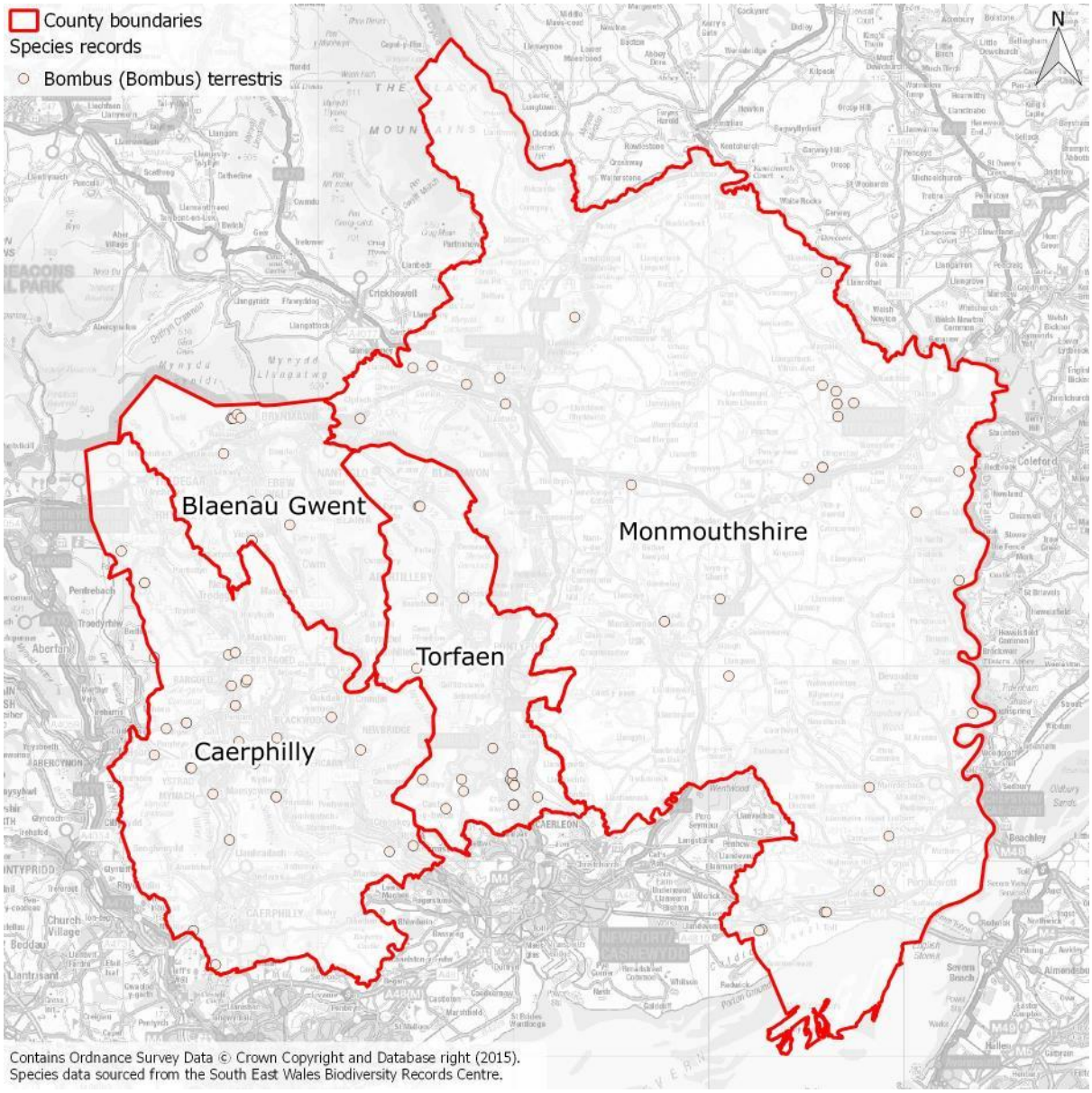


Figure 7 - Distribution of the buff-tailed bumblebee (*Bombus terrestris*) in SE Wales (SEWBReC data)

2.2.3 Flies (Diptera)

Flies are a large diverse group of insects in Britain and many species visit flowers, thus they are a very important group of pollinators. They tend to have sucking mouth-parts so feed mainly on nectar, and may transfer pollen during the process of collecting nectar. The larvae consume a range of food, sometimes including the very plants they pollinate.

Amongst the flies, hoverflies are a very important group which pollinate a range of flowers. There are over 250 species in Britain, and up to 85 species have been recorded in one garden. The larvae feed on a wide range of foods. Adult hoverflies mainly feed on nectar and pollen, and the females especially needing them to mature the eggs. Like bees they are widespread but under-recorded in the study area (Figure 8).

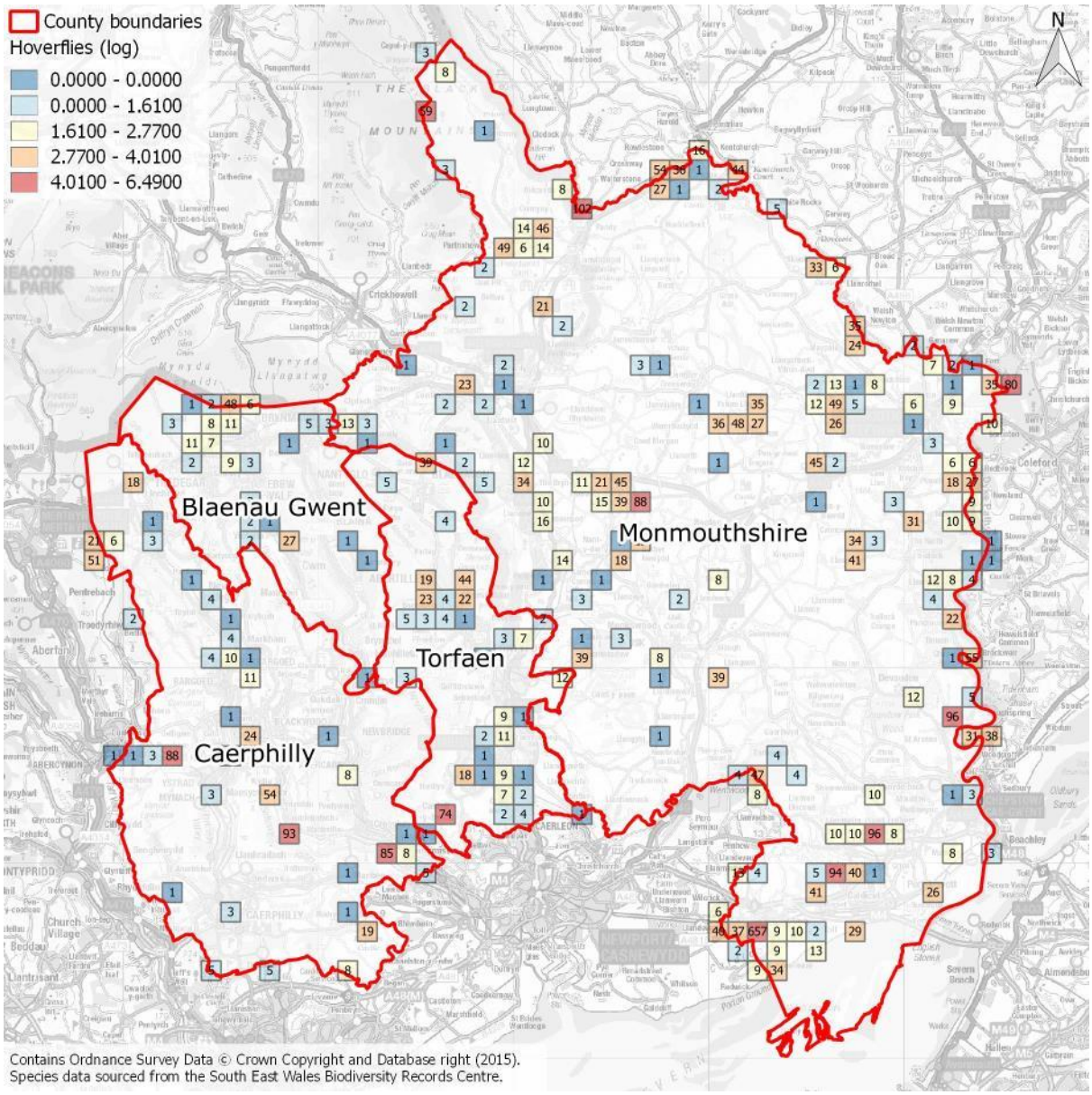


Figure 8 - Number of individual records of hoverflies within the study area (SEWBReC data)

An example of a pollinating hoverfly is the common banded hoverfly (*Syrphus ribesii*) which is found on a variety of food plants. It is a very common species, found throughout Britain and Europe though is under-recorded in the study area (Figure 9). It is often found in habitats including grassland, coastal, uplands, heathland, farmland, woodlands, gardens, hedgerows and waste ground between March and November. The larva predate upon aphids and overwinter in leaf litter. The adults are approximately 1 cm long but are difficult to distinguish by eye from other hoverflies. They may have multiple broods through the year.

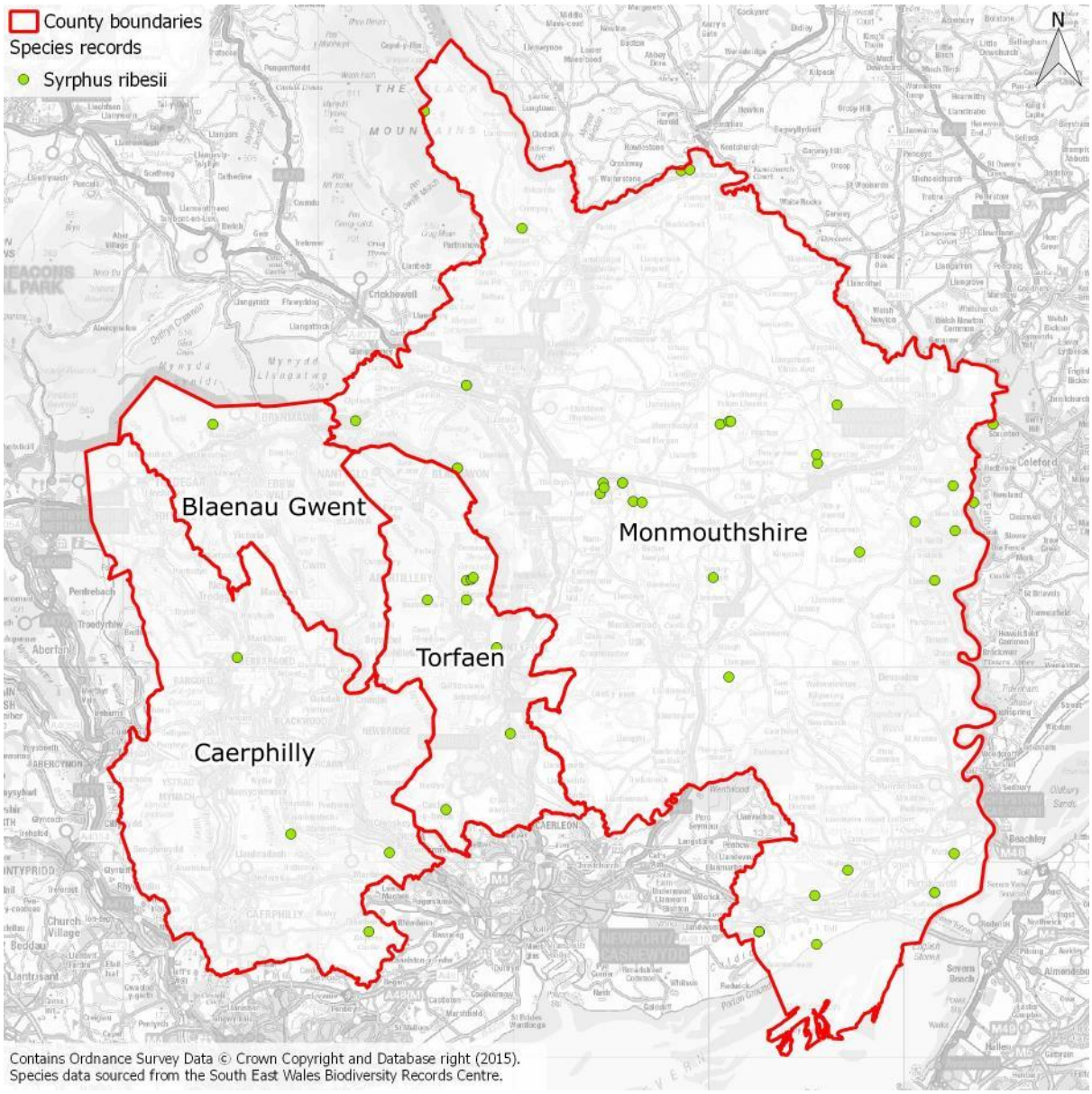


Figure 9 - Distribution of the common banded hoverfly (*Syrphus ribesii*) in SE Wales (SEWBReC data

2.2.4 Butterflies and moths (Lepidoptera)

Butterflies and moths are an important group of pollinators, of which there are over 2500 in Britain. Although the larvae feed on leaves and shoots, the adults feed only on liquids and thus nectar is the main food source. They use their long tongues to reach deep inside flowers where nectar is unavailable

to short-tongued insects. Butterflies are mainly active during the day, whilst the contribution of moths to pollination is often overlooked as most are active at night. Butterflies and moths are better recorded in the study area than bees and hoverflies (Figure 10 and Figure 11). The very high numbers of records for some areas are due to the activities of individual recorders running moth traps.

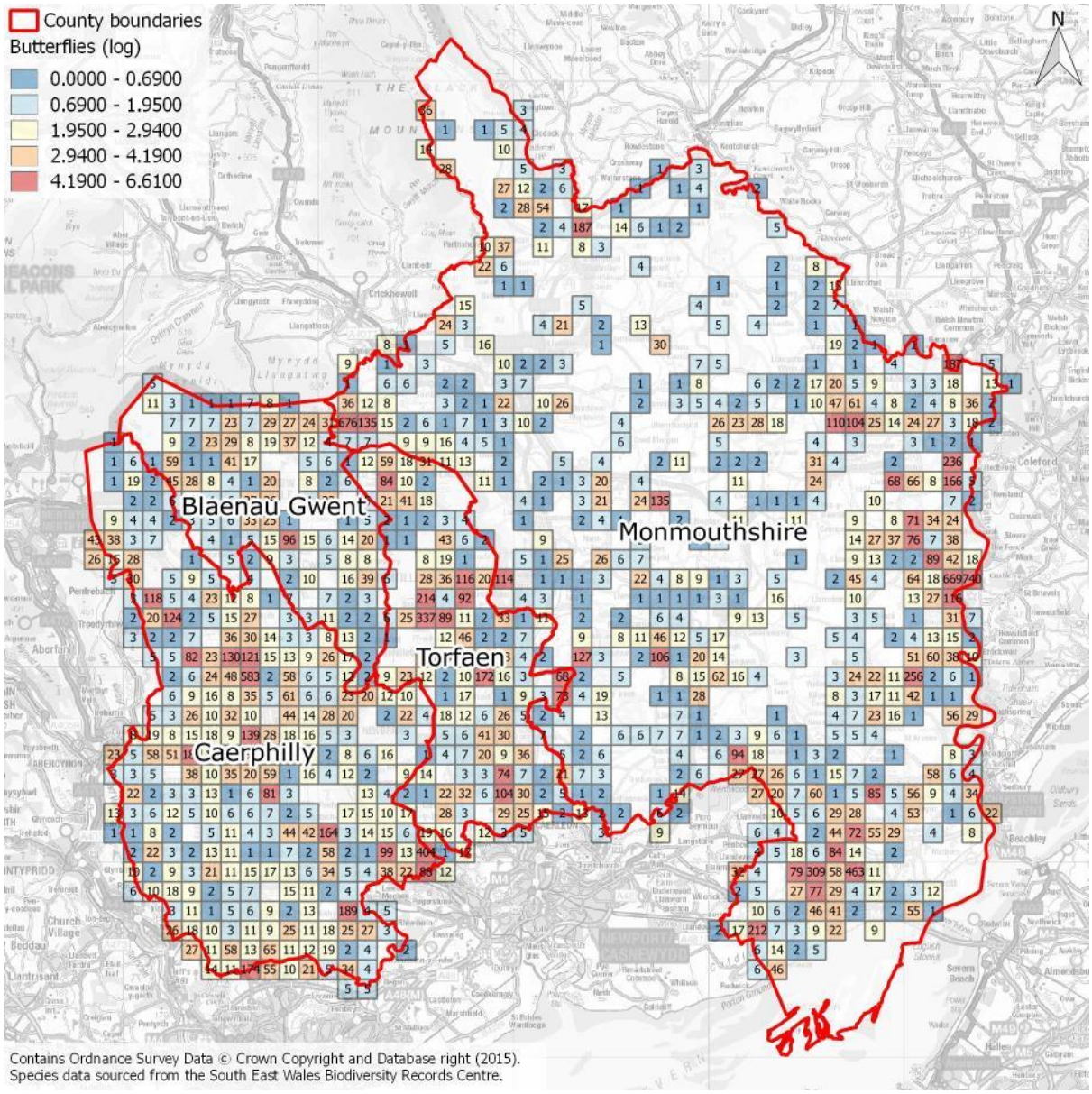


Figure 10 - Number of individual records of butterflies within the study area (SEWBReC data)

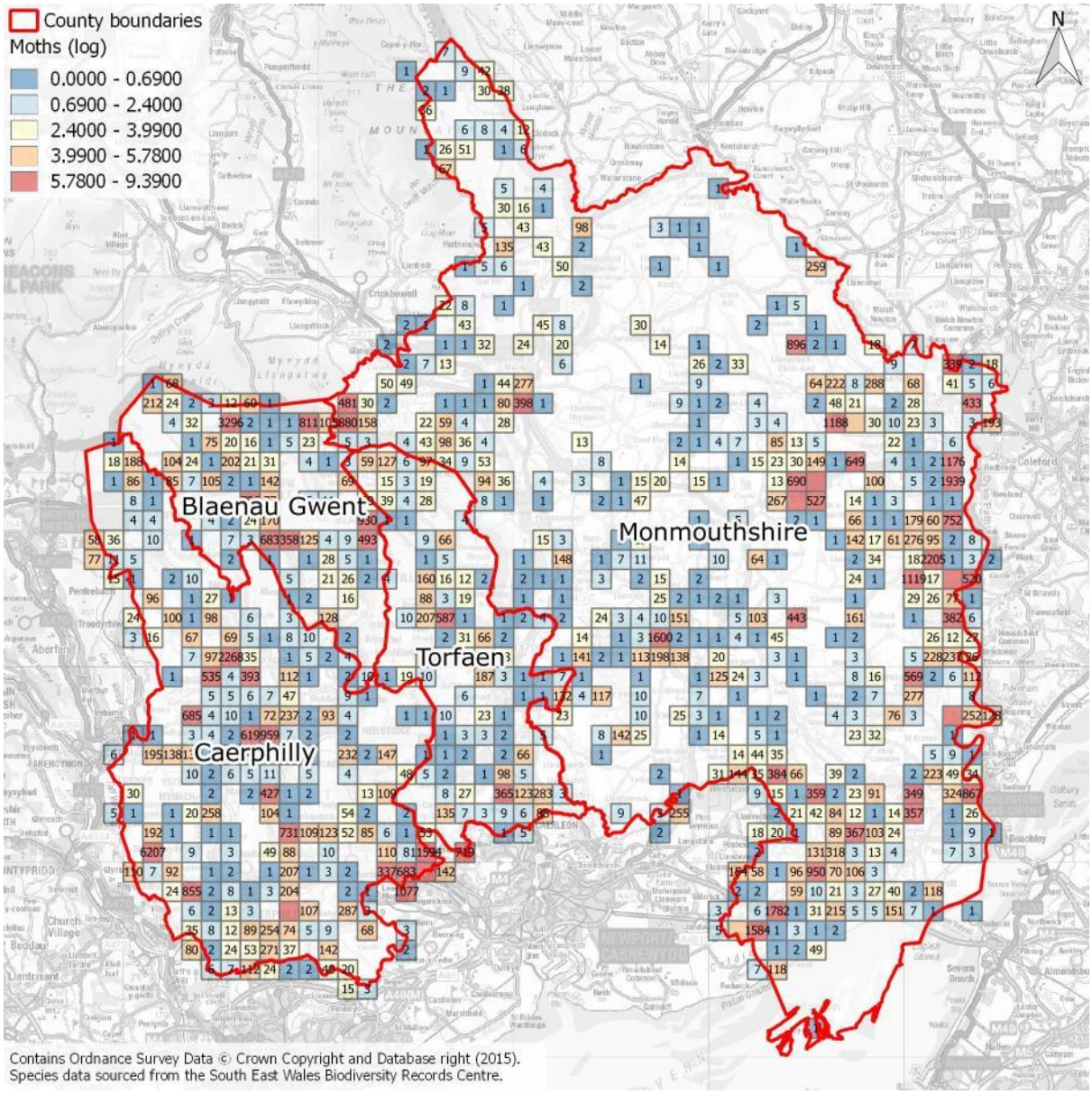


Figure 11 - Number of individual records of moths within the study area (SEWBReC data)

An example of a butterfly which acts as a pollinator in the study area is the small tortoiseshell butterfly (*Aglais urticae*) (Figure 12). This is a very common and well-known species which is widespread throughout Britain in a variety of habitats. Adults can be present throughout the year, dependent on temperature, however they are more commonly seen from the end of March / beginning of April after they have emerged from hibernation. They often hibernate in outbuildings or in hollow trees and wood piles. The primary food plants for the larvae are Common Nettle and Small Nettle. The adults visit flowers primarily of yellow and blue colouration to which they are attracted visually, such as thistles and knapweed. Although this species is widespread, it has suffered a large decline in recent years, which may potentially be due to the parasite *Sturmia bella*.

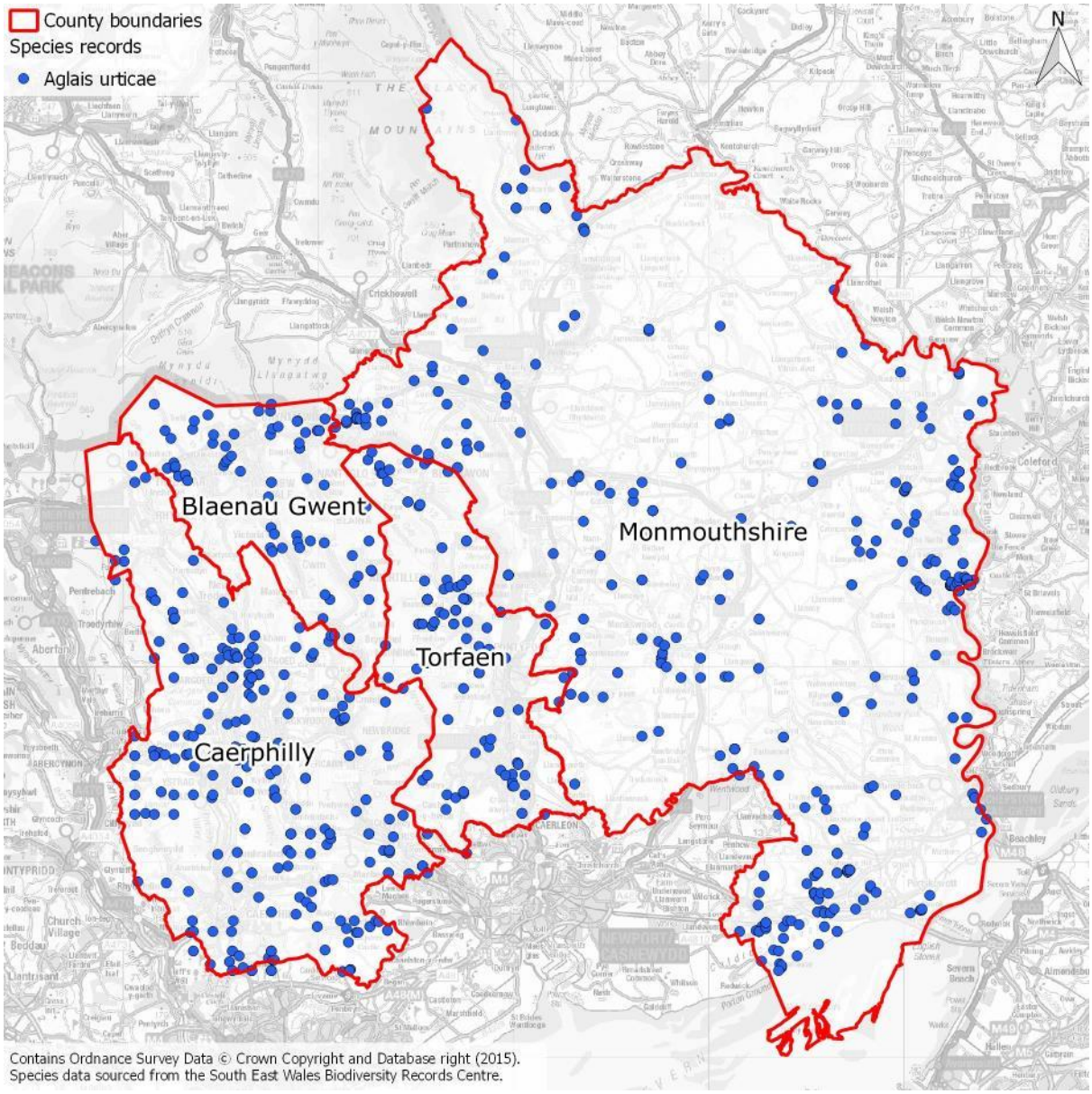


Figure 12 - Distribution of the small tortoiseshell butterfly (*Aglais urticae*) in SE Wales (SEWBReC data)

2.2.5 Beetles (Coleoptera)

Beetles are the largest group of insects, but relatively few species are significant pollinators. Beetles that contribute to pollination are typically the adults of winged species which live in the open, for example the Common Red Soldier beetle (*Rhagonycha fulva)*. Beetles can also vary in the degree to which they feed on flowers, some exclusively so, others only occasionally. Some beetles feed destructively on flowers, such as the click beetles and pollen beetles, though they may also provide some pollination service at the same time.

An example of a beetle pollinator is thick-kneed flower-beetle (also known as the false oil beetle, thick-legged flower beetle or Swollen-thighed beetle; *Oedemera nobilis)*; Figure 13) is found throughout Britain, most commonly in gardens, hedgerows, woodlands and waste ground. It is active between April and September and feeds on pollen as its main food source. Both the males and females are metallic green in colour and their name comes from the fact that they are often seen on flowers.

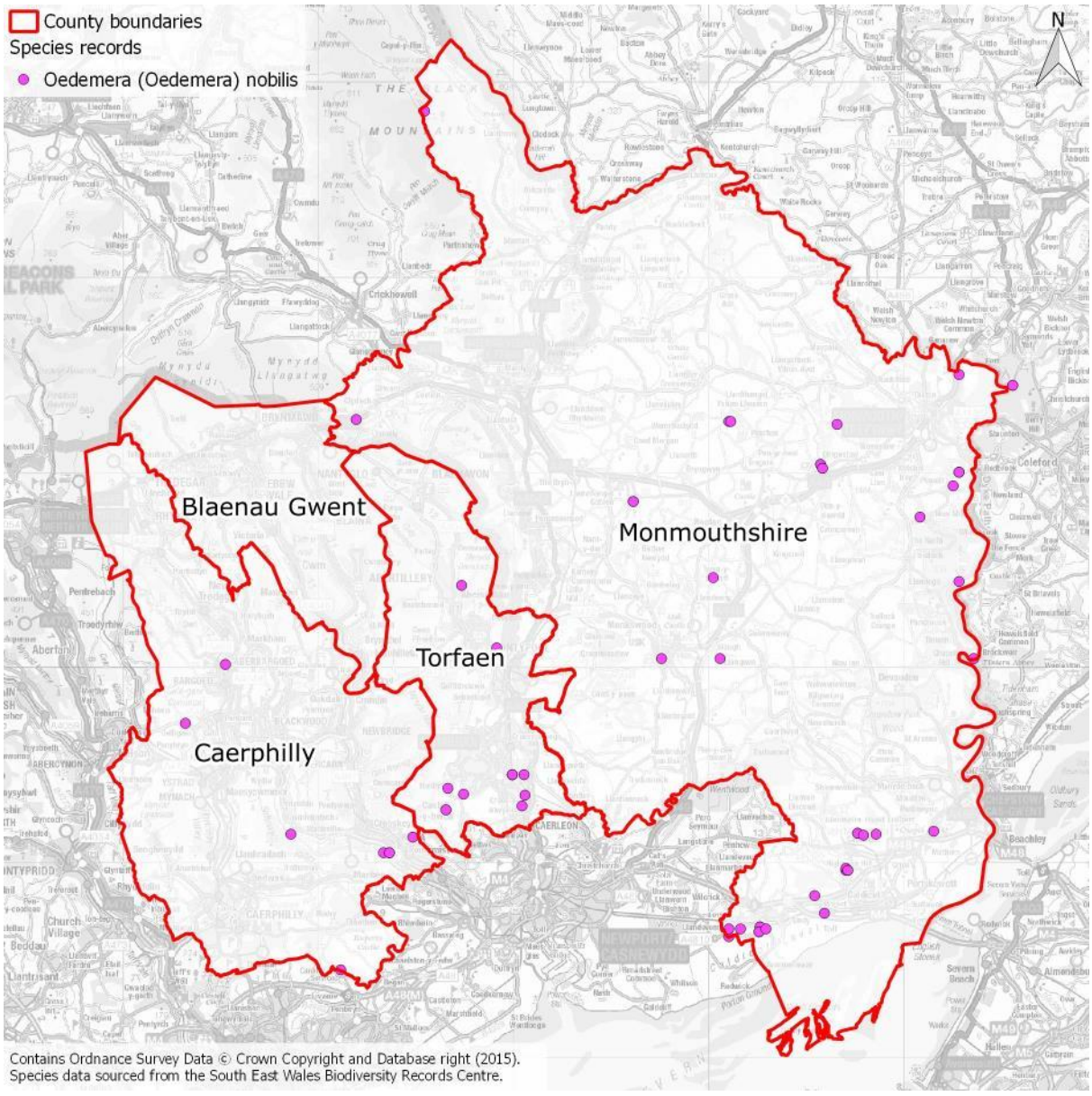


Figure 13 - Distribution of the thick-kneed flower-beetle *Oedemera nobilis* in SE Wales (SEWBReC data)

2.2.6 Rare species

Some of the pollinators are rare species, which are included under the Welsh Biodiversity Action Plan (Section 42 species are listed in Appendix 3) and local biodiversity action plans (Table 1). Figure 14 shows the distribution of records of the Section 42 species in the study area. Targeted conservation action may need to be carried out for these species.

Table 1 - List of Local Biodiversity Action Plan species which are pollinators.
The lists vary between the different Local Authorities depending on which species were originally selected for the Local Biodiversity Action Plans which were prepared prior to the concern about pollinators.

Local Authority	Major group	Species
Blaenau Gwent	Moths	Grey mountain carpet
		The Silurian
		Double line
		Grey scalloped bar
		Heath rustic
		Large ear
		Northern rustic
		Red sword-grass
		Scarce silver-lines
		Neglected rustic
		Wormwood
	Butterflies	Dark green fritillary
		Pearl bordered fritillary
		Small pearl bordered fritillary
		Small heath
		Grayling
		Wall brown
		Dingy skipper
Caerphilly	Moths	Bordered Gothic moth
		Buttoned Snout moth
		Double Line moth
		Other Moths (various species)
		Waved Carpet moth
	Butterflies	High Brown Fritillary
		Marsh Fritillary
		Pearl-Bordered Fritillary
Monmouthshire	Butterfly	Silver Washed Fritillary
Torfaen	Butterfly	Dark Green Fritillary
	Beetles	Long Horn beetles

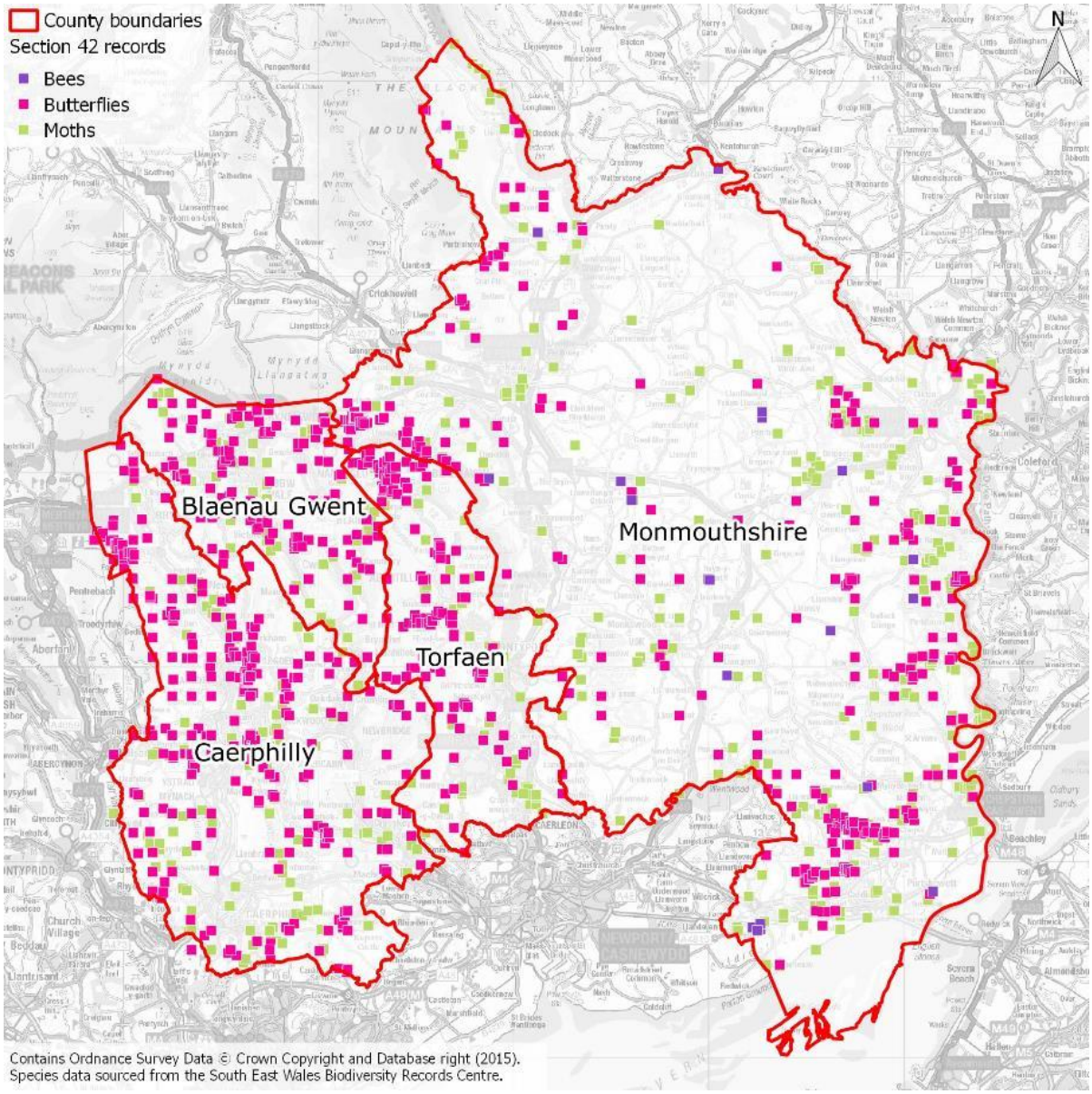


Figure 14 - Section 42 and Local Biodiversity Action Plan species in the study area

2.3 Existing pollinator resource

2.3.1 Resource assessment from land cover data

To assess the existing pollinator resource within the study area, an alternative approach to analysing the biological records is to use existing land cover mapping data as a proxy measure to indicate the relative value of the habitats for pollinators. There are three main land cover datasets: Phase 1 habitat survey, Corine Land Cover (CLC 2006) and GLOBCOVER2.3. All three were investigated but the latter two were found to be too crude and only the Phase 1 was analysed in detail.

Phase 1 habitat survey data were taken from the CCW/NRW GIS data which were collected between 1979 and 1997. The survey was carried out by sending out trained surveyors to record habitats in the field onto large-scale Ordnance Survey maps, according to the standard Phase 1 habitat classification and survey procedures set out in the Handbook for Phase 1 habitat survey (Joint Nature Conservation

Committee, 2003). Habitat patches as small as either 0.1 ha or 0.25 ha were recorded, although smaller patches were also frequently mapped.

The relative value of the habitat can be principally assessed on the floral diversity of plants which might offer pollen and/or nectar and how these vary in abundance and in time. Pollinators also need areas to breed and reproduce but this is hard to model. Phase 1 habitats were scored for their potential value for pollinators taking into account knowledge of the habitats in study area (Appendix 4) in four categories according to their relative general value for pollinators (Table 2):

Table 2 - Categories of value of Phase 1 habitats

Value	Explanation of general value for pollinators
0 – nil or very low	With no value for pollinators such as car parks, bare rock and screes, buildings
1 – low	With limited floral resource for pollinators, with low plant diversity and abundance e.g. conifer woodland, dense bracken
2- medium	With a range of floral resource but may comprise few species or only be
3 - high	Of high value for pollinators through most of year with a wide plant diversity of, for example hay meadows, bluebell woods

There are limitations to this approach. First, in the South Wales surveys, some features such as hedges and urban areas were not mapped or digitized. Second, the Phase 1 data may be significantly out of date through habitat change so ground truthing may be needed to confirm the current habitat type; work has been carried out to update this dataset using remote-sensing technology (Lucas *et al*., 2011) but this dataset is currently unavailable. Third, the categorizations are broad generalizations as there can be large differences in value within each category depending on the composition of the habitat. For example, natural broad-leaved deciduous woodland is immediately thought of as high value for pollinators which is probably acceptable for old diverse lime woodlands in the Wye Valley but probably not for the pure, dense, shaded beech woodlands with little in the ground layer in the Clydach Gorge.

The value of the habitats are mapped in Figure 15. This shows the main areas with higher value for pollinators are the Wye Valley, hilly ground in the south of Monmouthshire and the Uplands. Large areas with improved pasture and cereals are classified as of low value.

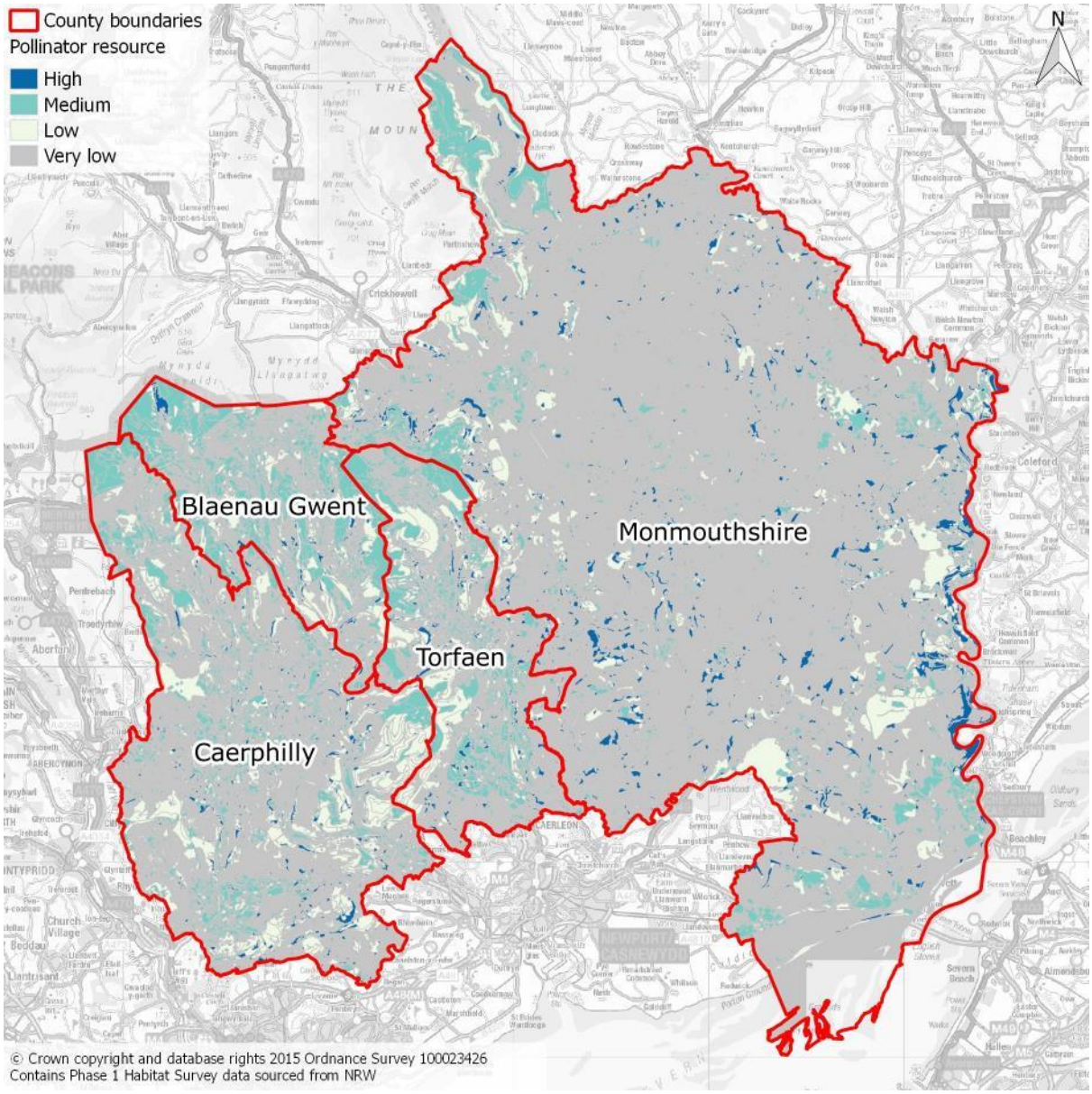


Figure 15 - Value of the resource for pollinators based in CCW Phase 1 habitat survey

2.3.2 Flora of Monmouthshire data

A second way to assess the potential resource is from the *Flora of Monmouthshire* data (Evans 2007), which are much more consistent in coverage than the biological records of pollinators. Evans (2007) presented distribution maps of all the plants in Vice-county 35 Monmouthshire (the Vice-county does not directly equate to the study area or to unitary authorities) recorded between 1984 and 2006 in 2 km x 2km squares of the national grid. The distribution maps can provide information on distribution of the food resource (i.e. plants) for pollinators; for example Figure 16 shows overall diversity of vascular plant richness showing the high diversity along the Wye valley and parts of the Usk and urban areas, with lower diversity in the uplands and in the intensive agricultural areas, but is not detailed enough to use at a site level.

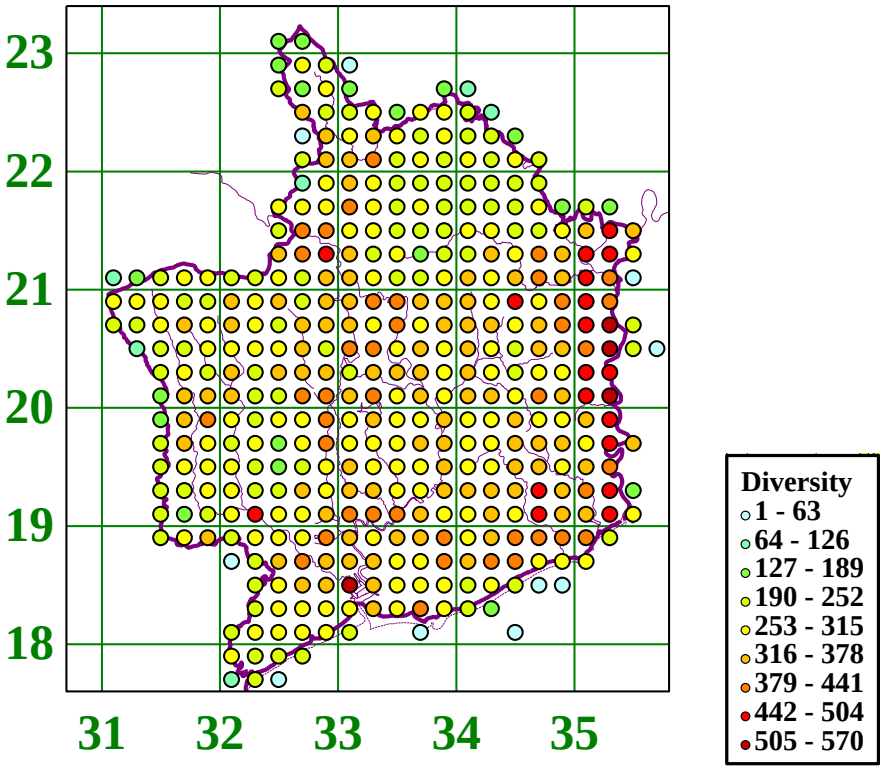


Figure 16 - Coincidence map of all vascular species in Vice-county 35 Monmouthshire to indicate general floral diversity of all species recorded (*Flora of Monmouthshire*; Evans 2007)

The diversity is number of different plant species recorded; this includes all species including species which do not provide food resources for pollinators. Marginal squares tend to appear less rich as they occupy smaller areas of land in the recording area.

2.4 Where are pollinators needed?

2.4.1 Pollinators needed to support human life

The areas in the study area where pollinators directly contribute to supporting human life and food security are mapped in Figure 17. The map shows the high demand in urban areas for pollinators for fruit and vegetables in gardens and allotments. Only a relatively small percentage of the arable land comprises crops such as oilseed rape which need pollinators, and this is concentrated in the lowland arable areas of Monmouthshire. Other areas of land have indirect requirements for pollinators.

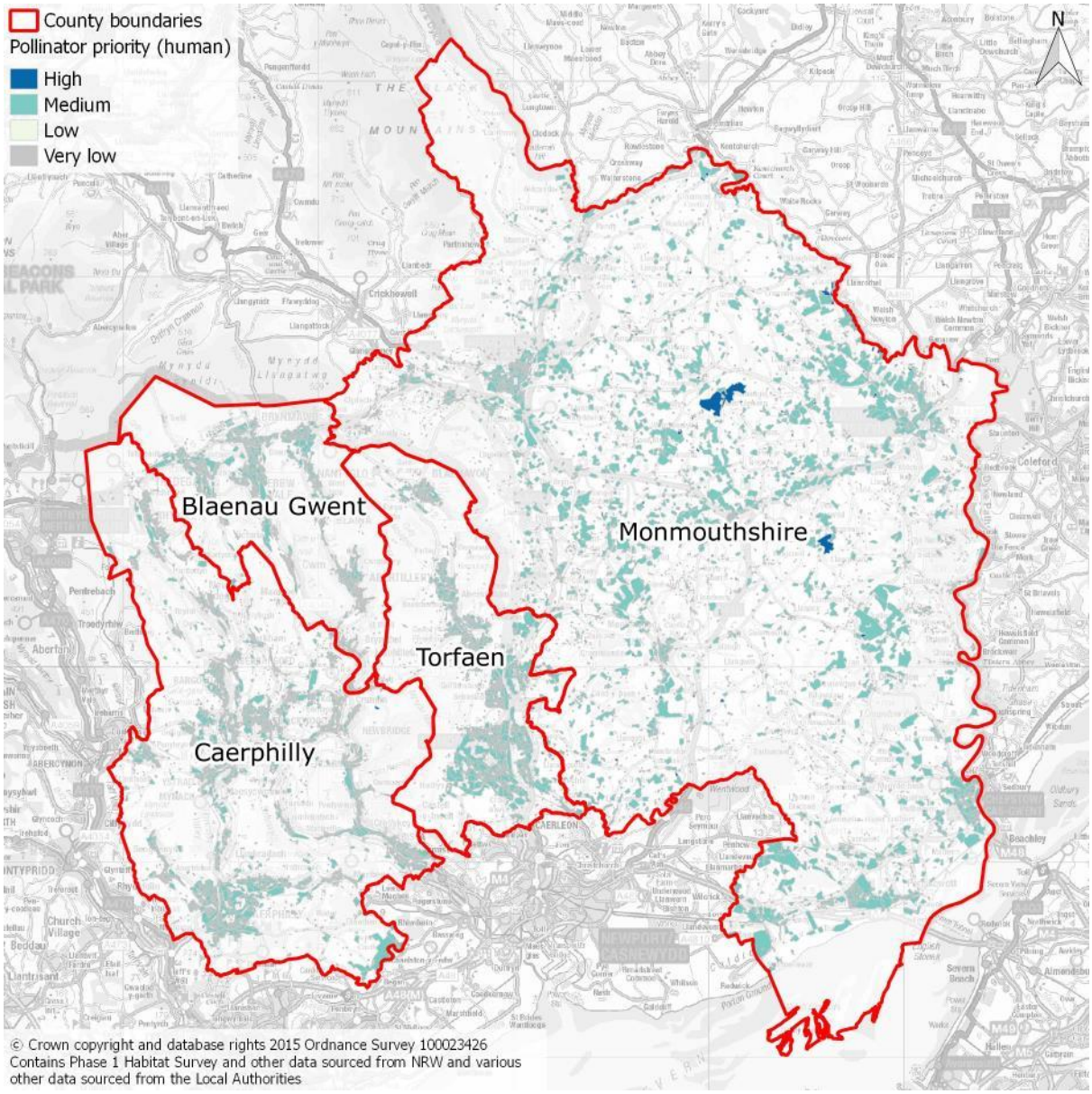


Figure 17 - Map showing areas where pollinators directly contribute to supporting human life in SE Wales.

The map includes orchards, allotments, gardens, nurseries, horticultural business, soft fruit farms and pick-your-own. Arable land (taken from CCW Phase 1 habitat survey 1979-1997) is mapped separately as only a relatively small proportion is oilseed rape which requires pollinators, whilst most is cereals which do not.

2.4.2 Pollinators needed to support ecosystems

Pollinators are needed to maintain biodiversity in ecosystems. As one measure of the natural demand for pollinators, key areas of plant diversity within the landscape are the statutory and non-statutory sites such as Sites of Special Scientific Interest (SSSIs), Local Nature Reserves (LNRs) and Sites of Interest for Nature Conservation (SINCs). Figure 18 shows the distribution of such sites within the study area. These show high demand for pollinators in the uplands, the Gwent Levels and the Wye Valley with relatively low demand in the agricultural lowlands of Monmouthshire. Differences in the designation criteria for SINCs in different Local Authorities result in significant areas being designated in the different areas.

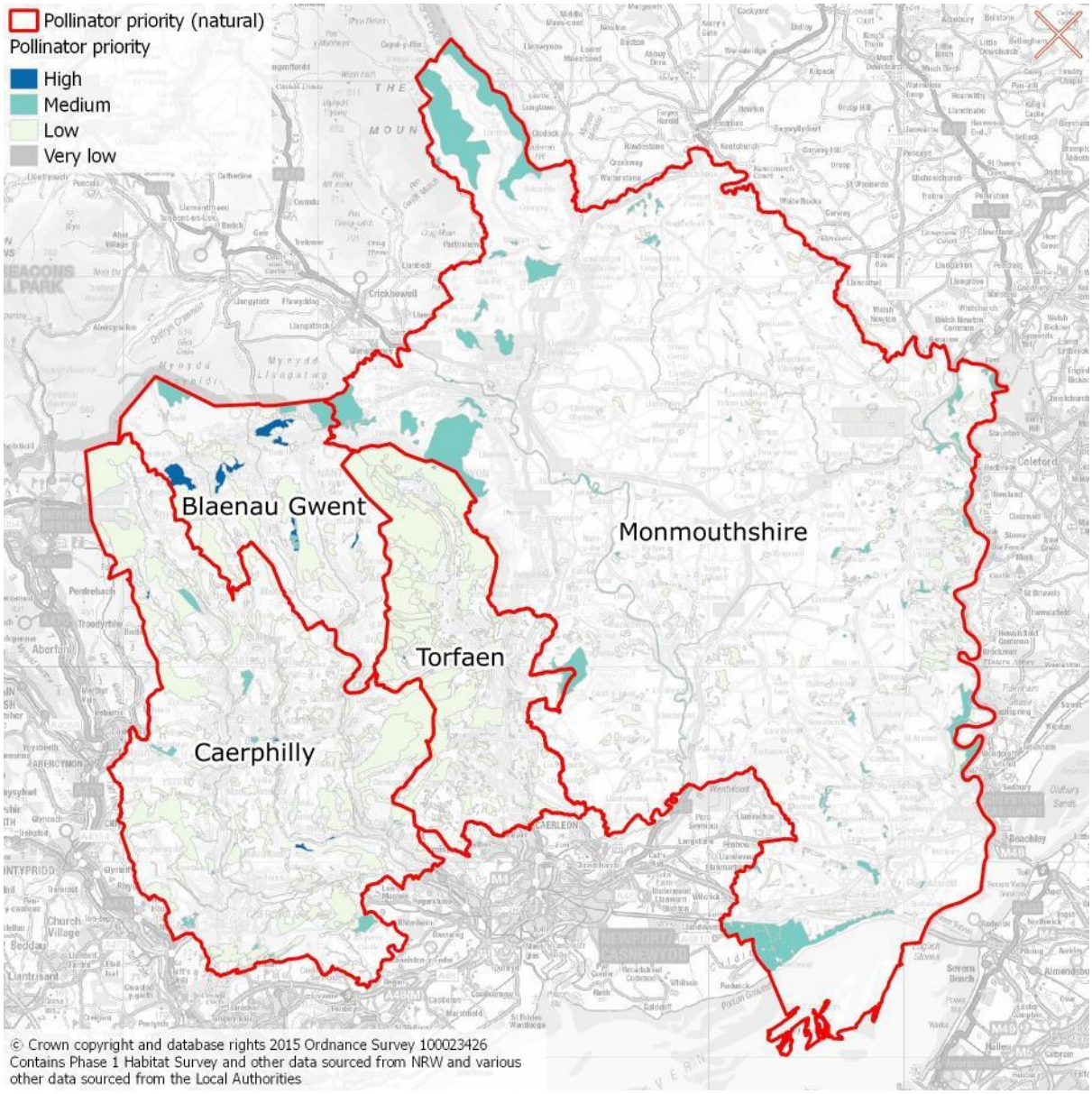


Figure 18 - Map showing areas where pollinators directly contribute to supporting biodiversity in key places such as Sites of Special Scientific Interest (excluding marine sites), nature reserves, and Site of Importance for Nature Conservation in SE Wales

2.4.3 Combined human support and key biodiversity map

Figures 17 and 18 have been combined to give one map indicating priority areas for pollinators (Figure 19).

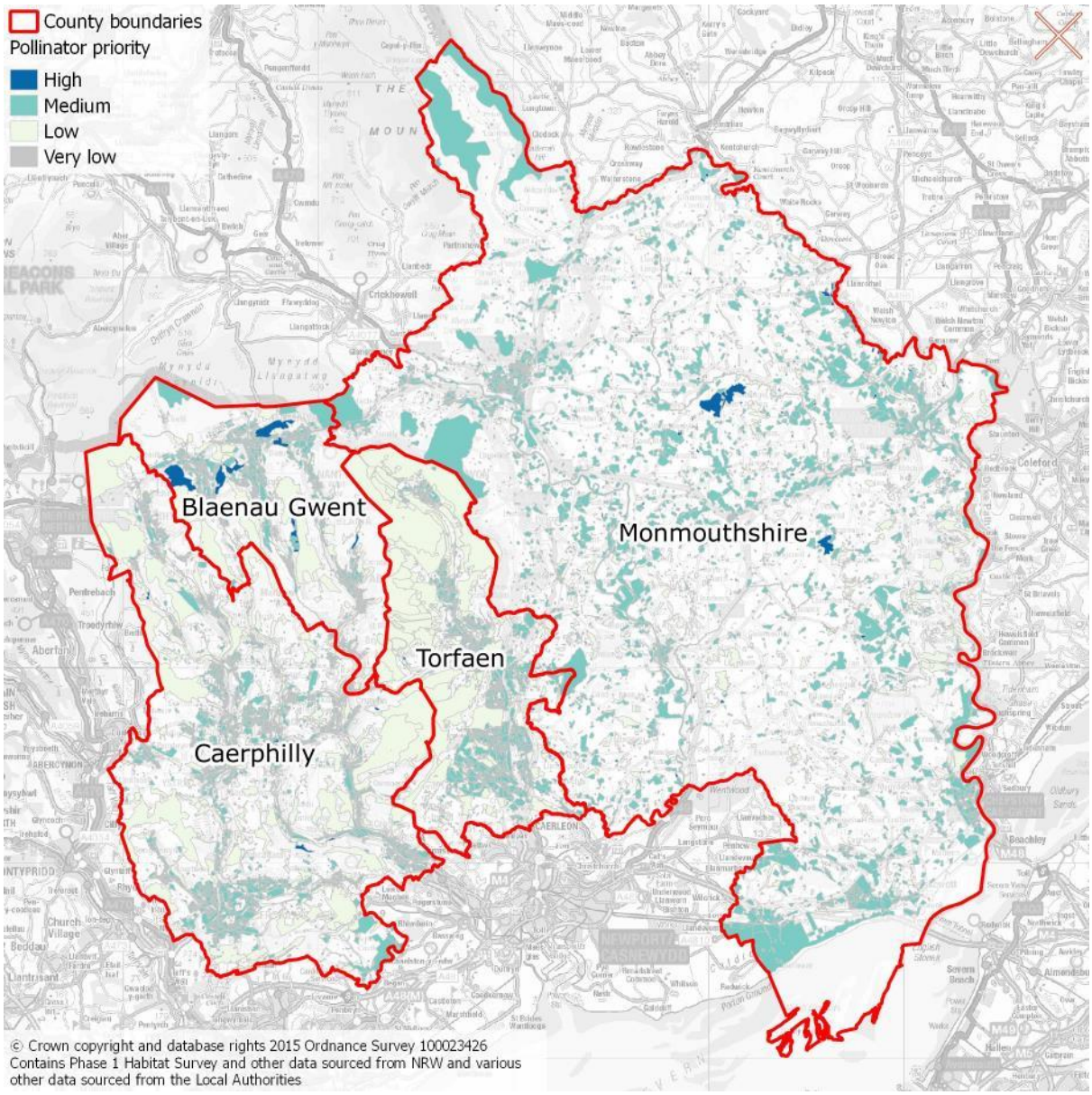


Figure 19 - Map showing combined areas where pollinators are required for supporting human life and biodiversity in SE Wales (combined from Figures 17 and 18)

2.4.4 Pollinators needed to support rare plants

Different species of plants often require specific pollinators, and rare plants in particular are vulnerable to extinction if pollination failure results in them being unable to reproduce. Table 3 lists the 12 Section 42 vascular plants (i.e. rare species of priority for conservation in Wales) in the study area which require pollination to set seed; a range of different pollinators are needed.

Table 3 - Section 42 plants in the study area that require pollination to set seed. The pollinators have been compiled from a few internet searches

Section 42 plant	Pollinator	Source
Bupleurum tenuissimum Slender Hare's-ear	General insects	No specific references found; open flower structure indicates probably pollinated by non-specialist insects
Campanula patula Spreading bellflower	Mainly bees, some flies and beetles	http://www.tandfonline.com/doi/abs/10.1080/00218839.2015.1030243?journalCode=tjar20
Centaurea cyanus Cornflower	Mostly bees, with diverse range of other insects; also partially self-compatible	Journal of Pollination Ecology, 8, 2012, pp 52-58
Euphrasia officinalis subsp. *anglica* Glandular eyebright	Probably most self-pollinated, but also probably visited by hoverflies and bumblebees	http://www.nature.com/hdy/journal/v94/n1/full/6800553a.html
Euphrasia pseudokerneri Chalk eyebright	Probably most self-pollinated, but also probably visited by hoverflies and bumblebees	http://www.nature.com/hdy/journal/v94/n1/full/6800553a.html
Gymnadenia conopsea Fragrant orchid	Butterflies and moths	http://www.ncbi.nlm.nih.gov/pubmed/15586296
Hypopitys monotropa Yellow bird`s-nest	Bumblebees	http://www.amjbot.org/content/96/7/1337.full
Oenanthe fistulosa Tubular water-dropwort	General insects	No specific references found; open flower structure indicates probably pollinated by non-specialist insects
Platanthera bifolia Lesser butterfly-orchid	Moths	Maad, J. 2002. Selection and floral evolution in Platanthera bifolia and P. chlorantha (Orchidaceae). Acta Univ. Ups. Comprehensive Summaries of Uppsala Dissertations from the Faculty of Science and Technology 685. 26 pp. Uppsala. ISBN 91-554-5226-4.
Ranunculus arvensis Corn buttercup	Flies	http://www.pfaf.org/user/Plant.aspx?LatinName=Ranunculus+arvensis
Sorbus eminens Round-leaved whitebeam	Probably mostly bees	Shanna Ludwig PhD thesis, University of Bristol; this species require pollination for seed set but the pollen provides no genetic input into the seed.
Vicia orobus Wood bitter-vetch	bumblebees	Kay, Q.O.N. & John, R.F. 1997. Patterns of variation in relation to the conservation of some rare and declining plant species, in T.E. Tew et al. (eds) The role of genetics in conserving small populations, pp.41-55. Joint Nature Conservation Committee, Peterborough.

3 MEASURES TO BENEFIT POLLINATORS

3.1 General principles to benefit all pollinators

Pollinators need flowers as food sources. They may collect either nectar or pollen from the flower or both, depending on the plant as different plants produce different amounts of pollen and nectar. The nectar is mainly used as an energy source and the pollen is especially important for feeding their young.

Different crops and different wild plants require different pollinators, often to include a range of species. Therefore measures to encourage a range of insects groups need to be considered to maintain pollinator ecosystem services. The main groups of pollinators (e.g. bees and wasps, hoverflies, beetles, flies, butterflies and moths) also have very different habitat requirements and life cycles; one solution will not fit all species. A number of general principles need to be considered.

3.1.1 Increasing diversity of flower-rich resources will benefit pollinators

In general, a diversity of habitats which support a diversity of plants will support a diversity of pollinators, so an increase in plant diversity will help support more pollinators. Recent research into bee declines has indicated that colonies that have access to diverse and plentiful pollen and nectar sources are better able to withstand the impacts of disease, parasites and non-lethal doses of pesticides.

Different pollinators may be adapted to different plants and vice versa. For example many species in the deadnettle family require pollination by bees of a certain size, whilst some orchids require pollination by specific wasps or moths. Other plants such as hogweed have open flowers which can be pollinated by a range of insects. Long-tongued bees are adapted to pollinating clovers.

Individual pollinator species usually require a range of plant species to feed on, not just one. For any one pollinator there may be quite a range of different flowers visited, both spatially and temporarily, as different flowers are available at different times of the year and in different places.

3.1.2 Increase in abundance of food resource will benefit pollinators

The abundance of flower food resource can affect the pollinator populations; it is likely that larger areas of flower rich habitat will support larger populations of pollinators if other factors such as nesting sites are not limiting. Pollinators also tend to be attracted to larger concentrations of suitable plants than scattered isolated plants.

3.1.3 Availability of flower-rich resource is required throughout life cycle

Flowers need to be available throughout their adult life cycle. Insects do not only need food when crops are flowering, but also at other times of year to enable populations to be built up and maintained. For example, early nectar sources are very important for bumblebee queens seeking to establish successful colonies in the spring.

3.1.4 Other stages of life cycles are also important

Pollinators may also require resources for other stages in their life cycles. These include juvenile food plants, nesting sites and over-wintering sites. Different species may have very different requirements.

Individual pollinator species may require different plant species to feed on in juvenile stages compared to adults. For example, red admiral caterpillars feed on nettle foliage which does not provide nectar for the adult butterflies. Maintaining overall plant diversity is therefore important for maintaining pollinator diversity.

