Northamptonshire Natural Capital Maps: User Guide

Authors:
Dr Jim Rouquette, Natural Capital Solution Ltd
Rosalind Johnston, Northamptonshire Biodiversity Records Centre

Report prepared for and funded by:
NCEA Project, NBRC, Wildlife Trust BCN & Defra

Last Updated: July 2023

Contents

1. Introduction

1.1 What are natural capital and ecosystem services?

Natural Capital is defined as:

> *"..elements of nature that directly or indirectly produce value or benefits to people, including ecosystems, species, freshwater, land, minerals, the air and oceans, as well as natural processes and functions"* (Natural Capital Committee 2014).

These benefits (often referred to as ecosystem services) include food production, regulation of flooding and climate, pollination of crops, and cultural benefits such as aesthetic value and recreational opportunities. Different types of ecosystem service are shown in Figure 1 and key attributes of natural capital are illustrated in Figure 2 (overleaf).

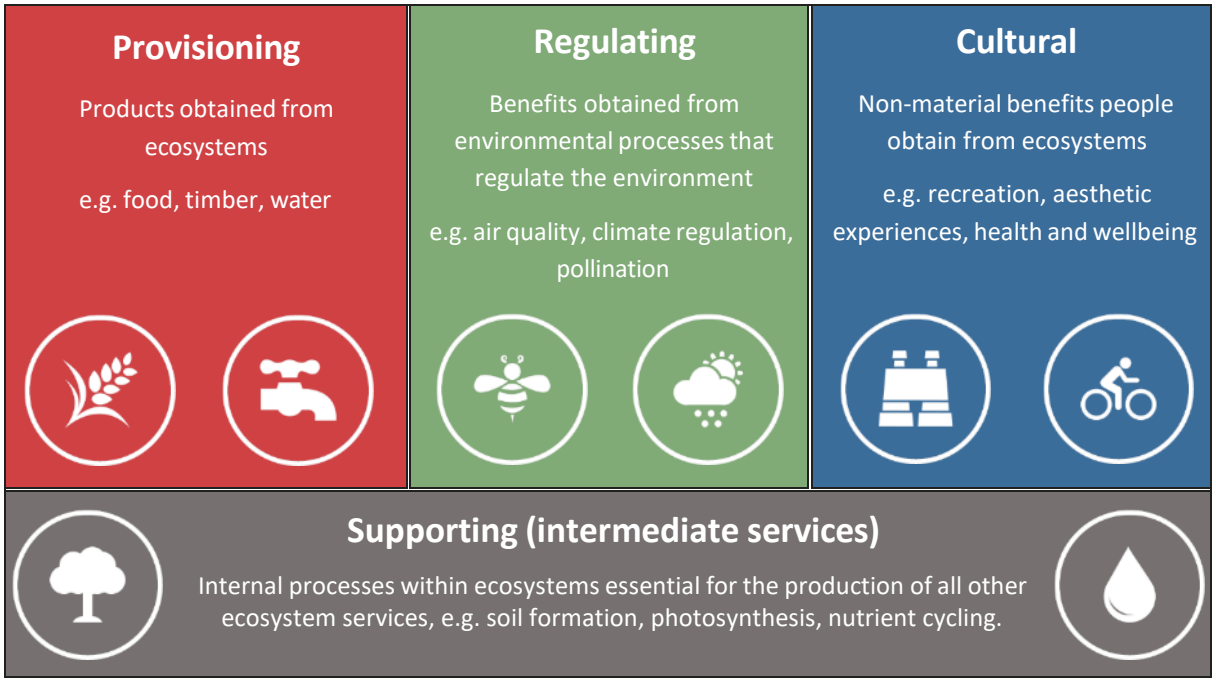


Figure 1. Key types of ecosystem services (based on MA 2005 [1]). Note that supporting or intermediate services are now categorised as ecological functions (CICES [2]). They are the underpinning structures and processes that give rise to ecosystem services.

The environment is increasingly regarded as 'multi-functional', delivering a range of environmental, social and economic benefits to society. Greenspaces and well-planned developments can reduce carbon emissions, downstream flood risk and water quality problems, as well as providing quality space for recreation and biodiversity gain. Greenspaces are also important components of 'place-making' providing local landscape identities to residents and businesses. Quality green spaces deliver real value

[1] Millennium Ecosystem Assessment (2005) Ecosystems and human well-being: Synthesis. Island Press, Washington D.C. https://www.millenniumassessment.org/en/index.html

[2] Haines-Young, R. & Potschin, M. (2018) Common International Classification of Ecosystem Services (CICES) V5.1. Guidance on the application of the revised structure. Fabis Consulting.

to society, create community well-being, and enhance liveability and sense of place. By spatially showing the multi-functional benefits or 'ecosystem services' that can be delivered and optimal locations to deliver those enhanced benefits, natural value can be utilised in planning decision making. The supplied maps help show the value of local ecosystem assets, and that value can aid in the protection of these assets, and where they might fit with local opportunities of funding for nature.

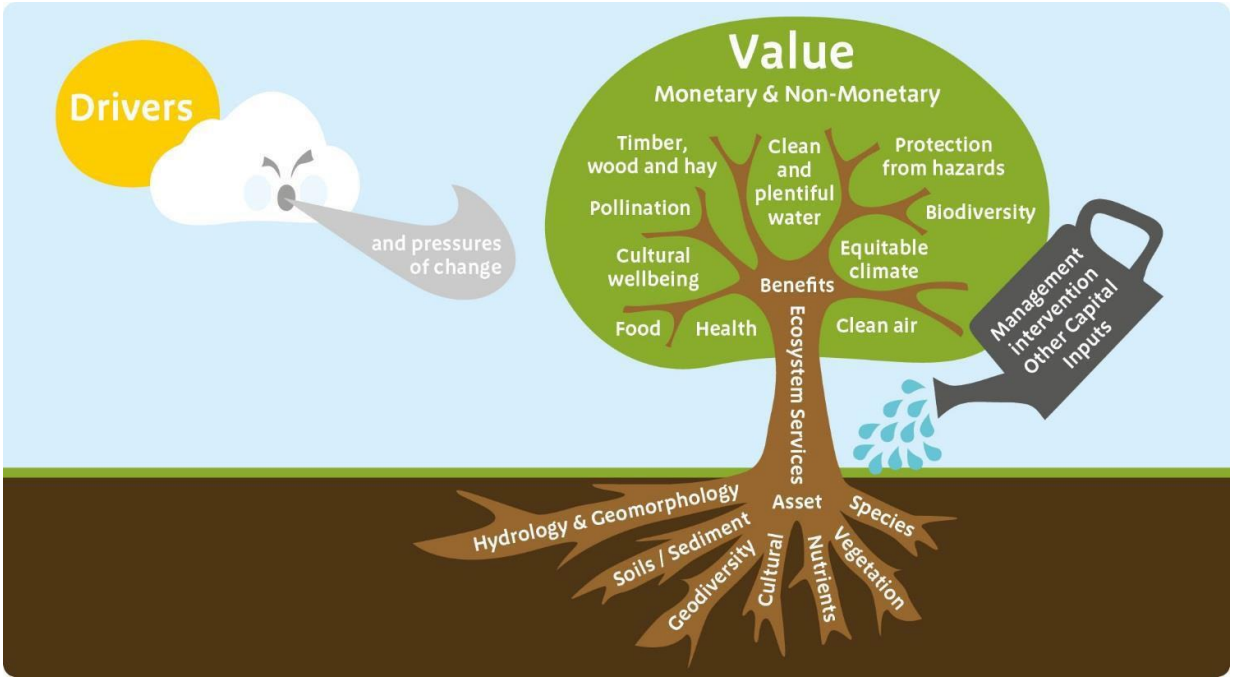


Figure 2. Key attributes of natural capital (from Natural England 2019[3])

Adopting the natural capital and ecosystem services approach is a key policy objective of the UK Government and central to Defra's 25 year plan. Lawton et al. (2010) concluded that England's wildlife sites needed to be "Better", "Bigger", "More" and "Joined" to constitute a resilient ecological network. The 25-year environment plan for England (DEFRA, 2018) outlines the opportunity to put this Lawton vision into practice. The concepts of natural capital and ecosystem services are widely supported in the scientific community. The current challenge is taking theory to practice; in implementation of the approach, to embed it in working practices and to aid strategic decision making. This is a new approach on the ground, to deliver resilient ecological networks that act for the co-challenges of climate change and biodiversity loss. At local level, decision-making on a site-by-site case should be guided with professional ecologist advice. Retention of existing high value assets should be a first priority, next, good habitat management and condition improvement to maximise the identified natural capital benefits and last, where land use change is proposed, we recommend careful consideration with ecologist support and with use of all local level site specific data (site history, species records) from historic and current survey alongside the supplied local section of the county level models.

Northamptonshire faces increasing pressures from human development, and is highlighted for significant growth over the next few years. This presents potential pressure on natural environments, if an understanding of the existing natural capital value of existing environments is missed, with possible deterioration of these natural capital assets. This also presents potential opportunities, with considered

[3] Sunderland, T., Waters, R.D., Marsh, D. V. K., Hudson, C., And Lusardi, J. (2019). Accounting for National Nature Reserves: A natural capital account of the National Nature Reserves managed by Natural England. Natural England Research Report, Number 078.

use of all available evidence in decision making, to achieve conservation of biodiversity and ecosystem services at a landscape scale. To practically embed the approach for implementation on the ground, Natural Capital Solutions Ltd have produced a series of county level modelled maps. These show; the most likely habitat composition across the county; the natural capital benefits being delivered for any location across Northamptonshire; and the most opportune locations for new habitats to deliver further benefits. We include a map indicating the constraints including 'existing good habitat' and 'built features' as applied in the modelling. The models are indicative, and are based on the best available current data at the point of modelling. Please note that the mapping identifies areas based on landscape-scale ecological principles and indicative ecosystem services models, and does not take into account local site-based factors that may affect suitability, for which professional ecological advice should be sought.

These maps are provided as a component tool, as guided by the Lawton principles, for use by ecological professionals to aid local decision-making for connectivity, condition improvement and to guide land use change. The maps are provided with, and should be used alongside the Northamptonshire Biodiversity Records Centre standard ecological reports which show the current designated sites, validated and verified species records and professionally collected BAP habitat data (annually updated where ground survey has been completed by the Wildlife Trust for Bedfordshire, Cambridgeshire and Northamptonshire and the Northamptonshire Biodiversity Records Centre). Any areas suggested for land use change through habitat creation, will require assessment of the species assemblages, local site history, where available as a citation, and ground-truth survey with professional ecological advice before implementation. The habitat opportunity maps should be seen as a tool to highlight key locations to apply the 'bigger, better, and more joined up' approach to nature recovery and to guide decision making, rather than an end in themselves. It is imperative to use all available current information alongside the report models. The Northamptonshire Biodiversity Records Centre supplies the Natural Capital Maps alongside the quality assured and most current information available on local designated sites, species and habitat. This information, used alongside any recommended on-the-ground survey for habitat condition and species abundance, will arm your ecologist with the data led decision making and the best chance of delivering optimal results for your investment in nature.

Box 1: Uses of the maps

There are a wide range of potential uses for these maps at local or parish level, including:

- Guiding the preparation of Parish or Neighbourhood Plans
- Assessing planning applications
- Providing evidence to support green infrastructure and local green space designations
- Planning for habitat protection, restoration and expansion
- Planning for climate change mitigation and tree planting schemes
- Providing supporting evidence for funding applications
- Helping to define future ambitions for an area
- Awareness raising of natural assets within local areas
- Interacting with land owners for optimal habitat management

The Northamptonshire Biodiversity Record Centre website compiles up-to-date references, funding opportunities and good practice case studies to support users of the service.

2. Report summary & scope

This section briefly describes all of the maps received as part the Natural Capital service from the Northamptonshire Biodiversity Record Centre. The following sections describe the maps in detail.

Box 2: Obtaining maps, support and providing feedback

The Northamptonshire Biodiversity Record Centre can provide the Natural Capital Maps for a parish boundary or a circular buffer search around a supplied grid reference of 2km^2 and above. The maps are only supplied as additional to a standard data report of over 2km^2 circular search. They are supplied as a set of pdf maps, together with this accompanying User Guide. Please note, due to the county level scale of the modelling, from which the maps are provided, in some locations the provided maps will appear 'blank' where there are no identified features. The methodologies used to produce the Natural Capital Maps are broadly explained in; Habitat opportunity mapping in Northamptonshire and Peterborough, May 2018. The supplied Natural Capital Maps go a little further than in this report. Rather than presence and absence of opportunities, they detail 3 levels of priority of the opportunity areas identified, representing the top 10%, 10-25% and 25-50% best areas for each ecosystem service. Therefore, the combined opportunity maps present a score out of a theoretical maximum of 15 (3 levels of 5 services).The Northamptonshire Biological Record Centre website has details of further external resources to aid good practice in local use of the mapping.

There will be a charge for this service, to cover the costs of administering the service, for ongoing improvement of base habitat information and accuracy of the base mapping, and to periodically update the models and maps. Charges are based on fair non-profit principles, as with other Northamptonshire Biodiversity Record Centre services

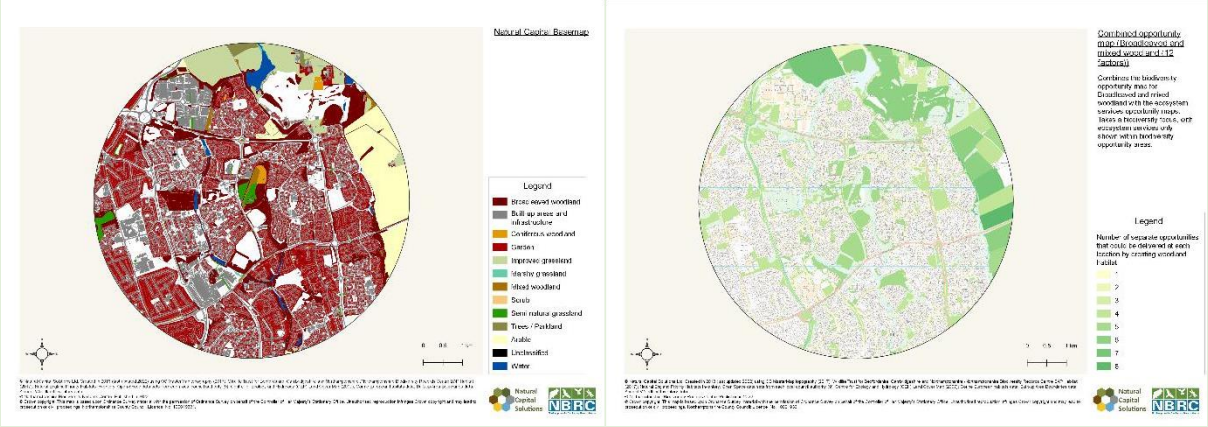


Figure 3. Example circular search Natural Capital maps

We welcome feedback from users of the maps and hope to build case studies of local implementation and good practice projects. We would also welcome local feedback on the basemap and rights of way for incorporation in the new round of remodelling. Citizen biological recording, commissioned survey and ecological reporting to the record centre is encouraged. For further information, to purchase maps and to supply feedback, please contact:

Northamptonshire Biodiversity Records Centre (NBRC) at https://www.northantsbrc.org.uk/

2.1 NBRC Standard Information Request

The Natural Capital maps are supplied as additional to a standard information report of 2km search area and above. This is provided for use alongside the models. The information is quality checked and updated annually.

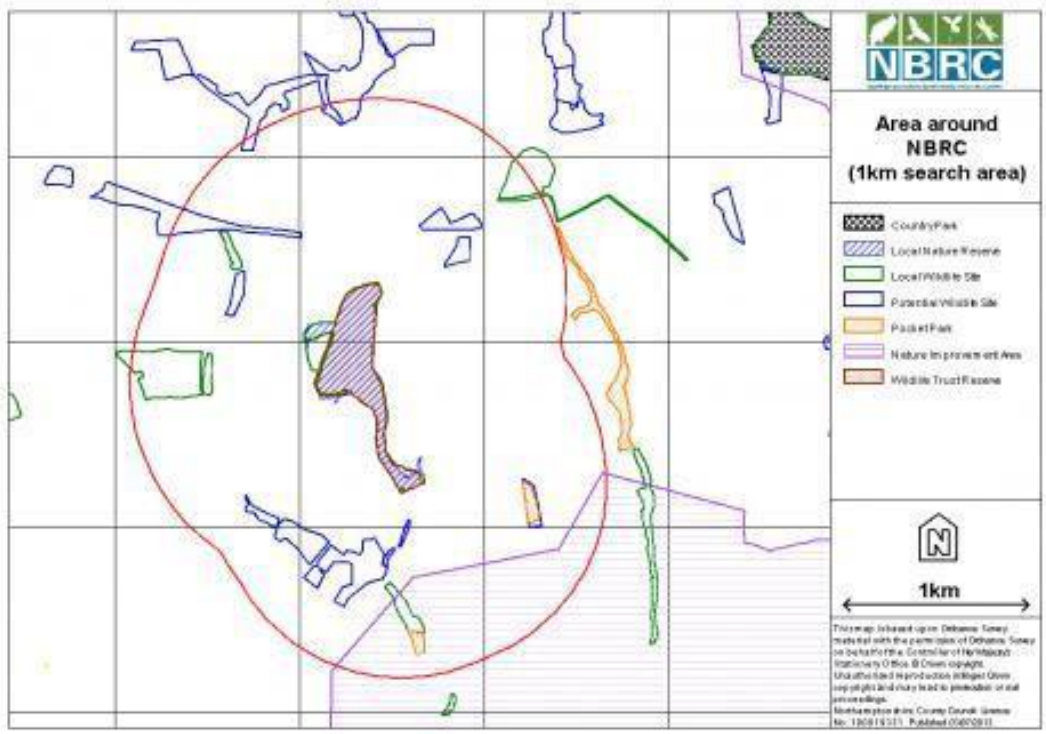


Figure 4. Example circular search NBRC standard report maps

A standard NBRC data search for a given area will provide a map and a report (PDF) including:

- Location of statutory sites that have been designated as; Special Protected Areas (SPAs), Sites of Special Scientific Interest (SSSI), National Nature Reserves (NNRs) or Local Nature Reserves (LNRs).
- Location and where available, descriptions of non-statutory sites that have been designated as Local Wildlife Sites (LWS), Protected Wildflower Verges (PWV), Wildlife Trust Nature Reserves, Local Geological Sites (LGS), Pocket Parks, Important Invertebrate Areas (IIA) and Potential Wildlife Sites (PWS).
- Lists of protected and notable species records (including red data book and Biodiversity Action Plan species) with dates and spatial references
- Location of UK Biodiversity Action Plan (BAP) habitat information (where held).

