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NENE VALLEY
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Mapping Natural Capital and Ecosystem Services in the Nene Valley

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About this report

The natural environment underpins our wellbeing and economic prosperity, providing multiple benefits to society, yet is consistently undervalued in decision-making.

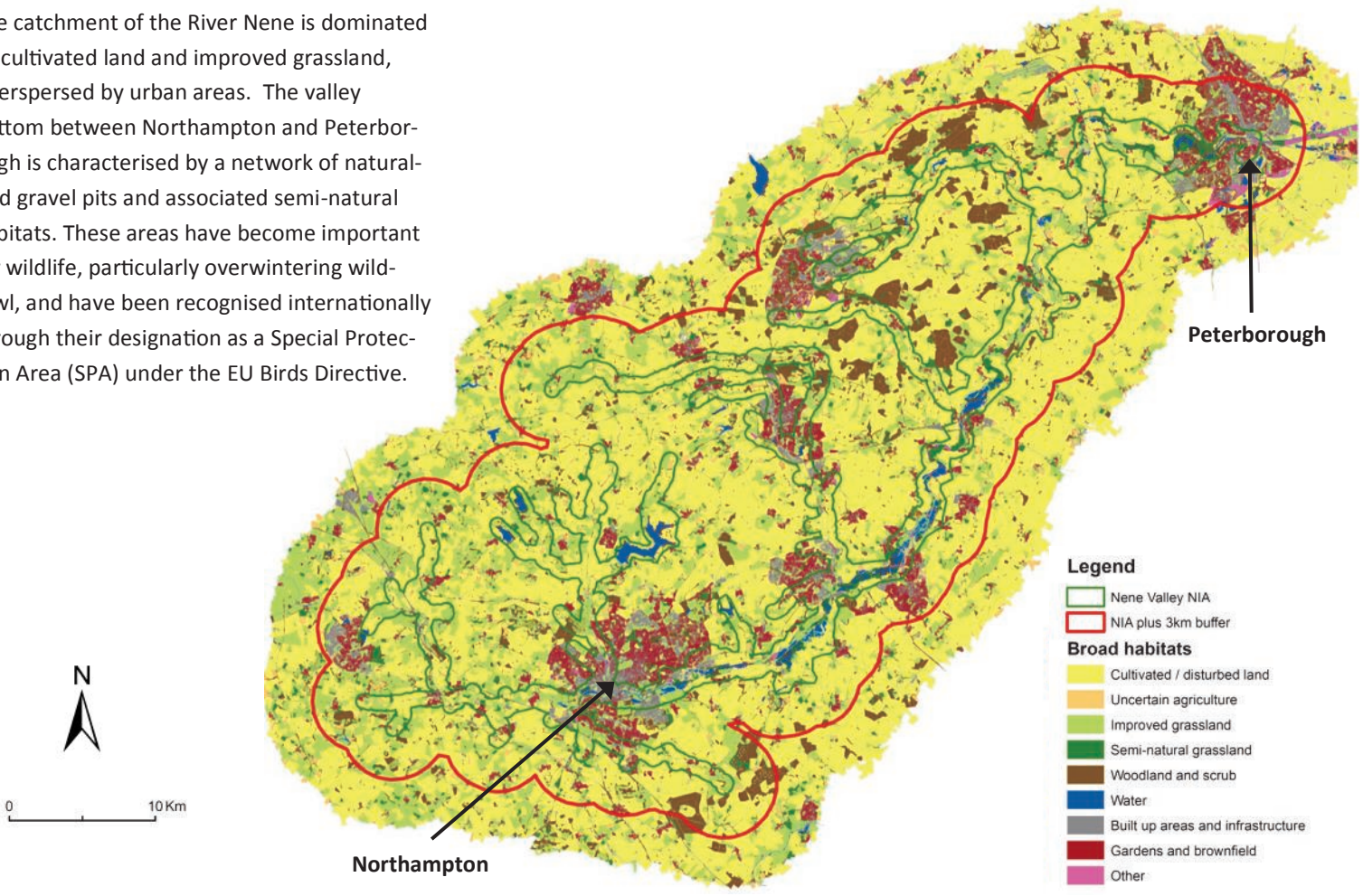
Natural capital is the stock of natural assets, including habitats, water and biodiversity that produces a wide range of benefits for people. These benefits are known as ecosystem services and include, for example, food, timber production, regulation of flooding and climate, pollination of crops, and cultural benefits such as aesthetic value and recreational opportunities.

The Nene catchment occupies most of Northamptonshire and Peterborough. It faces increasing pressures from human development as most of the catchment falls within an area highlighted for significant growth over the next few years. This will place considerable pressure on the catchment, but also presents an opportunity to achieve conservation of biodiversity and ecosystem services at a landscape scale. The Nene Valley was designated as a Nature Improvement Area (NIA) in 2012, a flagship nature conservation initiative launched by the UK Government to promote landscape-scale conservation.

