



BIODIVERSITY

The Worcestershire Biodiversity Action Plan



Abstract

Following its commitment to the 1992 Convention on Biological Diversity the UK began to develop a policy and strategy framework, beginning with Biodiversity Action Plans and recently with a focus on ecological networks and green infrastructure. This project contributed to Worcestershire's Biodiversity Action Plan review process by demonstrating how green infrastructure (GI) can be identified and delivered in the Urban Habitat Action Plan. GI provides multifunctional benefits, so will help encourage biodiversity through a wide network of green spaces and corridors in urban and natural environments. It is crucial that biodiversity is conserved and sustainably managed for future generations because it provides direct and indirect services for people, such as food and climate regulation.

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Abbreviations

| | |
|-------------------|----------------------------------------------------|
| AW | Ancient Woodland |
| BAP | Biodiversity Action Plan |
| CBD | Convention on Biological Diversity |
| Defra | Department of Environment, Food, and Rural Affairs |
| EU | European Union |
| GI | Green Infrastructure |
| HAP | Habitat Action Plan |
| LNR | Local Nature Reserve |
| LDP | Local Development Plan |
| LS | Local Site |
| NCA | National Character Area |
| NEA | National Ecosystem Assessment |
| NERC | Natural Environment and Rural Communities Act |
| NNR | National Nature Reserve |
| PPS ₁₂ | Policy Planning Statement 12 |
| SAC | Special Area of Conservation |
| SAP | Species Action Plan |
| SPA | Special Protection Area |
| SSSI | Site of Special Scientific Interest |
| SWS | Special Wildlife Sites |
| UK | United Kingdom |
| VT | Veteran Tree |
| WBRC | Worcestershire Biological Records Centre |



Urban Habitat Action Plan

1 Introduction

Planning Policy Statement (PPS) 12 defines green infrastructure (GI) as “a network of multi-functional green space, both new and existing, both rural and urban, which supports the natural and ecological processes and is integral to the health and quality of life of sustainable communities” (British Parliament, 2008). In 2013, the Worcestershire Green Infrastructure Partnership published the Worcestershire Green Infrastructure Strategy (WGIS), which put the environment front and center during development and planning because it offers multiple economic, health and social benefits (Worcestershire Green Infrastructure Partnership, 2013).

This action plan is necessary because biodiversity loss continues across the UK. Biodiversity and the natural environment provide benefits to communities, but in recent years, according to the UK National Ecosystem Assessment (NEA) published in June 2011, “continuing pressures are causing deterioration” of ecosystems and habitats (HM Government, 2011). Fragmentation is one of the major causes of biodiversity loss. In 2008, 43% of priority habitats and 31% of priority species were still declining across the UK (HM Government, 2011).

This action plan also primarily focuses on the urban biodiversity in Worcestershire. Urban biodiversity incorporates a variety of living organisms located in urban developments, such as cities, whose habitats and ecological systems are impacted by a “rapidly urbanizing world” (Puppim de Oliveira, Doll, & Moreno-Penaranda, 2014). GI is an adaptation strategy that considers the importance of urban biodiversity to create spaces that improve and protect habitats and species, as well as provide benefits for residents. GI also facilitates a cohesive system within natural spaces between the urban biodiversity and residential population (HM Government, 2011). The new system not only helps the biodiversity, but also promotes the benefits it provides for the community.

We can deliver gains for locally important habitats and species through the GI approach by:

- Incorporating greenspace in development plans
- Including species specific habitat elements in current greenspaces
- Monopolizing on vertical and roof structures in areas with more buildings
- Considering factors that affect species’ population
- Communicating green infrastructure during the urban planning application process
- Educating researchers, developers and the public on various habitats and species

The geographical focus of this plan is the county of Worcestershire. (Figure 1)

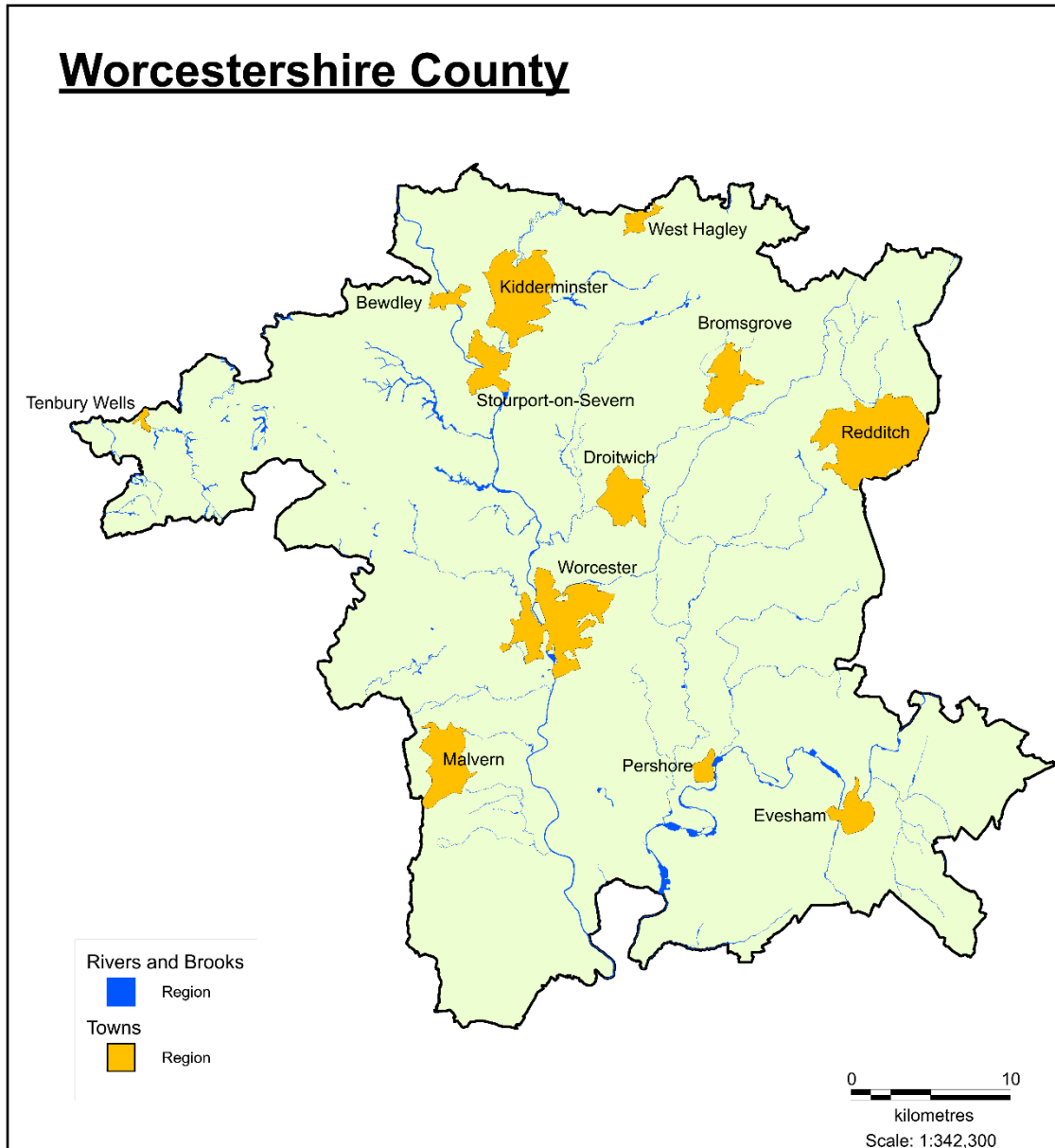


Figure 1 Map of Worcestershire County. Data from the WBRC (2018)

2 Current Status

2.1 Description of habitat

For the purposes of this plan the urban habitat includes all those areas of land, water and physical structures capable of supporting biodiversity, both in terms of providing shelter and as foraging habitat, which are located within the planning boundary of a major settlement as defined in relevant Local Development Documents (Worcestershire Biodiversity Partnership, Urban Habitat Action Plan, 2008).

However, many biodiversity-rich habitats appear in both urban and rural areas and have their own Habitat Action Plans. They will not therefore require specific action under this plan (examples include rivers and streams, woodland, road verges, orchards and neutral grassland). Certain habitats though are unique to, or typical of, the urban environment and it is these that this plan will focus on (Worcestershire Biodiversity Partnership, Urban Habitat Action Plan, 2008).

2.2 Green Infrastructure typology

Researchers have classified GI based on vegetation layers (VL), ground surfaces (GS), and building structures (BS), which were further broken down into four different typologies which incorporate green and grey structures:

- Tree canopy (TC),
- Green open space (GOS),
- Green roofs (GR), and
- Vertical greenery systems (VGS) (Koc, Osmond, & Peters, 2016).

Figure 2 taken from *A Green Infrastructure Typology Matrix to Support Urban Microclimate Studies* is a wonderful example of how the typologies can be introduced and incorporated into the green – to – grey structures.