Within the provided information of existing protected and notable sites, we include citations (where held) which detail the condition and habitat history of sites within the area requested. Species lists can also be used to check the habitat classification and plan for effective biodiversity enhancement. ***All of the maps should be used with professional ecologist guidance, and in conjunction with commissioned ecological survey where advised.***

2.2 Natural Capital Report summary: natural capital basemap

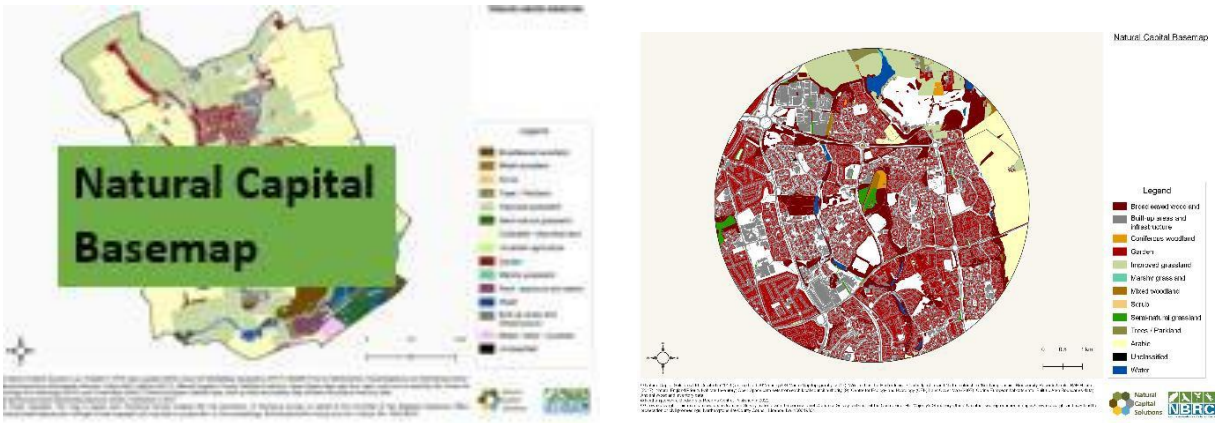


Figure 5. Example parish and circular search Natural Capital basemaps

The Natural Capital basemap shows the natural capital assets present in the area requested. This is split into 18 broad categories. The model shows broad categories *i.e. categorised as semi-natural grassland rather than acid grassland*, where held, your BAP habitat report shows the detailed level of survey information held by the record centre. *See Section 3 for details*.

The Natural Capital basemap provides the most comprehensive coverage possible, at county level, at the point of modelling. It is based on existing data at the time of modelling (current version 2021) and a breakdown of the sources used in the model (with dates) are described in Box 3. All of the following ecosystem services and habitat opportunity maps use this natural capital basemap as the basis to model and map.

Whilst every effort has been made to provide the most comprehensive and current available information, please note the map will be prone to some error. Some components have not been extensively surveyed, and on a field-by-field basis habitats may have changed since last surveyed. We are continually improving the base habitat information and the natural capital basemap is remodelled periodically using the best available habitat information.

The record centre would welcome your reports, if you find through local professional ground survey any discrepancies in the classification. In supplying this information, you will contribute to the capture of quality habitat information available for the next round of remodelling.

2.3 Natural Capital Report summary: combined opportunity maps

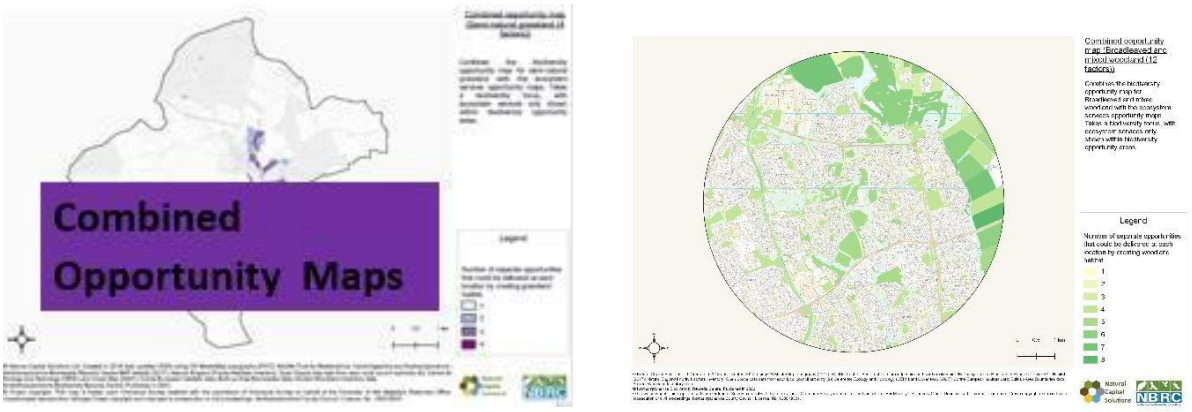


Figure 6. Example parish and circular search combined ecosystem opportunities maps

The maps present a score out of a theoretical maximum of 15 (3 levels of 5 services) for each broad habitat for the number of services that would be met through habitat creation:

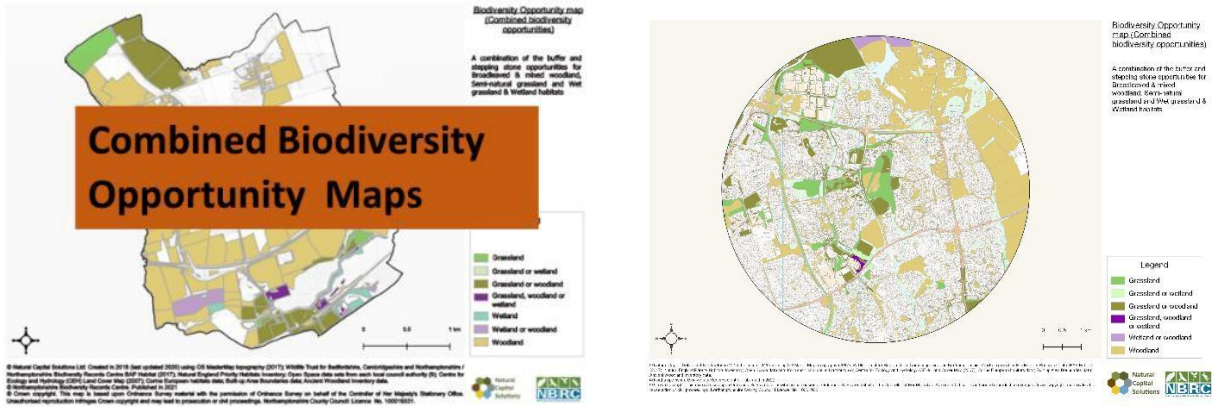
- Broadleaved and mixed woodland
- Semi-natural grassland
- Wet grassland and wetlands

These maps consider where multiple benefits could be delivered, combining all ecosystem services opportunities and the biodiversity opportunities for each habitat. They can be used alongside the biodiversity opportunity and individual ecosystem services opportunites maps to see which opportunities would be met. *See Section 4 for details.*

These maps take a biodiversity focus, with ecosystem services only shown within fields identified for biodiversity opportunity areas. The opportunity mapping identifies areas based on landscape-scale ecological principles. On a site level basis, this should be considered alongside species records and site history from the supplied citations. We recommend a full understanding of your local assets, with professional ecological support to ensure good decision making on existing habitat for biodiversity.

The maps should be seen as a tool to highlight key opportunity locations to deliver natural capital benefits and to guide decision-making, rather than an end in themselves.

2.4 Natural Capital Report summary: combined biodiversity opportunity maps



These maps combine buffer (adjacent to existing sites) and stepping stone (usually further from existing sites) opportunities for all three broad habitat types, but exclude the core zones (existing habitats) for

clarity. These core zones can be seen in the basemap, in the constraints map, the individual biodiversity opportunity maps and checked alongside site citations. *See Section 5.1 for details*.

Seven categories are provided to show the potential options for land use change. It is useful to consider the wider picture, and number of opportunities at county level of each habitat type.

Figure 7. Example parish and circular search combined biodiversity opportunities maps

Ecologist consideration of historic habitat and existing species assemblages alongside these maps are recommended. Any areas suggested for habitat creation will require ground-truth by professional ecologists before implementation.

2.5 Natural Capital Report summary: biodiversity opportunity maps

Figure 8. Example parish and circular search biodiversity opportunities maps

Maps showing the core (existing habitat), buffer and stepping stone opportunities for each broad habitat type at field level (*see Section 5.2 for details)*.

- Broadleaved and mixed woodland opportunity zones
- Semi-natural grassland opportunity zones
- Wet grassland and wetlands opportunity zones

2.6 Natural Capital Report summary: ecosystem services opportunity maps

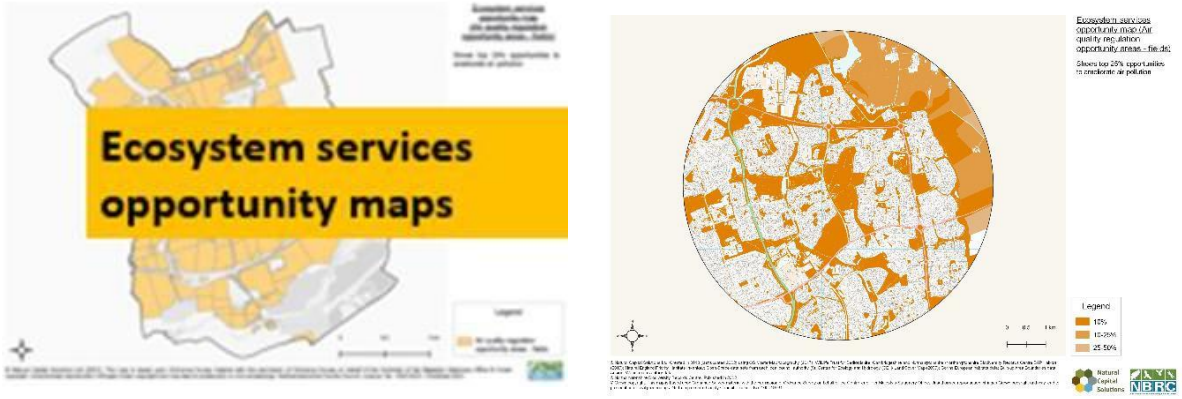


Figure 9. Example parish and circular search ecosystem services opportunity maps

These maps consider the top 10%, 10-25% and 25-50% best areas (from the below ecosystem services maps) to deliver enhancement of the following ecosystem services *(see Section 6 for details)*:

a) Reduce surface runoff
b) Reduce soil erosion and improve water quality
c) Ameliorate air pollution
d) Enhance recreation in the natural environment.

2.7 Natural Capital Report summary: ecosystem services maps

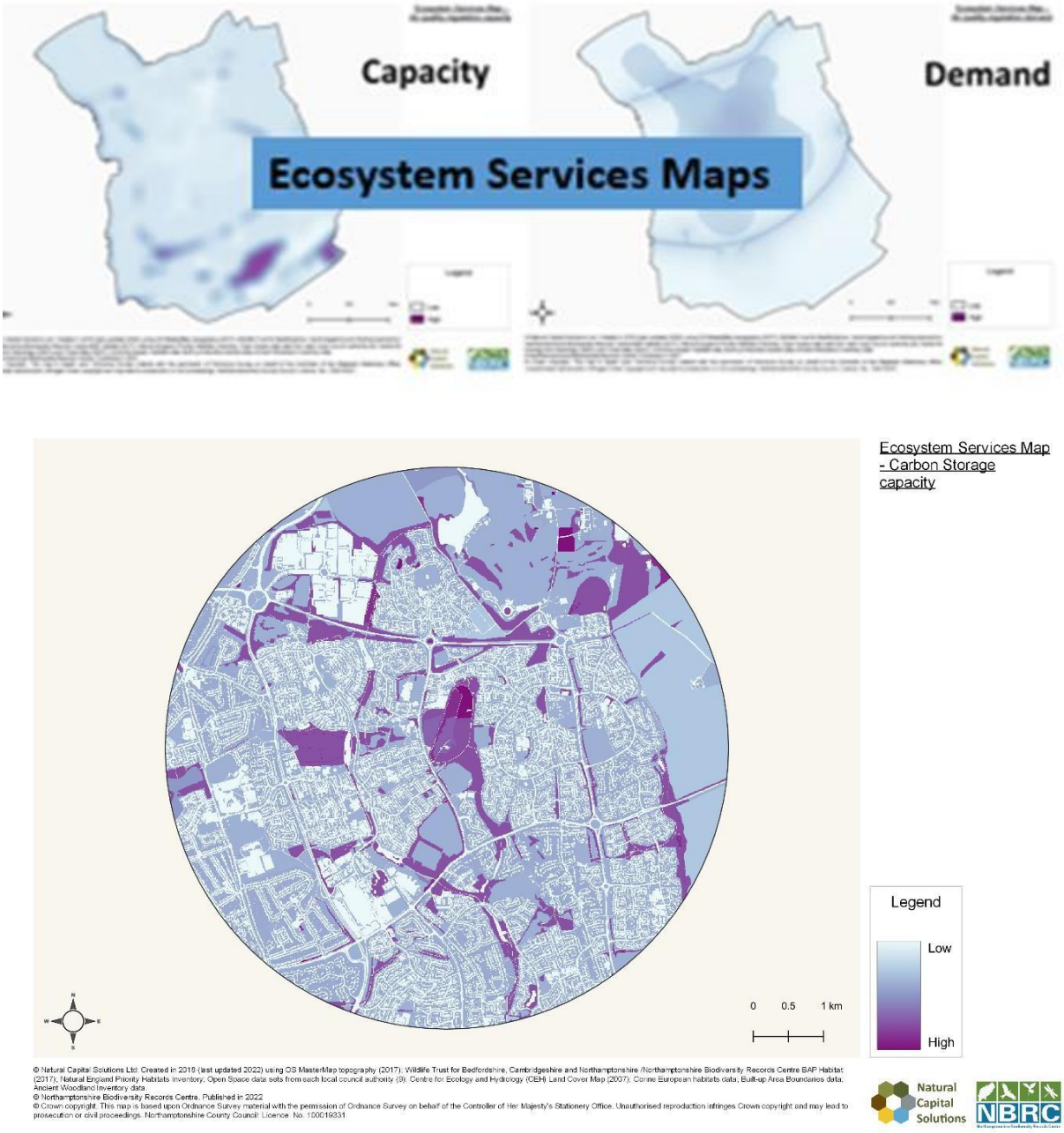


Figure 10. Example parish and circular search ecosystem services maps

This set of maps use the natural capital basemap to model and map the capacity for ecosystem services (the benefits) to be delivered by the existing natural capital. We provide maps to assess eight different ecosystem services and whenever possible we also map the demand for these services across the area.