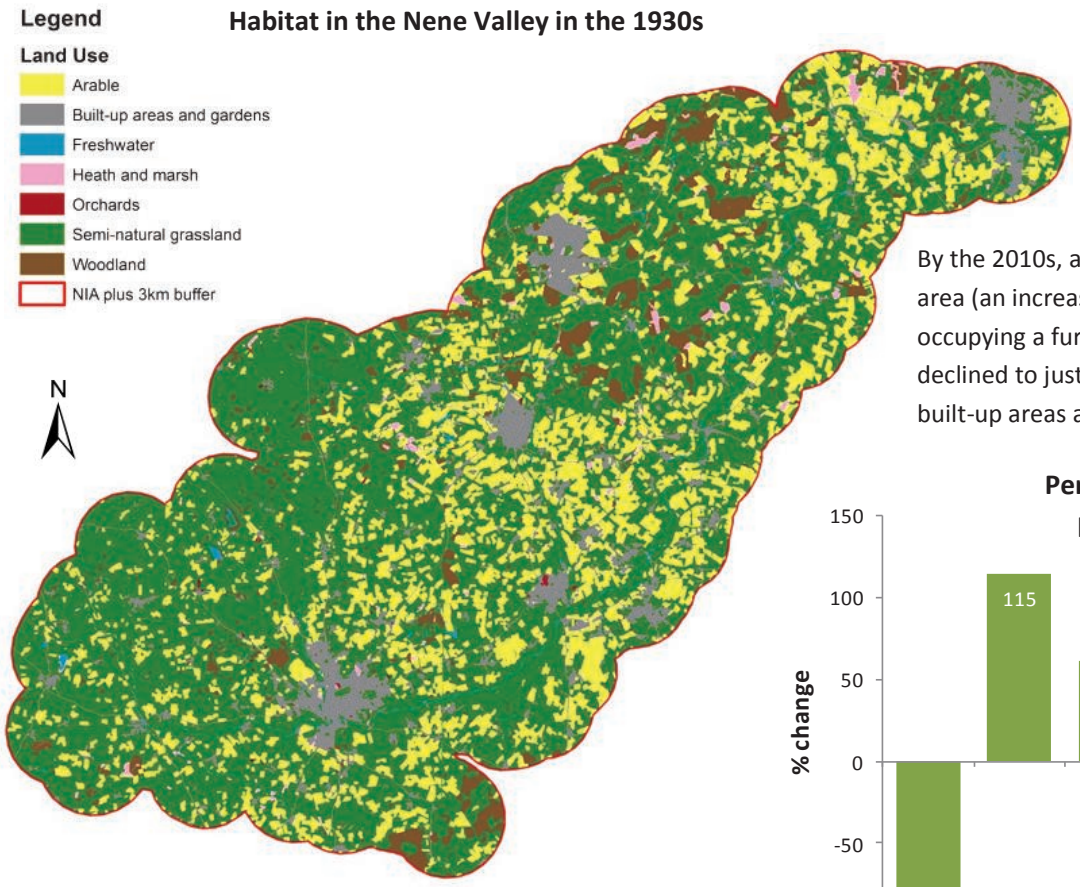
This report is a summary of a major project to identify, map and value natural capital and ecosystem services across the Nene Valley. The aims are to highlight the key benefits provided by the natural environment, to increase understanding of the interdependencies between the natural environment, people and the economy, and to help planners and decision makers protect, enhance and restore the natural environment for the benefit of both people and wildlife. A technical report accompanies this summary report, containing many more maps and further detail on the methods and results reported here (see back cover for link).

Land-use and habitats

The catchment of the River Nene is dominated by cultivated land and improved grassland, interspersed by urban areas. The valley bottom between Northampton and Peterborough is characterised by a network of naturalised gravel pits and associated semi-natural habitats. These areas have become important for wildlife, particularly overwintering wildfowl, and have been recognised internationally through their designation as a Special Protection Area (SPA) under the EU Birds Directive.



Change in habitats over 80 years



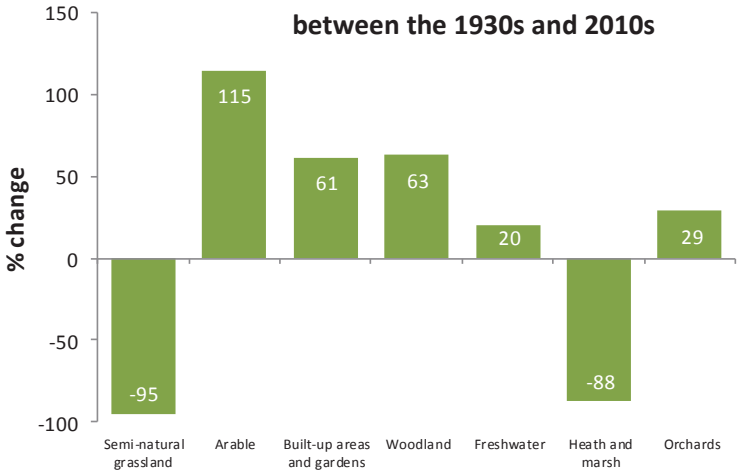
Habitat in the Nene Valley in the 1930s

Habitat in the Nene Valley in the 1930s was mapped and compared to the current situation (2010s).

Semi-natural grassland was the dominant habitat type In the 1930s, occupying 59.9% of the area.

By the 2010s, arable had increased to 50.3% of the land area (an increase of 115%), with improved grasslands occupying a further 18.9%. Semi-natural grassland had declined to just 2.9%, a decline of 95%. Woodland and built-up areas and gardens had both increased by >60%.