Nesting sites are also important for some groups that tend their young. Some bumblebees nest underground in small mammal holes, under sheds and in heaps of compost, whilst others make nests above ground in thick grass or in trees. Solitary bees may make their nests in lawns and others may dig tunnels in compacted soil, masonry or wood. Wild bees may nest in dead trees so provision of dead standing wood in woodlands may help provide suitable habitat. Honeybee colonies tend to be much larger than bumblebees (c. 50,000 vs c. 400 for bumblebees) and as such require much larger nesting sites. In terms of holes in trees, the optimum size is around 40 litres, so leaving large, dead tree trunks standing may be required to allow suitable habitats to develop.

Over-wintering requirements vary between groups too, and only a few species remain active over the winter. Some species burrow into soil or leaf litter, under the bark of trees or in ivy, in standing vegetation, or in crevices in rocks or buildings. This may require some areas to be left unmanaged through the whole winter allowing pollinators to hibernate and emerge.

Some blue butterflies have larvae that spend some of their life cycle as parasites in ants nests, so may also depend on the requirements of the ants.

In addition to provision of flowers, it is also possible to assist with other stages of the life cycle. For example, provision of bee boxes or 'hotels' with plants stems and canes and blocks of wood have proved popular and can attract some solitary bees to nest. Bumblebee boxes can provide nesting habitat and attract them to gardens, though some studies show only limited uptake of artificial bumblebee hives (Goulson 2010). Tree bumblebees will use bird boxes. Provision sacrifice crops adjacent to cultivated crops (for example cabbages grown and left to be eaten by large white caterpillars) can provide resources for the juvenile stages.

3.1.5 Surrounding land context

The surrounding land context can have a massive effect on pollinator populations, as pollinators are often mobile and use more than one habitat. If a pollinator site is in an agricultural context, the dominance of single crops and use of pesticides, even if selective, can markedly affect pollinator diversity and abundance. An intensive agricultural context may have a greater effect on pollinator populations than green infrastructure development, e.g. negative impacts of pesticides could in some circumstances could over-ride potential short term benefits of localised habitat creation or improvement. Some other pollinators are far less mobile and may not be affected in the same way.

By far the biggest impact on conservation of pollinators in the lowlands in the study area could be made by more appropriate management of agricultural land, though this is not in public control. Simple measures such as reduction of pesticide use, promotion of integrated pest management systems which were reasonably successful in the 1970-80s, organic farming systems and creation of wild flower habitats, either a meadows or headland strips around fields would all contribute massively to maintaining pollinators.

3.2 Measures to benefit individual species

While it is possible to propose measures to conserve individual pollinators within an area, or re-introduce them, evidence from reintroduction of the short-haired bumblebee at Dungeness (Gammans et al. 2015) shows it can be a complicated process as the full requirements of each species are usually simply not known. Requirements may include the full range of food plants, the habitats they require to complete other stages of their life cycles and the impact of predators and parasites; for most rare species these are simply not known.

In some cases, measures for specific species are the same as those which benefit all pollinators. Typically the more generalist bee species are better able to cope with a wide range of conditions and have not suffered such noticeable declines as some of the more specialist species, due to habitat loss. By taking measures to redress some of this habitat loss, the situation can be improved for the rarer species, and much of this is incorporated in the Action Plan. Many specific measures will also bring more general benefits too, for example planting devil's bit scabious which is primary food plant of marsh fritillary, also provides a favourite nectar source for many bumblebees.

One such habitat restoration scheme near Bridgend is the Coity Wallia Commons Biodiversity Enhancement Project, which is aimed at restoring and reconnecting wildlife habitats across a 1000 acre site. It is hoped that by changing management of the site, altering grazing patterns and recreating areas of traditional hay-meadow, the needs of two rare butterflies (marsh fritillary and high brown fritillary) and one rare bee (shrill carder bee) can be met.

Many butterfly and moth species are even more specific in terms of their habitat requirements, and here targeted actions will be required – while the Action Plan identifies that specific measures will be required, the level of detail involved will need to be researched and developed.

A broad action to identify suitable locations to develop appropriate measures for individual key species has been included but the actual task of deciding what these measures should, be and where to focus them requires species-specific research. The plan should however help to provide a framework of other actions into which such specific measures may fit, and provide some support towards developing such measures.

3.3 Pollinators and management

Across all the green infrastructure types, there are some common management principles which should be adhered to unless there is a clear reason not to do so. Land needs to be actively managed for pollinators even though the management required may not be intensive or more costly in terms of resources and manpower.

3.3.1 Understand the existing resource

In many cases there are existing valuable features present, which need to be considered prior to implementing any major changes. For example, on grass verges that contain orchids and have successfully maintained them for many years, it would be inappropriate to plough them up to create annual wildflower meadows. This highlights the importance of undertaking survey work prior to making changes, and ensuring that any measures taken are based on a good knowledge and understanding of the site, including any existing designations.

3.3.2 Aim to increase diversity

The general principle is to increase species and habitat diversity. Several different types of habitat in close proximity are preferred to a single treatment applied to one large area. The greatest benefits will probably be achieved across larger sites with smaller sites benefitting from simpler treatment.

3.3.3 Pollinators may take time to use green infrastructure

As insect populations may take time to respond to the provision of extra resources, sometimes over several years, patience may be required to see increases in pollinators.

3.3.4 Rotational maintenance

As well as spatial diversity, creating temporal diversity can be beneficial. Adjusting maintenance regimes so that a large area is not all cut at once creates vegetation at different stages of growth. For example on an area of close mown grass, reducing the cutting frequency will allow more flowering plants within the sward to reach the point of flowering and provide nectar for pollinators. If this area is all cut at once the entire resource is removed but by cutting half at one time, and the other half a few weeks later, a much more constant supply of food is maintained. The same principle applies to hedgerows, or areas of scrub, which could have different areas cut each year on a 2-3 year cycle.

3.4 Assessing existing pollinator resource – the Pollinator Evaluation and Grading System (PEGS)

When planning green infrastructure projects for pollinators, it is important to assess the value of the existing resource for pollinators before making changes, so that poor resources can be targeted for improvement and good resources are not accidentally replaced with new infrastructure.

Pollinators have a huge range of requirements and assessing the value of a habitat is complex. As it may not be practical to have an ecologist with knowledge of pollinators to assess each and every site before work is planned, some guidance is needed for non-specialists.

A very simple grading system has been drawn up based on the general principles that structural diversity and floristic diversity will be good for pollinators; this is called the pollinator evaluation and grading system (PEGS).

Each site is scored for a range of generalised features and the scores are added to give an assessment of value. Different habitats should be scored separately within a site, targeting areas where green infrastructure could be created. Pictures of some habitats with assessments are given in Table 4.

As with all simplifications, there are of course limitations which include the following:

- It does not account for seasonal variation (so ideally would be surveyed May-September)
- The proxy measures of species diversity (number of flower colours) could include lots of different species all with, say, yellow flowers, but is easier for non-specialist to assess than to determine the actual number of different species.
- It does not take into account the actual pollinator's present, or rare species.
- Different people see and score features slightly differently.

None-the-less it provides a basic assessment tool which can be used by the general public to assess their sites. Expert opinion will always provide a better assessment and advice.

Table 5 - A Sample Proforma for PEGS

POLLINATOR EVALUATION AND GRADING SYSTEM (PEGS)				
Site:		Grid reference:		
Surveyor/s:		Date:		
Site Description:				
Feature	**0**	**1**	**2**	**Score**
Habitat	Amenity grassland Bracken Cereal crops Conifer plantation Improved grassland Bare rocks, stone, earth, etc. (less than 10% vegetation cover) Open water	Flowering crops Heathland Hedges Marsh and swamp Mires, fen and bogs Mixed woodland Railway Riverbank Road verge Saltmarsh Semi-improved grassland Urban (including gardens, parks, churchyards, etc.)	Broadleaved woodland and scrub Orchards Sand dunes Sea cliffs Shingle Tall weedy areas Unimproved grassland Waste ground	
Adjacent habitats within 25 m	Score as for habitat; select highest score	Score as for habitat; select highest score	Score as for habitat; select highest score	
Vegetation structure	Uniform, all one height and cover	Variable in height or in patchiness (not both)	Varied in height and lots of different patches	
% vegetation covered with flowers	Less than 5%	5-20%	More than 20%	
No. different colours of flowers present (e.g. blue, pink, red, yellow)	0 or 1 colour only	2-3 colours	4 colours or more	
Clover (all types)	Absent	Small amounts present	Lots present	
			Total score:	

Evaluation: total scores	Poor 0-3; great potential for improvement!	Moderate 4-7; some potential for improvement	Good 8-12; maintain good features

Table 4 - Examples of habitat of different value for pollinators

Habitat	Evaluation
	Poor pollinator habitat – Amenity grassland a relatively uniform area of grass with few flowers (except on short mown area); this would score 1-3, mainly for urban adjacent habitat.
	Moderate pollinator habitat - road verge with lots of flowers with playing field adjacent (behind ball fence), varying in cover with lots of flowers of 2 main colours; this would score 4-5
	Good - unimproved grassland with adjacent broad-leaved woodland, varied structure and yellow and white flowers; this would score 8-9

4 STAKEHOLDER CONSULTATION

4.1 Consultations with key stakeholders

Telephone interviews covering the range of green infrastructure types with 12 key local authority staff were carried out in April-May 2015 using a standard questionnaire (Appendix 5; not all questions were relevant to all staff).

Two hour workshops were held with local authority staff in Blaenau Gwent**,** Caerphilly, Monmouthshire and Torfaen in June and July 2015, to report on progress on the project, to discuss green infrastructure options, what the constraints and opportunities were and learn from their experience. The workshop consisted of a brief introduction, a summary of the work undertaken so far and a discussion of individual case study sites within each local authority area demonstrating how the accompanying GIS Database could be used. The case studies were used to stimulate discussion to help develop an understanding of the local issues, obstacles and opportunities.

By having representatives from different departments such as Highways, Estates, Education, etc. present at the same workshop sessions, it was possible to develop a broader understanding of the range of different priorities that affect how people in different job roles may approach green infrastructure. It also provided the opportunity to explore a range of opportunities that exist, and begin to see how some of these opportunities could be taken forward.

It was clear that each local authority worked in different ways and had different experiences. For example school maintenance in some local authorities is largely carried out by Parks departments whereas this work is undertaken by contractors in other local authority areas.

4.2 Summary of key points

Many important points were raised throughout the telephone and workshop consultations which are combined and summarised below:

4.2.1 Pictorial Meadows

4.2.1.1 *Baseline information*

- ‘Pictorial Meadows’ type annual or perennial wildflower mixes can be well received by the public.
- While offering far more nectar and pollen than close-mown grass, pictorial meadows do not meet all the needs of all pollinators.
- There is a very high demand from Community Councils and other groups for seed and/or sowing for pictorial meadows which is hard to keep up with.
- Perennial mixes can be hard to establish properly. Often they revert to grass and a small number of other species in a short period if correct maintenance procedures are not followed.

4.2.1.2 *Recommendations for project/outcomes*

- In many places the public have come to expect pictorial meadows as pollinator provision. Therefore there is a need to raise awareness that this is not a complete solution, although they offer a powerful way of getting people on board with the idea of pollinator provision.
- Pictorial meadows are acceptable in urban areas but not in the countryside.

4.2.2 Highway Management

4.2.2.1 *Baseline information*

- In many cases highway verge mowing has been reduced to a 1m wide strip along the edge of the carriageway and around infrastructure such as barriers and signs.
- Verges are cut to maintain visibility for safety reasons, and therefore visibility splays will continue to be maintained.
- Using a flail to cut this 1 m strip also re-distributes the build-up of road surface debris along the edge of the carriageway. This can be important for maintaining adequate drainage.
- In some local authorities, highway hedge trimming is often carried out by land owners (farmers). Effective management is not always carried out and enforcement may be required to ensure land owners responsible for hedges do cut them.
- Road verges in lower speed areas do not have the same visibility requirements, and in some cases reducing visibility can lead to lower traffic speeds and safer environments.
- Vegetation on the very edges of roads may need spraying with herbicide to prevent encroachment.
- Completely eliminating routine maintenance behind the 1m strip is leading to some areas already reverting to scrub, which could develop into woodland if not maintained. This is expected to become a much greater issue as budget savings have to be found.
- There is evidence that important rich grassland habitats which have been actively managed to preserve biodiversity are reverting to scrub due to reduced maintenance. This is resulting in a reduction of these habitats which will impact negatively on pollinators.
- Where maintenance has been minimised and grassland habitats are becoming scrub, there will be road safety issues resulting in vegetation clearance. This form of intervention will be intensive and expensive, so small scale management in the short term should be considered.
- Where hedges not cut for 3 years, there is more woody debris to remove from site and often larger equipment is required which can lead to disruption on the local road network.
- Some good verges have been ploughed up for planting with annual mixes of lower value than the existing vegetation.

4.2.2.2 *Recommendations for project/outcomes*

- There is already a wide range of cutting/mowing specifications within Highways and Parks Department so changes just need formalising and planning.
- It may be possible to make adjustments to the height to which verges are cut, even if frequency is kept the same (little financial scope for cutting some areas and not others)
- Highways Authorities have the power under Section 142 of the Highways Act 1980 to confer rights to maintain certain areas of their land to other individuals or groups. Conditions can be attached to the licence to ensure such areas are treated in an appropriate way. There are currently three licence agreements in Blaenau Gwent, although this could be implemented much more widely through the local authorities.
- There is a lot of scope for pollinator provision on road islands in residential areas etc.
- Major bulb planting exercises (e.g. daffodil beds) should be restricted to urban areas.

4.2.3 Grass cutting

4.2.3.1 *Baseline information*

- Some arrangements are in place within local authorities for local farmers to cut areas on their behalf in exchange for keeping the hay crop collected from it. This is limited to the more commercially viable large, flat, uniform areas. Litter, ragwort and dog faeces in hay can be an issue.
- Few local authority teams are equipped to cut and collect, and there is still a labour cost in doing this, plus any extra requirement for transporting and disposing of cuttings. Caerphilly have bought 2 rear-mounted flail and collect machines through the Nature Fund.
- There are costs associated with disposing of cuttings if removed from site for central disposal, therefore the current preference is to dispose of arisings onsite e.g. in a discrete corner. In Caerphilly there are internal charges accrued in offsite disposal. .
- In some local authorities, cuttings could possibly count towards green waste targets – further action is required to investigate how the cost of collection compares to savings from the reduction in fines for not hitting recycling targets.
- If cuttings go to green waste, they must be litter-free or they have are classified as general waste which is much more costly and does not attract the recycling benefits.
- Wild flower verges with signs and management plans are widely used elsewhere in Britain but are not currently used in the study area.
- Signage to indicate areas managed for biodiversity has been used, but could be improved. School children could be asked to design 'bee' and 'butterfly' signs for such sites.
- Long dry grass can be fire risk, especially from cigarettes adjacent to roads.
- Sowing yellow rattle seeds in areas of dense grass to reduce the vigour of the grass growth has worked in some areas. Monmouthshire have reported a success rate of approximately 90% in its use to reduce grass growth. Caerphilly are now in their third year of successfully using yellow rattle at some sites.
- If cuttings are removed, the quantity of cuttings will decline with time as soil fertility declines leading to cost savings in longer term.
- Reducing grass cutting frequency can bring many benefits, but there are also a number of issues, and in some cases little or no benefit for pollinators.
- After years of intense cutting there are few wild flowers left within areas of amenity grassland, so when the intensity and height of cutting is changed grasses dominate giving little or no pollinator value.
- There are potential issues relating to existing machinery and changing cut heights as it takes time to keep changing cutter heights. It is really important that operatives understand the importance of making relevant changes.

4.2.3.2 *Recommendations for project/outcomes*

- There may be scope in some areas for small scale local composting of cuttings, especially if combined with community growing projects, allotments etc.
- There may be options for manual collection of cuttings on sites by volunteers/trainees etc. In many cases saving costs by reducing the number of cuts, even without the collection of arisings, can be part of a wider strategy. The cost savings can be used to create some relatively more expensive areas of wildflowers which have greater benefits. For example, a piece of

land with close mown margins, long grass and some distinct areas of intensive wildflowers will be more beneficial than having it all close mown. This example should still represent a saving, as well as offering a diversity of different habitats which would benefit species such as moths and butterflies.

- The timing of cutting may be an issue if maintenance teams all want the machines at same time, however low value biodiversity verges etc. could be cut outside peak times to create a more even spread of operations.
- Local authorities will need to investigate the likely tonnage of cut material that would require disposal in order to develop a cost effective strategy within the authority.

4.2.4 School grounds

4.2.4.1 *Baseline information*

- School grounds present a number of opportunities for pollinators. Schools manage their own budgets regarding maintenance of their grounds and can appoint their contractor of choice, and set their own requirements.
- The Polli:nation project is currently working with clusters of schools and is showing great potential.
- The 'Plant a patch' project provided mixes of annuals to give instant results in first year which were under-planted with perennials for second year
- Many older schools have significantly larger grounds although it is generally managed as close mown grass.

4.2.4.2 *Recommendations for project/outcomes*

- Consideration should be given to having a funded Education officer to work with schools on promoting pollinators generally and as an educational resource. This officer could help develop projects, identify and obtain funding and guide the schools in structuring maintenance contracts. The local authorities currently have people doing elements of this especially through the 21st Century Schools programme, and initiatives such as Forest and Eco Schools but there could be further opportunities, especially for joined up working between schools and between local authority departments. In 2015 Caerphilly has 97 schools participating in projects to improve school grounds.
- There may be scope to include greater priority on pollinator provision when writing briefs for new school builds, and include this within the weighting of tender assessment criteria.
- Schools often need help with identification of the pollinators and how to change maintenance regimes to maximise impact

4.2.5 Estates

4.2.5.1 *Baseline information*

- Industrial estates have large areas of land but there is an expectation among tenants that the land is maintained to look neat and tidy.
- The original landscape design is often high maintenance although some companies cannot afford this now and areas are left and revert to scrub.
- Some industrial estates are quite good for pollinators with cotoneasters, heathers and trees, even though they are in formal planting beds.

- Local authorities are reducing maintenance of leased sites to reduce costs and many areas are only being mown every 3-4 weeks.
- Bee hives on roofs have not proved practical due to access where this has been tried.
- Some estate land is leased for grazing (e.g. <5% in Caerphilly). Grazing is not currently controlled although it might be possible to specify grazing levels to enhance pollinators
- Concern was expressed that enhancing the value of council estates department land for biodiversity might affect the saleability of land for development.
- When grass cutting was reduced in one industrial estate, it was noted that orchids colonised.

4.2.5.2 *Recommendations for project/outcomes*

- A wider understanding of sustainability and green credentials may be required to change the perception of industrial estate tenants' but this could have more general benefits beyond pollinators.

4.2.6 Housing Associations

4.2.6.1 *Baseline information*

- In Caerphilly, tenants groups are already working well, but there are many competing interests for space e.g. children exercise and *no ball games* signs are being taken down.
- Littering can be a problem when grass is left longer, both in terms of general litter but it can encourage fly tipping etc.

4.2.6.2 *Recommendations for project/outcomes*

- There is scope on road islands or in small left over pieces of land in residential areas to increase pollinators. Even when they are used as kick-about areas, usually there are parts of a plot that could be enhanced by reducing the mowing regime or introducing wildflower meadow areas.
- The link between pollinators and healthy eating should be made to encourage vegetable growing, community orchards etc.
- It is important to get tenants on-side very early in the process of increasing pollinators.
- Staff appointed to deliver Welsh Housing Quality Standard may be useful for helping to deliver green infrastructure too.

4.2.7 Churchyards and cemeteries

4.2.7.1 *Baseline information*

- Cemeteries such as Ebbw Vale cemetery have hay cut and removal by local farmers.
- Gwent Wildlife Trust 'Living Churchyards' project, has run well in Brithdir and Abercarn cemeteries and resulted in increased value for pollinators, although there have been issues regarding access to graves
- In some cemeteries in Caerphilly yellow rattle and plug planting in long grassy areas and banks has been undertaken.

4.2.7.2 *Recommendations for project/outcomes*

- Cemeteries offer potential benefits for pollinators but care must be taken with respect to where the changes are undertaken and the perception of families with relatives located within them.

4.2.8 Working with communities

4.2.8.1 *Baseline information*

- There is significant scope to work with local communities, friends groups, tenants and Residents Associations etc. to improve pollinator provision.
- Greenmeadow Community Farm, Torfaen, do a range of educational activities and is keen to look at options for developing pollinator training schemes, whether for community volunteers, LA staff, or others. One of the issues with traditional consultation is that people want what they know – in many cases they need to learn what they could have (and why they might want that) before being asked to choose

4.2.8.2 *Recommendations for project/outcomes*

- Opportunities should be considered to fund a post, or posts, to work with such groups or to support those already working with such groups.
- Also opportunities should be pursued to develop joint projects with organisations such as Gwent Wildlife Trust, Keep Wales Tidy, Groundwork, Monmouthshire Meadows etc. Many such groups have access to funding that the local authorities do not, or are able to allocate resources to finding funding.
- Increasingly volunteers/charities are being given management of some service facilities such as bowling greens, leisure centres and cricket grounds, but they do not have resources to manage them fully. Many need to encourage small enterprises to look after smaller land units.
- There may be opportunities to build in Pollinator provision to the Single Integrated Plan and associated processes, helping to ensure that resources are protected where required.
- There are issues around expectations, both from the public, and elected members.
- Partly there is a need to move away from the mentality of expecting all grass to be kept very short all the time.
- Such changes in attitudes and public perception will take time, and demonstrating how things can be acceptable in key location before rolling them out more widely is important.
- Not everyone will buy into the changes, and staff need to be prepared to robustly defend a decision to make changes.
- Having policies and procedures that set out clearly and succinctly what is being done and why helps provide this support system.
- It is essential to ensure that decisions are well communicated to elected members, and throughout the local authority, across different departments.
- A 'toolkit' available to staff to provide answers to common questions would help ensure a common response to any public challenges.

4.2.9 Opportunities for on-going development

4.2.9.1 *Baseline information*

- Opportunities may exist to use Section 106 agreements and Community infrastructure levy (CIL) to pay for maintenance essential tasks and to avoid loss of important grassland habitats through neglect.
- Opportunities exist around new developments which are maintained by management companies, rather than adopted by the local authority.

- Ensure that suitable provision and appropriate maintenance is built into a scheme in early planning phases – this can help ensure areas are maintained in a way local authorities may not be able to afford to.

4.2.9.2 *Recommendations for project/outcomes*

- A possible funding source could be some sort of additional levy (such as the carrier bag charging scheme), that could then be protected to only be used for pollinator-related projects.
- There may be opportunities to 'Invest to Save' – these need to be explored, but if investment now e.g. in cut and collect equipment, or possibly even actual maintenance work, can be shown to save money in the longer term then it becomes more viable. Schemes exist to borrow money for such investments and pay back over a longer term.

4.2.10 Seed sources

4.2.10.1 *Baseline information*

- It can be hard to source wild flower seed of local South-east Wales provenance, or even of Welsh provenance. Sourcing of local trees can be much easier. Bulbs sourced can be from West Wales as they are not all native species.
- Local seed can be much more expensive.
- Much current 'wild flower' sowing is cheap Californian mix of little value to local pollinators, it is important that people are educated about native mixes.

4.2.10.2 *Recommendations for project/outcomes*

- Advice on native seed sources and native mixes to be included in the guidance.
- There is potential for collection of seed for green infrastructure projects from Local Authority or public land holdings.

4.2.11 Weed control

4.2.11.1 *Baseline information*

- Some plants that are good for pollinators are regarded as weeds. There are complaints about dandelions going to seed and spreading. The public need greater knowledge and understanding about pollinators and how some species considered as weeds, such as the dandelion, are good for pollinators. It was noted that one local authority is having to use selective herbicides on dandelions after complaints.
- Japanese knotweed and Himalayan balsam can cause problems on some roads and public spaces and control by spraying is required.
- Some ragwort control (pulling) is required on major roads adjacent to agricultural land (Weeds Act 1959).
- Local authorities use pesticides in some situation (e.g. control of aphids in formal gardens).

4.2.11.2 *Recommendations for project/outcomes*

- Some weeds like nettles are important for caterpillars, so they should be managed and retained in some areas.

5 ACTION PLAN

This plan describes actions that can be used to benefit pollinators in South-east Wales through the management of publicly-owned green infrastructure. It has been developed for use by local authorities, their partners and community groups.

It is based on existing information, best practice review and stakeholder consultation. It is also available as a separate stand-alone document. Further explanation of the derivation of the action plan is given in Appendix 6.

5.1 How to use this action plan

The Action Plan contains a series of tools to guide the user through it. These are:

- the **Geographic Information System (GIS) Database**;
  - The GIS database is a collection of about 120 datasets which can be used to identify priority sites, confirm public ownership, land classification, ecological connectivity (e.g. Latham et al. 2013) and understand its characteristics and constraints.
  - The land classification is important as it enables appropriate actions to be selected for the geographic context.

- the **Pollinator Evaluation and Grading System (PEGS)**;
  - PEGS is a simple form for assessing existing pollinator resources at a site where expert opinion is not available. The scoring systems enables a user to quickly establish the potential for improvement or whether to maintain existing features.

- the **Green Infrastructure Action Plans**;
  - The Green Infrastructure Action Plans cover 18 different infrastructure types, such as road verges and parks. The plans set out the aims, desired outcomes, assessment steps, options, risks, main stakeholders and sources of further information for each infrastructure type.

- the **Land Classification Matrix**;
  - The Land Classification Matrix allows appropriate management actions to be selected by cross-relating the land classification and green infrastructure type.

- the **Management Actions Toolkit**;
  - The Management Actions Toolkit contains details of management actions including the aims, potential benefits, risks/hazards/considerations, indicative cost and related actions. It is split across eight themes, such as grass cutting actions or hedgerow actions, with each action having a code (e.g. GR1, CR3).

- the **Case Studies**
  - Four case studies have been developed to provide examples of how the Action Plan could be used.

Figure 20 - Tools and users associated with the Action Plan

These tools form a process split into the following stages:

Figure 21 - The Action Plan Process

There are two main approaches to using the action plan, site-based and strategic.

The site-based approach is for those wishing to improve resources for pollinators on a specific site. For example, a Head Teacher may wish to change management practices on part of the school grounds. In this instance, the site, land ownership and green infrastructure type are already known, so the process can begin with identifying the land classification.

The strategic approach is for those who wish to improve resources for pollinators across wider areas without any specific sites in mind. Using the GIS database, priority sites can be identified with their land ownership and green infrastructure type before continuing on with the land classification.

After this first stage, the middle and final stages of the Action Plan are the same for both the site-based and strategic approaches.

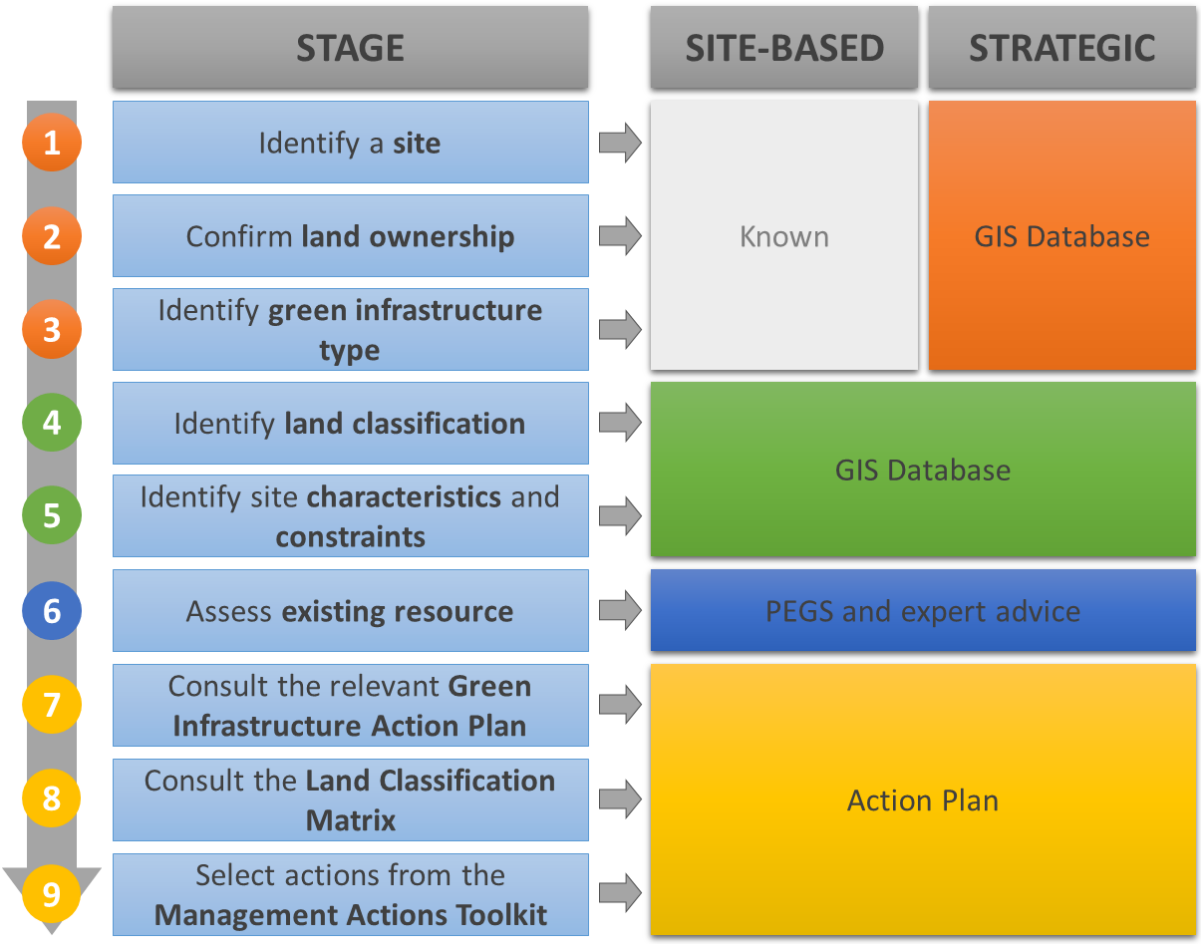
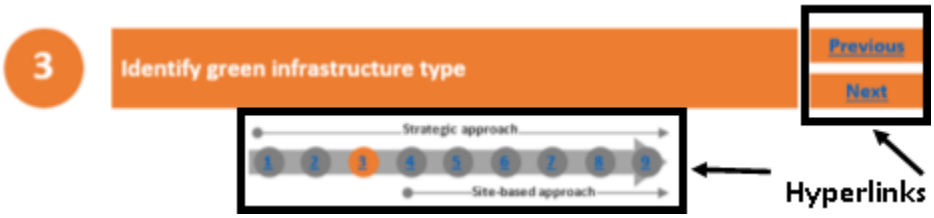
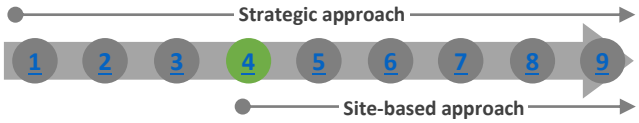


Figure 22 - The Action Plan process detailing the site-based and strategic approaches

The Action Plan process is explained below with the different stages hyperlinked throughout allowing for quick navigation through the different steps.



5.1.1 Site-based approach



The land classification provides geographic context so that appropriate actions can be selected (e.g. for urban areas). It is used in combination with the green infrastructure type in the Land Classification Matrix.

The land classification is based on the LANDMAP Visual and Sensory level 2 classification. There are seven categories of land classification:

- Inland Water (e.g. Llandegfedd Reservoir)
- Upland (Upland valleys, Exposed upland plateau)
- Hills, lower plateaux and scarp slopes
- Lowland (Flat lowland/levels, Rolling lowland, Lowland valleys)
- Coastal
- Built land
- Developed unbuilt land

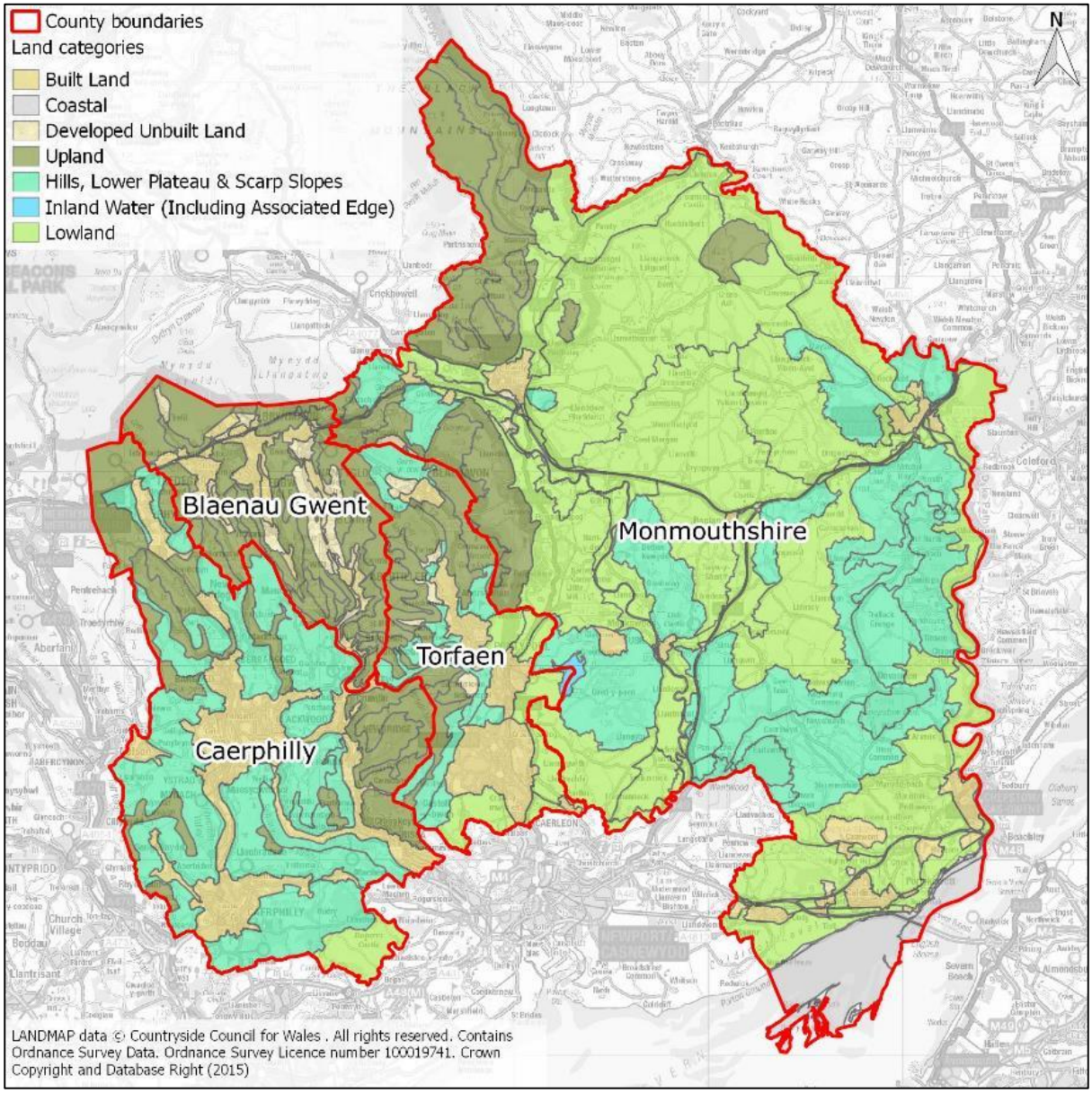
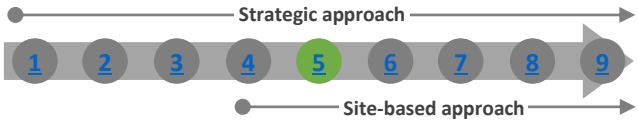


Figure 23 - Land classification map

5 Identify site characteristics and constraints

Previous
Next



The GIS database can be used to identify helpful site characteristics and constraints (e.g. existing designations). A wide range of information is incorporated such as slope, public rights of way and ecological designations.

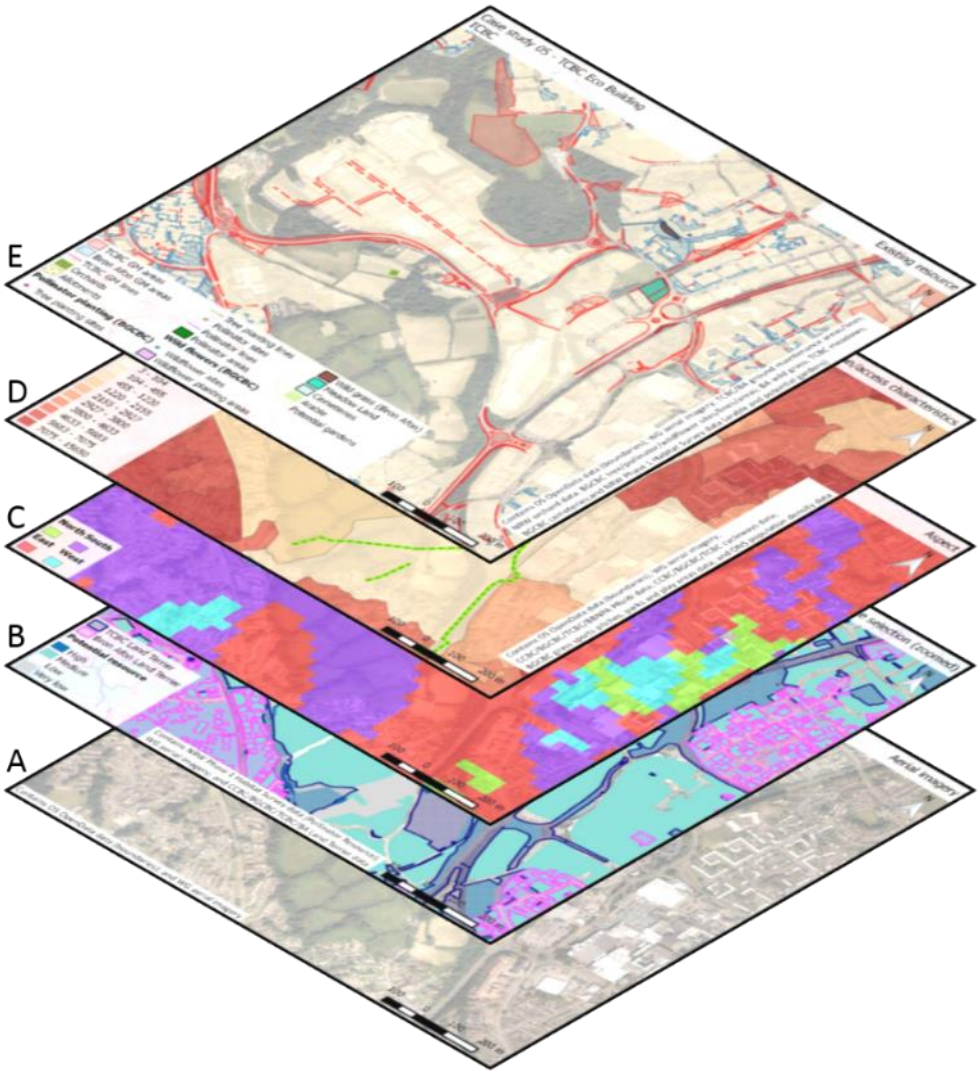
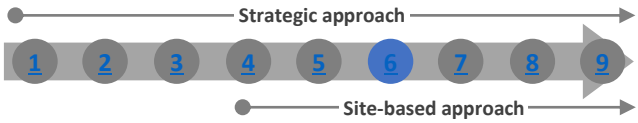


Figure 24 - Sample of the GIS database and the method of overlay mapping –

A) aerial imagery B) Pollinator resource and land ownership C) aspect D) population density and public rights of way E) existing resource

6 Assess existing resource

Previous
Next



When planning green infrastructure projects for pollinators, it is important to assess the value of the existing resource for pollinators before making changes.

The Pollinator Evaluation and Grading System (PEGS) is based on the general principles that structural diversity and floristic diversity will be good for pollinators.

Each site is scored for a range of generalised features, then summed together to indicate the value.

Different habitats should be scored separately within a site, targeting areas where green infrastructure could be created.

PEGS is only a guide and expert advice may be required.

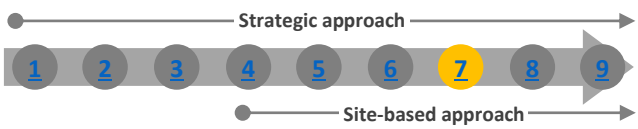
Score	0	1	2	Score
Habitats	Amenity grassland Bracken .... (see Action Plan for full list)	Flowering crops Heathland Hedges Marsh ...	Broadleaved woodland and scrub Orchards ...	
Adjacent habitats within 25 m	Score as for habitat; select highest score	Score as for habitat; select highest score	Score as for habitat; select highest score	
Vegetation structure	Uniform, all one height and space	Variable in height or in patchiness (not both)	Varied in height and lots of different patches	
% vegetation covered with flowers	Less than 5 %	5-20 %	More than 20 %	
No. different colours of flowers present (e.g. blue, pink, red, yellow)	0 or 1 colour only	2-3	4 or more	
Clover (all types)	Absent	Small amounts	Lots	

Score	Value for pollinators
0-3	Poor value for pollinators, high potential for improvements
4-7	Moderate value for pollinators, room for some improvement
8-12	Good value for pollinators, maintain

Figure 25 - The Pollinator Evaluation and Grading System (PEGS)

7 **Consult the relevant Green Infrastructure Action Plan**

Previous
Next



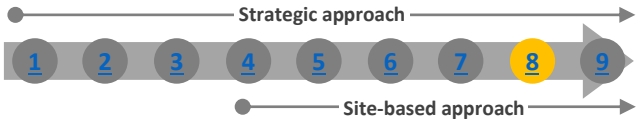
The Green Infrastructure Action Plans are a series of plans split into 18 different green infrastructure types. They set out the aims, desired outcomes, assessment steps, options, risks, main stakeholders and sources of further information for each of the green infrastructure types. The following green infrastructure types are covered:

- Roadside verges
- Public parks and gardens
- Outdoor sports facilities
- Car parks, office grounds etc.
- Historic sites
- Civic spaces
- Housing green space
- School grounds
- Managed gardens, care homes etc.
- Other amenity green space
- Allotments and community gardens
- Churchyards and cemeteries
- Water margins
- Derelict land and demolition sites
- Provision for children and young people
- Cycle routes and other non-motorised route ways

The plans give lists of management actions (using a code system) which are detailed in the Management Actions Toolkit.

8 Consult the Land Classification Matrix

Previous
Next



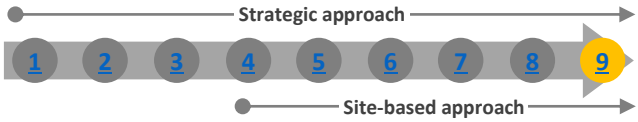
Once the land classification and green infrastructure type are known they can be used together in the Land Classification Matrix to select appropriate management actions.

		Land Classification Type						
		Inland Water	Upland	Hills, lower plateaux and scarp slopes	Lowland	Coastal	Built Land	Developed Unbuilt Land
Green Infrastructure Type	Roadside Verges		G1, G2, G3, G4, G5, G7 CR3, CR4 AU2, AU3 SCR1, SCR2, SCR3 HDG1, HDG2, HDG3, HDG4, HDG5, HDG6, HDG7 WD1, WD2, WD3				G1, G2, G3, G5, G7 CR1, CR2, CR3, CR4 AU2, AU3 FM1 WD1, WD2, WD3	G1, G2, G3, G5, G7 CR1, CR2, CR3, CR4 AU2, AU3 HDG1, HDG2, HDG3, HDG4, HDG5, HDG6, HDG7 FM1 WD1, WD2, WD3
	Public Parks and Gardens					G1, G2, G3, G5, G6, G7 CR1, CR2, CR5 AU3 FM1, FM2 WD1, WD2, WD3		
	Outdoor Sports Facilities (excluding pitches)		G1, G2, G3, G5, G7 AU3 CR4, CR5 FM1				G1, G2, G3, G5, G7 AU3 CR1, CR2, CR4, CR5 FM1	
	Provision for Children and Young People		G1, G2, G3, G5, G6, G7 CR3, CR4, CR5 AU3 FM1, FM2				G1, G2, G3, G5, G6, G7 CR1, CR2, CR4, CR5 AU3 FM1, FM2	

Figure 26 - Example of the Land Classification Matrix

9 Select actions from the Management Actions Toolkit

Previous



The final planning stage is to select management actions from the Management Actions Toolkit. These are split across eight themes:

- Grass Cutting Actions (G1-7)
- Creation Actions (CR1-4)
- Augmentation Actions (AU1-3)
- Grazing Actions (GR1-4)
- Scrub Management Actions (SCR1-3)
- Hedgerow Actions (HDG1-7)
- Formal Planting (FM1 and FM2)
- Woodland Management Actions (WD1-4)

The Management Actions Toolkit contains details on the management actions including the aims, potential benefits, risks/hazards/considerations, indicative cost and related actions.

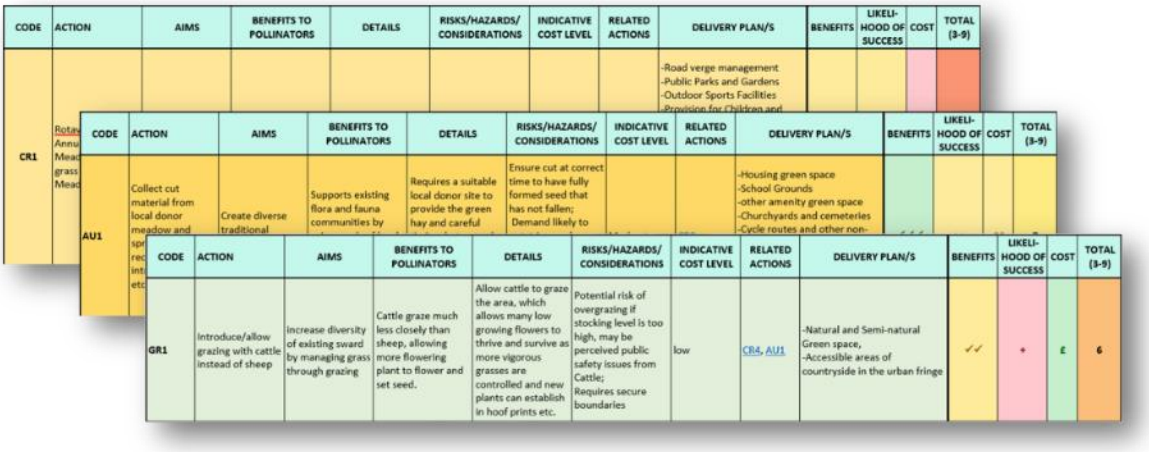


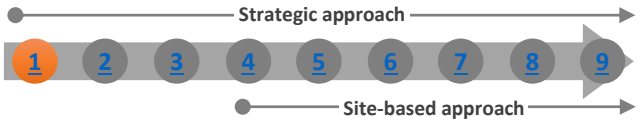
Figure 27 - Examples of the Management Actions Toolkit

5.1.2 Strategic approach

1

Identify a site

Next



The identification of appropriate sites begins with the GIS database and the *Pollinator action areas* layer. The *Pollinator action areas* layer is scored 0-3 with higher scores representing a greater priority and opportunity to improve resource for pollinators. The layer is coloured blue-green-orange-red with red indicating higher values.

These data have been derived from *Pollinator resource* and *Pollinator demand* layers using a rule-based scoring system. More detailed information about this method can be found in Section 2.3 of the main report.

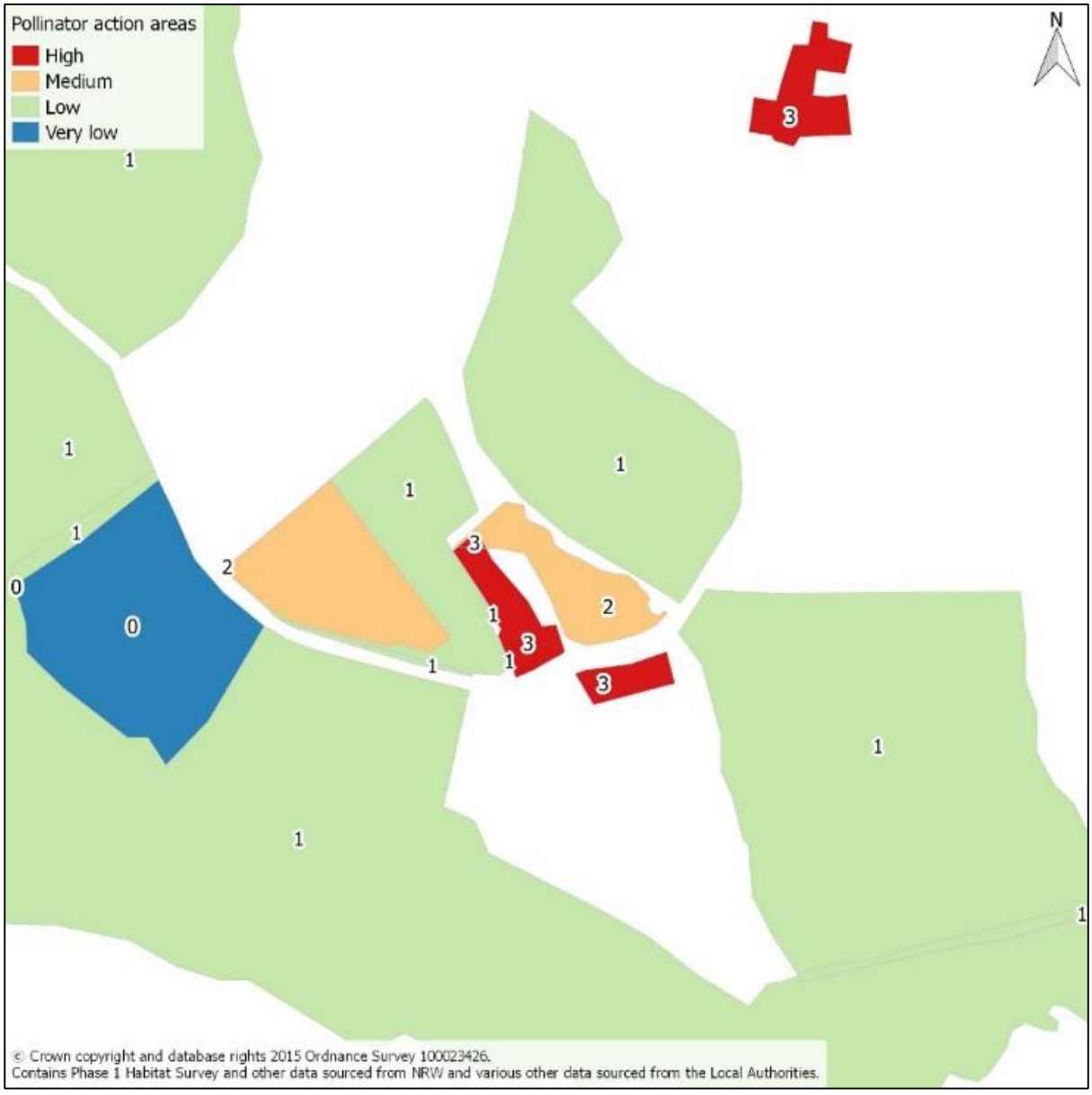
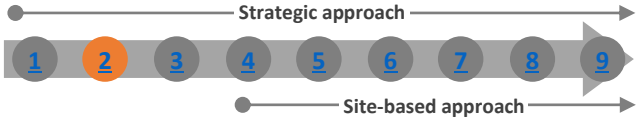


Figure 28 - Example of the Pollinator Action Areas dataset

2 Confirm land ownership

Previous
Next



Once a site has been identified it is necessary to confirm ownership of the land. This can be done using the GIS database where it possible to overlay a selected site with data relating to land ownership (in the case of the Local Authorities this information is contained in the Land Terrier, and can be confirmed by the Estates Department).

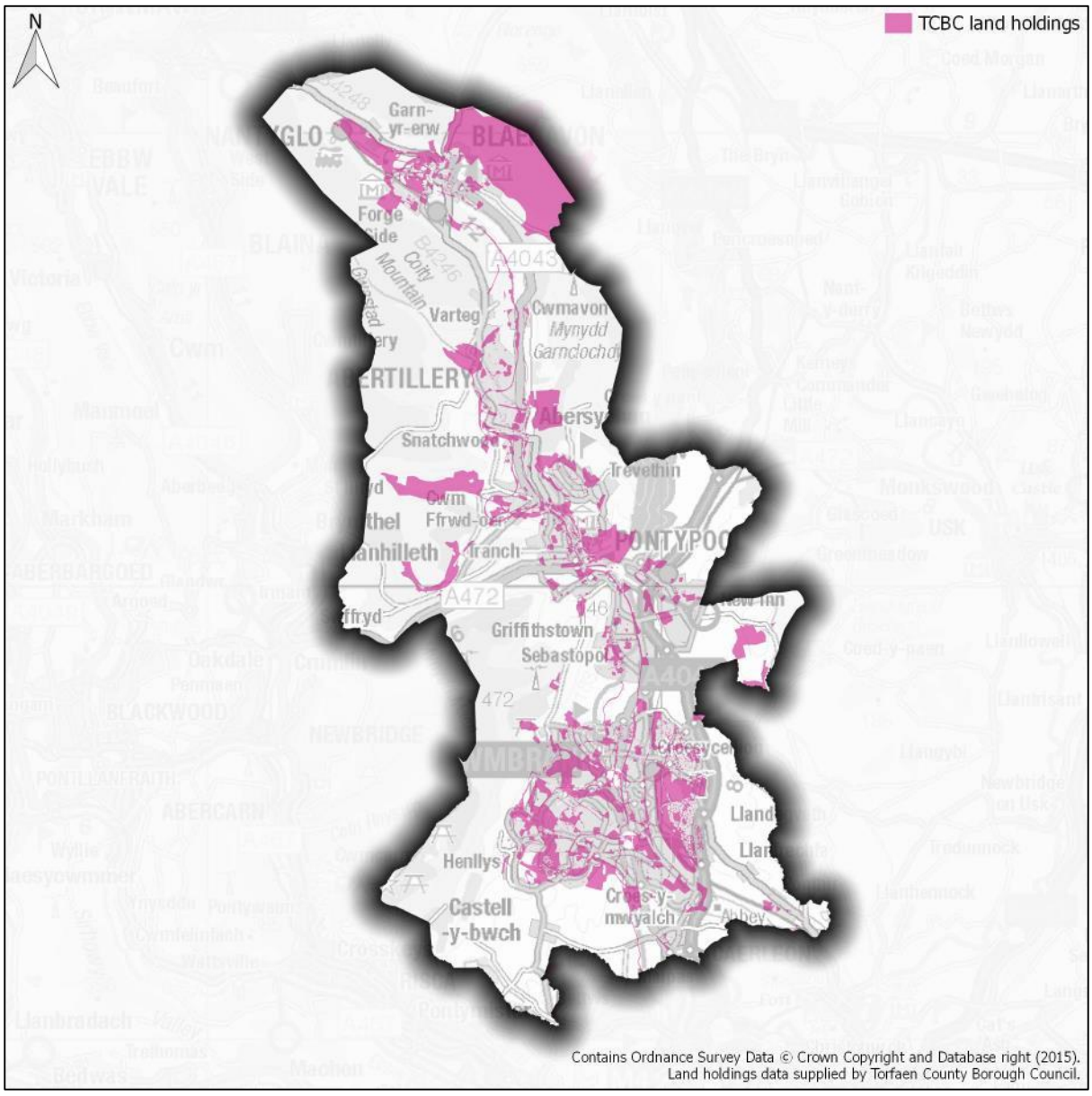
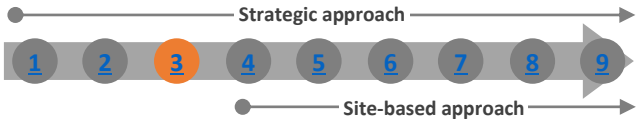


Figure 29 - Example of land ownership data narrowing the selection of site

Previous
Next

3 Identify green infrastructure type



It is important to identify the existing types of green infrastructure present at the selected site as this information is required later the Action Plan. The green infrastructure type can be identified via the GIS database using data such as aerial imagery or it can be identified by visiting the site. The following green infrastructure types are covered by the Action Plan:

- Roadside verges
- Public parks and gardens
- Outdoor sports facilities
- Provision for children and young people
- Car parks, office grounds etc.
- Historic sites
- Civic spaces
- Housing green space
- School ground
- Managed gardens, care homes etc.
- Other amenity green space
- Allotments and community gardens
- Churchyards and cemeteries
- Cycle routes and other non-motorised route ways
- Water margins
- Derelict land and demolition sites
- Natural and semi-natural green space
- Accessible areas of countryside in the urban fringe

Repeat Site-based approach steps:

5.2 Further considerations

As well as the benefit to pollinators, the potential for engagement with the public should be considered. Public support of the Action Plan is crucial if it is to be implemented so when selecting specific management actions, the involvement of the public should be considered. For example, additional signage may be required to inform why a certain management action is being put in place. Involving community groups in the selection and implementation of management actions at a site is a great way to engage and will help to harbour a sense of pride and social responsibility towards the sites. This may ultimately lead to community groups taking on the management of these sites.

Wherever possible, multiple management actions should be implemented, both within and between sites. Mosaics of management treatments will create diverse habitats for pollinators within a site and will be more aesthetically pleasing than single treatments. Similar actions implemented on neighbouring sites will provide spatial continuity with an increase in habitat connectivity (large sites can be linked by small sites by 'connectivity corridors' or 'rivers of flowers' which allow pollinators to move across the study area). Similarly, planting flowers which flower at different times of the year will improve temporal connectivity, ensuring resources are available to pollinators year-round.

The action plans will have wider benefits beyond those for the pollinators alone. They will contribute to the overall conservation of biodiversity and to food security, and through their popularity to the public contribute towards the sense of well-being and appreciation of nature. For those who become involved there will also be health benefits of activities putting in the infrastructure and monitoring its success.

How the plans are implemented by the Local Authorities and other public bodies will depend on their specific management capability, capacity and priorities. Cross border planning and interdisciplinary working may significantly augment delivery beyond the capacity of individual bodies. These will include opportunities such as shared or loaned equipment, purchase of varied types and size of machinery, training of operatives and apprenticeship schemes, use of contractors versus in-house maintenance teams etc. Some of these and related issues are discussed further in Section 11 of this report.

5.3 Land Classification Matrix

To ensure that appropriate actions are selected for different areas, the Land Classification Matrix (Table 5) indicates which management actions are suitable for each green infrastructure type in each of the different land classification areas. For example, one of many actions for roadside verge in built land area is the creation action CR1 (rotavate and seed annual and perennial wildflower meadows without grass) which is appropriate for an urban environment. However, this action is not necessarily appropriate for rural areas such as the uplands, so it is not listed for those land types.

For ease of use, the management actions are hyperlinked to the relevant plan (highlight the code, and then Ctrl+Click)

Table 5 - Land Classification Matrix

		Land Classification Type						
		Inland Water	**Upland**	**Hills, lower plateaux and scarp slopes**	**Lowland**	**Coastal**	**Built Land**	**Developed Unbuilt Land**
Green Infrastructure Type	**Roadside Verges**		G1, G2, G3, G4, G5, G6, G7 CR3, CR4, CR5, AU1, AU2, AU3 SCR1, SCR2, SCR3 HDG1, HDG2, HDG3, HDG4, HDG5, HDG6, HDG7 WD1, WD2, WD3				G1, G2, G3, G5, G6, G7 CR1, CR3, CR4, CR5 AU1, AU2, AU3 FM1 WD1, WD2, WD3	G1, G2, G3, G5, G6, G7 CR1, CR3, CR4, CR5 AU1, AU2, AU3 HDG1, HDG2, HDG3, HDG4, HDG5, HDG6, HDG7 FM1 WD1, WD2, WD3
	Public Parks and Gardens					G1, G2, G3, G5, G6, G7 CR1, CR2, CR3, CR4, CR5 AU1, AU2, AU3 FM1, FM2 HDG1, HDG2, HDG3, HDG4, HDG5, HDG6, HDG7 WD1, WD2, WD3		
	Outdoor Sports Facilities (excluding pitches)	G1, G2, G3, G5, G6, G7 AU1, AU2, AU3 CR4, CR5 FM1 HDG1, HDG2, HDG3, HDG4, HDG5, HDG6, HDG7					G1, G2, G3, G5, G7 AU1, AU2, AU3 CR1, CR4, CR5 FM1, HDG1, HDG2, HDG3, HDG4, HDG5, HDG6, HDG7	

		Land Classification Type						
		Inland Water	Upland	Hills, lower plateaux and scarp slopes	Lowland	Coastal	Built Land	Developed Unbuilt Land
	Provision for Children and Young People	G1, G2, G3, G5, G6, G7 CR3, CR4, CR5 AU3 FM1, FM2					G1, G2, G3, G5, G6, G7 CR1, CR2, CR4, CR5 AU3 FM1, FM2	
	Car Parks, Office Grounds etc.	G1, G2, G3, G5, G7 AU3 CR5 FM1, FM2	G1, G2, G3, G5, G7 AU3 FM1, FM2	G1, G2, G3, G5, G7 AU3 FM1, FM2 CR5 HDG1, HDG2, HDG3, HDG4, HDG5, HDG6, HDG7			G1, G2, G3, G5, G7 CR1, CR2, CR5 AU3 FM1, FM2	
	Historic Sites	G1, G2, G3, G5, G6, G7 CR4, CR5 AU3 FM1, FM2 WD1, WD2, WD3 SCR1, SCR2, SCR3 HDG1, HDG2, HDG3, HDG4, HDG5, HDG6, HDG7					G1, G2, G3, G6, G7 CR1, CR4, CR5 AU3 FM1, FM2 WD1, WD2, WD3	
	Civic Spaces		AU3 FM1, FM2 CR5				AU3 CR1, CR2, CR5 FM1, FM2	

		Land Classification Type						
		Inland Water	Upland	Hills, lower plateaux and scarp slopes	Lowland	Coastal	Built Land	Developed Unbuilt Land
	Housing Green Space		G1, G2, G3, G5, G7 CR3, CR4, CR5 AU1, AU2, AU3 FM1, FM2				G1, G2, G3, G5, G7 CR1, CR2, CR3, CR5 AU3 FM1, FM2	
	School Grounds		G1, G2, G3, G5, G6, G7 CR1, CR2, CR3, CR4, CR5 AU1, AU2, AU3 HDG1, HDG2, HDG3, HDG4, HDG5, HDG6, HDG7 FM1, FM2				G1, G2, G3, G5, G6, G7 CR1, CR2, CR3, CR5 AU1, AU2, AU3 HDG1, HDG2, HDG3, HDG4, HDG5, HDG6, HDG7 FM1, FM2	
	Managed Gardens, Care Homes etc.		G1, G2, G3, G5, G7 CR3, CR4, CR5 AU3 FM1, FM2				G1, G2, G3, G5, G7 CR1, CR2, CR4, CR5 AU3 FM1, FM2	
	Other Amenity Green Space		G1, G2, G3, G5, G7 CR4, CR5 AU1, AU2, AU3 SCR1, SCR2, SCR3 FM1, FM2				G1, G2, G3, G5, G7 CR1, CR2, CR3, CR4, CR5 SCR2, SCR3 FM1, FM2 AU3	
	Allotments, Community Gardens and Urban Farms		HDG1, HDG2, HDG3, HDG4, HDG5, HDG6, HDG7 FM1					

		Land Classification Type						
		Inland Water	Upland	Hills, lower plateaux and scarp slopes	Lowland	Coastal	Built Land	Developed Unbuilt Land
	Churchyards and Cemeteries		G1, G2, G3, G5, G6, G7 HDG1, HDG2, HDG3, HDG4, HDG5, HDG6, HDG7 CR4, CR5 AU2, AU3 FM1, FM2				G1, G2, G3, G5, G6, G7 HDG1, HDG2, HDG3, HDG4, HDG5, HDG6, HDG7 CR1, CR5 AU2, AU3 FM1, FM2	
	Cycle Routes and other non-motorised route ways	G1, G2, G3, G4, G5, G7 CR3, CR4, CR5 AU1, AU2, AU3 SCR1, SCR2, SCR3 HDG1, HDG2, HDG3, HDG4, HDG5, HDG6, HDG7 WD1, WD2, WD3					G1, G2, G3, G5, G7 CR1, CR3, CR4, CR5 AU1, AU2, AU3 FM1 HDG1, HDG2, HDG3, HDG4, HDG5, HDG6, HDG7 WD1, WD2, WD3	
	Water	G1, G2, G3, G5, G7 SCR1, SCR2, SCR3 CR5 HDG1, HDG2, HDG3, HDG4, HDG5, HDG6, HDG7					G1, G2, G3, G5, G7 FM1, FM2 CR5 HDG1, HDG2, HDG3, HDG4, HDG5, HDG6, HDG7	
	Derelict Land and Demolition Sites		G1, G2, G3 SCR1, SCR3				G1, G2, G3 CR1, CR4 SCR1, SCR3	
	Natural and Semi-Natural Green Space	G4 CR4, AU1, AU2 GR1, GR2, GR3, GR4 SCR1, SCR2, SCR3 HDG1, HDG2, HDG3, HDG4, HDG5, HDG6, HDG7 WD1, WD2, WD3, WD4						
	Accessible areas of countryside in the urban fringe						G4 AU1, AU2 HDG1, HDG2, HDG3, HDG4, HDG5, HDG6, HDG7 FM1 SCR1, SCR2, SCR3 WD1, WD2, WD3, WD4 GR1, GR2, GR3	

5.4 Green Infrastructure Action Plans

Each of the following 18 green infrastructure types is listed below, with a general introduction and then a Table settings out the aims, desired outcomes, assessment steps and the main options for the site. The relevant management action plans are then listed (again for ease of use, the actions are hyperlinked) and these can be selected from according to local resources and context. A brief risk appraisal is then given with likely key stakeholders listed and some sources of further information.