These maps show the current situation at the point of modelling. Dates are supplied in the legend of the supplied maps *(see Section 7 for details).*

2.8 Natural Capital Report summary: constraints map

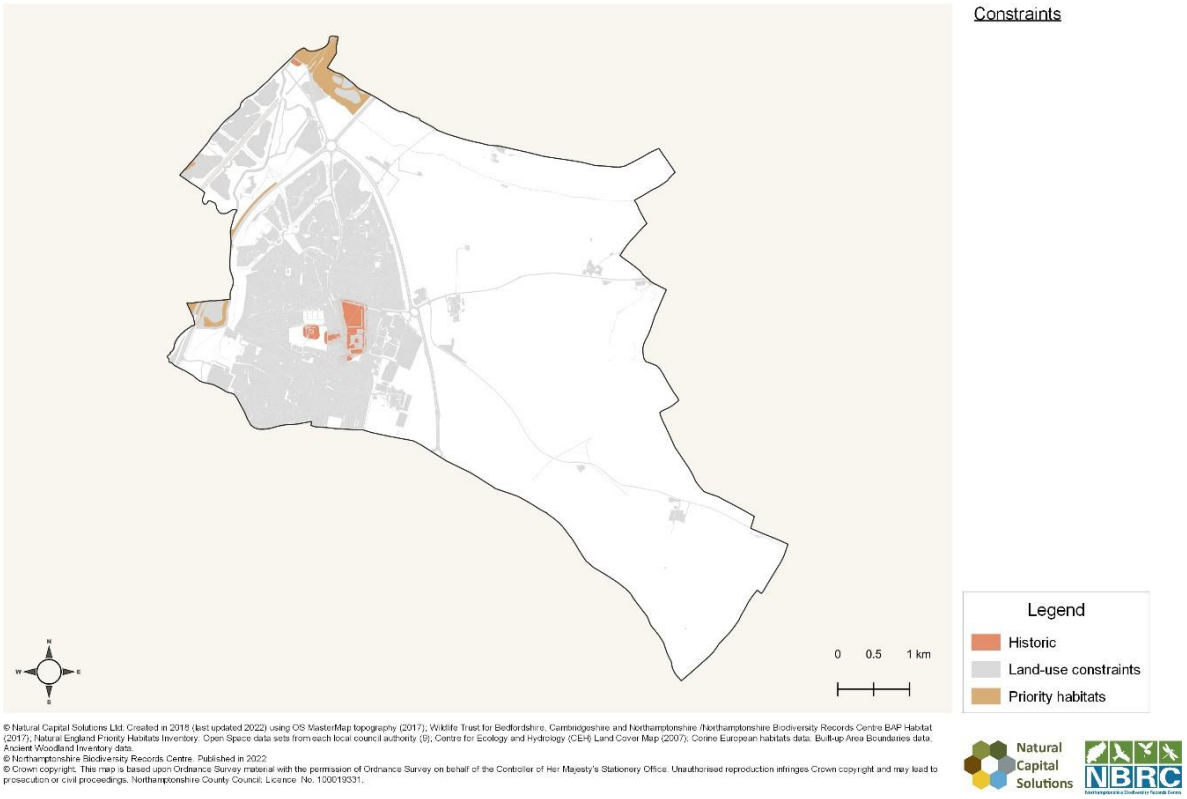


Figure 11. Example of Natural Capital Report Constraint maps*example map *for reference only*

A number of constraints exist that need to be taken into account when producing opportunity maps. This map highlights the constrained areas and includes:

- Land-use constraints – infrastructure (roads, railways, and paths), urban (all buildings), gardens, and water (standing and running).
- Priority habitats – all existing habitats of high nature conservation interest. It would not make sense to destroy existing high-quality habitat to create new habitat of a different type.
- Historic – Scheduled Monuments, Registered Parks and Gardens, and Registered Battlefields (data from Historic England) with a 30m buffer applied around each individual site. This constraint was not applied for semi-natural grassland opportunity areas, which should be feasible at historic sites.
- National Grid gas pipelines, overhead lines and cables (data from the National Grid), with a 10m buffer applied. This constraint was only applied when woodland opportunities were being mapped, as it would not be possible to plant trees in these areas, although other habitats should be feasible.

3. Natural capital basemap

What is it and why is it important?

The first and key part of any assessment of natural capital and the benefits that it provides is to produce a detailed map of the current habitats present across the area. This is an important component of any assessment of natural capital assets, and is required before an assessment of the benefits (ecosystem services, Section 7) or opportunities for enhancing those benefits (Sections 5 and 6) can be undertaken. To do this we used Ordnance Survey MasterMap polygons as the underlying mapping unit and then a series of different data sets to classify each polygon to a detailed habitat type, and to associate a range of additional data with each polygon. The data that was used to classify habitats is shown in Box 3.

Box 3: Data used to classify habitats in the basemap (last updated 2021)

- OS MasterMap Topography layer (2021)
- Detailed (BAP) habitat data supplied by the Wildlife Trust for Bedfordshire, Northamptonshire & Cambridgeshire and Northamptonshire Biodiversity Records Centre (2020)
- Natural England Priority Habitats Inventory (2021)
- Forest Research National Forest Inventory (2019 - *most recent available at time of modelling*)
- Corine European habitat data (2018 - *most recent available*)
- RPA's CROME (Crop Map of England) dataset (2019 - *most recent available*)
- OS Open greenspace data (2021 download)
- Open space (green infrastructure) data sets for each local council
- Built-up Area Boundaries data
- Digital terrain model (based on OS Terrain 5 data)

Polygons were classified into detailed (Phase 1) habitat types and were also classified into broader habitat groups. The final basemap covered the whole of Northamptonshire and Peterborough, and covers an area of 275,000 ha or 2,750 km^2. It contained 1.72M polygons, each of which was classified to an appropriate habitat type.

Note that the basemap provides the best approximation of habitat types that can be achieved based on available data. But it has not been ground-truthed further and will inevitably contain errors. A particular challenge was classifying polygons where more than one habitat was present. Mixed habitats containing woodland and scrub, or grassland with woodland were classified in detail, but not all combinations of habitats could be accommodated. This basemap will be provided along with the most current BAP habitat information (from received professional habitat surveys to the Northamptonshire Biodiversity Record Centre, including professional site survey information gained with Wildlife Trust for Bedfordshire, Cambridgeshire & Northamptonshire).

What do the results show?

Figure 12 (overleaf) shows the distribution of broad habitat types across an example parish, in this case Higham Ferrers. Rural areas are dominated by arable land and improved grassland here and across Northamptonshire, but this parish also contains lakes next to the River Nene, and small areas of woodland, wet grassland and other more natural habitats. The built-up area is apparent in the eastern half of the Parish, and the mapping is detailed enough to distinguish individual buildings, gardens and infrastructure (roads, railways, pavements and paths).

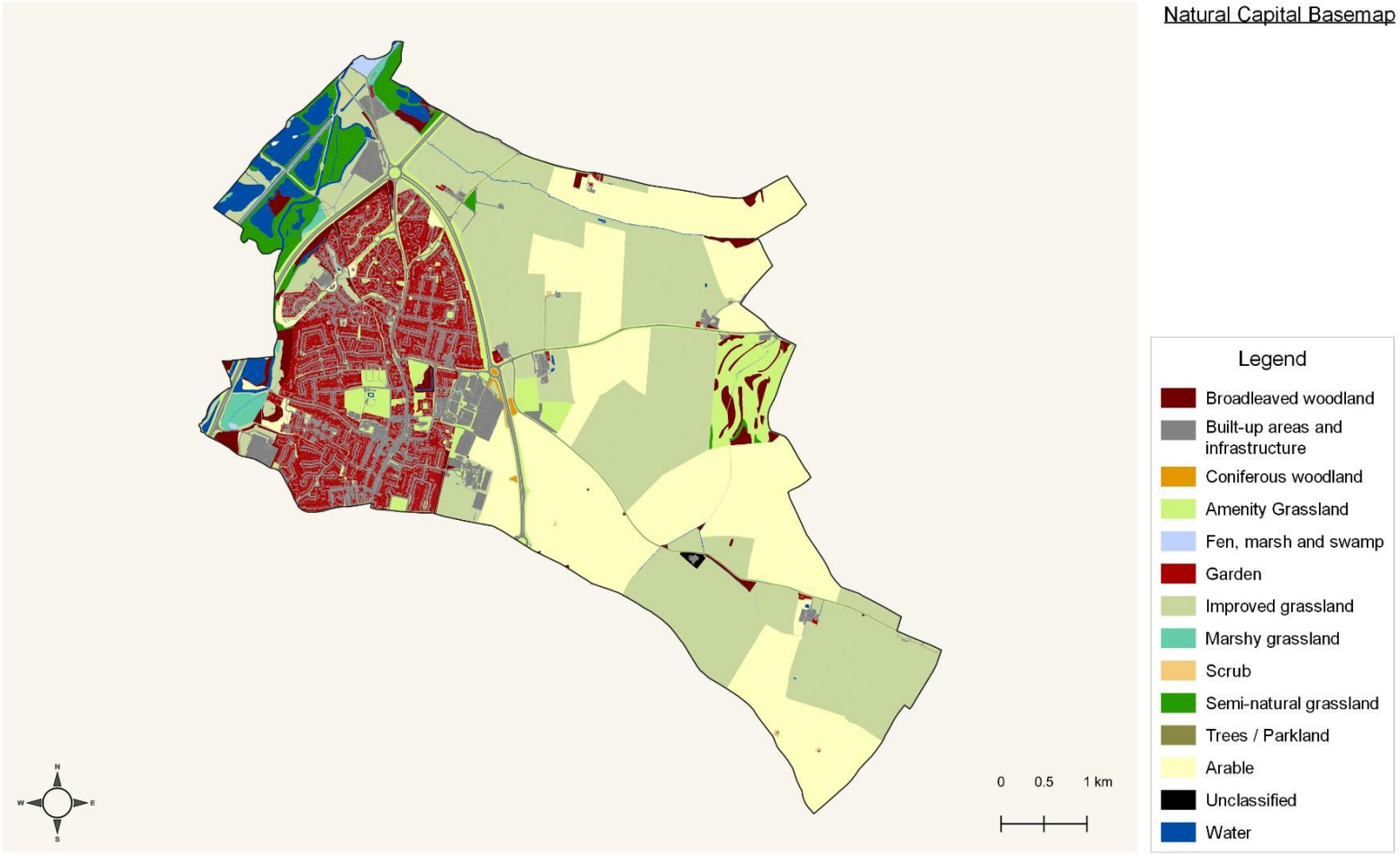


Figure 12. Natural capital basemap, showing broad habitats across the parish of Higham Ferrers. *example map *for reference only*

4. Combined opportunities for new habitats

In the following maps we examine multiple opportunities, which are areas where new habitat can be created that provide opportunities to enhance more than one of the services as shown in the following sections. This is assessed by overlaying each individual opportunity map, presented in Sections 5 and 6, to determine the degree of overlap, examining each of the main habitat types in turn. This distinguishes between the top 10%, 10-25% and 25-50% best opportunity areas for each ecosystem service. In reality, creating any new habitat for one ecosystem service is likely to provide benefits for other services, even if this does not fall within a top priority zone.

We have combined maps for each habitat by restricting combined opportunities to areas that present a biodiversity opportunity. Hence, opportunities are only included for areas that are ecologically connected to existing habitats (the buffer and stepping stone opportunity zones identified in Section 5). This follows the ethos of environmental net gain being focused on biodiversity net gain first, and then natural capital net gain as an additional feature.

4.1 Combined opportunities for new broadleaved woodland

What is it and why is it important?

Opportunities to deliver enhancement to water flow, water quality, and air quality regulation can all be achieved through planting native hedgerow, trees and woodland. Woodland can also provide high quality accessible natural greenspace. Creating woodland habitats will also deliver benefits in the form of **carbon sequestration**. These have not been mapped separately as location choice does not have a large effect of carbon sequestration benefits (there will be some difference in the growth rate of trees in different places, but all will deliver this benefit). Therefore, the opportunity maps for five services: water flow, water quality, accessible natural greenspace, and air quality regulation were overlain with the opportunity map for biodiversity enhancement through the creation of broadleaved woodland.

What do the results show?

The map focusses on areas that present opportunities for planting broadleaved woodland, and in these areas shows the degree of multi-functionality that could be delivered by creating new woodland in each field if all benefits are treated equally. The results tend to show that there are lots of areas identified as opportunities to create new woodland, and many areas that offer multiple opportunities (Figure 13). Locations at the edges of built-up areas are most often highlighted as being able to deliver multiple benefits. If the aim of woodland creation was to maximise the delivery of as many ecosystem services as possible, then these locations should be considered as the most likely to deliver to the greatest benefits. If looking to identify the separate opportunities of a highlighted location; compare this combined map with your Ecosystem Service Opportunity and Biodiversity Opportunity maps.

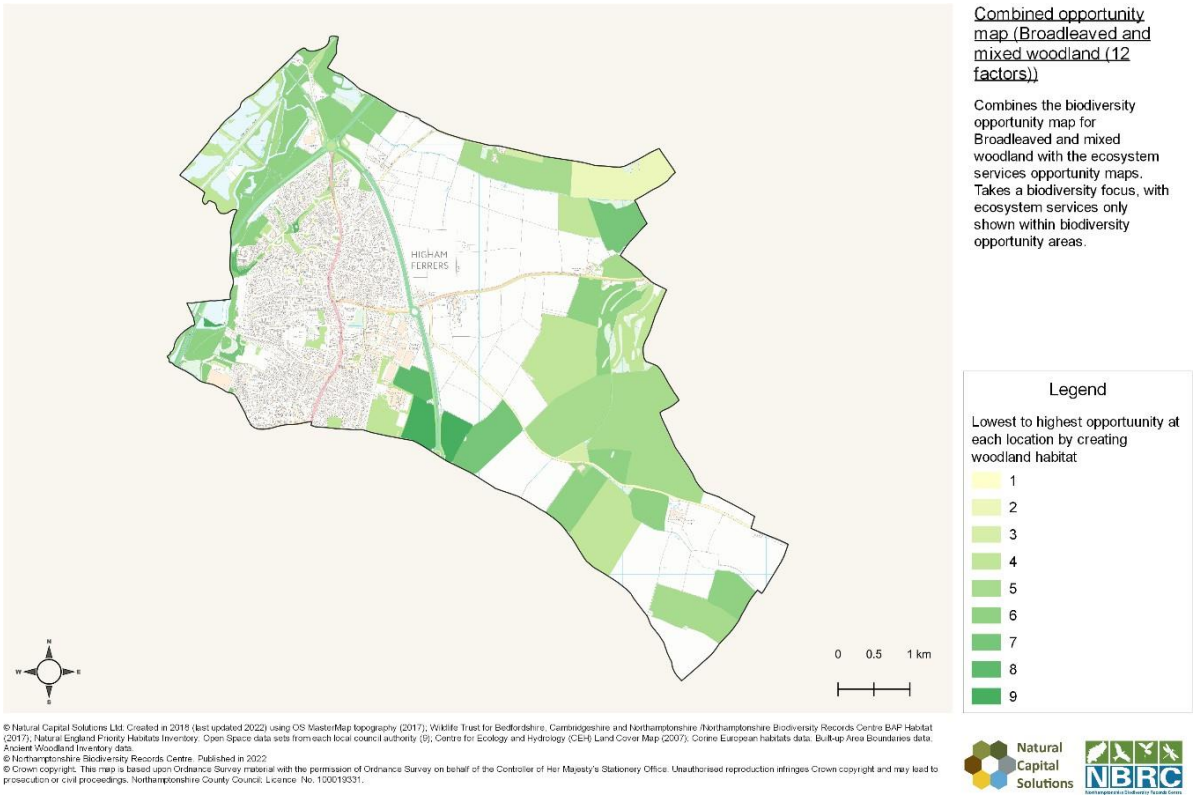


Figure 13. Combined opportunities for new woodland across the parish of Higham Ferrers, restricted to areas that are ecologically connected to existing woodlands (woodland opportunity areas). *example map *for reference only*

4.2 Combined opportunities for new semi-natural grassland

What is it and why is it important?

Creating semi-natural grassland provides natural habitats that are important for biodiversity and spaces that people enjoy visiting. Semi-natural grassland will enhance the reduction of water flow and enhance water quality significantly better than arable, although less effectively than planting woodland. Grassland is better than sealed surfaces at ameliorating air pollution, however broadleaf trees, woodland or hedgerow are more effective in delivering this service. Hence, for semi-natural grassland, combined opportunities were examined for four out of the five services: water flow, water quality, accessible natural greenspace, and biodiversity enhancement, while air quality regulation was not included.

What do the results show?

Combined opportunities for new semi-natural grasslands are not as extensive as for woodland, but less restricted than for wetland (Figure 14). There are a number of areas that support multiple opportunities, with the majority of these being close to built-up areas. If looking to identify the separate opportunities of a highlighted location; compare this map with your Ecosystem Service Opportunity and Biodiversity Opportunity maps.