Percentage change in habitat types between the 1930s and 2010s



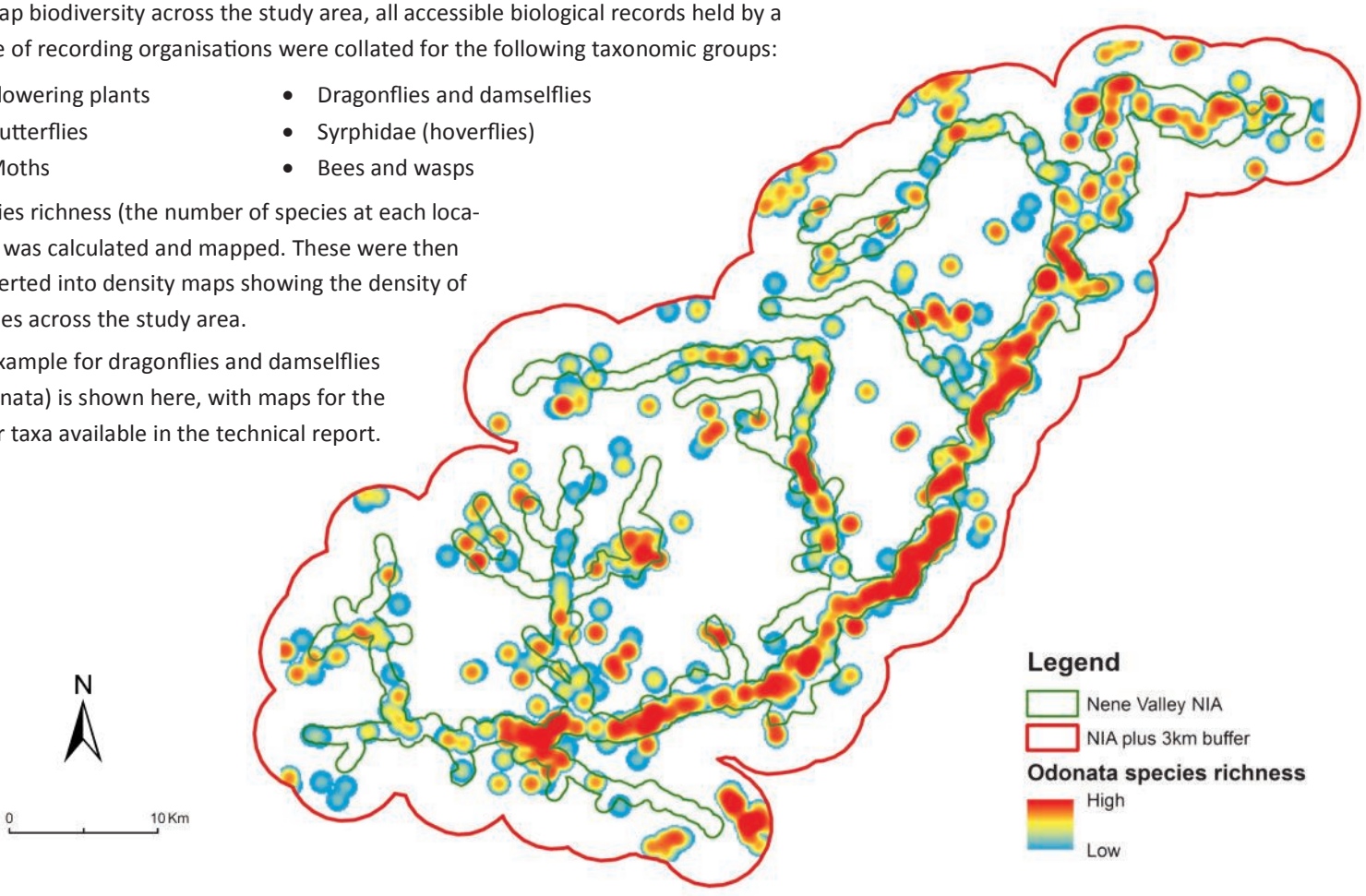
Mapping biodiversity

To map biodiversity across the study area, all accessible biological records held by a range of recording organisations were collated for the following taxonomic groups:

- Flowering plants
- Butterflies
- Moths
- Dragonflies and damselflies
- Syrphidae (hoverflies)
- Bees and wasps

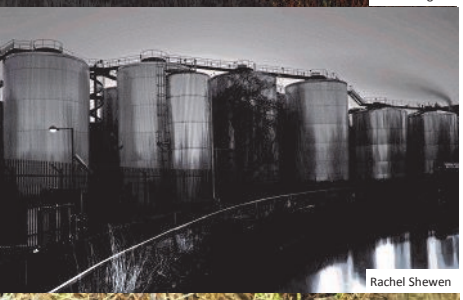
Species richness (the number of species at each location) was calculated and mapped. These were then converted into density maps showing the density of species across the study area.

An example for dragonflies and damselflies (Odonata) is shown here, with maps for the other taxa available in the technical report.



Ecosystem services


Martin Rogers


Rachel Shewen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Wildlife Trust BCN

Ecosystem services are the benefits that people derive from the natural environment. It is a way of recognising the natural environment for the many and multiple benefits that it provides. The key types of ecosystem services are shown below and the associated photographs illustrate some of these services in the Nene Valley:

Provisioning

Products obtained from ecosystems

e.g. food, timber, water

Regulating

Benefits obtained from environmental processes that regulate the environment

e.g. air quality, climate regulation, pollination

Cultural

Non-material benefits people obtain from ecosystems

e.g. recreation, aesthetic experiences, health and wellbeing

Adopting the ecosystem services approach is a key policy objective of the UK Government and much work is progressing on how to deliver the approach on the ground and how to use it to inform and influence management and decision-making. One of the most important steps is to recognise and quantify ecosystem service delivery .