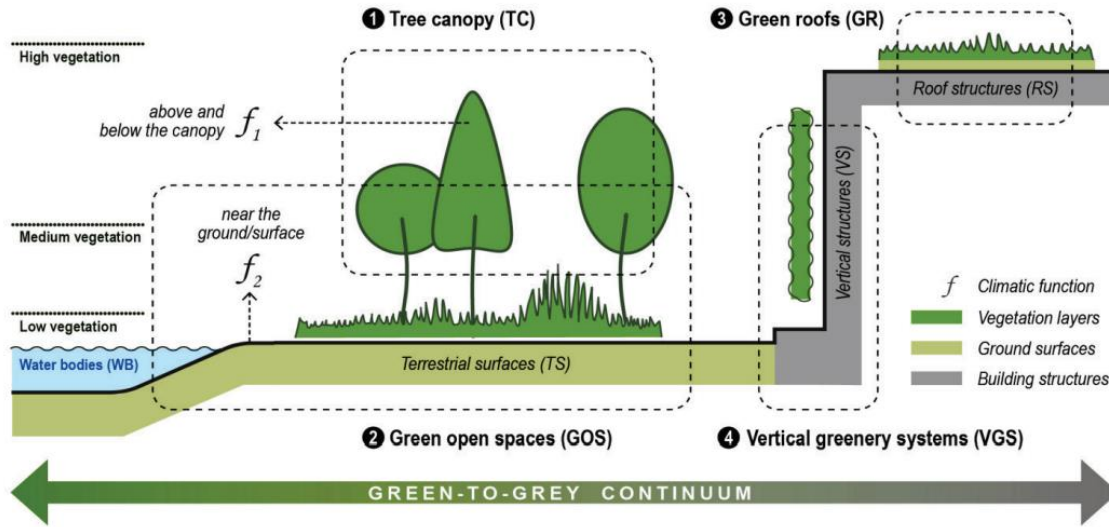


Figure 2 Identification of main GI typologies as a combination of different vegetation layers, ground surfaces and building structures (Koc, Osmond, & Peters, 2016)

Determining GI typologies and how they can be applied to the environment is important for understanding how to protect, enhance, create, and promote urban biodiversity across Worcestershire County. Natural England has developed a GI guidance document which outlines the following GI typologies (Natural England, Green Infrastructure Guidance, 2009):

- **Parks and Gardens – urban parks, Country and Regional Parks, formal gardens**

Municipal parks: Though they are sometimes heavily managed these are of particular importance, not only for the broad biodiversity they contain but also because they are often the first point of contact between people and wildlife.

Gardens: Though frequently overlooked in the past gardens make a substantial contribution to urban biodiversity. Whilst they may contain non-native plants these still provide habitat for nesting birds, invertebrates and other wildlife. In places networks of gardens form the only 'green' corridor in the landscape and can play a vital role in ensuring the permeability of our towns for wildlife. In many cases the garden will be the first and most frequent point of contact between people and the outdoors.

- **Amenity Greenspace – informal recreation spaces, housing green spaces, domestic gardens, village greens, urban commons, other incidental space, green roofs**

Playing fields and/or school grounds: Whilst the frequently mown pitch of an open playing field has limited value for wildlife the surrounding grassland areas can be rich in biodiversity. In addition, thick hedges, trees and shrubs border many school grounds and playing pitches adding to their value. Open spaces, managed or otherwise, can also provide a significant buffer to rapid urban runoff, an opportunity for people to experience the outdoors and in some circumstances an important component of wider green corridors and networks.

- **Natural and semi-natural urban greenspaces – woodland and scrub, grassland (e.g. downland and meadow), heath or moor, wetlands, open and running water, wastelands and disturbed ground, bare rock habitats (e.g. cliffs and quarries)**

Local Nature Reserves (LNR) and Local Wildlife Sites (LWS): many natural and semi-natural greenspaces within the urban area will be designated as a LWS or LNR (or both). Local Nature Reserves offer informal access opportunities to wildlife-rich green space.

- **Green corridors – rivers and canals including their banks, road and rail corridors, cycling routes, pedestrian paths, and rights of way**

Street trees: play an important role in bringing wildlife into urban spaces. They can offer feeding, nesting and roosting opportunities for birds, be valuable for invertebrates, lichen and fungi and help to provide or strengthen feeding and commuting routes for bats and other mobile species. In addition, they help to ameliorate the effects of atmospheric pollution and can be an attractive addition to the street scene.

- **Other – allotments, community gardens, city farms, cemeteries, and churchyards**

Allotments: a feature of many of Worcestershire's built up areas and have a significant role to play in the conservation of urban biodiversity. In Worcester City they provide a refuge for some of the best populations of *Anguis fragilis* slow-worm in the West Midlands and elsewhere they provide a broad range of grassland, herb and scrub habitats and act as reservoirs of biodiversity for the wider townscape. This function can be particularly valuable where they occur adjacent to ecological corridors such as canals or rail infrastructure. Figure 3 shows the locations of allotments located in Worcester City.

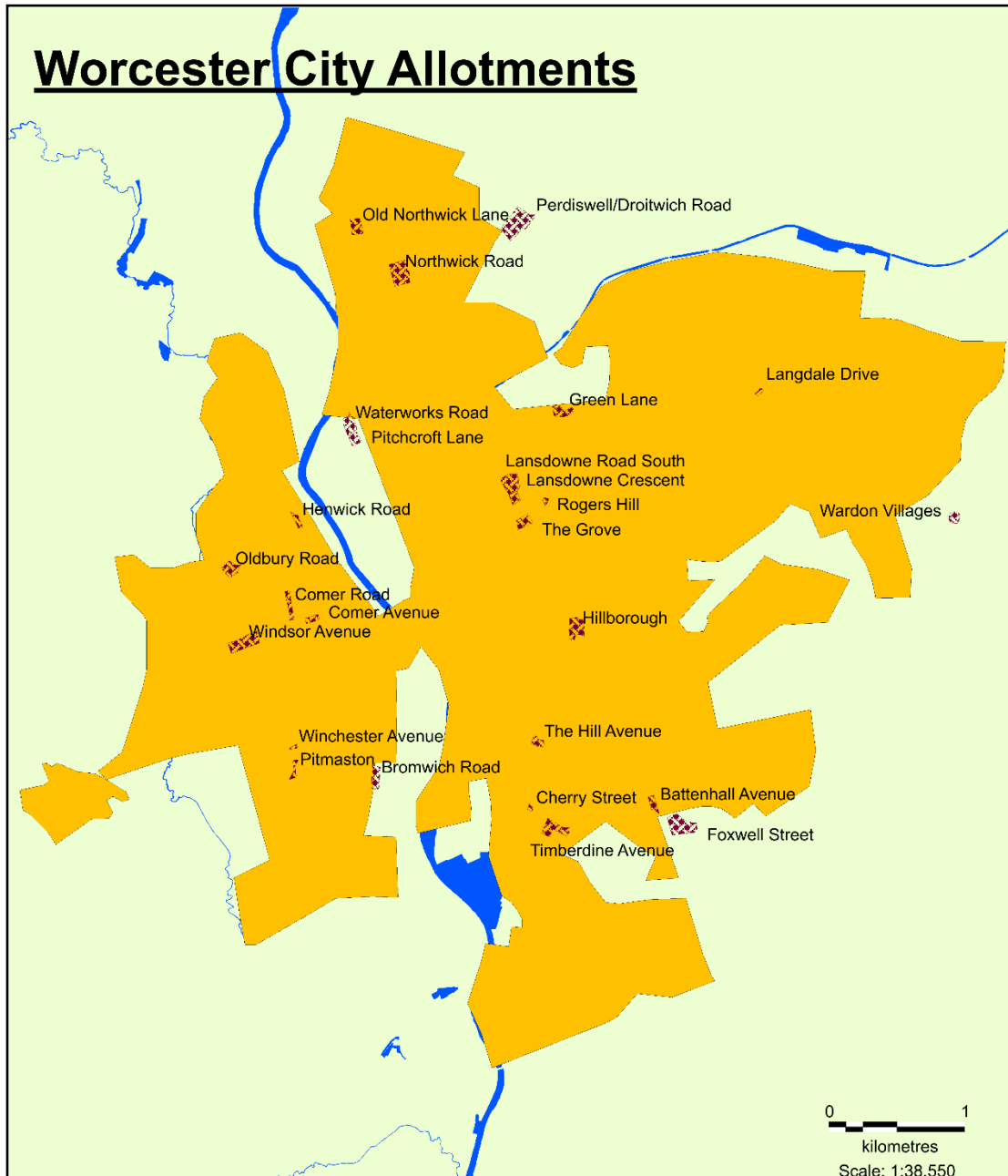


Figure 3 Worcester City has 26 allotments that vary in location and number of plots available to rent. Data from WBRC (2018)

Churchyards: though churchyard are often heavily managed they can be very valuable for lichens and in some places relict grassland communities. Where they have untended corners, these can develop into suitable habitats for priority species such as slow worm. Some will also contain good numbers of significant trees and shrubs and can be important to the local landscape character as well as for biodiversity.

2.3 Description of Key Species

Over generations, some species have adapted to more urban environments. Generally speaking, species are organisms of the same population that can interbreed in nature (University of California Museum of Paleontology, 2018). With the addition of grey infrastructure such as roads, tall buildings, and housing developments, some species lose much of their habitat. The UK has targeted species that need protection because their habitats are isolated and shrinking as more areas become developed (Worcestershire Biodiversity Partnership, Urban Habitat Action Plan, 2008).

This urban action plan focuses on six species identified in the Worcestershire County as important. They include:

- Slow worm (*Anguis fragilis*),
- European hedgehog (*Erinaceus europaeus*),
- House sparrow (*Passer domesticus*),
- Great crested newt (*Triturus cristatus*),
- Water vole (*Arvicola terrestris*), and
- Pipistrelle bat (*Pipistrellus spp.*).

These species' populations are predicted to be positively impacted by the addition of GI.

2.3.1 Slow-worm *Anguis fragilis*¹

Apart from its appearance, the slow-worm is actually a legless lizard. As a defense mechanism, it is capable of shedding its tail. Slow-worms are found in almost any open or semi-open habitat. It likes warmth but instead of basking in the open sun it prefers to hide under a stone, log or piece of discarded rubbish such as a sheet of corrugated iron or plank of wood exposed to the sun. Slow-worms are also keen on compost heaps where they find warmth and plenty of food. They feed on slow moving prey, particularly slugs. Slow-worms hibernate throughout the winter months, sometimes sharing hibernation sites with other animals.