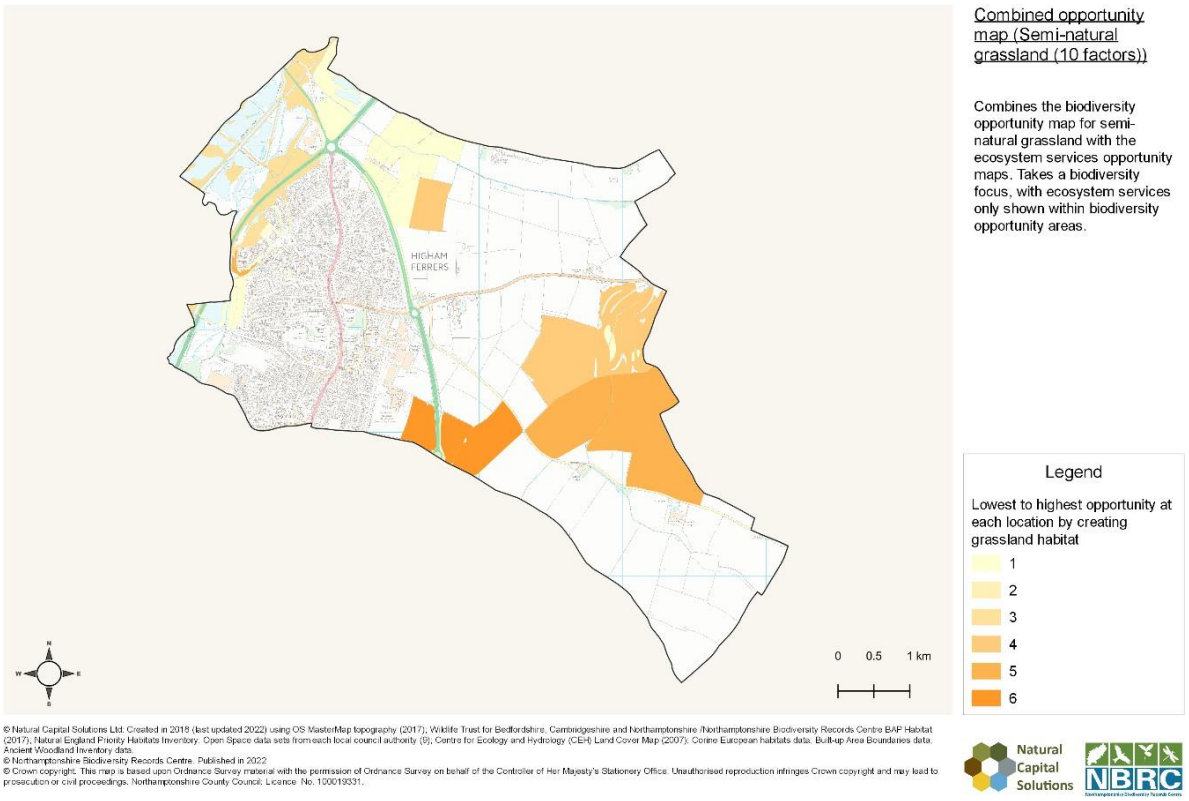


Figure 14. Combined opportunities for new semi-natural grassland across the parish of Higham Ferrers, restricted to areas that are ecologically connected to existing grasslands (semi-natural grassland opportunity areas). *example map *for reference only*

4.3 Combined opportunities for new wet grassland and wetlands

What is it and why is it important?

Combined opportunities for new wet grassland and wetlands were mapped in the same way as for semi-natural grassland, except that all opportunities were restricted to areas within floodplains. Wetland habitats are effective at reducing water flow and enhancing water quality and provide important natural habitats that people enjoy visiting. Hence, combined opportunities were examined for four out of the five services: water flow, water quality, accessible natural greenspace, and biodiversity enhancement, while air quality regulation was not included, as like grassland there is a minimal effect for this service.

What do the results show?

The location of opportunities for this habitat type is far more restricted than for the previous two, due to the requirement for being located on floodplains. Nevertheless, there are some opportunities along the floodplain of the River Nene and along some of the smaller rivers in Northamptonshire and these should be considered for prioritisation. A few of these locations are opportunity areas for two or more services (Figure 15). If looking to identify the separate opportunities of a highlighted location; compare this map with your Ecosystem Service Opportunity and Biodiversity Opportunity maps.

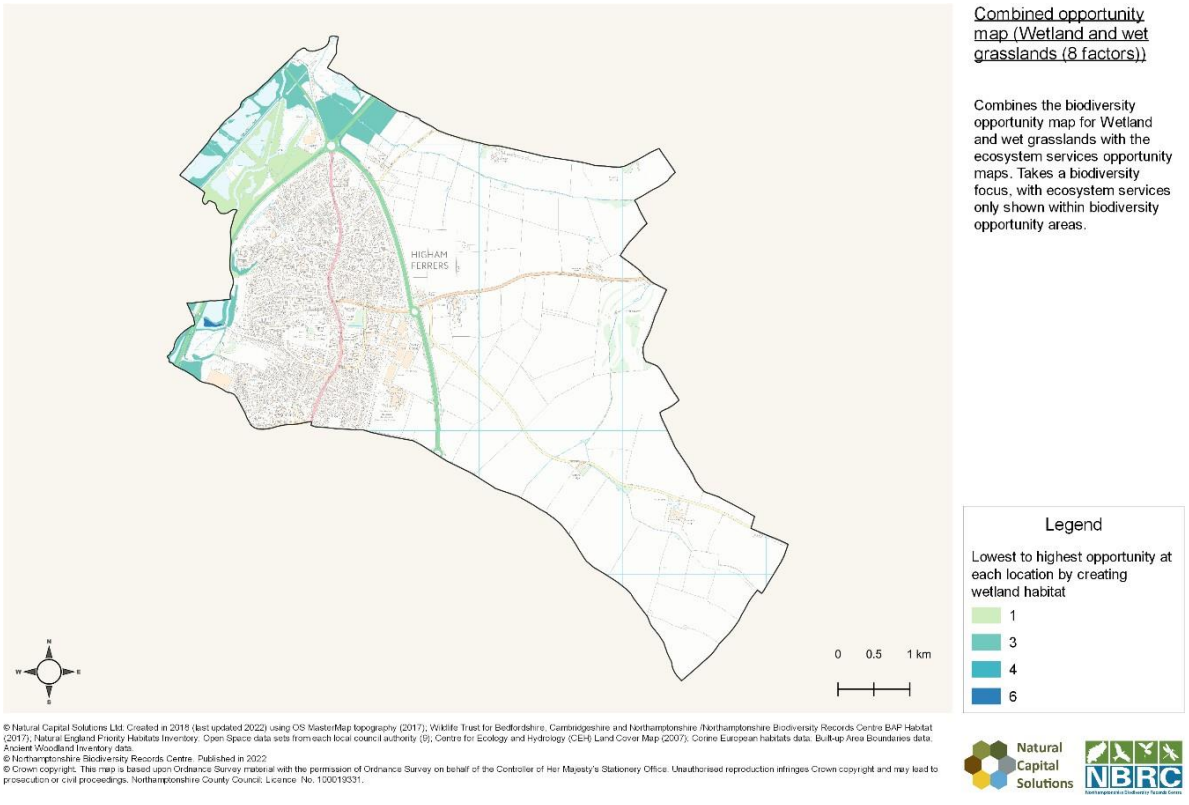


Figure 15 Combined opportunities for new wetland and wet grassland across the parish of Higham Ferrers, restricted to areas that are ecologically connected to existing wetlands and wet grasslands (opportunity areas). *example map *for reference only*

5. Biodiversity opportunity maps

The importance of landscape-scale conservation and ecological networks has become increasingly recognised over recent years. Many wildlife sites have become isolated in a landscape of unsuitable habitats and efforts are now being directed towards linking existing habitat patches and increasing connectivity. Species are more likely to survive in larger habitat networks, are able to move and colonise new sites, and are more resilient to climate change and other detrimental impacts.

Habitat opportunity mapping to enhance biodiversity follows this ethos by using ecological networks to identify potential areas for new habitats. Identified areas will be ecologically connected to existing habitats, thereby expanding the size of the existing network, increasing connectivity and resilience, and potentially increasing the ecological quality of the new site. It was performed for three key habitat groupings, incorporating the main semi-natural habitats found in Northamptonshire. The broad habitats and their constituent types are shown below:

Broad habitat	Specific habitats included
Semi-natural grassland	Acid, neutral, calcareous, rough and semi-improved grasslands
Wet grassland & wetlands	Marshy grassland, floodplain grazing marsh, lowland fen and swamp (reedbed)
Woodland	Broadleaved and mixed woodland types (excludes coniferous woodland, parkland or individual trees)

Biodiversity opportunity mapping followed a four-step process, and was based on the approach developed by Catchpole (2006)[4] and Watts et al. (2010)[5].

5.1 Combined biodiversity opportunities

Often biodiversity opportunities overlap, hence a piece of land may have been identified as being potentially suitable for habitat creation for two, or even all three, different habitat types. This occurs where existing areas of the three habitat types are in close proximity to each other.

The combined biodiversity opportunities map, therefore, combines the opportunities for all three habitat types (as shown individually by broad habitat type in Section 5.2) onto one map, although for clarity it does not distinguish between buffer and stepping stone opportunities. This map shows which habitats would be suitable to be created in each location (Figure 16). The map does not state which of these habitats should be chosen as this will depend on a number of factors including:

- If other benefits are being taken into account beyond biodiversity benefits
- The spatial location of the site
- General ecological or policy objectives for the area
- Site factors such as hydrology and soil type
- Landowner and stakeholder preferences

[4] Catchpole, R.D.J. (2006). Planning for Biodiversity – opportunity mapping and habitat networks in practice: a technical guide. *English Nature Research Reports*, No 687

[5] Watts, K., Eycott, A.E., Handley, P., Ray, D., Humphrey, J.W. & Quine, C.P (2010). Targeting and evaluating biodiversity conservation action within fragmented landscapes: an approach based on generic focal species and least-cost networks. *Landscape Ecology,* 25: 1305–1318.

We recommend professional ecological consideration of existing species richness and habitat condition enhancement alongside any new habitat creation. In general, opportunities for wetland / wet grassland habitats are much more limited across Northamptonshire, so priority should be considered where they have been identified. Please seek advice from the Wildlife Trust or other ecological experts if requiring further assistance. We encourage local monitoring and ecological reporting to the record centre in order to show the effect of any changes.

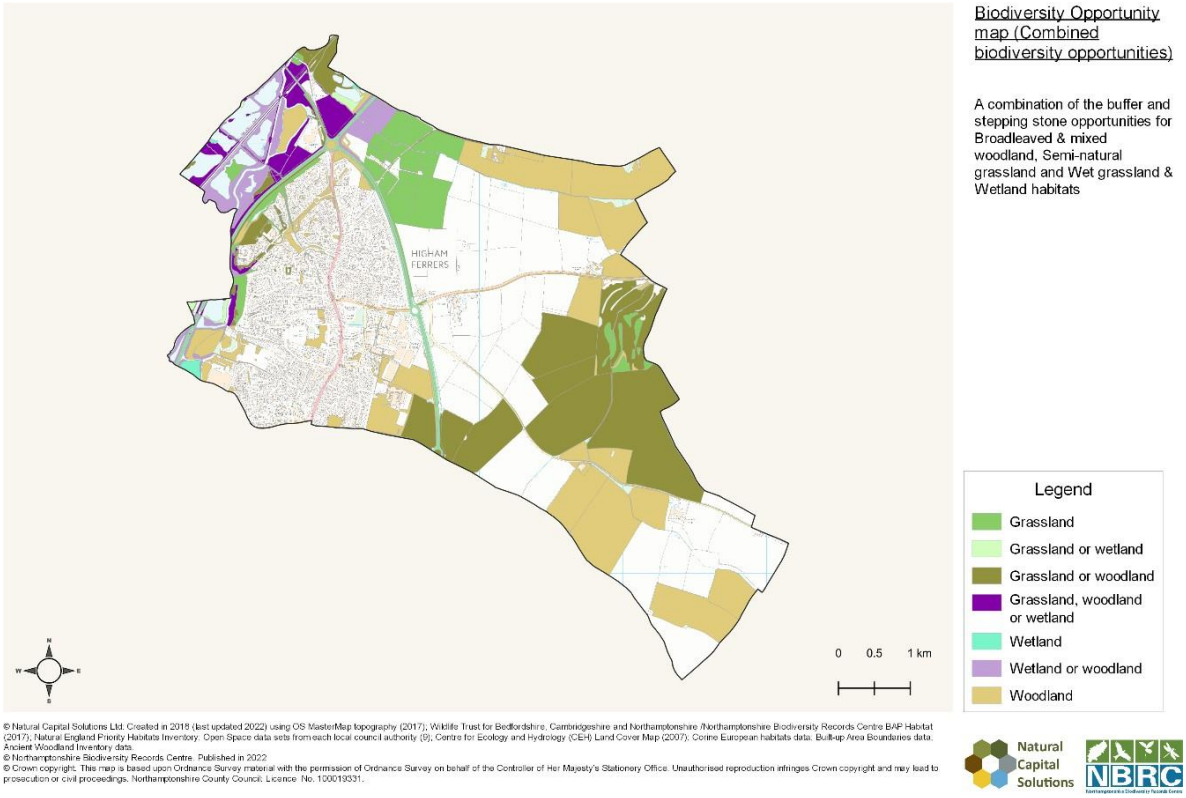


Figure 16 Combined biodiversity opportunities across the parish of Higham Ferrers. *example map *for reference only*

5.2 Biodiversity Opportunity Maps

The maps identify three different opportunity zones for each broad habitat type:

- **Core** – existing areas of habitat, these will provide source populations for new areas of habitat created.
- **Buffer** – areas that are immediately adjacent to existing habitat patches (the Core zones) and will usually be the priority for habitat creation.
- **Stepping stone** – areas that are slightly further away from existing habitats, but are close enough to be ecologically connected, and could potentially be used to create stepping-stone habitats that could link up more distant habitat patches.

Maps for the three broad habitat types are presented below: broadleaved woodland (Figure 17), semi-natural grassland (Figure 18), and wet grassland and wetlands (Figure 19).

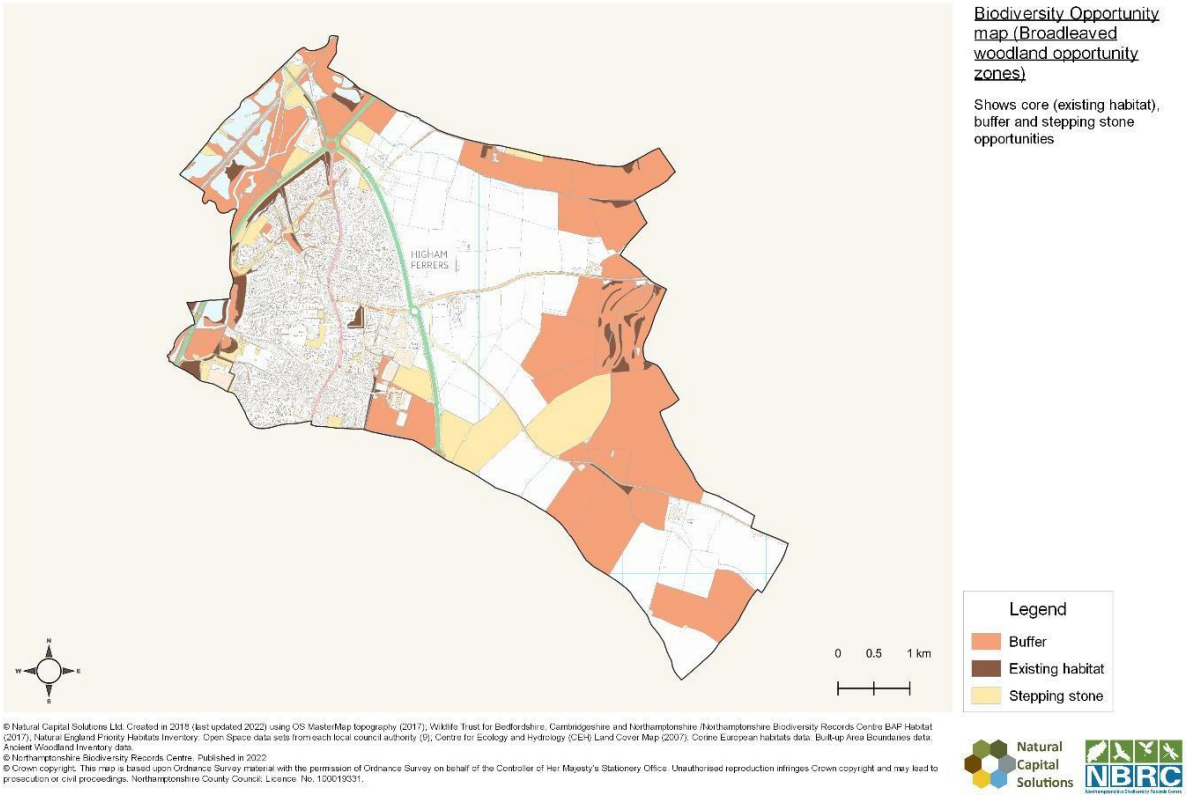


Figure 17. Broadleaved woodland opportunity zones across the parish of Higham Ferrers *example map *for reference* only