Mapping of ecosystem services

Maps were developed for 11 different ecosystem services. Each map was created by running a Geographic Information System (GIS) based model, using standardised methods taken from the scientific literature. These rely on the detailed habitat information determined in the habitat basemap, together with a number of additional data sets for each ecosystem service. The following ecosystem services have being mapped:

1. Carbon storage
2. Noise regulation
3. Local climate regulation
4. Air purification
5. Water flow
6. Water quality
7. Pollination
8. Agricultural production
9. Tranquillity
10. Accessible nature
11. Green travel

The approach used was based on the EcoServ GIS toolkit developed by the Wildlife Trusts, but with a number of modifications to better suit the situation in the Nene Valley. In addition, bespoke models were created for several ecosystem services. In all cases the models are applied at a 10m by 10m resolution to provide extremely fine scale mapping across the area. The models are indicative (showing that certain areas have higher capacity or demand than other areas) and are not process-based mathematical models.

For all of the ecosystem services listed, the capacity of the natural environment to deliver that services – or the current supply— is mapped. Wherever possible, the local demand (beneficiaries) for each ecosystem service was also mapped .

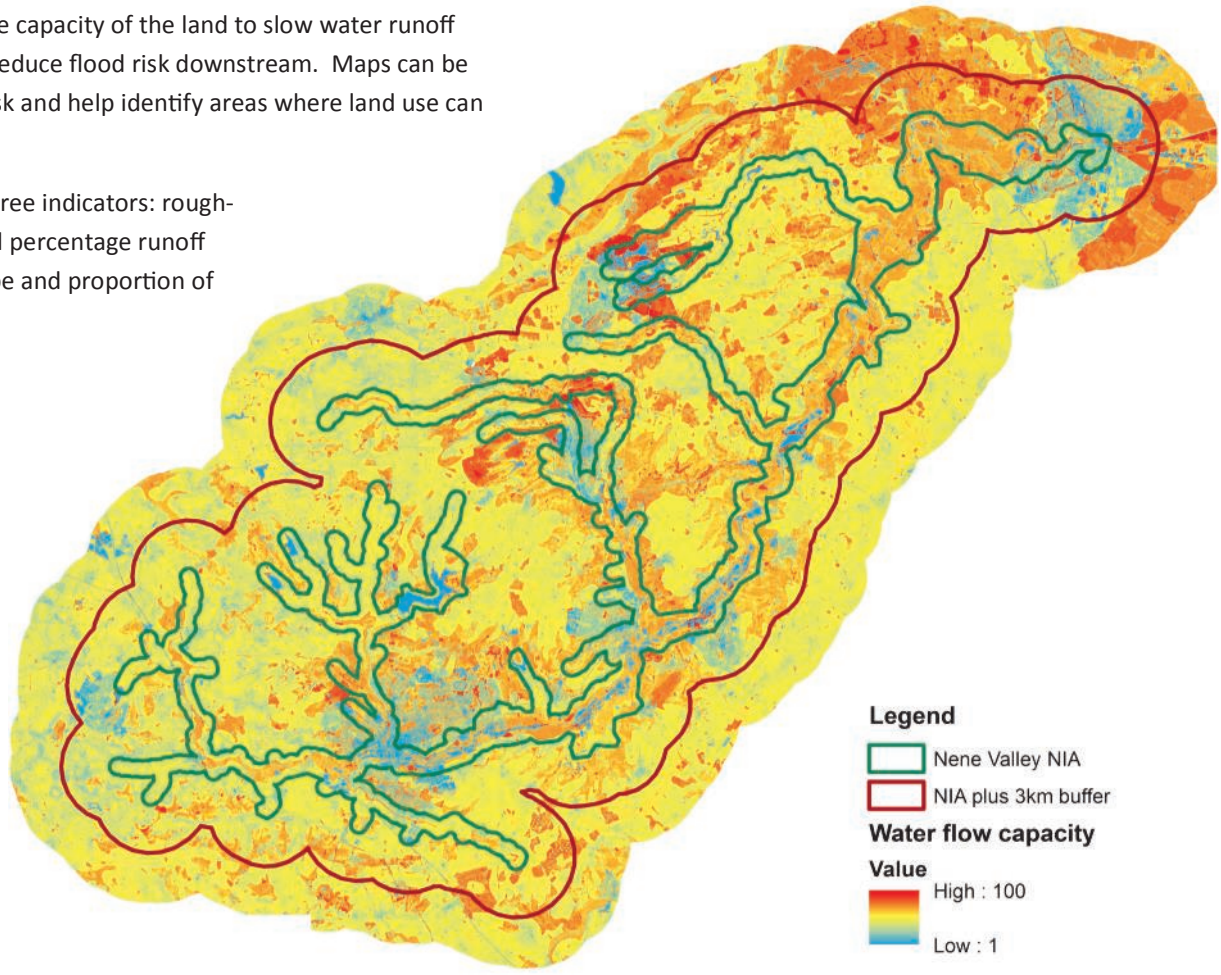
In all cases the capacity and demand for ecosystem services is mapped relative to the values present within the study area. In all the ecosystem services maps, the highest amounts (hotspots) are shown in red, with a gradient of colour to blue, which shows the lowest amounts (coldspots).

On the next page, two of the ecosystem services maps are provided as examples. The complete set of maps is included in the technical report and on the NCC mapping portal (see back page for links).

Water flow capacity (natural flood risk management)

Water flow capacity is the capacity of the land to slow water runoff and thereby potentially reduce flood risk downstream. Maps can be used to assess relative risk and help identify areas where land use can be changed.