5.4.1 Roadside Verges

Roadside verges have the potential to offer a very important pollinator resource but they also have a number of important considerations that do not apply to the other green infrastructure types. A particular benefit is that they have the potential to form 'pollinator highways' linking many other habitats together.

Safety, both in terms of visibility for motorists and the safety of operatives undertaking maintenance work, is a key consideration for opportunities within the soft estate. In general a short mown strip will be maintained adjacent to the carriageway to ensure safety and visibility, and at bends and junctions there will be much larger visibility splays. In addition the heights of trees and shrubs will be determined by the presence of overhead cables and services.

Whilst the scope for different treatments will vary significantly from road to road and verge to verge, as a general rule, the bigger the verges or areas of land the more potential benefit there would be.

Verges, particularly on the busier roads, are seen by a large number of road users and therefore they can provide an important gateway on the approach to settlements and also raise awareness of results from different management techniques.

Scrub and bramble invasion is becoming an issue on verges away from the immediate carriageway where diverse grasslands once maintained by mowing are being lost. However, leaving some areas less 'managed' and only undertaking essential maintenance can be beneficial for pollinators. Stinging nettles in particular provide a valuable food source for small tortoiseshell and peacock butterfly caterpillars, and brambles provide a valuable late source of nectar. If they require cutting back this should be done later in the year, after flowering, and once all caterpillars have gone. Reducing the quantity of close mown grass can allow for resources to be concentrated on summer grass cuts where these are more beneficial.

For large, diverse verges, there is a potential to harvest 'green hay' for use in creation of other green infrastructure for pollinators.

For the purposes of this Action Plan, roadside verges include land at junctions, roadside hedges and the wider soft estate where this is maintained by or on behalf of either the local authority or the South Wales Trunk Road Agency (SWTRA). They may not be grass/flower 'verges' in the traditional sense, and the category also covers roadside hedges.

Table 6 – Green Infrastructure Action Plan: Road verge management

Green Infrastructure type: Road verge management	
Aims	• Management of road verges to provide enhanced resource for pollinators • Maintenance of safe driving environment for road users • Maintenance of safe working environment for those maintaining roads
Desired Outcomes	• Road verges with varied structure and diverse range of flowers providing a range of food and breeding habitat resources throughout the year with appropriate management for pollinators
Assessment steps	• Assess road status (e.g. trunk road, A road, etc.) • Confirm land ownership and stakeholder interest • Assess existing pollinator resource, biodiversity interest, site designations and context of adjacent land use • Ascertain current management • Ascertain highway safety and utility constraints • Assess how existing pollinator resource can be enhanced • Select appropriate management options below • Estimate costs

Main options for site	• Alter grass mowing regimes
	  ○ Reduce cutting frequency (G1)
	  ○ Increase cut height (G2)
	  ○ Introduce rotational mowing (G3)
	  ○ Delay first cut (G7)
	• Augmentation of diversity
	  ○ Collect cut material from local donor meadow and spread on recipient site to introduce seed etc. (Green Hay) (AU1)
	  ○ Plug plant selected wild flowers (AU3)
	  ○ Rotavate and seed annual and perennial wildflower meadows without grass (e.g. Pictorial Meadows) (CR1)
	• Reducing soil fertility
	  ○ Strip topsoil prior to seeding with native mixes (CR3)
	  ○ Remove cuttings from site and dispose of centrally or at an appropriate place on site (G5)
	• Alternative management
	  ○ Highways Act Section 142 agreement
	  ○ Sow wild flower/pollinator verge with local wildlife groups
	• Hedge management
	  ○ Implement rotational cutting on 3 year cycle (e.g. top one year one side one year, other side one year) (HDG3)
	  ○ Reduce hedge cutting frequency (HDG1)
	  ○ Cut hedges later to allow flowering (HDG2)
	• Woodland edge management
	• Scrub management

Relevant Management Action Plans	G1, G2, G3, G4, G5, G6, G7, CR1, CR3, CR4, CR5, AU1, AU2, AU3, SCR1, SCR2, SCR3, HDG1, HDG2, HDG3, HDG4, HDG5, HDG6, HDG7, WD1, WD2, WD3, FM1
Risk Appraisal	• Safety constraints are paramount; there is likely to be little scope for change in management of 1 m wide verge adjacent to road • Weed control may be required • Adjacent land management can have a big effect; for example runoff of fertiliser from arable field can result in dense vegetation dominated by grasses or nettles • Immediate edges of roads may need herbicide spray to control vegetation encroachment
Key stakeholders	• LA highways departments • WG Trunk road maintenance / SWTRA
Further information	• http://www.wildlifetrusts.org/sites/default/files/6192_defra_info_sheet_transport_corridors_final.pdf • http://www.biodiversitywales.org.uk/File/546/en-GB • http://www.snh.org.uk/pdfs/publications/commissioned_reports/551.pdf

5.4.2 Public Parks and Gardens

Public parks and gardens traditionally offer some pollinator provision through the inclusion of flowering plants in formal bedding and borders, and parkland trees and shrubs. These are generally managed by the local authorities and therefore it should be feasible to alter their maintenance regimes to improve pollinator services, especially as they often form important refuges for wildlife within urban areas.

Public parks, by their very nature, are areas designed for people, so how they are perceived and viewed by the public is very important and measures should be considered to maximise public acceptance when making changes to such areas. Maintaining capacity for use for large public events may be essential.

Parks traditionally contain some areas that are managed intensively, such as annual bedding displays etc. There is scope to significantly reduce current maintenance input and associated costs, while creating much better provision for pollinators.

Large areas of close mown grass, or specific areas within them could be managed differently. However public perception is important as such areas might prove unpopular with the public if it is seen purely as a cost saving measure.

In formal urban settings, there is less need to consider using only native species, however choice of plants is important as many ornamental species may be of little use for pollinators. 'Double' or 'multiple' flowers which tend to flower continuously for long periods often have no pollen and nectar and many garden hybrids produce no fertile pollen and thus may only provide nectar.

Leaving discrete areas less 'managed' for species such as stinging nettles and brambles can be beneficial. These areas should be cut back, if necessary, later in the year after flowering.

Table 7 – Green Infrastructure Action Plan: Public parks and gardens

Green Infrastructure type: Public Parks and Gardens	

Aims	• Manage public parks and gardens in a way which provides greater benefit for pollinators
	  ○ manage some areas of grassland for pollinators
	  ○ incorporate pollinator-friendly planting into formal beds
	  ○ select pollinator-friendly parkland trees and shrubs for gardens
	• Ensure public amenity needs are still met
	• Reduce cost of maintenance or avoid increases

Desired Outcomes	• Public parks and gardens with a diversity of sward types for grass areas, and featuring a range of flowering species throughout the year. • Formal beds planted with species that attract and provide for a range of pollinators throughout the year. • Trees and shrubs that attract and provide for a range of pollinators throughout the year. • Areas that are attractive to the public and offer the opportunity to interact with and learn about the natural environment; signage and interpretation materials can be provided. • Reduction in the need for herbicides and watering. • Orchards and 'edible landscapes'
Assessment steps	• Assess constraints such as public use of space, e.g. festivals and recreation or historical context • Assess value of existing biodiversity and pollinator resource of grasslands, formal and informal beds and tree planting. The existing species diversity of grassland can be quite rich but may need augmenting with suitable species • Assess soil conditions • Assess resources/options available for on-going management • Consult with stakeholders

Main options for site	• Grasslands
	  ○ Alter mowing regimes:
	  ▪ Reduce cutting frequency (G1)
	  ▪ Increase cut height (G2)
	  ▪ Introduce rotational mowing (G3)
	  ▪ Delay first cut (G7)
	  ○ Augmentation of diversity:
	  ▪ Collect cut material from local donor meadow and spread on recipient site to introduce seed etc. (Green Hay) (AU1)
	  ▪ Plug plant selected wildflowers (AU3)
	• Flower beds
	  ○ Rotavate and seed annual and perennial wildflower meadows without grass (e.g. Pictorial Meadows) (CR1)
	  ○ Create food growing opportunities to include raised beds, allotments, fruits trees and shrubs, etc. (CR2)
	• Trees and shrubs
	  ○ Plant formal beds with a range of perennials and shrubs that provide good pollinator resources (FM2)

	• Consider provision of nesting sites such as solitary bee hotels and bumblebee boxes • Ensure some areas are left unmanaged over winter for hibernating pollinators
Relevant Management Action Plans	G1, G2, G3, G5, G6, G7, CR1, CR2, CR3, CR4, CR5, AU1, AU2, AU3, FM1, FM2, HDG1, HDG2, HDG3, HDG4, HDG5, HDG6, HDG7, WD1, WD2, WD3
Risk Appraisal	• Areas of grass may look unkempt if un-mown; signage may be needed • Possible issues if longer areas are seen as a litter trap; consider community engagement projects and litter picking events. • Be flexible if specific trees unsuitable for pollinators (e.g. oak) are requested to be planted in memory of relatives.
Key stakeholders	• LA Parks Departments • Friends Groups • Local businesses • Community groups
Further information	• http://www.wildlifetrusts.org/sites/default/files/6192_defra_info_sheet_gardens_final.pdf • https://www.buglife.org.uk/b-friendly-in-your-community • https://www.rhs.org.uk/science/conservation-biodiversity/wildlife/encourage-wildlife-to-your-garden/plants-for-pollinators • http://www.wildlifetrusts.org/bees-needs Free wildflower seeds are available to people to create pollinator-friendly habitat in community areas from parks to hospital grounds, through Friends of the Earth's Bee Worlds project and Kew Garden's 'Grow Wild' programme.

5.4.3 Outdoor Sports Facilities

Outdoor Sports Facilities include a range of facilities including golf courses, formal sports pitches, bowling greens, etc.

The key relevance of these areas is that whilst there are a strict controls on how pitches and greens are maintained, they are often contained within larger grass areas which are maintained in the same way. For the purposes of this plan, the focus is on grassland actions, immediately around the facilities – in many cases there will also be other opportunities around hedgerows, planting beds etc. It is envisaged that Outdoor Sports Facilities will also usually be associated with other green infrastructure types, such as School Grounds, or Public Parks, which will pick up such opportunities.

Another consideration is whether they are required through the year. For example, once the football or rugby season is over it might be possible to change the mowing regime allowing plants such as daisies and dandelions the chance to flower and in so doing boosting nectar supplies during that time. Such areas may then be harvested for hay or silage potentially bringing in some income.

When reducing maintenance or introducing other changes, consideration should be given to whether there are supplementary needs, such as space for spectators, or access requirements. In most cases there is scope to introduce some sort of beneficial changes.

Table 8 - Green Infrastructure Action Plan: Outdoor sports facilities

Green Infrastructure type: Outdoor Sports Facilities	

Aims	• Manage Outdoor Sports Facilities in a way which provides greater benefit for pollinators
	  ○ manage some non-playing areas of grassland for pollinators
	  ○ incorporate pollinator-friendly planting into formal beds
	• Ensure public amenity needs are still met
	• Reduce cost of maintenance or avoid increases

Desired Outcomes	• Improved diversity of grassland, incorporating flowering plants in areas where this is compatible with intended usage for sports.
Assessment steps	• Assess constraints such as requirements for grass length, spectator areas and seasons for use. • Assess value of existing biodiversity and pollinator resource of grasslands. The existing species diversity of grassland can be quite rich or may need augmenting with suitable species • Assess soil conditions • Assess resources/options available for on-going management • Consult with stakeholders

Main options for site	• Surrounding grassland areas
	  ○ Alter mowing regimes:
	  ▪ Reduce cutting frequency (G1)
	  ▪ Increase cut height (G2)
	  ▪ Introduce rotational mowing (G3)
	  ▪ Delay first cut (G7)
	  ○ Augmentation of diversity:
	  ▪ Collect cut material from local donor meadow and spread on recipient site to introduce seed etc. (Green Hay) (AU1)
	  ▪ Plug plant selected wildflowers (AU3)
	• Sports pitches
	  ○ Reduce cutting frequency (G1)
	  ○ Consider seeding/re-seeding pitches with mixes that incorporate micro-clover which can reduce reliance on herbicide and fertiliser.

Relevant Management Action Plans	G1, G2, G3, G5, G6, G7, AU1, AU2, AU3, CR1, CR4, CR5, FM1, HDG1, HDG2, HDG3, HDG4, HDG5, HDG6, HDG7
Risk Appraisal	• Areas of grass may look unkempt if un-mown; signage may be needed • Possible issues if areas of longer grass are seen as a litter trap; consider community engagement projects and litter picking events.

Key stakeholders	• Sports clubs • LA Parks Departments • Friends Groups • Community groups
Further information	• https://www.buglife.org.uk/b-friendly-in-your-community • https://www.rhs.org.uk/science/conservation-biodiversity/wildlife/encourage-wildlife-to-your-garden/plants-for-pollinators • http://www.landscapeinstitute.co.uk/PDF/Contribute/2013GreenInfrastructureLIPositionStatement.pdf • http://www.wildlifetrusts.org/bees-needs

5.4.4 Provision for Children and Young People

Children's play areas have for traditionally been designed in a way that essentially treats them in isolation from their surroundings. More recently there has been a change in approach in favour of a more 'natural play' approach. These areas rely on vegetation, landform, boulders and tree trunks etc., to create a stimulating landscape in which children are encouraged to play imaginatively, use their senses and interact with the natural environment to develop a better understanding of how they relate to the world around them.

There is considerable scope to incorporate pollinator-friendly planting and management into play spaces although a more robust approach to risk/benefit analysis is required rather than focussing only on perceived risks.

Leaving discrete areas less 'managed' for species such as stinging nettles and brambles can be beneficial. These areas should be cut back, if necessary, later in the year after flowering. . Clearly these species should not be actively encouraged immediately adjacent to play equipment etc. there are usually areas within these sites where such areas could be acceptable.

By encouraging closer interaction with nature generally, children and young people develop a better inherent understanding of the importance of natural resources and the need to protect them for future generations.

Facilities such as teen shelters and wheeled sports provision can be designed to provide opportunities for pollinator provision which will also help integrate them into the surrounding landscape.

Table 9 – Green Infrastructure Action Plan: Provision for children and young people

Green infrastructure type: Provision for Children and Young People	

Aims	• Manage provision for children and young people in a way which provides greater benefit for pollinators
	  ○ manage some areas of grassland for pollinators
	  ○ incorporate pollinator-friendly planting into wider design
	  ○ select pollinator-friendly trees and shrubs
	• Create spaces in which users are encouraged to interact with the natural environment, fostering a connection with nature.
	• Reduce cost of maintenance or provide better facilities at no extra cost

Desired Outcomes	• Provision for children and young people with a diversity of vegetation types used to create spaces and opportunities for play, and featuring a range of flowering species throughout the year. • Planting areas including species that attract and provide for a range of pollinators throughout the year • Trees and shrubs that attract and provide for a range of pollinators throughout the year • Consider design ideas such as floral spirals or sensory gardens with high ration of pollinator friendly plants • Areas that are attractive to the public and offer the opportunity to interact with and learn about the natural environment; signage and interpretation may be required.
Assessment steps	• Assess constraints such as public use of space, e.g. festivals and recreation or historical context • Assess value of existing biodiversity and pollinator resource of grasslands, formal and informal beds and tree planting. The existing species diversity of grassland can be quite rich or may need augmenting with suitable species • Assess soil conditions • Assess which bedding and tree or shrub species are suitable for pollinators • Assess resources/options available for on-going management • Assess current level of understanding by surrounding communities • Consult with stakeholders

Main options for site	• Grasslands
	  ○ Alter mowing regimes:
	  ▪ Reduce cutting frequency (G1)
	  ▪ Increase cut height (G2)
	  ▪ Introduce rotational mowing (G3)
	  ▪ Delay first cut (G7)
	  ○ Augmentation of diversity:
	  ▪ Plug plant selected wildflowers (AU3)
	  ○ Use these measures to create and define spaces for playing, and offer opportunities for imaginative, non-prescriptive play
	• Flower beds
	  ○ Rotavate and seed annual and perennial wildflower meadows without grass (e.g. Pictorial Meadows) (CR1)
	  ○ Create food growing opportunities to include raised beds, allotments, fruits trees and shrubs, etc. (CR2)
	• Trees and shrubs
	  ○ Plant formal beds with a range of perennials and shrubs that provide good pollinator resources (FM2)

Relevant Management Action Plans	G1, G2, G3, G5, G6, G7, CR1, CR2, CR3, CR4, CR5, AU3, FM1, FM2
Risk Appraisal	• Lack of public understanding and therefore acceptance; community engagement work may be required to explain ideas around 'natural play' and risk-benefit analysis

Key stakeholders	• LA Parks Departments • Friends Groups • Community groups • Possibly local schools or Resident's Associations
Further information	• https://www.buglife.org.uk/b-friendly-in-your-community • https://www.rhs.org.uk/science/conservation-biodiversity/wildlife/encourage-wildlife-to-your-garden/plants-for-pollinators • http://www.landscapeinstitute.co.uk/PDF/Contribute/2013GreenInfrastructureLIPositionStatement.pdf • http://www.wildlifetrusts.org/bees-needs Free wildflower seeds are available to people to create pollinator-friendly habitats in community areas from parks to hospital grounds, through Friends of the Earth's Bee Worlds project and Kew Garden's 'Grow Wild' programme.

5.4.5 Car parks, Office Grounds etc.

Falling within the 'Amenity Greenspace' category, there is a significant amount of land in car parks and office grounds that could be managed more effectively to provide a resource for pollinators.

Often there is a need to create some sort of pedestrian boundary, often achieved by the use of low shrubs that maintain sight lines. Careful species choice, appropriate cutting regimes and the introduction of a variety of flowering plants could all increase pollinator provision while potentially improving visual amenity. Cotoneasters have been widely used in these space which are noted to attract pollinators, especially bees but some cotoneasters are highly invasive species (e.g. *C. microphyllus, C. simonsii*) and should not be planted. In addition tree species can be chosen for their value for pollinators as well as for shade and visual interest such as cherry tress (*Prunus* species), sweet chestnut, or rowan (*Sorbus aucuparia*).

Consideration should be given within the design of new carparks to encourage connectivity to other green spaces and plant appropriate species for year round pollination. These areas are generally within an urban context so the use of ornamental and non-native species would be appropriate. In new developments there is scope for Sustainable Urban Drainage Systems (SUDS) schemes which could incorporate flowering plants that also benefit pollinators.

Table 10 – Green Infrastructure Action Plan: Car parks, office grounds etc.

Green Infrastructure type: Car parks, office grounds etc.	

Aims	• Areas of amenity green space managed in a way which provides greater benefit for pollinators
	  ○ manage grassland areas to provide benefits for pollinators
	  ○ Include formal planting that is pollinator friendly
	  ○ select pollinator-friendly trees and shrubs
	• Create spaces in which users are encouraged to interact with the natural environment, fostering a connection with nature.
	• Reduce cost of maintenance or avoid increased costs

Desired Outcomes	• Planting areas including species that attract and provide for a range of pollinators throughout the year • Trees and shrubs that attract and provide for a range of pollinators throughout the year • Areas that are attractive to the public and local businesses/customers
Assessment steps	• Assess constraints such as sightlines or whether planting blocks are intended to create barriers • Assess value of existing biodiversity and pollinator resource of grasslands, formal beds and tree planting • Assess soil conditions • Assess which bedding and tree or shrub species are suitable for pollinators • Assess resources/options available for on-going management • Consult with stakeholders

Main options for site	• Grasslands
	  ○ Alter mowing regimes:
	  ▪ Reduce cutting frequency (G1)
	  ▪ Increase cut height (G2)
	  ▪ Introduce rotational mowing (G3)
	  ▪ Delay first cut (G7)
	  ○ Augmentation of diversity:
	  ▪ Plug plant selected wildflowers (AU3)
	  ○ Rotavate and seed annual and Perennial wildflower meadows without grass (e.g. Pictorial Meadows) (CR1)
	  ○ Create food growing opportunities to include raised beds, allotments, fruits trees and shrubs, etc. (CR2)
	• Flower beds
	  ○ Rotavate and seed annual and Perennial wildflower meadows without grass (e.g. Pictorial Meadows) (CR1)
	• Trees and shrubs
	  ○ Plant formal beds with a range of perennials, shrubs and trees that provide good pollinator resources (FM2)
	• Consider provision of nesting sites such as solitary bee hotels and bumblebee boxes.
	• Ensure some areas are left unmanaged over winter for hibernating pollinators.

Relevant Management Action Plans	G1, G2, G3, G5, G7, AU3, FM1, FM2, CR1, CR2, CR5, HDG1, HDG2, HDG3, HDG4, HDG5, HDG6, HDG7
Risk Appraisal	• Local businesses not supporting changes/seeing it as a priority; may be beneficial to show examples and demonstrate how this can make their surroundings more attractive. • Perception that other issues such as littering may be linked to maintenance changes – need to ensure appropriate maintenance to keep areas 'tidy'
Key stakeholders	• LA Parks Departments • Friends Groups • Community group • Consider possible business sponsorship of sites
Further information	• http://www.wildlifetrusts.org/sites/default/files/6192_defra_info_sheet_gardens_final.pdf • https://www.buglife.org.uk/b-friendly-in-your-community • https://www.rhs.org.uk/science/conservation-biodiversity/wildlife/encourage-wildlife-to-your-garden/plants-for-pollinators • http://www.landscapeinstitute.co.uk/PDF/Contribute/2013GreenInfrastructureLIPositionStatement.pdf • http://www.wildlifetrusts.org/bees-needs

5.4.6 Historic Sites

The opportunities for green infrastructure development are similar to those in Public Parks and Gardens, with an added constraint of ensuring that any actions reflect the historic context and value. This is likely to put a different emphasis on any proposals, plant species used and management regimes.

Many of these sites will have a high profile, and as such offer good opportunities for promoting pollinator projects.

Many sites have a long history of low intensity management and may already be quite floristically diverse and have other biodiversity interest. However, they often have large areas of grass and formal planting which in some locations could be managed more effectively for pollinators

Table 11 – Green Infrastructure Action Plan: Historic sites

Green Infrastructure type: Historic Sites	

Aims	• Manage historic sites in a way which provides greater benefit for pollinators
	  ○ Ensure historic context and features are maintained
	  ○ Ensure public amenity needs are still met
	  ○ Manage some areas of site, especially grassland, for pollinators
	• Avoid increases or reduce cost of maintenance

Desired Outcomes	• Historic sites with a diversity of sward types for grass areas, and featuring a range of flowering species throughout the year. • Areas that are attractive the public and offer the opportunity to interact with and learn about both the historic and natural environment.
Assessment steps	• Check if site is already designated for its historical importance (e.g. Listed, SAM), and if proposed changes in management will support or conflict with those designations. • Assess constraints (such as public use of space, e.g. re-enactments) and maintenance of historic value • Assess value of existing biodiversity and pollinator resources. • Assess where pollinator provision could be accommodated • Assess resources/options available for on-going management • Consult with stakeholders

Main options for site	• Grasslands
	  ○ Alter mowing regimes:
	  ▪ Reduce cutting frequency (G1)
	  ▪ Increase cut height (G2)
	  ▪ Introduce rotational mowing (G3)
	  ▪ Delay first cut (G7)
	• Medicinal herb gardens
	  ○ Medicinal herbs often good context for historic site and also good for pollinators, but may have health risk to public
	• Kitchen herb garden
	  ○ Again may be good for context and pollinators, though in this case for display not food production
	• Bee keeping
	  ○ There may also be historic links to honey as a sweetener and traditional beekeeping

Relevant Management Action Plans	G1, G2, G3, G5, G6, G7, CR1, CR4, CR5, AU3, FM1, FM2, WD1, WD2, WD3, SCR1, SCR2, SCR3, HDG1, HDG2, HDG3, HDG4, HDG5, HDG6, HDG7
Risk Appraisal	• Ivy is very good for pollinators but can be damaging to old masonry • Historic tree avenues (e.g. lime avenues) should be maintained rather than augmented with other tree species • Public may regard pollinator areas as unkempt; signage may be appropriate
Key stakeholders	• Cadw • Friends groups • LA Conservation Officer and Parks Department

5.4.7 Civic Spaces

These include civic and market squares, promenades and other predominantly hard surfaced areas designed for pedestrians. Largely in urban areas, they usually offer limited space for planting, but there is potential to provide a long season of nectar sources. These spaces often link to other spaces such as car parks, highway verges, urban parks and gardens and should be considered in their context.

As with parks, formal planting beds may be relatively intensively managed so there may be scope to identify cost and resource savings by using annual/perennial wildflower mixes and shrub/groundcover planting in place of high maintenance annual bedding plants. Similarly large areas of close mown grass could be managed more effectively for pollinators by changing the mowing regime.

When replacement or infill planting is required consideration should be given to trees and shrubs high in value for pollinators. Where possible pollinator planting should be linked to other urban green spaces with consideration to extending the range of plants to provide year round pollinators.

These spaces are often high profile sites, with a high footfall, so can be good for publicity and raising the profile of pollinators within urban areas.

Table 12 – Green Infrastructure Action Plan: Civic spaces

Green Infrastructure type: Civic Spaces	

Aims	• Manage green elements of civic spaces to provide greater benefit for pollinators
	  ○ if present, manage some areas of grassland for pollinators
	  ○ incorporate pollinator-friendly planting into formal beds
	  ○ select pollinator-friendly parkland trees and shrubs
	• Ensure public amenity needs are still met

Desired Outcomes	• Formal beds planted with species that attract and provide for a range of pollinators throughout the year • Trees and shrubs that attract and provide for a range of pollinators throughout the year • Show support for Welsh Government Action Plan for Pollinators in Wales • Public education
Assessment steps	• Assess possible opportunities to provide for pollinators within the wider design of the space. • Assess public access requirements • Assess constraints such as public use of space, e.g. festivals and recreation or historical context • Assess resources/options available for on-going management • Consult with stakeholders
Main options for site	• Remove traditional annual bedding and plant formal beds with a range of perennials and shrubs that provide good pollinator resources (FM2) • Rotavate and seed annual and perennial wildflower meadows without grass (e.g. Pictorial Meadows) (CR1) • Create food growing opportunities to include raised beds, allotments, fruits trees and shrubs, etc. (CR2) • Consider 'sensory' garden ideas, e.g. Thyme or Chamomile lawn areas etc., using species attractive to pollinators. • Use opportunity to provide public education on importance of pollinators.
Relevant Management Action Plans	AU3, CR1, CR2, CR5, FM1, FM2

Risk Appraisal	• Public perception that the area looks untidy – consider signage to publicise reason behind changes. • Possible issues with vandalism
Key stakeholders	• LA Parks Departments/town centre management teams • Community/town councils • Local Businesses
Further information	• http://www.wildlifetrusts.org/sites/default/files/6192_defra_info_sheet_gardens_final.pdf • https://www.buglife.org.uk/b-friendly-in-your-community • https://www.rhs.org.uk/science/conservation-biodiversity/wildlife/encourage-wildlife-to-your-garden/plants-for-pollinators • http://www.landscapeinstitute.co.uk/PDF/Contribute/2013GreenInfrastructureLIPositionStatement.pdf • http://www.wildlifetrusts.org/bees-needs

5.4.8 Housing Green Space

Many mid-twentieth century social housing areas feature a large amount of communal green space as part of their design. In most cases this is largely maintained as close mown grass with occasional standard trees and sometimes shrub beds.

People living around these spaces often feel a strong sense of attachment to what is seen as 'their space'. Whilst there is an opportunity to improve these areas for pollinators, it is important to ensure that the local residents are involved in the process.

Where supportive local community groups exist or can be formed, they are often able to access external grant funding, and are willing to carry out some physical works, organise and run community events, raise funds, undertake litter picks, etc. The process of generating this kind of support can be slow as it can take time build the trust and relationships required.

There may be opportunities for residents to 'adopt', either formally or informally, small patches of land (usually in front of their properties) and tend them as gardens, thus increasing floristic diversity. Another approach that could help generate community support and simultaneously benefit pollinators is to develop or support community food growing projects within the communal land. This can help reinforce the need for pollinators, as well as bringing wider social benefits such as improved health through exercise, free healthy food, better connections with neighbours, increased community cohesion and the fact that people are making positive use of these green spaces can deter anti-social behaviour. By following basic organic/permaculture principles, these projects can provide pollinators and help reinforce wider approaches to pollinator provision.

Leaving discrete areas less 'managed' for species such as stinging nettles and brambles can be beneficial. These areas should be cut back, if necessary, later in the year after flowering. Changing the maintenance regimes can allow for reallocation of existing funding to provide wider benefits to pollinators whilst ensuring that highly used grass areas are also effectively managed.

Table 13 – Green Infrastructure Action Plan: Housing green space

Green Infrastructure type: Housing Green Space	

Aims	• Manage housing green space in a way which provides greater benefit for pollinators
	  ○ manage some areas of grassland for pollinators
	  ○ incorporate pollinator-friendly planting into new or existing beds
	  ○ select pollinator-friendly trees and shrubs
	• Ensure public amenity needs are still met
	• Reduce cost of maintenance or avoid increases

Desired Outcomes	• Housing green space with a diversity of sward types for grass areas, and featuring a range of flowering species throughout the year. • Formal beds planted with species that attract and provide for a range of pollinators throughout the year • Trees and shrubs that attract and provide for a range of pollinators throughout the year • Areas that are attractive to the public and offer the opportunity to interact with and learn about the natural environment. • Local residents understanding the value and importance of pollinators and the plants they need
Assessment steps	• Assess constraints such as public use of space, e.g. active and formal recreation • Assess value of existing biodiversity and pollinator resource of grasslands, formal beds and tree planting. The existing species diversity of grassland can be quite rich and left to grow long or may need augmenting with suitable species • Assess soil conditions • Assess which bedding and tree or shrub species are suitable for pollinators • Assess resources/options available for on-going management • Consult with stakeholders

Main options for site	• Grasslands
	  ○ Alter mowing regimes:
	  ▪ Reduce cutting frequency (G1)
	  ▪ Increase cut height (G2)
	  ▪ Introduce rotational mowing (G3)
	  ▪ Delay first cut (G7)
	  ○ Augmentation of diversity:
	  ▪ Collect cut material from local donor meadow and spread on recipient site to introduce seed etc. (Green Hay) (AU1)
	  ▪ Plug plant selected wildflowers (AU3)
	• Flower beds
	  ○ Rotavate and seed annual and perennial wildflower meadows without grass (e.g. Pictorial Meadows) (CR1)
	  ○ Create food growing opportunities to include raised beds, allotments, fruits trees and shrubs, etc. (CR2)

	• Trees and shrubs
	  ○ Plant formal beds with a range of perennials and shrubs that provide good pollinator resources (FM2)
	• Other opportunities
	  ○ Consider developing small scale local composting facilities to take grass cuttings, for use by residents
	  ○ Set up licence agreements for individuals or groups to maintain areas of land
	  ○ Consider provision of nesting sites such as solitary bee hotels and bumblebee boxes.
	  ○ Ensure some areas are left unmanaged over winter for hibernating pollinators.

Relevant Management Action Plans	G1, G2, G3, G5, G7, CR1, CR2, CR3, CR4, CR5, AU1, AU2, AU3, FM1, FM2
Risk Appraisal	• Areas of grass may look scruffy and unkempt if un-mown; signage may be needed • Possible issues if longer areas are seen as a litter trap; consider community engagement projects and litter picking events.
Key stakeholders	• Local residents • Tenants and Residents Associations • Housing Associations • Grounds maintenance teams
Further information	• http://www.wildlifetrusts.org/sites/default/files/6192_defra_info_sheet_gardens_final.pdf • https://www.buglife.org.uk/b-friendly-in-your-community • https://www.rhs.org.uk/science/conservation-biodiversity/wildlife/encourage-wildlife-to-your-garden/plants-for-pollinators • http://www.landscapeinstitute.co.uk/PDF/Contribute/2013GreenInfrastructureLIPositionStatement.pdf • http://www.wildlifetrusts.org/bees-needs Free wildflower seeds are available to people to create pollinator-friendly habitat in community areas from parks to hospital grounds, through Friends of the Earth's Bee Worlds project and Kew Garden's 'Grow Wild' programme.

5.4.9 School Grounds

School grounds have similarities to Provision for Children and Young People and Public Parks and Gardens. They often have large areas of green space, the majority of which is maintained as close mown grass. This has a high potential for improvement for pollinators within other constraints.

Sports pitches will need to be maintained as close mown grass, but there is clear scope to introduce a wider variety of treatments for other areas. Concerns around visibility and supervision of pupils may exist and need to be considered, but this will not apply to all areas.

Developing a more varied and diverse structure of habitats across school grounds can provide an important teaching and learning resource, and link into various aspects of the curriculum. In terms of developing pollinator-specific approaches, one example is a London Primary School (Charlton Manor) where bee hives have been kept on the school premises.

Schools also potentially have access to their own funding, whether it is directly from the school budget, via PTA fundraising etc. or externally sourced grants for example from the Polli:nation project.

One of the main practical issues in terms of changing management regimes is how to deal with the current maintenance contract – in some cases sites are maintained by local authority staff, but in many cases individual schools have their own arrangements with private contractors in place. Changes would need to be made on a school by school basis.

School management teams often have many other pressures to deal with and in reality, grounds maintenance changes can often be seen as a low priority. However there are some simple measures that could be taken which could reduce costs and improve the grounds for pollinators.

Leaving discrete areas less 'managed' for species such as stinging nettles and brambles can be beneficial. These areas should be cut back, if necessary, later in the year after flowering.

Schools offer a strong opportunity to embed principles of biodiversity into children's minds and to educate them in the basic needs of pollinators.

Table 14 – Green Infrastructure Action Plan: School grounds

Green infrastructure type: School Grounds	

Aims	• Manage school in a way which provides greater benefit for pollinators
	  ○ manage some areas of grassland for pollinators
	  ○ incorporate pollinator-friendly planting into wider design
	  ○ select pollinator-friendly trees and shrubs
	• Create spaces in which offer an educational resource and where users are encouraged to interact with the natural environment, fostering a connection with nature.

Desired Outcomes	• School grounds with a diversity of vegetation types used to create spaces and opportunities for play and education, and featuring a range of flowering species throughout the year. • Planting areas including species that attract and provide for a range of pollinators throughout the year • Trees and shrubs that attract and provide for a range of pollinators throughout the year • Areas that are attractive to the pupils, staff and visitors and offer the opportunity to interact with and learn about the natural environment.
Assessment steps	• Assess constraints such as need for clear sight lines, sport and recreation or historical context • Assess value of existing biodiversity and pollinator resource of grasslands, formal beds and tree plantings. The existing species diversity of grassland can be quite rich and left to grow long or may need augmenting with suitable species

	• Assess soil conditions • Assess which bedding and tree or shrub species are suitable for pollinators • Assess resources/options available for on-going management • Assess external funding opportunities • Consult with stakeholders

Main options for site	• Grasslands
	  ○ Alter mowing regimes:
	  ▪ Reduce cutting frequency (G1)
	  ▪ Increase cut height (G2)
	  ▪ Introduce rotational mowing (G3)
	  ▪ Delay first cut (G7)
	  ○ Augmentation of diversity:
	  ▪ Collect cut material from local donor meadow and spread on recipient site to introduce seed etc. (Green Hay) (AU1)
	  ▪ Plug plant selected wildflowers (AU3)
	• Flower beds
	  ○ Rotavate and seed annual and perennial wildflower meadows without grass (e.g. Pictorial Meadows) (CR1)
	  ○ Create food growing opportunities to include raised beds, allotments, fruits trees and shrubs, etc. (CR2)
	• Trees and shrubs
	  ○ Plant formal beds with a range of perennials and shrubs that provide good pollinator resources (FM2)
	• Other opportunities
	  ○ Consider developing small scale local composting facilities to take grass cuttings collected on site
	  ○ Consider provision of nesting sites such as solitary bee hotels and bumblebee boxes.
	  ○ Ensure some areas are left unmanaged over winter for hibernating pollinators and wildlife areas

Relevant Management Action Plans	G1, G2, G3, G5, G6, G7, CR1, CR2, CR3, CR4, CR5, AU1, AU2, AU3, HDG1, HDG2, HDG3, HDG4, HDG5, HDG6, HDG7, FM1, FM2
Risk Appraisal	• Staff time and resources may be prioritised on other issues; need to ensure that potential direct benefits in terms of potential accreditation or teaching resources made clear • Perception of risk; ensure staff, parents and governors are made aware the details of any proposals and the benefits they would bring • Areas of grass may look scruffy and unkempt if un-mown; signage may be needed and can be developed with pupils helping reinforce to the message
Key stakeholders	• School staff • Governors • Parents • Local Authority environmental education staff • Local Authority education departments

Further information	• http://www.wildlifetrusts.org/sites/default/files/6192_defra_info_sheet_gardens_final.pdf • http://www.charltonmanorprimary.co.uk/top-news/bees-chickens • https://www.buglife.org.uk/b-friendly-in-your-community • https://www.rhs.org.uk/science/conservation-biodiversity/wildlife/encourage-wildlife-to-your-garden/plants-for-pollinators • http://www.landscapeinstitute.co.uk/PDF/Contribute/2013GreenInfrastructureLIPositionStatement.pdf • http://www.wildlifetrusts.org/bees-needs • https://www.monmouthshire.gov.uk/home/education/mon-green-schools-resources Free wildflower seeds are available to people to create pollinator-friendly habitat in community areas from parks to hospital grounds, through Friends of the Earth's Bee Worlds project and Kew Garden's 'Grow Wild' programme.

5.4.10 Managed gardens, care homes etc.

Within local authority and other public ownership there are a number of 'gardens' which form semi-private spaces, usually for the use of a specific group of people. Typically these may be associated with care homes, community centres etc. Although they fall within the very broad 'Amenity Greenspace', there are some important characteristics that set them apart.

One feature is their semi-private nature – this brings with it the opportunity to take approaches which might include more fragile plant species and these gardens often have a higher amount of manpower or resource input available to them, and ownership by the users.

This connection with a group, or groups, from the general public brings with it both the opportunity to develop, look after and care for plants etc. in way that might not be economically viable otherwise, especially in times of dwindling local authority budgets, but also potentially the opportunity to access other funding sources, by linking in to the healthcare and wellbeing agenda. It also provides an opportunity to increase knowledge and understanding of pollinators and their importance to society in general.

Table 15 – Green Infrastructure Action Plan: Managed gardens, care homes etc.

Green Infrastructure type: Managed gardens, care homes etc.	

Aims	• Manage gardens in a way which provides greater benefit for pollinators
	  ○ manage some areas of grassland for pollinators
	  ○ incorporate pollinator-friendly planting into wider design
	  ○ select pollinator-friendly trees and shrubs
	• Create spaces in which offer opportunities for users to interact with and learn about the natural environment, fostering a connection with nature.

Desired Outcomes	• Gardens with diverse grass areas that are allowed to flower, and featuring a range of flowering species throughout the year. • Formal beds planted with species that attract and provide for a range of pollinators throughout the year

	• Trees and shrubs that attract and provide for a range of pollinators throughout the year • Areas that are attractive to the users and offer the opportunity to interact with and learn about the natural environment
Assessment steps	• Assess constraints such as need for clear sight lines, sport and recreation or historical context • Assess value of existing biodiversity and pollinator resource of grasslands, formal beds and tree plantings. The existing species diversity of grassland can be quite rich and left to grow long or may need augmenting with suitable species • Assess soil conditions • Assess which bedding and tree or shrub species are suitable for pollinators • Assess resources/options available for on-going management • Assess external funding opportunities • Consult with stakeholders

Main options for site	• Remove traditional annual bedding and plant formal beds with a range of perennials and shrubs that provide good pollinator resources (FM2)
	• Rotavate and seed annual and perennial wildflower meadows without grass (e.g. Pictorial Meadows) (CR1)
	• Create food growing opportunities to include raised beds, allotments, fruits trees and shrubs, etc. (CR2)
	• Alter mowing regimes:
	  ○ Reduce cutting frequency (G1)
	  ○ Increase cut height (G2)
	  ○ Introduce rotational mowing (G3)
	  ○ Delay first cut (G7)
	• Consider 'sensory' garden ideas, e.g. Thyme or Chamomile lawn areas etc., using species attractive to pollinators.
	• Consider provision of nesting sites such as solitary bee hotels and bumblebee boxes.

Relevant Management Action Plans	G1, G2, G3, G5, G7, CR1, CR2, CR3, CR4, CR5, AU3, FM1, FM2
Risk Appraisal	• Those involved may have a more traditional view of gardening; need to ensure that projects are developed in consultation with the residents.
Key stakeholders	• Community Groups • Service users • Health boards and local authority social care departments • Individual centre managers
Further information	• http://www.wildlifetrusts.org/sites/default/files/6192_defra_info_sheet_gardens_final.pdf • https://www.buglife.org.uk/b-friendly-in-your-community • https://www.rhs.org.uk/science/conservation-biodiversity/wildlife/encourage-wildlife-to-your-garden/plants-for-pollinators

	• http://www.landscapeinstitute.co.uk/PDF/Contribute/2013GreenInfrastructureLIPositionStatement.pdf • http://www.wildlifetrusts.org/bees-needs

5.4.11 Other amenity green space

A number of other areas of publicly owned greenspace exist, without a clear and obvious purpose, and often with little direct care. In many cases these areas will fill the gaps between housing and road verges, and in most cases offer opportunities that complement these other uses. In certain circumstances, such as where they are in residential areas, or near schools there may be scope for some sort of link with community groups, who could be involved in the development of pollinator schemes, but even without this, basic management could be undertaken in a pollinator-friendly way. Actions in these areas can raise awareness and generate respect as they are unexpected.

Leaving discrete areas less 'managed' for species such as stinging nettles and brambles can be beneficial. These areas should be cut back, if necessary, later in the year after flowering. There may be scope for commercial sponsorship, similar to that which is often seen at roundabouts, which could offer local businesses the opportunity to promote their pollinator-friendly credentials.

Table 16 – Green Infrastructure Action Plan: Other amenity green space

Green Infrastructure type: Other amenity green space	

Aims	• Manage amenity green space in a way which provides greater benefit for pollinators
	  ○ manage much of the grassland for pollinators
	  ○ incorporate pollinator-friendly planting into new or existing beds
	  ○ select pollinator-friendly trees and shrubs
	• Ensure public amenity needs are still met
	• Reduce cost of maintenance or avoid increases

Desired Outcomes	• Housing green space with a diversity of sward types for grass areas, and featuring a range of flowering species throughout the year. • Formal beds planted with species that attract and provide for a range of pollinators throughout the year • Trees and shrubs that attract and provide for a range of pollinators throughout the year • Areas that are attractive to the public and offer the opportunity to interact with and learn about the natural environment. • Local residents understanding the value and importance of pollinators and the plants they need
Assessment steps	• Assess constraints such as public use of space, need for clear sightlines, informal recreation such as dog walking use of surrounding areas • Assess value of existing biodiversity and pollinator resource of grasslands, formal beds and tree plantings. The existing species diversity of grassland can be quite rich and left to grow long or may need augmenting with suitable species • Assess soil conditions

	• Assess which bedding and tree or shrub species are suitable for pollinators and the site conditions • Assess resources/options available for on-going management • Establish who local stakeholders are and make contact

Main options for site	• Grasslands
	  ○ Alter mowing regimes:
	  ▪ Reduce cutting frequency (G1)
	  ▪ Increase cut height (G2)
	  ▪ Introduce rotational mowing (G3)
	  ▪ Delay first cut (G7)
	  ○ Augmentation of diversity:
	  ▪ Collect cut material from local donor meadow and spread on recipient site to introduce seed etc. (Green Hay) (AU1)
	  ▪ Plug plant selected wildflowers (AU3)
	• Flower beds
	  ○ Rotavate and seed annual and perennial wildflower meadows without grass (e.g. Pictorial Meadows) (CR1)
	  ○ Create food growing opportunities to include raised beds, allotments, fruits trees and shrubs, etc. (CR2)
	• Trees and shrubs
	  ○ Plant formal beds with a range of perennials and shrubs that provide good pollinator resources (FM2)
	• Other opportunities
	  ○ Consider developing small scale local composting facilities to take grass cuttings, for use by residents
	  ○ Set up licence agreements for individuals or groups to maintain areas of land
	  ○ Ensure some areas are left unmanaged over winter for hibernating pollinators.

Relevant Management Action Plans	G1, G2, G3, G5, G7, CR1, CR2, CR3, CR4, CR5, SCR1, SCR2, SCR3, FM1, FM2, AU1, AU2, AU3
Risk Appraisal	• Areas of grass may look scruffy and unkempt if un-mown; signage may be needed • Possible issues if longer areas are seen as a litter trap; consider community engagement projects and litter picking events.
Key stakeholders	• Local residents • Tenants and Residents Associations • Housing Associations • Grounds maintenance teams
Further information	• https://www.buglife.org.uk/b-friendly-in-your-community • https://www.rhs.org.uk/science/conservation-biodiversity/wildlife/encourage-wildlife-to-your-garden/plants-for-pollinators • http://www.landscapeinstitute.co.uk/PDF/Contribute/2013GreenInfrastructureLIPositionStatement.pdf

	• http://www.wildlifetrusts.org/bees-needs Free wildflower seeds are available to people to create pollinator-friendly habitat in community areas from parks to hospital grounds, through Friends of the Earth's Bee Worlds project and Kew Garden's 'Grow Wild' programme.

5.4.12 Allotments and community gardens

Many allotments and garden will already have both a relatively high pollinator demand and resource, especially if they are managed organically and in an ecologically sensitive way. In other cases there may be scope to improve upon current practice.

There is also a significant potential for education about pollinators, both within the allotments and within the local areas.

Table 17 – Green Infrastructure Action Plan: Allotments and community gardens

Green Infrastructure type: Allotments and community gardens	
Aims	• To manage allotments and community gardens for the benefit of both pollinators and people.
Desired Outcomes	• Sufficient pollinators are available to ensure seed set in allotments and gardens through year. • Supportive action from gardeners for pollinators. • Reduced pesticide use.
Assessment steps	• Confirm stakeholder interests such as Allotment Associations, gardening societies • Assess existing pollinator provision such as bee keepers on site • Assess existing pollinator resource and potential for augmentation • Assess pollinator needs for crops being grown (in most cases bees) • Consult with stakeholders
Main options for site	• Currently unused allotments could be planted with quick-flowering annual plants (such as mustard) to give 'fast food' sources for pollinators • Boundaries of site can be augmented with pollinator-friendly planting • Provision of nesting spaces (e.g. bee hives, solitary bee hotels and bumblebee boxes) • Ensure some areas are left unmanaged over winter for hibernating pollinators • Assess pesticide use and advise on organic methods of reducing usage such as good hygiene and companion crops (e.g. marigolds) and integrated pest management • Organise workshops to educate how to look after pollinators • Have signage with good and bad practice • Specify non-persistent selective pesticides in leases

Relevant Management Action Plans	HDG1, HDG2, HDG3, HDG4, HDG5, HDG6, HDG7, FM1
Risk Appraisal	• Pesticide sprays for aphids and caterpillars may be persistent and affect pollinators
Key stakeholders	• Allotment holders • Gardening societies
Further information	• http://www.wildlifetrusts.org/sites/default/files/6192_defra_info_sheet_gardens_final.pdf • https://www.rhs.org.uk/science/conservation-biodiversity/wildlife/encourage-wildlife-to-your-garden/plants-for-pollinators • https://www.buglife.org.uk/advice-and-publications/publications/b-lines-resources

5.4.13 Churchyards and cemeteries

Churchyards and cemeteries have the potential to offer good pollinator resources, but need to be managed sensitively with respect to users and local communities. Measures need to be seen to enhance the visual amenity of the site, especially in areas of active operation, and simply reducing grass cutting, or measures which take a long time to show any obvious benefit should be used with care.

Churchyards and cemeteries may be floristically very rich following many years of mowing without herbicide or fertiliser input, and may themselves be derived from old meadows. Some may have significant populations of rare plants or waxcap fungi, which should be taken into account before changing management. For example, St Saunan's Churchyard at Bedwellty has an important population of the Section 42 plant Wood bitter-vetch, and Chepstow Cemetery has a large population of Autumn Lady's-tresses orchid.

The long association of flowers with funerals means unmown flower-rich churchyards are becoming more acceptable. The cultivated flowers planted on graves can also significantly augment the diversity of flowers available for pollinators, especially early bulbs. Some 'lawned' cemeteries do not allow planting on graves (such plants are usually removed), but suitable planting can be encouraged in memorial gardens.

Within cemeteries there may be scope for managing different areas in different ways, for example leaving uncut banks and margins where there are no graves, or reducing grass cuts on the older areas of graveyards where there may be few visitors. Areas of new ground awaiting development as graveyards can be managed for pollinators with few constraints.

The increasing popularity of 'woodland' or 'natural' burials in designated grounds has associated opportunities, though these are usually privately run.

Table 18 – Green Infrastructure Action Plan: Churchyards and cemeteries

Green Infrastructure type: Churchyards and cemeteries	
Aims	• To manage churchyards and cemeteries for the benefit of both pollinators and people.
Desired Outcomes	• Graveyards managed appropriately for relatives to visit graves • Existing biodiversity managed appropriately • Suitable areas of graveyards managed appropriately for pollinators with varied structure and diverse range of flowers providing a range of food and breeding habitat resources through year
Assessment steps	• Assess existing biodiversity and pollinator resource of churchyard or cemetery • Ascertain current management and constraints • Assess how existing resource can be augmented • Select appropriate management options, including where access to graves is required and plan mown paths between rows of graves • Estimate costs

Main options for site	• Alter mowing regimes:
	  ○ Reduce cutting frequency (G1)
	  ○ Increase cut height (G2)
	  ○ Introduce rotational mowing (G3)
	  ○ Delay first cut (G7)
	• Hay cutting
	  ○ Cut grass in summer as a hay crop (G6)
	  ○ For larger areas, hay cutting and harvesting by local farmer may be possible (e.g. Ebbw Vale Cemetery)
	• Augmentation of diversity
	  ○ Plug plant selected wildflowers (AU3)
	  ○ Provide list of pollinator-friendly plants for planting on graves (e.g. use Royal Horticultural Society's 'Perfect for Pollinators' logo at their garden centre or supplier).
	• Consider provision of nesting sites such as solitary bee hotels and bumblebee boxes
	• Ensure some areas are left unmanaged over winter for hibernating pollinators

Relevant Management Action Plans	G1, G2, G3, G5, G6, G7, HDG1, HDG2, HDG3, HDG4, HDG5, HDG6, HDG7, CR1, CR4, CR5, AU2, AU3, FM1, FM2
Risk Appraisal	• Some old graveyards can be very rich in waxcap fungi which are dependent on long term mowing, thus it is important to assess the existing biodiversity resource. • Once long grass has developed it can be hard to see flat headstones or low headstones which presents hazard to walking and mowing. Collapsed graves may also not be obvious • 'Lawned cemeteries' do not allow planting on graves

Key stakeholders	• Churches • Relatives • Groundsmen
Further information	• https://www.buglife.org.uk/b-friendly-in-your-community • https://www.rhs.org.uk/science/conservation-biodiversity/wildlife/encourage-wildlife-to-your-garden/plants-for-pollinators • http://www.landscapeinstitute.co.uk/PDF/Contribute/2013GreenInfrastructureLIPositionStatement.pdf • http://www.wildlifetrusts.org/bees-needs

5.4.14 Cycle routes and other non-motorised route ways

This category has similarities to road verges in terms of managing linear grass verges and boundary hedge features. Cycle routes, footpaths and bridleways offer great opportunities to create linear features which can improve connectivity between other green infrastructure assets. With cycle routes in particular, but also other routes where the surrounding land is in Local authority or public sector ownership, there are many opportunities to manage the land alongside the main path surface in a more effective way for pollinators.

Leaving discrete areas less 'managed' for species such as stinging nettles and brambles can be beneficial. These areas should be cut back, if necessary, later in the year after flowering. Sustrans have produced a number of guidance documents on how to manage such land, including 'Ecology Notes' on grass verges and hedgerows.

In many cases the organisation responsible for maintenance and the land owner are not the same. There are cycle routes where Sustrans maintain the surrounding land, although the local authority still own it, and some where the authority has a contract to maintain areas for Sustrans. Also, large sections of other Rights of Way are on private land, and although local authorities have some powers to ensure safe access is maintained, this power does not extend to wider maintenance activities. There are however many cases where a local authority can or does make voluntary arrangements with landowners that go beyond their statutory duties.

Table 19 – Green Infrastructure Action Plan: Cycle routes and other non-motorised route ways

Green Infrastructure type: Cycle routes and other non-motorised route ways	
Aims	• Management of cycle routes, footpaths and bridleways to provide enhanced resource for pollinators • Maintenance of access cycle routes, footpaths and bridleways
Desired Outcomes	• Cycle routes, footpaths and bridleways with varied structure and diverse range of flowers providing a range of food and breeding habitat resources through year with appropriate management for pollinators
Assessment steps	• Confirm land ownership and stakeholder interest • Assess existing pollinator resource and biodiversity interest and context of adjacent land use • Ascertain current management • Ascertain safety and utility constraints

	• Assess how existing pollinator resource can be enhanced • Select appropriate management options below • Estimate costs

Main options for site	• Alter mowing regimes:
	  ○ Reduce cutting frequency (G1)
	  ○ Increase cut height (G2)
	  ○ Introduce rotational mowing (G3)
	  ○ Delay first cut (G7)
	• Augmentation of diversity
	  ○ Collect cut material from local donor meadow and spread on recipient site to introduce seed etc. (Green Hay) (AU1)
	  ○ Plug plant selected wildflowers (AU3)
	  ○ Rotavate and seed annual and perennial wildflower meadows without grass (e.g. Pictorial Meadows) (CR1)
	• Reducing soil fertility
	  ○ Strip topsoil prior to seeding with native mixes (CR3)
	  ○ Remove cuttings from site and dispose of centrally or at an appropriate place on site (G5)
	• Hedge management
	  ○ Implement rotational cutting on 3 year cycle (e.g. top one year one side one year, other side one year) (HDG3)
	  ○ Reduce hedge cutting frequency (HDG1)
	  ○ Cut hedges later to allow flowering (HDG2)

Relevant Management Action Plans	G1, G2, G3, G4, G5, G7, CR1, CR3, CR4, CR5, AU1, AU2, AU3, SCR1, SCR2, SCR3, HDG1, HDG2, HDG3, HDG4, HDG5, HDG6, HDG7, WD1, WD2, WD3, FM1
Risk Appraisal	• Visibility for safety is important; there is likely to be little scope for change in management of 1 m wide verge adjacent to • Weed control may be required • Adjacent land management can have a big effect;
Key stakeholders	• Sustrans • LA rights of way officers • Public

Further information	• http://www.sustrans.org.uk/our-services/infrastructure/route-design-resources/wider-considerations/maintenance-and-management
	
	The following documents available from SUSTRANS illustrate their approach to the design and maintenance of green space on land surrounding their cycle routes and emphasize the importance of diversity. The clear, easy to follow language and structure make them a good model, as they are mainly aimed at volunteers with no existing specialist knowledge.
	  • Sustrans Design Manual Chapter 5 - Traffic free routes: Conceptual Design
	  • Ecology Note 01-Hedge Management
	  • Ecology Note-02 – Grass Verge Management
	  • Ecology Note 06 – Ecology in the Planning System

	Consideration should also be given to the Active Travel (Wales) Act 2013 and the supporting guidance. • https://www.buglife.org.uk/b-friendly-in-your-community • https://www.rhs.org.uk/science/conservation-biodiversity/wildlife/encourage-wildlife-to-your-garden/plants-for-pollinators • http://www.landscapeinstitute.co.uk/PDF/Contribute/2013GreenInfrastructureLIPositionStatement.pdf • http://www.wildlifetrusts.org/bees-needs

5.4.15 Water margins

While water bodies and watercourses themselves are of little direct benefit to most pollinators (a few pollinators such as drone flies have an aquatic stage of their life cycle), the marginal habitats such as river banks, canal banks, lakes, fishing ponds, reservoirs and the reen network of the Levels, have a high potential to support flower-rich vegetation which can be of great benefit for pollinators. In many cases margins of water bodies need or receive little maintenance.

Where grassland is associated with water bodies such as canals, this can be treated in accordance with Other Amenity Green Space (see above).

Table 20 – Green Infrastructure Action Plan: Water margins

Green Infrastructure type: Water margins	
Aims	• Manage the edges of water bodies for pollinators • Manage associated grasslands for pollinators • Ensure safe access to water is maintained where required.
Desired Outcomes	• Water margins and associated habitats with appropriate management for pollinators with varied structure and diverse range of flowers providing a range of food and breeding habitat resources through year
Assessment steps	• Confirm land ownership and stakeholder interest • Assess existing pollinator resource, biodiversity interest, site designations and context of adjacent land use • Ascertain current management • Assess how existing pollinator resource can be enhanced • Select appropriate management options below • Estimate costs

Main options for site	• Existing water margins
	  ○ Control scrub development on water margins to maintain flower-rich vegetation (NB willow scrub can be very good of early season pollinators)
	  ○ Control invasive non-native species (e.g. Himalayan Balsam) to increase overall diversity
	• New water margins

	○ Plant with appropriate wetland plants with flowers which may also control erosion • Associated grasslands • Alter mowing regimes: ○ Reduce cutting frequency (G1) ○ Increase cut height (G2) ○ Introduce rotational mowing (G3) ○ Delay first cut (G7) • Non-intervention (natural colonisation)
Relevant Management Action Plans	G1, G2, G3, G5, G7, SCR1, SCR2, SCR3, CR5, HDG1, HDG2, HDG3, HDG4, HDG5, HDG6, HDG7, FM1, FM2
Risk Appraisal	• Unfortunately open water margins provide perfect habitat for the invasive alien Himalayan Balsam, especially where ground is disturbed. • Scrub removal should also consider impact on otter and bird nesting habitat
Key stakeholders	• Natural Resources Wales • Welsh Water • Monmouthshire Brecon and Abergavenny Canals Trust. • Angling Associations • Sailing clubs
Further information	• https://www.buglife.org.uk/sites/default/files/B-Friendly%20in%20your%20Community%202.pdf • https://www.rhs.org.uk/science/conservation-biodiversity/wildlife/encourage-wildlife-to-your-garden/plants-for-pollinators • http://www.landscapeinstitute.co.uk/PDF/Contribute/2013GreenInfrastructureLIPositionStatement.pdf • http://www.wildlifetrusts.org/bees-needs

5.4.16 Derelict land and demolition sites

Derelict land and brownfield sites (including quarries, spoil heaps, old docks, demolition sites, landfill, neglected areas of intensively managed active industrial sites, etc.) can develop into important habitats in their own right which may provide good habitat for pollinators. In many cases there is a long term plan to re-use such areas for new development, but over recent years their intrinsic value has become more recognised and there is increasing interest in retaining some such habitats. In particular, the combinations of varied structure such as bare ground, scrub, weedy patches with low intensity land use with no pesticides and numerous over-wintering opportunities can result in high quality habitats. These sites are often at their highest value for pollinators at 10-15 years post industry but by 20 years their value is often reduced due to the succession to scrub and woodland.

In the study area there are large areas of land associated with the coal mining industry that are subject to long term strategies to mitigate their environmental effects. Depending on the previous use of ex-industrial sites there could be issues of land contamination.

Whilst there may be long term plans for these sites, by their very nature they are usually temporary in nature. It is this temporary character that leads to them becoming important habitats as they are gradually colonised from outside.

There is significant scope to intervene in this natural colonisation process, to favour pollinators. Annual urban wildflower meadows have been created on a crushed brick substrates which provide ideal low fertility soils. Such approaches can be relatively cheap and have successfully been used as part of the regeneration of an area, and can provide a valuable pollinator resource until the area is redeveloped. Whilst the temporary nature of these sites might be

One of the key considerations might revolve around managing people's expectations, particularly around the temporary nature of any such interventions. It is important to remember that even in nature nothing stands still though and actually while development continues, the built environment is ever changing, some land is always being lost so, as part of this, temporary provision should certainly be given due consideration.

Table 21 – Green Infrastructure Action Plan: Derelict land and demolition sites

Green Infrastructure type: Derelict land and demolition sites	
Aims	• Manage brownfield sites for pollinators, at least in the short term
Desired Outcomes	• Brown field sites and associated habitats with appropriate management for pollinators with varied structure and diverse range of flowers providing a range of food and breeding habitat resources through year
Assessment steps	• Confirm land ownership and stakeholder interest and future planning constraints • Assess ground contamination and invasive species • Assess existing pollinator resource, biodiversity interest, site designations and context of adjacent land use • Ascertain current management, if any • Assess how existing pollinator resource can be enhanced or maintained • Select appropriate management options below • Estimate costs
Main options for site	• Non-intervention (natural colonisation) • Rotational vegetation clearance to create bare ground patches to provide colonization opportunities • Sowing recently derelict areas with wild flowers to speed up colonisation ○ Rotavate and seed annual and perennial wildflower meadows without grass (e.g. Pictorial Meadows) (CR1) • Introduce rotational mowing (G3)
Relevant Management Action Plans	G1, G2, G3, CR1, CR4, SCR1, SCR3

Risk Appraisal	• Sites could be redeveloped at short notice, thus minimal cost input options should be considered • Land owners may be concerned about sites developing biodiversity interest • Vegetation clearance may need checking for nesting birds, reptiles etc. which may affect timing • Industrial sites may have significant problems with invasive species such as Japanese Knotweed and Himalayan Balsam
Key stakeholders	• Land owners
Further information	• http://www.wildlifetrusts.org/sites/default/files/6192_defra_info_sheet_industrial_final.pdf • http://www.buglife.org.uk/brownfield-hub. • http://habitatsurveys.esdm.co.uk/home.aspx.