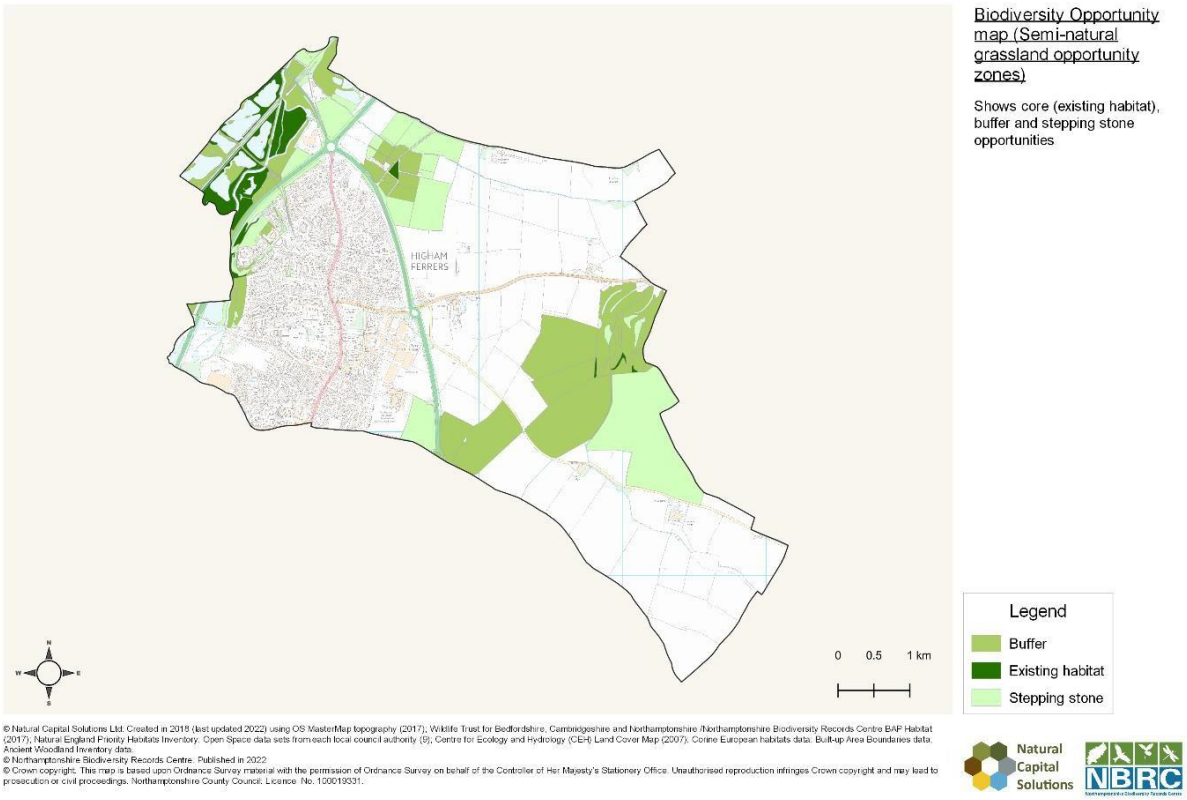


Figure 18. Seminatural grassland opportunity zones across the parish of Higham Ferrers. *example map *for reference only*

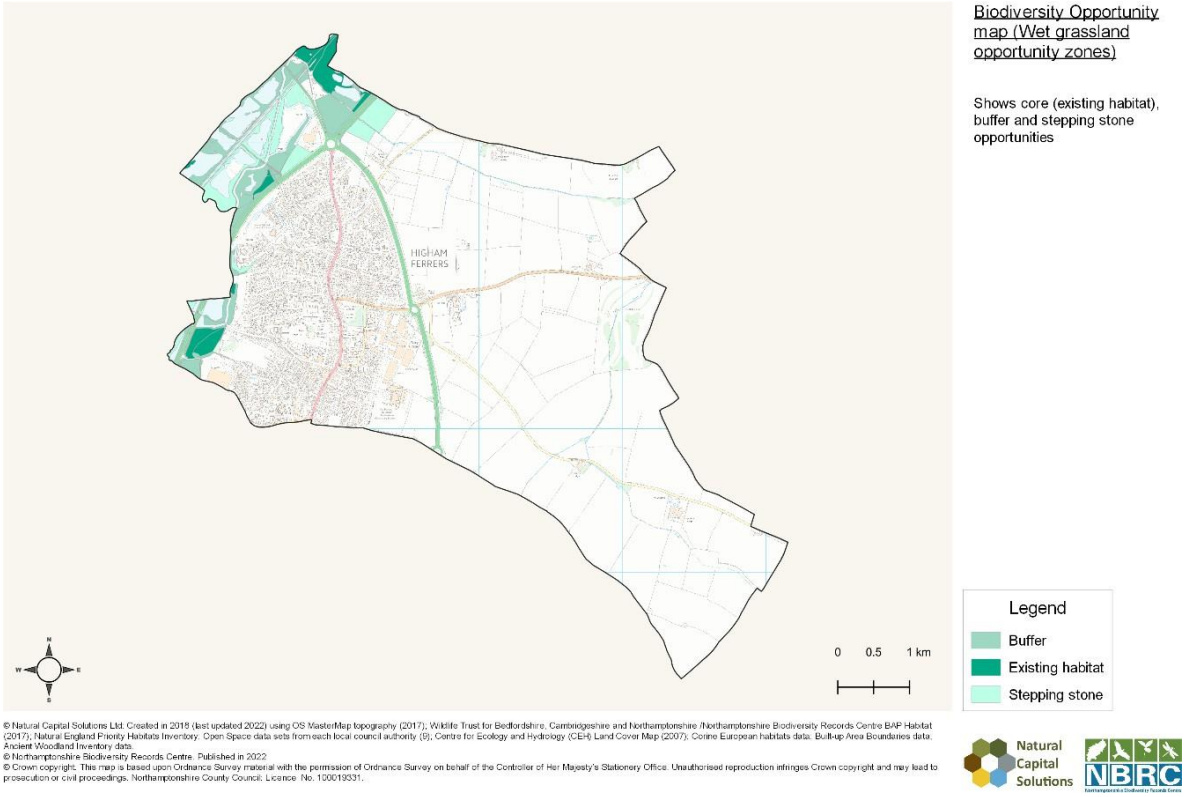


Figure 19. Wet grassland and wetland opportunity zones across the parish of Higham Ferrers. *example map *for* reference only

6. Ecosystem services opportunity maps

6.1 Opportunity mapping to reduce surface runoff

What is it?

Opportunity mapping to reduce surface runoff was based on the water flow regulation model described in Section 7.8 and highlights the top 10%, 10-25% and 25-50% of areas across the whole catchment where changing land-use would have the greatest impact on reducing surface water runoff. Note that the model identifies the best areas across the county as a whole, and in some locations none or only a few opportunities will be identified.

What do the results show?

The map (Figure 20) identifies fields where land use could be changed to greatest effect to reduce runoff. Across Northamptonshire as a whole, the greatest opportunities were identified in the west of the county, although some opportunities are present across the county, especially on sloping land. Note that some of the worst areas for water flow regulation relate to buildings and infrastructure, which were not assessed here, although could be suitable for the installation of green roofs and other types of retrofitted Sustainable Drainage Systems (SuDS).

How can this be achieved?

Approaches to consider with ecologist support to reduce surface water runoff in the identified locations may involve planting woodland or wetland habitats (depending on the suitability of the location), woody debris dams and ponds in upstream areas.

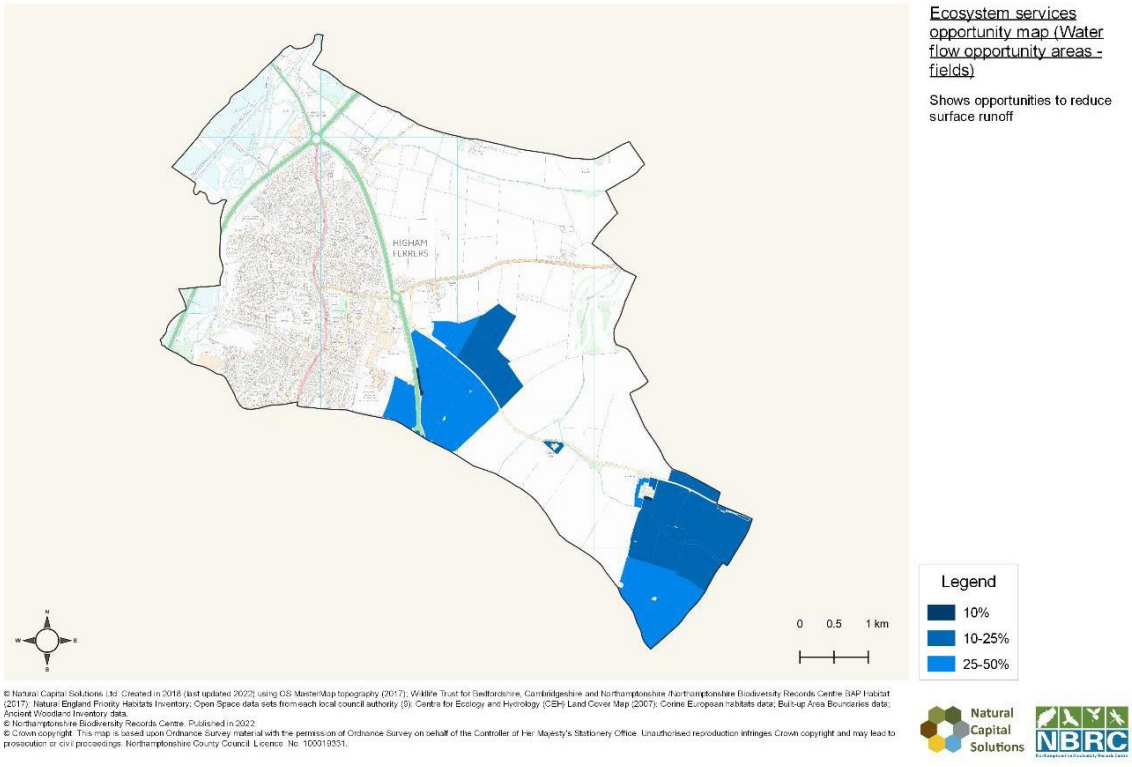


Figure 20. Water flow regulation opportunity areas across the parish of Higham Ferrers. *example map *for reference only*

6.2 Opportunity mapping to reduce soil erosion and improve water quality

What is it?

Agricultural diffuse pollution has a major impact on water quality in the UK. Water treatment plants are much less effective in these circumstances than when dealing with point source pollutants, and there is growing interest in catchment sensitive farming and working with natural processes to tackle this issue. These aim to reduce the amount of sediment and pollutants entering the watercourses in the first place by, for example, adjusting farming practices and planting riparian buffer strips. Opportunity mapping focussed on identifying areas at highest risk of sedimentation, and highlights areas across the whole catchment where changing land use would have the greatest impact on reducing soil erosion.

What do the results show?

Arable farmland scores particularly badly when mapping water quality regulation (Section 7.9) and these areas are, therefore, often highlighted as the areas with greatest opportunity to reduce sediment loads and enhance water quality on the opportunity map (Figure 21). In addition, distance to watercourses is another key factor.

How can this be achieved?

Woodland would be the most effective habitat to reduce soil loss, although semi-natural grasslands, wet grasslands and wetlands would also deliver significant benefits. In many cases the areas that would be most effective for tackling water quality are often zones adjacent to watercourses, and changing land use in riparian buffer strips may be the most effective solution, rather than converting whole fields.

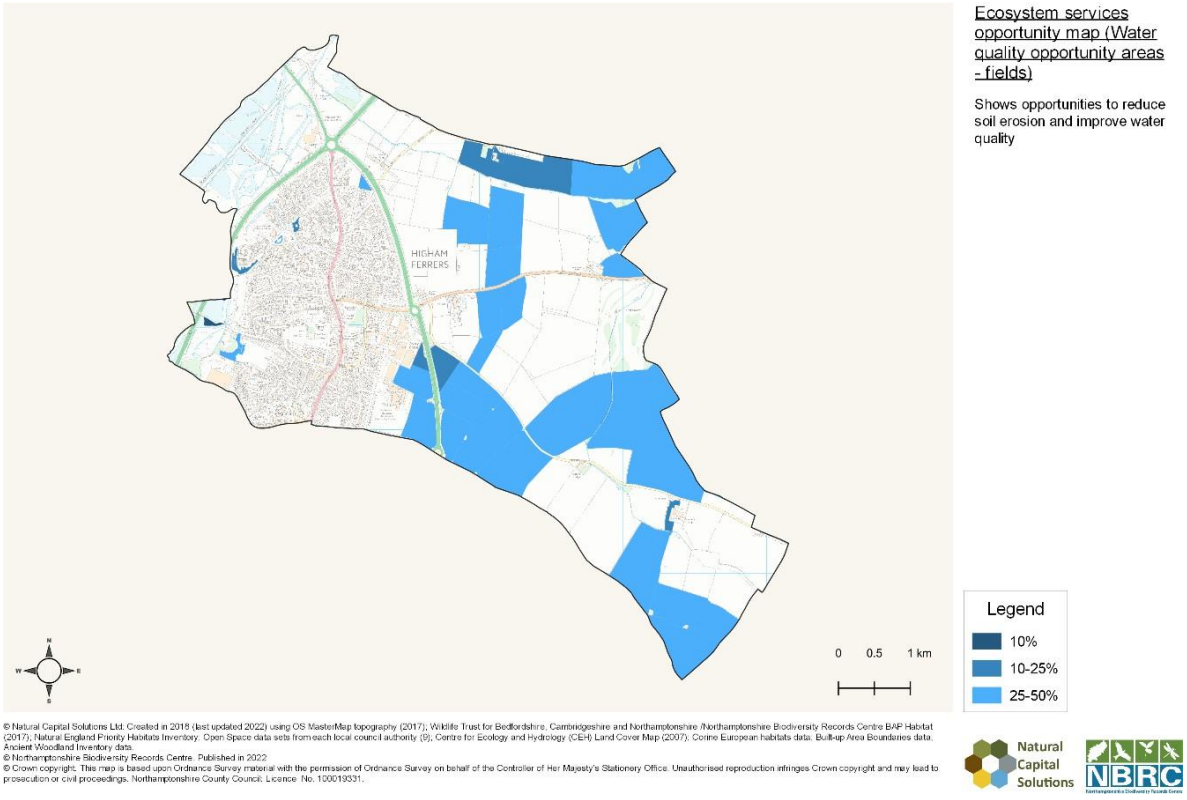


Figure 21. Water quality regulation opportunity areas across the parish of Higham Ferrers. *example map *for reference only*

6.3 Opportunity mapping to ameliorate air pollution

What is it?

Air pollution is often highly localised and vegetation is most effective at mitigating pollutants when planted close to pollution sources. Opportunities to ameliorate air pollution were focussed around areas with greatest demand, as described in Section 7.3. The opportunity maps therefore highlight areas that currently have no trees, but where it would be most beneficial to plant them.

What do the results show?

Demand for air quality regulation is highest in urban centres and along the main road network. In built-up areas, large areas are constrained, where it is not possible to plant trees or green infrastructure. Good existing habitats (where present) were also identified as a constraint, and removed from the opportunity map. The remaining areas are highlighted on the opportunity map (Figure 22), along with a number of fields on the edges of urban areas and along main roads. These locations provide the most potential to plant trees that could trap air pollution in areas of greatest need for this service. The model does not include pavements, where there may be further opportunities, if pavements are sufficiently wide, to plant street trees.

How can this be achieved?

Trees are very effective at mitigating the effects of air pollution. However, there are major differences in the ability of different species to intercept pollution. The location of trees relative to pollution sources also determines how effective they are at removing pollutants, with trees close to sources being the most effective. Thus, urban woodland is particularly effective. You should consult an ecologist for other factors such as habitat suitability and species recommendation.

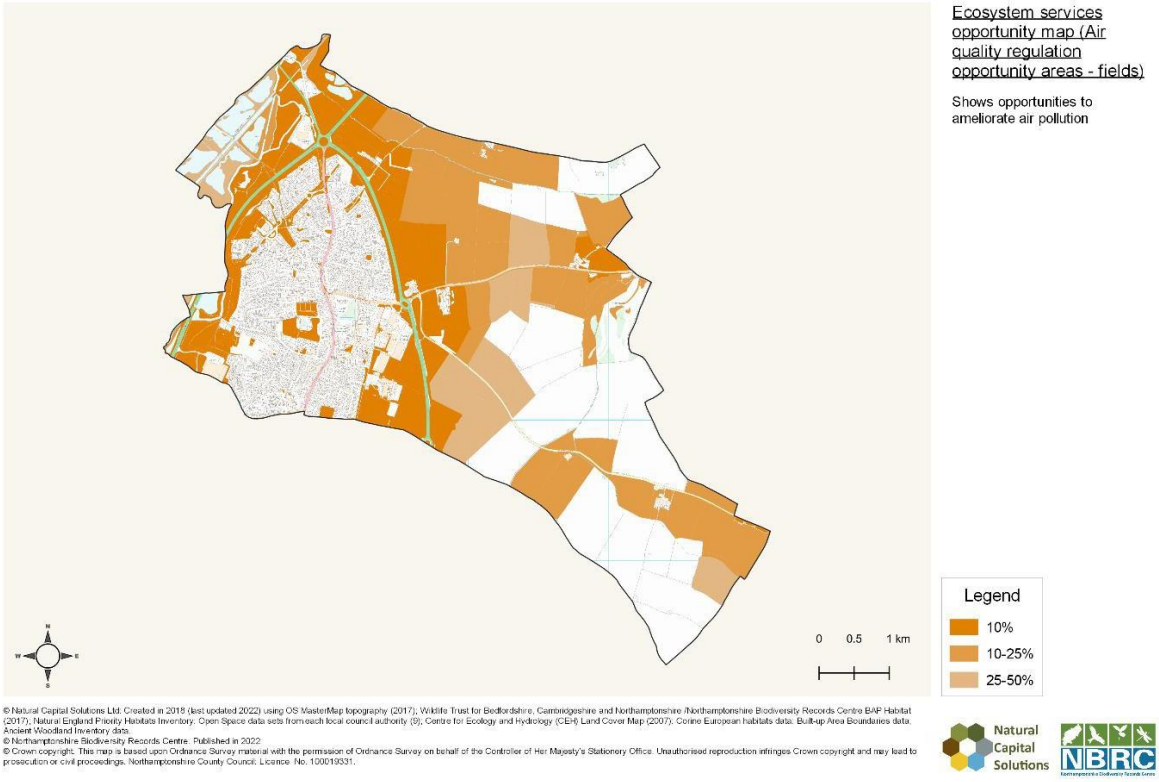


Figure 22. Air quality regulation opportunity areas across the parish of Higham Ferrers. *example map *for reference only*

6.4 Opportunity mapping to enhance recreation in the natural environment

What is it?