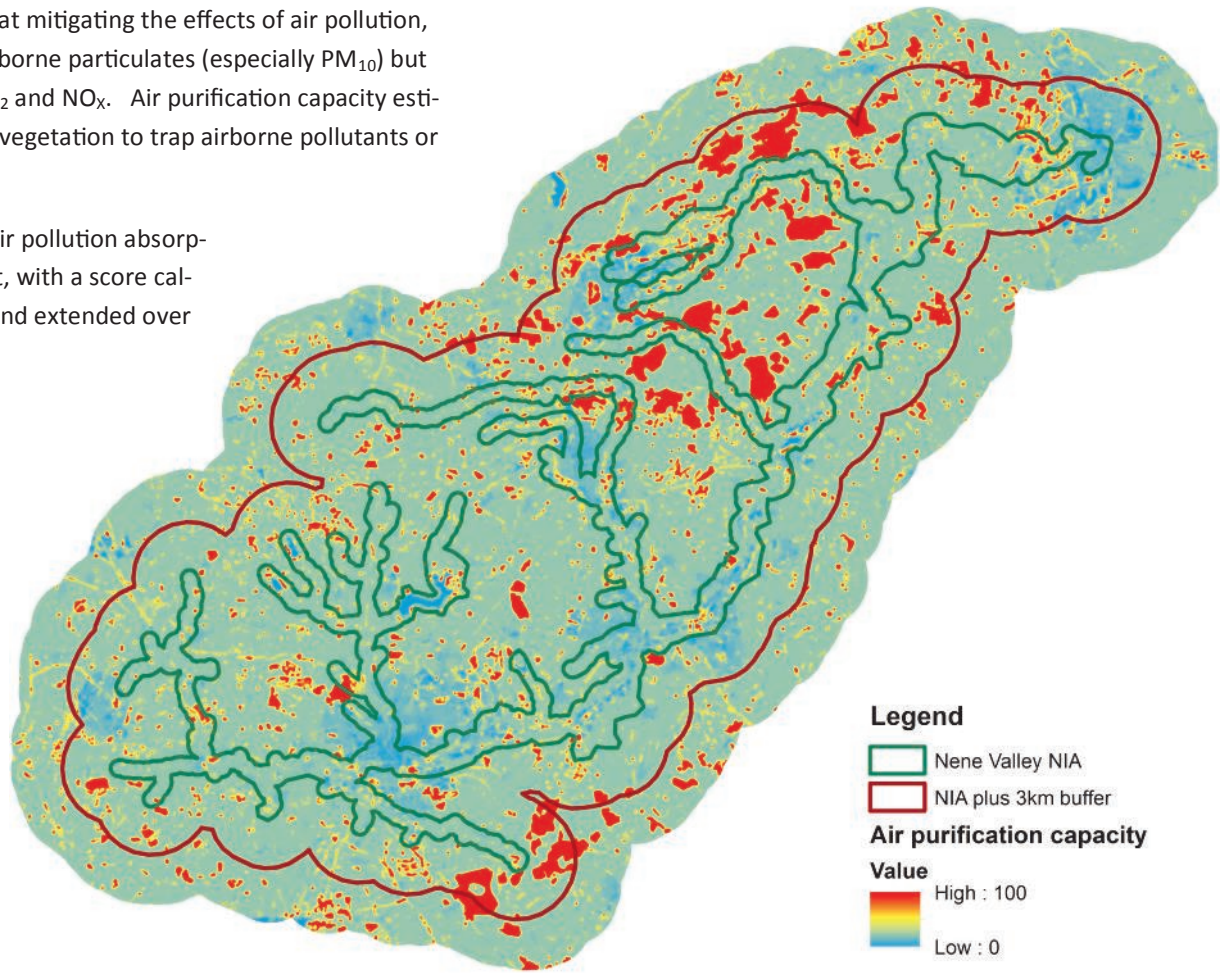
The model is based on three indicators: roughness, slope, and standard percentage runoff (dependent upon soil type and proportion of sealed surface).



Air purification capacity

Vegetation can be effective at mitigating the effects of air pollution, primarily by intercepting airborne particulates (especially PM_{10}) but also by absorbing ozone, SO_2 and NO_X. Air purification capacity estimates the relative ability of vegetation to trap airborne pollutants or ameliorate air pollution.

The model is based on the air pollution absorption capacity of each habitat, with a score calculated around each point and extended over the adjacent area.