In Worcestershire County, it is common to find slow-worms in allotments and railway sidings, which makes these habitats important for the species' population.

Figure 4 shows the population data of slow-worms over the last 20 years. The large visual shows the dense population of slow-worms near Bewdley.

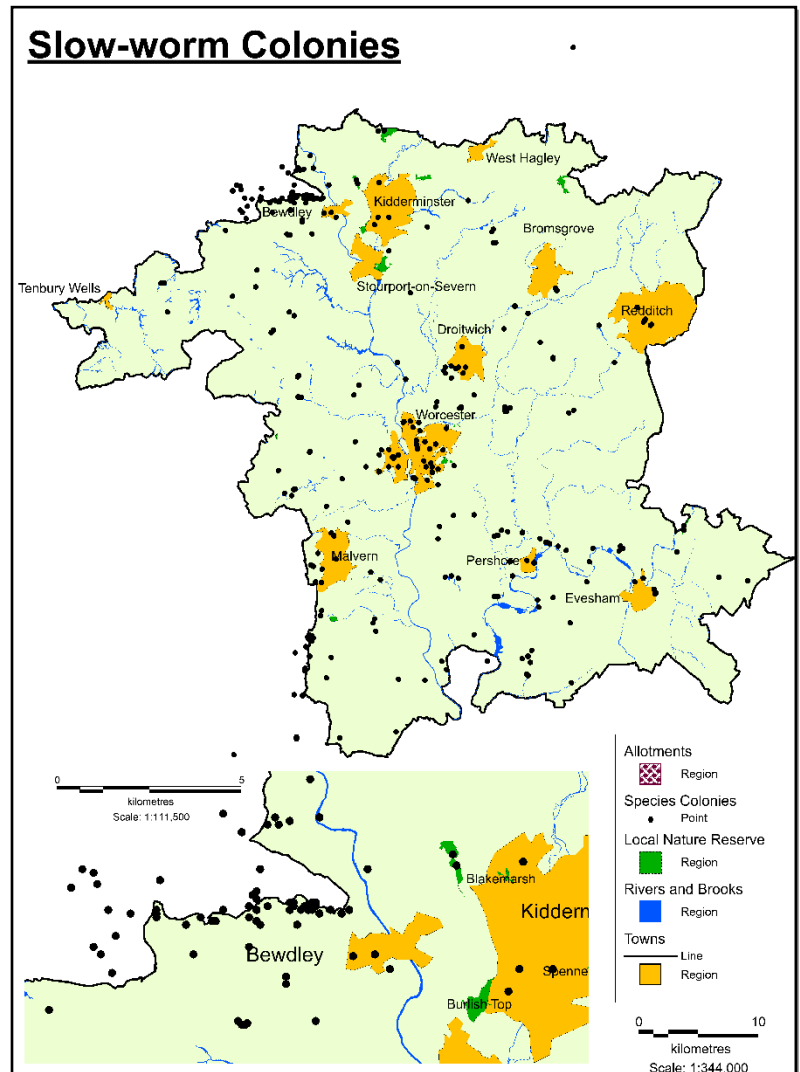


Figure 4 Slow-worm colonies in Worcestershire. Data from WBRC (2018)

¹ Details found in (Worcestershire Biodiversity Partnership, Slow-worm Species Action Plan, 2008)

2.3.2 European Hedgehog
*Erinaceus europaeus*²

The European hedgehog is equipped with over 7,000 spines, which are “thick, hollow hairs” and serve as their primary defense mechanism. They also hibernate from about November to March or April, so it is imperative that they can find enough food in their habitat to store enough fat reserves. European hedgehogs live in a variety of environments, which include woodlands, grasslands, and man-made habitats in orchards, vineyards, farmland, parks and gardens.

Figure 5 shows the population data of hedgehogs over the last 20 years. The large visual shows colonies near several allotments in the north-western corner of Worcestershire.

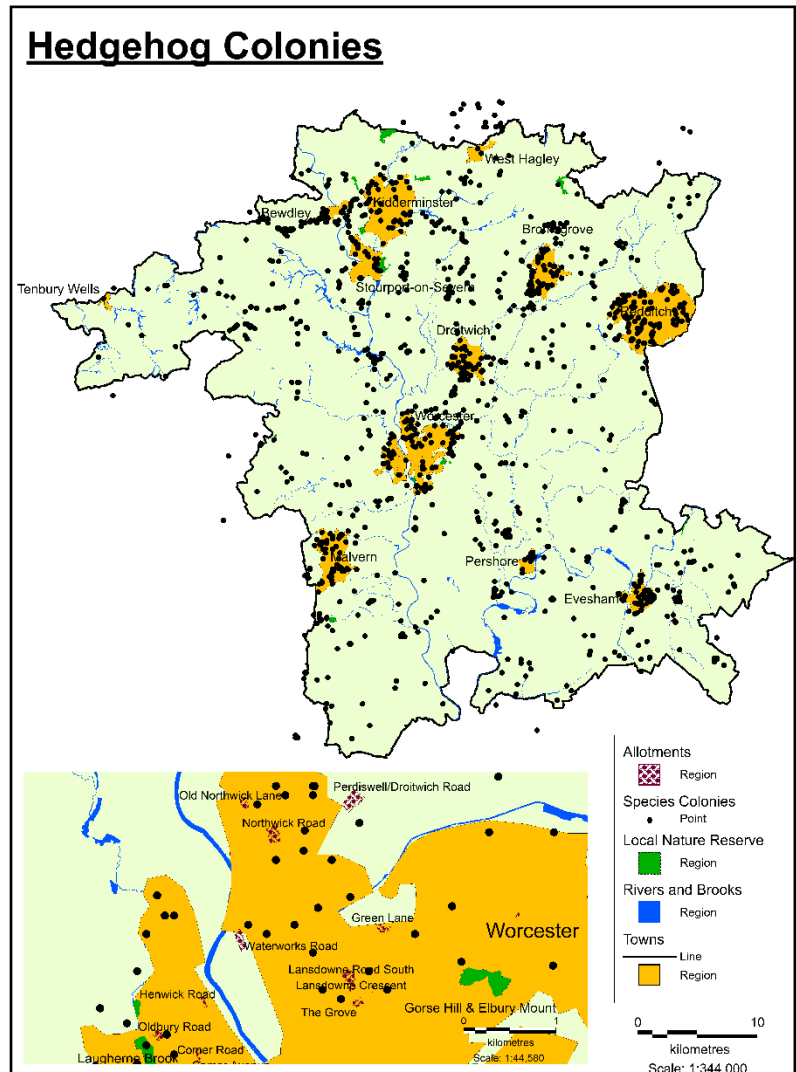


Figure 5 Hedgehog colonies in Worcestershire. Data from WBRC (2018).

² Details found in (World Land Trust, 2018)

2.3.3 House Sparrow *Passer domesticus*³

House sparrows live in a variety of habitats including farmland, grassland, towns and gardens, and woodlands. They are widespread and common in towns, cities, parks, gardens, and farmlands. They have easily adapted to urbanization by living in holes or crevices in buildings, among ivy bushes, and in man-made nest-boxes.

Figure 6 shows the population data of house sparrows over the last 20 years. The large visual shows a cluster of house sparrows south of Malvern near the St. Wulstan's Local Nature Reserve.

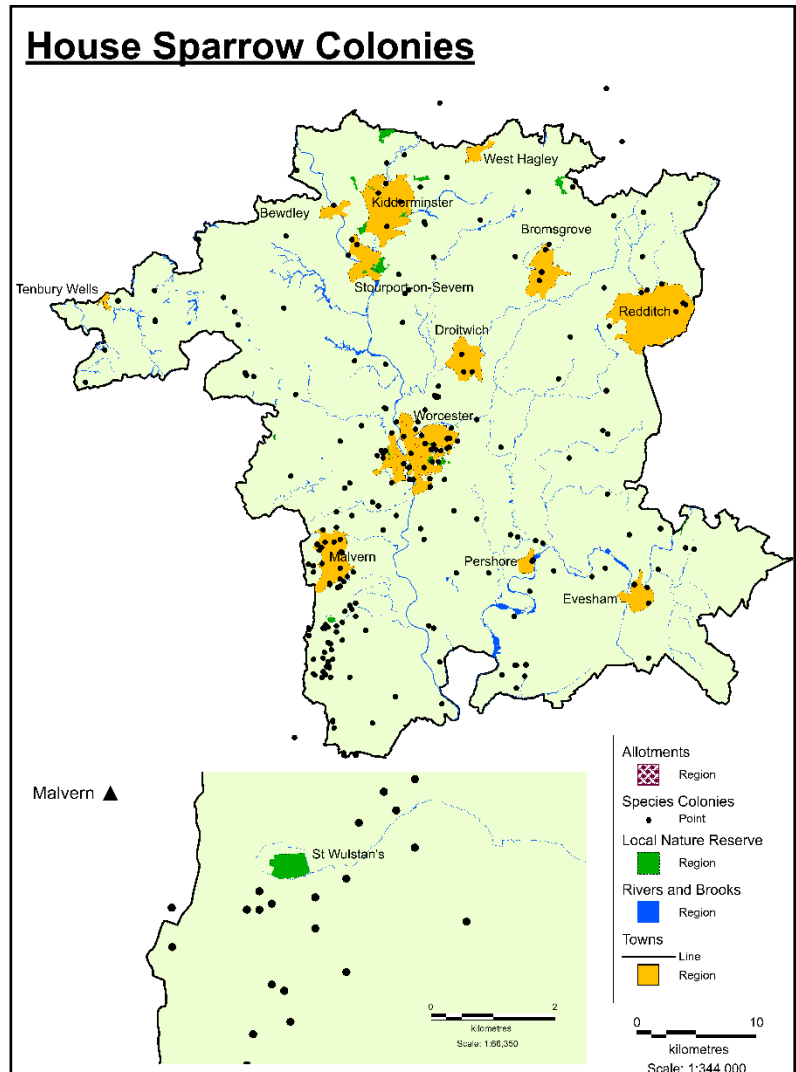


Figure 6 House sparrow colonies in Worcestershire. Data from WBRC (2018).