There are many benefits of enhancing public access to natural greenspaces and the key features that maximise benefits are proximity to where people live and the naturalness of the habitats. Here, opportunities to provide accessible natural greenspace were mapped, based on creating new habitats at new sites, based purely on demand.

What do the results show?

Demand for accessible natural greenspace was described in Section 7.12 and is strongly focussed around urban areas. Therefore, the majority of the opportunity areas identified are centred around these built-up areas. As opportunities for new greenspaces are usually highly constrained within towns and villages, opportunity areas tend to form a ring around the edges. These may be locations that have been targeted for development, so it is important that planners and developers take into account the strong demand for greenspace at these sites from both the new developments and from the existing population.

How can this be achieved?

The opportunities identified are immediately adjacent to urban areas, but these are often on arable fields and improved grassland. Hence new habitats would need to be created to enhance the quality of the greenspace offering. Woodland, semi-natural grassland, wetland and water features are considered to be the most natural habitats in the area and all of these would be beneficial habitats to create.

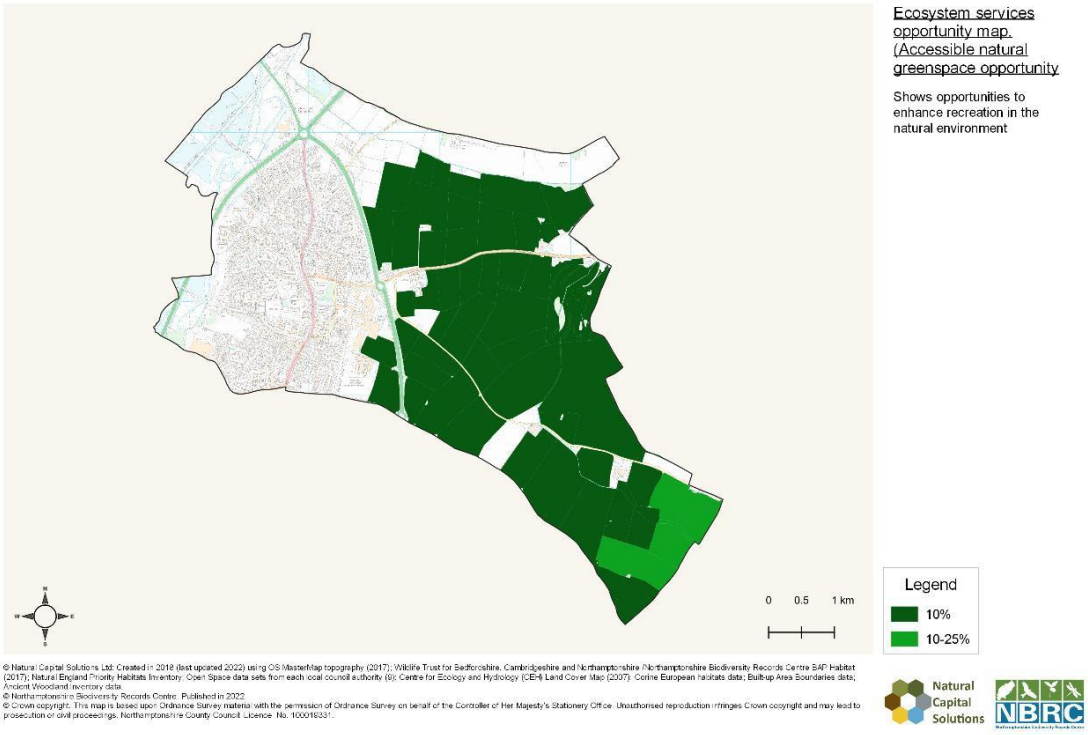


Figure 23. Accessible natural greenspace opportunity areas across the parish of Higham Ferrers. *example map *for reference only*

7. Ecosystem services maps

Once a detailed habitat basemap had been created for Northamptonshire, it was then possible to quantify and map the benefits that these habitats (natural capital) provide to people. The following benefits (ecosystem services) have been assessed:

- Carbon storage
- Air quality regulation
- Noise regulation
- Local climate regulation
- Water flow regulation
- Water quality (soil erosion) regulation
- Pollination
- Accessible nature

In all cases the models were applied at a 10m by 10m resolution to provide fine scale mapping across the area. The models are based on the detailed habitat information determined in the basemap, together with a variety of other external data sets (e.g. digital terrain model, UK census data 2011, open space data, and many other data sets and models). Note, however, that many of the models are indicative (showing that certain areas have higher capacity or demand than other areas) and in all cases the capacity and demand for Ecosystem Services is mapped relative to the values present within the study area. Full methodological details of each model can be provided on request.

For every ecosystem service listed, the capacity of the natural environment to deliver that service – or the current supply – was mapped. For air quality regulation, noise regulation, local climate regulation, and accessible nature, it was also possible to map the local demand (the beneficiaries) for these services. The importance and value of ecosystem services can often be dependent upon its location in relation to the demand for that service, hence capturing this information provides useful additional insight. Mapping demand was not, however, possible, for the other services where there was no obvious method to apply, or local demand is not relevant.

In all the ecosystem services maps that follow, the highest amounts of service provision and demand are shown in darker colour, with a gradient to very pale colours, which shows the lowest amounts.

Box 4: Data used in the Ecosystem Services Models (last updated 2021)

- 5m Digital Terrain Model
- Public Rights of Way data (see below)
- Hydrology of Soil Types (HOST) dataset
- Agricultural Land Classification
- WFD Waterbody Catchments
- Defra road and rail noise modelling

7.1 Carbon storage capacity

What is it and why is it important?

Carbon storage capacity indicates the amount of carbon stored naturally in soil and vegetation. Carbon storage and sequestration (uptake of carbon by vegetation) is seen as increasingly important as we move towards a low-carbon future. The importance of managing land as a carbon store has been recognised by the UK Government, and land use has a major role to play in tackling climate change. Changing land use from one type to another can lead to substantial changes in carbon storage, as can restoration of degraded habitats.

What do the results show?

Carbon storage capacity is usually highest in areas of broadleaved woodland and in other types of woodland. However, most green spaces support some level of carbon storage, with much lower levels in urban areas dominated by buildings and sealed surfaces (e.g. roads). An example map is shown below (Figure 24) for a typical parish.

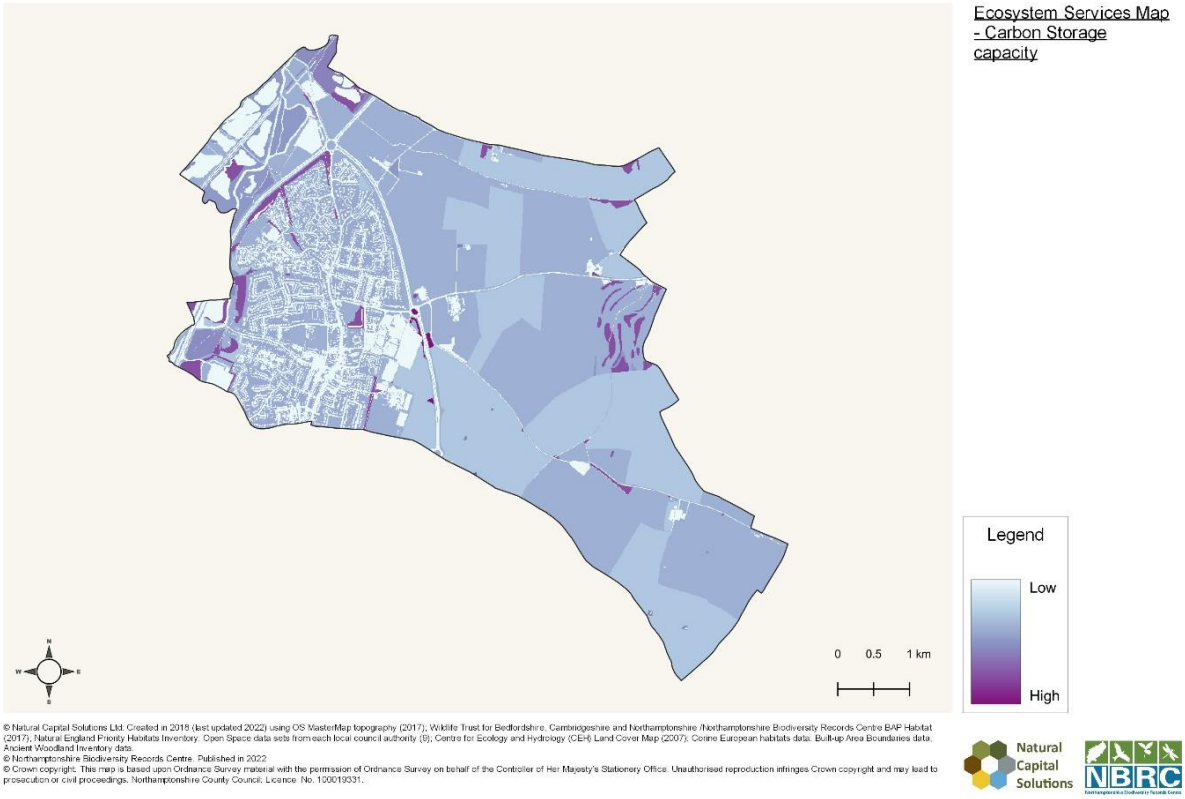


Figure 24. Carbon storage capacity across the parish of Higham Ferrers. Darker colours indicate higher carrying capacity for carbon storage, with lighter colours showing the lowest carrying capacity areas (least carbon storage).*example map *for reference only*

7.2 Air quality regulation capacity

What is it and why is it important?

According to the Public Health England, air pollution is the biggest environmental threat to health in the UK, with between 28,000 and 36,000 deaths a year attributed to long-term exposure, with the greatest threats from particulate matter ($PM_{2.5}$) and nitrous oxides (NO_x). Even small changes can make a big difference, just a 1µg/m^3 reduction in $PM_{2.5}$ concentrations could prevent 50,000 new cases of coronary heart disease and 9,000 new cases of asthma by 2035[6]. Air pollution also contributes to climate change, reduces crop yields, and damages habitats and biodiversity. Air quality regulation capacity estimates the relative ability of vegetation to trap airborne pollutants or ameliorate air pollution. Vegetation can be effective at mitigating the effects of air pollution, primarily by intercepting airborne particulates (especially $PM_{2.5}$) but also by absorbing ozone, SO_2 and NO_X.

What do the results show?

Trees provide the most effective mitigation, more than low vegetation, although this varies depending on the species. The map (Figure 25) highlights areas of woodland as by far the best habitat at intercepting and absorbing air pollution. The highest scores are from coniferous forests and the lowest are from sealed surfaces (roads, buildings) and water which effectively has zero capacity.

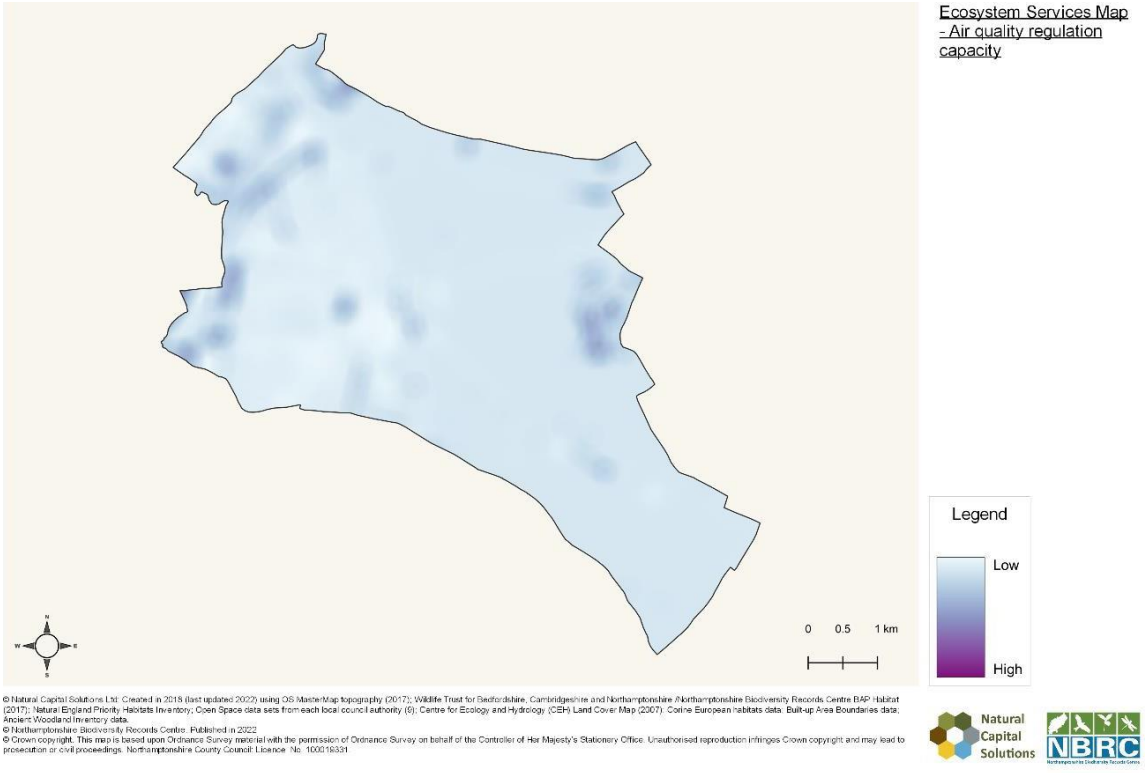


Figure 25. Air quality regulation capacity across the parish of Higham Ferrers. Darker colours indicate higher capacity, with lighter colours showing the lowest capacity areas. *example map *for reference only*

[6] Public Health England (2018) Estimation of costs to the NHS and social care due to the health impacts of air pollution. Crown Copyright.

7.3 Air quality regulation demand

What is it and why is it important?

Air purification demand estimates societal and environmental need for ecosystems that can absorb and ameliorate air pollution. Demand is assumed to be highest in areas where there are likely to be high air pollution levels and where there are lots of people who could benefit from the air purification service.

What do the results show?

Air purification demand is highest in urban centres as these have both higher air pollution levels and higher populations that would benefit from better air quality. The main road network is also clearly visible (Figure 26) as a major pollution source, and where these main roads pass through built up areas, there is increased demand for air purification. Outside of built-up areas, demand is low.

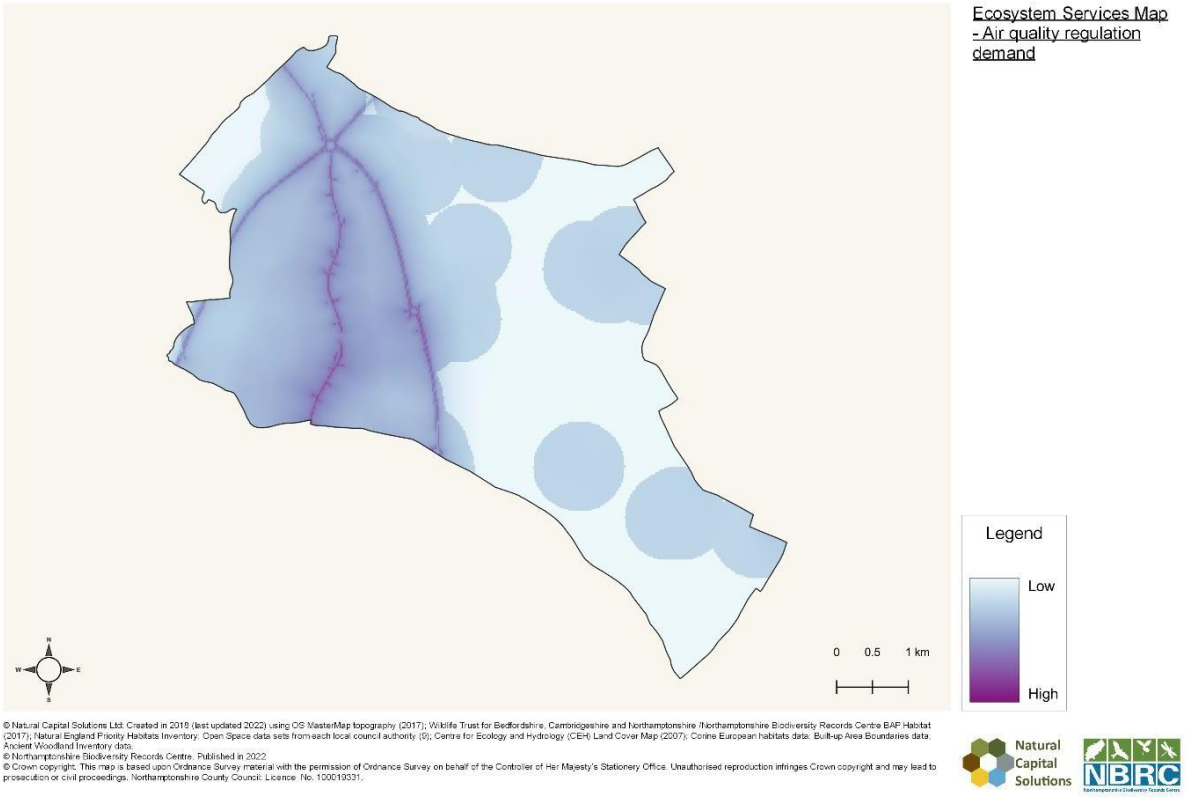


Figure 26. Air quality regulation demand across the parish of Higham Ferrers. Darker colours indicate higher demand, with lighter colours showing lower demand. *example map *for reference only*

7.4 Noise regulation capacity

What is it and why is it important?