5.4.17 Natural and Semi-natural Green space

Natural and semi-natural green space includes woodland, urban forestry, scrub, grasslands, open access land (e.g. mountain, moor, heath, common land and meadows), wetlands, and rocky areas (e.g. inland cliffs), and coastal land. Where these are in public ownership, they may provide some opportunities for managing pollinators.

While this is a broad category, much of it is land that already may have a high intrinsic biodiversity value, so interventions need to be judged carefully.

Many of these spaces are also geographically large, and as such the level of intense intervention or habitat creation that can be carried out in small, highly populated areas is not feasible. It is usually far more appropriate to consider management changes that can improve the situation without high cost, or look at how pollinator benefits can be linked to other improvements such as restoring upland peat bog by increasing heather cover which can reduce peat erosion as well as providing an important source of pollen in late summer. To maximise the benefits of these areas other plant species need to be encouraged to support populations throughout the year.

Where other initiatives or management plans are being implemented in these areas these should also be considered in terms of pollinators.

Table 22 – Green Infrastructure Action Plan: Natural and semi-natural green space

Green Infrastructure type: Natural and semi-natural Green space	
Aims	• Natural and semi-natural green space managed for pollinators, at least in part
Desired Outcomes	• Some areas of natural and semi-natural green space with appropriate management for pollinators with varied structure and diverse range of flowers providing a range of food and breeding habitat resources through year
Assessment steps	• Confirm land ownership and identify stakeholder interest • Check if site is already designated for nature conservation (e.g. SSSI, SINC), and if proposed changes in management will support or conflict with those designations • Assess existing pollinator resource, biodiversity interest, site designations and context of adjacent land use • Ascertain current management • Assess how existing pollinator resource can be enhanced or maintained • Select appropriate management options below • Estimate costs

Main options for site	• Non-intervention (natural colonisation)
	• Reduced grazing pressure or change in grazing management:
	  ○ Introduce/allow grazing with cattle instead of sheep (GR1)
	  ○ Introduce/allow grazing with ponies instead of sheep (GR2)
	• Cut grass in summer as a hay crop (G6)
	• Identify space for bee hives
	• Hedge management
	  ○ Implement rotational cutting on 3 year cycle (e.g. top one year one side one year, other side one year) (HDG3)
	  ○ Reduce hedge cutting frequency (HDG1)
	  ○ Cut hedges later to allow flowering (HDG2)
	• Woodland edge management
	• Scrub management

Relevant Management Action Plans	G4, CR4,, AU1, AU2, GR1, GR2, GR3, GR4, SCR1, SCR2, SCR3, HDG1, HDG2, HDG3, HDG4, HDG5, HDG6, HDG7, WD1, WD2, WD3, WD4,
Risk Appraisal	• May conflict with other biodiversity interests • The agricultural context may have a dominant effect if significant quantities of pesticides are being used in adjacent intensively managed farmland. • Plantings should be restricted to appropriate native species for context
Key stakeholders	• Landowners • Recreation users • Commoners • NRW • Gwent Wildlife Trust

	• Community groups
Further information	• http://www.wildlifetrusts.org/sites/default/files/6192_defra_info_sheet_woodlands_final.pdf

5.4.18 Accessible areas of countryside in the urban fringe

This category shares many similarity with Natural and Semi-natural Green Space, but with a much greater influence of regular interactions with humans. Such areas provide a very valuable resource to communities for recreation and has other beneficial effects for public health and wellbeing.

There are a number of increased pressures on this land, both from urban expansion, and as direct results of issues such as fly tipping, over grazing and illegal off-road vehicle use.

Leaving discrete areas less 'managed' for species such as stinging nettles and brambles can be beneficial. These areas should be cut back, if necessary, later in the year after flowering. Unmanaged areas can sometimes become a location for fly-tipping, so where possible it is important to ensure that such issues are dealt with promptly.

The areas of land are often smaller and more enclosed than Natural and Semi-natural Green Space, but there are opportunities for volunteer involvement and possibility for establishing community groups which could allow access to external funding.

Table 23 – Green Infrastructure Action Plan: Accessible areas of countryside in the urban fringe

Green Infrastructure type: Accessible areas of countryside in the urban fringe	
Aims	• Urban fringe green space managed for pollinators
Desired Outcomes	• Some areas of natural and semi-natural green space with appropriate management for pollinators with varied structure and diverse range of flowers providing a range of food and breeding habitat resources through year
Assessment steps	• Confirm land ownership and identify stakeholder interest • Check if site is already designated for nature conservation (e.g. SSSI, SINC), and if proposed changes in management will support or conflict with those designations • Assess existing pollinator resource, biodiversity interest, site designations and context of adjacent land use • Ascertain current management • Assess how existing pollinator resource can be enhanced or maintained • Select appropriate management options below • Estimate costs

Main options for site	• Non-intervention (natural colonisation)
	• Reduced grazing pressure or change in grazing management:
	  ○ Introduce/allow grazing with cattle instead of sheep (GR1)
	  ○ Introduce/allow grazing with ponies instead of sheep (GR2)
	• Cut grass in summer as a hay crop (G6)
	• Identify space for bee hives
	• Ensure some areas are left unmanaged over winter for hibernating pollinators.
	• Hedge management
	  ○ Implement rotational cutting on 3 year cycle (e.g. top one year one side one year, other side one year) (HDG3)
	  ○ Reduce hedge cutting frequency (HDG1)
	  ○ Cut hedges later to allow flowering (HDG2)
	• Woodland edge management
	• Scrub management

Relevant Management Action Plans	G4, CR4, AU1, AU2, GR1, GR2, GR3, GR4, SCR1, SCR2, SCR3, HDG1, HDG2, HDG3, HDG4, HDG5, HDG6, HDG7, WD1, WD2, WD3, WD4, FM1
Risk Appraisal	• May conflict with other biodiversity interests • The agricultural context may have a dominant effect if significant quantities of pesticides are being used in adjacent intensively managed farmland. • Plantings should be restricted to appropriate native species for context
Key stakeholders	• Landowners • Recreation users • Commoners • NRW • Gwent Wildlife Trust • Community groups
Further information	• http://www.wildlifetrusts.org/sites/default/files/6192_defra_info_sheet_woodlands_final.pdf • https://www.buglife.org.uk/b-friendly-in-your-community

5.5 Management Actions Toolkit

Land management opportunities that can improve the provision of pollen and nectar for pollinators are summarised below. These specific actions have been given codes which are referenced in the Pollinator Action Plan summary table. Each of these actions is then described in much more detail below, explaining what the action is, how it might be carried out and the key issues relevant to it. The actions are grouped in sections or 'themes' such as grass cutting, hedgerow treatment etc.

The tables below set out the main management changes that could be made for each category. They also highlight issues such as the main relative benefits, risks and cost. Many of the actions can be best used in combination with other actions, so these are listed under 'Related Actions'.

The actions are rated in relative terms for their potential:

- Benefits to pollinators from ✓ low - ✓✓✓ high;
- Relative cost from £ low - £££ high;
- Likelihood of success from + low - +++ high;
- Total value (calculated as a simple sum scoring 1 for each benefit tick ✓and 1 for each likelihood of success +, but 3 for the least cost option (£), 2 for the mid cost option (££) and 1 for the highest cost option (£££)).

5.5.1 Grass Cutting Actions (G1-7)

The following seven management action plans set out a range of options for land that is currently managed as mown grass. Traditionally the majority of these areas have been kept relatively closely cut, especially through summer months, which would have offered little in the way of opportunities for pollinators or wider biodiversity benefits. The actions share the core aims of trying to increase floral availability and diversity in the grass sward, but bring this about in different ways for different circumstances.

Selection of suitable treatments may depend on the local situation and influencing factors such as road safety, community use or ecological concerns. One important factor to consider is the soil. Under mowing regimes, nutrient-rich, fertile soils tend to favour grasses resulting in many wildflowers being outcompeted. Poorer quality, low nutrient soils offer better opportunities for many wildflowers. The main ways to improve the chances of wildflowers compared to grasses is to reduce soil fertility (e.g. topsoil stripping or collection of arisings), or reduce the vigour of the grasses using yellow rattle. Consequently, unless there is already a low fertility soil, the following actions are often most effective when paired with actions from some of the other sections.

It does not always follow that more is better – e.g. delaying the first cut or reducing cutting frequency slightly may be more effective in terms of pollinator provision than stopping it completely or just making an annual cut. Many of the flowering plants that cope well under mowing regimes are likely to already be present in a typical grass sward, such as dandelions, clover and buttercups, will flower at a height of between 100mm and 200mm – letting the grass grow to maybe 500mm will mean that a number of these flowers may be shaded out. Gradually reducing the fertility by removing cuttings over a number of years will decrease soil fertility and slowly encourage other plants to colonise, eventually leading to a more diverse sward. Collection of cuttings, which can sometimes swamp grasslands and increase fertility, may also be important locally.

One of the most important considerations is what the starting point of the grassland is. A good survey of the site before any changes are made will allow any important existing species such as orchids to be identified, and will also provide detailed information to guide any proposals. The information contained in the following table will also assist in choosing which approaches are most appropriate.

Table 24 – Management Actions Toolkit: Grass cutting actions

CODE	ACTION	AIMS	BENEFITS TO POLLINATORS	DETAILS	RISKS/HAZARDS/ CONSIDERATIONS	INDICATIVE COST LEVEL	RELATED ACTIONS	DELIVERY PLAN/S	BENEFITS	LIKELI-HOOD OF SUCCESS	COST	TOTAL
G1	Reduce cutting frequency	Produce species rich grassland for pollinators with more flowers	Allows many lower growing plants to reach flowering before being cut back providing more flowering resource for longer periods	Can reduce mowing costs as well, to be cost effective operator need to set machinery and leave it ideally, so most suitable when cut heights can be increased across the board.	Sward can become dominated with grasses - which produce no nectar. May result in larger quantities of arisings which need removal after cutting. Longer sward may require higher specification machinery when it is cut.	Low (unless frequent changes needed)	G2, G3, G4, G5, AU2, AU3	- Roadside Verges - Public Parks and Gardens - Outdoor Sports Facilities (excluding pitches) - Provision for Children and Young People - Car Parks, Office Grounds etc. - Historic Sites - Housing Green Space - School Grounds - Managed Gardens, Care Homes etc. - Other Amenity Green Space - Churchyards and Cemeteries - Cycle Routes and other non-motorised route ways - Water - Derelict Land and Demolition Sites	✓	++	£	6

CODE	ACTION	AIMS	BENEFITS TO POLLINATORS	DETAILS	RISKS/HAZARDS/ CONSIDERATIONS	INDICATIVE COST LEVEL	RELATED ACTIONS	DELIVERY PLAN/S	BENEFITS	LIKELI-HOOD OF SUCCESS	COST	TOTAL
G2	Increase cut height	Produce species rich grassland for pollinators with more flowers	Allows many lower growing plants to reach the point of flowering	Frequent cuts may still be made, if grass length cannot become excessive, e.g. highway visibility splays	May result in larger quantities of arisings which need removal after cutting	Low	G1, G3, G5, AU2, AU3	- Roadside Verges - Public Parks and Gardens - Outdoor Sports Facilities (excluding pitches) - Provision for Children and Young People - Car Parks, Office Grounds etc. - Historic Sites - Housing Green Space - School Grounds - Managed Gardens, Care Homes etc. - Other Amenity Green Space - Churchyards and Cemeteries - Cycle Routes and other non-motorised route ways - Water - Derelict Land and Demolition Sites	✓	++	£	6
G3	Introduce rotational mowing	Produce species rich grassland for pollinators with more flowers	Always some flowers present on site at any one time. Can allow insects to overwinter in uncut areas.	Can reduce time spent on individual visits, or at least not increase it, while bringing about significant benefits.	May result in larger quantities of arisings which need removal after cutting. May require weed control	Low	G1, G2, G4, G5, AU3	- Roadside Verges - Public Parks and Gardens - Outdoor Sports Facilities (excluding pitches) - Provision for Children and Young People - Car Parks, Office Grounds etc. - Historic Sites - Housing Green Space - School Grounds - Managed Gardens, Care Homes etc. - Other Amenity Green Space - Churchyards and Cemeteries - Cycle Routes and other non-motorised route ways - Water - Derelict Land and Demolition Sites	✓✓✓	++	£	8

CODE	ACTION	AIMS	BENEFITS TO POLLINATORS	DETAILS	RISKS/HAZARDS/ CONSIDERATIONS	INDICATIVE COST LEVEL	RELATED ACTIONS	DELIVERY PLAN/S	BENEFITS	LIKELI-HOOD OF SUCCESS	COST	TOTAL
G4	Stop cutting to allow natural colonisation	Produce species rich grassland for pollinators with more flowers	Possible option if adjacent to species-rich grasslands.	Will usually tend towards scrub and woodland without further intervention, resulting in irreversible loss of wild flowers	Longer term costs of controlling scrub or woodland may be higher. May require weed control.	Low (short term - may be high in the long term)	SCR1, SCR2, SCR3	- Roadside Verges - Cycle Routes and other non-motorised route ways - Natural and Semi-Natural Green Space - Accessible areas of countryside in the urban fringe	✓✓	++	£	7
G5	Remove cuttings from site and dispose of centrally or at an appropriate place on site.	Produce species rich grassland for pollinators with more flowers	It decreases soil fertility allowing greater floral diversity.	Potential for issues around cost/practicality of transporting cut material	Will require machinery to gather arisings either at cutting time or subsequently	Medium - high (Reflects cost of investing in collection machinery)	G1, G2, G3, CR4, AU2	- Roadside Verges - Public Parks and Gardens - Outdoor Sports Facilities (excluding pitches) - Provision for Children and Young People - Car Parks, Office Grounds etc. - Historic Sites - Housing Green Space - School Grounds - Managed Gardens, Care Homes etc. - Other Amenity Green Space - Churchyards and Cemeteries - Cycle Routes and other non-motorised route ways - Water	✓✓	++	££	6
G6	Cut grass in summer as a hay crop	Produce species rich grassland for pollinators with more flowers	It decreases soil fertility allowing greater floral diversity.	more cost effective to harvest in large flat areas, local farmers may cut and collect for free	needs to be free of ragwort and dog faeces to be of value as a hay crop	low	G1, G2, G3, CR4, AU2	- Roadside Verges - Public Parks and Gardens - Outdoor Sports Facilities (excluding pitches) - Provision for Children and Young People - Historic Sites - School Grounds - Churchyards and Cemeteries	✓✓	++	£	7

CODE	ACTION	AIMS	BENEFITS TO POLLINATORS	DETAILS	RISKS/HAZARDS/ CONSIDERATIONS	INDICATIVE COST LEVEL	RELATED ACTIONS	DELIVERY PLAN/S	BENEFITS	LIKELI-HOOD OF SUCCESS	COST	TOTAL
G7	Delay first cut until desired plants have flowered	Increase diversity and allow plants to flower and set seed	Allows many plants to reach the point of flowering	date of cut depends on what the area is being managed for	Public perception may be an issue, especially with Dandelions	low	G1, G2, G3, G4, AU2	- Roadside Verges - Public Parks and Gardens - Outdoor Sports Facilities (excluding pitches) - Provision for Children and Young People - Car Parks, Office Grounds etc. - Historic Sites - Housing Green Space - School Grounds - Managed Gardens, Care Homes etc. - Other Amenity Green Space - Churchyards and Cemeteries - Cycle Routes and other non-motorised route ways - Water	✓	++	**£**	**6**

5.5.2 Creation Actions (CR1-5)

Sometimes the most appropriate action for all, or more usually part, of a site is to create a completely new area for pollinators. This is usually a high cost option, and should be used with caution until the existing biodiversity or presence of rare species has been assessed.

The first management option (CR1) involves sowing the area with a pure flower seed mix, without any grass content ('pictorial meadows'). This will give a rich and vibrant display of flowers, provided appropriate preparation and management is also undertaken, and will give a long lasting flowering period if a range of flowers is included in the mix. These mixes usually include non-native species and are unlikely to be from local seed sources, so are best suited to urban areas where there is already a wide range of exotic plants in private gardens etc. In rural areas, where native plant communities are present a different approach using native, locally appropriate (ideally locally sourced) seed mixes should be used, or some form of augmentation of the existing sward (see next section).

Creating pollinator displays create a high visual appeal which can be important in terms of winning people around to the idea of an alternative to closely mown grass. In the correct location though, very often on small plots of land, planting either perennial or annual flower mixes can be suitable alternatives. The cost per square meter is significantly higher than for some other treatments, but it can deliver impressive results and be used to compliment other approaches on different parts of a site.

These areas require a relatively rich soils, and rely heavily on grass and perennial weeds being removed prior to sowing. This is a particular issue with perennial mixes, where many of the flowers are less vigorous and can take two or three years to establish. Perennial mixes also usually benefit from two, or even three, cuts in the first year, meaning that the initial display is less impressive. Once establishment is achieved, they can be much cheaper to maintain in the long term than annual mixes that need re-cultivating and sowing each year. They can also save money over mown grass as they only require one cut (and ideally collect) in winter.

In traditional wildflower meadows, the flowers are part of a grassy sward and thrive on low fertility soils where the grasses are less vigorous. Stripping topsoil can help reduce soil fertility but this is expensive and complicated. Alternatively collecting cuttings over time will eventually reduce soil fertility as the nutrients are used up by the plant growth and not returned to the soil. However the optimum conditions are achieved if attempting to create a native meadow from seed, again one of the main things is ensuring that there is little competition from unwanted weeds, and cutting, especially during establishment is useful to ensure a diverse range of plants thrive. Cuttings need to be collected and removed to maintain the area.

Creating new food growing opportunities for fruit and vegetable production (CR2), such as new community food gardens and allotments, has the advantage of directly linking food to pollinators. Although the provision is likely to be small scale, flower-rich resources may be present for a long period of the year.

Table 25 – Management Actions Toolkit: Creation actions

CODE	ACTION	AIMS	BENEFITS TO POLLINATORS	DETAILS	RISKS/HAZARDS/ CONSIDERATIONS	INDICATIVE COST LEVEL	RELATED ACTIONS	DELIVERY PLAN/S	BENEFITS	LIKELI-HOOD OF SUCCESS	COST	TOTAL
CR1	Rotavate and seed annual and perennial wildflower meadows without grass (e.g. Pictorial Meadows)	Establish a vibrant and intense display of flowers from spring through to autumn	Pollen and Nectar resource available from Spring until late into autumn.	Gives highest intensity of colour throughout the year, and long lasting display	Need to treat emergent perennial weeds and grasses to ensure success	High initial, but low maintenance costs if successfully established.		- Roadside Verges - Public Parks and Gardens - Outdoor Sports Facilities (excluding pitches) - Provision for Children and Young People - Car Parks, Office Grounds etc. - Historic Sites - Civic Spaces - Housing Green Space - School Grounds - Managed Gardens, Care Homes etc. - Other Amenity Green Space - Churchyards and Cemeteries - Cycle Routes and other non-motorised route ways - Derelict Land and Demolition Sites	✓✓✓	++	£££	6
CR2	Create food growing opportunities to include raised beds, allotments, fruits trees and shrubs, etc.	To make the area more productive, encourage local growing of fruit and vegetables	Pollen and Nectar resource available from Spring until late into autumn.	Autumn or spring sowing of food crops; year round pollinators for fruit trees, shrubs and perennials can be intensive and requires community involvement	Needs regular inputs throughout the year depending on what food crops are grown.	High initial, but low maintenance costs depending on what crops/plants are grown. Could provide income for community groups.		- Public Parks and Gardens - Provision for Children and Young People - Car Parks, Office Grounds etc. - Civic Spaces - Housing Green Space - School Grounds - Managed Gardens, Care Homes etc. - Other Amenity Green Space	✓✓✓	++	£££	6
CR3	Strip topsoil prior to seeding with native mixes	Remove high fertility soil, leaving a less nutrient rich substrate, which favours native	Wildflowers are not outcompeted by grasses, so higher diversity of nectar sources available	This is usually an expensive option unless it can be combined with other works.	topsoil needs to be disposed of	High	AU2	- Roadside Verges - Public Parks and Gardens - Outdoor Sports Facilities (excluding pitches) - Provision for Children and Young People	✓✓✓	+	£££	5

CODE	ACTION	AIMS	BENEFITS TO POLLINATORS	DETAILS	RISKS/HAZARDS/ CONSIDERATIONS	INDICATIVE COST LEVEL	RELATED ACTIONS	DELIVERY PLAN/S	BENEFITS	LIKELI-HOOD OF SUCCESS	COST	TOTAL
		wildflowers over more vigorous grasses.						- Housing Green Space - School Grounds - Managed Gardens, Care Homes etc. - Other Amenity Green Space - Cycle Routes and other non-motorised route ways - Derelict Land and Demolition Sites				
CR4	Establish native wildflower-meadow (including grasses) from seed	Create diverse traditional meadow	Provide a wide range of nectar and pollen sources	Requires cut and collect late enough in summer for annuals to have set seed, to maintain diversity in future years; May be more effective to use plug planting for many of the wildflowers	Requires thorough preparation of the area to eliminate perennial weeds and ryegrass, plus correct cutting especially in first year	Moderate	CR3, AU3, GR4	- Roadside Verges - Public Parks and Gardens - Outdoor Sports Facilities (excluding pitches) - Provision for Children and Young People - Historic Sites - Housing Green Space - School Grounds - Managed Gardens, Care Homes etc. - Other Amenity Green Space - Churchyards and Cemeteries - Cycle Routes and other non-motorised route ways - Derelict Land and Demolition Sites - Natural and Semi-Natural Green Space - Accessible areas of countryside in the urban fringe	✓✓✓	+	££	6
CR5	Planting pollinator-friendly trees and shrubs	Create plantings of diverse range of trees and shrubs friendly for pollinators	Potentially large food resource from trees and shrubs flowering at range of times during year	Planting selected range of trees and shrubs, not all one species.	Ensure pollinator-friendly species used without double-flowers. Will require maintenance during establishment.	Moderate		- Roadside Verges - Public Parks and Gardens - Outdoor Sports Facilities (excluding pitches) - Provision for Children and Young People - Car Parks, Office Grounds etc. - Historic Sites - Civic Spaces	✓✓✓	++	£££	6

CODE	ACTION	AIMS	BENEFITS TO POLLINATORS	DETAILS	RISKS/HAZARDS/ CONSIDERATIONS	INDICATIVE COST LEVEL	RELATED ACTIONS	DELIVERY PLAN/S	BENEFITS	LIKELI-HOOD OF SUCCESS	COST	TOTAL
								- Housing Green Space - School Grounds - Managed Gardens, Care Homes etc. - Other Amenity Green Space - Churchyards and Cemeteries - Cycle Routes and other non-motorised route ways - Water				

5.5.3 Augmentation Actions (AU1-3)

A successful way to establish flower-rich grassland is to augment the existing sward. This can be done by bringing in seed from other sources, or planting pre-grown wildflower plug plants.

One option is to use 'green hay', cut and collected from a local donor site. This has a number of advantages as it can be from a very local source (provided a suitable species rich area exists – e.g. local SSSIs or Coronation Meadows), but it is important to get the timing right to ensure good seed supply (ripe enough, but not so much so that it is already fallen). By spreading the cut hay across a pre-prepared area, the seed drops onto the ground should germinate, as if it had naturally fallen there from an existing plant. Exact timing will effect which seeds are at that stage and hence what has the chance to establish, and good ground preparation is required to ensure that the seeds make contact with soil. Subsequent cutting while the seedling germinate and establish is also important.

Sowing seeds of Yellow rattle can also help to open up an established grass sward as it is parasitic on the most vigorous components (usually the grasses). It needs to be sown in open swards in autumn so it can chill over winter in order to germinate. It germinates in spring and once established can prove very effective at reducing grass density, creating gaps in which a variety of other species can flourish. It sometimes takes two or three seasons to establish a significant population and as it is an annual plant is often reappears in different locations each season but must not be mown. Bees love it.

Another method to establish a flower rich meadow is to plant wildflower plugs into an existing sward. This can be quite a labour intensive process, but can also provide one of the most successful ways of achieving the desired results. Because the plants have already begun their growth and establishment they have a much higher success rate than seed, so far fewer are required. Competition is still a big issue though, so best results are still achieved where fertility is lower, or this method is used in conjunction with others.

All the actions in the following table work usually well in combination with others, whether they are cutting regime changes or others.

Table 26 – Management Actions Toolkit: Augmentation actions

CODE	ACTION	AIMS	BENEFITS TO POLLINATORS	DETAILS	RISKS/HAZARDS/ CONSIDERATIONS	INDICATIVE COST LEVEL	RELATED ACTIONS	DELIVERY PLAN/S	BENEFITS	LIKELI-HOOD OF SUCCESS	COST	TOTAL
AU1	Collect cut material from local donor meadow and spread on recipient site to introduce seed etc. (Green Hay)	Create diverse traditional meadow of local provenance	Supports existing flora and fauna communities by using seeds of local provenance, with a wide range of nectar and pollen sources.	Requires a suitable local donor site to provide the green hay and careful timing, but a good way of reproducing a traditional habitat if the above are possible	Ensure cut at correct time to have fully formed seed that has not fallen; Demand likely to outstrip supply; for best resource use high quality local donor site: e.g. SSSI, coronation meadows etc.	Moderate	CR3	- Roadside Verges - Public Parks and Gardens - Outdoor Sports Facilities (excluding pitches) - Housing Green Space - School Grounds - Other Amenity Green Space - Cycle Routes and other non-motorised route ways - Natural and Semi-Natural Green Space - Accessible areas of countryside in the urban fringe	✓✓✓	++	££	**7**
AU2	Introduce yellow rattle to grass sward	Reduce vigour of grasses allowing more diverse sward to develop. Bees like yellow rattle.	Parasitic on vigorous grasses, so allows the sward to open up giving less vigorous flowering plants a better chance of survival. Good nectar source.	Sow in Autumn (up to December) after grass has been cut	Keep stock off seeded areas until at least August, once it has died back.	Low	G1, G2, G3, G4, G5, G6, G7	- Roadside Verges - Public Parks and Gardens - Outdoor Sports Facilities (excluding pitches) - Housing Green Space - School Grounds - Other Amenity Green Space - Churchyards and Cemeteries - Cycle Routes and other non-motorised route ways - Natural and Semi-Natural Green Space - Accessible areas of countryside in the urban fringe	✓✓	++	£	**7**

CODE	ACTION	AIMS	BENEFITS TO POLLINATORS	DETAILS	RISKS/HAZARDS/ CONSIDERATIONS	INDICATIVE COST LEVEL	RELATED ACTIONS	DELIVERY PLAN/S	BENEFITS	LIKELI-HOOD OF SUCCESS	COST	TOTAL
AU3	Plug plant selected wildflowers	increase diversity of existing sward	Provides increased diversity of flowers, especially in areas that are initially offer little resource	Most suitable where fertility low, so there is less competition	Competition from grasses etc. H&S risk to those planting on road verges	Moderate (volunteers) High (paid staff)	CR4, G5	- Roadside Verges - Public Parks and Gardens - Outdoor Sports Facilities (excluding pitches) - Provision for Children and Young People - Car Parks, Office Grounds etc. - Historic Sites - Civic Spaces - Housing Green Space - School Grounds - Managed Gardens, Care Homes etc. - Other Amenity Green Space - Churchyards and Cemeteries - Cycle Routes and other non-motorised route ways	✓✓	+++	££	7

5.5.4 Grazing Actions (GR1-4)

Stock grazing has long been an important part of meadow management, whether all season, at a low density, or allowing the animals on to an area once the hay crop has been harvested. It has a number of beneficial effects, including disturbing the ground and allowing seed to reach the soil as well as being a way to stay on top of grass growth.

Different animals graze differently though, and are suited to different conditions. The Bedfordshire, Cambridgeshire, Northamptonshire and Peterborough Wildlife Trusts have produced a very useful guide to conservation grazing, which gives useful details on the merits of different species and is available here at http://www.wildlifebcn.org/sites/bcnp.live.wt.precedenthost.co.uk/files/ConservationGrazing_FINAL_0.pdf

Overgrazing can lead to problems, especially during winter, so sometimes eliminating stock from certain areas at certain times is important.

Stock grazing can also be used after hay has been cut and collected (see above).

Table 27 – Management Actions Toolkit: Grazing actions

CODE	ACTION	AIMS	BENEFITS TO POLLINATORS	DETAILS	RISKS/HAZARDS/ CONSIDERATIONS	INDICATIVE COST LEVEL	RELATED ACTIONS	DELIVERY PLAN/S	BENEFITS	LIKELI-HOOD OF SUCCESS	COST	TOTAL
GR1	Introduce/allow grazing with cattle instead of sheep	increase diversity of existing sward by managing grass through grazing	Cattle graze much less closely than sheep, allowing more flowering plant to flower and set seed.	Allow cattle to graze the area, which allows many low growing flowers to thrive and survive as more vigorous grasses are controlled and new plants can establish in hoof prints etc.	Potential risk of overgrazing if stocking level is too high, may be perceived public safety issues from Cattle; Requires secure boundaries	low	CR4, AU1	- Natural and Semi-Natural Green Space - Accessible areas of countryside in the urban fringe	✓✓	+	£	6

CODE	ACTION	AIMS	BENEFITS TO POLLINATORS	DETAILS	RISKS/HAZARDS/ CONSIDERATIONS	INDICATIVE COST LEVEL	RELATED ACTIONS	DELIVERY PLAN/S	BENEFITS	LIKELI-HOOD OF SUCCESS	COST	TOTAL
GR2	Introduce/allow grazing with ponies instead of sheep	increase diversity of existing sward by managing grass through grazing	Ponies graze less selectively than sheep, allowing more flowering plants to flower and set seed.	Allow ponies to graze the area, which allows many low growing flowers to thrive and survive as more vigorous grasses are controlled and new plants can establish in hoof prints etc.	Potential risk of overgrazing if stocking level is too high; Requires secure boundaries; Ragwort is good for pollinators and potentially lethal for horses.	low	CR4, AU1	- Natural and Semi-Natural Green Space - Accessible areas of countryside in the urban fringe	✓✓	++	£	7
GR3	Create stock proof boundaries to eliminate grazing	Allow for recovery of areas that have been overgrazed, giving many plants the chance to flower and set seed	Helps allow for natural regrowth of areas that have been over grazed	Useful in areas suffering overgrazing	Boundaries vandalised or not maintained	high	GR1, GR2, GR4	- Natural and Semi-Natural Green Space - Accessible areas of countryside in the urban fringe	✓✓	++	£££	5
GR4	Allow seasonal Grazing after summer hay cut	Manage grass and improve sward structure	Can improve sward structure through nutrient recycling and opening up gaps with their hooves.	Allowing this in more areas could reduce grazing pressure on permanently grazed areas	Public perception issues, (especially with cattle); Requires secure boundaries	low	CR4, AU1	- Natural and Semi-Natural Green Space - Accessible areas of countryside in the urban fringe	✓✓	+	£	6

5.5.5 Scrub Management Actions (SCR1-3)

If grassland is left uncut (and ungrazed) over time it will usually revert to scrub, before this eventually becomes woodland. Sometimes scrub can be a valuable habitat in its own right, and certainly has an important role to play as part of a diverse ecosystem. Many shrubs have insect-pollinated flowers as well as providing fruit and seeds for many other animals, and nesting habitats.

Because scrub is naturally in a transition between grassland and woodland it requires regular cutting to maintain it in a more or less constant state. This can be done selectively by hand (labour intensive and costly unless done by appropriately knowledgeable or well supervised volunteers) or by a tractor mounted flail (far less selective and can look very brutal immediately after cutting, but much quicker and cheaper, and in many cases the area will regenerate quickly).

Plants like brambles, which while valuable in their own right, can soon dominate vegetation unless cut back. Whenever part of an area is cut, other parts can be left and cut back at different times. When done by hand this can be individual plant, or even parts of a plant, but when using a flail it is more practical to split an area into blocks. A larger number of smaller blocks will be more beneficial to wildlife than a few large ones. If blocks are selected, cutting back a third of an area once a year is far better than cutting back all on an area every three years. This practice known as rotational maintenance applies in numerous situations, as it never removes all any one resource at once – some areas always remain.

Table 28 – Management Actions Toolkit: Scrub management actions

CODE	ACTION	AIMS	BENEFITS TO POLLINATORS	DETAILS	RISKS/HAZARDS/ CONSIDERATIONS	INDICATIVE COST LEVEL	RELATED ACTIONS	DELIVERY PLAN/S	BENEFITS	LIKELI-HOOD OF SUCCESS	COST	TOTAL
SCR1	Flail Cut every 2-3 years to maintain scrub cover	Maintain scrub cover to the area without it reverting to high woodland.	encourages re-growth while not allowing any one species to completely dominate and take over, at the expense of greater diversity	Completely clear everything, cutting to ground - then allow natural regrowth.	Flail cutting can be very indiscriminate, and brutal - can cause damage to certain vegetation - especially woody varieties.	Low	SCR3	- Roadside Verges - Car Parks, Office Grounds etc. - Historic Sites - Other Amenity Green Space - Cycle Routes and other non-motorised route ways - Water - Derelict Land and Demolition Sites - Natural and Semi-Natural Green Space - Accessible areas of countryside in the urban fringe	✓✓✓	++	£	8

CODE	ACTION	AIMS	BENEFITS TO POLLINATORS	DETAILS	RISKS/HAZARDS/ CONSIDERATIONS	INDICATIVE COST LEVEL	RELATED ACTIONS	DELIVERY PLAN/S	BENEFITS	LIKELI-HOOD OF SUCCESS	COST	TOTAL
SCR2	Selectively hand cut/strim to maintain individual areas at the desired height etc.	Maintain scrub cover to the area without it reverting to high woodland.	Allows for careful selection to retain the most valuable vegetation and ensure it does not become swamped by other types. Also allows opportunity for close inspection of the area.	particularly useful in areas where relatively skilled/knowledgeable volunteer labour is available along with trained supervisors	ensuring steady supply of suitable, reliable volunteers	High (paid staff) Moderate (volunteers)	SCR3	- Roadside Verges - Car Parks, Office Grounds etc. - Historic Sites - Other Amenity Green Space - Cycle Routes and other non-motorised route ways - Water - Natural and Semi-Natural Green Space - Accessible areas of countryside in the urban fringe	✓✓	++	£££	**5**
SCR3	Introduce rotational cutting	Maintain scrub cover to the area without it reverting to high woodland.	maintains a level of floral diversity	cut back - in part of the site at a time, so some is always maintained at 1 year growth, some at 2 year etc.	As with SCR1 and SCR2	As with SCR1 and SCR2	SCR1, SCR2	- Roadside Verges - Car Parks, Office Grounds etc. - Historic Sites - Other Amenity Green Space - Cycle Routes and other non-motorised route ways - Water - Derelict Land and Demolition Sites - Natural and Semi-Natural Green Space - Accessible areas of countryside in the urban fringe	✓✓✓	++	££	**7**

5.5.6 Hedgerow Actions (HDG1-7)

Hedgerows are important to biodiversity in general and good practice in managing them will bring benefits to pollinators as well as other species. The measures shown in the tables below will allow more flowering (for pollinators) and enhance the diversity and habitat value generally. The hedgerow ground flora should also be considered as well as the tree/shrub species.

The tables refer to specific green infrastructure type action plans, as this is where most hedgerow occur, but the principles apply to any area however classified. Broadly the tables focus on rotating and reducing cuts, making them later in the year, and removing cuttings where reasonable to reduce fertility at the base, and avoid this important area becoming swamped by vigorous grasses.

Table 29 – Management Actions Toolkit: Hedgerow actions

CODE	ACTION	AIMS	BENEFITS TO POLLINATORS	DETAILS	RISKS/HAZARDS/ CONSIDERATIONS	INDICATIVE COST LEVEL	RELATED ACTIONS	DELIVERY PLAN/S	BENEFITS	LIKELI-HOOD OF SUCCESS	COST	TOTAL
HDG1	Reduce hedge cutting frequency	Produce species rich hedges for pollinators	Allows for flowers to fully develop and provide nectar/pollen source		May be issues with access/visibility if hedge allowed to grow taller/wider; Higher volume of cuttings when it is cut	Low	HDG4, HDG7	- Roadside Verges - Public Parks and Gardens - Outdoor Sports Facilities (excluding pitches) - Car Parks, Office Grounds etc. - Historic Sites - School Grounds - Allotments, Community Gardens and Urban Farms - Churchyards and Cemeteries - Cycle Routes and other non-motorised route ways - Water - Natural and Semi-Natural Green Space - Accessible areas of countryside in the urban fringe	✓✓	+++	£	8

CODE	ACTION	AIMS	BENEFITS TO POLLINATORS	DETAILS	RISKS/HAZARDS/ CONSIDERATIONS	INDICATIVE COST LEVEL	RELATED ACTIONS	DELIVERY PLAN/S	BENEFITS	LIKELI-HOOD OF SUCCESS	COST	TOTAL
HDG2	Cut hedges later to allow flowering	Produce species rich hedges for pollinators	Allows for flowers to fully develop and provide nectar/pollen source	only required if currently cut before flowering, or if hedge contains nectar rich species	May be issues with access/visibility if hedge allowed to grow taller/wider;	Low - provided resources free later in the year	HDG4, HDG5	- Roadside Verges - Public Parks and Gardens - Outdoor Sports Facilities (excluding pitches) - Car Parks, Office Grounds etc. - Historic Sites - School Grounds - Allotments, Community Gardens and Urban Farms - Churchyards and Cemeteries - Cycle Routes and other non-motorised route ways - Water - Natural and Semi-Natural Green Space - Accessible areas of countryside in the urban fringe	✓	+++	£	7
HDG3	Implement rotational cutting on 3 year cycle (e.g. top one year one side one year, other side one year)	Produce species rich hedges for pollinators	Ensures that at any given time a large amount of hedge is allowed to flower, while still being cut sufficiently to maintain its form	Only benefits pollinators if species present have nectar rich flowers, brings wider biodiversity benefits though, such as better nesting opportunities	May be issues with access/visibility if hedge allowed to grow taller/wider; Higher volume of cuttings when it is cut	Low	HDG4, HDG5	- Roadside Verges - Public Parks and Gardens - Outdoor Sports Facilities (excluding pitches) - Car Parks, Office Grounds etc. - Historic Sites - School Grounds - Allotments, Community Gardens and Urban Farms - Churchyards and Cemeteries - Cycle Routes and other non-motorised route ways - Water - Natural and Semi-Natural Green Space - Accessible areas of countryside in the urban fringe	✓✓	+++	£	8
HDG4	Remove hedge cuttings after cutting has taken place	Produce species rich hedges for pollinators	reduces the nutrient level at the base, favouring a diverse vegetation mix	helps keep nutrient level lower, as cutting do not rot down in-situ	May be difficult, time consuming or expensive, especially in public highways	High	HDG1, HDG2, HDG3	- Roadside Verges - Public Parks and Gardens - Outdoor Sports Facilities (excluding pitches) - Car Parks, Office Grounds etc.	✓✓	+	£££	4

CODE	ACTION	AIMS	BENEFITS TO POLLINATORS	DETAILS	RISKS/HAZARDS/ CONSIDERATIONS	INDICATIVE COST LEVEL	RELATED ACTIONS	DELIVERY PLAN/S	BENEFITS	LIKELI-HOOD OF SUCCESS	COST	TOTAL
								- Historic Sites - School Grounds - Allotments, Community Gardens and Urban Farms - Churchyards and Cemeteries - Cycle Routes and other non-motorised route ways - Water - Natural and Semi-Natural Green Space - Accessible areas of countryside in the urban fringe				
HDG5	Reduce cutting at base to encourage diverse ground flora, and remove cuttings	Produce species rich hedges for pollinators	Allows ground flora at the base to	reduce mowing of the ground flora if it is cut currently	May be difficult, time consuming or expensive, especially in public highways	High - unless carried out by volunteers	HDG1, HDG2, HDG3	- Roadside Verges - Public Parks and Gardens - Outdoor Sports Facilities (excluding pitches) - Car Parks, Office Grounds etc. - Historic Sites - School Grounds - Allotments, Community Gardens and Urban Farms - Churchyards and Cemeteries - Cycle Routes and other non-motorised route ways - Water - Natural and Semi-Natural Green Space - Accessible areas of countryside in the urban fringe	✓✓	++	£££	5
HDG6	Infill 'gappy' hedges with Pollinator friendly species	Produce species rich hedges for pollinators	Increases pollen/nectar resource	Species to be selected carefully to suit the location and should be of local provenance if possible		moderate		- Roadside Verges - Public Parks and Gardens - Outdoor Sports Facilities (excluding pitches) - Car Parks, Office Grounds etc. - Historic Sites - School Grounds - Allotments, Community Gardens and Urban Farms - Churchyards and Cemeteries	✓✓	++	££	6

CODE	ACTION	AIMS	BENEFITS TO POLLINATORS	DETAILS	RISKS/HAZARDS/ CONSIDERATIONS	INDICATIVE COST LEVEL	RELATED ACTIONS	DELIVERY PLAN/S	BENEFITS	LIKELI-HOOD OF SUCCESS	COST	TOTAL
								- Cycle Routes and other non-motorised route ways - Water - Natural and Semi-Natural Green Space - Accessible areas of countryside in the urban fringe				
HDG7	Lay 'gappy' hedges	Produce species rich hedges for pollinators	Helps maintain integrity of hedge - thus the reason for it to exist at all	species in hedge may not be pollinator friendly; assumes suitable stems present	Hedge laying is a skilled craft that requires time and experience	high		- Roadside Verges - Public Parks and Gardens - Outdoor Sports Facilities (excluding pitches) - Car Parks, Office Grounds etc. - Historic Sites - School Grounds - Allotments, Community Gardens and Urban Farms - Churchyards and Cemeteries - Cycle Routes and other non-motorised route ways - Water - Natural and Semi-Natural Green Space - Accessible areas of countryside in the urban fringe	✓✓	+	£££	4

5.5.7 Formal Planting (FM1 and FM2)

In areas that contain formal planting, there are opportunities to make this more beneficial to pollinators. The following tables focus on both bulb planting and formal planting beds.

Both bulbs and formal beds offer good opportunities for pollinators, although these are often not fully realised. Particularly in Wales where they are culturally significant, daffodils are planted in enormous numbers, but as they are selectively bred for their flowers most varieties produce little nectar or pollen. New plantings could also include other bulbs – crocus, snowdrops and bluebells all provide excellent pollinator resources, and numerous other woodland bulb are also available. The key aim to is the ensure that there is a good range of flowering plants available from early in the year, when new queen bees emerge right through until later in the season when there is a plentiful supply of nectar from other sources.

Formal planting beds offer various opportunities but the key is choosing the best species, and again having a range to ensure a good choice of flowers throughout the year. The RHS have a 'Perfect for Pollinators' accreditation which has been earned by numerous commercially available plants, and lists of suitable plants can be found at https://www.rhs.org.uk/science/conservation-biodiversity/wildlife/encourage-wildlife-to-your-garden/plants-for-pollinators. Good information is also available from the London Bee Keepers Association at http://www.lbka.org.uk/forage.html.

Table 30 – Management Actions Toolkit: Formal planting actions

CODE	ACTION	AIMS	BENEFITS TO POLLINATORS	DETAILS	RISKS/HAZARDS/ CONSIDERATIONS	INDICATIVE COST LEVEL	RELATED ACTIONS	DELIVERY PLAN/S	BENEFITS	LIKELI-HOOD OF SUCCESS	COST	TOTAL
FM1	Plant a range of bulbs suited to specific conditions	Increase biodiversity and length of flowering period	Ensuring good, ideally varied, supply of nectar, especially early in the year	good task for volunteers, school groups etc.	Areas mown too early in the season will damage them; H&S risk to those planting in Road Verges	Moderate	G7	- Roadside Verges - Public Parks and Gardens - Outdoor Sports Facilities (excluding pitches) - Provision for Children and Young People - Car Parks, Office Grounds etc. - Historic Sites - Civic Spaces - Housing Green Space - School Grounds - Managed Gardens, Care Homes etc. - Other Amenity Green Space - Allotments, Community Gardens and Urban Farms - Churchyards and Cemeteries - Cycle Routes and other non-motorised route ways - Water - Accessible areas of countryside in the urban fringe	✓✓	+++	££	7
FM2	Plant formal beds with a range of perennials and shrubs that provide good pollinator resources	Increase biodiversity and length of flowering period	Ensuring good, ideally varied, supply of nectar	Ensure plants chosen provide good resources for pollinators: See useful resources here: https://www.rhs.org.uk/science/conservation-biodiversity/wildlife/encourage-wildlife-to-your-garden/plants-for-pollinators and here:	Poor choice of plants - ensure that they are attractive to pollinators	Moderate - high (but no more than it would be for other plants)		- Public Parks and Gardens - Provision for Children and Young People - Car Parks, Office Grounds etc. - Historic Sites - Civic Spaces - Housing Green Space - School Grounds - Managed Gardens, Care Homes etc. - Other Amenity Green Space - Churchyards and Cemeteries - Water	✓✓	+++	££	7

CODE	ACTION	AIMS	BENEFITS TO POLLINATORS	DETAILS	RISKS/HAZARDS/ CONSIDERATIONS	INDICATIVE COST LEVEL	RELATED ACTIONS	DELIVERY PLAN/S	BENEFITS	LIKELI-HOOD OF SUCCESS	COST	TOTAL
				http://www.lbka.org.uk/forage.html								

5.5.8 Woodland Management Actions (WD1-4)

Woodland can be important for various pollinators, especially ancient broadleaved woodland. In most cases it is not the high woodland canopy that is the most valuable though – the woodland edge habitats, and glades, where more light reaches the understorey and ground cover plants can offer much higher diversity and wide range of nectar sources. Many of the major dominant trees such as beech, ash and oak are wind-pollinated and offer no feeding reward to pollinators.

Recent plantation woodland often has closely spaced saplings on the expectation that they will be thinned out as future maintenance (this does not always happen resulting in thin, tall spindly trees). Thinning saplings out allows more light into the woodland and encourages growth outwards rather upwards and, more importantly for pollinators, allows more light to reach other plants below the canopy, meaning that they do better and provide more nectar.

By creating a varied woodland edge, rather than a straight line, the total distance of edge relative to woodland can be significantly increased. This provides good opportunities for woodland edge plants to thrive, such as foxgloves which are popular with bumblebees.

The first three actions relate to increasing diversity of flowering plants within or around the woodland, whereas the fourth is about ensuring that there are natural nesting sites available to wild bee colonies. Although usually known as a commercially managed species, wild honey bees exist, and as they originated as a forest animal they are well suited to woodland conditions leaving dead tree trunks standing is beneficial to a huge number of insects and consequently other animals, but one of the beneficiaries are bees. Once a cavity inside a tree trunk has reached about 40 litres in volume it is the ideal size for a swarm of bees to take up residence within the space.

Table 31 – Management Actions Toolkit: Woodland management actions

CODE	ACTION	AIMS	BENEFITS TO POLLINATORS	DETAILS	RISKS/HAZARDS/ CONSIDERATIONS	INDICATIVE COST LEVEL	RELATED ACTIONS	DELIVERY PLAN/S	BENEFITS	LIKELI-HOOD OF SUCCESS	COST	TOTAL
WD1	Thin out dense areas of woodland	create varied diverse woodland structure	allows light in, and increases diversity of vegetation	Allows for better health and stronger growth in remaining trees, as well as more diverse ground flora and understorey; Aim for a range of densities	If soil fertility is high, ground flora may still become dominated by the most vigorous species	Moderate	WD3	- Roadside Verges - Public Parks and Gardens - Historic Sites - Cycle Routes and other non-motorised route ways - Natural and Semi-Natural Green Space - Accessible areas of countryside in the urban fringe	✓✓	+++	££	7

CODE	ACTION	AIMS	BENEFITS TO POLLINATORS	DETAILS	RISKS/HAZARDS/ CONSIDERATIONS	INDICATIVE COST LEVEL	RELATED ACTIONS	DELIVERY PLAN/S	BENEFITS	LIKELI-HOOD OF SUCCESS	COST	TOTAL
WD2	open up woodland edge	increase total length of woodland edge, with diverse structure	allows for natural colonisation with flowering woodland edge species	will require ongoing maintenance	area become dominated by rank grasses or brambles if not maintained; increased length may increase maintenance requirements	low-moderate	WD3	- Roadside Verges - Public Parks and Gardens - Historic Sites - Cycle Routes and other non-motorised route ways - Natural and Semi-Natural Green Space - Accessible areas of countryside in the urban fringe	✓✓✓	+++	£	9
WD3	plant or sow woodland edge species	ensure woodland edge habitats have sufficient variety of flowering plant species present	increased floral diversity means wider range of nectar and pollen sources	May be particularly important in relatively young plantations - ancient woodland likely to have a good reserve of species ready to colonise if conditions are appropriate	further preparation may be required to	low - moderate	WD1, WD2	- Roadside Verges - Public Parks and Gardens - Historic Sites - Cycle Routes and other non-motorised route ways - Natural and Semi-Natural Green Space - Accessible areas of countryside in the urban fringe	✓✓	++	£	7
WD4	Leave Standing dead wood	Provide nesting opportunities	Honeybees are traditionally a woodland animals require and nest in hollow trees	Honey bees require approx. a 40 litre volume hole	Potential H&S issue if trees become unstable - removing limbs but leaving main trunk	low	WD1, WD2, WD3	- Historic Sites - Natural and Semi-Natural Green Space - Accessible areas of countryside in the urban fringe	✓✓	++	£	7

6 CASE STUDIES

Four case studies to demonstrate the application of the action plan were chosen in consultation with the steering group. These sites were chosen to be representative of a broad range of green infrastructure types distributed spatially across the study area. Green Infrastructure Action Plans, the Pollinator Evaluation and Grading System (PEGS) and the GIS database are each explained in more detail.

The four examples selected are:

Historic Sites / Green Infrastructure Action Plan

- Caerphilly Castle surroundings, Porset Brook and Lansbury Park housing estate
- Selected because of the historical context potential for a partnership to be formed between Cadw and Caerphilly County Borough Council
- The Green Infrastructure Action Plans are also described in more detail in this case study

School Grounds

- Tredegar Comprehensive School
- Selected due to its size and proximity to neighbouring housing estates and ecological designations

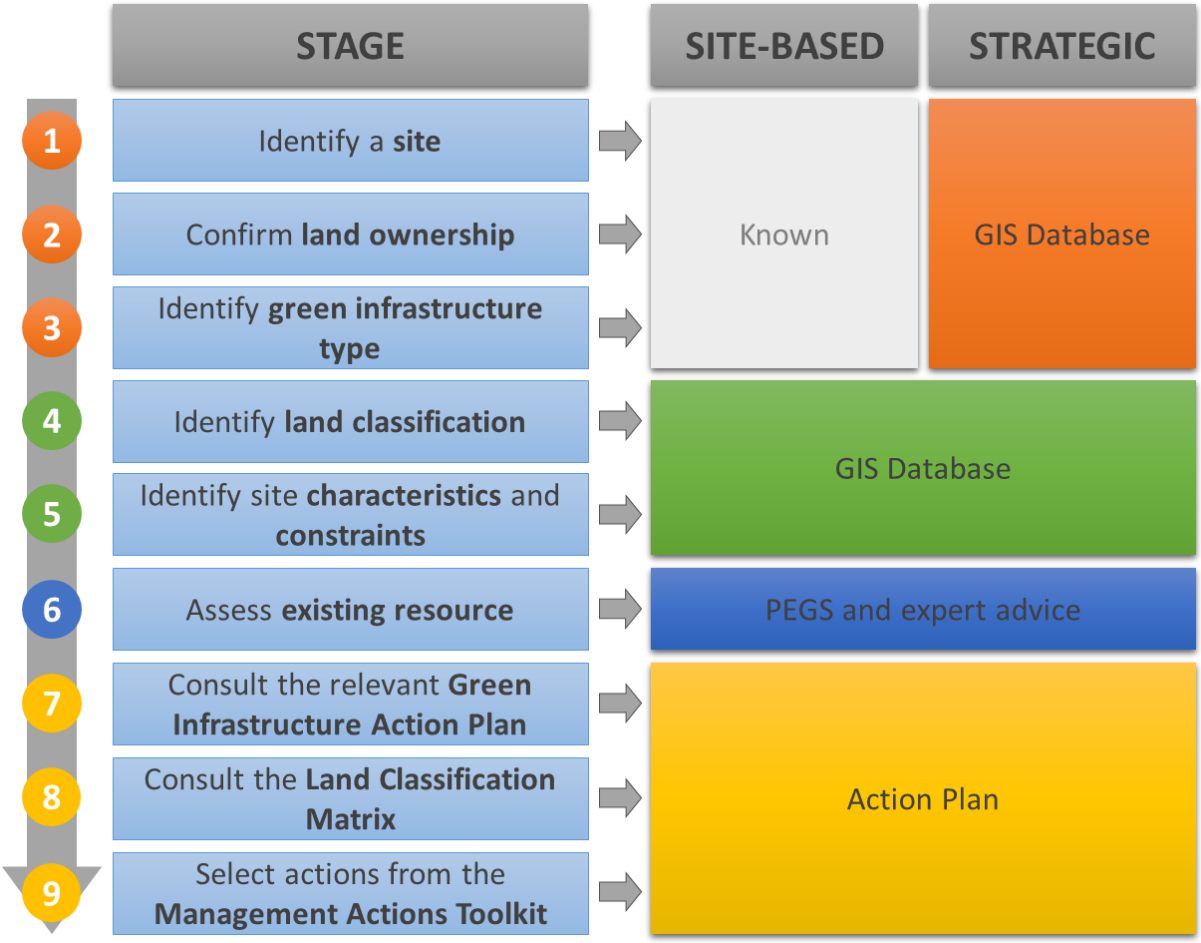
Other amenity green space / PEGS

- Rogiet Primary School and adjacent housing and recreation ground
- Selected to represent a number of pockets of urban land that offer good potential for improving pollinator provision and for its proximity to Rogiet Country Park
- A good example of Local Authority/social housing organisation partnership
- The Pollinator Evaluation and Grading System (PEGS) is also focussed on in more detaiul in this case study

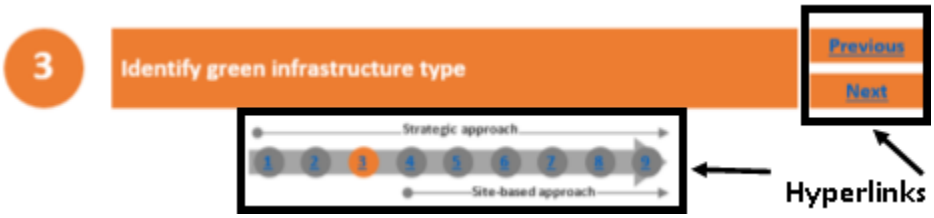
Car parks, Office Grounds etc. / GIS Database

- Torfaen County Borough Council's Eco Building
- Selected due to its example of innovative sustainable building design and linkage to green infrastructure
- The GIS Database is also focussed on in more detail in this case study

The case studies follow the Action Plan process as detailed in the diagram below.



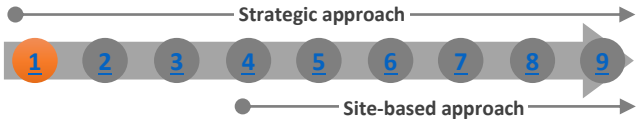
The different stages are hyperlinked throughout allowing for quick navigation through the different steps and between different case studies.



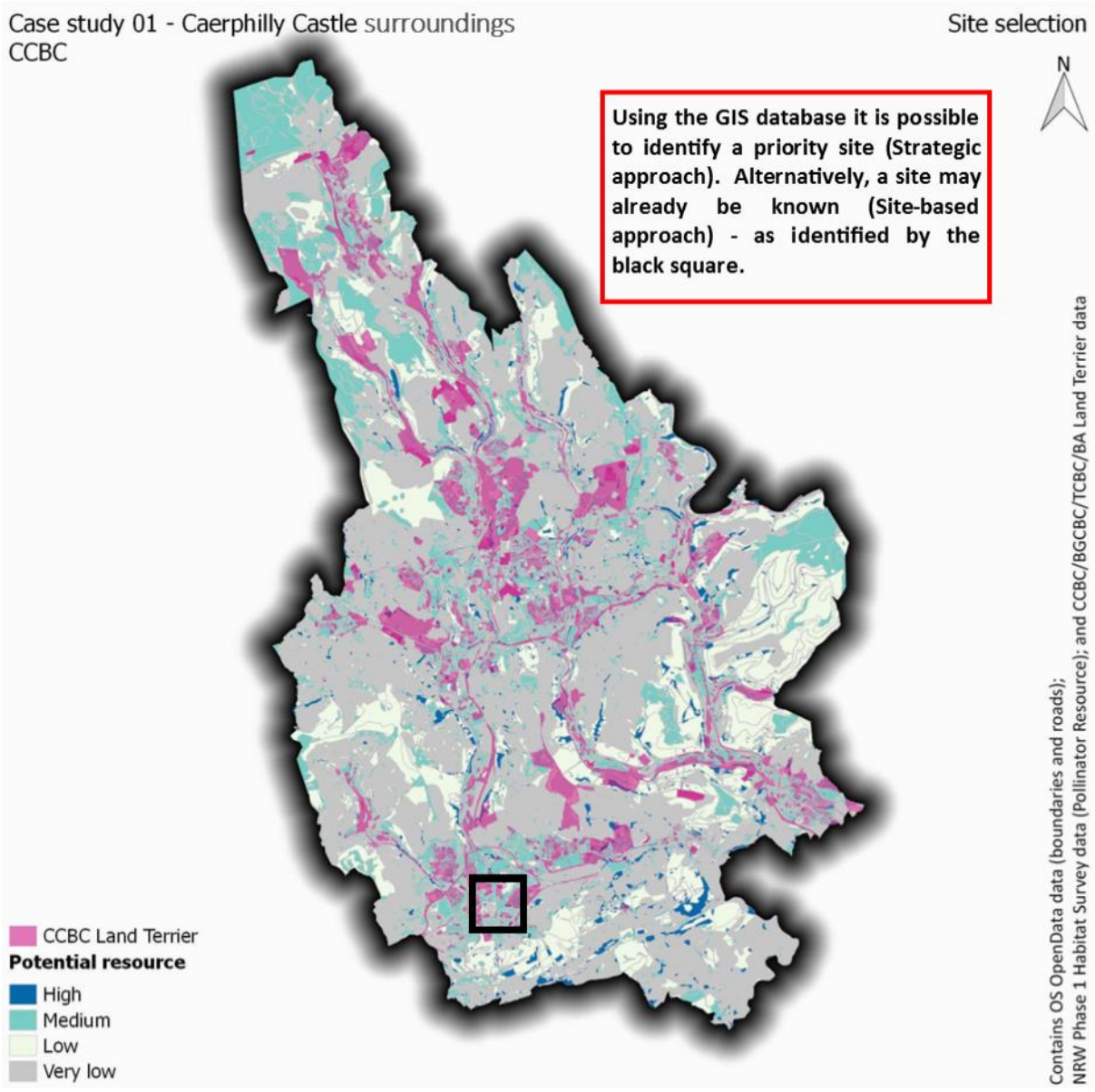
6.1 Historic Sites

Caerphilly Castle was selected because of its historical context and potential for partnerships to be formed between Cadw and Caerphilly County Borough Council. This case study also includes a more detailed example of the Green Infrastructure Action Plan, in Step 7.

1 **Identify a site** **Next**



Caerphilly Castle and its surroundings (such as Dafydd Williams Park) are public land which have potential for development of some green infrastructure for pollinators within other constraints.



2 Confirm land ownership

Previous
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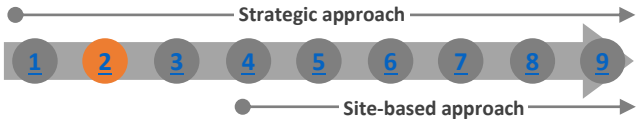
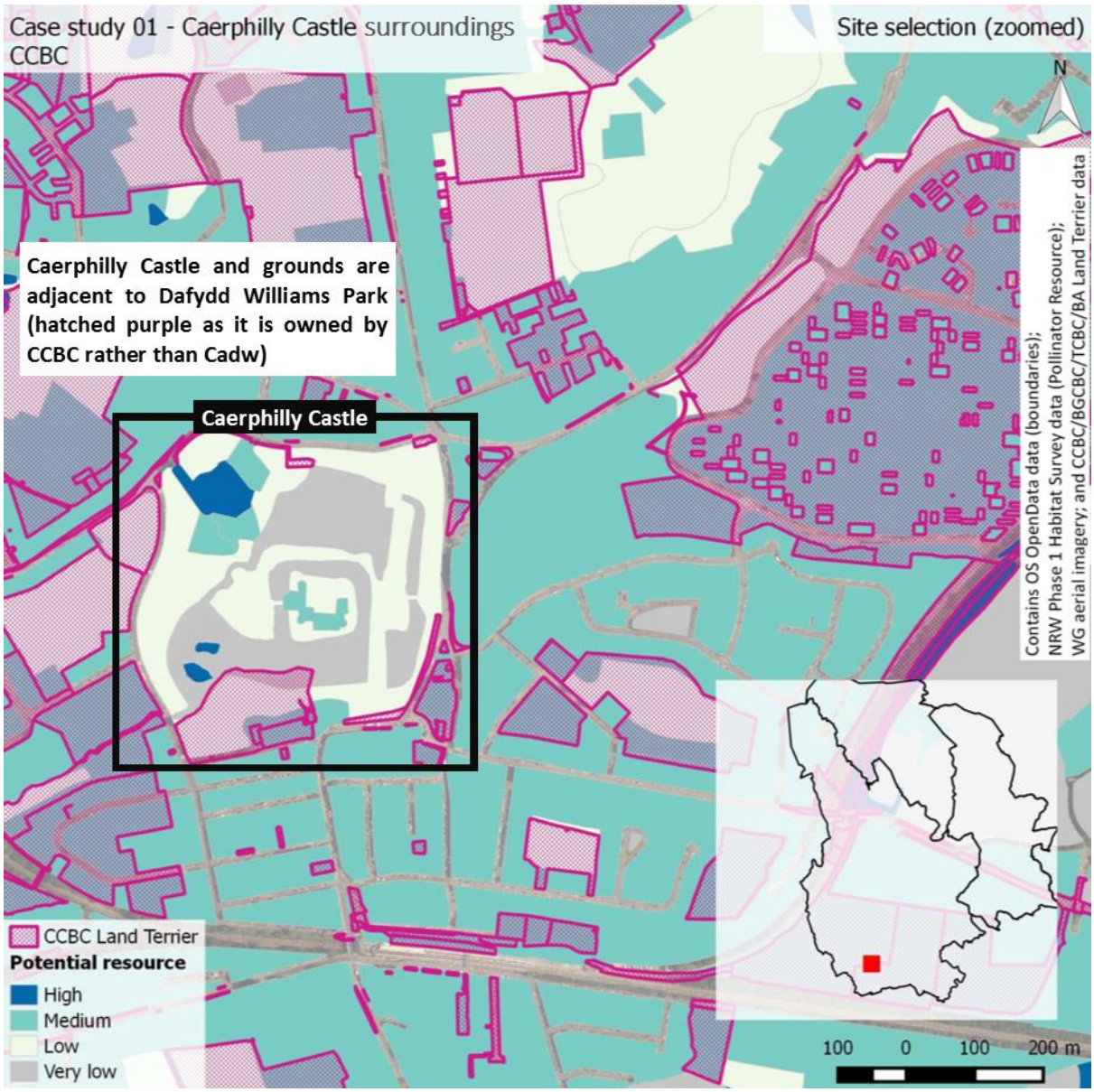


Land ownership can be identified from the Land Terrier in the GIS database and checked further with Estates Departments.