³ Details found in (Worcestershire Wildlife Trust, House Sparrow *Passer domesticus*, 2018)

2.3.4 Great Crested Newt
*Triturus cristatus*⁴

The great crested newt is the largest native British newt, reaching up to 17 cm in length. It has a granular skin texture (caused by glands which contain toxins making it unpalatable to predators), and in the terrestrial phase is dark grey, brown or black over most of the body, with a bright yellow/orange and black belly pattern

They are widely distributed across the UK, but largely populated in England and Wales. Many of the largest populations are centered on disused mineral-extraction sites, but lowland farmland forms the majority of great crested newt habitat in the UK. Climate may influence the range edge at the north of its distribution in Scotland, but other ecological or landscape factors such as pond density are probably more important in determining distribution across the main part of its British range

Many regionally important meta-populations of great crested newt are present in Worcestershire, distributed throughout the county. Areas of importance include the Warndon area of Worcester, Redditch, Guarlford, Hallow, Castlemorton, Hanbury and Crowle. The average pond density in Worcestershire is 2.9 per 1km square whereas the landscapes within these areas contain what is known as 'core ponds' with pond densities of between five to ten ponds or more per square kilometre.

Figure 7 shows the population data of great crested newts over the last 20 years. The large visual shows a large population at the Nunnery Wood Local Nature Reserve in Worcester City.

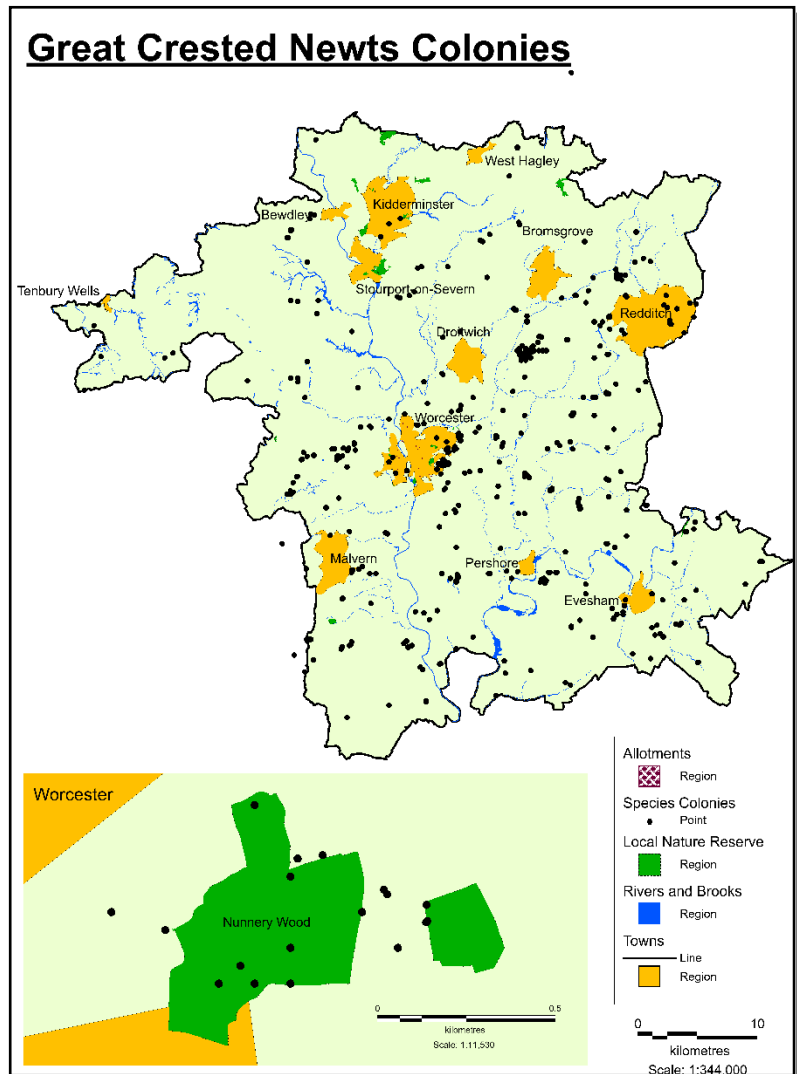


Figure 7 Great crested newt colonies in Worcestershire. Data from WBRC (2018).

⁴ Details found in (Worcestershire Biodiversity Partnership, Great Crested Newt Species Action Plan, 2008)

2.3.5 Water vole *Arvicola terrestris*⁵

Water voles are small aquatic mammals that primarily inhabit the banks of rivers, canals, ditches, pools and marshes. On the banks they create a network of burrows. Vegetation along the banks provide food and cover from predators.

Water voles are found throughout Britain, mainly in lowland areas. However, they are increasingly being sighted in upland sites, urban areas and isolated pools. This change in behaviour and the occupation of sites at the extreme of their habitat requirements is thought to be mainly attributable to predation by the American mink. The water vole population in Worcestershire shows decline in many areas.

Figure 8 shows the population data of water voles over the last 20 years. The large visual shows the largest population in Bromsgrove.

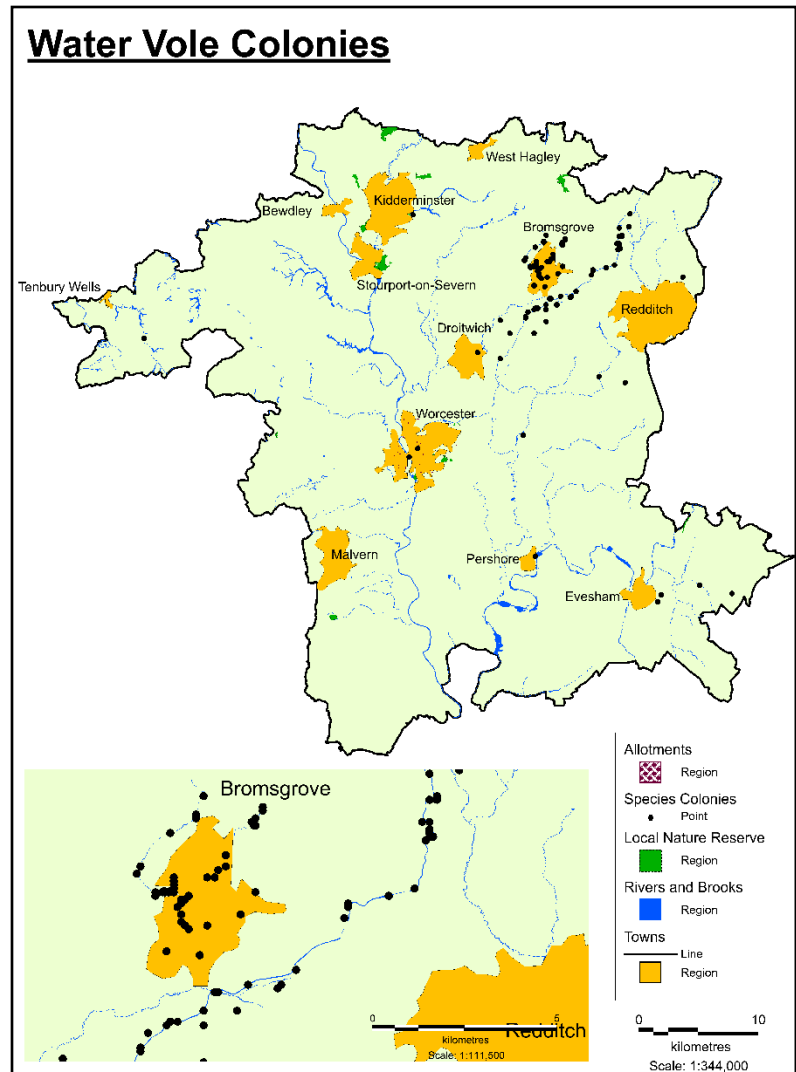


Figure 8 Water vole colonies in Worcestershire. Data from WBRC (2018).

⁵ Details found in (Worcestershire Biodiversity Partnership, Water Vole Species Action Plan, 2008)

2.3.6 Pipistrelle bat *Pipistrellus spp.*⁶

The common pipistrelle bat is the most common and widespread of all British bats but are not likely to be seen as they appear fast and jerky in flight. They feed in a wide range of habitats comprising woodlands, hedgerows, grassland, farmland, suburban, and urban areas. During roosting they find tree holes and crevices, and bat boxes.

Pipistrelle populations have recently declined as a result of modern agricultural practices. They are also vulnerable if roosting in buildings due to building renovations, exclusion and toxic remedial timber treatment chemicals. The common pipistrelle is one species of 17 UK bat species. The current combined distribution of all of Worcestershire’s bat species and indicates that bats are widespread throughout the County. However, bat species in the County are generally under-recorded and therefore current records cannot represent their true range and distribution. Until a more coordinated and systematic countywide survey is undertaken, bat distribution in Worcestershire will not be adequately understood.

Figure 9 shows the population data of pipistrelle bats over the last 20 years. The large visual shows the bat populations in Worcester City.