Noise regulation capacity is the capacity of the land to diffuse and absorb noise pollution. Noise can impact on health, wellbeing, productivity and the natural environment and the World Health Organisation (WHO) have identified environmental noise as the second largest environmental health risk in Western Europe (after air pollution). It is estimated that the annual social cost of urban road noise in England is £7 to £10 billion (Defra 2013[7]). Major roads, railways, airports and industrial areas can be sources of considerable noise, but use of vegetation can screen and reduce the effects on surrounding neighbourhoods. Complex vegetation cover, such as woodland, trees and scrub, is considered to be most effective, although any vegetation cover is more effective than artificial sealed surfaces, and the effectiveness of vegetation increases with width.

What do the results show?

Maps of noise regulation capacity (Figure 27) are similar to air quality regulation capacity. Woodland is by far the most effective habitat at absorbing noise, although the effects are modest, with reductions of 2-4 dB typically recorded across dense tree belts (such as hedges). Noise regulation capacity is relatively low in urban areas, but green spaces in urban areas can be important.

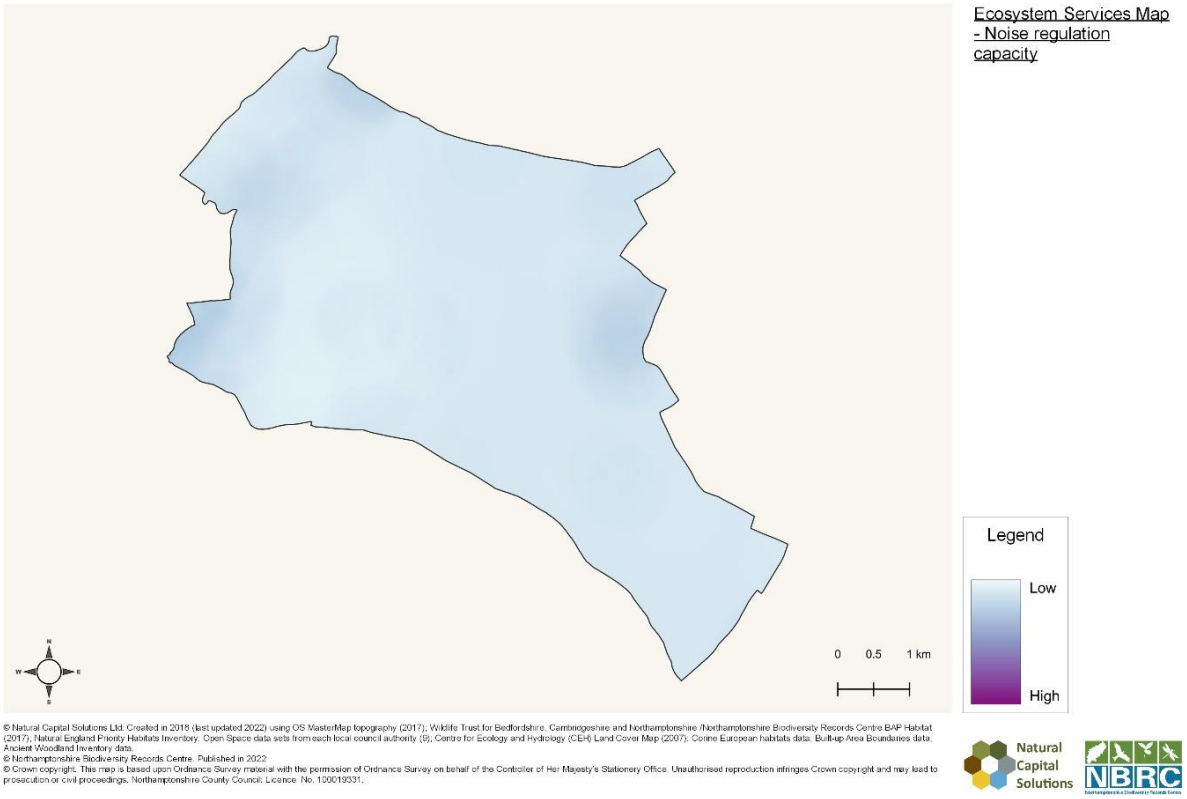


Figure 27. Noise regulation capacity across the parish of Higham Ferrers. *example map *for reference only*

[7] Defra (2013) Noise pollution: economic analysis. Crown Copyright.

7.5 Noise regulation demand

What is it and why is it important?

Noise regulation demand estimates societal and environmental need for ecosystems that can absorb and reflect anthropogenic noise. It considers noise sources (roads and railways) and the location of people who would benefit from noise regulation.

What do the results show?

Demand is greatest in urban areas close to major roads, as these contain large populations, with potentially poor health, that would benefit from noise abatement from the main roads (Figure 28). There is no demand in entirely rural areas.

Studies in many countries have shown that densely planted tree belts (and hedges) can reduce noise levels, but the effects are modest, with reductions of 2-4 dB typically recorded. But there is some evidence to suggest that the presence of vegetation blocking views of a noise source such as a road can enhance the perception of noise reduction. Densely planted and complex vegetation cover such as trees mixed with scrub is considered to be most effective, although any vegetation cover is more effective than artificial sealed surfaces.

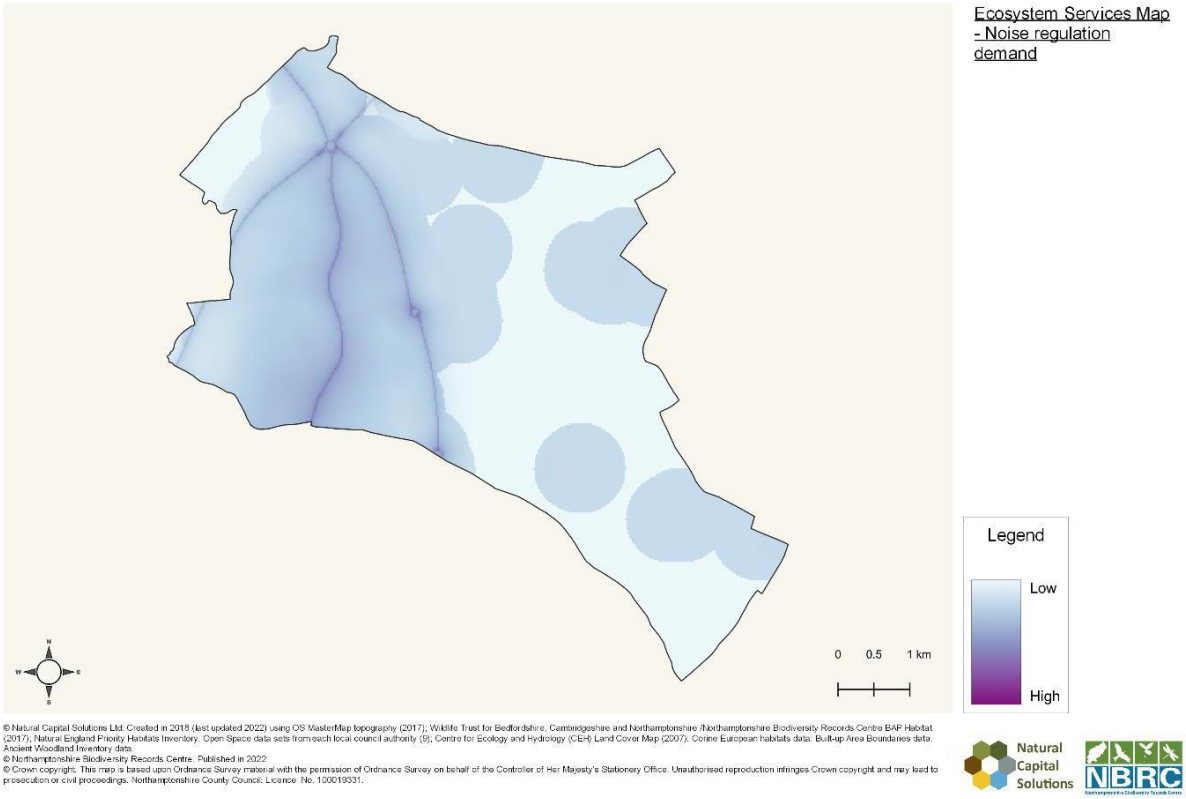


Figure 28. Noise regulation demand across the parish of Higham Ferrers. Darker colours indicate higher demand, with lighter colours showing lower demand and blank areas showing zero demand. *example map *for reference only*

7.6 Local climate regulation capacity

What is it and why is it important?

Local climate regulation capacity estimates the capacity of the natural environment to cool the local environment and cause a reduction in urban heat. Land use can have a significant effect on local temperatures. Urban areas tend to be warmer than surrounding rural land due to a process known as the "urban heat island effect". This is caused by urban hard surfaces absorbing more heat, which is then released back into the environment, coupled with energy released by human activity such as lighting, heating, vehicles and industry. Climate change impacts are predicted to make the overheating of urban areas and urban buildings a major environmental, health and economic issue over the coming years. Natural vegetation is able to have a moderating effect on local climate, making nearby areas cooler in summer and warmer in winter. Local climate regulation capacity estimates the capacity of the natural environment to cool the local environment and cause a reduction in urban heat maxima.

What do the results show?

This ecosystem service is primarily delivered by woodland and waterbodies, so these areas show most prominently on the maps (Figure 29). Also, the greater the extent of the woodland or waterbody, the greater the impact that it will have on local climate, hence larger areas, such as the lakes along the Nene Valley in the map below, are shown in the darkest colours.

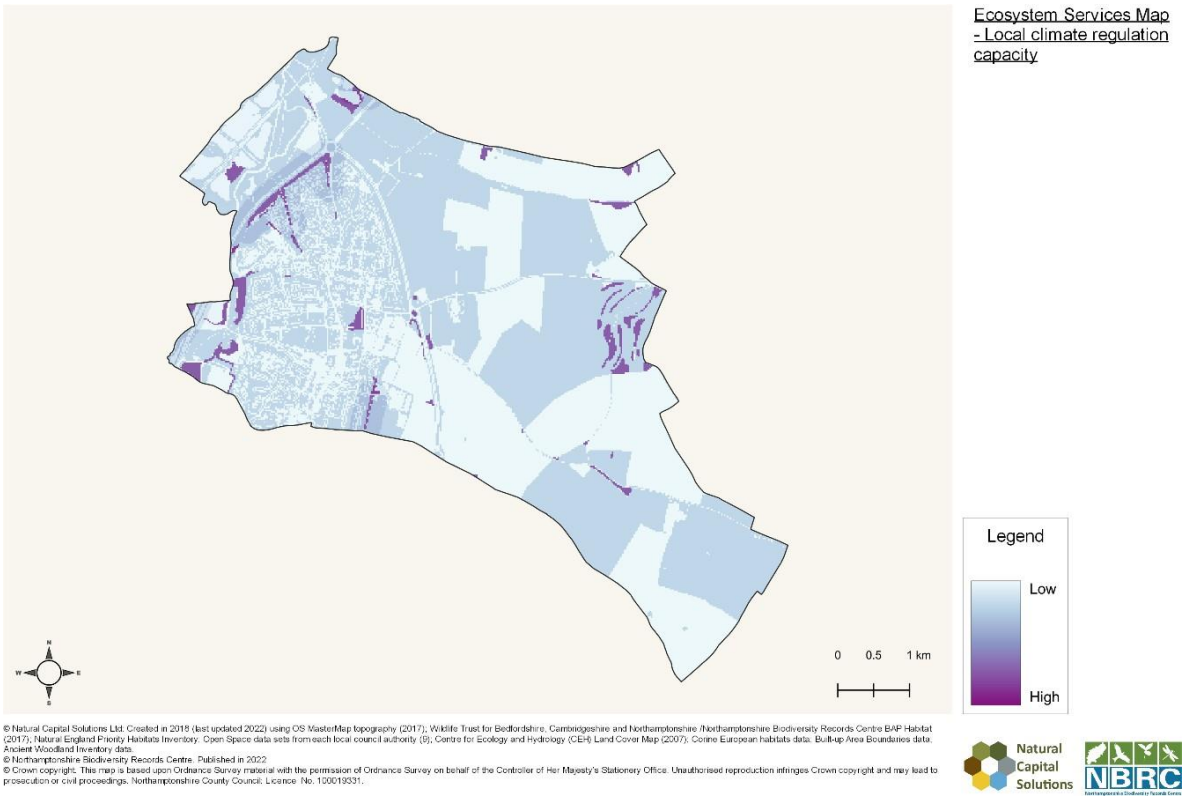


Figure 29. Local climate regulation capacity across the parish of Higham Ferrers. *example map *for reference only*

7.7 Local climate regulation demand

What is it and why is it important?

Local climate regulation demand estimates societal and environmental need for ecosystems that can regulate local temperatures and reduce the effects of the urban heat island. It combines information on the location of areas that are subject to the urban heat island effect, with information showing societal need for local climate abatement.

What do the results show?

Demand is heavily clustered around urban centres, but also in smaller towns, and is greater in more densely populated areas and in areas with higher proportions of older people and children (Figure 30). Demand for local climate regulation is considered to be very low in villages and rural areas and thus if looking to enhance local climate regulation, a focus on urban areas would be best.

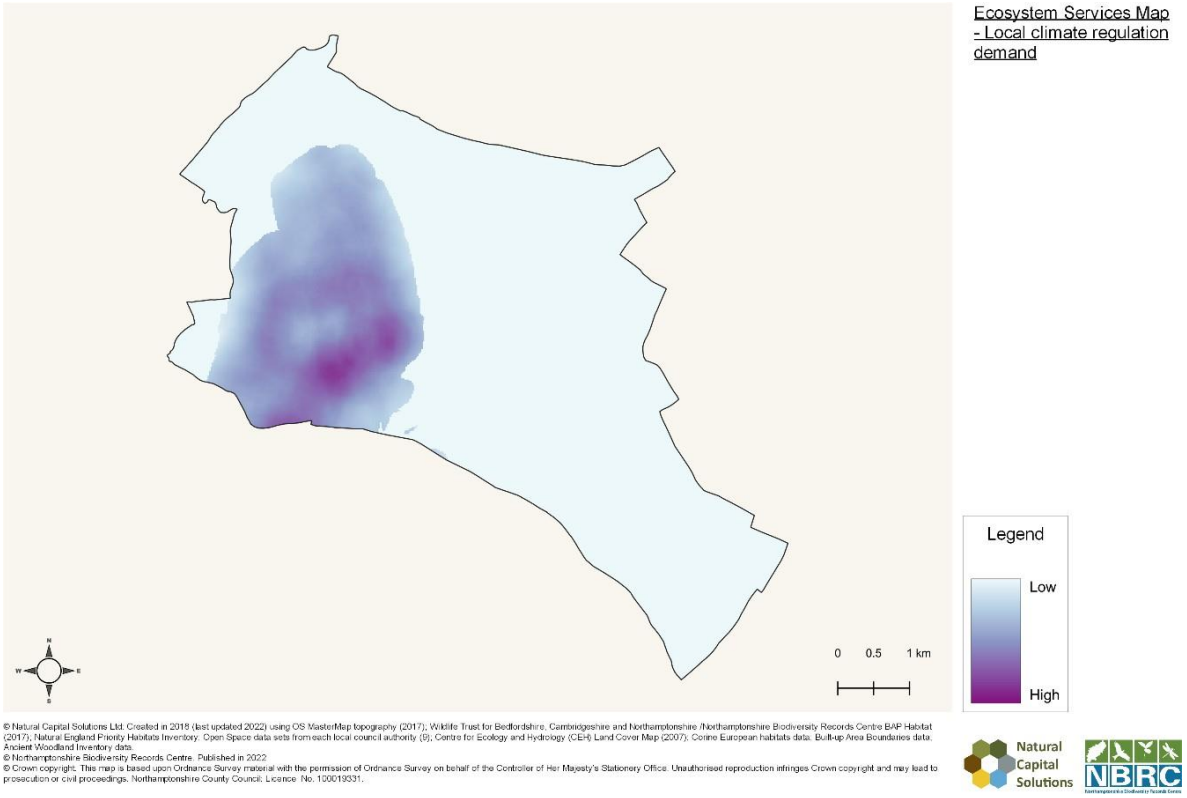


Figure 30. Local climate regulation demand across the parish of Higham Ferrers. *example map *for reference* only

7.8 Water flow regulation

What is it and why is it important?