3 Identify green infrastructure type

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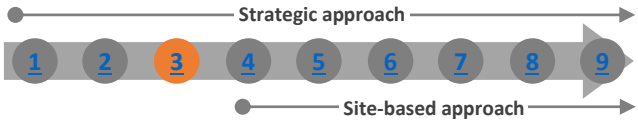
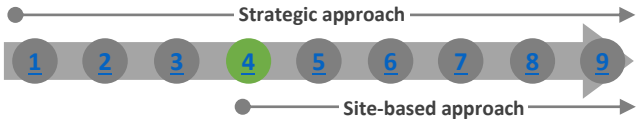


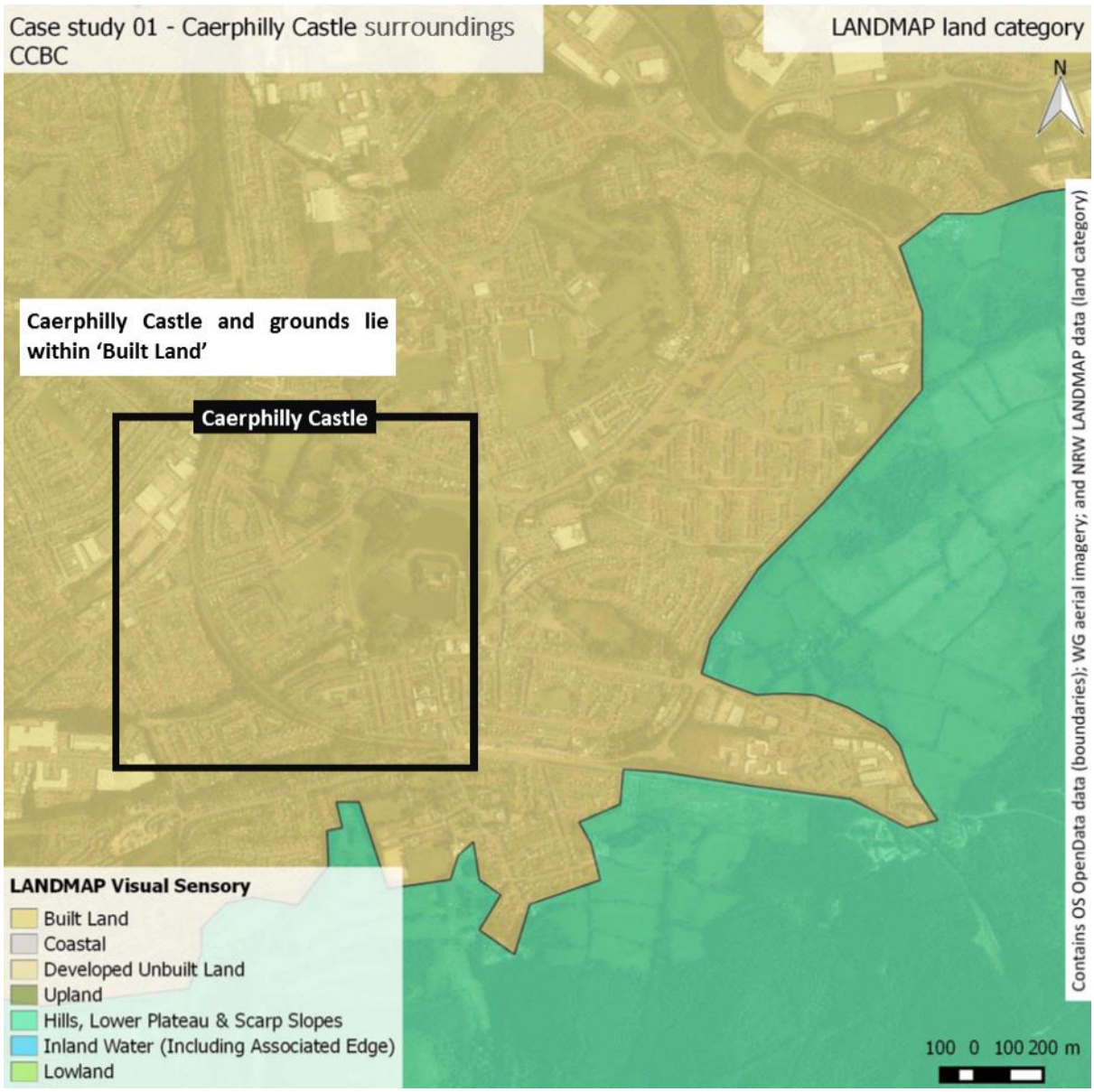
The green infrastructure type is a Historic Site. Much of the castle grounds is closely mown grass or grazed short by geese, with a net result that large expanses are currently of very little value for pollinators.

4 Identify land classification

Previous
Next



The land classification type enables selection of appropriate actions within the geographic context of the site and is a required input to the Land Classification Matrix in Step 8.



5 Identify site characteristics and constraints

Previous
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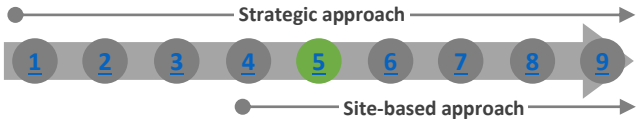
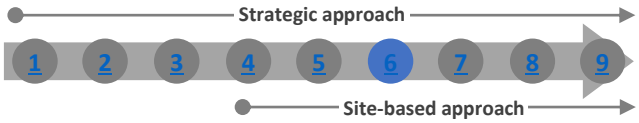


The GIS database indicates the following characteristics (a more detailed example of use of the GIS database can be found in the Car parks, Office Grounds etc. case study), for example:

- Designations – Scheduled Ancient Monument
- Elevation - low altitude
- Temperature – warm
- Rainfall - moderate
- Slope - predominantly flat
- Soil fertility - low fertility surrounding soils
- Connectivity - opportunities to build and enhance connectivity with other surrounding areas with links to Porset Brook and Lansbury Park housing estate

6 Assess existing resource

Previous
Next

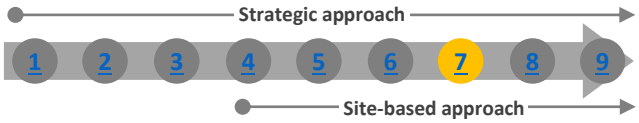


The GIS resource map derived from Phase 1 habitat survey indicates the area is mostly of low value for pollinators (Step 2). The site can also be assessed using the Pollinator Evaluation and Grading System (a more detailed example of PEGS can be found in the Other amenity green space case study), and would score as poor value due to the uniform vegetation with no flowers. There is thus great potential to improve the site for pollinators.


Case study 01 - Caerphilly Castle surroundings
CCBC
Site selection (zoomed)
N
Caerphilly Castle
The aerial photograph shows more clearly the green space across the area. Whilst there is some existing resource associated with the area of woodland north-west of the castle, the map in Stage 2 identifies the castle area as currently being of low value to pollinators.
100 0 100 200 m
Contains OS OpenData data (boundaries); and WG aerial imagery

7 Consult the relevant Green Infrastructure Action Plan

Previous
Next



The green infrastructure action plan sets out the main considerations and options.

Green Infrastructure type: Historic Sites	

Aims	• Manage historic sites in a way which provides greater benefit for pollinators
	  ○ Ensure historic context and features are maintained
	  ○ Ensure public amenity needs are still met
	  ○ Manage some areas of site, especially grassland, for pollinators
	• Avoid increases or reduce cost of maintenance

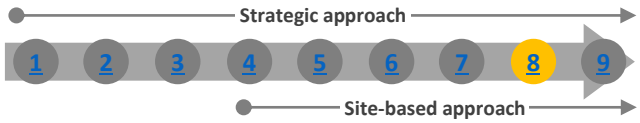
Desired Outcomes	• Historic sites with a diversity of sward types for grass areas, and featuring a range of flowering species throughout the year. • Areas that are attractive to the public and offer the opportunity to interact with and learn about both the historic and natural environment
Assessment steps	• Check if site is already designated for its historical importance (eg Listed, SAM), and if proposed changes in management will support or conflict with those designations • Assess constraints (such as public use of space, e.g. re-enactments) and maintenance of historic value • Assess value of existing biodiversity and pollinator resources • Assess where pollinator provision could be accommodated • Assess resources/options available for on-going management • Consult with stakeholders

Main options for site	• Grasslands
	  ○ Alter mowing regimes:
	  ▪ Reduce cutting frequency (G1)
	  ▪ Increase cut height (G2)
	  ▪ Introduce rotational mowing (G3)
	  ▪ Delay first cut (G7)
	  ○ Augmentation of diversity:
	  ▪ Collect cut material from local donor meadow and spread on recipient site to introduce seed etc. (Green Hay) (AU1)
	• Medicinal herb gardens
	  ○ Medicinal herbs often good context for historic site and also good for pollinators, but may have health risk to public
	• Kitchen herb garden
	  ○ Again may be good for context and pollinators, though in this case for display not food production
	• Bee keeping

	○ There may also be historic links to honey as a sweetener and traditional beekeeping
Relevant Management Action Plans	G1, G2, G3, G6, G7, CR1, CR4, CR5, AU3, FM1, FM2, WD1, WD2, WD3, WD4, SCR1, SCR2, SCR3, HDG1, HDG2, HDG3, HDG4, HDG5, HDG6, HDG7
Risk Appraisal	• Ivy is very good for pollinators but can be damaging to old masonry • Historic tree avenues (e.g. lime avenues) should be maintained rather than augmented with other tree species • Public may regard pollinator areas as unkempt; signage may be appropriate
Key stakeholders	• Cadw • Friends groups • LA Conservation Officer and Parks Department

8 Consult the Land Classification Matrix

Previous
Next

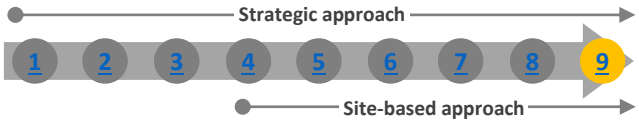


Knowing the Green Infrastructure type from Step 3 and the land classification type from Step 4 allows appropriate management actions to be selected.

Green Infrastructure Type	Land Classification Type						
	Inland Water	Upland	Hills, lower plateaux and scarp slopes	Lowland	Coastal	Built Land	Developed Unbuilt Land
Historic Sites	G1, G2, G3, G6, G7 CR4, CR5 AU3 FM1, FM2 WD1, WD2, WD3, WD4 SCR1, SCR2, SCR3 HDG1, HDG2, HDG3, HDG4, HDG5, HDG6, HDG7					G1, G2, G3, G6, G7 CR1, CR4, CR5 AU3 FM1, FM2 WD1, WD2, WD3, WD4	

9 Select actions from the Management Actions Toolkit

Previous



Appropriate actions identified in the Land Classification Matrix (Step 8) and the Green Infrastructure Action Plan (Step 7) can then be considered, such as changing summer grass cutting e.g.

- Reduce cutting frequency (G1)
- Increase cut height (G2)
- Introduce rotational mowing (G3)
- Grass cut in summer as a hay crop (G6), etc.

In the immediate grounds of Caerphilly Castle the responsibility for maintenance lies directly with Cadw but the same principles apply. Regardless of what may happen with summer grass cutting, there would be scope to introduce a wider range of spring flowering bulbs (FM1) and other flowers such as cowslips etc. This could be relatively simply combined with postponing the first cut for maximum benefit (G7). The woodland area to the NW of the site could also incorporate some of the suggested measures including perhaps leaving standing deadwood (WD4). The Council-owned areas such as Porset Brook and the Lansbury Park Housing estate can also be linked in to create more diverse connected areas.

In addition to the specific actions identified in the Management Actions Toolkit other methods for encouraging understanding of pollinators could be considered. For example there is an historic link to pollinators through the use of honey as a sweetener. Links could be developed into bee-keeping and selling local honey in the astle gift shop.

CODE	ACTION	AIMS	BENEFITS TO POLLINATORS	DETAILS	RISKS/HAZARDS/ CONSIDERATIONS	INDICATIVE COST LEVEL	RELATED ACTIONS	DELIVERY PLAN/S	BENEFITS	LIKELI-HOOD OF SUCCESS	COST	TOTAL
G1	Reduce cutting frequency	Produce species rich grassland for pollinators with more flowers	Allows many lower growing plants to reach flowering before being cut back providing more flowering resource for longer periods	Can reduce mowing costs as well, to be cost effective operator need to set machinery and leave it ideally, so most suitable when cut heights can be increased across the board.	Sward can become dominated with grasses - which produce no nectar. May result in larger quantities of arisings which need removal after cutting. Longer sward may require higher specification machinery when it is cut.	Low (unless frequent changes needed)	G2, G3, G4, G5, AU2, AU3	-Road verge management -Public Parks and Gardens -Outdoor Sports Facilities -Provision for Children and Young People -Car parks, Office Grounds etc. -Historic Sites -Housing green space -School Grounds -Managed gardens, care homes etc. -other amenity green space -Allotments and community gardens -Churchyards and cemeteries -Cycle routes and other non-motorised route ways -Derelict land and demolition sites -Natural and Semi-natural Green space -Accessible areas of countryside in the urban fringe	✓	++	£	6

6.2 School grounds

Tredegar Comprehensive School was selected due to its size and proximity to neighbouring housing estates and ecological designations.

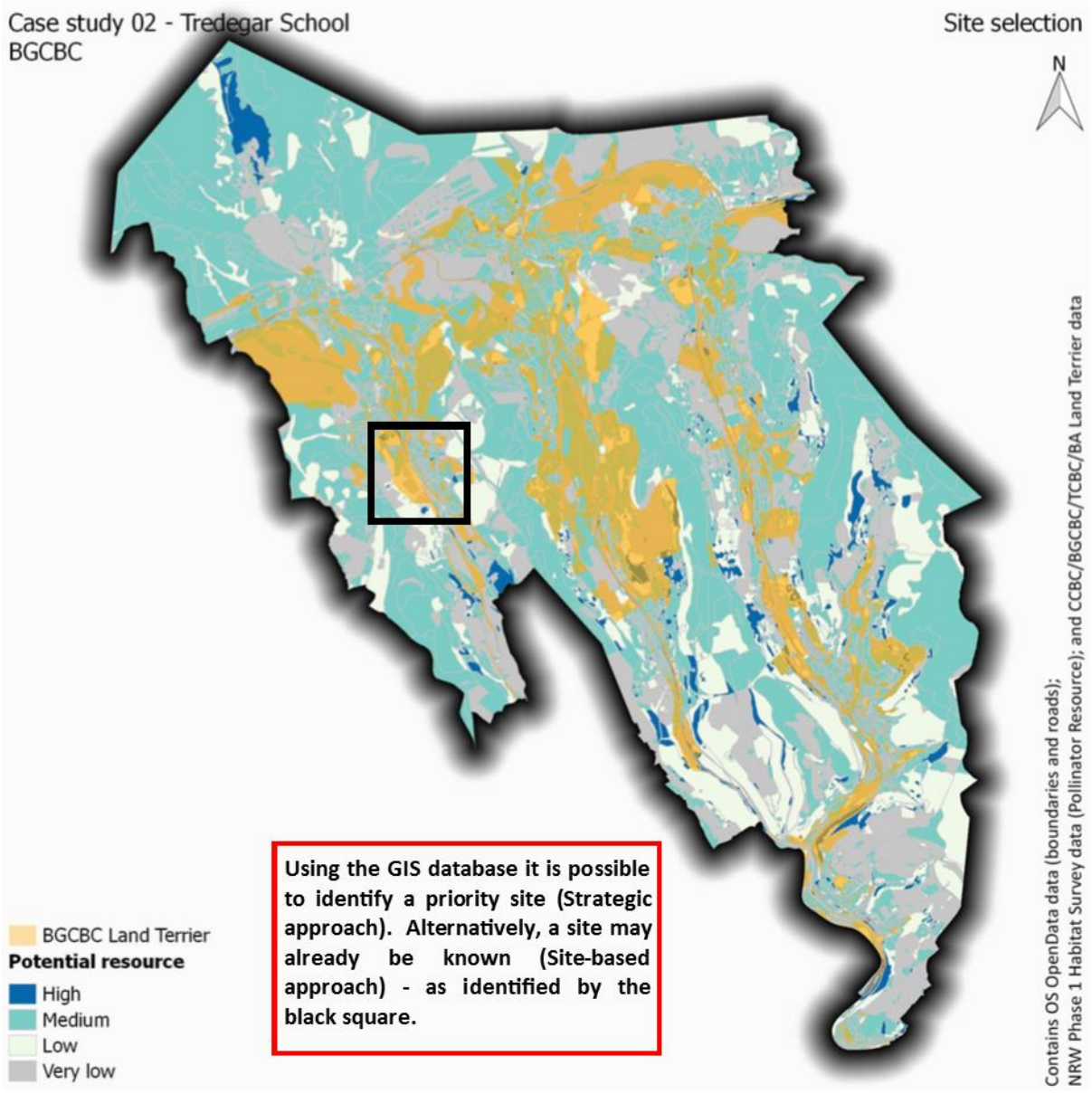
1 **Identify a site** **Next**

Strategic approach

1 2 3 4 5 6 7 8 9

Site-based approach

Tredegar School is public land which has potential for development of some green infrastructure for pollinators within other constraints.



2 Confirm land ownership

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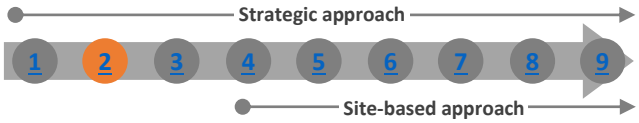
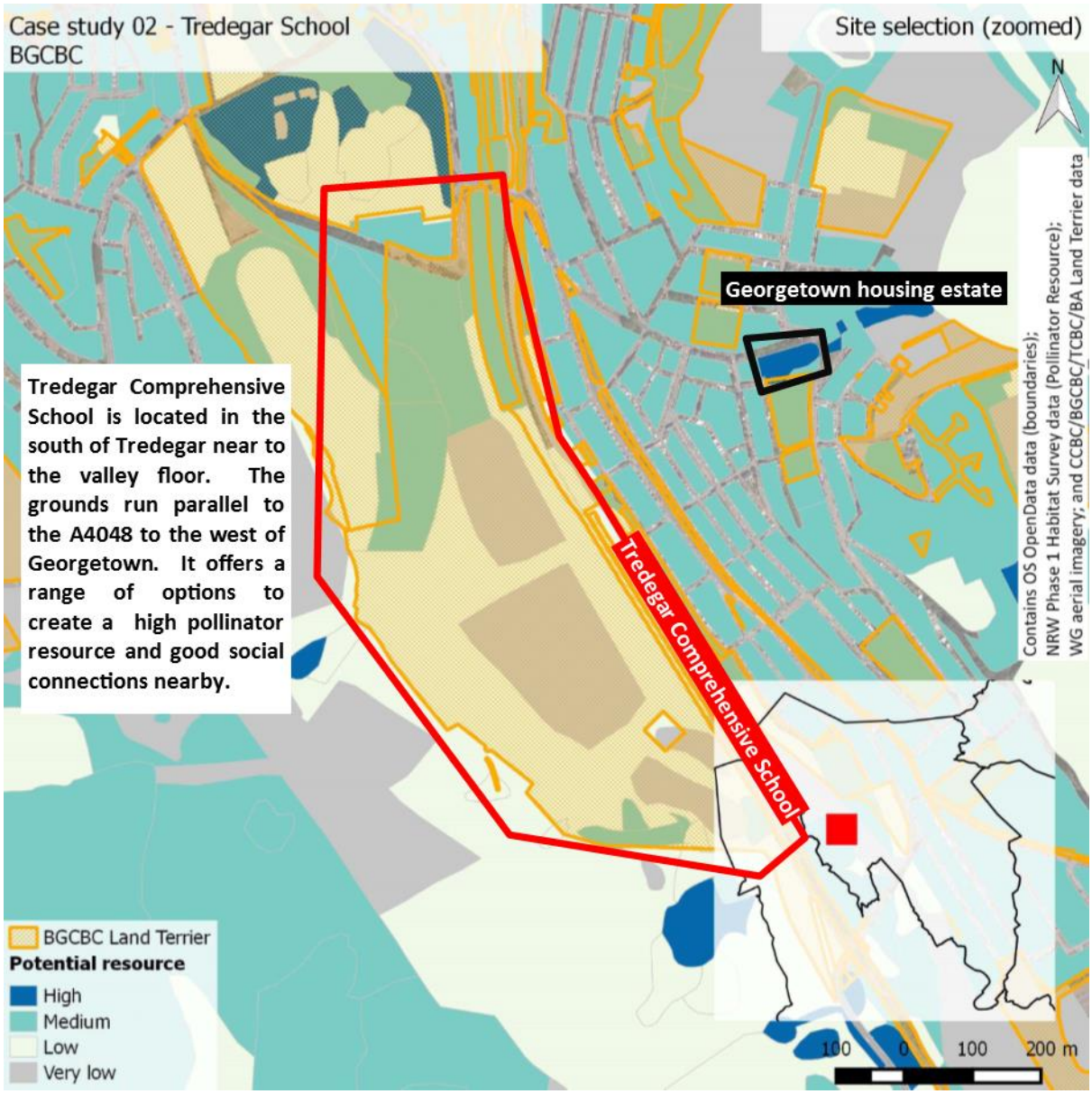


Land ownership can be identified from the Land Terrier in the GIS database and checked further with Estates Departments.



3 Identify green infrastructure type

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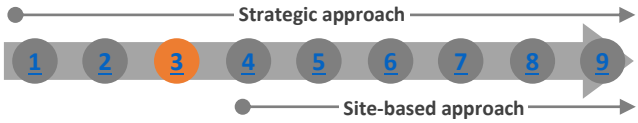

The green infrastructure type is School Grounds.

4 Identify land classification

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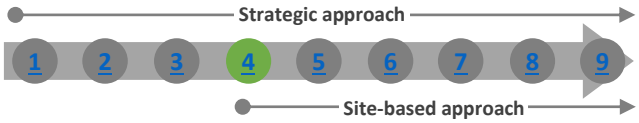
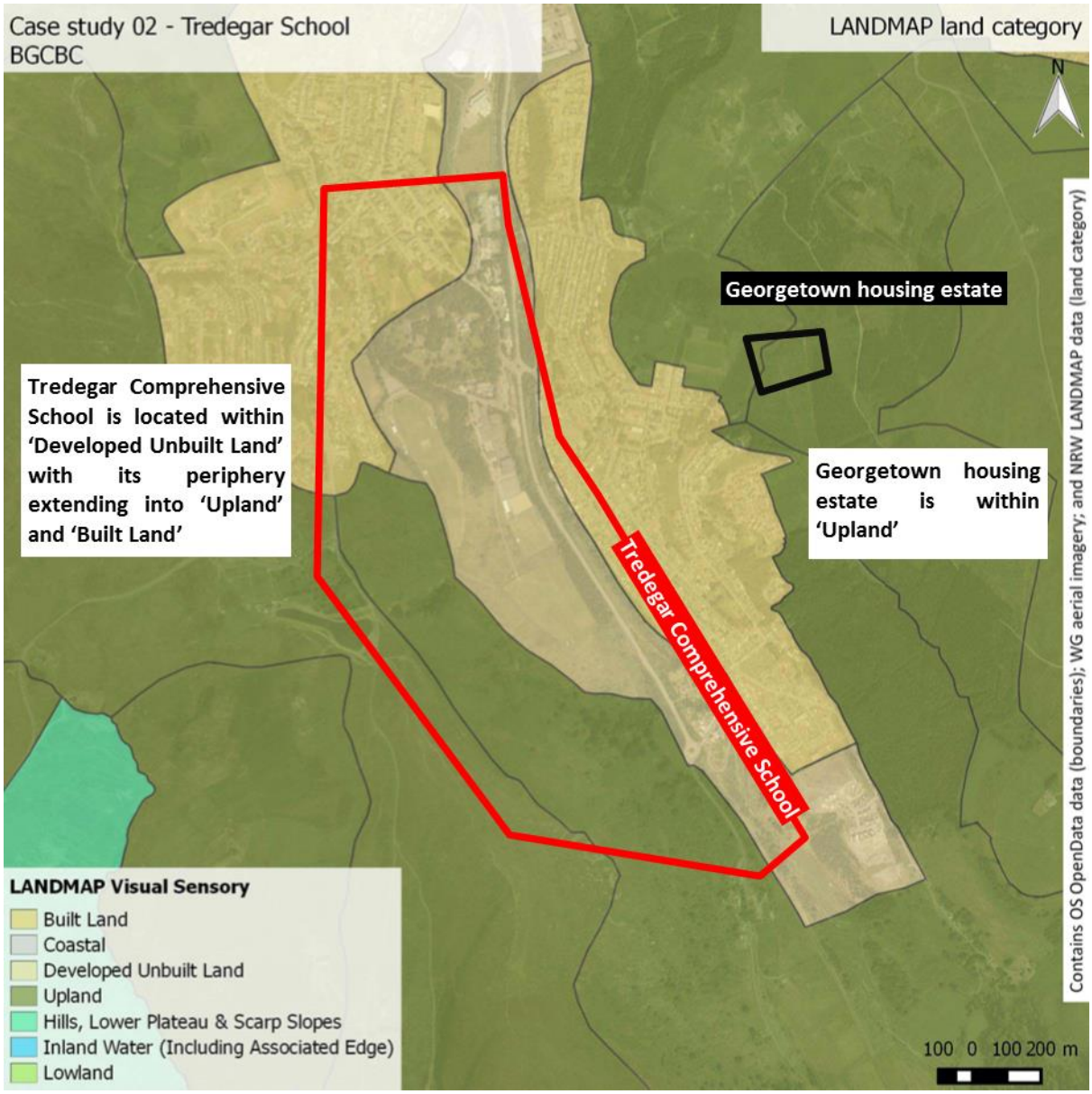


The land classification type enables selection of appropriate actions within the geographic context of the site and is a required input to the Land Classification Matrix in Step 8.



5 Identify site characteristics and constraints

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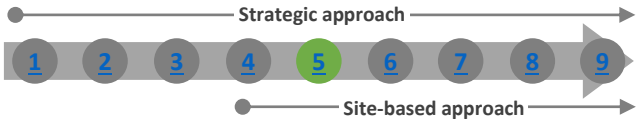
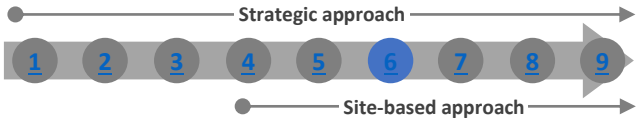


The GIS database indicates the following conditions (a more detailed example of the GIS database can be found in the Car parks, Office Grounds etc. case study):

- Elevation - relatively high altitude
- Temperature – cool
- Rainfall - moderate
- Slope - predominantly flat, surrounded by steep slopes
- Soil fertility - low fertility surrounding soils
- Adjacent to nearby SINC
- Connectivity - opportunities to build and enhance connectivity with other surrounding areas

6 Assess existing resource

Previous
Next

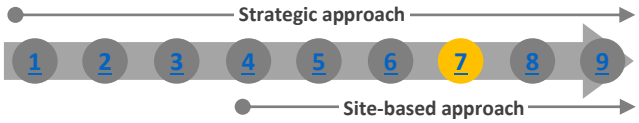


The GIS resource map derived from Phase 1 habitat survey indicates the area is mostly of low value for pollinators with some of moderate value (Step 2). The site can also be assessed using the Pollinator Evaluation and Grading System (a more detailed example of PEGS can be found in the Other amenity green space case study), and would score as poor value due to the uniform vegetation with no flowers. There is thus great potential to improve the site for pollinators.


Case study 02 - Tredegar School
BGCBC
Aerial imagery
N
Georgetown housing estate
Tredegar Comprehensive School
The aerial photograph shows the green space around the school and its grounds. Much of this is classified as low pollinator resource on the map in Stage 2 – some of this cannot easily be changed as playing fields need to be maintained for their intended purpose. Many of the other areas could be relatively easily improved by simple management changes or more intensive works if funds allow. Involving pupils and the local community could help bring wider benefits.
100 0 100 200 m
Contains OS OpenData data (boundaries); and WG aerial imagery

7 Consult the relevant Green Infrastructure Action Plan

Previous
Next



Below is a short version of the School Grounds Green Infrastructure Action Plan (a more detailed example of a Green Infrastructure Plan can be found in the Historic Sites case study).

Green infrastructure type: School Grounds	

Aims	• Manage school in a way which provides greater benefit for pollinators
	  ○ manage some areas of grassland for pollinators
	  ○ incorporate pollinator-friendly planting into wider design
	  ○ select pollinator-friendly trees and shrubs
	• Create spaces in which offer an educational resource and where users are encouraged to interact with the natural environment, fostering a connection with nature.

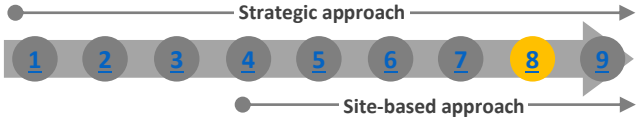
Desired Outcomes	• School grounds with a diversity of vegetation types used to create spaces and opportunities for play and education, and featuring a range of flowering species throughout the year.
Assessment steps	• Assess constraints such as need for clear sight lines, sport and recreation or historical context

Main options for site	• Grasslands
	  ○ Alter mowing regimes:
	  ▪ Reduce cutting frequency (G1)
	  ▪ Increase cut height (G2)
	  ▪ Introduce rotational mowing (G3)
	  ▪ Delay first cut (G7)

Relevant Management Action Plans	G1, G2, G3, G5, G7, CR1, CR2, CR4, CR5, AU1, AU2, AU3, HDG1, HDG2, HDG3, HDG4, HDG5, HDG6, HDG7, FM1, FM2
Risk Appraisal	• Staff time and resources may be prioritised on other issues; need to ensure that potential direct benefits in terms of potential accreditation or teaching resources made clear
Key stakeholders	• School staff • Governors
Further information	http://www.wildlifetrusts.org/sites/default/files/6192_defra_info_sheet_gardens_final.pdf

8 Consult the Land Classification Matrix

Previous
Next



Knowing the Green Infrastructure type from Step 3 and the land classification type from Step 4 allows appropriate management actions to be selected.

		Land Classification Type						
		Inland Water	Upland	Hills, lower plateaux and scarp slopes	Lowland	Coastal	Built Land	Developed Unbuilt Land
Green Infrastructure Type	School Grounds		G1, G2, G3, G5, G7 CR1, CR2, CR4, CR5 AU1, AU2, AU3 HDG1, HDG2, HDG3, HDG4, HDG5, HDG6, HDG7 FM1, FM2				G1, G2, G3, G5, G7 CR1, CR2, CR5 AU1, AU2, AU3 HDG1, HDG2, HDG3, HDG4, HDG5, HDG6, HDG7 FM1, FM2	

9 Select actions from the Management Actions Toolkit

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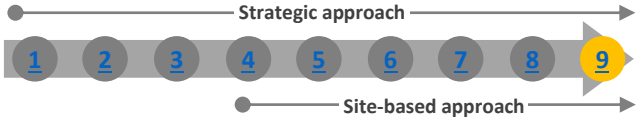


Appropriate actions identified in the Land Classification Matrix (Step 8) and the Green Infrastructure Action Plan (Step 7) can then be considered.

School grounds present a number of unique opportunities. While some are maintained by local authorities, schools themselves may have individual control over their budgets and many contract maintenance out to private firms which offers the potential to make changes quickly and easily.

There is clear potential to involve a large number of young people in school pollinator projects and there are numerous opportunities to direct reinforce the school curriculum. Where signage is recommended, involving students in the design of it can help foster a sense of engagement. Bee and bug houses can also be built within school grounds. Projects within schools can have wider and far reaching benefits within the wider community.

The first stage of developing the areas should be understanding what is already on site and in the immediate surroundings. This is to avoid damaging existing important features and so that proposals can add connectivity. Key areas of focus could be the entrance to the school where replacing some of the low value close-mown-grass with annual or perennial 'Pictorial Meadows' type areas could be considered (CR1) with a carefully selected mix so as to focus on native species. The banks around the sports pitches provide an opportunity for mowing regime changes (G1, G2, G3, G5), combined with augmentation of some sort (AU3 or perhaps AU2 if required). Other parts of the school grounds could

have pollinator friendly planting added (FM2), perhaps a range of spring bulbs (FM1) and again a degree of relaxation of the mowing regimes (increase cutting height – G2 perhaps). Along the eastern boundary with the woodland planting block adjacent to the A4048 there may be scope to develop an area of woodland edge habitat (WD3) even if the woodland itself is on the other side of a fence.

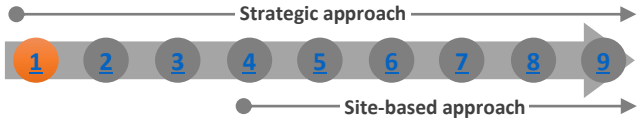
CODE	ACTION	AIMS	BENEFITS TO POLLINATORS	DETAILS	RISKS/HAZARDS/ CONSIDERATIONS	INDICATIVE COST LEVEL	RELATED ACTIONS	DELIVERY PLAN/S	BENEFITS	LIKELI-HOOD OF SUCCESS	COST	TOTAL
CR1	Rotavate and seed annual and perennial wildflower meadows without grass (e.g. Pictorial Meadows)	Establish a vibrant and intense display of flowers from spring through to autumn	Pollen and Nectar resource available from Spring until late into autumn.	Gives highest intensity of colour throughout the year, and long lasting display	Need to treat emergent perennial weeds and grasses to ensure success	High initial, but low maintenance costs if successfully established.		-Road verge management -Public Parks and Gardens -Outdoor Sports Facilities -Provision for Children and Young People -Car parks, Office Grounds etc. - Historic Sites -Civic Spaces -Housing green space -School Grounds -Managed gardens, care homes etc. -other amenity green space -Churchyards and cemeteries	✓✓✓	++	£££	6

6.3 Other amenity green space

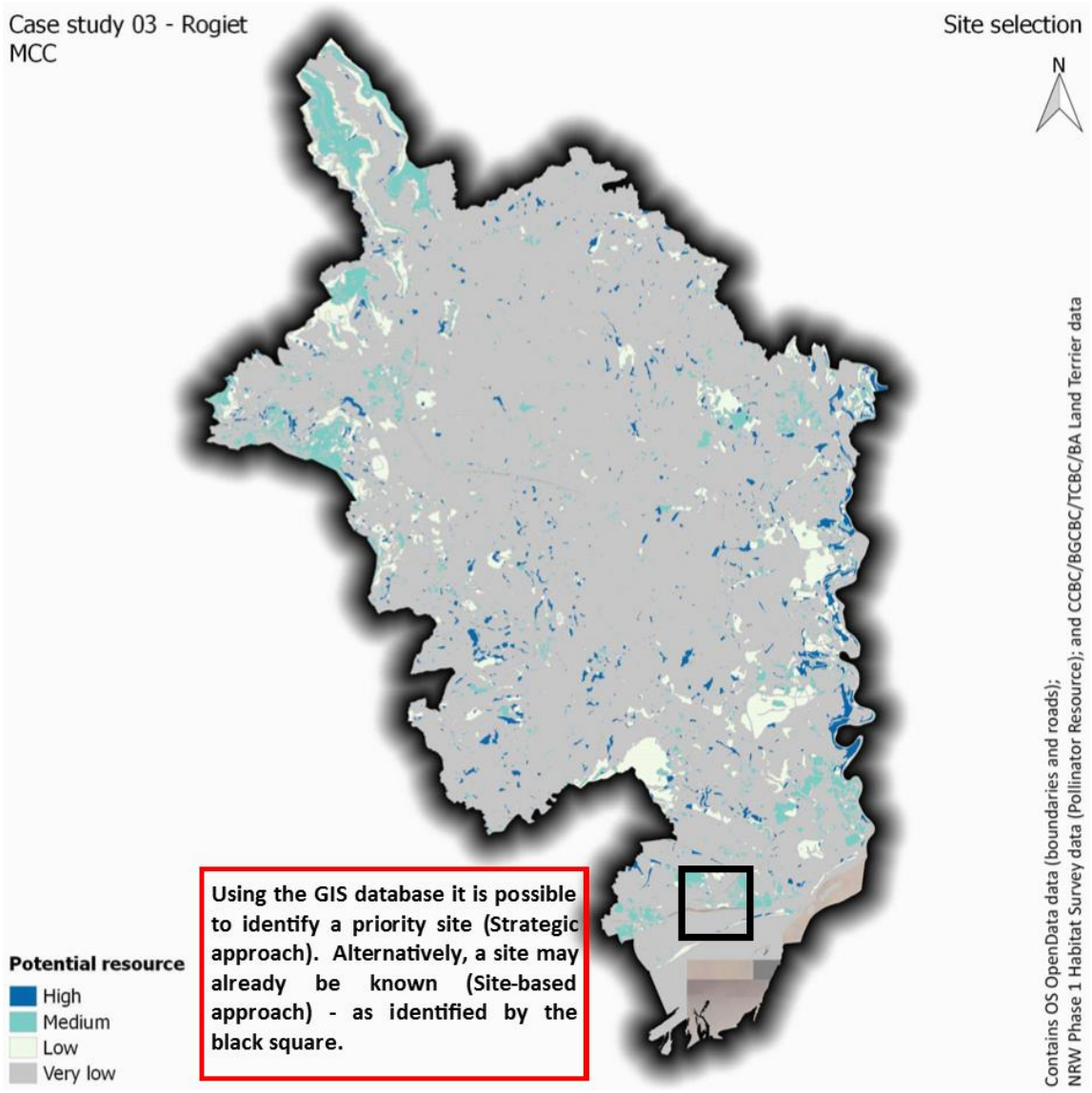
Rogiet Primary School and adjacent housing and recreation ground were selected as they represent a number of pockets of urban land that offer good potential for improving pollinator provision and for their proximity to Rogiet Country Park. This case study is also a good example of Local Authority/social housing organisation partnership. The Pollinator Evaluation and Grading System (PEGS) is also focussed on in more detail in this case study.

1 **Identify a site**

Next



Some urban areas have lots of publically-owned, small pockets of land which have potential for development of some green infrastructure for pollinators, within other constraints.



2 Confirm land ownership

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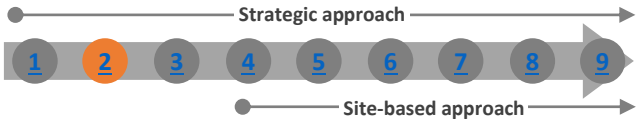
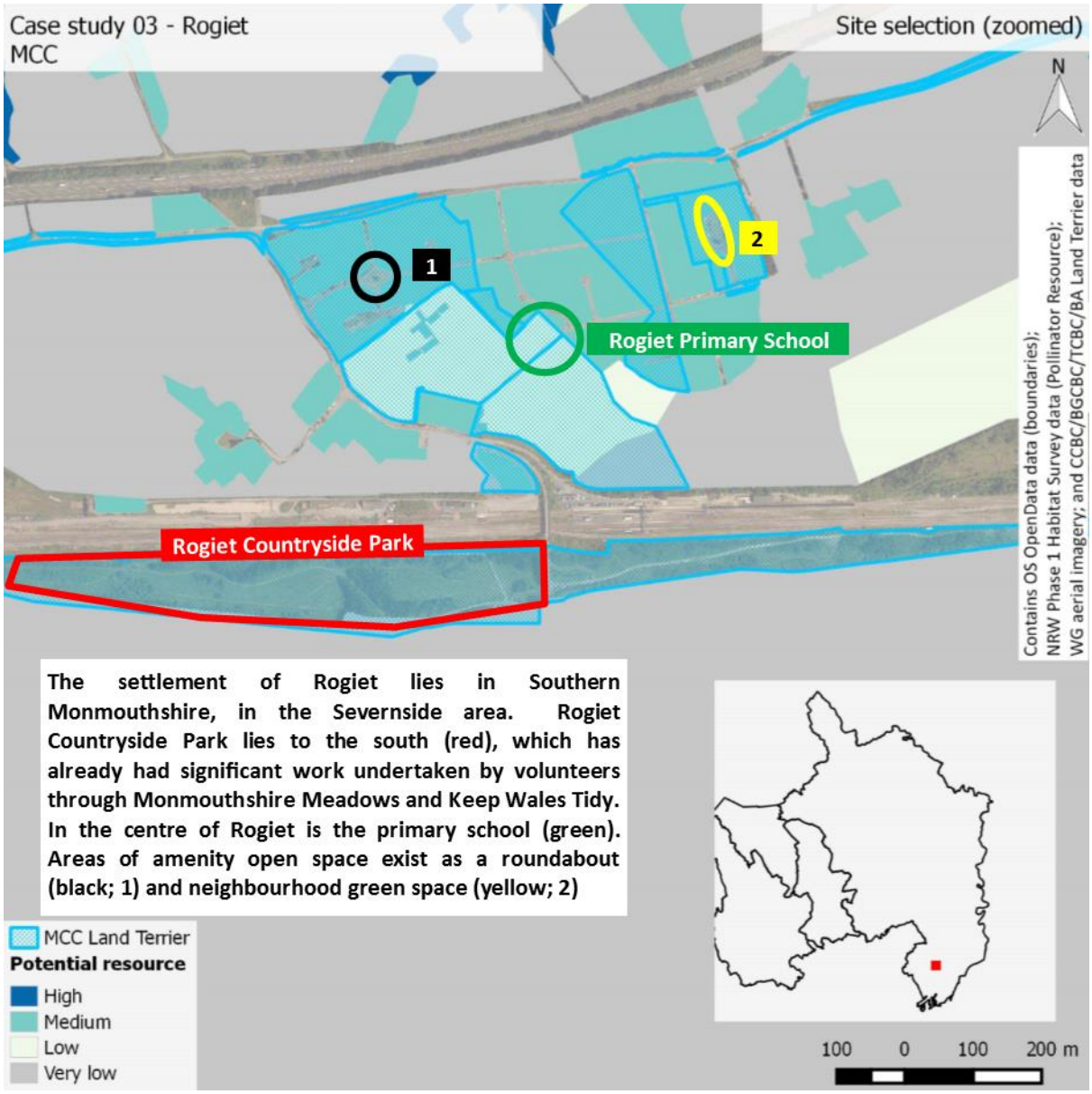


Land ownership can be identified from the Land Terrier in the GIS database and checked further with Estates Departments.



3 Identify green infrastructure type

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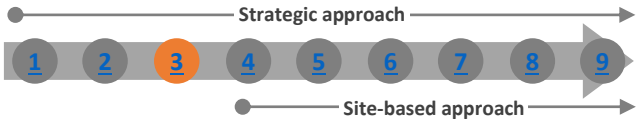

The green infrastructure type is 'Other amenity green space' as it does not fit clearly with the other categories.

4 Identify land classification

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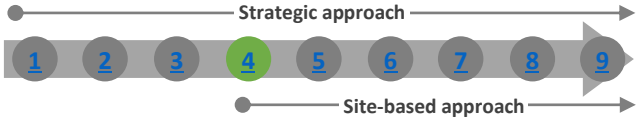
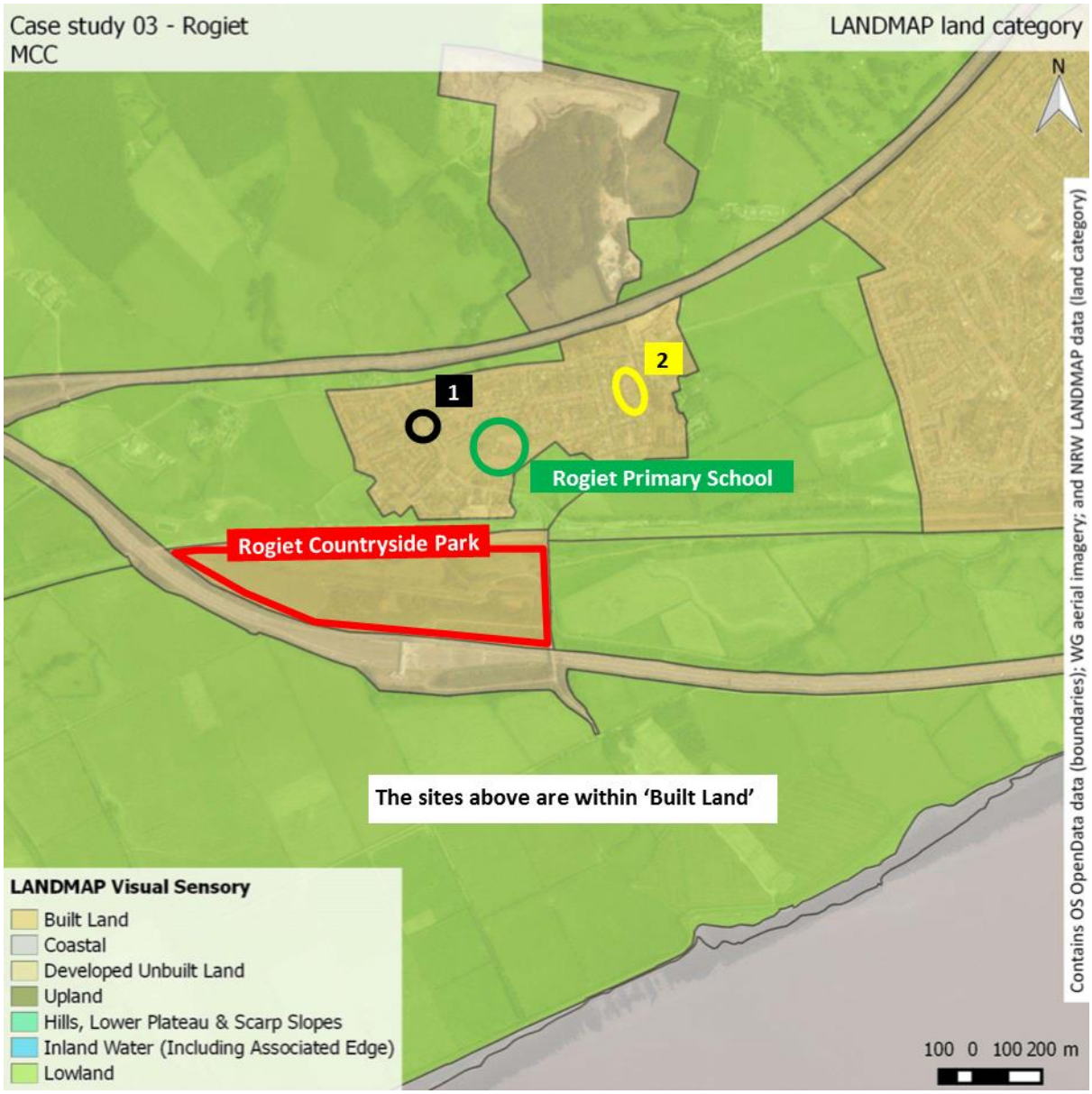


The land classification type enables selection of appropriate actions within the geographic context of the site and is a required input to the Land Classification Matrix in Step 8.


Case study 03 - Rogiet
MCC
LANDMAP land category
N
1
2
Rogiet Primary School
Rogiet Countryside Park
The sites above are within 'Built Land'
LANDMAP Visual Sensory
Built Land
Coastal
Developed Unbuilt Land
Upland
Hills, Lower Plateau & Scarp Slopes
Inland Water (Including Associated Edge)
Lowland
Contains OS OpenData data (boundaries); WG aerial imagery; and NRW LANDMAP data (land category)
100 0 100 200 m

5 Identify site characteristics and constraints

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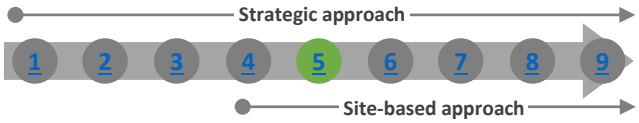
Next

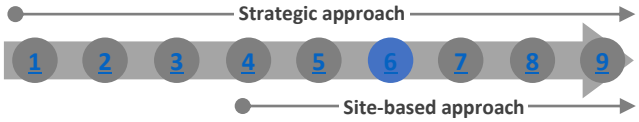


The GIS database indicates the following characteristics (a more detailed example of the GIS database can be found in the Car parks, Office Grounds etc. case study):

- Elevation – low lying coastal environment
- Temperature – relatively warm
- Rainfall – relatively dry
- Slope - gentle
- Soil fertility – low soil fertility
- A variety of species recorded in the area
- Existing roadside verges in the vicinity
- Medium to high population density
- Historic landscapes to the south
- SINC to south
- Connectivity - opportunities to build and enhance connectivity with other surrounding areas

6 Assess existing resource

Previous
Next



The GIS existing pollinator resource map derived from Phase 1 habitat survey indicates the Rogiet areas are of low to moderate value for pollinators (Step 2).

In practice, the GIS maps may not be up-to-date or be at a fine enough scale, so areas need assessing for their current value using PEGS. A completed PEGS form is shown below for the small amenity grass island in Crossway (area 2 on the maps in Step 2):

The amenity grassland scores 0 for habitat (the birch tree can be ignored as it is wind-pollinated), but adjacent habitats score 1 as gardens often have a range of flowers, shrubs and trees which may offer good resources for pollinators. The grass is uniform and short and scores 0 for structure, and there are no obvious flowers of any type (scoring 0 for both % vegetation covered with flowers and number of different flower colours present). There is clover in the mown grass, which may flower if the grass is not cut too short (score 1). The total score is 2, indicating poor value for pollinators with great potential for improvement.

POLLINATOR EVALUATION AND GRADING SYSTEM (PEGS)

Site name: Crossway	Grid reference: ST/460.879
Surveyor(s): TCBR	Date: 7/10/15

Site description (with photographs if possible): amenity grassland with tree in housing (birch tree ignored)

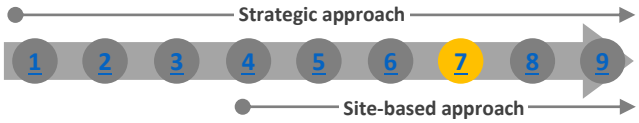
Feature	0	1	2	Score
Habitats	Amenity grassland Bracken Cereal crops Conifer plantation Improved grassland with no flowers Bare rocks, stone and earth (<10% vegetation cover) Water	Flowering crops Heathland Hedges Marsh Mires: fen and bogs Mixed woodland Railway Riverbank Road verge Saltmarsh Partly-improved grassland with few flowers Swamp Urban (including gardens, allotments, parks, churchyards, etc.)	Broadleaved woodland and scrub Orchards Sand dunes Sea cliffs Shingle Tall weedy areas Mixed flowery unimproved grassland Waste ground	0
Adjacent habitats within 25 m	Score as for habitat; select highest score	Score as for habitat; select highest score	Score as for habitat; select highest score	1
Vegetation structure	Uniform, same in height and space	Variable in height or in patchiness (not both)	Varied in height and lots of different patches	0
% vegetation covered with flowers	Less than 5%	5-20%	More than 20%	0
No. different colours of flowers present (e.g. blue, pink, red, yellow)	0 or 1 colour only	2-3 colours	4 colours or more	0
Clover (all types)	Absent	Small amounts	Lots	1
			Total score:	2

Evaluation: total scores	**Poor 0-3.** Great potential for improvement!	**Moderate 4-7.** Has potential for selected careful improvements!	**Good 8-12.** Great pollinator habitat, consider maintaining it!

The Rogiet Country Park is of unknown value in the existing pollinator resource map (Step 2) as when mapped in the 1990s there was no habitat information available for it (access restrictions due to railway sidings). The Country Park is now very diverse and floriferous and is of high value for pollinators, and it is recommended that it continues to be managed in the same way to maintain it. This also provides a resource from where colonisation of new green infrastructure can occur.

7 Consult the relevant Green Infrastructure Action Plan

Previous
Next



Below is a short version of the Provision for Children and Young People Green Infrastructure Action Plan (a more detailed example of a Green Infrastructure Plan can be found in the Historic Sites case study), one of the relevant plans for these areas.

Green infrastructure type: Provision for Children and Young People	

Aims	• Manage provision for children and young people in a way which provides greater benefit for pollinators
	  ○ manage some areas of grassland for pollinators
	  ○ incorporate pollinator-friendly planting into wider design

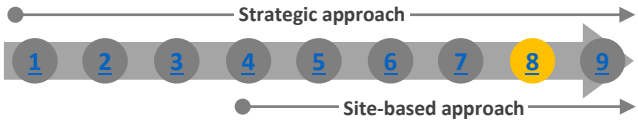
Desired Outcomes	• Planting areas including species that attract and provide for a range of pollinators throughout the year
Assessment steps	• Assess value of existing biodiversity and pollinator resource of grasslands, formal and informal beds and tree planting. The existing species diversity of grassland can be quite rich or may need augmenting with suitable species
Relevant Management Action Plans	G1, G2, G3, G5, G6, G7, CR1, CR2, CR4, CR5, AU3, FM1, FM2

Main options for site	• Grasslands
	  ○ Alter mowing regimes:
	  ▪ Reduce cutting frequency (G1)
	  ▪ Increase cut height (G2)
	  ▪ Introduce rotational mowing (G3)
	  ▪ Delay first cut (G7)
	  ○ Augmentation of diversity:
	  ▪ Collect cut material from local donor meadow and spread on recipient site to introduce seed etc. (Green Hay) (AU1)
	  ▪ Plug plant selected wildflowers (AU3)

Risk Appraisal	• Lack of public understanding and therefore acceptance; community engagement work may be required to explain ideas around 'natural play' and risk-benefit analysis
Key stakeholders	• LA Parks Departments • Friends Groups
Further information	https://www.buglife.org.uk/b-friendly-in-your-community

8 Consult the Land Classification Matrix

Previous
Next

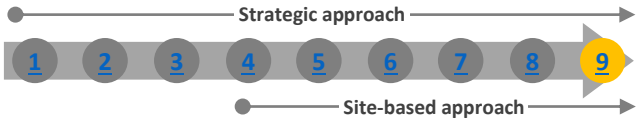


Knowing the Green Infrastructure type from Step 3 and the land classification type from Step 4 allows appropriate management actions to be selected.

		Land Classification Type						
		Inland Water	Upland	Hills, lower plateaux and scarp slopes	Lowland	Coastal	Built Land	Developed Unbuilt Land
Green Infrastructure Type	Outdoor Sports Facilities (excluding pitches)	G1, G2, G3, G5, G7 AU3 CR4, CR5 FM1					G1, G2, G3, G5, G7 AU3 CR1, CR4, CR5 FM1	
	Provision for Children and Young People	G1, G2, G3, G5, G6, G7 CR3, CR4, CR5 AU3 FM1, FM2					G1, G2, G3, G5, G6, G7 CR1, CR2, CR4, CR5 AU3 FM1, FM2	
	Other Amenity Green Space		G1, G2, G3, G5, G7 CR4, CR5 AU1, AU2, AU3 SCR1, SCR2, SCR3 FM1, FM2				G1, G2, G3, G5, G7 CR1, CR2, CR3, CR4, CR5 SCR2, SCR3 FM1, FM2 AU3	

9 Select actions from the Management Actions Toolkit

Previous



Appropriate actions identified in the Land Classification Matrix (Step 8) and the Green Infrastructure Action Plan (Step 7) can then be considered, e.g. grass cutting actions

- Reduce cutting frequency (G1)
- Increase cut height (G2)
- Introduce rotational mowing (G3), etc.

The Monmouthshire settlement of Rogiet presents a range of examples of green infrastructure. The frontage of the primary school represents a good opportunity to develop a mosaic of different habitats, using narrow swathes of 'Pictorial Meadow' either side of the main entrance (CR1) with sports pitches themselves kept close mown, but incidental areas left to grow longer (G1 and G2), and cut on rotation (G3) in different areas (the relatively low fertility of the area suggests a reasonably diverse sward should develop). The recreation ground behind the school offers the above as well as a number of additional opportunities - possibly allied to other improvements to the area through wider community involvement and potentially other capital projects. There would also be scope to allow some areas to develop more into scrub habitats (G4, SCR1, SCR2, SCR3).

The two road islands demonstrate areas currently maintained as close mown grass that have the opportunity (at least in part) to be treated differently - perhaps by creating 'Pictorial Meadows' type areas (CR1) or even community food gardens (CR2) where it is safe and appropriate to do so. These need not be across the whole area and could still allow for areas of informal recreation and ball games.

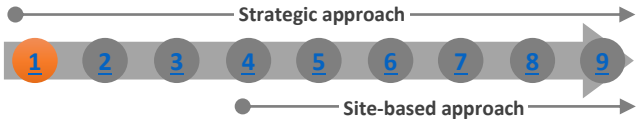
CODE	ACTION	AIMS	BENEFITS TO POLLINATORS	DETAILS	RISKS/HAZARDS/ CONSIDERATIONS	INDICATIVE COST LEVEL	RELATED ACTIONS	DELIVERY PLAN/S	BENEFITS	LIKELI-HOOD OF SUCCESS	COST	TOTAL
CR2	Create food growing opportunities to include raised beds, allotments, fruits trees and shrubs, etc.	To make the area more productive, encourage local growing of fruit and vegetables	Pollen and Nectar resource available from Spring until late into autumn.	Autumn or spring sowing of food crops; year round pollinators for fruit trees, shrubs and perennials can be intensive and requires community involvement	Needs regular inputs throughout the year depending on what food crops are grown.	High initial, but low maintenance costs depending on what crops/plants are grown. Could provide income for community groups.	-	-Public Parks and Gardens -Provision for Children and Young People . -Cadw Historic Sites -Housing green space -School Grounds -Managed gardens, care homes etc. -other amenity green space -Churchyards and cemeteries	✓✓✓	++	£££	6

6.4 Car parks, Office Grounds etc.

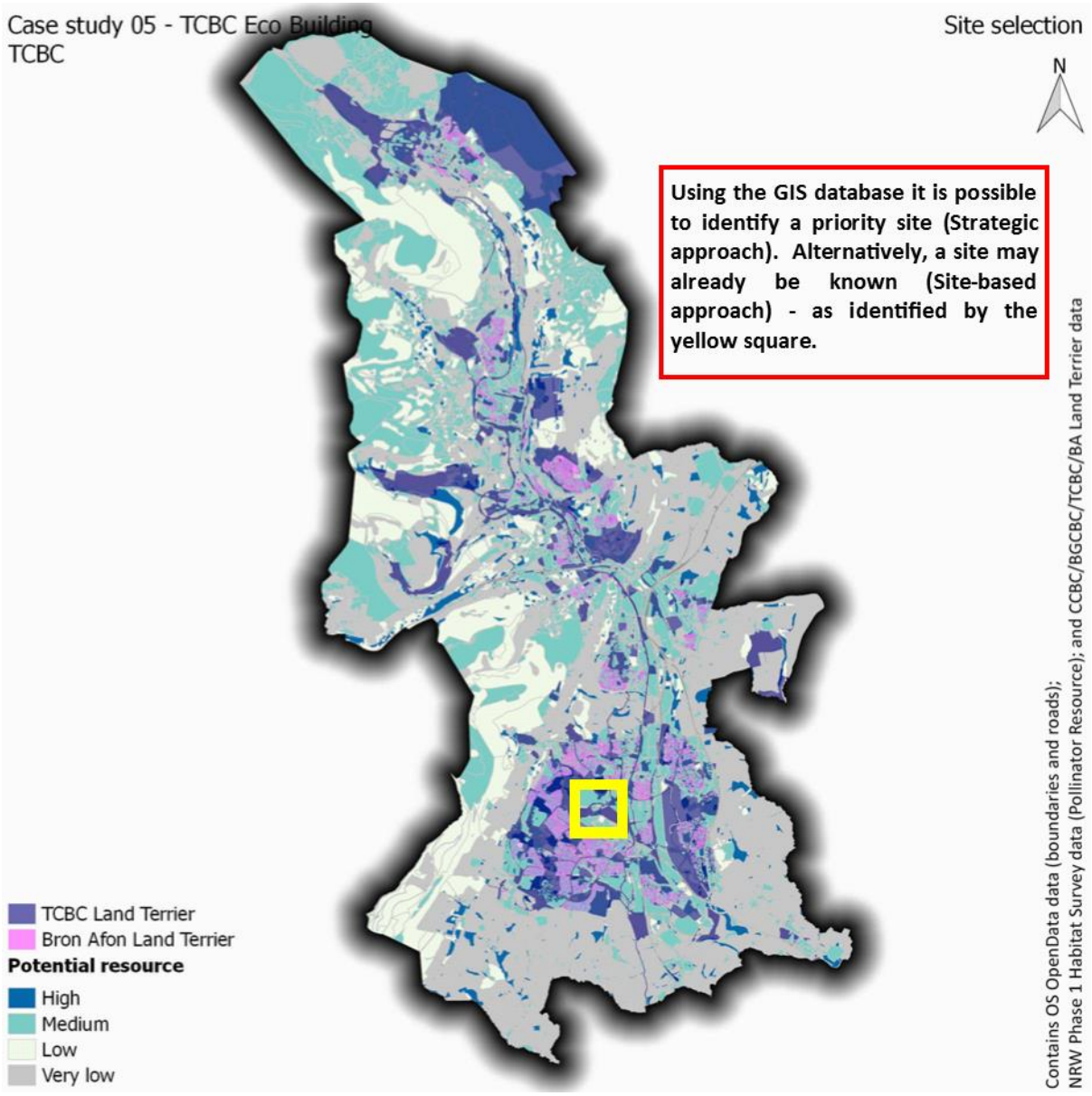
Torfaen County Borough Council's Eco Building was selected as an example of an innovative sustainable building design with potential for linkage to green infrastructure. The GIS Database is also focussed on in more detail in this case study

1 **Identify a site**

Next

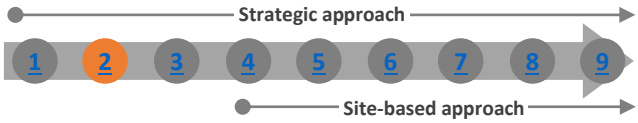


Torfaen's Eco Building offers an interesting opportunity to integrate sustainable building with green infrastructure for pollinators.

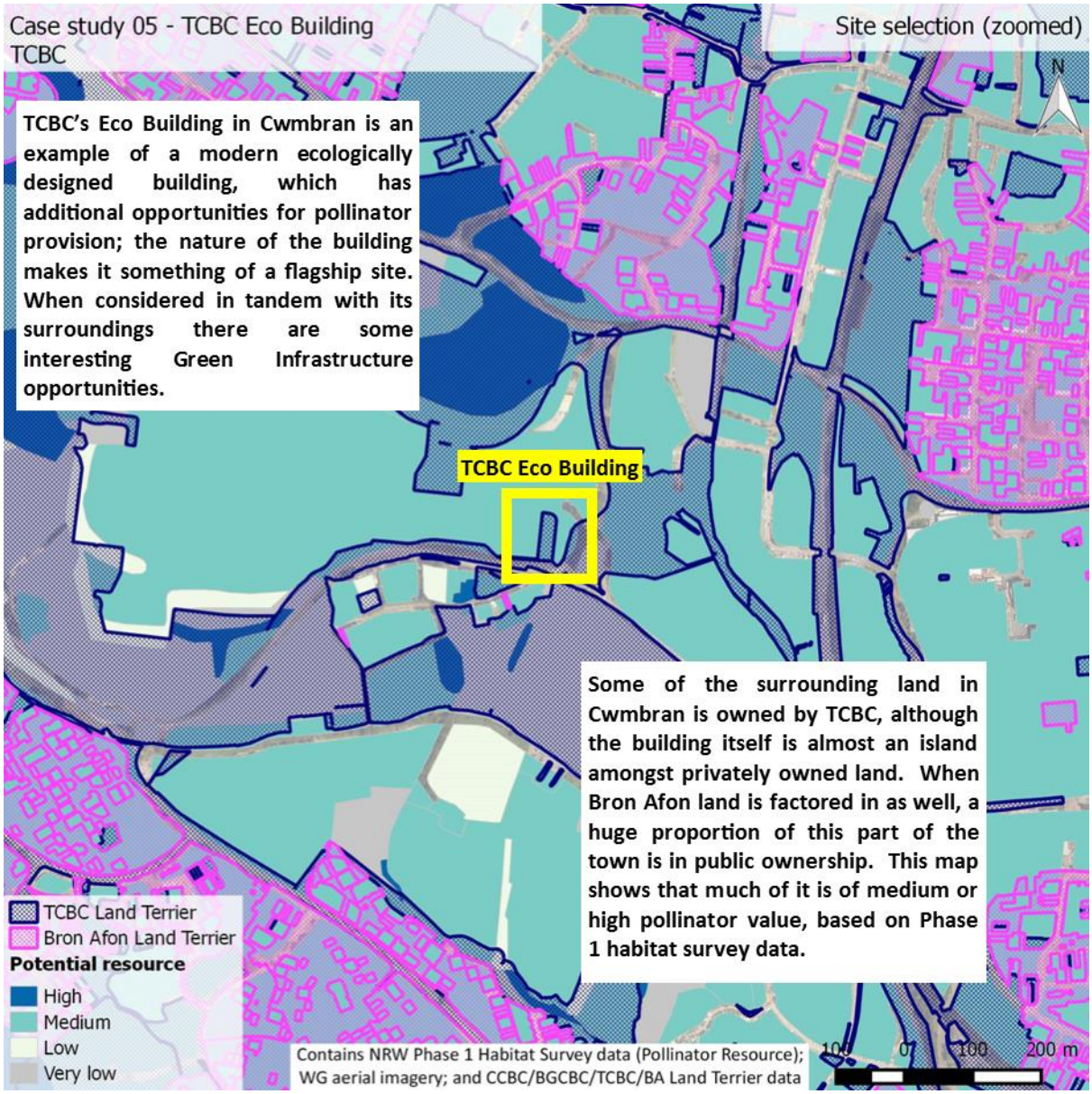


2 Confirm land ownership

Previous
Next



Land ownership can be identified from the Land Terrier in the GIS database and checked further with Estates Departments.