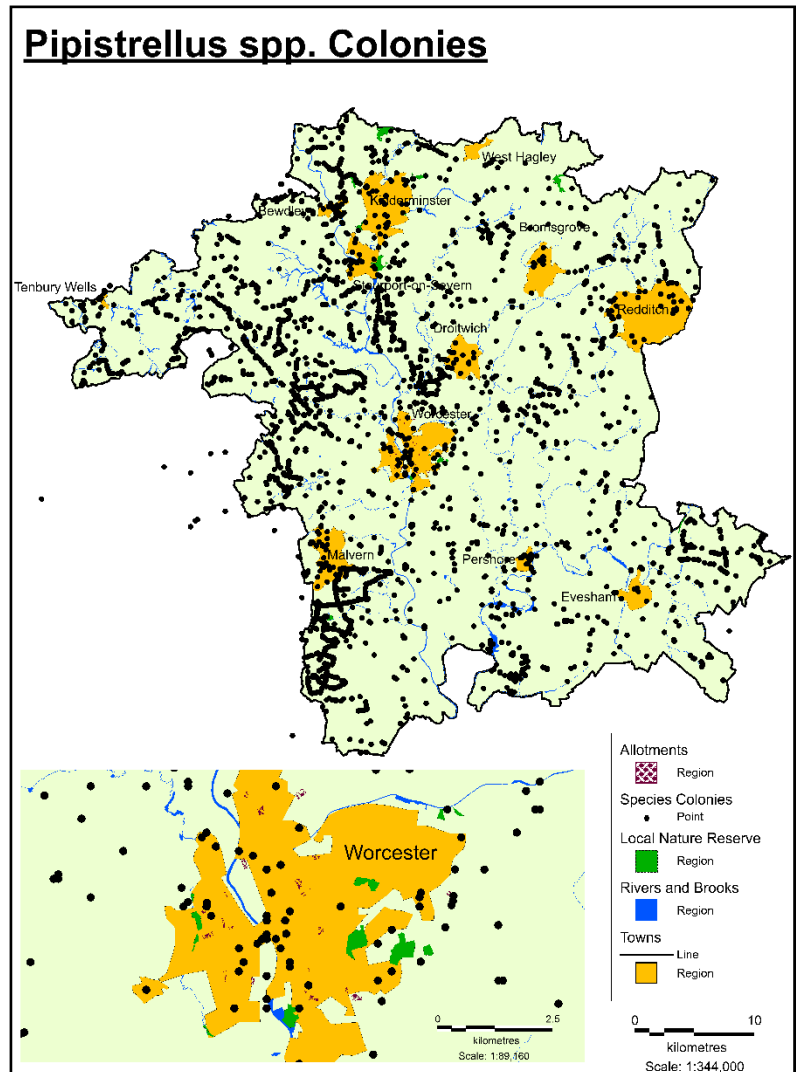


Figure 9 *Pipistrellus spp.* colonies in Worcestershire. Data from WBRC (2018).

⁶ Details found in (Worcestershire Biodiversity Partnership, Bat Species Action Plan, 2008) and (Bat Conservation Trust, 2010)

2.4 Legislation and Policy Drivers

- The Natural Environment and Rural Communities (NERC) Act 2006 establishes a duty for Public Bodies to have regard to Biodiversity in their decision-making processes. This duty does not differentiate between the urban and rural environment and is therefore relevant in the urban planning context
- National Planning Policy Framework (NPPF) sets out the Government's planning policies for England and how these are expected to be applied. It sets out the Government's requirements for the planning system only to the extent that it is relevant, proportionate and necessary to do so. It provides a framework within which local people and their accountable councils can produce their own distinctive local and neighbourhood plans, which reflect the needs and priorities of their communities
- Worcestershire Green Infrastructure Strategy (WGIS) aims to drive forward the delivery of GI in the county. It sets out county-scale principles to inform plans and strategies being developed by partner organisations to enable a coherent approach to delivery across a range of initiatives.

2.5 Summary of Important Sites

- Bromsgrove is an important site for water vole populations. Bromsgrove has 9 nature reserves, mixed rural farmland, old pastures, woodlands, and ancient hedgerows and trees (Worcestershire Wildlife Trust, Bromsgrove District, 2011). Other habitats include rivers and canals for water voles and other species such as dragonflies and otters, woodlands, and meadows. (Worcestershire Wildlife Trust, Bromsgrove District, 2011)
- Lansdowne Crescent Allotments is a site in Worcester City best known for large populations of slow-worms. It is considered a 'slow-worm' sanctuary by the Worcester City Council and therefore has several shelters, hibernating and hiding areas for the species (Shepard, n.d.). Figure 10 shows size and location of the Lansdowne Road South and Lansdowne Crescent allotments.

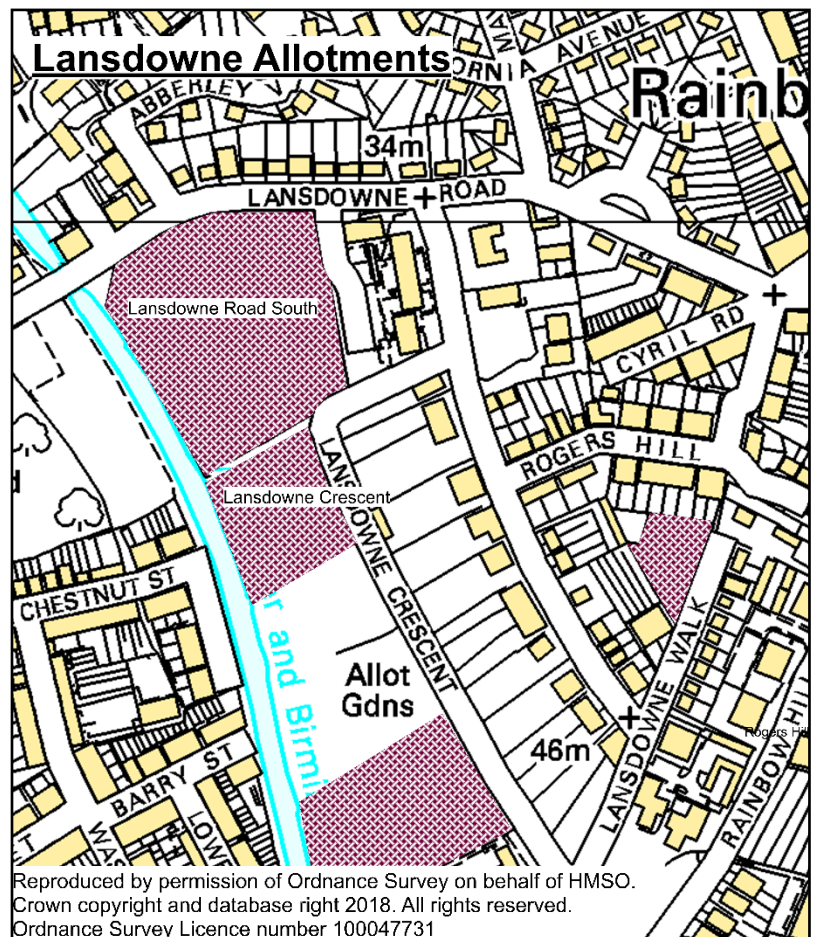


Figure 10 Lansdowne allotments in Worcester City.

- Lyppard Grange Ponds is a designated Special Area of Conservation (SAC) characterized by its inland water bodies, heath, scrub, maquis and garrigue, phrygana, and improved grassland. SAC SAC/SSSI. The Annex II species protected in the site is the great crested newt (Joint Nature Conservation Committee, 2018). Lyppard Grange Ponds is also a designated Site of Special Scientific Interest (SSSI) because it supports the largest known breeding colony of great crested newts in the county (Lyppard Grange Ponds SSSI, 2000). The ponds are in Warndon Villages, a recent housing development on former pastoral farmland, and isolated within the development (Worcestershire Biodiversity Partnership, Great Crested Newt Species Action Plan, 2008).
- Malvern Hills, cared for by the Malvern Hills Trust, are covered with a wide variety of habitats – grasslands, woodlands, scrub, grass, rock, wildflower meadows, ponds, mire, bog, quarries and orchards (Malvern Hills Trust, 2018). The variety of habitats allows for a variety of species.
- Redditch is a great example of a town with good green infrastructure. When Redditch town was planned and developed, an extensive network of woodlands, hedgerows, and meadows were preserved or created for landscaping and recreation purposes. There are over 168 hectares of woodlands in Redditch, some designed as Ancient or Semi-Natural Woodland (Redditch Borough Council, 2018). The Worcestershire Wildlife Trust have written a vision for Redditch Borough.⁷
- Severn Valley. “There are nine internationally designated sites in the National Character Area (NCA). The area is particularly important in terms of the floodplain wetland and associated bird assemblages, lowland meadow and traditional orchards. Most of the woodland is semi-natural ancient woodland, and important invertebrate assemblages are supported by the veteran trees of parkland such as that in the Bredon Hill SAC” (Natural England, National Character Area profile: 106. Severn and Avon Vales, 2014).
- Teme Valley is an NCA located in the northwest region of Worcestershire. “There are 10 SSSI covering 2 per cent of the NCA, including the River Teme and parts of the Wyre Forest SSSI. The NCA contains important areas of priority habitats that include broadleaved woodland – ancient semi-natural woodland forms 40 per cent of the woodland resource – lowland grassland and traditional orchards that form part of the larger fruit-growing area in the counties of Worcestershire, Herefordshire and Gloucestershire, supporting England’s main population and concentration of noble chafer beetle, currently classified as vulnerable in the UK” (Natural England, National Character Area profile: 102. Teme Valley, 2014).
- Wychavon District has been found to have the highest overall density of great crested newts in the county, with a percentage occurrence in those ponds surveyed of 62%. One of the best examples from within this area is Hanbury parish, where 32 ponds were surveyed and 26 of

⁷ The Worcestershire Wildlife Trust vision for Redditch: <http://bit.ly/2CqgX7b>

these found to contain great crested newts (Watson, 2000). 26 of the ponds surveyed were on the National Trust’s Hanbury Hall estate and 21 of these contained great crested newts (Watson, The Status and Distribution of Great Crested Newts in Worcestershire 2000: part 2, 2001) (Worcestershire Biodiversity Partnership, Great Crested Newt Species Action Plan, 2008).