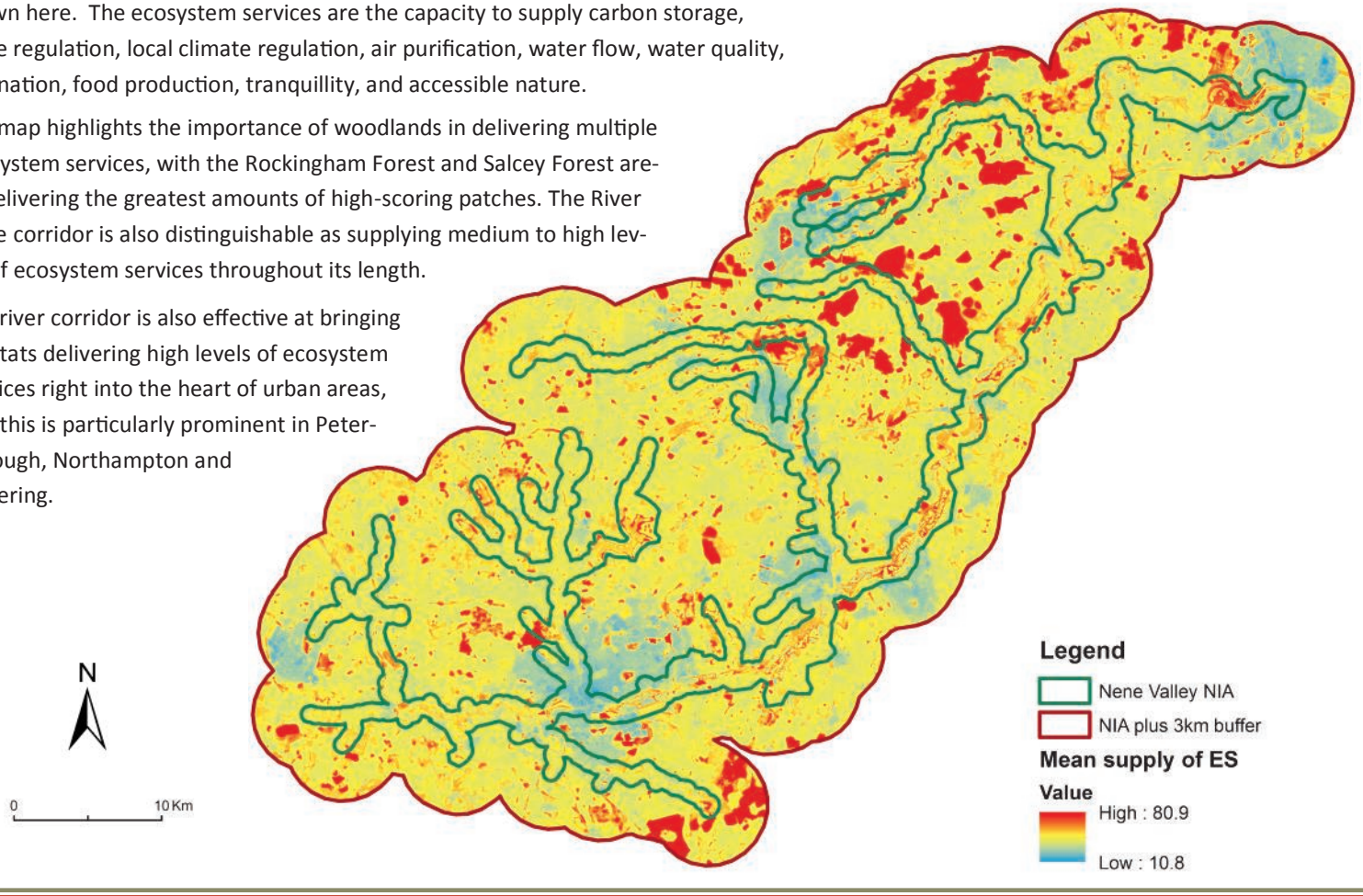


Overall supply of ecosystem services

The average provision across ten ecosystem services modelled in this project is shown here. The ecosystem services are the capacity to supply carbon storage, noise regulation, local climate regulation, air purification, water flow, water quality, pollination, food production, tranquillity, and accessible nature.

The map highlights the importance of woodlands in delivering multiple ecosystem services, with the Rockingham Forest and Salcey Forest areas delivering the greatest amounts of high-scoring patches. The River Nene corridor is also distinguishable as supplying medium to high levels of ecosystem services throughout its length.

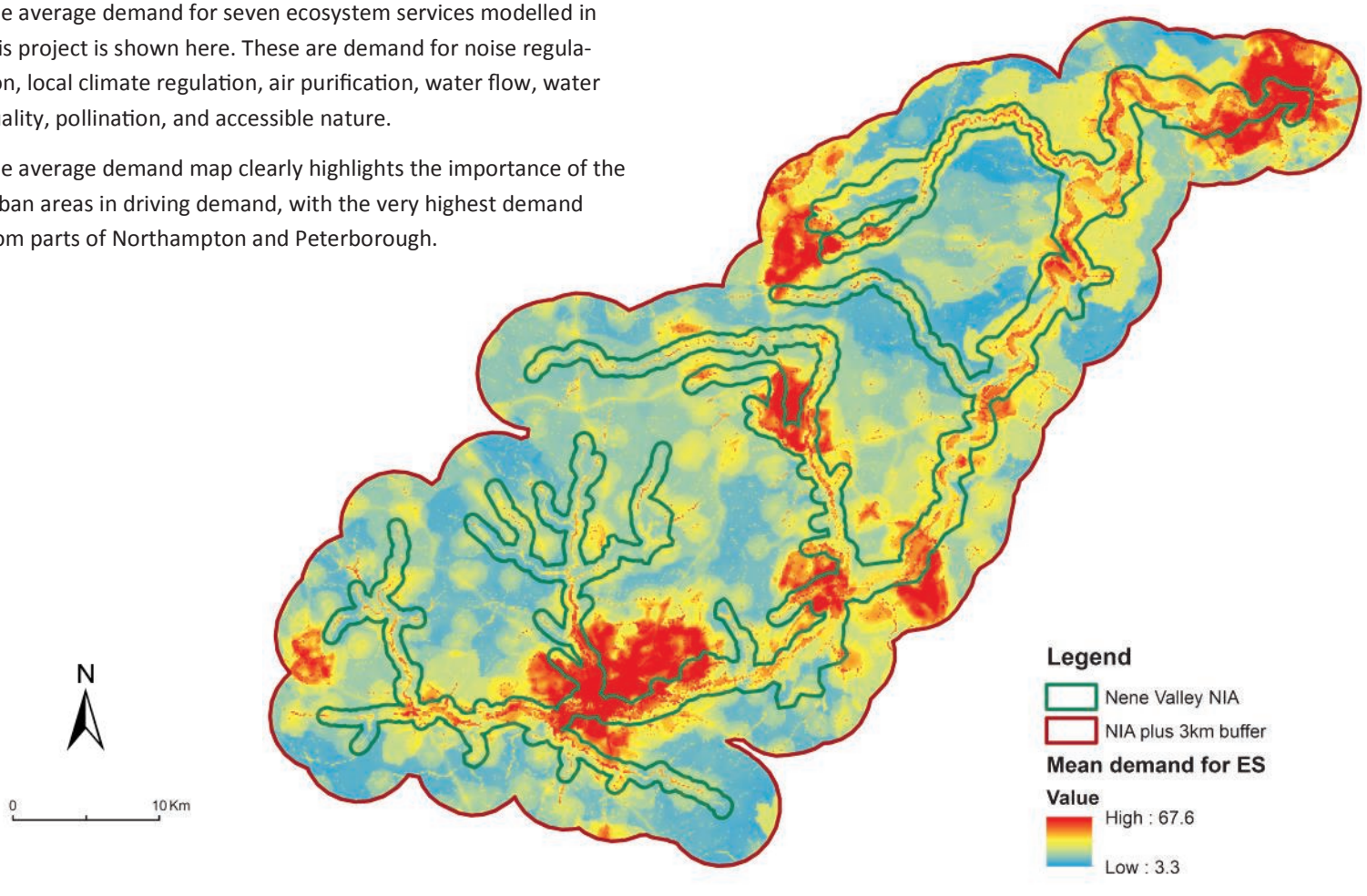
The river corridor is also effective at bringing habitats delivering high levels of ecosystem services right into the heart of urban areas, and this is particularly prominent in Peterborough, Northampton and Kettering.