3 Identify green infrastructure type

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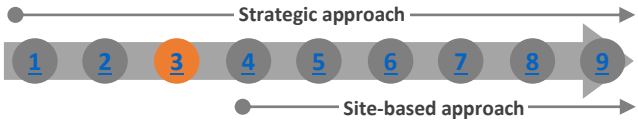
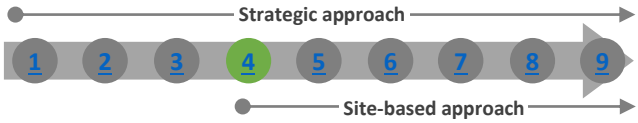
Next



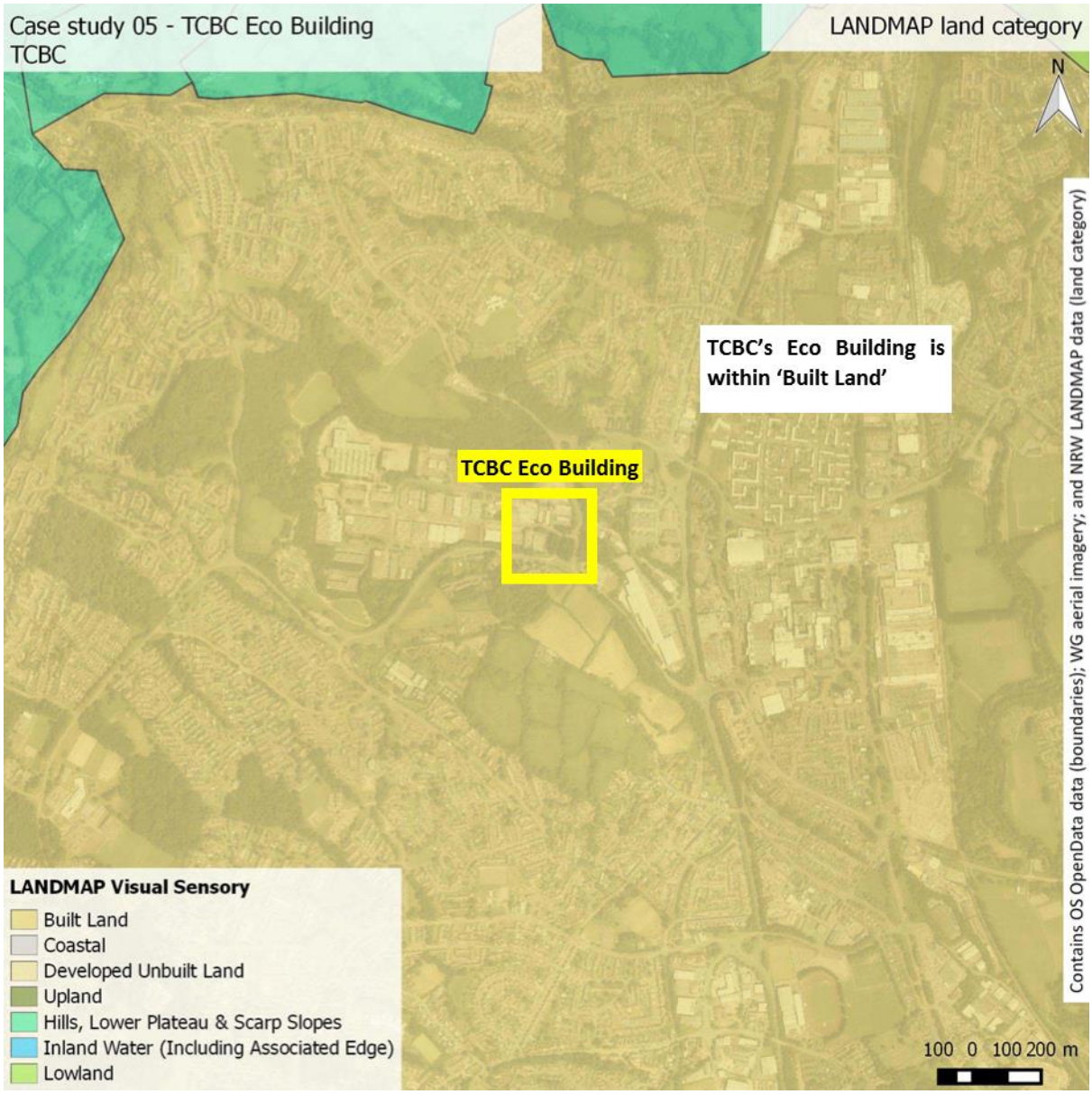
The green infrastructure type is Car parks, office grounds etc. The Eco Building constructed in 2006 featured planting areas around the perimeter, with flower boxes, shrub beds with trees and a mown grass strip. There is potential to enhance the planting for pollinators.

4 Identify land classification

Previous
Next

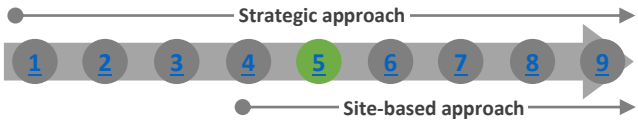


The land classification type enables selection of appropriate actions within the geographic context of the site and is a required input to the Land Classification Matrix in Step 8.

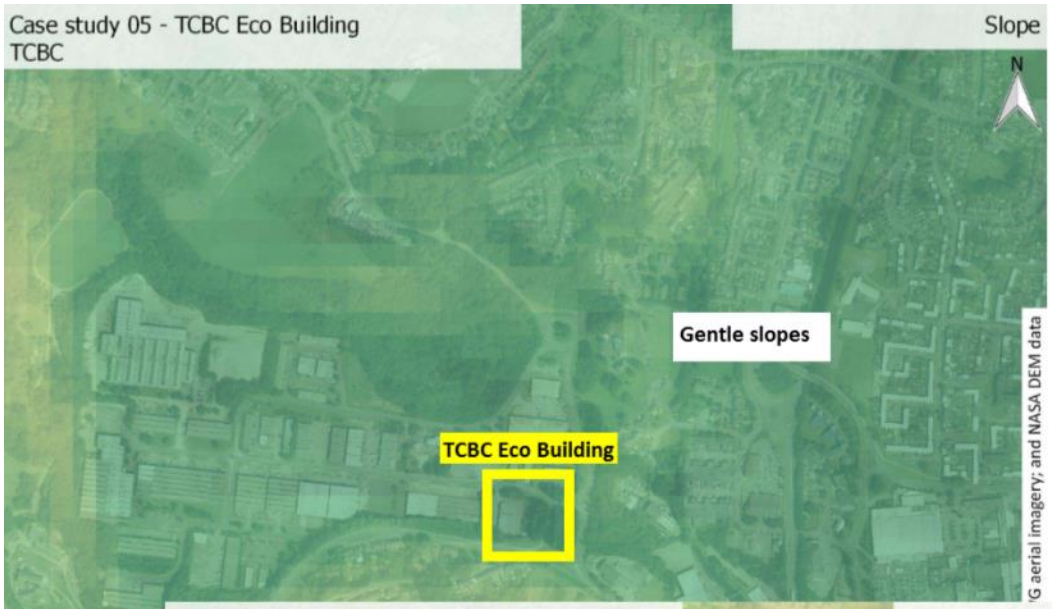


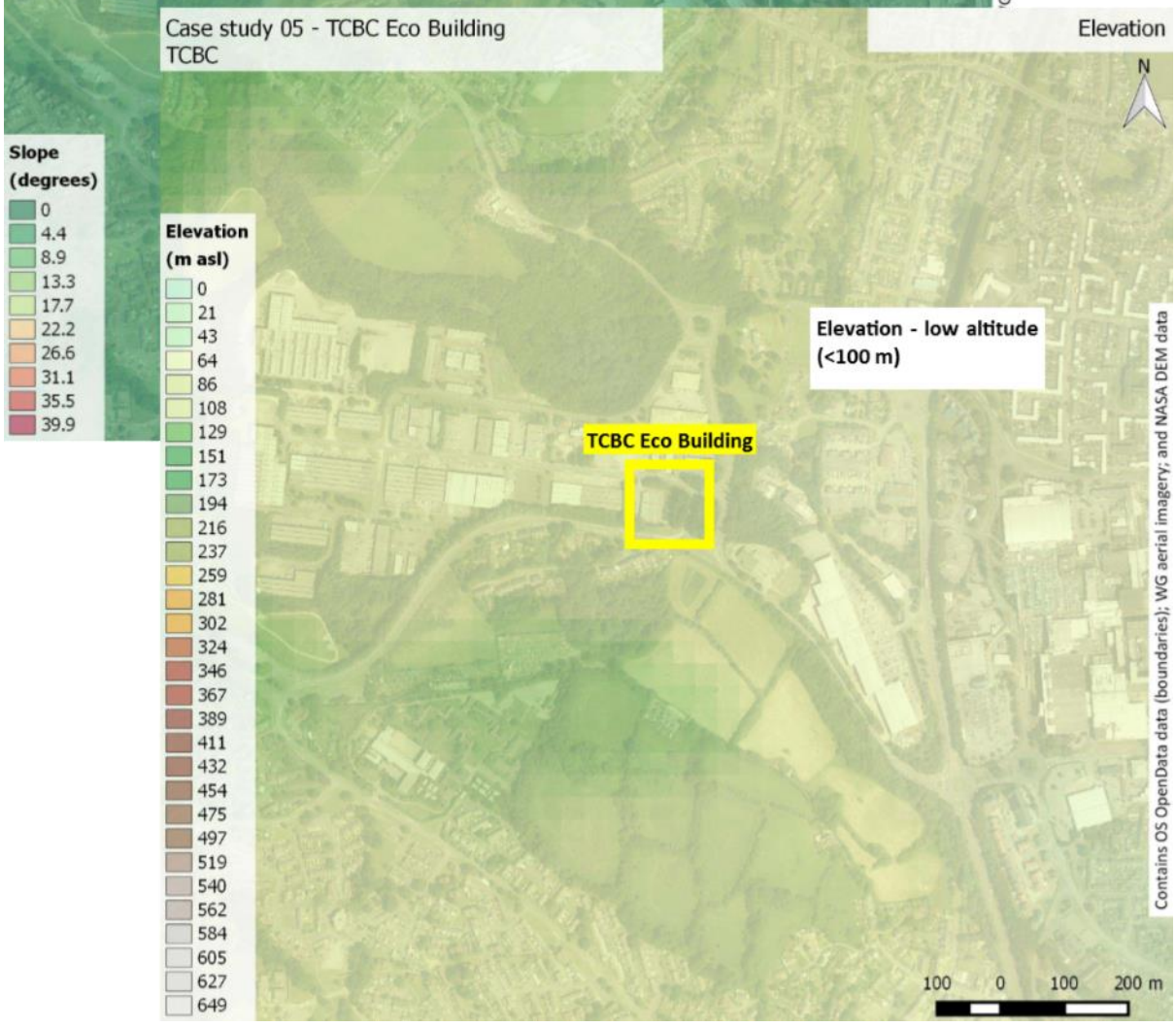
5 Identify site characteristics and constraints

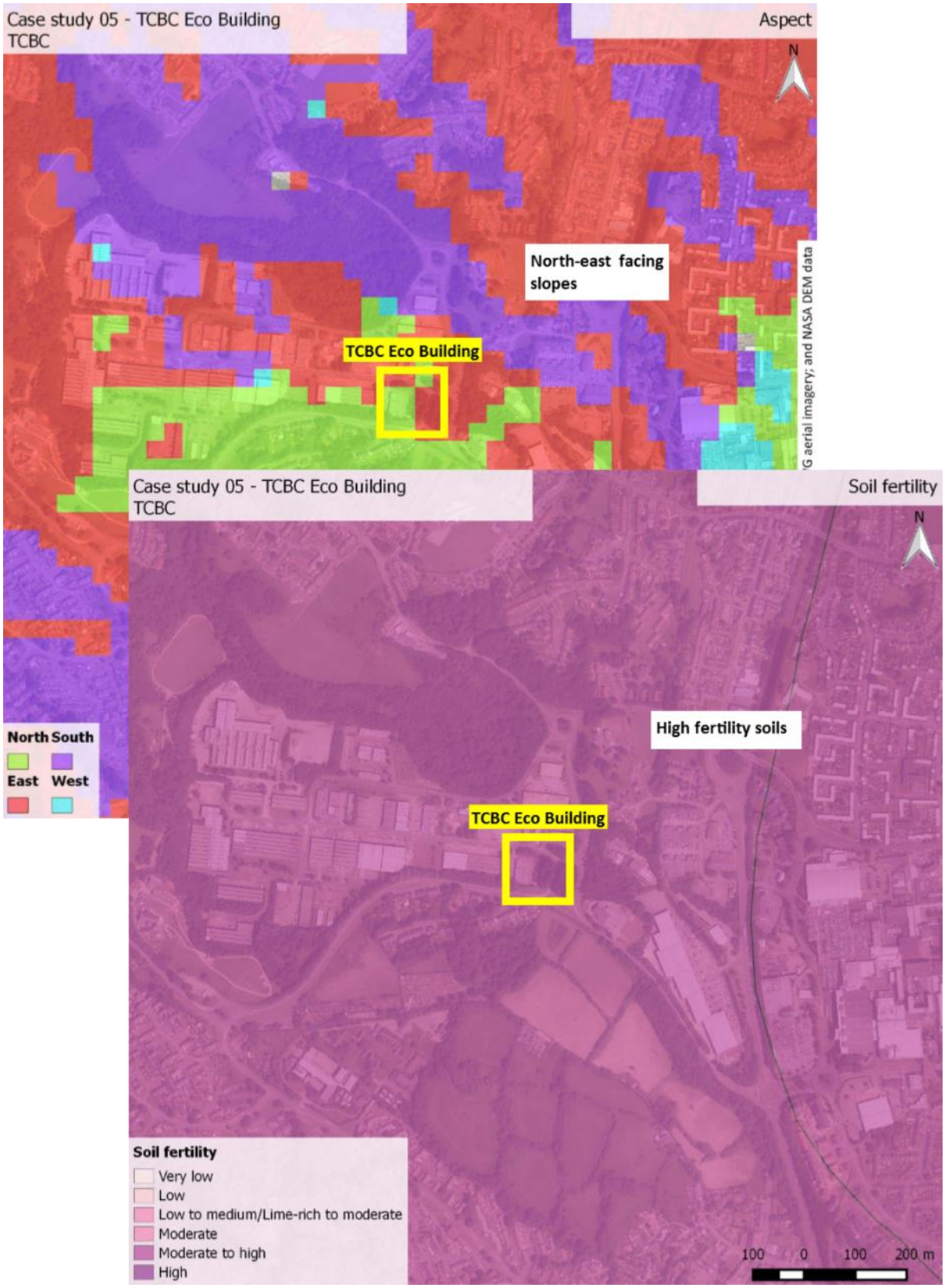
Previous
Next

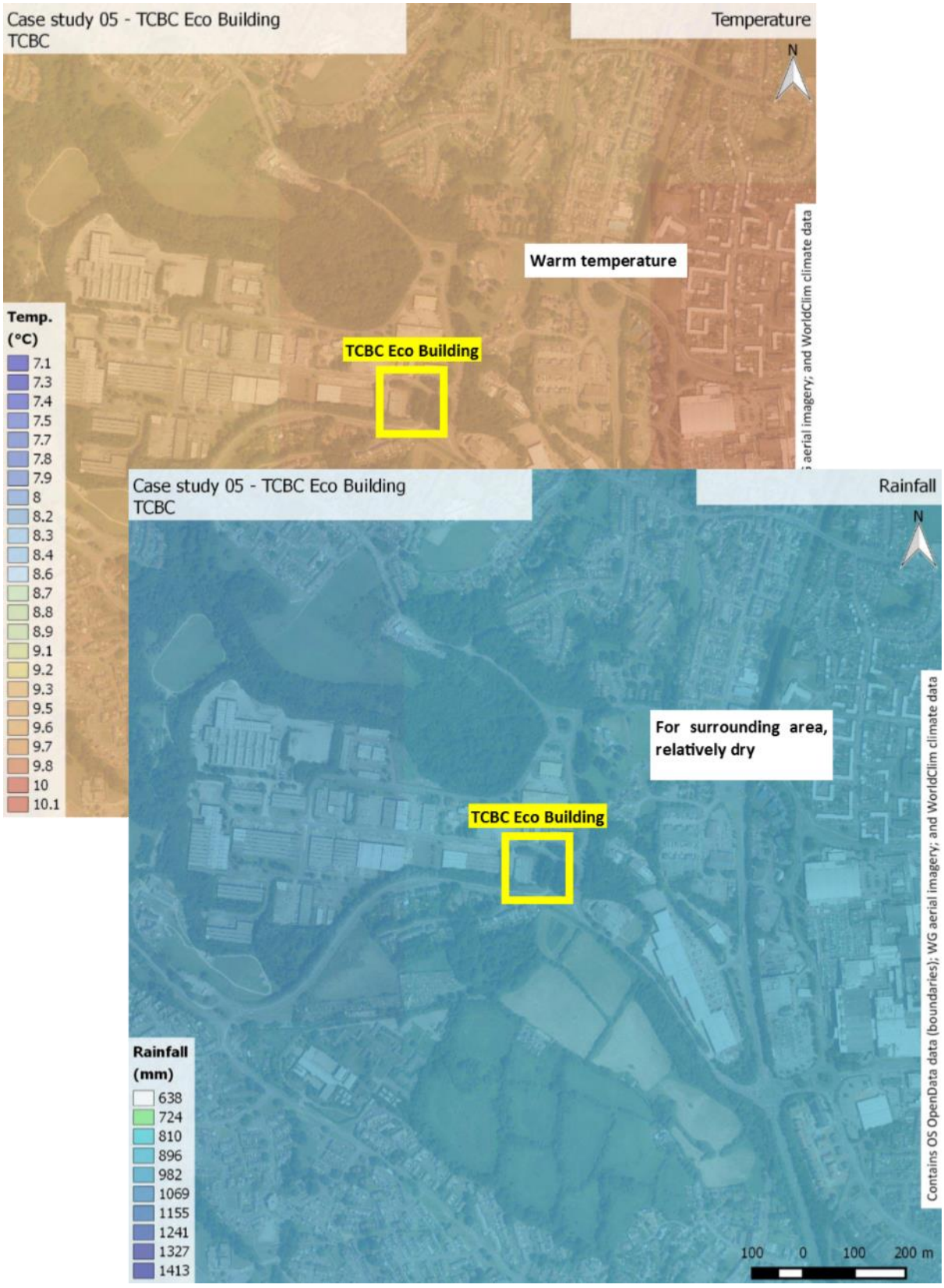


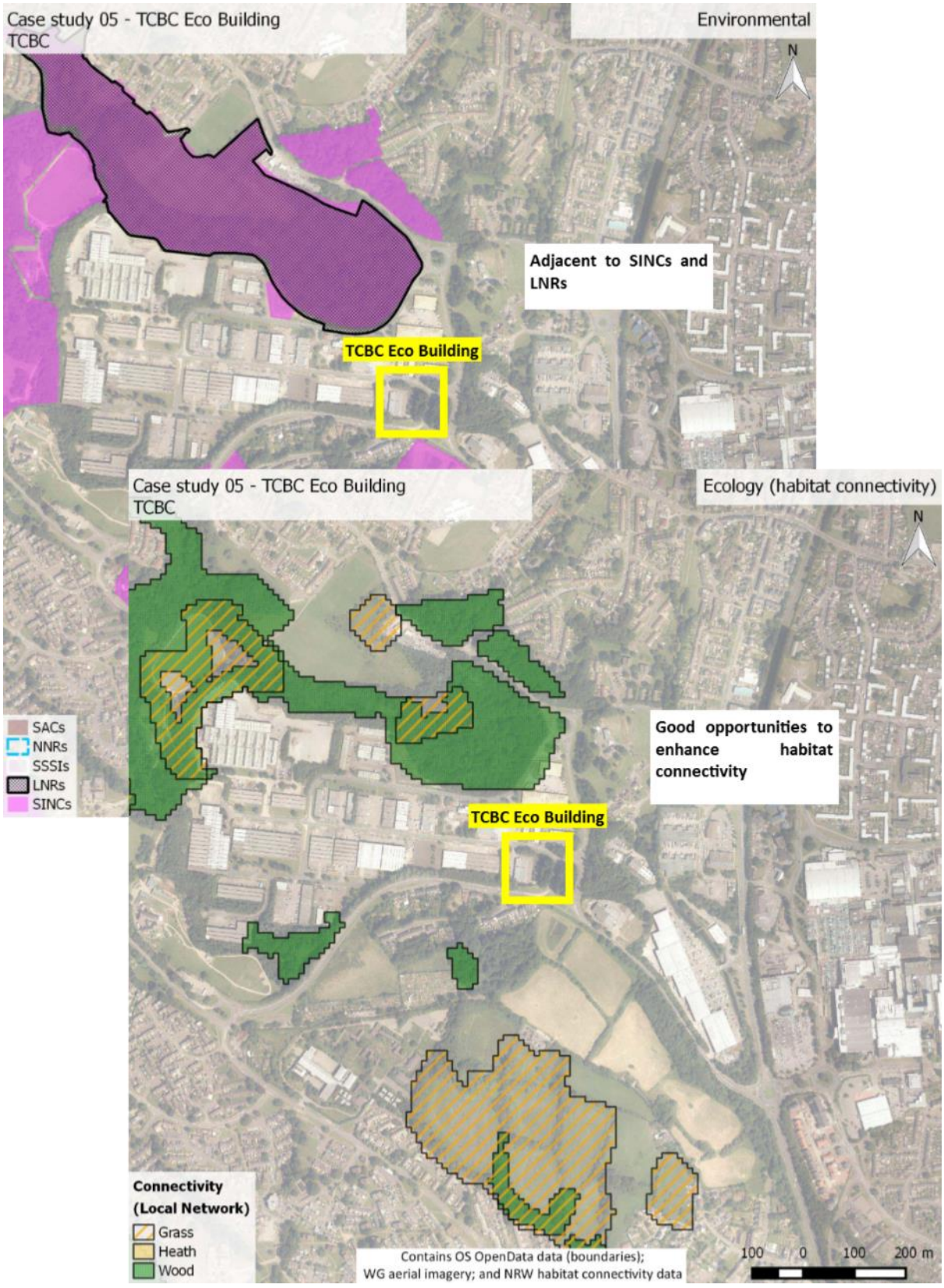
The GIS database allows a range of site characteristics to be identified, such as gradients, elevation (altitude), aspect and soil type, all of which are needed to select appropriate plants to grow. Context layers includes designated sites (for example Sites of Nature Conservation Importance) and ecological connectivity showing potential linkages to similar habitats. Constraints such as site designations (e.g. Scheduled Ancient Monuments) and population density are also included.

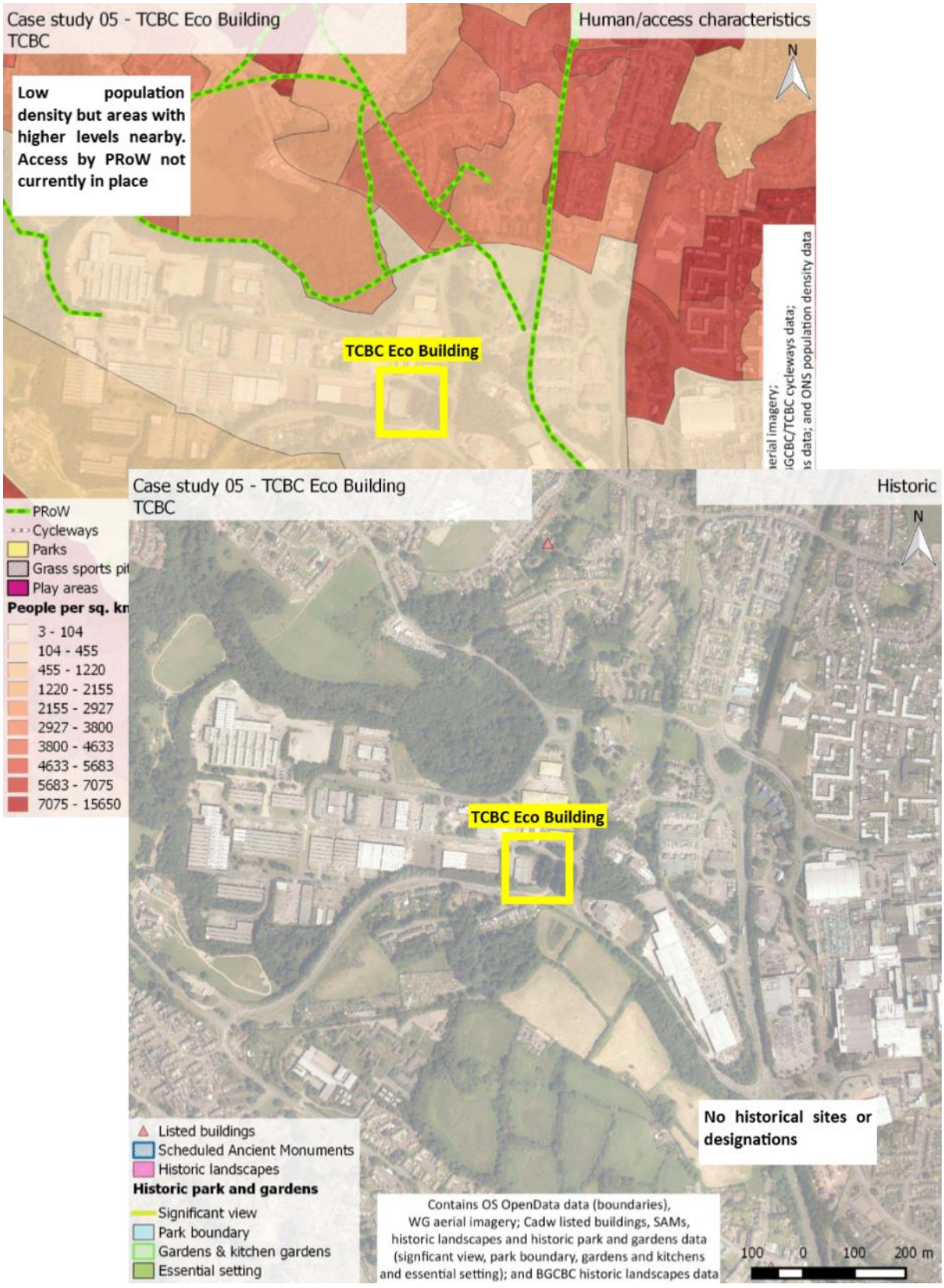

Case study 05 - TCBC Eco Building
TCBC
Slope
N
Gentle slopes
TCBC Eco Building
G aerial imagery; and NASA DEM data


Case study 05 - TCBC Eco Building
TCBC
Elevation
N
Slope (degrees)
0
4.4
8.9
13.3
17.7
22.2
26.6
31.1
35.5
39.9
Elevation (m asl)
0
21
43
64
86
108
129
151
173
194
216
237
259
281
302
324
346
367
389
411
432
454
475
497
519
540
562
584
605
627
649
Elevation - low altitude (<100 m)
TCBC Eco Building
Contains OS OpenData data (boundaries); WG aerial imagery; and NASA DEM data
100 0 100 200 m


Case study 05 - TCBC Eco Building
TCBC
Aspect
N
North-east facing slopes
TCBC Eco Building
G aerial imagery; and NASA DEM data
North South
East West
Case study 05 - TCBC Eco Building
TCBC
Soil fertility
N
High fertility soils
TCBC Eco Building
Soil fertility
Very low
Low
Low to medium/Lime-rich to moderate
Moderate
Moderate to high
High
100 0 100 200 m

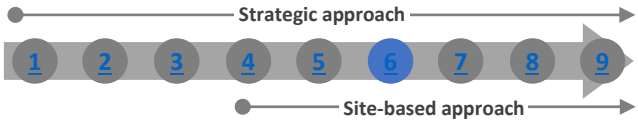

Case study 05 - TCBC Eco Building
TCBC
Temperature
N
Warm temperature
TCBC Eco Building
Temp. (°C)
7.1
7.3
7.4
7.5
7.7
7.8
7.9
8
8.2
8.3
8.4
8.6
8.7
8.8
8.9
9.1
9.2
9.3
9.5
9.6
9.7
9.8
10
10.1
Case study 05 - TCBC Eco Building
TCBC
Rainfall
N
For surrounding area, relatively dry
TCBC Eco Building
Rainfall (mm)
638
724
810
896
982
1069
1155
1241
1327
1413
Contains OS OpenData data (boundaries); WG aerial imagery; and WorldClim climate data
100 0 100 200 m


Case study 05 - TCBC Eco Building
TCBC
Environmental
N
Adjacent to SINCs and LNRs
TCBC Eco Building
Case study 05 - TCBC Eco Building
TCBC
Ecology (habitat connectivity)
N
SACs
NNRs
SSSIs
LNRs
SINCs
Good opportunities to enhance habitat connectivity
TCBC Eco Building
Connectivity (Local Network)
Grass
Heath
Wood
Contains OS OpenData data (boundaries); WG aerial imagery; and NRW habitat connectivity data
100 0 100 200 m

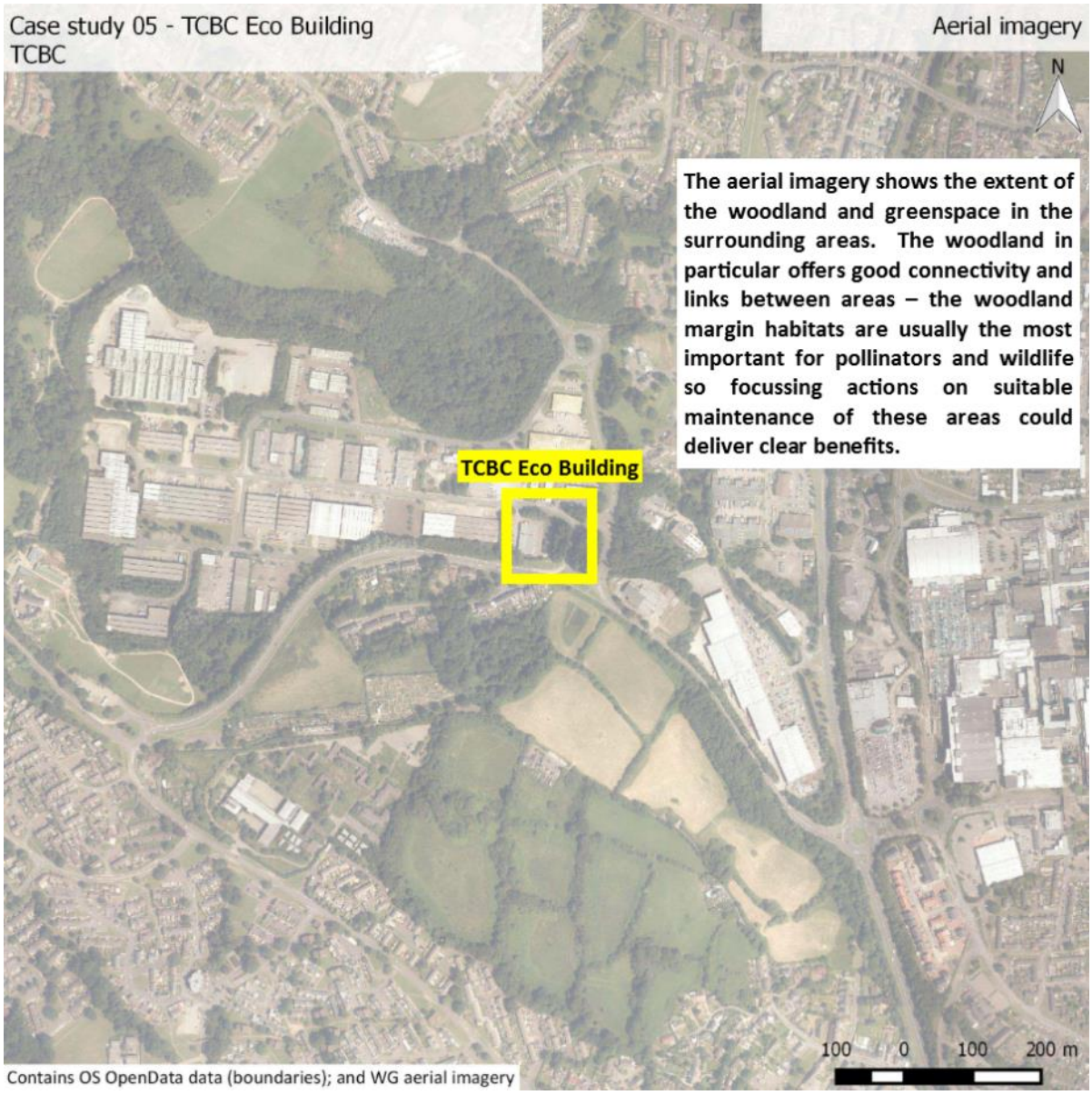

Case study 05 - TCBC Eco Building
TCBC
Human/access characteristics
N
Low population density but areas with higher levels nearby. Access by PRoW not currently in place
TCBC Eco Building
PRoW
Cycleways
Parks
Grass sports pit
Play areas
People per sq. km
3 - 104
104 - 455
455 - 1220
1220 - 2155
2155 - 2927
2927 - 3800
3800 - 4633
4633 - 5683
5683 - 7075
7075 - 15650
Case study 05 - TCBC Eco Building
TCBC
Historic
N
TCBC Eco Building
No historical sites or designations
Listed buildings
Scheduled Ancient Monuments
Historic landscapes
Historic park and gardens
Significant view
Park boundary
Gardens & kitchen gardens
Essential setting
Contains OS OpenData data (boundaries), WG aerial imagery; Cadw listed buildings, SAMs, historic landscapes and historic park and gardens data (signficant view, park boundary, gardens and kitchens and essential setting); and BGCBC historic landscapes data
100 0 100 200 m

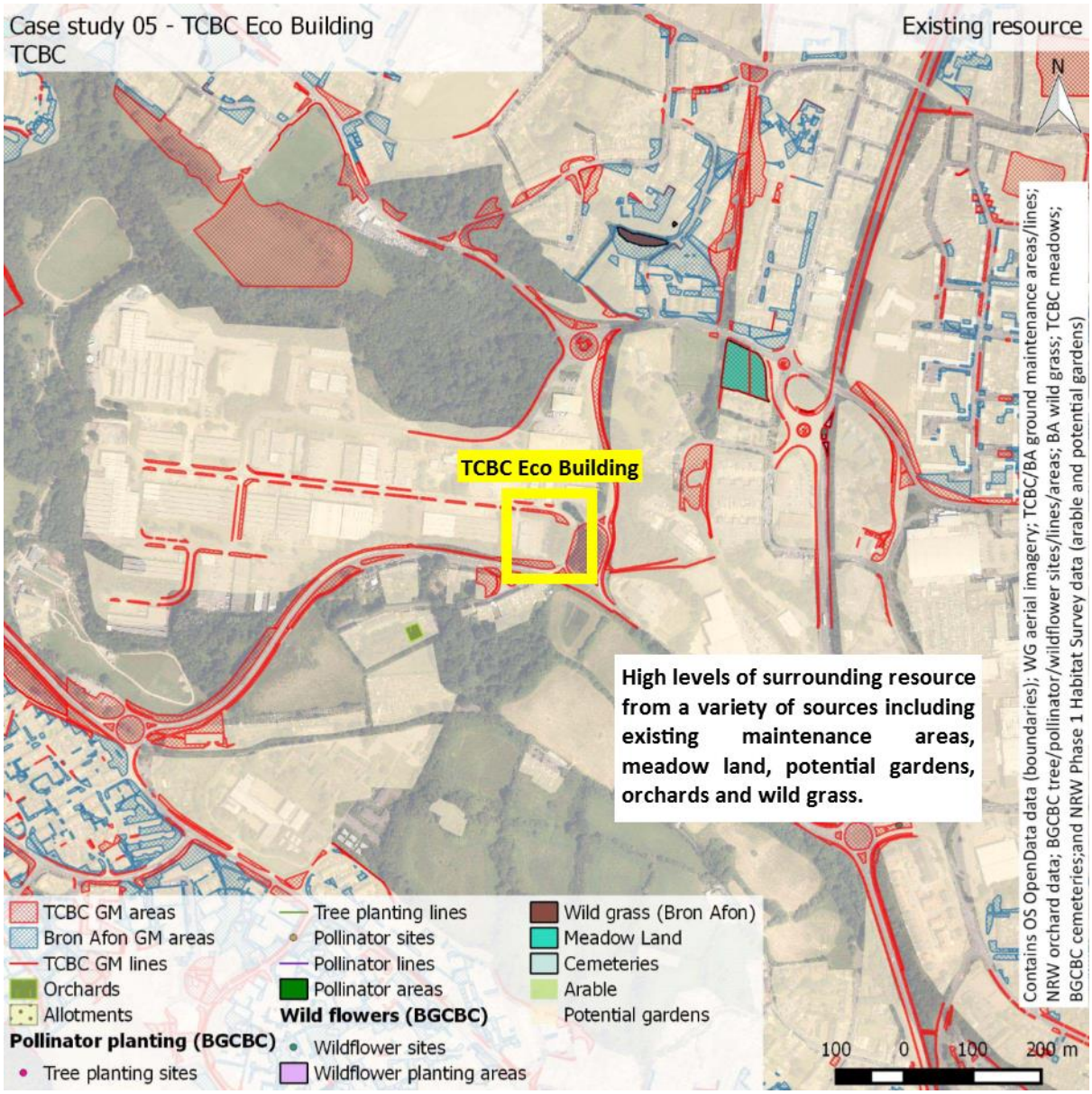
6 Assess existing resource

Previous
Next



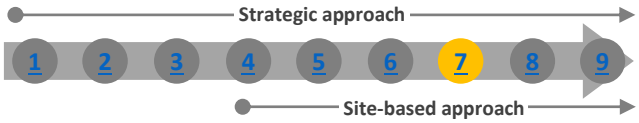
The GIS existing pollinator resource map derived from Phase 1 habitat survey indicates the general area as of moderate value for pollinators (Step 2). The site can also be assessed using the Pollinator Evaluation and Grading System (a more detailed example of PEGS can be found in the Other amenity green space case study). A PEGS evaluation would suggest a similar score with the habitat or gardens scoring 1, adjacent broad-leaved woodland as 2, a varied vegetation structure (score 2) but few flowers (remaining scores 0), giving a total of 5 indicating moderate value, with potential for selected improvements.




Case study 05 - TCBC Eco Building
TCBC
Existing resource
N
TCBC Eco Building
High levels of surrounding resource from a variety of sources including existing maintenance areas, meadow land, potential gardens, orchards and wild grass.
TCBC GM areas
Bron Afon GM areas
TCBC GM lines
Orchards
Allotments
Pollinator planting (BGCBC)
Tree planting sites
Tree planting lines
Pollinator sites
Pollinator lines
Pollinator areas
Wild flowers (BGCBC)
Wildflower sites
Wildflower planting areas
Wild grass (Bron Afon)
Meadow Land
Cemeteries
Arable
Potential gardens
100 0 100 200 m
Contains OS OpenData data (boundaries); WG aerial imagery; TCBC/BA ground maintenance areas/lines; NRW orchard data; BGCBC tree/pollinator/wildflower sites/lines/areas; BA wild grass; TCBC meadows; BGCBC cemeteries;and NRW Phase 1 Habitat Survey data (arable and potential gardens)

7 Consult the relevant Green Infrastructure Action Plan

Previous
Next

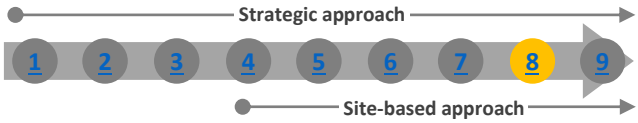


Below is a short version of the Car parks, office grounds etc. Green Infrastructure Action Plan (a more detailed example of a Green Infrastructure Plan can be found in the Historic Sites case study).

Green Infrastructure type: Car parks, office grounds etc.	
Aims	• Reduce cost of maintenance or avoid increased costs
Desired Outcomes	• Areas that are attractive to the public and local businesses/customers
Assessment steps	• Assess soil conditions • Assess which bedding and tree or shrub species are suitable for pollinators
Main options for site	• Flower beds ○ Rotavate and seed annual and Perennial wildflower meadows without grass (e.g. Pictorial Meadows) (CR1)
Relevant Management Action Plans	G1, G2, G3, G5, G7, AU3, FM1, FM2, CR1, CR2, CR5, HDG1, HDG2, HDG3, HDG4, HDG5, HDG6, HDG7, SCR1, SCR2, SCR3
Risk Appraisal	• Perception that other issues such as littering may be linked to maintenance changes – need to ensure appropriate maintenance to keep areas 'tidy'
Key stakeholders	• Consider possible business sponsorship of sites
Further information	http://www.wildlifetrusts.org/bees-needs

8 Consult the Land Classification Matrix

Previous
Next

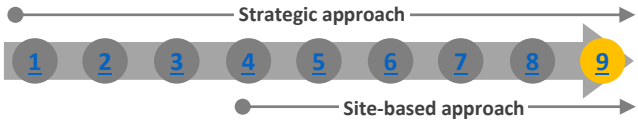


Knowing the Green Infrastructure type from Step 3 and the land classification type from Step 4 allows appropriate management actions to be selected.

		Land Classification Type						
		Inland Water	Upland	Hills, lower plateaux and scarp slopes	Lowland	Coastal	Built Land	Developed Unbuilt Land
Green Infrastructure Type	Car Parks, Office Grounds etc.	G1, G2, G3, G5, G7 AU3 CR5 FM1, FM2	G1, G2, G3, G5, G7 AU3 FM1, FM2	G1, G2, G3, G5, G7 AU3 FM1, FM2 CR5 HDG1, HDG2, HDG3, HDG4, HDG5, HDG6, HDG7 SCR1, SCR2, SCR3			G1, G2, G3, G5, G7 CR1, CR2, CR5 AU3 FM1, FM2	

9 Select actions from the Management Actions Toolkit

Previous



Appropriate actions identified in the Land Classification Matrix (Step 8) and the Green Infrastructure Action Plan (Step 7) can then be considered.

The Torfaen Eco-Building demonstrates a number of eco-friendly modern building features but lacks particular features for pollinators giving potential for enhancement. For example, the flower boxes and shrub beds could have mixed pollinator-friendly flower beds (FM2). Also of note is the already existing green links in the immediate surroundings – managing hedges (HDG1, HDG2, HDG3 and HDG6) and woodland blocks (WD1, WD2, WD3 and WD4) sensitively could bring increased benefits.

For new office developments, opportunities can be taken to develop and manage for pollinators from the outset.

CODE	ACTION	AIMS	BENEFITS TO POLLINATORS	DETAILS	RISKS/HAZARDS/ CONSIDERATIONS	INDICATIVE COST LEVEL	RELATED ACTIONS	DELIVERY PLAN/S	BENEFITS	LIKELI-HOOD OF SUCCESS	COST	TOTAL
FM2	Plant formal beds with a range of perennials and shrubs that provide good pollinator resources	Increase biodiversity and length of flowering period	Ensuring good, ideally varied, supply of nectar	Ensure plants chosen provide good resources for pollinators: See useful resources here: https://www.rhs.org.uk/science/conservation-biodiversity/wildlife/encourage-wildlife-to-your-garden/plants-for-pollinators and here: http://www.lbka.org.uk/forage.html	Poor choice of plants - ensure that they are attractive to pollinators	Moderate - high (but no more than it would be for other plants)	-	-Public Parks and Gardens -Provision for Children and Young People -Car parks, Office Grounds etc. - Historic Sites -Civic Spaces -Housing green space -School Grounds -Managed gardens, care homes etc. -Other amenity green space -Churchyards and cemeteries -Water -Accessible areas of countryside in the urban fringe	✓✓	+++	££	7

7 COMMUNITY INVOLVEMENT

To ensure that any changes to the landscape management of public sector land are well-received it is important to involve the community in the process of making those changes and that the messages about why changes are being made are properly communicated to them. Getting this right is key to building public support as well as minimising issues with vandalism.

7.1 Developing support

It is important that the public trust those making the changes. In an area that has all been close mown for many years, changing it to a more diverse mixture of grass heights and habitats will most likely be treated with suspicion by many, especially if they believe it will have a negative impact on them, for example restricting areas where they can play ball games or use for recreational activities.

Involving local community groups, schools etc. directly in both planning and implementation of activities such as planting or creating new areas helps build a sense of ownership, and gives people the chance to feel they are being listened to. It usually helps if they feel they are getting something back, so for example allowing people to manage areas of land themselves or implementing food growing projects, as part of wider changes.

Ensuring local communities are properly engaged in a range of schemes that can benefit pollinators and people is a great way of spreading the message that pollinators need to be protected and embedding the principles of how to do that should be a core part of any such work. These basic principles include the importance of biodiversity and how we rely on our world's natural resources to deliver a range of services.

As well as the general public there are other key groups who all need to be made aware of the changes and the reasons behind them. Without the support of the following it is very hard to maintain public support:

- Elected members
- Department managers
- Senior officers
- Front line staff

In order to get people on board with a new initiative or idea, it is important to ensure that they can see clear needs and benefits. In the case of pollinators, the key areas to emphasise all relate to the vital roles they play in food provision and security (the value of pollinators to the UK economy has been put in excess of £500m) and the survival of many wild plants. There is considerably more to improving pollinator provision than just conserving bees for the sole aim of providing a pollination service to crops.

When dealing with public concerns and complaints it is essential to maintain a consistent attitude. If every council/housing association staff member reinforces the importance of proposed changes have on biodiversity and pollinators in particular, this will be more effective if it is backed up by council policy and wider government policy and initiatives.

7.2 Barriers

Financial barriers may always be an issue, but there are a number of ways that investing in changes to benefit pollinators can be shown. In many scenarios it may be that maintenance changes that require an initial investment, save money over the longer term, so Invest-to-Save schemes may be accessible. There may also be opportunities to tie in to other finance schemes, such as through Section 106 agreements or Community Infrastructure Levy.

Other physical barriers include the limitations of existing machinery and its availability. Again creative thinking can help overcome these barriers. For example using local farmers to cut and collect hay crops can avoid the limitations of not having appropriate machinery to collect cut long grass. Another approach could be to purchase machinery for a central pool and make it available for community use through a booking scheme. Obviously there may be a high initial capital outlay, but if this up-front cost could be shared between local authorities it becomes easier to manage. Such machinery may require training to use or even skilled operatives who might also need to be available for community projects.

7.3 Making Change

When it comes to making long term changes there some key approaches and considerations which can make the process easier.

Creating examples and trial sites allow for issues to be ironed out on a small scale, but also give people the chance to see the benefits of an approach that they might not have been convinced by, before they are expected to commit to it on a wider scale.

Ensuring that public or staff understand the basic principles behind the need for positive action to help pollinators allows them to have a very different perspective on any changes. The need to resource education and training must be recognised.

Another factor to consider is that making changes and establishing the required change in attitude may take time. In many cases, several interim stages are required to reach a desired outcome but in the long term a greater degree of change will be accepted. In many areas this process is already underway. The general public are now familiar with annual flowering meadow mixes on road verges and roundabouts, but to realise the greatest benefit for native pollinator species this needs to develop into an understanding of the importance of a diverse range of healthy ecosystems, to provide resilience and support a wide range of species throughout their lifecycles.

Citizen Science projects can serve an important role in ensuring that the general public are involved and supportive of the changes. These may also have the potential to bring about other benefits for example if a community has been involved in creating 'its own' wildflower area then the members of the community are more likely to be involved in its upkeep, and undertake tasks such as community litter picks etc.

7.4 Community groups potentially involved in the pollinators action plan

Communities can be involved delivering practical projects through direct grant funding of projects and through citizen science. Relevant groups who may be involved in pollinators may include:

- Allotment groups
- Bee keepers
- Churches – managing churchyards
- Commoners Associations
- Farmers/NFUW
- Gwent Wildlife Trust
- Friends groups e.g. Friends of Parks
- Local businesses such as supermarkets (e.g. Waitrose and Sainsburys who have already been involved in raising awareness of pollinators)
- Other NGOs
- Schools
- Tenant's groups
- Women's Institute

7.5 Interpretation

There is a significant opportunity for public engagement with pollinators through interpretation and environmental education, in many cases building on the work already carried out in SE Wales through the *Pollinators for life* project. The clear link between pollinators and food production is a particularly powerful tool for engagement with people.

Simple signage of green infrastructure projects, such as using bee symbol use by Monmouthshire County Council (see Figure 30), can raise awareness simply and effectively. More detailed interpretation panels can be developed for projects in public space such as schools, parks or allotments. The full green infrastructure action plan and associated documents will also be a major interpretation resource if available online.

Figure 30 - Example of 'Bee Friendly Monmouthshire' signage

Social media and the press can also be used to help to raise awareness.

There is potential to develop an educational program of talks and lectures in schools and local community groups which could also encourage participation in the monitoring and citizen science projects. Yearly conferences to exchange ideas and share best practice could also be considered.

8 MONITORING

"Monitoring is the regular observation and recording of activities taking place in a project or programme. It is a process of routinely gathering information on all aspects of the project. To monitor is to check on how project activities are progressing. It is observation; – systematic and purposeful observation. Monitoring also involves giving feedback about the progress of the project to the donors, implementers and beneficiaries of the project. Reporting enables the gathered information to be used in making decisions for improving project performance."
(Phil Bartle, PhD)

Monitoring is essential to demonstrate the success or failure of the green infrastructure project, and can be carried out at different levels for different purposes. It will form an integral component of the on-going research into successful green infrastructure management for this and other similar projects across Wales and further afield. Project monitoring can be achieved through normal reporting mechanisms such as areas of land managed for pollinators or items of equipment purchased. Public opinion can also be monitored to obtain views on the project. Changes in pollinator populations as a result of the green infrastructure plan can also be monitored.

A combination of citizen science projects and professional studies will probably be required to monitor pollinators in the study area to achieve cost-effective coverage. It is proposed to have a controlled scientific monitoring programme to run in parallel a with Citizen Science project, such as the Great Sunflower project (See 8.1.6) below. This will allow the quality of the Citizen Science project to be tested against the results of a carefully structured, replicated monitoring program as unsystematic samples sent in from community projects are unlikely to provide any conclusions about the wider effectiveness of the pollinator action plan on their own.

8.1 Related monitoring projects

Some existing projects can be drawn upon and used, adapted or expanded to provide information about pollinators in the study area.

8.1.1 English Pollinator Monitoring

As part of the English National Pollinator Strategy, DEFRA are developing and implementing a sustainable, long term monitoring programme to be implemented by professionals and citizen science. Field testing of the method is being carried out in 2014-2016, followed by deployment by both volunteer recording schemes and by professional monitoring groups from 2016. Full details of this monitoring project are awaited.

8.1.2 UK Butterfly Monitoring Scheme

Butterfly Conservation monitor butterflies through the UK Butterfly Monitoring Scheme, where a 2-4 km fixed-route walk is selected and butterflies are recorded along the route on a regular (weekly) basis under reasonable weather conditions by volunteers. Four sites are involved in monitoring in the study area at Aberbargoed Grasslands NNR, Brockwells Farm and Newport Wetlands.

This scheme has the potential for monitoring pollinator abundance, but relies on volunteers belonging to the society and the existing coverage in the study area is inadequate for routine monitoring of pollinator abundance. It has great potential to be promoted to expand coverage in the study area.

8.1.3 Bumblebee Conservation Trust

The Bumblebee Conservation Trust monitor UK bees by using their volunteers who walk fixed-route of 1-2 km each month and record what they see, though this requires reasonably good bumblebee identification skills to take part. There are currently bee walk transects in Chepstow, Usk and south of Ebbw Vale (Richard Comont, pers. comm., June 2015).

As for the Butterfly Monitoring Scheme above, there is considerable scope for expanding participation in this scheme in the study area.

8.1.4 Bee-friend

The Bee-friend project developed by Earthwatch, Waitrose and the Crown Estates used a free smartphone App to help collect 'snapshot' data about the bees, beetles, hoverflies and other pollinating insects in gardens and which plants they visit. The data were fed in to a University of Sussex research project which aimed to create a more detailed national picture on pollinator activity and help secure a future for bees by understanding better the plants and flowers that encourage them into our gardens.

The project was not supported after 2013 (pers. comm. F. Ratnieks, University of Sussex April 2015) but the apps and software developed for the project have the potential to be adapted for citizen science monitoring in the study area.

8.1.5 SEWBReC

SEWBReC already hold data on a wide range of pollinators (cf. Section 2). To enable future data to be used for monitoring, survey data would need to be collected in a more structured way.

8.1.6 Great Sunflower project (USA)

The Great Sunflower Project has aimed to involve citizens in monitoring pollinators in gardens in the USA. It was first established in 2008 and now has over 100,000 volunteers across North America. The basic method is as follows:

- A single sunflower variety, Lemon Queen, is planted in the gardens of participants.
- 15-minute observation period are carried out every week.
- Environmental data (e.g. weather) are also collected.
- Pollinators are identified to level of comfort of the observer (e.g. ranges from major classification such as bee, wasp, fly, beetle, butterfly, moth, to species level e.g., sphinx moth.
- The number of individuals of each pollinator observed is counted and recorded.

Source: http://www.greatsunflower.org/

8.1.7 Penn State Extension Master Gardeners (Pennsylvania, USA)

The aim of this Master Gardener project is to gather data on the attractiveness of various floral resources to native bees and honeybees for public education. The basic method is as follows:

- Weekly observations are made from early May to late October between 11.30-16.00 in good weather.

- plants (including 3 standard plants common to all groups) were observed for 10 minutes per blooming plant group
- Data from pairs of volunteers led by local team leader feed into central collection point

Source: http://extension.psu.edu/plants/master-gardener

8.1.8 Grey Bruce Centre for Agroecology (Ontario, USA)

This excellent project aims to develop and promote quantitative monitoring of native pollinators in collaboration with ecological farmers and engaged citizens. The objectives are to initiate a citizen science network in Ontario that tracks the diversity and abundance of native pollinators, promotes knowledge and awareness of native pollinators, and ultimately supports the protection of these and other insects in a diverse landscape.

A range of methods are being used including measuring pollination success in plants (this shows pollinators are active; 3 measures), direct observation and counting of pollinator diversity and abundance (these indicate number and types of pollinators; 6 measures) and colonization of nesting habitat using bumblebee boxes.

Source: http://www.gbcae.com/pollinators.html

8.2 Standard pollinator observation method

Standard pollinator observation techniques can be used to quantify visits to flowers, which provide a measure of the pollinator availability. A basic widely-used method to assess pollinator provision through the season at a site is as follows:

- A reasonably warm dry day is selected at, say, weekly or 2 weekly intervals; the air temperature is noted as this can affect pollinator activity.
- Individual flowers or small groups of flowers of one species are selected be observed by a single observer who stands 1-2 m away.
- A photograph is taken of the species and the group surveyed.
- The flowers are observed for insect visitors for 10 minute periods.
- Records are kept of the total number of insect visitors, or can be broken down into the major groups of bees, wasps, hoverflies, flies, beetles, butterflies and moths depending on the experience of the observer (photographs may help with subsequent identification).
- 15-30 different groups of flowers are watched.
- Data are collated and analysed centrally.

If identification of individual species is required for a specific study, the method is to capture the insect, kill with ether and store in IMS or glycerol for later examination but this is unlikely to be practical or acceptable for public involvement.

8.3 Monitoring action plan implementation

Whilst the basic observation method in Section 8.2 is simple, designing a sampling strategy for the whole study area is much more complex and the level of data collection needs to be adapted to the question being tested, for example:

- Are the number of pollinators increasing (equivalent to mandatory monitoring to assess trends, cf. Lindenmayer & Likens 2010)?
- Are the number of pollinators increasing as a result of the green infrastructure project (equivalent to question-driven monitoring to assess the cause of a change, cf. Lindenmayer & Likens 2010)?

Ecological responses are usually complex and under multifactorial control, and in monitoring it is often hard to ensure that the changes observed are real and not due to variables such as the observers, sampling design or other unrelated factors. It is essential that the basic method is repeatable (i.e. separate signal from noise). As ecological responses can be slow and take time to develop, which is especially true of pollinator responses which can vary markedly with the weather, monitoring would probably be required for at least 10 years to demonstrate long term success.

It would be logical for monitoring in the study area to fit into the wider DEFRA programme to contribute to the wider UK picture rather than develop a separate method. The actions and data also need to be reported in a form which can be uploaded to the UK Biodiversity Action Reporting System (BARS). The approach recommended has both a scientific monitoring component and citizen science monitoring component and is outlined below:

8.3.1 Design of scientific monitoring scheme

To assess the impact of the action plan on pollinator populations across the study area it is proposed to carry out a properly replicated, structured survey across 30 green infrastructure projects with 30 controls over the 10 years life of the plan. Control sites will need to be selected at least 0.5 km from any green infrastructure sites. Ideally the sites should be monitored before and after implementation of any green infrastructure project, but in practice this is unlikely to occur with a sufficient run of data before action is taken, hence control sites are needed.

It is recommended that each site will be monitored once a month during the 4 summer months (May-August). At each site, the 15 plant patches c. 1 m² will be monitored in random order on any day between 10.00-16.00. The work should be carried out by moderately skilled entomologists to enable a breakdown of the responses into the major insect groups (e.g. hoverflies) and common species (e.g. red-tailed bumblebee). Due to change in flowering times over the season, it will not be possible to consistently monitor the same patches. With travel, identification (as required) and data compilation, it is estimated that this would take 1 day per site. To cover 60 sites each month will require 3 entomologists for the summer months, with one entomologist for an additional 3 months to compile the report and carry out statistical analyses.

8.3.2 Design of Citizen Science monitoring scheme

A Citizen Science project could be run along the lines of the Great Sunflower Project in North America (see Section 8.1.6), with a central organiser (see Section 11.6.2). It should focus on bumblebees and honey bees as these are easily recognised by the majority of the public who have considerable empathy with their plight, and should use the same varieties of plant.

Although sunflowers grow well in the USA, they tend to be late-flowering (August and September) and subject to wind in the UK, and may not be generically suitable in Britain. A range of easy-to-grow species that are very good for attracting bumblebees could therefore be provided to cover a wider range of the year such as:

- Fritillaries for spring flowering (May).
- Borage for summer flowering.
- Sunflowers (to compare with North America).
- Raspberries (often 2 flowering periods).

The basic method is as follows:

- Seeds/bulbs/rootstocks of the same plant species are provided for planting in the gardens of participants.
- 15-minute observation periods are carried out every week beginning from when each flowers.
- Environmental data (e.g. weather) is also collected.
- Pollinators are identified to the level of comfort of the observer.
- The number of individuals of each pollinator observed is counted and recorded.
- Data are uploaded by individuals, perhaps with a mobile app, to a central database and internet presentation with feedback

9 GIS DATABASE

The GIS database contains approximately 120 relevant baseline and derived datasets (see Figure 31 and Table 32). It is used throughout the Green Infrastructure Action Plan to:

- facilitate the initial identification of a site for further investigation (when taking a strategic approach);
- confirm land ownership;
- identify the land classification and green infrastructure type; and
- outline the likely constraints to pollinator planting and identify the physical conditions that can be expected

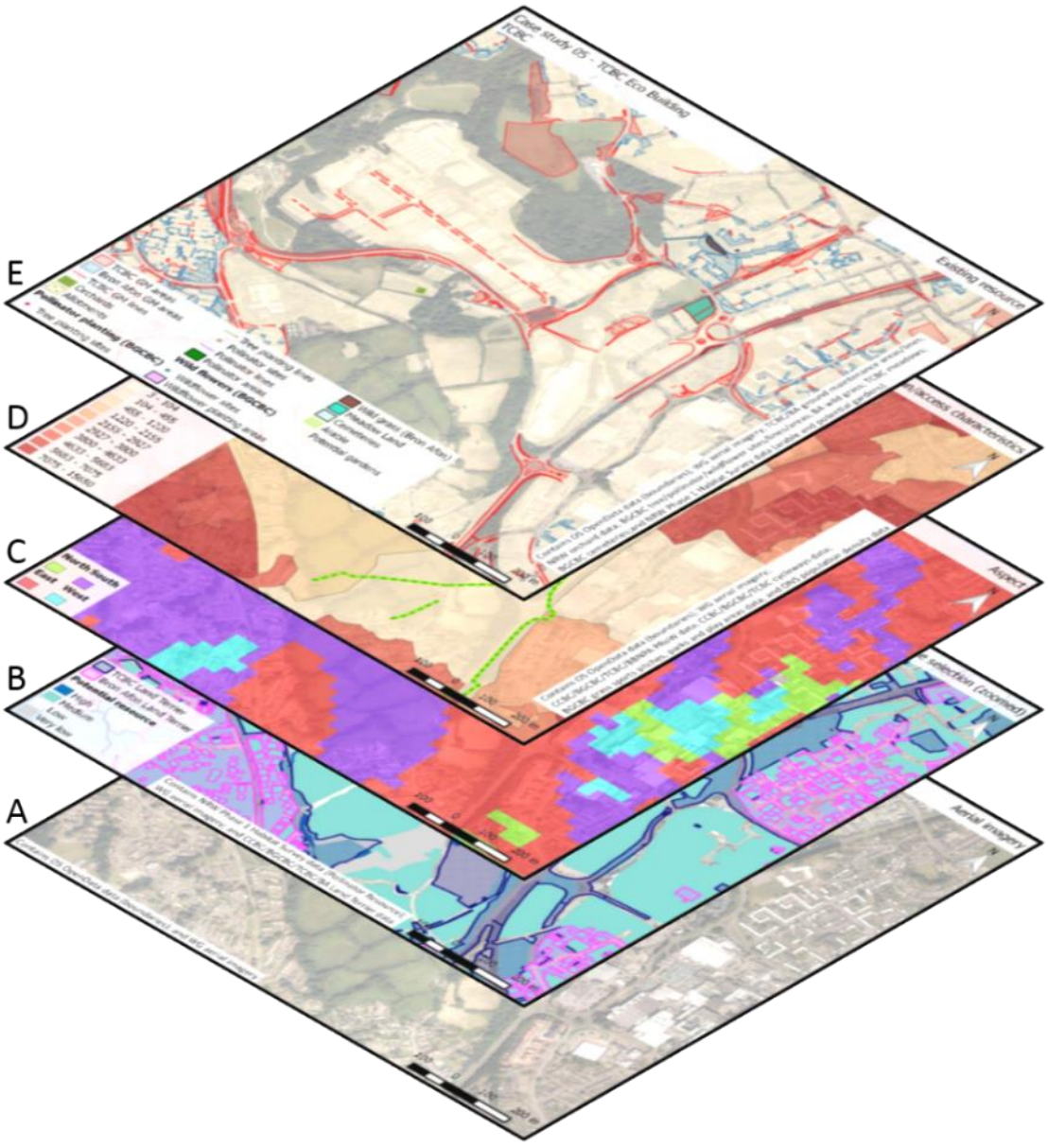


Figure 31 - Sample of the GIS database and the method of overlay mapping

A) aerial imagery B) Pollinator resource and land ownership C) aspect D) population density and public rights of way E) existing resource

With the project crossing four Local Authorities, inevitably there have been differences in the amount of data relating to land holdings supplied and/or held by each of them. Each Local Authority has received the study-area-wide data together with the data they provided regarding their individual land holdings (see Table 32). Additional data relating to land holdings can be included at a later date should they become available.