- Wyre Forest is the northern district in the Worcestershire County. Within the district are areas of countryside, villages, and three towns – Kidderminster, Bewdley, and Stourport-on-Severn. Wyre Forest is named for the Forest of Wyre (Wyre Forest District Council, 2017).

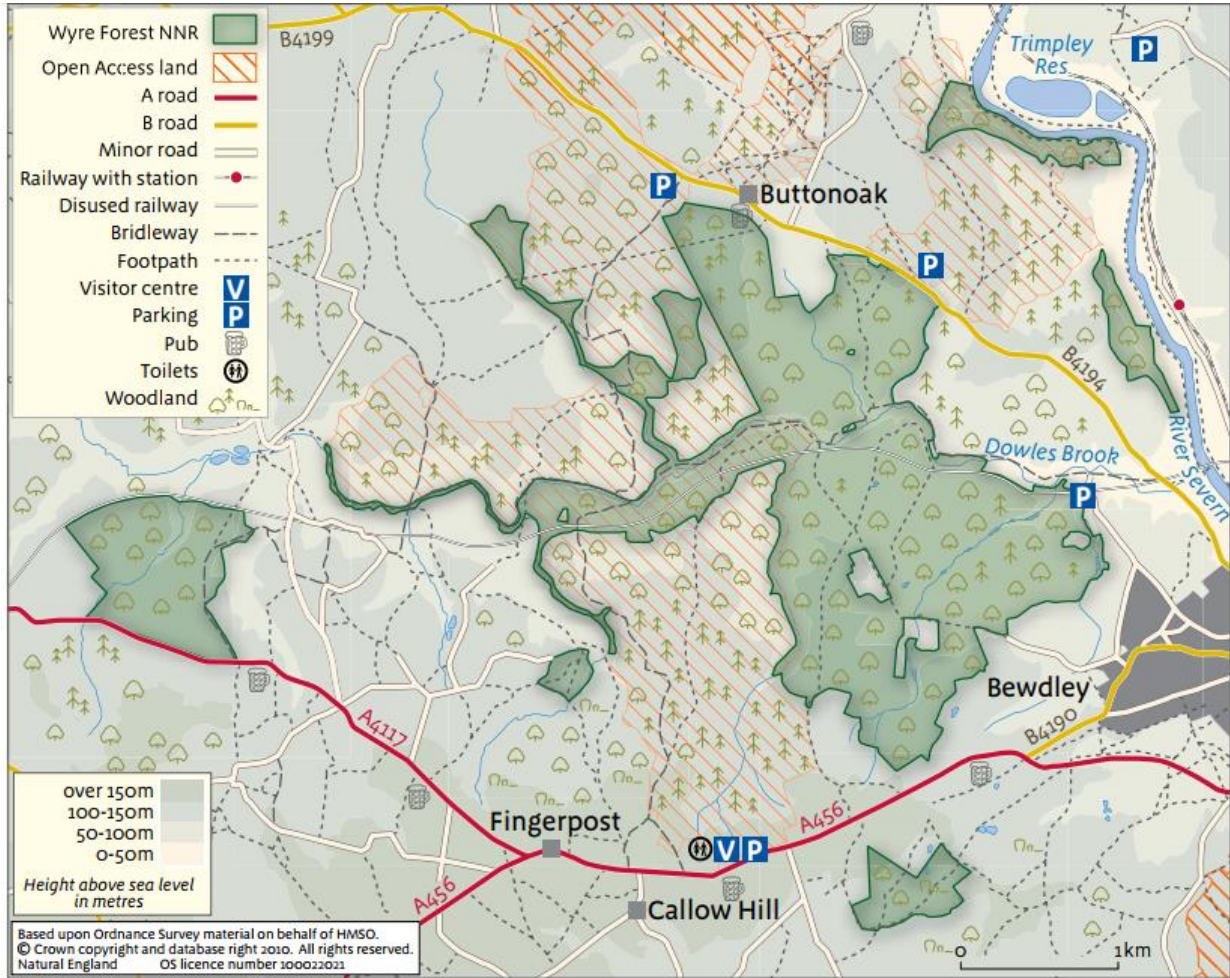


Figure 11 Map of Wyre Forest (Natural England, Wyre Forest: National Nature Reserve, 2010)

3 Current Pressures

3.1 Factors Affecting Habitats and Species

Management, development pressure, human activity, contamination, isolation and fragmentation, and health and safety concerns all negatively affect the targets species habitats in various ways.

- **Management.** The quality and biodiversity potential of urban habitat can be overlooked, ignored or inappropriately identified leading to deficiencies in management. In addition, much of the urban habitat resource must meet the needs of multiple users and cannot always be managed in the most appropriate manner to maximise biodiversity benefit.
- **Development Pressure.** Urban locations are very important ecologically and often contain protected species. Unfortunately, such areas are also subject to significant development pressure, in part because of Government policy on the re-use of brownfield sites. Such pressure is leading to a decline in the overall habitat resource, but it can also act a driver for providing biodiversity benefit within the built environment.
- **Human Activity.** There are many associated problems and benefits from this variable, including the effect of domestic animals, especially cats, and the increased use of footpaths, parks etc.
- **Contamination.** Industrial pollutants may be present and can have a detrimental effect upon the habitat, biodiversity and site users.
- **Isolation and fragmentation.** Many urban habitats suffer from fragmentation because of development or changing land use. This combined with the small size of many sites can lead to a decline in species diversity and population size even in situations where the habitats themselves are well managed.
- **Health and safety concerns.** This can be a problem with respect to street trees and their proximity to roads and public buildings.

Among all targeted species several factors affect the decline in populations because of the factors described above: loss of hibernation and roosting habitats, poor management practices of farmlands, grasslands, allotments, ponds and other waterways, use of pesticides and other toxic or poisonous chemicals, and population fragmentation as a result of poor urban planning and development.

3.2 Slow-worm Case Study

During 1994 and 1995, slow-worm mitigation exercises took place in Kent at two locations. This exercise yielded information about translocating populations away from sites in question, possibly planned for new developments (Platenberg & Longton). Authors Platenberg and Longton discovered that it is difficult to estimate populations of slow-worms due to irregular behavior and inaccurate models, which only consider slow-worms removed and all other conditions constant.

Once thought to mitigate vulnerable populations of slow-worms, translocating may not result in any mitigation. According to Platenberg and Griffiths, “the conservation value of [translocating] is unproven for many species” including the slow-worm (Platenberg & Griffiths, 1999). During their study, 103 slow-worms were removed from the development site and relocated to a receptor site. However, after two years, the monitored slow-worms showed “little evidence of successful reproduction” and were in “poorer condition” than the surrounding slow-worms.

From these studies, alternative conservation methods are needed to protect urbanized species. GI is designed to incorporate the environment into urban settings which may lead to natural migrations of species from development sites. Instead of isolating small patches of species’ population, these habitats can be interconnected with gardens, parks, or roadside trees to enhance habitats and natural species migrations, hibernation, and roosting

4 Current Action

4.1 Delivering and Protecting GI through Policy and Legislation

- **SAC Designation.** Special Areas of Conservation (SACs) “are sites that have been adopted by the European Commission and formally designated by the government of each country in whose territory the site lies” (JNCC, 2018). The sites are established based on their contribution to conserving 189 habitat types and 788 species identified in the European Commission (EC) Habitats Directive (JNCC, 2018).
- **SSSI Designation.** Sites of Special Scientific Interest are nationally important and legally protected natural sites that often exhibit some of the best and most beautiful wildlife habitats. They account for about 7% of England’s land and many are also designated as SACs, Special Protection Areas (SPAs), National Nature Reserves (NNRs), and/or Local Nature Reserves (LNRs) (Natural England, Sites of Special Scientific Interest (SSSIs), 2008). SSSIs are protected through cooperation between people who manage the sites and the government.

There are a number of legal designations relevant to Worcestershire’s urban environment.

- There is one European protected site, The Lyppard Grange in Worcester
- There are several SSSIs including Ipsley Alders March in Redditch and Northwick March in Worcester
- There are also several urban Local Nature Reserves spread widely throughout Worcestershire

4.1.1 Worcestershire Local Sites (LS’s)

Worcestershire has 553 LS’s. LS fall outside the national statutory protection but are given protection under local government policy. LS’s cover sites of biological or geological value and significant local ecology and/or geology (Worcestershire County Council, Worcestershire Local Sites Partnership, 2018).

The Worcestershire Wildlife Trust manages 75 nature reserves throughout the county. The organization aims to restore, recreate, and reconnect natural habitats by working with farmers, landowners, and communities to encourage wildlife (Worcestershire Wildlife Trust, Find a nature reserve, 2018).

Worcester is home to 18 wildlife sites managed by the Worcester City Council's Wildlife Ranger Team. Over 120 hectares provide various habitats – ponds, ancient semi-natural woodland, unimproved grassland and wildflower, meadows, scrub, reedbed and riverbanks – for numerous species. The wildlife sites are important GI because they interconnect biodiversity throughout urban areas across the city and county (Worcester City Council, 2018).

4.1.2 Local Plan Documents (LPDs)

Although the Worcestershire Biodiversity Action Plan provides information on targeted species and habitats, local districts have established their own LPDs with brief policies on GI and biodiversity.