Water flow capacity is the capacity of the land to slow water runoff and thereby potentially reduce flood risk downstream. Following a number of recent flooding events in the UK and the expectation that these will become more frequent over the coming years due to climate change, there is growing interest in working with natural processes to reduce downstream flood risk. These projects aim to "slow the flow" and retain water in the upper catchments for as long as possible. Maps of water flow capacity can be used to assess relative risk and help identify areas where land use can be changed.

What do the results show?

The amount of water flow regulation depends on slope, soil type and landuse (habitat). The best locations for slowing water runoff (darkest areas on the map, Figure 31) are areas of woodland and rough vegetation on flat land and permeable soils. The worst areas (lightest areas) are areas of impermeable surface (e.g. roads, buildings), water features, impermeable soils and steep slopes. We recommend use of this map alongside OS terrain topographical elevation.

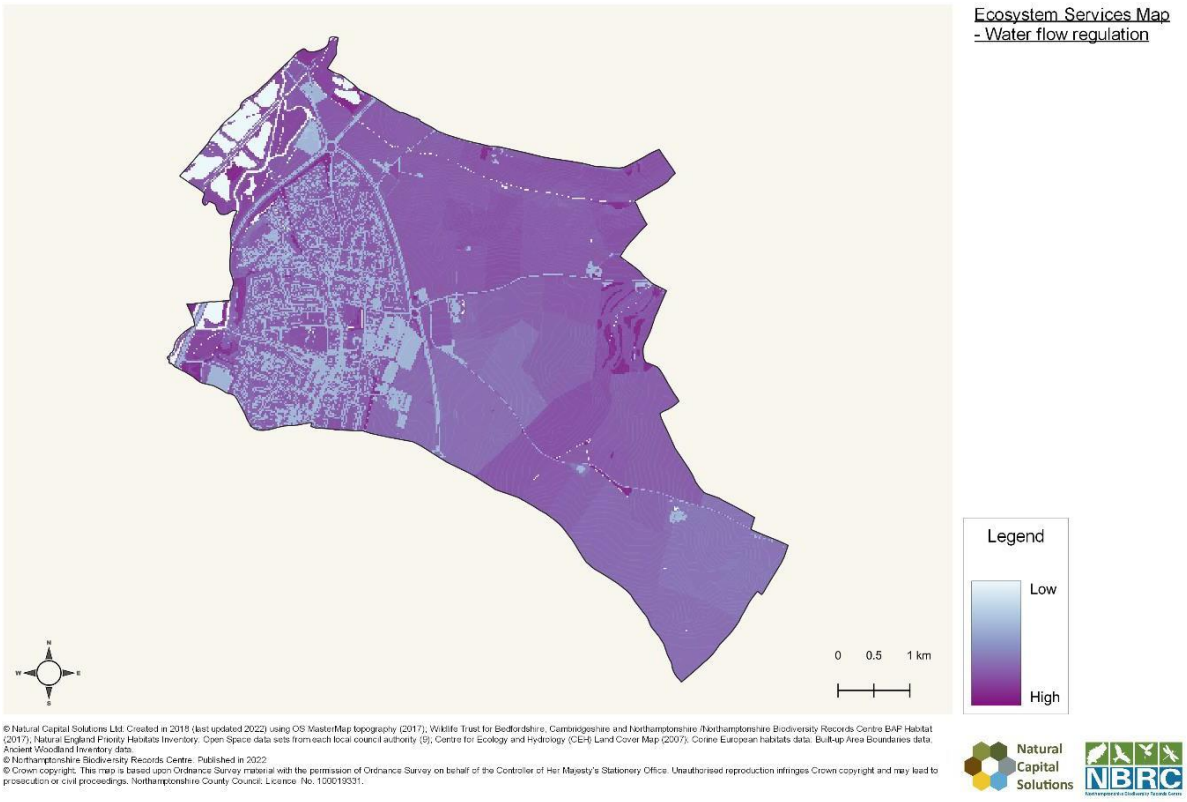


Figure 31. Water flow regulation capacity across the parish of Higham Ferrers. Darker areas (high capacity) are best at reducing runoff and lighter areas (low) are worst, with greater runoff. *example map *for reference only*

7.9 Water quality (soil erosion) regulation

What is it and why is it important?

Water quality capacity maps the risk of surface runoff becoming contaminated with high sediment loads before entering a watercourse, with a higher water quality capacity indicating that water is likely to be less contaminated. Note that although urban diffuse pollution is partially captured in the model, the focus is on sedimentation risk from agricultural land, hence built-up areas are not particularly well accounted for in the existing model.

What do the results show?

Water quality regulation tends to be lower in arable areas (lighter areas on the map, Figure 32), due to the potential for soil erosion from ploughed fields, and is also lower close to watercourses. Permanently vegetated habitats are considerably better at regulating water quality (darker colours), especially when some distance from watercourses. Urban areas score relatively well, but, as highlighted above, the water quality model does not fully account for urban diffuse pollution as it focuses on sedimentation risk from agricultural land.

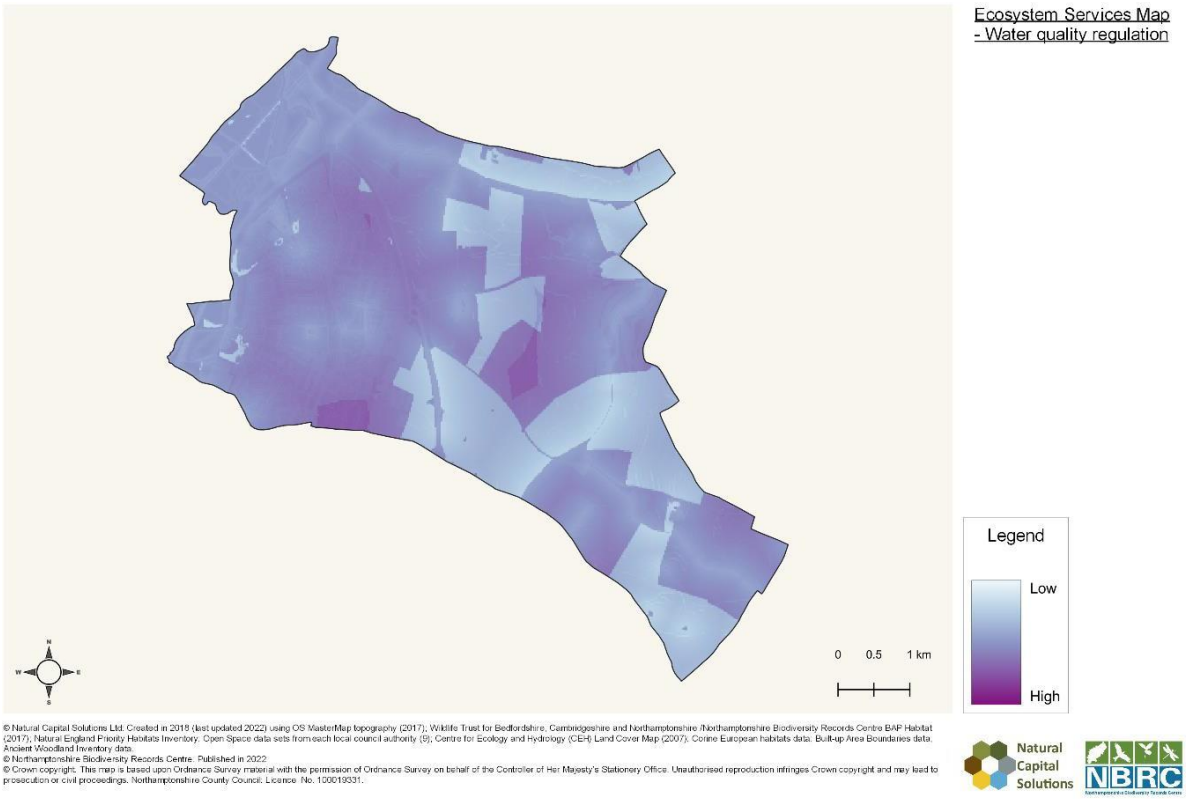


Figure 32. Water quality regulation capacity across the parish of Higham Ferrers. Soil erosion is lowest in the darker areas (high capacity to regulate water quality), whereas soil erosion is greatest (water quality potentially worst) in the lighter (low capacity) areas. *example map *for reference only*

7.10 Accessible nature capacity

What is it and why is it important?

The importance of access to greenspace is being increasingly recognised due to the multiple benefits that it can provide to people. In particular there is strong evidence linking access to greenspace to a variety of health and wellbeing measures. Research has also shown that there is a link between wellbeing and perceptions of biodiversity and naturalness. Natural England and others have published guidelines that promote the enhancement of access, naturalness and connectivity of greenspaces.

The two key components of accessible nature capacity are therefore public access and perceived naturalness. Both of these components are captured in the model, which maps the availability of natural areas and scores them by their perceived level of "naturalness".

What do the results show?

The map (Figure 34) shows accessible nature capacity for publicly accessible land only. Darker colours (high scores) indicate areas that are more natural, while blank areas have no public access. Larger continuous blocks of more natural habitat types will have higher scores than smaller isolated sites of the same habitat type. One consequence is that linear routes, such as footpaths, that pass through land with no other access will not score highly. Rights of way are captured in the model, but there may be local level inaccuracies, and permissive routes may not be captured. This information is held by Northamptonshire County Council, and we recommend checking your local map in conjunction with the most up to date Public Rights of Way.

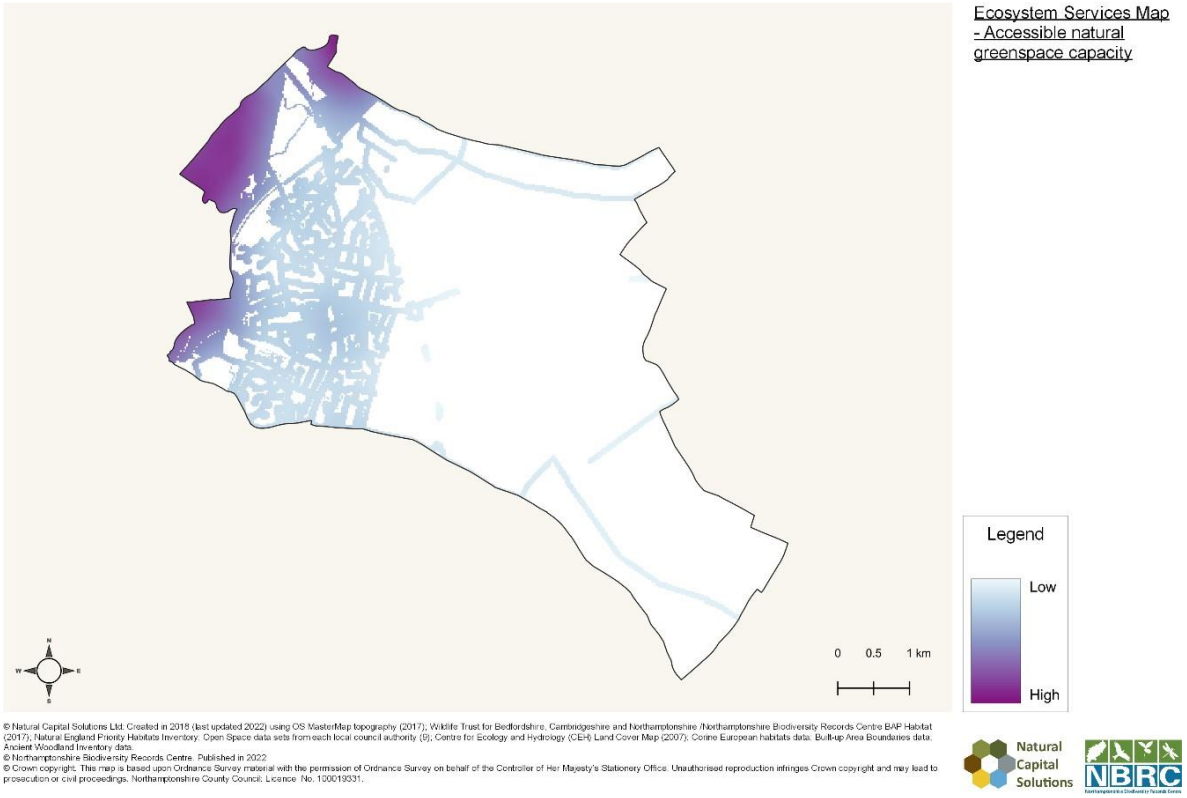


Figure 33. Accessible nature capacity across the parish of Higham Ferrers. *example map *for reference only*

7.11 Accessible nature demand

What is it and why is it important?

This indicates where there is greatest demand for accessible nature, which is strongly related to where people live. Research, including large surveys such as the Monitor of Engagement with the Natural Environment (MENE), have shown that there is greatest demand for accessible greenspace close to people's homes, especially for sites within walking distance.

What do the results show?

Demand for accessible nature is focussed around where people live, with higher demand (darker colours, Figure 35) in and around larger settlements.

Numerous researchers have shown that people travel most frequently to greenspaces very close to their homes and Natural England recommend that everyone should have access to at least some greenspace within 300m (5 minutes walk) and larger sites within 2 km. Any new accessible greenspace being created should therefore be close to housing areas. Furthermore, research has shown that people gain greater well-being from visiting sites that they perceive to be more natural and richer in biodiversity. This shows that as well as providing access to greenspace, it is important that the greenspace is of a high quality and as natural as possible.

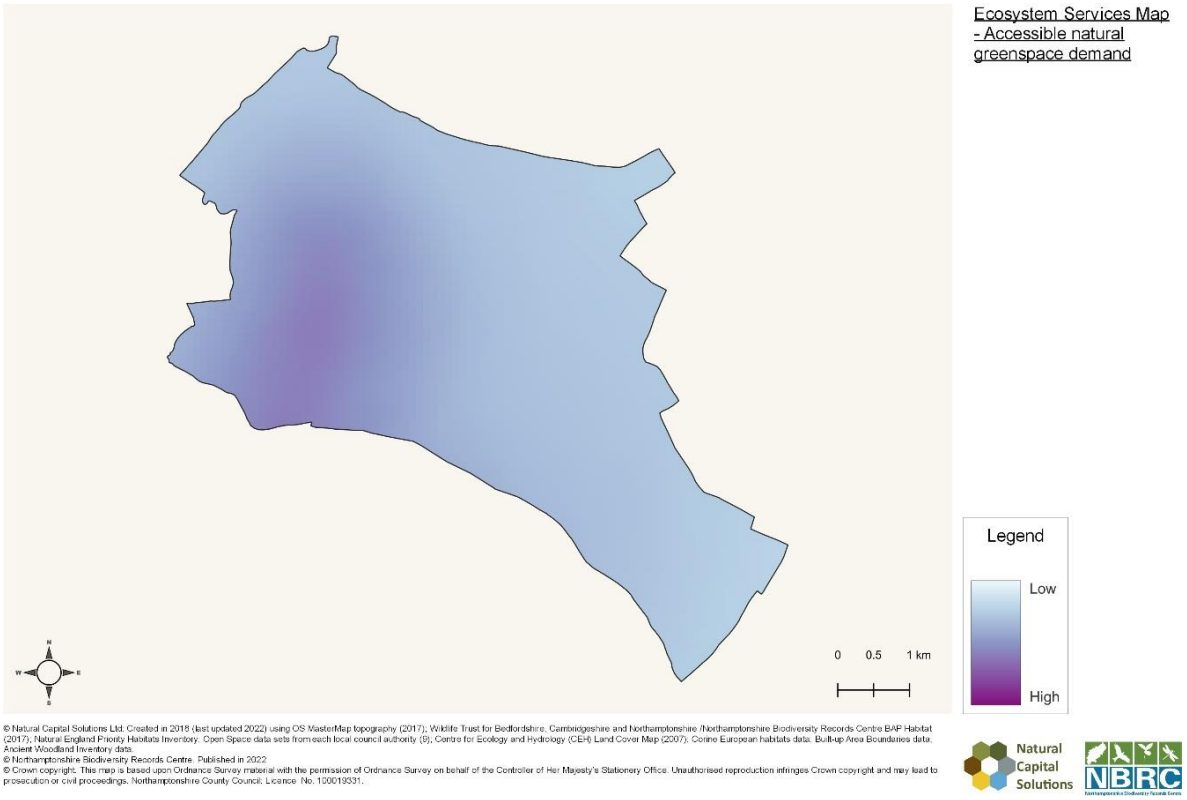


Figure 34. Accessible nature demand across the parish of Higham Ferrers. *example map *for reference only*

7. Further sources for practical guidance

This user guide is intended for use with the Natural Capital Solution maps as provided by the Northamptonshire Biodiversity Records Centre, supplied as additional to standard ecology reports. It is intended to be used with the support of a professional ecologist and aid informed decision-making for nature recovery. Search the Chartered Institute of Ecology and Environmental Management website to find professional ecological support https://cieem.net/i-need/finding-a-consultant/.

Please see https://northantsbrc.org.uk/ for up to date sources of reference, case study, and local opportunities and contact the Wildlife Trust for Bedfordshire, Cambridgeshire and Northamptonshire for further support and advice https://www.wildlifebcn.org.