The database is not intended to be a replacement for the knowledge and experience of those working in the area and nor is it intended to replace site visits. Rather, it is intended to bridge the gap between the baseline data and the Green Infrastructure Action Plans providing a data-driven point-of-entry into them and an evidence base to support selected actions.

The database is split into seven themes of data:

1. **Site selection**
2. **Constraints**
3. **Human & access characteristics**
4. **Existing resources**
5. **Ecology**
6. **Physical characteristics**
7. **LANDMAP**

Table 32 - Data themes available for use in a GIS

Site selection	SINCs	Arable farming
Land Terrier		Gardens
Land categories for project	**Human and access characteristics**	
Pollinator action areas by LA	PRoW	**Ecology**
Pollinator action areas	Cycle/walking paths	Habitat connectivity
Pollinator demand	Grass sports pitches	Species records
Pollinator resource	Parks	
	Play areas	**Physical characteristics**
Constraints	Population density	Climate
Listed buildings		Elevation/Aspect/Slope
Scheduled Ancient Monuments	**Existing resources**	Soil
Historic park and gardens	Ground maintenance	
Historic landscapes	Pollinator planting	**LANDMAP**
RAMSARs	Wild flowers and grass	Cultural Landscape
SPAs	Roadside verges	Geological Landscape
NNRs	Meadow land	Historic Landscape
SACs	Cemeteries	Landscape Habitats
SSSIs	Orchards	Visual and Sensory
LNRs	Allotments	

Initial selection of a site begins using the **Site selection** group with subsequent groups then available to identify further details about a selected site and what management actions may or may not work (see Figure 32).

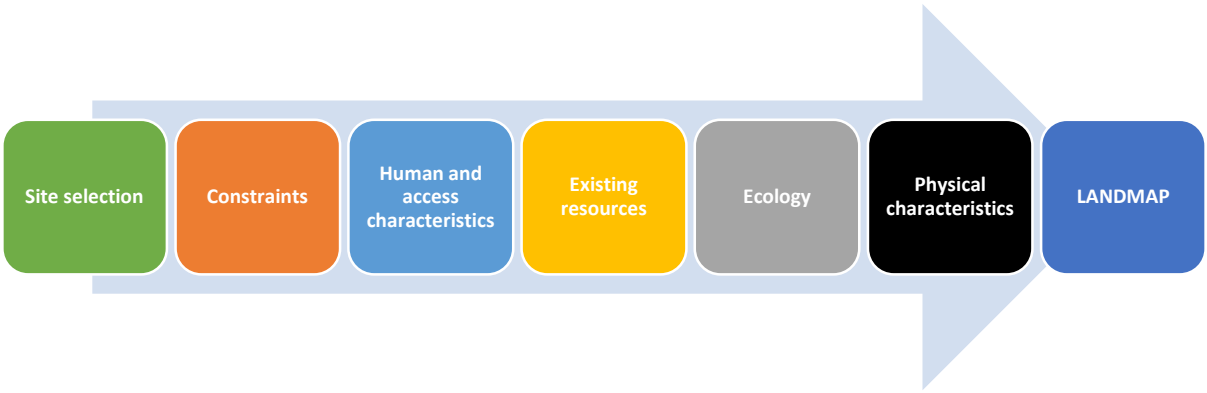


Figure 32 - The process of identifying a site using data groups

Full details of the GIS database, including instructions on using it and maintaining it can be found in the separate *GIS Training and Handover* report.

9.1 GIS Strategies

In order to empower Local Authority staff, partners and contractors with up-to-date and accurate data, it is necessary to consider cross-border working and the sharing of data between organisations.

9.1.1 Data inconsistencies

There are a number of inconsistencies across the study area relating to the naming of data, their schemas and their extents (see Table 33). These are either gaps which need filling or the data, if they already exist, need centralising with their respective Local Authority's GIS department. It could also be that the data are stored within other datasets. Regardless of the cause, the issue created remains the same; it is difficult to create a region-wide system without consistent data structures. Correcting this is an important step if the project is to be expanded beyond the existing study area.

Table 33 - Data 'gaps' identified across the study area – where these gaps appear it may be that the data are named differently or stored within other datasets. For example the *ground maintenance*, *tree planting* and *pollinator planting* datasets contain similar data but were provided as individual datasets.

Torfaen	Blaenau Gwent	Monmouthshire	Caerphilly
	Ground maintenance	Ground maintenance	Ground maintenance
Tree planting		Tree planting	Tree planting
		Pollinator planting	Pollinator planting
	Meadows	Meadows	Meadows
Cemeteries		Cemeteries	Cemeteries
Allotments		Allotments	Allotments
		PRoW	
		Cycleways	
Grass sports pitches		Grass sports pitches	Grass sports pitches
Parks		Parks	Parks
Play areas		Play areas	Play areas

9.1.2 Data collection

A program of data collection will provide more up-to-date information for use in Local Authority GIS environments and therefore, will ultimately benefit this project and help facilitate its roll out to other parts of Wales. More detailed information relating to current conditions and actions would help to provide an understanding about which actions proposed by this project would be suitable. A single, cross-boundary database of existing resource would be a step in the right direction. Table 36 presents an example of the kinds of information to be collated.

Table 34 - Example of the information to be collated from across the study area

Field	Example
Green infrastructure type	*Roadside verge*
Lead organisation	*Caerphilly County Borough Council*
Lead department	*Estates*
Lead person	*A. Person*
First survey date	*12/07/2013*
First survey person	*A. Person*
Last survey date	*19/06/2015*
Last survey person	*A. Person*
Predominant habitat type	*Neutral unimproved grassland*
Key plants present	*Knapweed, yellow rattle*
Key pollinators present	*Shrill carder bee, red admiral*
Current management	*None, becoming scrubbed over*
Proposed management	*G3 rotational mowing, G5 cut and collect*
Notes	*Beware of sightlines around the corner to the north*

Every effort should be made to keep the data provided in the GIS database up-to-date. More information regarding these data and their sources can be found in the separate *GIS Training and Handover* report.

Any data collection should also be tied together with the monitoring proposed in Section 8. Scientific and citizen-science approaches to monitoring are discussed and both would benefit from spatial data being collated in order to review progress.

9.1.3 Pollinator Evaluation and Grading System (PEGS)

A simple *Pollinator Evaluation and Grading System (PEGS)* (see Section 3.4) has also been developed for assessing existing resource and helping to guide decision-making regarding whether to leave a site as-is or make management changes. *PEGS* is site specific and therefore, the scores attributed could easily be stored in a spatial dataset and areas receiving scores that prompt further review could be flagged accordingly.

9.1.4 Online GIS

The publication of spatial data relating to green infrastructure such that Local Authority (and partner organisation) employees (and potentially the public, if desired) can interrogate it in an environment familiar to them (i.e. similar to Google Maps) will speed up the process of making effective change.

The extension of existing individual Local Authority spatial data sharing platforms (i.e. MapInfo Stratus, ArcGIS Server, GIS Cloud etc.) or development of one cross-boundary system should be explored. TCBC currently use the MapInfo Stratus hosted solution available from Pitney Bowes whereas CCBC are running an installation of Esri's ArcGIS Server and use the GIS cloud (a hosted solution).

9.1.5 Mobile GIS

Providing operatives with up-to-date information regarding the different management plans whilst they are in the field carrying out their maintenance duties will place them in a better position to make the correct changes. There are solutions available (e.g. Esri Collector for ArcGIS) which provide location based information and these can be configured to inform operatives of the management actions for the green infrastructure they are within at any given time. These mobile solutions can work both ways allowing the operatives to update information stored in a central database (such as that discussed in Section 9.1.2) thereby helping to maintain the spatial data available to this project. If such a system were rolled out then protocols for its use would be necessary which could be considered at a cross-border level.

10 GUIDANCE BOOKLETS

A series of guidebooks have been produced which are designed to be used as publicity and communication aids, and to inspire different groups or users to take action to improve pollinator provision. The guidebooks are focussed and aimed at the following sectors/groups:

- Managing Green Spaces for Pollinators – an introduction for managers
- Managing Highway Verges for Pollinators – an introduction for highway managers
- Managing Residential Areas for Pollinators – an introduction for estates managers
- Managing School Grounds for Pollinators – an introduction for head teachers

It is acknowledged that through the same parent project, *Pollinators for Life*, Gwent Wildlife Trust are in the process of producing a series of guidebooks too. Every effort has been made to ensure that the two projects' guidebooks complement one another where possible.

The guidebooks have been provided to the four Local Authorities in a format that can be edited in Microsoft Publisher in order that they can update and add to the series should it be necessary in the future.

Figure 33 - Example guide books

11 THE FUTURE FOR POLLINATORS

There are several key considerations in taking the action plan forward in the study area.

11.1 Cross-border working

There are definite benefits to working across existing local authority borders to implement the action plan to provide a more holistic approach, especially considering the current Welsh Government proposals to merge some local authorities.

It is clear from the data compilation exercise and from the workshops that there are significant differences in resources and structures between different local authorities; a cross-border approach could simplify implementation and reduce costs. For example, cut-and-collect machinery can probably be used 2-3 weeks earlier in the lowlands of Monmouthshire than in the uplands of Blaenau-Gwent, Caerphilly and Torfaen, leading to effective sharing of equipment and resulting in reduced capital costs. It should be noted that this action plan could also be applied to other adjacent local authority areas through Wales.

Furthermore, as the local authority borders are not recognised by the pollinators, projects can be planned more strategically. The GIS database should help to provide a more consistent approach and allow for planning across borders using the same information (some GIS data such as land holdings are confidential). It is anticipated that the GIS database will develop over time with additional datasets, such as monitoring data, becoming available. Sharing lessons learnt for specific and allied projects between local authorities and other user groups will be of value to all levels of personnel involved in using the action plan. Similarly, training of operatives, development of NVQ or similar schemes for technical competency, research and development, filling gaps in information, sharing of data, changing policies such as use of pesticides etc. is more effective when developed strategically.

11.2 Pollinator policies

Monmouthshire is currently the only local authority in the study area to have a pollinator policy. It would support the whole planning and implementation process if the other local authorities prepare pollinator policies integrating the green infrastructure action plan.

11.3 Incorporating pollinators into the planning process

Planning policy can be adapted to incorporate the needs of pollinators into future developments. For example, when planning landscaping and planting proposals for new housing or industrial developments, specifying a range of plants and street trees which provide pollen and/or nectar through the year, rather than one or two species giving uniform appearance would have significant benefits. New road verges could be designed for ease of maintenance and enhanced suitability for pollinators, by planting with a diverse range of plants covering needs of the range of pollinator groups, or target for locally important species. Green roofs may provide pollinator habitat in industrial areas though they are often composed of one species such as White stonecrop (*Sedum album*, not a native species) or a narrow range of similar plants; using a variety of species would enhance pollinator provision, though whether these are native or not for this specialised habitat probably does not matter to the pollinator. 'Soft' Sustainable Urban Drainage Schemes (SUDS) which incorporate planting, rain-gardens and open swales, create opportunities to incorporate pollinator friendly planting within them.

Decision making through the planning and development control process has a relevant and important role in this respect and it is recommended that consideration is given to how planners can influence pollinator provision at an early stage of project development through supplementary planning guidance or similar. For example, TAN 5 provides advice about how the land use planning system should contribute to conserving, restoring and enhancing biodiversity.

11.4 Further research and development

There are a series of research and development needs, which can also be developed as part of the implementation.

- A key area for development will be the provision of adequate supplies of locally-sourced seeds for green infrastructure creation; currently there are few or no supplies of local South Wales seed.
- Further research is needed into to the winter hibernation habitat requirements of many pollinators and how such sites can be created or enhanced.
- The specific requirements of most Section 42 pollinators (Appendix 3) need detailed research if these species are to be benefitted.
- There is a need to demonstrate that there is a long term, sustained increase in pollinators as a direct consequence of putting in green infrastructure; this will be addressed by the monitoring plan.
- More detailed costs need to be developed.

11.5 Priority areas for action

Figures 30-33 shows the priority areas for action from a strategic overview of the whole study area, which are areas of publically owned land with a high demand for pollinators where there is a low existing provision.

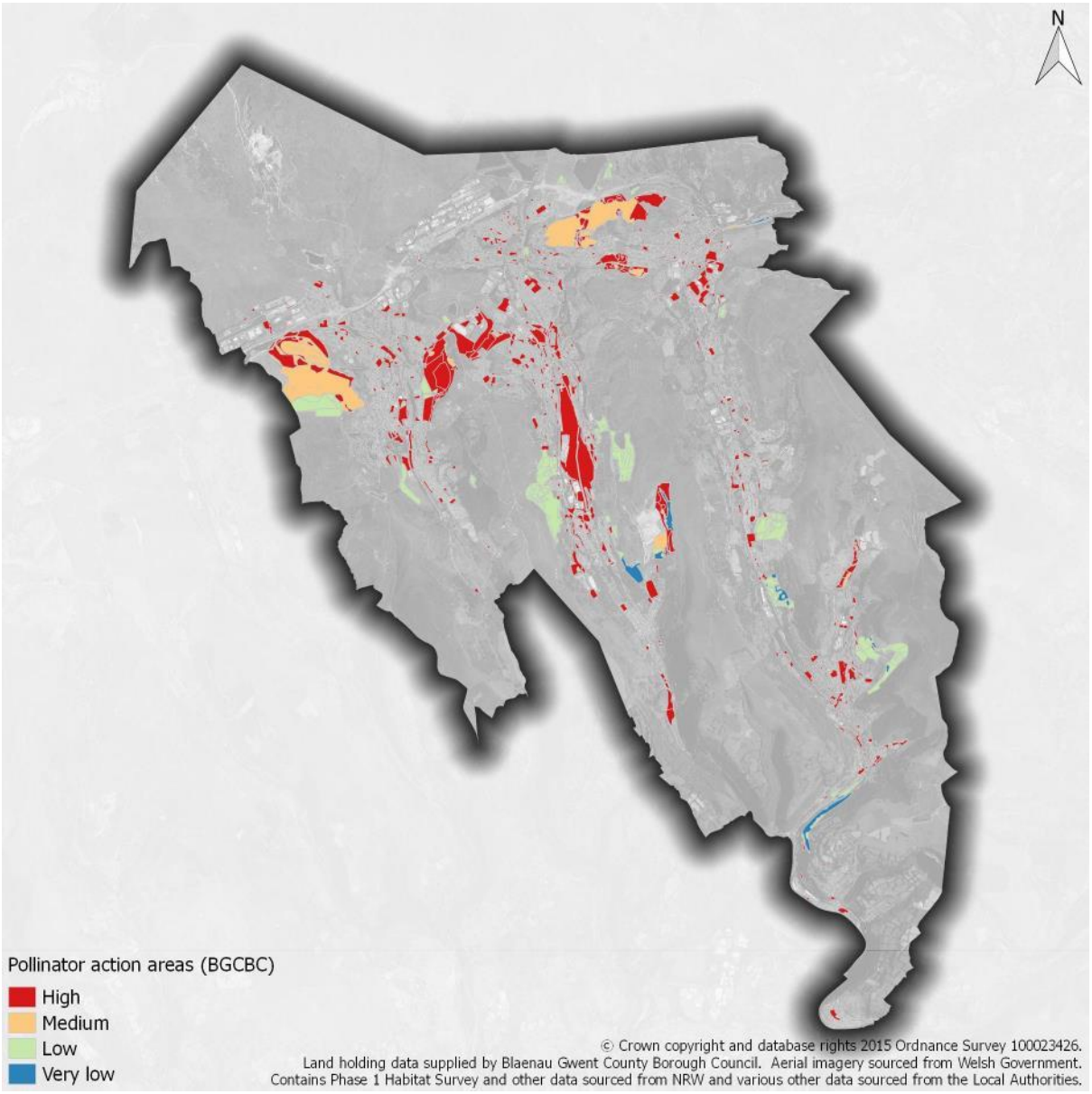


Figure 34 - Priority areas for pollinators in Blaenau Gwent CBC

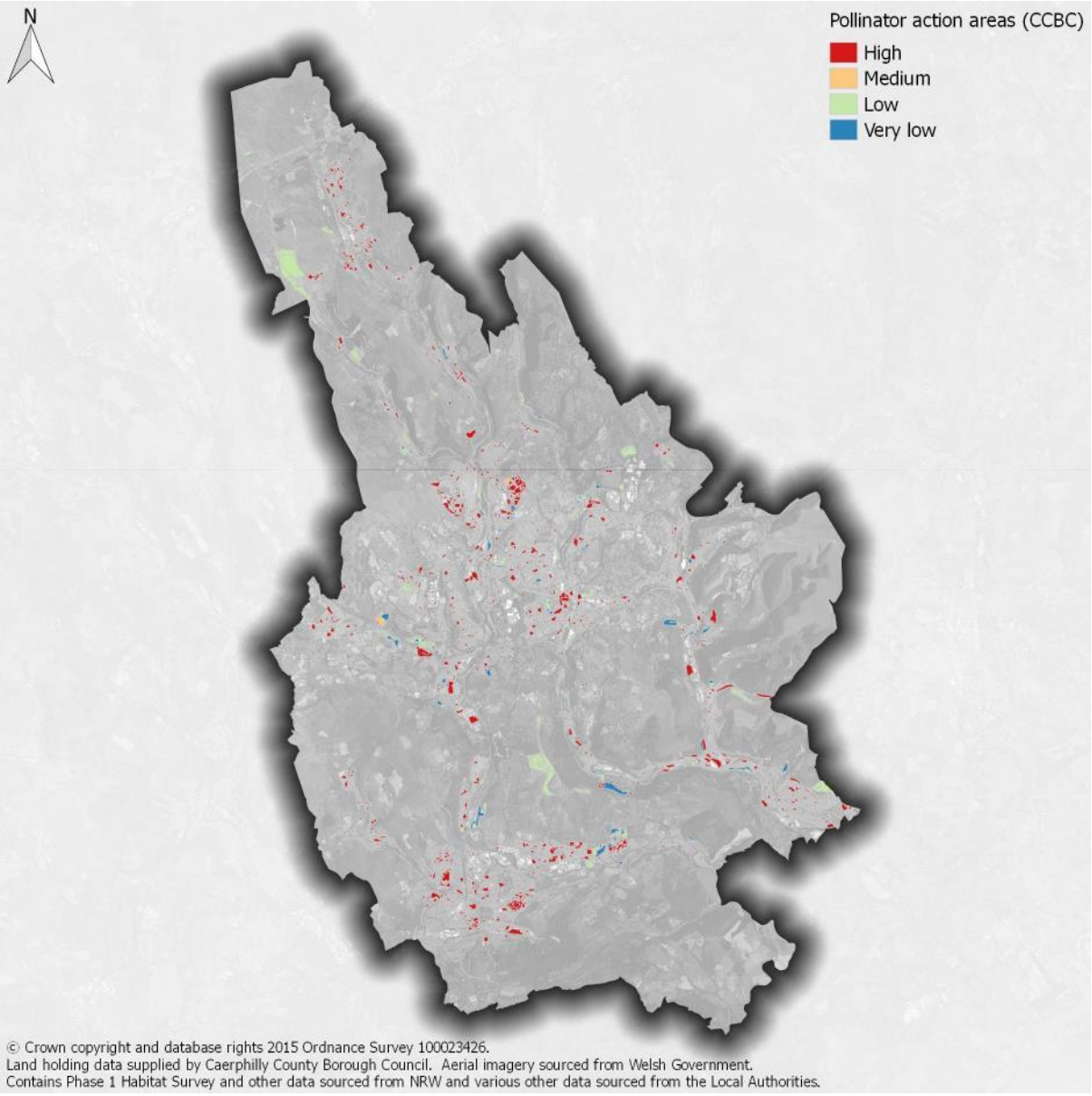


Figure 35 - Priority areas of action in Caerphilly CBC

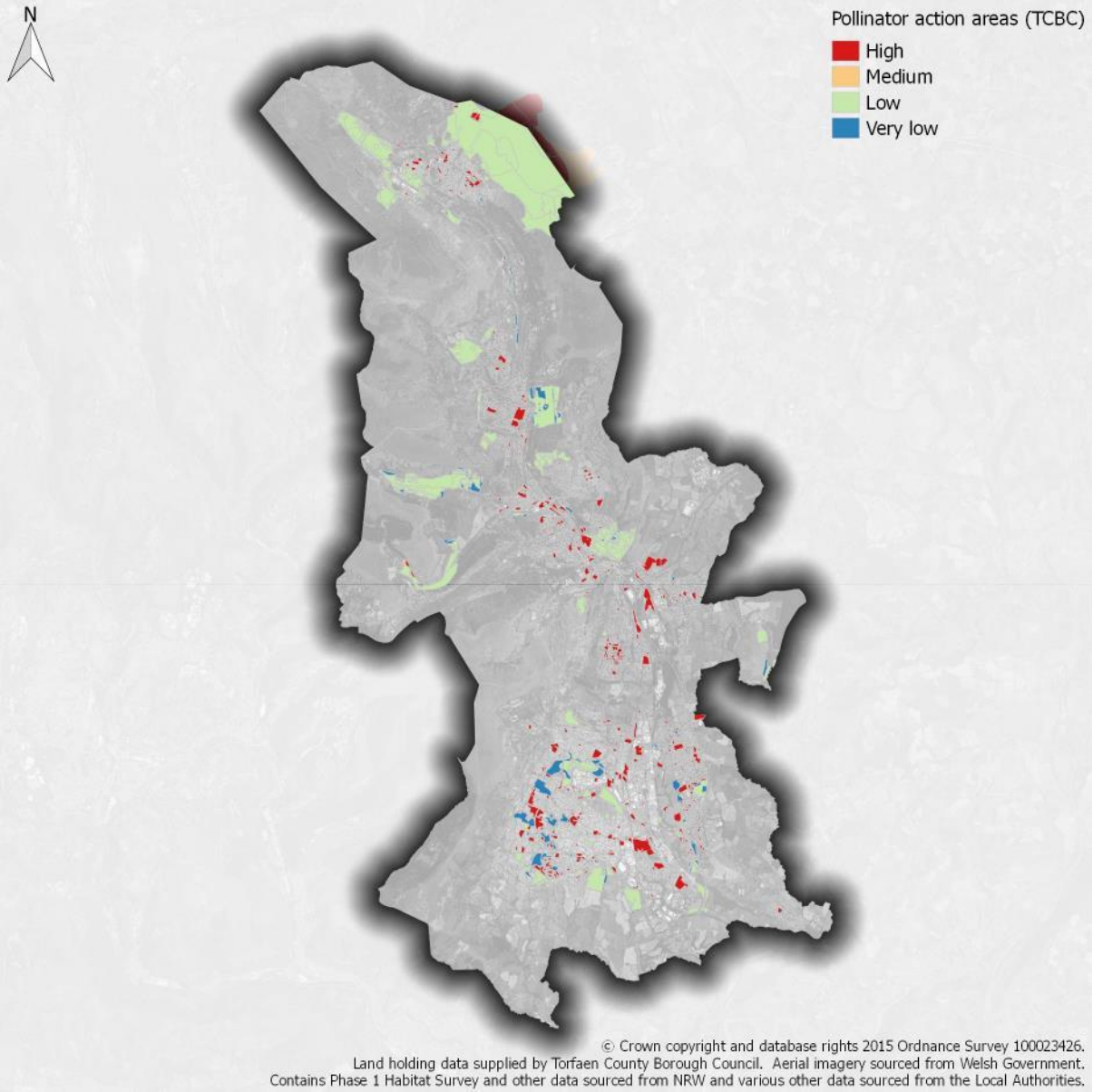


Figure 36 - Priority areas for action in Torfaen CBC

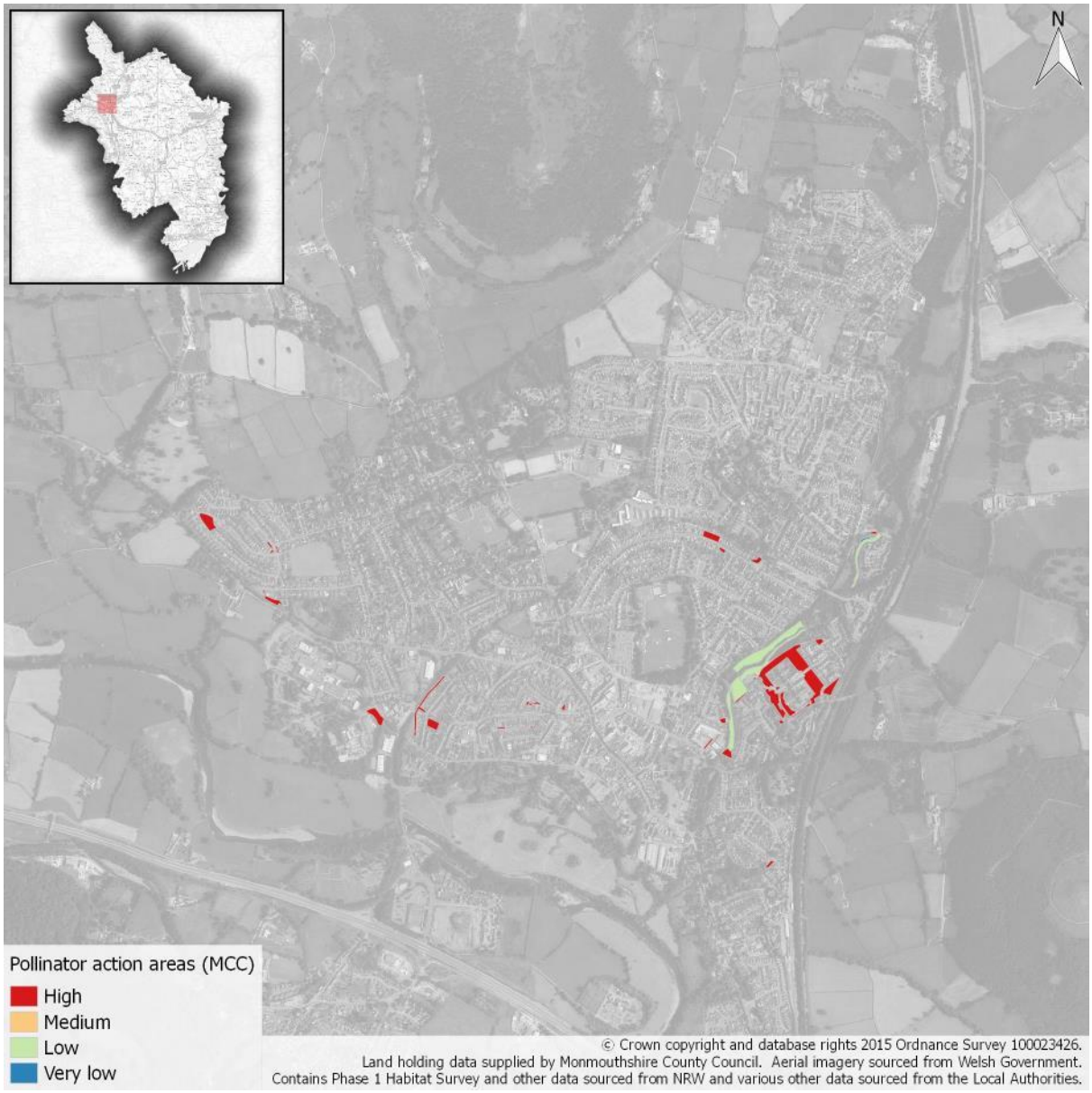


Figure 37 - Example of priority land for action for pollinators in Monmouthshire CC; only a small area of the county is shown is shown as an example due to scale

To give an indication of the potential scale of the publically-owned land which might be available for green infrastructure provision, Table 35 summarises the percentages of land in each of the pollinator priority action areas for Blaenau-Gwent, Caerphilly and Torfaen County Borough Councils. The GIS data for land holdings for Monmouthshire County Council are incomplete so no breakdown is given.

Table 35 - Percentages of Local Authority areas in pollinator priority areas (data unavailable for Monmouthshire County Council).

Local authority	Local authority area (km²)	Local authority owned (km²)	% local authority owned	% pollinator priority action area:		
				Low	Medium	High
Blaenau Gwent CBC	108.73	19.22	18%	25.7%	7.9%	23.9%
Caerphilly CBC	277.39	37.32	13%	11.4%	0.5%	20.9%
Torfaen CBC	126.24	18.98	15%	46.4%	11.1%	35.7%

11.6 Targets

As part of the Pollinator Action Plan consideration should be given to developing targets for its implementation. Key to ensuring the implementation and relevance of the Action Plan is the development of an agreed Vision for Pollinators within the SE Wales region and pollinator policies for each of the Local Authorities. It is important that specific targets are developed, ideally across the region, to identify the effectiveness of the action plan and help in its ongoing revision/amendment.

Examples of targets could be:

- 5% of public land managed for pollinators by 2020; and
- 10% of public land managed for pollinators by 2030.

The Vision for the Pollinators Action Plan for Wales 2013 is that:

Wales supports healthy populations of wild and managed pollinators to benefit the people, economy and environment of Wales.

To meet this overarching vision and to ensure effective implementation of this plan it is recommended that the following are undertaken by each of the Local Authorities:

- Pollinator Policy prepared for each Local Authority
- Embed actions for pollinators in local authority policy
- Work closely with the Welsh Government, NRW and other relevant bodies to ensure that there is consistency of targets/processes/procedures and dissemination of lessons learnt
- Each local authority, individually or combined, to set targets for implementation and review of the Action Plan
- Agree monitoring methods and exchange of data across and between local authority areas, Welsh Government, NRW, Wildlife Trusts and other relevant bodies
- Undertake training for local authority and other public section personnel who will be involved in the implementation of the Action Plan.
- Consult with NRW, Welsh Government and other key organisations on the Action Plan and ensure periodic review and revision of the Plan.

In developing targets consideration should be given to the outcomes set out in The Action Plan for Pollinators in Wales 2013:

Outcome 1: Wales has joined up policy, governance and a sound evidence base for action for pollinators.

Outcome 2: Wales provides diverse and connected flower rich habitats to support our pollinators.

Outcome 3: Wales' pollinator populations are healthy.

Outcome 4: Wales' citizens are better informed and aware of the importance and management of pollinators.

11.7 Community working and stakeholder engagement

Community working and stakeholder engagement are key to the success of the project and require early engagement. Early indication are that pollinators are seen in a very positive light by the public and there has been excellent support for the parts of the overall pollinators' project which have already been put in place.

The involvement of volunteers is essential to help deliver the plan. To support them, appropriate machinery and trained operatives may be required for some of the larger tasks such as harvesting large areas of cut grass, or specific funding for contractors to undertake the work.

11.8 Sharing information with other pollinator initiatives

There are many pollinator initiatives already being implemented across Wales and the UK. A forum for sharing and exchanging best practice and lessons learnt, perhaps similar to the SE Wales Landscape Officers Group, would be of benefit. This could be co-ordinated through the Wales Biodiversity Partnership.

11.9 Management of wider countryside

Publically-owned land covers c. 18%, 13% and 15% of the land in Blaenau Gwent, Caerphilly and Torfaen respectively, usually concentrated in and around urban areas (full data not available for Monmouthshire). Pollinators will also benefit from improved management of the wider countryside outside these areas, especially in areas of intensive arable agriculture in the Monmouthshire lowlands. This should be encouraged, for example, through promotion of organic practices, reduced pesticide use, integrated pest management and creation of flower-rich headlands around arable fields.

11.10 Overseeing Implementation of the Action Plan

11.10.1 Strategic Overview

To take the plan forward an appropriate strategic, cross-border group is required, such as the newly formed **South-east Wales Directors of Environment and Regeneration** (SEWDER) group. SEWDER reports to the South-east Wales Chief Executives and Managing Directors Group and the Welsh Local Government Association South-east Wales Regional Partnership Board, and has developed a Regional Strategic Framework endorsed by the Leaders of all ten unitary authorities which identifies the key strategic priorities to ensure growth and prosperity for the region as physical connectivity, business and growth, and people and skills. SEWDER has established several thematic groups that are identifying opportunities for collaborative project development across the region.

A strong case has been made to SEWDER and the Cardiff Capital Region Board for a specific thematic partnership group to be established focused on natural resources and has been working with the local authority environment lead officers and NRW to develop terms of reference for the group. The need for such a group is particularly important to develop a legacy from the Valleys Regional Park work and respond to the Well Being of Future Generations (Wales) Act 2015 and the Environment Bill. The terms of reference should enable the group to have a coordination and advisory role for pollinator green infrastructure delivery across South-east Wales.

There are many organisations in Wales concerned with the management, conservation and monitoring of pollinators in Wales, most of whom have been involved as stakeholders in the

development of the Action Plan for Pollinators in Wales 2013 and components of the delivery of the existing Nature Fund projects. It is important that the lessons learnt from these organisations are understood and therefore close liaison is required for the overseeing body with NRW and the Wales Biodiversity Partnership.

11.10.2 Proposed Project Staffing

To take the Pollinators Action Plan forward across the study area, it is anticipated that a number of roles would be required to coordinate and support specific parts of the project. These roles could be provided as part of existing roles within local authorities or as project specific roles ideally to cover the SE Wales region. Brief descriptions of the proposed roles are given below.

Pollinator co-ordinator

- Overall control of project coordinating across 4 Local Authorities, with Welsh Government and with UK Government
- Management of technical advice, community engagement and schools education and liaison
- Funding applications
- To direct monitoring
- Financial management
- Public relations
- Developing innovative ideas
- Liaise with NGOs (e.g. Butterfly Conservation, Gwent Wildlife Trust etc.).

Technical Advice

- Technical advice on plant species selection, management, equipment specifications, etc.
- Developing solutions to problems including design on new equipment
- To coordinate with Local Authority departments with responsibility of management (e.g. Parks Dept., Highways Dept.)

Community Engagement

- Community education (excluding schools)
- Working with housing communities
- Practical project management and delivery
- Public relations
- To encourage monitoring through citizen science project
- To encourage biological recording to feed into SEWBReC

Schools Education and Liaison

- To enable applications for schools-specific funding (e.g. Polli:nation, The One Tree Per Child scheme)
- To enable pollinator planting projects in schools
- To run workshops in schools on pollinators, including basic plant and pollinator identification

The flow diagram below outlines the proposed structure for the delivery of the GI Action Plan (Figure 38).

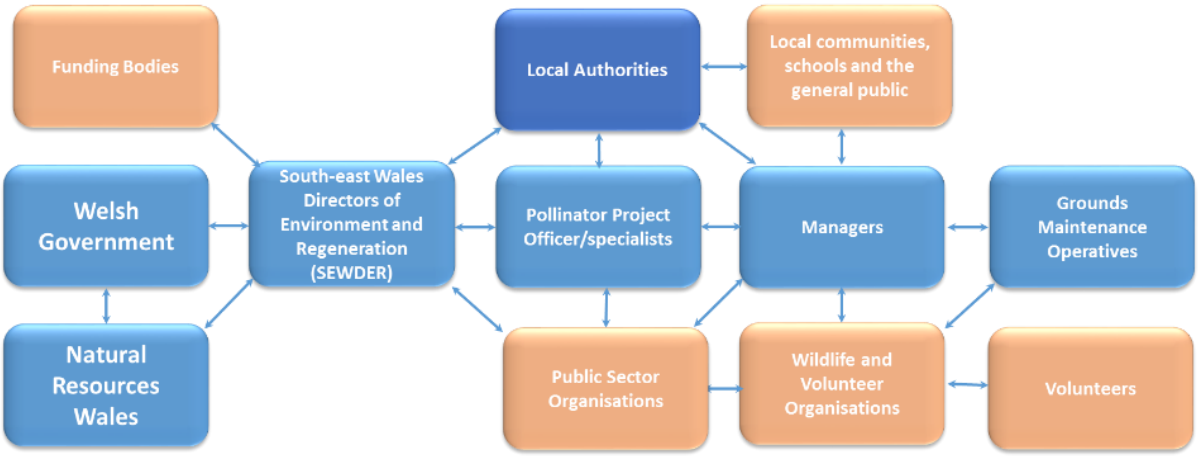


Figure 38 - Organogram of proposed structure for delivery of Green Infrastructure plan.

11.11 Costs

11.11.1 Individual action plans

The following table provides a broad estimation of costs which can be applied to each action plan. Costs will vary locally depending on scale, how staff time towards the project is costed and contractors and will be best assessed by local staff.

Where wild flowers are to be sown, seed of local origin should be preferentially sourced to maintain local genetic integrity, and from businesses which have adopted the Flora Locale and Plantlife's Code of Practice for supply of native wild flowers (specific guidance is available in the Flora Locale *Advisory Note Buying native flora* and in *Go native! Guidelines for planting projects* http://www.floralocale.org/; see also Plant Link and Invertebrate Link 2011).

Table 36 – Management actions and potential costs for guidance only. These have been taken from Sturgess Ecology (2012), TACP (2012) and a variety of online sources.

CODE	ACTION	COSTS AND SOURCES
G1	Reduce cutting frequency	Proportional savings
G2	Increase cut height	Neutral
G3	Introduce rotational mowing	Potentially neutral
G4	Stop cutting to allow natural colonisation	Neutral
G5	Remove cuttings from site and dispose of centrally or at an appropriate place on site.	Cut and remove £0.75-2.00/ m^2
G6	Cut grass in summer as a hay crop	Potential income from sale of hay
G7	Delay first cut until desired plants have flowered	Neutral
CR1	Rotavate and seed annual and perennial wildflower meadows without grass (e.g. Pictorial Meadows)	Annuals £110-£660/ha, perennial £500-1000/ha seed + capital costs
CR2	Create food growing opportunities to include raised beds, allotments, fruits trees and shrubs, etc.	Various

CR3	Strip topsoil prior to seeding with native mixes	Turf stripping £500/ha (Sturgess 2012)
CR4	Establish native wildflower-meadow (including grasses) from seed	£400-1000/ha seed + capital costs
CR5	Planting pollinator-friendly trees and shrubs	<1m = £7.50/ tree >1m = £23/ tree
AU1	Collect cut material from local meadow and spread on recipient site (Green Hay)	Cut and remove £0.75-2.00/ m²
AU2	Introduce yellow rattle to grass sward	£0.1/ m² if sowing 25 seeds/ m² (small quantities)
AU3	Plug plant selected wildflowers	£5/ m² planting 5 plants per m²
GR1	Introduce/allow grazing with cattle instead of sheep	Liaise with local graziers
GR2	Introduce/allow grazing with ponies instead of sheep	Liaise with local graziers
GR3	Create stock proof boundaries to eliminate grazing	Post and wire fence = £1.67/m (Sturgess 2012)
GR4	Allow seasonal grazing after summer hay cut	Neutral
SCR1	Flail cut every 2-3 years to maintain scrub cover	Typical costs of <25% scrub cover = £228/ha, 25-75% scrub cover = £376/ha and >75% scrub cover = £583/ha (Sturgess 2012) reduced proportionally by 2-3
SCR2	Selectively hand cut/strim to maintain individual areas at the desired height etc.	<25% scrub cover = £228/ha, 25-75% scrub cover = £376/ha, >75% scrub cover = £583/ha (Sturgess 2012)
SCR3	Introduce rotational cutting	<25% scrub cover = £228/ha, 25-75% scrub cover = £376/ha, >75% scrub cover = £583/ha (Sturgess 2012)
HDG1	Reduce hedge cutting frequency	£3.3/m/yr (Sturgess 2012) reduced proportionally
HDG2	Cut hedges later to allow flowering	Nil
HDG3	Implement rotational cutting on 3 year cycle (e.g. top one year, one side next year, other side third year)	£3.3/m/yr (Sturgess 2012) reduced proportionally by 2-3
HDG4	Remove hedge cuttings after cutting has taken place	Cut and remove £4-£5/m/yr
HDG5	Reduce cutting at base to encourage diverse ground flora, and remove cuttings	Neutral
HDG6	Infill 'gappy' hedges with pollinator-friendly species	£5/m (Sturgess 2012)
HDG7	Lay 'gappy' hedges	£10/m
FM1	Plant a range of bulbs suited to specific conditions	£5-10/ m² for bulbs planting at 10/ m²
FM2	Plant formal beds with a range of pollinator-friendly perennials and shrubs	£1-3/m² seed, £5/m² plugs 5 plants per m²
WD1	Thin out dense areas of woodland	£115/ha (Sturgess 2012)
WD2	Open up woodland edge	£115/ha (Sturgess 2012)
WD3	Plant or sow woodland edge species	£5/ m² plugs 5 plants per 1m²
WD4	Leave standing dead wood	Nil

11.11.2 Project staff

It is recommended that a central pollinator co-ordinator is employed or seconded collectively between the local authorities to drive delivery of the Action Plan. Ideally officers dedicated to the delivery of technical advice, community engagement and schools education and liaison would be engaged directly as part of the delivery process although it is acknowledged that these roles could be incorporated into existing roles.

To employ 4 project staff to deliver the action plan over 10 years is estimated to cost £1,200,000 including travel and office accommodation.

11.11.3 Equipment

Much of the existing Local Authority machinery should be suitable for use, but where there are new requirements such as collection of cuttings further equipment may be required. Specialist equipment such as small-scale seed harvesters or cuttings collectors may be needed for some sites.

The first step would be to audit the existing equipment that would be available within the Local Authority for what periods in relation to existing management requirements. Clearly the costs for any additional equipment would depend upon the appropriateness and capacity of the existing machinery/equipment to the proposed changes and the options for obtaining the relevant inputs at the correct times. Approximate costs of purchasing relevant agricultural machinery are as follows:

- Rotavators - £800-£3,500.
- Self-propelled cut-and-collect machinery - £7,000-£18,000.
- Tractor driven cut-and-collect machinery - £30,000-£40,000.
- Small-scale seed harvesters – less than £5,000.
- Stand-alone chipping machines - £11,000-£23,000.
- Tractor driven chipping machines - £7,000-£8,000.
- Small scale ploughs – less than £1,000.

It could be possible to reduce costs by sharing specialist equipment with neighbouring local authorities, wildlife trusts and other bodies. For example, seed harvesters could be used first in the lowlands in Monmouthshire, and then subsequently in the uplands of Torfaen where the seeds ripen later in the season. In addition, costs could be reduced by sub-contracting out relevant activities to specialist sub contractors.

11.11.4 Monitoring

To carry out the scientific monitoring programme across the study area including both professionals and volunteers as outlined in Section 8.3.1 is estimated to cost approximately £300,000 over 10 years.

These costings may need revising to ensure that the methods are compatible with and contribute to national monitoring programmes, such as those being developed for the English National Pollinator Strategy or by Natural Resources Wales, if and when they become available.

11.12 External funding sources

The following external funding sources could provide support for pollinator initiatives as identified above.

- European Union;
- European Union Life Fund;
- Heritage Lottery Fund and derivatives;
- Glastir;
- Natural Resources Wales;
- Rural Development Programme;
- Welsh Government Single Revenue Grant;
- Welsh Water for management of their infrastructure;
- Polli:nation (schools);
- The One Tree Per Child scheme (Schools);
- Grow Wild (Kew Gardens); and
- Supermarket funds such as Tesco and Sainsbury community funds.

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APPENDICES

Appendix 1 - Relevant national and local policies and strategies for pollinators

This review establishes a baseline for what is currently known about the provision for pollinators. It considers the existing situation regarding relevant national and local legislation and considers some available information that has been made available on maintenance practices already followed in the study area. It also looks at research into the impacts of numerous other factors on pollinator populations, and aims to draw conclusions from all of this to inform the Green Infrastructure Action Plan for Pollinators.

National Legislation and Policy

The Well-being of Future Generations (Wales) Act 2015

The key purposes of the Bill are to:

- set a framework within which specified Welsh public authorities will seek to ensure the needs of the present are met without compromising the ability of future generations to meet their own needs (the sustainable development principle);
- put into place well-being goals which those authorities are to seek to achieve in order to improve wellbeing both now and in the future;
- set out how those authorities are to show they are working towards the well-being goals;
- put Public Services Boards and local well-being plans on a statutory basis and, in doing so, simplify current requirements as regards integrated community planning; and
- establish a Future Generations Commissioner for Wales to be an advocate for future generations who will advise and support Welsh public authorities in carrying out their duties under the Bill.

There will be a need to provide evidence of how sustainable development has been considered in decision making processes and that prevention and long-term thinking have been a key part of the thought processes. This is where it is particularly relevant to pollinator provision as the need for action has become increasingly recognised. The act has added weight to supporting any interactions to ensure there is sufficient provision for them in future. It also ensures that measures taken, target and progress towards them are can be easily tracked, to help ensure their success.

Environment (Wales) Bill

The Environment (Wales) Bill was announced in early May 2015. It contains a proposal to produce a State of Natural Resources Report.

“Accurate data, evidence and information are crucial for the decisions we all make on a daily basis. We want an up to date and comprehensive evidence base to guide us to manage our natural resources in a more sustainable way...

…It will provide an assessment of the state of natural resources in relation to Wales and show the condition and extent of our natural resources, their ability to respond to the pressures they face and their capacity to adapt to climate change.”

It also places and enhanced duty on Public authorities (when compared to the NERC Act 2006) “We’re enhancing the current NERC duty to require all public authorities, when carrying out their functions in Wales, to seek to ‘maintain and enhance biodiversity’ where it is within the proper exercise of their functions. In doing so, public authorities must also seek to “promote the resilience of ecosystems”.

Welsh Government Pollinators Taskforce - Action plan for pollinators in Wales July 2013

In July 2013 the Welsh Government published its 'Action Plan for Pollinators in Wales'. This plan identifies areas where action is needed, its vision for pollinators in Wales and also lays out an 'Agenda for Action'. The four main outcomes identified are that:

- Wales has joined up policy, governance and a sound evidence base for action for pollinators
- Wales provides diverse and connected flower rich habitats to support our pollinators
- Wales' pollinator populations are healthy
- Wales' citizens are better informed and aware of the importance and management of pollinators.

In this document the Welsh Government recognised they need to work in partnership in order to halt the decline in pollinators. Of particular note it states that:

'Pollinators are recognised and managed for within policies and programmes within Welsh Government and across public, private and the third sector'

'It is also likely that future funding streams will be aimed at promotion of pollinators and supporting the Ecosystem approach' 'Review Local Authority management of roadside verges, parks and public green spaces'. 'Promote community led projects to benefit pollinators and local communities through current annual funding streams such as Tidy Towns and Tranquil, Cleaner and Greener Places, and with partners: Keep Wales Tidy, local authorities and communities'.

Development of the Action Plan also involved a number of roadside verge seminars exploring the issues around this key are of GI – the presentations from these are listed below:

- Clare Dainham - Roadside-verges
- Jane Rees - Roadside verge seminar with notes 2014
- John Hambrey - The management of roadside verges for Pollinators
- Shaun Russell - Ecosystem services of roadside verges
- Stuart Smith - The flora of roadside verges in Wales
- Mike Howe - Pollinator and road verges in Wales

These contain useful information regarding the issues around managing roadside verges and will feed into the specific proposals, via consultation with local authority maintenance staff and other consultees.

Natural Environment and Rural Communities Act 2006

The Natural Environment and Rural Communities Act 2006 Section 40(1) (the NERC Act) places a duty on all public authorities to, in exercising their functions, 'have regard, so far as is consistent with the proper exercise of those functions, to the purpose of conserving biodiversity'. Local authorities are a key target of the Act, but other public bodies such as fire, police, health and transport authorities etc. are also included. Section 42 also requires the National Assembly for Wales in consultation with Natural Resources Wales to publish, review, revise and act on lists of organisms of principal importance in Wales. Compliance with this Act requires the Welsh Government to 'further the conservation' of species and habitats on this list.'

Forthcoming Wales Nature Recovery Plan

The forthcoming Nature Recovery Plan for Wales will set out the ambition, the goals and actions to reverse the decline of biodiversity in Wales within an integrated approach to natural resource management and to fulfil international commitments under the Convention on Biological Diversity by 2020. The consultations carried out in 2015 are being considered.

TAN 5

Technical Advice Note (TAN) 5 provides advice about how the land use planning system should contribute to protecting and enhancing biodiversity and geological conservation. The TAN provides advice for local planning authorities on:

- the key principles of positive planning for nature conservation;
- nature conservation and Local Development Plans;
- nature conservation in development management procedures;
- development affecting protected internationally and nationally designated sites and habitats; and
- development affecting protected and priority habitats and species.

TAN 16

Technical Advice Note (TAN) 16 provides advice on the role of the planning system in making provision for sport and recreational facilities and informal open spaces, as well as protecting existing facilities and open spaces in urban and rural areas in Wales. Provisions for pollinators should complement other functions of open space.

Local Authority Legislation and Policy

LBAPs

Local Biodiversity Action Plans (LBAPs) are the mechanism for the local delivery of the targets set out in the UKBAP. LBAPs identify local priorities for the conservation of species and habitats and have been developed throughout Britain by partnerships of local stakeholders. Each LBAP reflects the priorities of the UKBAP National Plan, covering priority habitats and species that are at risk or whose status are uncertain, as well as more widespread habitats and species of local concern.

While the LBAPs for the four authorities differ in terms of exact content, level of detail and when they were produced (March 2003 – March 2010), they all contain the same required information, listing both local priority species and priority habitats, and set out action plans for these. As part of this review the priority species for all four were considered with special attention given to any that carry out important pollination roles.

The following species of potential pollinator significance have been identified through the LBAPs as priority species, by the former Gwent area Local Authorities. The lists below do not include other LBAP priority species, and it should be noted that each of the four authorities has taken a different approach to preparing their LBAPs, hence the variation in species listed, e.g. Monmouthshire has focussed far more on priority habitats rather than individual species.

- Blaenau Gwent:
    - Moths
        - Grey mountain carpet (Entephria caesiata)
        - The Silurian (Eriopygodes imbecilia)

        - Double line (Mythimna turca)
        - Grey scalloped bar (Dyscia fagaria)
        - Heath rustic (Xestia agathina)
        - Large ear (Amphipoea lucens)
        - Northern rustic (Standfussiana lucernea)
        - Red sword-grass (Xylena vetusta)
        - Scarce silver-lines (Bena bicolorana)
        - Neglected rustic (Xestia castanea)
        - Wormwood (Cucullia absinthii)
    - Butterflies
        - Dark skipper (Erynnis tages)
- Caerphilly:
    - Butterflies and Moths
        - Bordered Gothic moth
        - Buttoned Snout moth
        - Double Line moth
        - High Brown Fritillary
        - Marsh Fritillary
        - Other Moths (various species)
        - Pearl-Bordered Fritillary
        - Waved Carpet moth
- Monmouthshire:
    - Silver Washed Fritillary
- Torfaen:
    - Dark Green Fritillary
    - Long Horn beetles
    - Small Pearl Bordered Fritillary

LDPs

A Local Development Plan (LDP) guides the future development of an area. The LDP provides a clear vision for how new development can address the challenges faced by the County and where, when and how much new development can take place.

LDPs have been reviewed from the four local authorities in the study area, to identify key parts of the document and policies that are relevant to producing the Green Infrastructure Action Plan for Pollinators. Individual policies that have particular relevance will be referenced in the action plan itself.

Blaenau Gwent County Borough Council LDP 2012

The following policies; allocations and designations have been identified from Blaenau-Gwent's LDP as being relevant to GI for Pollinators (only the relevant parts are quoted below):

SP10 Protection and Enhancement of the Natural Environment

Blaenau Gwent's unique, natural environment and designated landscape will be protected, and, where appropriate, enhanced. This will be achieved through (In particular):

c. Ensuring that the locally identified Site of Importance for Nature Conservation (SINC) and Local Biodiversity Action Plan (LBAP) species are protected and enhanced; Protecting those

attributes and features which make a significant contribution to the character, quality and amenity of the landscape;

d. Maintaining and enhancing the Green Infrastructure including creating a network of local wildlife sites and wildlife corridors, links and stepping stones;
e. Ensuring development seeks to produce a net gain in nature conservation by designing in wildlife, and ensuring any avoidable impacts are appropriately mitigated for;

DM1 New Development

Development proposals will be permitted provided:

1) Sustainable Design
    e. The proposal reduces surface water run off through minimising an increase in impermeable surfaces and using Sustainable Drainage systems, where appropriate; and (opportunity for improving pollinator provision through sensitive planting of SUDS systems)
    f. The proposal does not result in a net loss of biodiversity and provides where necessary mitigation and/or compensation measures.

DM3 Infrastructure Provision

Is there potential for links to CIL and Planning Obligations

DM12 Provision of Outdoor Sport and Play Facilities

Potential to include provision for pollinators, both in terms of physical provision and by increasing awareness)

DM13 Protection of Open Space

Development proposals which affect existing Open Space will only be permitted where it can be demonstrated that:

a. The site has no significant amenity, nature conservation or recreational value and; (including as a pollinators resource)
b. The loss can be replaced with an equivalent or greater provision in the immediate locality; or (opportunity to enhance provision)

DM14 Biodiversity Protection and Enhancement

2) Development proposals will only be permitted within, or in close proximity to sites designated as Sites of Importance for Nature Conservation (SINCs), and Local Nature Reserves (LNRs), or that affect ecological corridors and Priority Habitats and Species, where either:
    a. It maintains or enhances the ecological or geological importance of the designation and species, or;
    b. The need for the development outweighs the nature conservation importance of the site/ species and it can be demonstrated that the development cannot reasonably be located elsewhere and compensatory provision will be made equivalent to that lost as a result of the development.

DM15 Protection and Enhancement of the Green Infrastructure

1) Development proposals will be permitted provided there is no loss in connectivity within the Strategic Green Infrastructure network which comprises:
    a. River Corridors
    b. Special Landscape Areas

2) Where appropriate, they facilitate connections to Strategic and Local Green Infrastructure; and
3) Where appropriate, they create natural open space and features to enhance linkages between the Green Infrastructure.

DM16 Trees, Woodland and Hedgerow Protection

Development proposals will be permitted provided there would not be unacceptable harm to trees, woodlands and hedgerows that have natural heritage value or contribute to the character or amenity of a particular locality (Hedgerows in particular can be of particular value to pollinators and this should be considered, especially if they have added connectivity value).

All have Potential to seek pollinator provision as part of the scheme:

- T1 Cycle Routes
- T3 Safeguarding of Disused Railway Infrastructure
- T5 New Roads to Facilitate Development
- T6 Regeneration Led Highway Improvements
- CF1 Community Centre
- TM1 Tourism and Leisure
- L1 Formal Leisure Facilities
- ENV2 Special Landscape Areas
    - Within these areas a different approach may be required to ensure that pollinator provision is still in keeping with the designation
- ENV3 Sites of Importance for Nature Conservation
    - Again, a more site specific approach may be required to ensure that proposals are in keeping with the designation
- ENV4 Land Reclamation Schemes
    - There is great scope within the areas identified for pollinator provision as part of reclamation schemes, often on a large scale
- ENV5 Cemeteries
    - Through sensitive management, and especially where the three extensions are proposed, cemeteries have the potential to become important pollinator resources, while potentially enhancing their cultural appeal at the same time

Caerphilly County Borough Council LDP (2010)

The following policies; allocations and designations have been identified from Caerphilly's LDP as being relevant to GI for Pollinators (only the relevant parts are quoted below):

The Eight Key Components of the Strategy

7) Ensure development provides the necessary community facilities
    - Provision and management of well-designed open space and appropriate play facilities, providing a diverse network of parks, informal and formal recreation areas and children's play areas across the County Borough. Scope for all this to include pollinator provision if "well designed")
8) Reduce the impact of development upon the countryside
    - Scope for all this to include pollinator provision if "well designed". Also covers SLAs, SINCs and VILL and makes commitment to the Valleys Regional Park)

Strategy Policies

New development in these areas brings opportunity to ensure it is pollinator friendly:

- SP1 Development Strategy in the HOV Regeneration Area
- SP2 Development Strategy in the Northern Connections Corridor
- SP3 Development Strategy in the Southern Connections Corridor
- SP6 Place Making
    - "…full regard to the context of the local natural …environment … " and "The promotion of good design, … the enhancement of natural heritage will contribute to developments that encourage a sense of place and identity, whilst reflecting local distinctiveness"
- SP10 Conservation of Natural Heritage
    - The Council will protect, conserve, enhance and manage the natural heritage of the County Borough in the consideration of all development proposals within both the rural and built environment
- SP12 Development of the Valleys Regional Park
    - Development proposals that contribute to the Valleys Regional Park will be permitted provided that there is no adverse impact on areas of recognised environmental or landscape importance
- SP18 Protection of Strategic Leisure Network
- SP19 Transport Infrastructure Improvement

County Wide Policies

- CW4 Natural Heritage Protection
    - refers to developments in or near designated landscapes, but contain commitment to" Conserve and where appropriate enhance the ecological … importance" and for mitigation and offsetting where required – could include pollinator provision)
- CW6 Trees, Woodlands and Hedgerow Protection
    - Developments only permitted where:
        - C Development proposals have made all reasonable efforts to retain, protect and integrate trees, woodlands or hedgerows within the development site.
        - D Where trees, woodlands or hedgerows are removed, suitable replacements are provided where appropriate.
- CW10 Leisure and Open Space Provision
    - All new housing sites capable of accommodating 10 or more dwellings or exceeding 0.3ha in gross site area will be required to make adequate provision for:

- A Well designed useable open space as an integral part of the development; and
- B Appropriate formal children's play facilities either on or off site and
- C Adequate outdoor sport provision either on or off site

Need to consider that a different approach may be required in such areas – policies could back this up

- NH1 Special Landscape Areas (SLAs)
- NH2 Visually Important Local Landscapes (VILLs)
- NH3 Sites of Importance for Nature Conservation (SINCs)

All the development opportunities identified here, across the county borough have GI aspects and the potential for pollinator opportunities to be built into them, in many cases increasing connectivity and total resource.

- LE1 Protection of Formal Open Spaces
- LE2 Allocation of Country Parks
- LE3 Protection of Country Parks
- LE4 Formal Leisure Facilities
- LE5 Protection of Informal Open Spaces
- TR1 Cycle Routes
- TR1 Cycle Routes
- TR3 New Rail Stations
- TR7 New Roads to Facilitate Development

Monmouthshire County Council LDP (2011-2021)

The following policies; allocations and designations have been identified from Monmouthshire's LDP as being relevant to GI for Pollinators (only the relevant parts are quoted below):

The Monmouthshire LDP Vision states that 'by 2021 Monmouthshire will be a place where':

1) People live in more inclusive, cohesive, prosperous and vibrant communities, both urban and rural, where there is better access to local services, facilities and employment opportunities.
2) The distinctive character of its built heritage, countryside and environmental assets has been protected and enhanced.
3) People enjoy more sustainable lifestyles that give them opportunities for healthy activity, reduced reliance on the private motor car and minimised impact on the global environment.

Policy S5 – Community and Recreation Facilities

Development proposals that provide and/or enhance community and recreation facilities will be permitted within or adjoining town and village development boundaries subject to detailed planning considerations. Development proposals that result in the unjustified loss of community and recreation facilities will not be permitted.

Policy S7 – Infrastructure Provision

Planning Obligations may be sought to secure improvements in infrastructure, facilities, services and related works, where they are necessary to make development acceptable…

Such obligations may include:

3) Formal and informal open space
4) Recreation and leisure facilities
5) Green infrastructure
6) Ecological mitigation
12) Local climate change mitigation and adaptation measures

Monmouthshire specifically includes GI within this. Other potential pollinator opportunities also shown

Policy S13 – Landscape, Green Infrastructure and the Natural Environment.

Development proposals must:

1) Maintain the character and quality of the landscape by:
    - identifying, protecting and, where appropriate, enhancing the distinctive landscape and historical, cultural, ecological and geological heritage, including natural and man-made elements associated with existing landscape character;
    - protecting areas subject to international and national landscape designations;
    - preserving local distinctiveness, sense of place and setting;
    - respecting and conserving specific landscape features, such as hedges, trees and ponds;
    - protecting existing key landscape views and vistas.
2) Maintain, protect and enhance the integrity and connectivity of Monmouthshire's green infrastructure network.

3) Protect, positively manage and enhance biodiversity and geological interests, including designated and non-designated sites, and habitats and species of importance and the ecological connectivity between them.
4) Seek to integrate landscape elements, green infrastructure, biodiversity features and ecological connectivity features, to create multifunctional, interconnected spaces that offer opportunities for recreation and healthy activities such as walking and cycling.
    - this is probably the most significant Strategic policy in terms of GI for Pollinators with respect to new developments)

S13 covers the following relevant Development Management Policies:

- LC1 New Built Development in the Open Countryside
- LC2 Blaenavon Industrial Landscape World Heritage Site
- LC3 Brecon Beacons National Park
- LC4 Wye Valley AONB
- LC5 Protection and Enhancement of Landscape Character
- LC6 Green Wedges
- GI1 Green Infrastructure
    - Development proposals will be expected to maintain, protect and enhance Monmouthshire's diverse green infrastructure network by:
        a) Ensuring that individual green assets are retained wherever possible and integrated into new development. Where loss of green infrastructure is unavoidable in order to secure sustainable development appropriate mitigation and/or compensation of the lost assets will be required;
        b) Incorporating new and /or enhanced green infrastructure of an appropriate type, standard and size. Where on-site provision of green infrastructure is not possible, contributions will be sought to make appropriate provision for green infrastructure off-site.
- NE1 Nature Conservation and Development
- EP1 Amenity and Environmental Protection
    - Development, including proposals for new buildings, extensions to existing buildings and advertisements, should have regard to the privacy, amenity and health of occupiers of neighbouring properties.
    - Development proposals that would cause or result in an unacceptable risk /harm to local amenity, health, the character /quality of the countryside or interests of nature conservation, landscape or built heritage importance due to the following will not be permitted, unless it can be demonstrated that measures can be taken to overcome any significant risk: (provides a degree of protection to existing resources)

Policy S17 – Place Making and Design

Development shall contribute to creating high quality, attractive and sustainable places. All development proposals must include and promote high quality, sustainable inclusive design which respects local distinctiveness, respects the character of the site and its surrounding in order to protect and enhance the natural, historic and built environments and to create attractive, safe and accessible places.

S17 covers the following relevant Development Management Policies:

- DES1 – General Design Considerations

j. Achieve a climate responsive and resource efficient design. Consideration should be given to location, orientation, density, layout, built form and landscaping and to energy efficiency and the use of renewable energy, including materials and technology;

- DES2 – Areas of Amenity Importance
  - Development proposals on areas of amenity importance will only be permitted if there is no unacceptable adverse effect on any of the following:
    a) the visual and environmental amenity of the area, including important strategic gaps, vistas, frontages and open spaces;
    b) the relationship of the area of amenity importance to adjacent or linked areas of green infrastructure in terms of its contribution to the character of the locality and / or its ability to relieve the monotony of the built form;
    e) the nature conservation interest of the area, through damage to, or the loss of, important

Policy HE1 – Development in Conservation Areas

Within Conservation Areas, development proposals should, where appropriate, have regard to the Conservation Area Appraisal for that area…

Where development is acceptable in principle it should complement or reflect the architectural qualities of adjoining and other nearby buildings (unless these are harmful to the character and appearance of the area) in terms of its profile, silhouette, detailing and materials. However, good modern design may be acceptable, particularly where new compositions and points of interest are created. (This final point may be particularly relevant, and could be interpreted to mean that appropriate pollinator provision could help a development acceptable when it might otherwise not).