South Worcestershire Development Plan. Worcester City Council, Malvern Hills District Council, and Wychavon District Council developed this plan together. In regard to biodiversity, the plan states that development is not permitted if it would:

- A. Compromise the favourable condition of a SAC or other international designations or the favourable conservation status of European or nationally protected species or habitats,
- B. Have an adverse effect on a SSSI, except where the benefits of the development at that site clearly outweigh both its likely impact on the features of the site that make it of special scientific interest and any broader impacts on the national network of SSSIs,
- C. Result in the loss or deterioration of an Ancient Woodland (AW), a Veteran Tree (VT), or a nationally protected species, unless the need and the benefits of the proposed development in that location clearly outweigh the loss or deterioration, and
- D. Compromise the favourable condition or the favourable conservation status of a Grassland Inventory Site (GIS), a Local Wildlife Site (LWS), a Local Geological Site (LGS), an important individual tree or woodland and species or habitats of principal importance recognised in the Biodiversity Action Plan or listed under Section 41 of the Natural Environment and Rural Communities Act 2006, unless the need for and the benefits of the proposed development outweigh the loss.

The plan also states that development should, wherever practicable, be designed to enhance biodiversity and geodiversity (including soils) conservation interests as well as conserve on-site biodiversity corridors / networks. Developments should also take opportunities, where practicable, to enhance biodiversity corridors / networks beyond the site boundary.

Regarding GI, the plan states:

- A. Housing development proposals (including mixed-use schemes) are required to contribute towards the provision, maintenance, improvement and connectivity of Green Infrastructure (GI) as follows:
 - I. For greenfield sites exceeding 1ha (gross) – 40% GI
 - II. For greenfield sites of less than 1ha but more than 0.2ha (gross) – 20% GI
 - III. For brownfield sites – no specific GI figure.
- B. The precise form and function(s) of GI will depend on local circumstances and the Worcestershire Green Infrastructure Strategy's priorities. Developers should seek to agree these matters with the local planning authority in advance of a planning application. Effective management arrangements should also be clearly set out and secured. Once a planning

permission has been implemented, the associated GI will be protected as Green Space (SWDP 38 refers)

- C. Other than specific site allocations in the development plan, development proposals that would have a detrimental impact on important GI attributes within the areas identified as “protect and enhance” or “protect and restore”, as identified on the Environmental Character Areas Map, will not be permitted unless:
 - I. A robust, independent assessment of community and technical need shows the specific GI typology to be surplus to requirements in that location; and
 - II. Replacement of, or investment in, GI of at least equal community and technical benefit is secured.⁸

Bromsgrove District Plan. The Bromsgrove District Council developed this plan and adopted it in 2017. The district is home to rich biodiversity and geodiversity, with particular species and habitats of interest, such as water voles, bats, hay meadows, acid grasslands, VT’s, and canals. As such, strategic objective 8 states:

- Protect and enhance the unique character, quality, and appearance of the historic and natural environment, biodiversity and Green Infrastructure throughout the District.

This plan also incorporates GI and how the council will deliver a high-quality GI multi-functional GI network by:

- a. ensuring developments adopt a holistic approach to deliver the multiple benefits and vital services of Green Infrastructure, with priorities determined by local circumstances;
- b. Requiring development to improve connectivity and enhance the quality of Green Infrastructure;
- c. Requiring development to provide for the appropriate long-term management of Green Infrastructure;
- d. Requiring development to have regard to and contribute towards, the emerging Worcestershire Green Infrastructure Strategy, any local GI Strategy and where available, the GI Concept Plans. For large scale development, developers will need to prepare a Concept Plan for the area, which would then serve to inform all developments in that area as they come forward.⁹

Borough of Redditch Local Plan No. 4. The Borough of Redditch developed several objectives to create and sustain a green environment. The objectives are as follows:

- “To maintain and provide a high quality natural, rural and historic environment with a Green Infrastructure network which maximises opportunities for biodiversity value, wildlife and ecological connectivity”;

⁸ All excerpts were taken directly from the South Worcestershire Development Plan. 2016.

<http://www.swdevelopmentplan.org/wp-content/uploads/2016/06/The-Adopted-SWDP-February-2016.pdf>
Requirement E has been omitted from this section.

⁹ Excerpt taken directly from the Bromsgrove District Plan. 2017.

<http://www.bromsgrove.gov.uk/media/2673698/Adopted-BDP-January-2017.pdf>

- “To ensure that all new development in Redditch Borough will work towards the achievement of being carbon neutral in line with the National Standards”;
- “To reduce the causes of, minimise the impacts of and adapt to climate change”;
- “To protect, promote and where possible enhance the quality of the Boroughs landscape and Redditch Borough’s other distinctive features”;
- “To encourage safer, sustainable travel patterns, improve accessibility and maintain a balanced road hierarchy and reduce the need to travel”;
- “To protect and enhance water, air and soil and minimise flood risk”.¹⁰

Wyre Forest Core Strategy (2006-2026). The Wyre Forest District Council developed and adopted a Local Development Framework in 2010. Within the plan are statements for providing a GI network and opportunities for local biodiversity and geodiversity. The Wyre Forest District plans to develop green infrastructure by delivering a “comprehensive network of green spaces, corridors and stepping stones across the District. This will help to promote active lifestyles, improve health and wellbeing, promote walking and cycling as a means of sustainable transport, support biodiversity and help to deliver UK and local BAP (Biodiversity Action Plan) targets and objectives, address climate change, and safeguard and enhance the District's unique landscape character, including the historic environment. Green infrastructure is an important cross-cutting issue. Therefore, this policy has linkages with CP14: Providing Opportunities for Local Biodiversity and Geodiversity; CP01: Delivering Sustainable Development Standards; CP07: Delivering Community Wellbeing; and CP15: Regenerating the Waterways.¹¹

The District also plans to provide opportunities for local biodiversity and geodiversity by:

- Safeguarding existing biodiversity sites – SSSI, NNR, LNR, SWS, and species and habitats recognised in the Worcestershire BAP;
- Enhancing opportunities or contributing to off-site biodiversity project during new development;
- Conserving and enhancing trees and woodlands under the protection of Tree Prevention Orders (TPOs);
- Enhancing and not detrimentally impacting the geodiversity during new development.

4.2 Ongoing Management of GI Habitat Assets

Managing GI assets are important to the future and sustainability of environmental biodiversity. In the Worcestershire Green Infrastructure Strategy, environmental quality categories are as follows:

- Protect and enhance (greatest existing GI value),
- Protect and restore (medium existing GI value), and
- Restore and create (lowest existing GI value) (Worcestershire Green Infrastructure Partnership, 2013).

¹⁰ Excerpt taken directly from Borough of Redditch Local Plan No.4. 2017.

<http://www.redditchbc.gov.uk/media/2751956/Adopted-BORLP4-low-res-17-02-17.pdf>

¹¹ Excerpt taken directly from Core Strategy. 2010. <http://www.wyreforestdc.gov.uk/media/89829/Adopted-Core-Strategy-DPD.pdf>

Worcestershire should continue to assess natural habitats based on this criterion because they prioritize the value of GI. It also helps to identify green corridors, which link GI and strengthen the connections between target species and habitats.

The Worcestershire County Council also created a paper on the viability of delivering GI as part of the suite of GI Strategy documents. The report aims to provide “guidance on the viability, valuing, and costing of GI to support implementation and delivery of GI on new development sites delivered through the planning process” (Worcestershire County Council, 2015). It also recognizes that delivering GI is impacted by the scale and type of scheme. Figure 12 demonstrates the funneling down scale of different GI delivery projects and who is impacted by them.

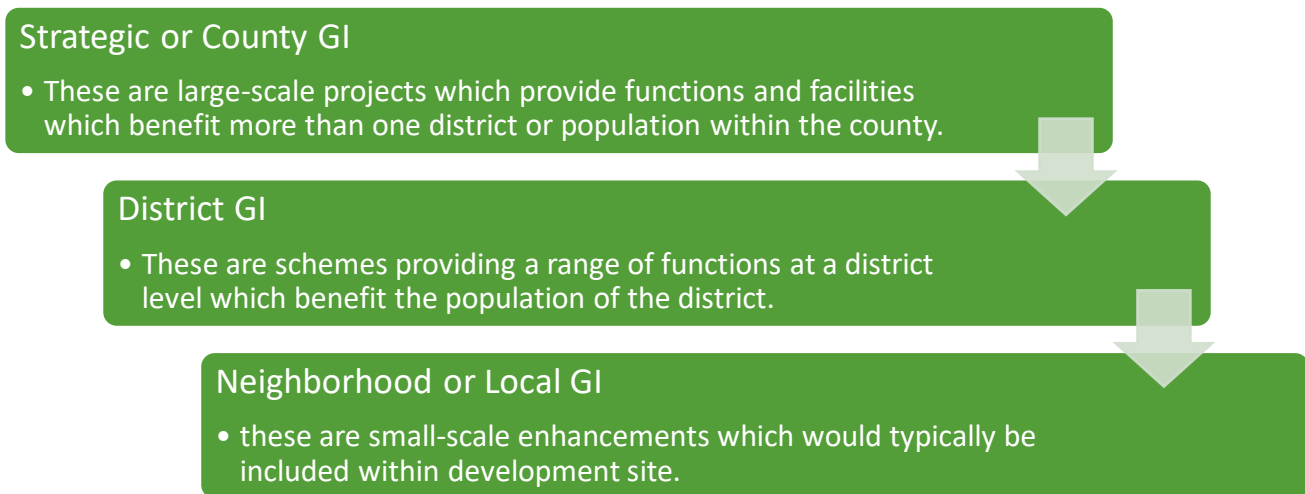


Figure 12 Delivering GI at different scales (modified from (Worcestershire County Council, 2015))

Assessing the viability of land development starts by asking: is the land development economically/financially feasible? Planning for high quality, sustainable, and multifunctional GI may increase developer’s financial return and the overall viability of the project. Determining the value of GI allows for understanding the qualitative and quantitative benefits which help planners and developers determine the appropriate GI’s. The value of GI can also help compare development sites. Finally, GI needs funding for both initial development and long-term management and maintenance. The whole document, *Viability, valuation and funding of green infrastructure on new development sites*, details more on delivering GI in new development sites (Worcestershire County Council, 2015).