Overall demand for ecosystem services

The average demand for seven ecosystem services modelled in this project is shown here. These are demand for noise regulation, local climate regulation, air purification, water flow, water quality, pollination, and accessible nature.

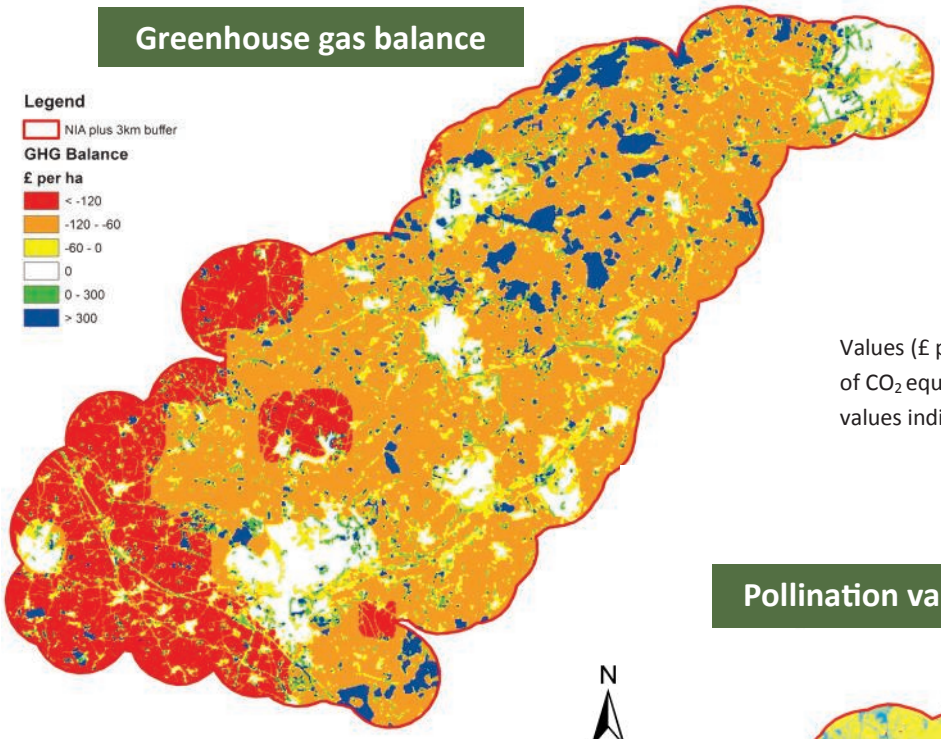
The average demand map clearly highlights the importance of the urban areas in driving demand, with the very highest demand from parts of Northampton and Peterborough.



Monetary valuation of ecosystem services

There is a great deal of interest in providing a monetary valuation of ecosystem services and is an area being actively pursued by government, researchers and practitioners. Gaining a spatial perspective on the variation in values across a study area using maps provides much additional insight and is at the cutting edge of ecosystem services research. Here the monetary value of a range of ecosystem services across the Nene catchment have been mapped. Two example maps are provided below with the others available in the technical report.