Policy MV3 – Public Rights of Way

Development that would obstruct or adversely affect a public right of way will not be permitted unless satisfactory provision is made which maintains the convenience, safety and visual amenity offered by the original right of way and this will be reflected in the layout and conditions / obligations on any permission granted.

Proposals to improve or create public rights of way will be permitted where they add to the utility and enjoyment of the network, including providing missing links in otherwise continuous routes, upgrading paths to bridleways or enhancing the green infrastructure network, provided they give rise to no unacceptable amenity or environmental impacts and comply with legislative requirements. Such proposals should be designed with the convenience, safety and visual amenity of users in mind and should also take into account the needs of those with limited mobility, the impact on the adjoining rights of way network and connectivity of that network. (Such new routes provide opportunities for pollinator provision).

Policy MV4 – Cycleways

New cycleways will be permitted where they provide improved opportunities for sustainable travel or recreational cycling, subject to no adverse impact on pedestrian / cyclist safety and subject to detailed planning considerations. In addition, where appropriate, cycleways should provide for the needs of walkers, horse riders and those with limited mobility.

Development that would obstruct or adversely affect a cycleway will not be permitted. (Such new routes provide opportunities for pollinator provision).

Torfaen County Borough Council LDP (2013)

The following policies; allocations and designations have been identified from Torfaen's LDP as being relevant to GI for Pollinators (only the relevant parts are quoted below):

The Vision Statement

At the eastern edge of the South Wales valleys, Torfaen will be part of a Networked City Region supporting thriving communities and a diverse economy in an outstanding historical, cultural and natural environment.

Strategy Policies

- S2 Sustainable Development
    - Development proposals will need to demonstrate they have taken account of the following principles and where relevant that they: -
        c) Conserve and enhance the natural and built environment
- S3 Climate Change
    - Development proposals shall seek to mitigate the causes of further climate change and adapt to the current and future effects of climate change; and will be supported where they demonstrate consideration of the following hierarchy of criteria (where appropriate):
        b) Achieving Sustainable Design to ensure residual energy requirements are minimised through: -
            ii. Reducing surface water run-off and flood risk through the use of Sustainable Urban Drainage Schemes (SUDS) unless it is shown that these measures are uneconomic or impractical; (Pollinator opportunities as part of many SUDS schemes).
            iv. Exploring opportunities to maintain habitat connectivity through the provision of green infrastructure in design;
- S4 Place Making / Good Design
    - Proposals for all new development must have full regard to the context of the local natural and built environment and its special features through: -
        b) Delivering a mix of uses to complement existing facilities and aim to address local deficiencies;
- S7 Conservation of the Natural and Historic Environment
    - Development proposals should seek to ensure the conservation and enhancement of the Natural, Built & Historic Environment of Torfaen, in particular: -
        a) Biodiversity resources; (very clear link to pollinators here: Note 'enhancement' not merely conservation).
- S8 Planning Obligations
    - Planning obligations will be required on development proposals through S106 legal agreements where they are necessary to address the impacts of development and to make the proposal acceptable in land use planning terms. Based on evidence of local need and / or generation of need by the proposal, taking into account site specific circumstances, viability and LDP Objectives, planning obligations will be specifically targeted to achieve the key priorities of:
        b) Open space, children's play spaces and formal outdoor recreation facilities;
        c) Investment in educational provision;
        d) Highways and transport infrastructure management and improvements (including walking and cycling infrastructure and public transport facilities and services); and

e) Maintenance and enhancement of the environment, historic assets and biodiversity networks and resources. (Very clear opportunity for the potential to support Pollinator schemes,).

Borough Wide Policy

- BW1 General Policy - Development Proposals
  - All development proposals will be considered favourably providing they comply with the following criteria where they are applicable: -
    - a) Amenity and Design
      - iv. The proposal includes a landscaping and planting scheme, which enhances the site and the wider context including green infrastructure and biodiversity networks and allows it to adapt to climate change;
    - b) Natural Environment
      - iv. The proposal contributes to the conservation and/or enhancement of the strategic biodiversity network of Torfaen and does not result in a significant adverse effect on the network;
      - v. The proposal does not result in the unacceptable loss or harm to features of landscape importance including trees and woodland that have natural heritage or amenity value;

Community Facilities

- CF4 Protection of Important Urban Open Space (potential to require pollinator provision as part of developments granted consent).
- CF5 Protection of Allotments and Recreation & Amenity Open Space (potential to require pollinator provision as part of any mitigation for developments granted consent).

Countryside

- C1 Green Wedges (potential to require pollinator provision as part of measures to help minimise visual intrusion).
- C2 Special Landscape Areas
  - Proposals that could impact on these designations will be expected to conform to high standards of design and environmental protection which is appropriate to the LANDMAP character of the area.

Biodiversity/Geodiversity

- BG1 Locally Designated Sites for Biodiversity and Geodiversity
  - Development proposals will not be permitted where they would cause significant adverse effects to local nature conservation designated sites (including the features of a Site of Importance for Nature Conservation, Local Nature Reserves, or Regionally Important Geological Sites unless it can be demonstrated that:
    - b) Adequate mitigatory and / or compensatory provision is made proportionate to; or an enhancement to the value of the ecological resources or geological site lost.

SPG

Across the four local authorities a number of Supplementary Planning Guidance documents exist to guide developers and local authority staff in terms of good practice and to assist in the decision making process regarding whether or not to permit development.

Of those, the following documents have been selected as relevant to pollinators and as such have been included in this review:

SPG-Annex-5-Ecology-and-Biodiversity (Torfaen CBC)

This document largely deals with situations where obligations are placed on developers as part of the planning process, requiring them to also undertake other works to enhance ecology and biodiversity as condition of being granted their permission. The SPG sets out details of this process and how it works.

SPG-Annex-6-Recreation-and-Public-Open-Space (Torfaen CBC)

Similarly this document details how provision for recreation and public open space can be required as part of new developments. It does not refer specifically to pollinator provision, but it refers to measures which would provide or preserve some pollinator resources.

Green Infrastructure SPG April-2015 (Monmouthshire CC)

Monmouthshire has already published comprehensive Supplementary Planning Guidance on Green Infrastructure, clearly defining the terms and their relationship to concepts such as ecosystem services, connectivity and the benefits it can bring. It links to other policies and suggests how developers can incorporate a Green Infrastructure based approach into their proposals.

Single Integrated Plans

In 2012 the Welsh Government challenged local authority areas across Wales to develop a Single Integrated Plan (SIP) and streamline their partnership arrangements by April 2013. The SIP was developed as a means of stripping away complexity and streamlining local leadership and decision-making. Guidance stated that a Single Integrated Plan should replace at least four of the existing statutory plans and strategies (the Community Strategy, the Children and Young People's Plan, the Health, Social Care and Well-being Strategy and the Community Safety Partnership Plan (which incorporates the 3 crime and disorder strategies)), thereby reducing complexity and duplication, and freeing up resources.

Making a difference Blaenau Gwent's SIP (2013 – 2017)

BGCBC's SIP sets out the following five themes for their plan, each with their own respective priorities.

- Thriving Communities
- Learning Communities
- Healthy Communities
- Fair and Safe Communities
- Vibrant Communities

Vibrant Communities, covers 'Housing; Built and Natural Environment; and Access and Transport', so in its current form this is the only real opportunity to bring in any commitments on behalf of Pollinators. This section states: "Issues such as housing and transport, as well as the look and feel of an area, are highlighted as things that make somewhere a good place to live". It contains a commitment to protect and where possible enhance the natural environment through:

- Protecting national and locally designated sites.
- Maintaining a green infrastructure network.
- Ensuring development sites produce a net gain.
- Identifying new Local Nature Reserves and managing existing sites.

- Continuing to implement the River Rangers project.

There are also commitments to improve town centres through 'environmental schemes'; extend the community cycle network; to increase connectivity through improving road links; and to prepare "a new Regeneration Strategy establishing Blaenau Gwent as a good place to live, work and visit, focussing on people and place."

Caerphilly Delivers Single Integrated Plan (2013 – 2017)

Caerphilly's SIP sets out a vision for sustainable communities, with "people who: …Live work or visit in a greener living environment" and identifies five key outcomes, one of which is a "Greener Caerphilly". It aims to Safeguard and, where necessary, enhance the living environment in the Caerphilly county borough for its own sake and secure quality of life for local people and visitors now and in the future. To achieve this the following priority areas have been identified:

- G1 - Improve local environmental quality.
    - Has specific headings of fly-tipping and biodiversity, and references to the LBAP as well as committing to monitoring key species and habitats. No specific mention of pollinators, but they do fall within this area.
- G2 - Reduce the causes of and adapt to the effects of climate change.
    - mainly focuses on renewable energy and recycling, but does also covers 'ecological footprint' and 'Eco-Schools', both of which have the potential to be used to support pollinator Initiatives.
- G3 - Maximise the use of the environment for health benefits.

Monmouthshire Single Integrated Plan (2013-2017)

Monmouthshire's vision has three themes, 'Nobody is Left Behind; People Are Confident, Capable and Involved; and Our County Thrives'. The final one includes a strand entitled 'People protect and enhance the environment.

Box entitled 'How can you make a difference?' which has several suggestions (not pollinator specific) but also links to MonmouthpeiA – which could potentially be used as a publicity tool for pollinators initiatives.

The SIP also contains a commitment to "deliver a range of activities and interventions that are well evidenced and reflect the needs of the community.

- Climate Change Adaption
- Community Climate Champions
- Monmouthshire Adult Community Education Gardening Schemes"

The final point here suggests an interesting opportunity that could be particularly relevant.

Torfaen Together Single Integrated Plan (2013 – 2023)

Torfaen's vision sets seven outcomes, including:

6) People in Torfaen live in clean, green, sustainable communities

The plan recognises the importance of the natural environment and its contribution to the health and wellbeing of communities. The specific activities mentioned largely focus on renewable energy,

emissions, waste and fly-tipping, but there is also a commitment to "Take action to increase the amount of land managed in a way to improve Biodiversity"

It is worth noting that while the other three authorities have produced four year plans, Torfaen's SIP covers a ten year period.

Other Policies and documents

A number of other documents, policies and studies have been produced by or on behalf of the local authorities in the study area that are relevant to the development of a Green Infrastructure Action Plan for Pollinators.

Monmouthshire Pollinator Policy

In March 2014 Monmouthshire CC adopted an official Pollinator Policy which recognises the need for action and sets out the authority's commitment to making changes to their "planting and grass cutting regimes around roadside verges, amenity space, cemeteries and flower beds". It makes clear commitments to reduce cutting regimes, identify areas for new pollinator provision and monitor progress of the measures taken. Further details can be found in Appendix 7.

All Ireland pollinator action plan

The All-Ireland Pollinator Plan 2015-2020 (www.biodiversityireland.ie/pollinator-plan) identified 81 voluntary actions across five key objectives:

1) Making Ireland pollinator friendly (farmland, public land and private land);
2) Raising awareness of pollinators and how to protect them;
3) Managed pollinators – supporting beekeepers and growers;
4) Expanding knowledge on pollinators and pollination service; and
5) Collecting evidence to track change and measure success.

Responsibility for delivering the 81 actions on farmland, public land and private land shared out between 68 organisations.

USA pollinator strategy

A national strategy to promote the health of honey bees and other pollinators was put forward in May 2015 to promote the health of honey bees and other managed bees, wild bees, butterflies and other pollinating insects, and birds and bats in the USA. One key item was the inclusion of pollinator-friendly landscaping at Federal facilities.

There were three overarching goals for action by Federal departments and agencies in collaboration with public and private partners were to:

1. Reduce honey bee colony losses during winter to no more than 15% within 10 years.

2. Increase the Eastern population of the monarch butterfly to 225 million butterflies in the overwintering grounds in Mexico by 2020.

3. Restore or enhance 7 million acres of land for pollinators over the next 5 years through Federal actions and public-private partnerships.

To achieve these goals, the Task Force developed a series of action plans and resources.

https://www.whitehouse.gov/sites/default/files/microsites/ostp/Pollinator%20Health%20Strategy%202015.pdf

Appendix 2 - Potential impacts of climate change on pollinators

To predict how pollinators in South-east Wales uplands might respond to climate change, the climate change predictions have been taken from the UK Climate Projections (UKCP09) as summarized by the Welsh Government using the medium carbon dioxide emissions scenarios. Compared to the 1961-1990 baseline, the climate is expected to become warmer and wetter in winter, and warmer and dryer in summer over the next 60 years).

Table 37 - Climate predictions for Wales (UKCP09; accessed May 2015)

Climatic variable	2020s	2050s	2080s
Mean annual temperature change	+ 1.3°C	+ 2.3°C	+ 3.3°C
Maximum annual temperature change	+ 1.6°C	+ 2.7°C	+ 3.8°C
Mean winter rainfall (% change)	+ 7%	+ 14%	+ 19%
Mean summer rainfall (% change)	- 6%	- 17%	- 20%

http://wales.gov.uk/topics/ environmentcountryside/climatechange/preparing/impacts/projections/?lang=en

Impacts on pollinators from climate change

From the predictions, the potentially most significant impacts on pollinators from climate change include (http://gov.wales/topics/environmentcountryside/climatechange/publications/ riskassess/?lang=en):

Changes in biodiversity due to warmer, drier summers

The native species composition is likely to change in response to the climate. For example, species adapted to warmer climates may increase in abundance as the climate warms whilst species adapted to colder climates may decrease or disappear.

Overall, the change in species composition may result in little overall change in pollinator services in terms of both wild plants and pollinators, provided plants and animals can migrate from areas with warmer climates. Many pollinator insects will be more mobile than plants, potentially resulting in an initial relative increase in pollinators. In the absence of migration of both plants and insects, there may be lower overall diversity of nectar and pollen provisioning by plants, with potentially lower pollinator services.

Seasonal changes

Availability of pollen and nectar at times of year may change, resulting in loss of synchronization between plants and their pollinators. For example, the recent run of warm mild autumns has resulted in many plants flowering at New Year (http://www.bbc.co.uk/news/science-environment-30754443), when there are few or no pollinators. Similarly, the warm springs mean some insects may be out looking for early nectar before most plants have come into flower, which may result in loss of early colonies.

As pollinators tend not to be active in rainy weather, an increase in dryer days may increase the total pollination activity resulting in higher reproductive output in both plants and insects.

Summer droughts may reduce flowering in dry-land species, resulting in fewer flowers to feed from in mid-summer.

Changes in landscape due to warmer, drier summers

The landscape may change through agriculture as crops better suited to warmer climates are grown, giving widespread changes. For example on the better lowland soils the crop types may change from permanent pastures to annual crops such as sunflowers and maize, or even vines and artichokes may be grown on gentle south-facing slopes.

Changes may have benefits as well as adverse effects on pollinators, depending on the crops. For example, new insect-pollinated crops such as sunflowers may provide a greater feeding opportunity for pollinators than traditional crops, as well as increasing the need for pollinators. Conversely, changing from improved permanent pasture to wheat is unlikely to have any benefit as neither crop requires pollinators, and indeed pesticide applications to wheat may also indirectly affect the wider insect community including pollinators.

Increases in alien and invasive species

Alien plants and insects may spread and compete with the native species, though this may not necessarily result in less pollinator services if the new alien insects are adapted to pollinating crops and wild flowers. Native pollinators will utilise both native and alien plants.

Alien plants currently limited by climate may spread and compete with native plants. For example, three-cornered leak (*Allium triquetrum*) is a garden plant now widely established in the countryside. In South-west Britain where the winters are mild it can rapidly spread and become dominant, forcing out native plants, as has happened widely in coastal areas of Cornwall and parts of Pembrokeshire. As the climate becomes milder in winter, this plant could become much more frequent further inland resulting in less habitat for more diverse communities which provide a greater range of opportunities for pollinators, though it does provide relatively early nectar itself. Similarly, the abundance of Himalayan Balsam away from riverbanks may become less prominent in dry summers, as it is an annual species which requires damp soils – this currently provides a very good nectar source of insects.

Increases in the risk of pests and diseases affecting pollinators and plants

Plants and pollinators already suffer from a range of introduced pests and diseases such as ash die back (*Hymenoscyphus fraxineus* (=*Chalara fraxinea*) introduced 2012) or verroa mite (*V. destructor* introduced to UK 1992). As the climate changes other pest and diseases may spread naturally or be accidentally brought by man, which may significantly affect individual species. It is hard to predict if the rates of introduction and spread of pests and diseases will change due to climate warming.

Ways to mitigate the effects of climate change

Maintaining genetic variation

Genetic variation is the fundamental unit on which natural selection works, so genetically variable species are more likely to be able to adapt and respond to climate change and other stresses than genetically depauperate species. The maintenance of genetic diversity through having large viable, reproducing populations of pollinators and their food plants with regular gene exchange will help to provide resilience against climate change. However, not every species will be able to adapt.

Maintaining viable pollinator populations will need to include enhanced quantities of resources (i.e. more food) as well as a diverse range of food plants (i.e. a varied diet). Utilisation of diverse resources has been linked to enhanced resistance to other stresses such as pollution and disease.

Ensuring migration at landscape scale

Maintaining or re-establishing connectivity in the landscape may help some pollinators and their food plants to migrate along suitable corridors or across 'stepping stone' patches of habitat to colonise new sites, as well as maintaining gene flow. The maintenance of a networks of SSSIs and SINCs and other semi-natural land cover will contribute towards this connectivity, as well as the pollinators green infrastructure allowing gene flow and migration to provide a buffer against major changes at landscape scales, or even a rapid response to utilise new resources.

Seasonal change

An increased seasonal mismatch between pollinators and normal flowering times of the plants they feed on due to climate change may be partly mitigated by using bulbs to ensure pollen and nectar are available early in the year. Flowering time in most plants is usually controlled by a combination of day length and temperature, but flowering time in most spring-flowering bulbs is usually controlled by accumulated winter temperature, thus they respond to warmer springs by flowering earlier. Different bulbs supply different amounts of pollen and nectar; for example, snowdrops and crocuses are reputed to provide lots of early nectar and pollen for bees, whilst daffodils in particular have been selectively bred to appeal to humans, rather than pollinators, and only produce a little nectar. However, not all pollinators visit bulbs.

Given that many plants show adaptation to local seasonal conditions (provenance), planting genotypes now that are adapted to future conditions would ensure they continue to flower in synchronicity with pollinators. However, there is probably insufficient research to make this practical except for a few forestry trees.

Appendix 3 – Section 42 Pollinators and pollination method of trees

Section 42 pollinator species

Table 38 – Section 42 species which are pollinators

Section 42 species	Major pollinator group
Acronicta psi Grey dagger Bidog llwyd	moth
Acronicta rumicis Knot grass Bidog y tafol	moth
Adscita statices The forester Coediwr	moth
Agrochola helvola Flounced chestnut Castan Grech	moth
Agrochola litura Brown-spot pinion Castan smotyn brown	moth
Agrochola lychnidis Beaded chestnut Castan leiniog	moth
Allophyes oxyacanthae Green Brindled crescent Cilgant brych	moth
Amphipoea oculea Ear moth Clustwyfyn llygeidiog	moth
Amphipyra tragopoginis Mouse moth Ôl-adain lyglwyd	moth
Anania funebris A Pyralid moth Gwyfyn o deulu'r Pyralidiau	moth
Andrena tarsata A mining bee (yn GyrA) Gwenynen durio	bee
Apamea anceps Large nutmeg Brithyn ocraidd	moth
Apamea remissa Dusky brocade Brithyn llwydolau	moth
Aporophyla lutulenta Deep-brown dart Gwladwr brownddu	moth
Arctia caja Garden tiger Teigr yr ardd	moth
Argynnis adippe High brown fritillary Britheg frown	butterfly
Asteroscopus sphinx The sprawler Cwcwll bwaog	moth
Atethmia centrago Centre-barred sallow Melyn yr onnen	moth
Blepharita adusta Dark brocade Pali tywyll	moth
Boloria euphrosyne Pearl-bordered fritillary Britheg berlog	butterfly
Boloria selene Small pearl-bordered fritillary Britheg berlog fach	butterfly
Bombus humilis Brown-banded carder-bee Cardwenynen lwydfrown	bee
Bombus muscorum Moss carder-bee Cardwenynen y mwsogl	bee
Bombus ruderarius Red-shanked carder-bee Cardwenynen goesgoch	bee
Bombus ruderatus Large garden bumblebee Gwenynen bwm yr ardd	bee
Bombus sylvarum Shrill carder-bee Cardwenynen feinlais	bee
Brachylomia viminalis Minor shoulder-knot Gwargwlwm bach	moth
Brachyptera putata Northern February red Coch y mis bach	moth
Caradrina morpheus Mottled rustic Gwladwr brith	moth
Celaena haworthii Haworth's minor Gwyfyn plu'r gweunydd	moth
Celaena leucostigma The crescent Clustwyfyn cilgantog	moth
Chesias legatella The streak Rhesen y banadl	moth
Chesias rufata Broom-tip Rhesen gam	moth
Chiasmia clathrata Latticed heath Seffyr delltog	moth
Coenonympha pamphilus Small heath Gweirlöyn bach y waun	butterfly
Coenonympha tullia Large heath Gweirlöyn mawr y waun	butterfly

Section 42 species	Major pollinator group
Cosmia diffinis White-spotted pinion Llwyfwyfyn brith	moth
Cossus cossus Goat moth Gwyfyn drewllyd	moth
Cupido minimus Small blue Glesyn bach	butterfly
Cyclophora pendularia Dingy mocha Moca tywyll	moth
Cymatophorima diluta Oak lutestring Tant y derw	moth
Dasypolia templi Brindled ochre Cwcwll melynaidd	moth
Diarsia rubi Small square-spot Smotyn sgwâr bach	moth
Diloba caeruleocephala Figure of eight Crwbach ffigwr wyth	moth
Ecliptopera silaceata Small phoenix Ffenics bach	moth
Ennomos erosaria September thorn Carpiog Medi	moth
Ennomos fuscantaria Dusky thorn Carpiog tywyll	moth
Ennomos quercinaria August thorn Carpiog Awst	moth
Entephria caesiata Grey mountain carpet Brychan llwyd y mynydd	moth
Epirrhoe galiata Galium carpet Brychan y friwydd	moth
Erynnis tages Dingy skipper Y gwibiwr llwyd	butterfly
Eucera longicornis Long-horned Bee Gwenynen gorniog	bee
Eugnorisma glareosa Autumnal rustic Gwladwr yr hydref	moth
Eulithis mellinata The spinach Brychan cyrens	moth
Eurodryas aurinia Marsh fritillary Britheg y gor	butterfly
Eustroma reticulatum Netted carpet moth Brychan rhwydog	moth
Euxoa nigricans Garden dart Dart y gerddi	moth
Euxoa tritici Whilte-line dart Dart gwynresog	moth
Graphiphora augur Double dart Dart deunod	moth
Heliophobus reticulata Bordered gothic Rhwyll ymylog	moth
Hemaris tityus Narrow-bordered bee hawkmoth Gwalchwyfyn gwenynaidd ymyl gul	moth
Hemistola chrysoprasaria Small emerald Emrallt barf yr hen ŵr	moth
Hepialus humuli Ghost moth Chwimwyfyn rhithiol	moth
Hipparchia semele Grayling Gweirlöyn llwyd	butterfly
Hoplodrina blanda The rustic Llwyd llyfn	moth
Hydraecia micacea Rosy rustic Gwladwr gwridog	moth
Idaea dilutaria Silky wave Ton sidan	moth
Idea contiguaria Weaver's wave Ton Gwynedd	moth
Jodia croceago Orange upperwing Uwchadain oren	moth
Lampronia capitella Currant shoot-borer Tyllwr egin cwrens	moth
Lasiommata megera Wall brown Gweirlöyn y cloddiau	butterfly
Leptidea sinapis Wood white Gwyn y coed	butterfly
Limenitis camilla White admiral Mantell wen	butterfly
Lycia hirtaria Brindled beauty Rhisglyn brith	moth
Lycia zonaria subsp. britannica Belted beauty Rhisglyn y morfa	moth
Macaria wauaria V moth Seffyr y ffyrch	moth

Section 42 species	Major pollinator group
Malacosoma neustria The lackey Gwaswyfyn	moth
Melanchra persicariae Dot moth Gwyfyn dotiog	moth
Melanchra pisi Broom moth Gwyfyn y banadl	moth
Melanthia procellata Pretty chalk carpet Brychan hardd y calch	moth
Mesoligia literosa Rosy minor Corrach gwridog	moth
Minoa murinata Drab looper Dolennwr llwydfelyn	moth
Mythimna comma Shoulder-striped wainscot Gwensgod gwar rhesog	moth
Noctua orbona Lunar yellow underwing Isadain felen loerol	moth
Odynerus melanocephalus A mason-wasp Saerbicwnen benddu	wasp
Orthonama vittata Oblique carpet Brychan lletraws	moth
Orthosia gracilis Powdered quaker Crynwr llychlyd	moth
Osmia parietina A mason bee Saerwenynen	bee
Osmia xanthomelana A mason bee Saerwenynen	bee
Pelurga comitata Dark spinach Brychan y wermod	moth
Perizoma albulata subsp. Albulata Grass rivulet Gwregys y gwair	moth
Plebejus argus Silver-studded blue Glesyn serennog	butterfly
Polia bombycina Pale shining brown Gwyfyn arennau disglair	moth
Pyrausta sanguinalis A pyralid moth Perl coch ac aur	moth
Pyrgus malvae Grizzled skipper Gwibiwr brith	butterfly
Rheumaptera hastata Argent and sable Brychan du a gwyn	moth
Rhizedra lutosa Large wainscot Gwelltwyfyn mawr	moth
Sabra harpagula Scarce hook tip Bachadain brin	moth
Satyrium w-album White letter hairstreak Brithribin wen	butterfly
Scopula marginepunctata Mullein wave Ton arfor	moth
Scotopteryx bipunctaria Chalk carpet Brychan y calch	moth
Scotopteryx chenopodiata Shaded broad-bar Rhesen lydan dywyll	moth
Spilosoma lubricipeda White ermine Ermin gwyn	moth
Spilosoma luteum Buff ermine Ermin llwydfelyn	moth
Stilbia anomala The anomalous Llwyd gloyw	moth
Synanthedon scoliaeformis Welsh clearwing Cliradain Gymreig	moth
Thecla betulae Brown hairstreak Brithribin brown	butterfly
Tholera cespitis Hedge rustic Rhwyll y crawcwellt	moth
Tholera decimalis Feathered gothic Rhwyll bluog	moth
Timandra comae Blood-vein Gwyfyn gwythïen goch	moth
Trichiura crataegi Pale eggar Wylun gwelw	moth
Tyria jacobaeae The cinnabar Teigr y benfelen	moth
Watsonalla binaria Oak Hook-tip Bachadain y derw	moth
Xanthia gilvago Dusky-lemon sallow Melyn y llwyf	moth
Xanthia icteritia The sallow Melyn penfelyn	moth
Xanthorhoe decoloraria Red carpet Brychan coch	moth

Section 42 species	Major pollinator group
Xanthorhoe ferrugata Dark-barred twin-spot carpet Brychan deusmotiog tywyll	moth
Xestia agathina Heath rustic Clai'r rhos	moth
Xestia ashworthii Ashworth's rustic Gwladwr Cymreig	moth
Xestia castanea Neglected rustic Clai'r waun	moth
Xylena exsoleta Sword-grass Cleddwyfyn c	moth

Pollination mode of Tree Species

When planning future tree and shrub plantings, trees and shrubs which are pollinated by insects can be selected in preference to those pollinated by the wind. Interestingly, bees have been reported collecting pollen from some wind-pollinated species such as hazel.

Table 39 - Tree and shrub species which are native or ancient introductions (archaeophytes) to the study area with their mode of pollination.

Species	Pollination type
Alder (*Alnus glutinosa*)	wind-pollinated
Alder Buckthorn (*Frangula alnus*)	insect-pollinated
Almond-leaved Willow (*Salix triandra*)	insect-pollinated
Ash (*Fraxinus excelsior*)	wind-pollinated
Aspen (*Populus tremula*)	wind-pollinated
Bay Willow (*Salix pentandra*)	insect-pollinated
Beech (*Fagus sylvatica*)	wind-pollinated
Bird Cherry (*Prunus padus*)	insect-pollinated
Black Poplar (*Populus nigra*)	wind-pollinated
Blackthorn (*Prunus spinosa*)	insect-pollinated
Common Whitebeam (*Sorbus aria*) and related species	insect-pollinated
Crab Apple (*Malus sylvestris*)	insect-pollinated
Crack Willow (*Salix fragilis*)	insect-pollinated
Dogwood (*Cornus sanguinea*)	insect-pollinated
Downy Birch (*Betula pubescens*)	wind-pollinated
Eared Willow (*Salix aurita*)	insect-pollinated
Elder (*Sambucus nigra*)	insect-pollinated
Elms (*Ulmus* spp.)	wind-pollinated
Field Maple (*Acer campestre*)	insect-pollinated
Grey Willow (*Salix cinerea*)	insect-pollinated
Guelder Rose (*Viburnum opulus*)	insect-pollinated
Hawthorn (*Crataegus monogyna*)	insect-pollinated
Hazel (*Corylus avellana*)	wind-pollinated
Holly (*Ilex aquifolium*)	insect-pollinated
Hornbeam (*Carpinus betulus*)	wind-pollinated
Large-leaved Lime (*Tilia platyphyllos*)	insect-pollinated

Species	Pollination type
Midland Hawthorn (*Crataegus laevigata*)	insect-pollinated
Osier (*Salix viminalis*)	insect-pollinated
Pedunculate Oak (*Quercus robur*)	wind-pollinated
Pines (*Pinus* spp.)	wind-pollinated
Privet (*Ligustrum vulgare*)	insect-pollinated
Purging Buckthorn (*Rhamnus cathartica*)	insect-pollinated
Purple Willow (*Salix purpurea*)	insect-pollinated
Rock Whitebeam (*Sorbus rupicola*)	insect-pollinated
Rowan (*Sorbus aucuparia*)	insect-pollinated
Goat Willow (*Salix caprea*)	insect-pollinated
Sessile Oak (*Quercus petraea*)	wind-pollinated
Silver Birch (*Betula pendula*)	wind-pollinated
Small-leaved Lime (*Tilia cordata*)	insect-pollinated
Smooth-leaved Elm (*Ulmus minor*)	wind-pollinated
Spindle (*Euonymus europaeus*)	insect-pollinated
Wayfaring tree (*Viburnum lantana*)	insect-pollinated
White Willow (*Salix alba*)	insect-pollinated
Wild Cherry (*Prunus avium*)	insect-pollinated
Wild pear (*Pyrus pyraster*)	insect-pollinated
Wild plum (*Prunus domestica*)	insect-pollinated
Wild Service-tree (*Sorbus torminalis*)	insect-pollinated
Willows (*Salix* spp.; several species)	insect-pollinated
Wych Elm (*Ulmus glabra*)	wind-pollinated
Yew (*Taxus baccata*)	wind-pollinated

Appendix 4 – Pollinator resource and and demand scores

Pollinator resource

Table 40 - Phase 1 habitats in study area in CCW data (1979-1997) with scoring of relative value to pollinators with rationale

Resource type (Phase 1 Habitat Survey code)	Resource score	Resource type	Rationale
(B.1.1)	1	Category unexplained; assumed to be acid grassland, mapped as B1.1	See B1.1
(D.1.1)	1	Category unexplained; assumed to be acid heath	See D1.1 acid heath
(?)	0	Category unexplained; unknown	No data to assess
NA	0	Not accessed land	No data to assess
A.1.1.1	3	Broadleaved woodland - semi-natural	Usually diverse with broad range of structure and species composition
A.1.1.2	2	Broadleaved woodland - plantation	May be diverse
A.1.2.2	1	Coniferous woodland - plantation	Generally species-poor and shaded, some woodland rides may have range of flowers
A.1.3.1	2	Mixed woodland - semi-natural	May be diverse, may have similar composition to broad-leaved woodland
A.1.3.2	2	Mixed woodland - plantation	May be diverse planting but usually ground flora poor
A.2.1	1	Scrub - dense/continuous	Some scrub types are diverse, others may more uniform with limited range of species e.g. gorse scrub
A.4.1	2	Broadleaved woodland - recently felled	Can have flush of flowering after felling
A.4.2	1	Coniferous woodland - recently felled	As for woodland – can be floriferous in short term with bramble and foxglove
B.1.1	2	Acid grassland - unimproved	Often not very species-rich
B.1.2	1	Acid grassland - semi-improved	Low diversity and usually dominated by grasses
		Neutral grassland - unimproved	Species-rich if allowed to flower
B.2.2	2	Neutral grassland - semi-improved	Can be moderately diverse though with a limited range of grazing-resistant herbs such as buttercups
B.3.1	3	Calcareous grassland - unimproved	Species-rich if allowed to flower
B.3.2	2	Calcareous grassland - semi-improved	May be quite diverse if allowed to flower
B.4	0	Improved grassland	Generally grazed rye-grass and crested dog's-tail with no flower
B.5	2	Marsh/marshy grassland	Could range from purple moor-grass to dense rushes or diverse
B.5.1	2	Marshy grassland Juncus dominated	Can have diverse range of flowering species amongst rushes and variable structure
B.5.2	2	Marshy grassland Molinia dominated	Although dominated by purple moor-grass suggesting ungrazed, there may be significant number of flowers such as tormentil amongst it
B.6	1	Poor semi-improved grassland	May have clover and buttercups

Resource type (Phase 1 Habitat Survey code)	Resource score	Resource type	Rationale
C.1.1	1	Bracken - continuous	May have brambles, violets and tormentil
C.3.1	3	Other tall herb and fern - ruderal	Can be diverse with range of species
D.1.1	2	Dry dwarf shrub heath - acid	Large areas of heather can provide huge amount of flowers for month in summer, but not necessarily divers otherwise. Some areas mapped as heath are grazed bilberry with limited pollinator potential
D.2	2	Wet dwarf shrub heath	Can be diverse with cross-leaved heath, tormentil
D.5	2	Dry heath/acid grassland mosaic	Range of species and diversity
D.6	2	Wet heath/acid grassland mosaic	Range of species and diversity
E.1.6.1	1	Blanket sphagnum bog	Generally in study area with moss, cottongrass and deergrass and few flowering plants, e.g. cross-leaved heath, so low value
E.1.7	1	Wet modified bog	Generally few flowering plants and low diversity
E.1.8	1	Dry modified bog	Generally few flowering plants and low diversity
E.2.1	1	Flush and spring - acid/neutral flush	Mostly dominated by bryophytes, sedges, grasses and rushes, low potential for pollinators
E.2.2	1	Flush and spring - basic flush	Mostly dominated by bryophytes, sedges and grasses, low potential for pollinators
E.3	2	Fen	Can be quite diverse with range of species such as angelica, loosestrife, meadowsweet
E.3.1	2	Fen - valley mire	Can be quite diverse with range of species such as angelica, loosestrife, meadowsweet
E.3.1.1	2	Modified valley mire	May have large amounts of heathers and varied structure
E.3.2	2	Fen - basin mire	Can be quite diverse with range of species such as angelica, loosestrife, meadowsweet
E.4	0	Peat - bare	No resource
F.1	1	Swamp	Mostly dominated by wind-pollinated monocots such as tall grasses, bulrushes and bur-reeds, relatively low potential
F.2.2	1	Marginal and inundation - inundation vegetation	Mostly dominated by wind-pollinated monocots such as tall grasses, bulrushes and bur-reeds, relatively low potential
G.1	0	Standing water	No resource
G.2	0	Running water	No resource, though water-buttercups can occur in some streams
H.1.1	0	Intertidal - mud/sand	No flowering plants giving resource
H.1.2	0	Intertidal - shingles/cobbles	No flowering plants giving resource
H.1.3	0	Intertidal - boulders/rocks	No flowering plants giving resource
H.2.6	1	Saltmarsh - dense/continuous	Mainly dominated by grasses and rushes, with a few species others like thrift

Resource type (Phase 1 Habitat Survey code)	Resource score	Resource type	Rationale
H.3.1	1	Shingle above high tide mark	Can be species-rich but often quite open
H.3.2	1	Shingle/gravel above mhw	Limited flowering plant diversity, usually developing late season, mainly wind-pollinated
H.4	0	Boulders/rocks above high tide mark	No resource
H.8.1	3	Hard cliff	The limited areas of sea cliff south of Chepstow are floriferous
H.8.4	3	Coastal grassland	Often quite diverse, depending on how managed
I.1.1	0	Inland cliff - acid/neutral	May have few ferns and woodrushes with <10% cover
I.1.1.1	1	Inland cliff - acid/neutral	<5% plant cover usually dominated by monocots giving flower resource
I.1.2	0	Scree	<5% cover usually dominated by monocots and ferns giving limited flower resource
I.1.2.1	0	Scree - acid/neutral	May have few ferns, some bee nesting potential
I.1.2.2	0	Scree - basic	May have few ferns, some bee nesting potential
I.1.4	0	Other rock exposure	<5% cover usually dominated by monocots and ferns giving limited flower resource
I.1.4.1	0	Other exposure - acid/neutral	No resource
I.1.4.2	0	Other exposure - basic	No resource
I.2.1	0	Quarry	No resource assuming quarry is active – old quarries can be quite rich and diverse
I.2.2	0	Spoil	No resource
I.2.3	0	Mine	No resource
I.2.4	0	Refuse-tip	Restored refuse-tips usually classified separately
J.1.1	0	Cultivated/disturbed land - arable	If wheat very low, if organic and oil seed rape can be high
J.1.2	1	Cultivated/disturbed land - amenity grassland	Often repeatedly mown, but low pesticide use
J.1.3	1	Cultivated/disturbed land - ephemeral/short perennial	Can be diverse for short periods, though many species are short-lived, self-pollinating weeds with little resource for pollinators.
J.1.4	2	Introduced shrub	Can provide significant flowering resource e.g. butterfly bush, garden privet or Cotoneaster
J.1.5	2	Gardens	Often diverse range of plants through year with many aliens, low pesticide use
J.2.1.1	3	Intact hedge - native species-rich	(no mapping available in study area)
J.2.1.2	1	Intact hedge - species-poor	(no mapping available in study area)
J.2.2.1	1	Defunct hedge - native species-rich	(no mapping available in study area)
J.2.2.2	1	Defunct hedge - species-poor	(no mapping available in study area)
J.2.3.1	2	Hedge with trees - native species-rich	(no mapping available in study area)
J.2.3.2	1	Hedge with trees - species-poor	(no mapping available in study area)

Resource type (Phase 1 Habitat Survey code)	Resource score	Resource type	Rationale
J.3.4	1	Caravan site	Often mown grass, sometimes with associated plantings
J.3.6	2	Urban areas	Includes gardens as well as buildings; gardens may be quite diverse, especially in areas with larger houses, but others may be paved for mown grass. Pesticide use affecting pollinators is often low, thus overall regarded as of medium value
J.3.7	1	Track (not comprehensively digitised)	No flowering plants giving resource; verges might offer some resource
J.4	0	Bare ground	Open ground may be good for nesting sites for some pollinators

Pollinator demand

Table 41 – Pollinator demand scores

Priority type	Priority score
Arable	2
Allotment	3
SINC	1
Garden	2
LNR	3
NNR	3
Orchard	3
SSSI	2

Appendix 5 - Green infrastructre consultation questionnaire

TACP have been commissioned to develop an Action Plan for Pollinators. We are looking at changes to management and maintenance of verges, hedgerows, public open space generally including changes in cutting regimes, frequency etc., new planting and generally increasing diversity.

Stakeholder organisation:

Name:

Contact telephone number:

Contact e-mail address:

Geographic area served by organisation:

1. What areas do you have any management or maintenance responsibility for?
    a. Is this documented in GIS format?
2. What types of maintenance operations are carried out?
    a. How is this recorded?
    b. What is the staff/management structure?
3. Is maintenance carried out by Council staff, or contracted out?
    a. If contracted out, on what sort of agreement? (Timescales etc. how long left?)
    b. Is there capacity to make changes to operations easily?
4. What opportunities do you see for making changes that would be beneficial to pollinators
5. Have you already made any specific changes?
    a. What are they?
    b. If so how have they been received by the public?
    c. If so how have they been received by staff carrying out the work?
    d. What has been the financial impact of such changes
    e. What barriers have you faced
    f. Do you feel it has been a success and would you do it again?
    g. Do you monitor the success of your pollinator projects e.g. Public perception, benefits for pollinators, how?
    h. If not, how would you suggest it could be done?
6. What do you see as the barriers to changing cutting regimes/timing/heights etc?

7. Do you envisage any health and safety risks associated with such changes?
8. Are you aware of any situations where changes have had impacts on other protected species, or risks of this happening (e.g. strimming slow-worms where grass has been allowed to grow longer)
9. Do you feel that you know enough about pollinators or would more information on what they need help you?
10. Do you feel that as a whole more action should be taken to help protect them?
    a. Why/why not?
11. What opportunities do you see on publicly owned land that are not currently being taken?
12. Do you work for/on behalf of other departments (or authorities)?
    a. If so, which ones and who are the key contacts?
13. What measures do you have in place to combat invasive species?
14. Do you/your staff use pesticides or herbicides and if so can you tell us which products are used, and how?
15. What machinery do you currently use for maintenance?
    a. Are you looking to replace/upgrade any equipment in the near future?
16. How do you feel about more collaborative work across local authority boundaries

Appendix 6 - Derivation of the action plan

Land type classification

Land type has been broadly classified to enable the most appropriate recommendations to be made for managing green infrastructure. For example, roadside verges in an urban setting may require different treatment from those that run through an upland area.

A number of different methods were considered for categorising the land types including the GLOBCOVER and Corine land cover datasets and the suite of LANDMAP layers. It was ultimately decided that the most suitable approach was to use the LANDMAP Visual and Sensory layer; specifically the level 2 classification. This was based on comparisons with temperature, rainfall, elevation, soil fertility, soil drainage, existing land-cover and existing pollinator resource which all showed positive correlations with the Visual and Sensory level 2 classification.

Further examination of the Visual and Sensory layer categories led to the grouping of *Upland Valleys* and *Exposed Upland Plateau* into *Upland* and *Flat lowland/levels*, *Rolling lowland*, *Lowland valleys* into *Lowland*. On this basis the following seven categories have been used to define the land type:

1. **Inland Water (included associated edge)**
    - Large expanses of generally freshwater
2. **Upland (Upland valleys, Exposed upland plateau)**
    - Upland valleys
        - Upland areas that are predominantly (>50 %) valleyed (with a valley floor to ridge height >50 m approximately)
    - Exposed upland plateau
        - Upland areas that are predominantly exposed; exposed does not necessarily equate to a lack of tree cover; exposed relates more to landform than land cover in this instance, in that it excludes upland areas which are sheltered by landform such as valleys.
3. **Hills, lower plateaux and scarp slopes**
    - Upland areas which are predominantly (<50 %) hills without well-defined valleys and scarp slopes. Hills and scarp slopes might be defined as the intermediate landform between Lowland and Upland, but this is extremely difficult to define accurately. So, for the purposes of LANDMAP, Hills & scarp slopes forms its own class under the level 1 Upland class. It is defined by the presence of lower landform than other Upland classes and will rarely extend much lower than about 100 m or much higher than about 300 m. However, it is more usefully defined as being the type of landform that neither falls comfortably into the Upland or Lowland classes. It will often form an intermediate band between the two. It may also be defined by having more Upland-type land use patterns, yet at a relatively low altitude. It can either be a relatively level landform such as a plateau or gentle hills at a lower level than the exposed upland plateaux or form the sloping sides of hills or scarps. A scarp slope is defined as a slope linking lowland with a plateau, and having no significant or equivalent facing slope, although it may form one side of a valley.

4. **Lowland (Flat lowland/levels, Rolling lowland, Lowland valleys)**
    - Flat lowland/levels
        - Lowland areas that are predominantly flat (<3° slope); mostly coastal and riverine levels, but also broad vales and valley bottoms.
    - Rolling lowland
        - Lowland Areas which are predominantly, rhythmically, gently sloped (3-10° slope), although less so than Lowland valleys. Rolling lowland generally differs from Hills & scarp slopes in that there rarely a significant change in land use.
    - Lowland valleys
        - Lowland areas that are predominantly (50 m.)
5. **Coastal**
    - Lowland Areas absolutely associated with the coast (this excludes open water and Flat lowland/levels)
6. **Built land**
    - Development areas which are predominantly (>50 %) covered in manmade structures or hard-standing
7. **Developed unbuilt land**
    - Development areas which is not Built land

Green infrastructure type classification

Green infrastructure has been categorised into the following 18 groups. The purposes of this is to recognise that different types of green infrastructure require specific consideration with respect to management actions.

In order to achieve an approach which is consistent with other documents and policies the green infrastructure types considered by this action plan are closely aligned with the categories of Green Space identified in TAN 16. The following list shows the identified categories, and how they fit with TAN 16:

- Roadside verges (Green Corridors: TAN 16)
- Public Parks and Gardens
- Outdoor Sports Facilities
- Provision for Children and Young People (play areas)
- Car parks, Office Grounds etc.
- Historic Sites (not ‘open space’ as per TAN16)
- Civic spaces
- Housing green space (Amenity Greenspace: TAN 16)
- School Grounds (Amenity Greenspace: TAN 16)
- Managed gardens, care homes etc. (Amenity Greenspace: TAN 16)
- Other amenity green space (Amenity Greenspace: TAN 16)
- Allotments, community gardens and urban farms
- Churchyards and cemeteries

- Cycle routes and other non-motorised route ways (Green Corridors: TAN 16)
- Water
- Derelict land and demolition sites (not 'open space' as per TAN16)
- Natural and Semi-natural Green space
- Accessible areas of countryside in the urban fringe

Appendix 7 - Good practice examples

The four Local Authorities whose areas are covered by the Green Infrastructure Action Plan for Pollinators, have all taken steps already to provide for pollinators. This section is by no means intended to be a comprehensive list of everything positive that has been carried out, but instead to highlight some key areas of existing good practice that can and should be followed by others. There are also other examples of good practice from other areas as well, and links to external guidance.

Monmouthshire Pollinator Policy

On Wednesday 19th March 2014 Monmouthshire County Council unanimously voted to adopt their previously proposed pollinator Policy. The policy itself contains a commitment to a number of measures intended to support pollinators:

- Reducing the number of cuts to grassed areas – This will allow a longer growing period, enabling plants to set seeds and encourage greater diversity of plant species.
- Introduce urban annual wildflowers to formal beds and perennial meadow mix (which will include garden species) to urban areas. Planting schemes in all other public areas will directly reflect the policy. *
- On A & B highways routes, where safe to do so, change the time of verge cuts and reduce to 2 cuts per year.
- Identify opportunities for the development of meadow areas within amenity and open spaces.
- Continually review our grass cutting and planting practices ensuring compliance with emerging legislation and best practice.
- Utilise the Bee Friendly Monmouthshire logo to raise awareness of the changes in practice and the underlying reasons
- Monitor the effectiveness of the changing practices. We will visit sites that have been subject to the changes to see if pollinator supporting habitats have been created and sustained.

While the commitments themselves are all positive in terms of the contribution they can make to providing good habitats for pollinators, one of the most important aspects is that it is formalised into an adopted policy. By taking this step, Monmouthshire County Council have secured the backing of their elected members, and as such made a commitment to delivering the measures listed above. The process of adopting a new policy ensures that the proposals have undergone rigorous scrutiny, and made certain that all relevant figures are aware of the details and have had an appropriate opportunity to pass comment on them.

Having a clear policy which is signed up to by all ensures that everyone who needs to be is fully aware of what the council's commitments are and that they have a responsibility to ensure they are met. Local Authorities are increasingly measured on their performance against established commitments.

Caerphilly – Plant a Patch for Pollinators Scheme

Caerphilly County Borough Council has recently run a scheme for schools within the County Borough. Schools have all been offered wildflower seed to create an area from 1m2 up to 10m2 on the school grounds. As well as the seed, each school also receives a free talk/workshop on pollinators and their importance.

By creating pollinator patches, schools are providing pollinators with a food source. As well as developing colourful wildflower patches in their grounds, they are also helping pollinators in their plight.

'Plant a Patch for Pollinators' is a project being run by the Caerphilly Countryside and Landscape section and Sustainable Development Team in partnership with Julian Rees from POLLEN8 CYMRU, funded by the Caerphilly Environment Quality project fund.

The uptake of this scheme has been incredibly high, with 97 schools in Caerphilly taking up the offer. Schools are a vitally important part of any joined up approach to pollinator provision and Green Infrastructure non Publicly Owned Land. Not only are they important landowners/managers, with the power to make their own decisions regarding maintenance (and their own budgets), but the connection with huge numbers of young people represents and enormous opportunity to help spread the message about how important pollinators are, and that we need to take action to improve their chances of surviving the various pressures they currently face.

Blaenau Gwent - Ebbw Vale Cemetery Hay Meadow

Since 2007 an unused area of Ebbw Vale Cemetery in Blaenau Gwent has been managed as a traditional hay meadow, instead of kept as close mown grass as it had been previously. This area is cut annually in late July/August by a local farmer who takes the hay in payment for the work. It has been very successful in terms of creating a wildflower rich habitat, and this approach has been well received in an otherwise unused area.

To be commercially viable for local farmers to do this, there are a number of constraints though – firstly the area needs to be large and flat enough to be cut and have cuttings collected efficiently. To make a useable hay crop it also needs to be free from dog faeces and ragwort, which requires a degree of maintenance to stay on top of. In areas like cemeteries where access is restricted, dogs can be controlled more easily than in some other public spaces.

Management of cemeteries can also promote emotive responses from those who visit them, and extending maintenance reductions to more active areas has been met with a very different response in some areas where it has been tried. This highlights the fine line to be walked between taking opportunities to increase pollinator habitats, and risking a public backlash where it can be seen as inappropriate, or purely being about cost savings. It may be that within other parts of cemeteries approaches such as increasing the diversity of spring bulb planting can deliver benefits while still maintaining a well-managed appearance. Any relaxation of grass cutting in active areas is best introduced slowly.

Torfaen – Greenmeadow Community Farm

Torfaen County Borough Council run a community farm in Cwmbran – Greenmeadow Community farm – it is used as an educational resource, providing both on-site training opportunities and outreach work with local schools. Through the Pollinators for Life Programme, their staff have run classroom workshops and quizzes in local schools to help the pupils understand the relationship between flowers and pollinating insects. They have also explained pollinators' importance to the food chain and the wider environment, as well as helping facilitate practical planting tasks in school grounds to increase pollinator provision.

The farm also organises a number of onsite holiday activities etc. which amongst other issues promote the importance of pollinators.

There is also significant scope to offer specific tailored training schemes, designed to meet the needs of community groups becoming involved in pollinator friendly maintenance, or even specific courses aimed at local authority maintenance staff. The flexible structure and knowledge of the staff, combined with the on-site resource available at the farm make it a valuable resource in terms of skilling and equipping others to undertake their roles in a pollinator friendly manner, and to spread the word amongst the general public.

Bees Needs – UK Case Studies

The Wildlife Trusts host a website, associated with the National Pollinator Strategy for England, published by DEFRA. It contains a variety of resources, including 5 simple actions aimed at the general public, but also has number of case studies, some of which are of particular relevance to managing of Green Infrastructure on publicly owned land.

- ***Brede High Woods***
  - This case study focuses on how opportunities for bees have increased in the woodland through the creation and maintenance of open areas, some grazing and careful management of woodland edge habitats.
  - http://www.wildlifetrusts.org/sites/default/files/brede_high_woods_case_study.pdf
- ***University Hospitals Birmingham***
  - This cases study looks at how 16,000m2 of hospital land has been identified to provide a number of greenspace enhancements for the benefit of patients and staff, as well as increasing biodiversity and enhancing provision for pollinators. It also demonstrates how these 'greening' measures are being used to contribute to patient care and recognises the importance of the natural environment to wellbeing
  - http://www.wildlifetrusts.org/sites/default/files/university_hospitals_birmingham_case_study.pdf
- ***Leighton Buzzard***
  - This is a great example of how a members of a local community has driven a number of changes with help from various local businesses, other organisations and the Town Council. The examples of involving various aspects of the community in the campaign given show how great successes can be achieved, and how they can make a real difference to local communities as well as pollinators.
  - http://www.wildlifetrusts.org/sites/default/files/leighton_buzzard_case_study.pdf
- ***Tata Steel, Scunthorpe***
  - This particular cases study is interesting, as although it doesn't directly relate to public land, it shows the potential value of brownfield sites and offers some good examples of management that has been undertaken to improve habitats for a variety of invertebrates (many of them pollinators)
  - http://www.wildlifetrusts.org/sites/default/files/tata_steel_case_study.pdf
- ***Wyre Forest, Kidderminster***
  - The Council Parks department from Wyre Forest District Council are working on a four year programme to increase the supply of nectar, to help pollinators within the urban

district of Kidderminster. The project is focussed on changes to roundabouts, verges and public parks in the area.
    - http://www.wildlifetrusts.org/sites/default/files/wyre_forest_case_study.pdf

The remainder of the case studies can be found on the Bees Needs pages of the Wildlife Trust's Website: http://www.wildlifetrusts.org/bees-needs/casestudies

Other Pollinator Projects

Other sources of guidance and examples of good practice can be found in recent publications such as Buglife's Manifesto for Pollinators, or the London's pollinators: Creating a buzz in the capital.

London's pollinators: Creating a buzz in the capital (Capital Bee – Sustain)

http://www.sustainweb.org/publications/londons_pollinators/?section= (suggested £5 donation)

Contains a number of sections identifying opportunities within London each of which contains a paragraph on 'what needs to happen' to achieve them

- **Enhancing land for bees**
    - Pollinator-friendly councils
    - Pollinator-friendly green infrastructure and 'soft estate'
    - Pollinator-friendly housing estates
    - Pollinator-friendly allotments and food growing sites
    - Pollinator-friendly brownfield sites
    - Pollinator-friendly green-space management by private contractors
    - Pollinator-friendly domestic gardens
    - Pollinator-friendly London garden centres and DIY stores
    - A pollinator-friendly approach to pest management
- **Creating space for pollinators**
    - Pollinator-friendly green roofs
    - Pollinator-friendly sustainable urban drainage systems
    - Pollinator-friendly street trees

Get Britain Buzzing: A Manifesto for Pollinators (Buglife)

https://www.buglife.org.uk/sites/default/files/Pollinator%20manifesto%20with%20covers_1.pdf

Buglife's manifesto for pollinators sets out seven principles for protecting pollinators. "We believe that there should be sustainable populations of all pollinators; this is Buglife's 'Get Britain Buzzing' manifesto – the 7 principles that society must choose to aspire to in order to save and sustain our pollinators."

- All pollinators valued for the service that they provide
- Our pollinator populations properly monitored and understood
- Pesticide use that harms pollinators reduced
- Wildflower rich landscapes restored - B-Lines established
- Declines in rare and threatened pollinator species reversed
- Places for pollinators planned around people
- Wild pollinators protected from imported parasites and diseases

This final principle relates to the subject of several other pieces of scientific research. Evidence suggests that managed populations of honeybees have been a source of pests and diseases in wild bee populations. This is especially significant if those populations are already struggling to cope with other pressures.

Appendix 8 - Review of pollinator research

In addition to national and local legislation, policies and strategies in Appendix 1, consideration has also been given to a number of recent studies and areas of research into pollinators. The recent acceleration in the decline of pollinators, especially bees, has led to increased research into the factors influencing their success. There are however a number of areas where the situation and complex inter-relationships are not yet fully understood – the picture is becoming clearer though, in part due to the findings of the following areas of research:

Insect Pollinators Initiative

The Insect Pollinators Initiative (IPI) is a joint research program set up to investigate the causes of declining insect pollinator populations and better understand the related issues. It provided up to £10M from late 2010 to fund research into the causes and consequences of insect pollinator decline and to inform efforts to do something about it.

The most relevant studies out of the project are:

Urban Pollinators Project – led by Bristol University

http://www.bristol.ac.uk/biology/research/ecological/community/pollinators/

"…towns and cities contain suitable habitats for bees…

…We recommend that improving the value of urban areas for pollinators should be part of any national strategy to conserve and restore pollinators. "

AgriLand: Linking agriculture and land use change to pollinator populations – Led by Leeds University

http://www.agriland.leeds.ac.uk/index.php

Contains useful research into key nectar sources, both in terms of individual species and existing habitat types.

Sustainable Pollination Services for UK Crops – University of Reading/University of Leeds/FERA

http://www.crop-pollination.co.uk/

"…researchers will investigate whether climate change will affect UK crop pollination in the future…

…From the start of the project the team will collaborate with major stakeholders (farmers, beekeepers, land managers, conservation agencies) to guarantee that this research produces information required by the UK agricultural community. "

Emergent Bee diseases: http://beediseases.org/

Part of Insect Pollinators Initiative. Looking at new diseases - Deformed Wing Virus and fungus-like microorganism called *Nosema ceranae*. Consideration to combined effects of both being greater than the sum of individuals and testing methods of control. Looking at UK honeybees and bumblebees. Lots of linked information. One of the key questions asked was: How are pests and diseases affecting bee pollinators? Their research shows that wild and managed pollinating bees are susceptible to a

range of diseases that are being shared between species. They also reference other studies showing reduced Homing Ability of *Nosema* Infected Honeybees

http://journals.plos.org/plosone/article?id=10.1371/journal.pone.0103989 and disease associations between honeybees and bumblebees as a threat to wild pollinators (20 February 2014) http://www.nature.com/nature/journal/v506/n7488/full/nature12977.html

The role played by commercially managed bees in spreading diseases to wild populations is becoming increasingly recognised.

The Insect Pollinator Initiative has also led to numerous articles, reports and guidance notes which have informed the writing of this report, and understanding behind the development of the Action Plan. Details can be found here:

Insect Pollinator Initiative – Journal Publications

https://wiki.ceh.ac.uk/display/ukipi/IPI+Journal+Publications?atl_token=837211d798f2c34f89feb03e0f1c89c4e82931ba

Insect Pollinator Initiative – Reports and Magazine Articles

https://wiki.ceh.ac.uk/pages/viewpage.action?atl_token=837211d798f2c34f89feb03e0f1c89c4e82931ba&pageId=215450868

Insect Pollinator Initiative – Policy and Practice Notes

https://wiki.ceh.ac.uk/display/ukipi/IPI+Policy+and+Practice+Notes?atl_token=837211d798f2c34f89feb03e0f1c89c4e82931ba

German Research – Heimholtz Centre for Environmental Research

http://www.ufz.de/index.php?en=33699 Diversity prevents resistance

In species-rich habitats, pests do not become resistant to chemical control measures so quickly. As well as bringing wide ecological advantages, species diversity also makes easier pest control.

http://www.ufz.de/index.php?en=33574 Fighting Decline of Pollinators in Europe

The analysis of the drivers responsible for observed status and declines in pollinators was coordinated by Oliver Schweiger from the Helmholtz-Centre for Environmental Research. The results indicate that although land-use change is currently considered as the major driver of pollinator declines in Europe, climate is the most important factor limiting the distribution of pollinators at large spatial scales. This gives rise to concern, especially in the light of ongoing climate change which is likely to affect not only the distribution of important pollinator species but also the entire functional structure of pollinator assemblages. Interestingly, also negative effects of agricultural chemicals such as fertilisers and pesticides can be seen even at the coarse European scale and even more worrying is the fact that these negative effects are likely to be amplified with increasing temperatures as they can be expected from climate change. One key message of the STEP project is that there is no single driver responsible for pollinator declines but there are multiple drivers and they do not act in isolation but interact in many ways. Yet, knowledge about these interactions can also be used to mitigate effects of global change and especially agri-environmental schemes and green infrastructure initiatives can help to buffer the effects of habitat loss, agricultural intensification and even climate change.

The STEP project has generated a substantial body of knowledge on how to conserve pollinators, safeguard the pollination of crops and better understand how to mitigate against threats.

Other Pollinator Projects

Over recent years the importance of pollinators and the scale of the threat posed to the services they offer has been recognised. A number of organisations have produced documents which summarise understanding of these issues and make recommendations of how the situation could be improved. These include the two in appendix 8 from Buglife (National), the London Pollinators Group (London) and the English National Pollinators Strategy from DEFRA (England).

The National Pollinator Strategy: for bees and other pollinators in England (DEFRA)

In November 2014 DEFRA published their National Pollinator Strategy for England. It describes the importance of pollinators, why we need them, and sets out five key areas across which the strategy aims to deliver. These are:

- Supporting pollinators on farmland
- Supporting pollinators across towns, cities and the countryside
- Enhancing the response to pest and disease risks
- Raising awareness of what pollinators need to survive and thrive
- Improving evidence on the status of pollinators and the service they provide

It is also supported by a Call to Action - Bees' Needs: Food and a Home – launched in July 2014 (www.beesneeds.org.uk). This outlines a series of simple things people can do to help pollinators find food and shelter.

Summary of key points

All these documents mentioned above, and numerous others, generally point to a few key findings, which have been used to influence the writing of the report and Action Plan. These main points are set out below:

- Pollinators have suffered as a result of continued habitat loss over a number of years.
- Measures to protect them need to provide for the entire life cycle, not just the adult insect, so food and habitat requirements are varied.
- Pollinators require food sources throughout the year as well as nesting habitats.
- Many pollinators also feed form a wide range of different food sources.
- Bees in particular have suffered very severe losses over recent years, with many cases of entire colonies disappearing (colony collapse disorder).
- Pests and diseases in bee colonies have played a large part in this decline.
- The use of pesticides and other chemicals in modern farming has also had a significant influence on pollinators.

Bee Keeping in Schools

Charlton Manor Primary School in London has used beekeeping as a way of developing children's interest in and understanding of pollinators and their requirements.

http://www.bbc.co.uk/programmes/b04jhmhh

http://www.charltonmanorprimary.co.uk/top-news/bees-chickens

Other Pollinator studies/reports/presentations

The following documents were also used to inform the preparation of the action plan and report.

- Vegetation Survey Report – Denbighshire Roadside Nature Reserves and Alternative Verge Management Pilot Areas
- Honey Bee Friendly Park Project (British Bee Keepers Association)
- 140314 Status And Value of Pollinators and Pollination Services (Defra)
- Tree cover in Wales' Towns and Cities (Summary - NRW)

Design and Management Guidance (GI for Pollinators)

Sustrans – general guidance

The following documents from SUSTRANS illustrate their approach to design and maintenance of the green space on land surrounding their cycle routes. The clear, easy to follow language and structure make them a good model, as they are aimed, at least in part, at public volunteers, potentially with no existing specialist knowledge. While not being specifically written with pollinators in mind, it contains examples of good practice in terms of management for biodiversity and makes good provision for invertebrates.

- Ecology Note 01-Hedge Management
- Ecology Note-02 - Grass Verge Management
- Ecology Note 06 - Ecology in the Planning System
- Traffic_free_routes-conceptual_design_09_12_14

The documents contain lots of generic examples of good management and design.

The main emphasis is on the importance of diversity, and it considers maintenance by volunteers as well as paid staff. It is written in a very accessible manor, which is particularly suited to the non-professional user.

In addition to the general design and maintenance documents, Sustrans also supplied an existing management plan for the Treforest to Tonteg Greenway, which runs along a dismantled railway line.

The Management plan contains specific details of how one site within the study area is currently managed. Importantly it begins with a detailed survey of the existing habitats and points of ecological interest. It also considers the human and historical aspects of the route before setting out the aims of restoring and enhancing particular habitat types, and defining constraints then specific objectives to achieve those aims. This section is followed with a series of management prescriptions, set out in tabular form.

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Blaenau Gwent
County Borough Council

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COUNTY BOROUGH COUNCIL
CYNGOR BWRDEISTREF SIROL
CAERFFILI

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