4.3 Taking Action for Priority Species in the Urban Environment

4.3.1 Sanders Park, Bromsgrove Case Study

The Battlefield Brook runs through Sanders Park and is home to one of only two populations of water voles. The brook is a concrete channel, which has negatively affected the wildlife in the park over the years. 2017 began the restoration project¹² in part of a Severn Trent Water’s wider National Environment Programme designed to improve the ecology of the brook, create a more natural

¹² Full details of the project can be found here: <https://sites.google.com/northmid.co.uk/battlefieldbrook>

environment in the park, and help the brook reach 'good' status in accordance with the Water Framework Directive (WFD) (Bromsgrove District Council, 2018).

4.3.2 Lansdowne Crescent Allotments

The Lansdowne Crescent Allotments are considered a 'slow-worm' sanctuary site by the Worcester City Council. This cite should further be monitored by the council to determine further actions to help the species in this urban environment.

4.4 Survey, Research, and Monitoring of GI Assets and Urban Wildlife

Monitoring of urban biodiversity has been somewhat piecemeal in the past but there have been several important projects carried out in the county. In Worcester there have been surveys for slow worms and great crested newts, a full appraisal of over 80 greenspaces and a comprehensive assessment of the wider 'green network' of interconnecting open space and gardens.

Malvern Hills DC and Wychavon DC have carried out open space audits covering urban greenspace as well as the wider countryside and Bromsgrove DC has initiated a survey for *Arvicola terrestris* water vole.

The Worcester Wildlife Trust supports research and surveys throughout the county. In 2011, the organization conducted a valuation case study of the Gwen Finch Wetland Reserve. The economic evaluation showed that projects such as creation of Gwen Finch Wetland Reserve and The John Bennett Reserve, are cost-effective (Holzinger & Dench, 2011). This finding supports implementing conservation and management practices to ensure that target species and habitats, biodiversity altogether, are protected in Worcestershire County.

The following actions for priority species are currently ongoing:

- Bromsgrove Water Vole Strategy. Resulting from surveys in Bromsgrove town the strategy sets out a number of habitat management mechanisms and targets designed to protect and enhance suitable water vole habitat along watercourses in the town.
- Worcester City Slow-Worm survey. Ongoing survey and site protection in the city designed to protect and enhance the important populations found within the greenspace network.

5 References

- Bat Conservation Trust. (2010). *Common pipistrelle*. London: Bat Conservation Trust.
- British Parliament. (2008). *Planning Policy Statement 12*. London: TSO.
- Bromsgrove District Council. (2018). *New Developments*. Retrieved from [bromsgrove.gov.uk: www.bromsgrove.gov.uk/things-to-do/parks-and-outdoors/parks-and-play-areas/sanders-park/new-developments.aspx](http://www.bromsgrove.gov.uk/things-to-do/parks-and-outdoors/parks-and-play-areas/sanders-park/new-developments.aspx)
- Burch, S., Berry, P., & Sanders, M. (2012). Embedding climate change adaptation in biodiversity conservation: A case study of England. *Environmental Science & Policy*, 79-90.
- City of London. (n.d.). *City of London Biodiversity Action Plan 2016-2020*. Legislation, London.
- Conservation on Biological Diversity. (2018). *About the Nagoya Protocol*. Retrieved from Conservation on Biological Diversity: <https://www.cbd.int/abs/about/>
- Department for Environment Food and Rural Affairs. (2011). *Biodiversity 2020: A strategy for England's wildlife and ecosystem services*. The Crown.
- Department of Environment Food and Rural Affairs. (2012). *The UK Post-2010 Biodiversity Framework*. Retrieved from JNCC: <http://jncc.defra.gov.uk/page-6189>
- GreenFacts. (2001-2017). *Biodiversity & Human Well-being*. Retrieved from GreenFacts: Facts on Health and the Environment: <https://www.greenfacts.org/en/biodiversity/l-3/1-define-biodiversity.htm>
- HM Government. (2011). *The Natural Choice: securing the value of nature*. Crown.
- Holzinger, O., & Dench, D. (2011). *The Economic Evaluation of Gwen Finch Wetland Reserve*. Worcester: Worcestershire Wildlife Trust.
- JNCC. (2018). *Special Areas of Conservation (SAC)*. Retrieved from JNCC: <http://jncc.defra.gov.uk/page-23>
- Joint Nature Conservation Committee. (2018). *Lyppard Grange Ponds*. Retrieved from Joint Nature Conservation Committee: <http://jncc.defra.gov.uk/protectedsites/sacselection/sac.asp?EUCode=UK0030198>
- Koc, C. B., Osmond, P., & Peters, A. (2016). A Green Infrastructure Typology Matrix to Support Urban Microclimate Studies. *Procedia Engineering*, 183-190.
- Lyppard Grange Ponds SSSI*. (2000). Retrieved from Designated Sites View: <https://designatedsites.naturalengland.org.uk/SiteDetail.aspx?SiteCode=s2000428>
- Malvern Hills Trust. (2018). *Habitats*. Retrieved from Malvern Hill: <http://www.malvern hills.org.uk/hills-and-commons/habitats/>
- Natural England. (2008). *Sites of Special Scientific Interest (SSSIs)*. Natural England.
- Natural England. (2009). *Green Infrastructure Guidance*.

- Natural England. (2010). *Wyre Forest: National Nature Reserve*. The Crown.
- Natural England. (2014). *National Character Area profile: 102. Teme Valley*.
- Natural England. (2014). *National Character Area profile: 106. Severn and Avon Vales*.
- Park, C., & Allaby, M. (2017). biodiversity action plan . *A Dictionary of Environment and Conservation , 3rd*. Oxford University Press. Retrieved from <http://www.oxfordreference.com.ezproxy.wpi.edu/view/10.1093/acref/9780191826320.001.0001/acref-9780191826320-e-750>
- Parliament. (2012). *National Planning Policy Framework*. London: The Crown.
- Platenberg, R. J., & Griffiths, R. A. (1999). Translocation of slow-worms (*Anguis fragilis*) as a mitigation strategy: a case study from south-east England. *Biological Conservation*, 125-132.
- Platenberg, R., & Longton, T. (n.d.). Slow-worms in Kent: estimates of population density and post-translocatin monitoring. *Natural England*, 61-70.
- Puppim de Oliveira, J. A., Doll, C. N., & Moreno-Penaranda, R. (2014). *Urban Biodiversity and Climate Change* (Vol. 1). Springer, Dordecht. doi:https://doi.org/10.1007/978-94-007-5784-4_21
- Redditch Borough Council. (2018). *Woodland management programme*. Retrieved from <http://www.redditchbc.gov.uk/my-place/landscape-and-trees/tree-maintenance/woodland-management-programme.aspx>
- Rescue, W. H. (2010). *Access4Hedgehogs*. Retrieved from Willows Hedgehog Rescue Broomsgrove: <http://www.willowshedgehogrescue.co.uk/willows-access-for-hedgehogs.html>
- Shepard, A. (n.d.). *Urban Slow-worms in Worcester City*. Retrieved from <http://www.wbrc.org.uk/WORCRECD/Vol1Iss3/slowworm.htm>
- University of California Museum of Paleontology. (2018). *Biological species concept*. Retrieved from Understanding Evolution: https://evolution.berkeley.edu/evolibrary/article/side_0_0/biospecies_01
- Watson, W. (2000). The Status and Distribution of Great Crested Newts in Worcestershire 2000: part 1. *Worcestershire Records*(9).
- Watson, W. (2001). The Status and Distribution of Great Crested Newts in Worchestershire 2000: part 2. *Worcestershire Record*(11).
- Worcester City Council. (2018). *Wildlife Sites in Worcester City*. Retrieved from Worcester City Council: <https://www.worcester.gov.uk/conservation-wildlife-sites>
- Worcestershire Biodiversity Partnership. (2008). *Bat Species Action Plan*. Woecester: Worcestershire County Council.
- Worcestershire Biodiversity Partnership. (2008). *Great Crested Newt Species Action Plan*. Worcester: Worcestershire County Council.

- Worcestershire Biodiversity Partnership. (2008). *Slow-worm Species Action Plan*. Worcester: Worcestershire County Council.
- Worcestershire Biodiversity Partnership. (2008). *Urban Habitat Action Plan*. Worcester: Worcestershire City Council.
- Worcestershire Biodiversity Partnership. (2008). *Water Vole Species Action Plan*. Worcester: Worcestershire County Council.
- Worcestershire County Council. (2015). *Viability, valuation and funding green infrastructure on new development sites*. Worcester.
- Worcestershire County Council. (2018). *Worcestershire Local Sites Partnership*. Retrieved from Worcestershire County Council: http://www.worcestershire.gov.uk/info/20014/planning/1025/worcestershire_local_sites_partnership
- Worcestershire Green Infrastructure Partnership. (2013). *Worcestershire Green Infrastructure Strategy 2013 - 2018*. Worcester County Council.
- Worcestershire Wildlife Trust. (2011). *Bromgrove District*.
- Worcestershire Wildlife Trust. (2018). *Find a nature reserve*. Retrieved from Worcestershire Wildlife Trust: <http://www.worcswildlifetrust.co.uk/wildlife/reserves>
- Worcestershire Wildlife Trust. (2018). *House Sparrow Passer domesticus*. Retrieved from Worcestershire Wildlife Trust: <http://www.worcswildlifetrust.co.uk/species/house-sparrow>
- World Land Trust. (2018). *European Hedgehog*. Retrieved from World Land Trust: <http://www.worldlandtrust.org/education/species/european-hedgehog>
- Wyre Forest District Council. (2017, March 15). *About Wyre Forest*. Retrieved from Wyre Forest District Council: <http://www.wyreforestdc.gov.uk/about-wyre-forest.aspx>