Greenhouse gas balance

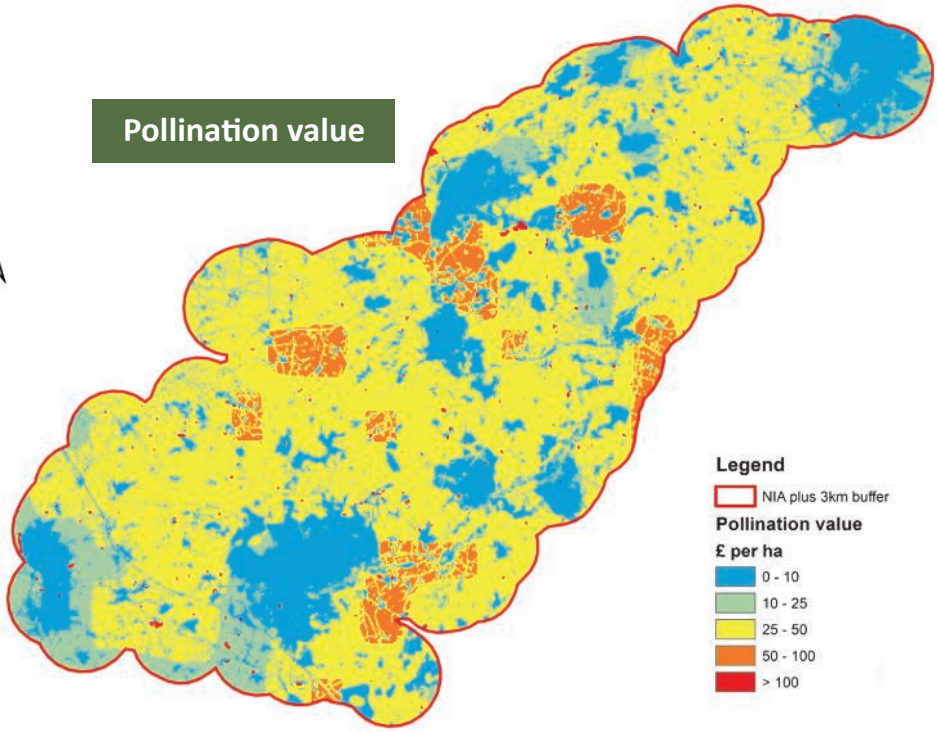


Greenhouse gas balance combines two valuation maps for each hectare:

- Agricultural emissions—calculates energy use for typical farming practices, emissions of N_2O and methane from livestock, and emissions of N_2O from fertilizers
- Carbon sequestration (capture) in woodland—based on values for typical broadleaved, coniferous and mixed woodland, adjusted for Northamptonshire

Values (£ per ha) are based on UK Government carbon price per tonne of CO_2 equivalent. Negative values indicate emissions, whereas positive values indicate sequestration (CO_2 capture).

Pollination value



Pollination value is determined by calculating the gross margin of agricultural crops and orchard fruits that rely on pollination. This is then multiplied by the percentage pollinator dependency of each crop/fruit.

The largest value is derived from orchards, which appear as small red dots on the map. The more extensive orange and yellow areas highlight the value of pollination to oil-seed rape and field bean crops.

	NIA	NIA & buffer
Agricultural production:	£ 16.5 M	£ 74.7 M
Orchard production:	£ 0.43M	£ 1.20M
Agricultural emissions:	-£ 3.01M	-£ 13.0 M
Carbon sequestration:	£ 1.04M	£ 7.15M
Greenhouse gas balance:	-£ 1.97M	-£ 5.89M
Pollination:	£ 1.35M	£ 5.53M
Recreational visits:	£ 94.4 M	£230.6M
Overall value of ES:	**£109.4M**	**£300.6M**

Overall value of ecosystem services

The annual flow of ecosystem services in the Nene Valley per year is shown on the adjacent table. On average, each hectare of land delivers £2,639 of services per year in the core NIA and £1,769 of services across the whole study area.

The maps highlight areas of high and low provision for each ecosystem service, as well as areas providing multiple benefits. Comparing across services, it is apparent that the value of recreational visits far outweighs the value of all other services in the Nene catchment.

This assessment has only considered a small number of ecosystem services on which it is possible to provide a monetary value, hence the true value of the natural environment will be considerably higher.

The maps and monetary values can be used in land-use planning, awareness raising, and ecosystem accounting.

Conclusions and applications

The Nene Valley delivers a wide range of benefits to people, many of which are unrecognised or undervalued in decision-making. The maps highlight the importance of woodlands and the River Nene corridor at delivering multiple ecosystem services. Furthermore, monetary valuation revealed the highly significant contribution that natural capital makes to the local economy. The majority of this value was derived from expenditure on recreational visits, illustrating the importance of the publicly accessible sites along the river valley. The maps are being used as evidence in the planning system, to identify suitable locations for investment and management, and to engage with stakeholders.

Some applications of natural capital and ecosystem services mapping

Maps show where investment and management should be targeted

The maps highlight areas that are delivering high levels of services where current land use should be continued and supported, and areas with low provision or high demand, where change could be beneficial.

Working with the planning system

The maps can be used as evidence for Local Plans Part 2, Green Infrastructure Delivery Plans, and as input into the planning of major development projects.

Delivering multifunctional landscapes

The maps can be used as a first step to achieving multi-objective land management, guiding new projects and developments that achieve a net gain for natural capital and ecosystem services.

Stakeholder engagement

The maps can be used to inform dialogue with stakeholders and the public and raise awareness of the benefits of the natural environment. They can be used to engage with different sectors e.g. planners and developers, water sector.

Spatial modelling of future scenarios

The effect of planning proposals, changes in policy, economic or environmental factors on the delivery of ecosystem services can be modelled. This can reveal risks and opportunities, and enables mitigation to be planned.

Payments for Ecosystem Services (PES) schemes

The values revealed can be used as a basis for setting up PES schemes and other ecosystem markets. They can also be used as part of natural capital accounting.

This report was written and produced by Jim Rouquette of Natural Capital Solutions and the University of Northampton.
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Further details of the methods and results, including many more maps, are included in the **technical report** available from:
http://www.naturalcapitalsolutions.co.uk/previous-projects/case-study-2/

The **ecosystem services maps** are also available to view, along with other GIS data, from Northamptonshire County Council's mapping portal (click on Add Feature/Place):
http://maps.northamptonshire.gov.uk/

For further information on the **Nene Valley Nature Improvement Area** please visit:
http://www.nenevalleynia.org/

Cover images: sunset over Irthlingborough Lakes and Meadows (John Abbott), recreation in Nene Park (Chris Porsz), golden plovers (Jamie Cooper), bumblebee (Lisa Rowley). Back cover: morning mist (Melvin Mallard).