North Kent Woods and Downs National Nature Reserve

Environmental & Ecological Strategy and Implementation Plan

February 2025

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Front page image: Hornbeam at Cobham Wood

Contents

1 Executive summary

The North Kent Woods and Downs National Nature Reserve (NNR) is a designation that encompasses a range of ecologically significant sites, home to many priority species and habitats.

Notable species are too many to mention here but cover the full range of taxonomic groups from the more well known such as Hazel Dormouse, Adder (*Vipera berus*) and the UK's largest beetle, the Stag Beetle (*Lucanus cervus)* to the perhaps more esoteric such as Six-spotted Pot Beetle (*Cryptocephalus sexpunctatus*), Liquorice Piercer *(Grapholita pallifrontana*) and the False Slender-footed Robberfly (*Leptarthrus vitripennis*).

The NNR is home to many important plants and plant assemblages including meadow clary (*Salvia pratensis)*, musk orchid (*Herminium monorchis)*, ground pine (*Ajuga chamaepitys*) and broad-leaved cudweed (*Filago pyramidata).*

Important habitats include ancient woodland which is home to a potentially internationally important assemblage of dead wood beetles, chalk, acid and neutral grasslands, each supporting a diverse range of species from orchids to butterflies. Scrub is another important habitat for many species including breeding birds and moths but also a possible threat to other habitats if not managed appropriately. Smaller areas of important habitats include traditional orchards, wood pasture and ponds, ditches and streams. Large expanses of arable land and vineyards are also home to a wide range of species including rare arable plants and an assemblage of farmland birds.

The NNR designation aligns with national conservation objectives, aiming to enhance biodiversity, support scientific research, promote sustainable land management, and increase public engagement.

It is co-ordinated and collaborative action on the ground that is needed to address the ecological and environmental priorities for the NNR. The headline messages for implementation of the strategy are as follows:

Collaboration and Partnerships

- Develop shared management frameworks and encourage collective branding for the NNR.
- Strengthen stakeholder collaboration with conservation organizations, local authorities, and community groups.
- Promote education, volunteer programs, and citizen science initiatives to foster long-term engagement.

Biodiversity and Habitat Restoration

- Implement habitat restoration through rotational woodland management, scrub clearance, and targeted seeding programs.
- Conduct species-specific conservation efforts, including monitoring and surveys of invertebrates, fungi, bats, and other rare species.
- Enhance ecological connectivity by linking fragmented habitats and creating wildlife corridors.

Sustainable Land and Resource Management

- Develop climate-adaptive management practices, including sustainable grazing, deer control, and veteran tree conservation.
- Monitor long-term ecological trends and select resilient tree species to mitigate climate change impacts.
- Implement coordinated land-use strategies, optimising shared resources and expertise.

Funding and Strategic Planning

- Secure funding through multiple avenues, including National Highways, National Lottery Heritage Fund, and agri-environment schemes.
- Establish a long-term financial and governance strategy to ensure sustainable conservation efforts.
- Prioritise conservation actions based on ecological significance, feasibility, and funding availability.

Public Access and Visitor Experience

- Improve accessibility through upgraded infrastructure and signage.
- Develop interactive visitor engagement programs, such as guided walks, educational hubs, BioBlitzes and public outreach events.
- Promote inclusivity by enhancing engagement opportunities for underrepresented groups.

2 Introduction

2.1 Objectives

- To assess the ecological significance of several sites as part of the candidate North Kent Woods and Downs NNR for a wide range of taxa.
- To assess landscape character and considerations in this regard for the North Kent Woods and Downs NNR.
- Highlight opportunities for integrated action across the NNR area.
- Identification of priority actions and management across the NNR including:
    - Land management
        - Including SSSI condition
    - Ecological surveys
    - User/local people surveys
    - Engagement opportunities
- To assess the vulnerability of the area in response to forecasted changes driven by climate change.
- To collate a wide range of information to support Natural England's declaration of the North Kent Woods and Downs candidate NNR.

2.2 Background

The Kent Downs National Landscape Unit commissioned this work as part of the wider NNR project to ultimately lead to the declaration of an NNR.

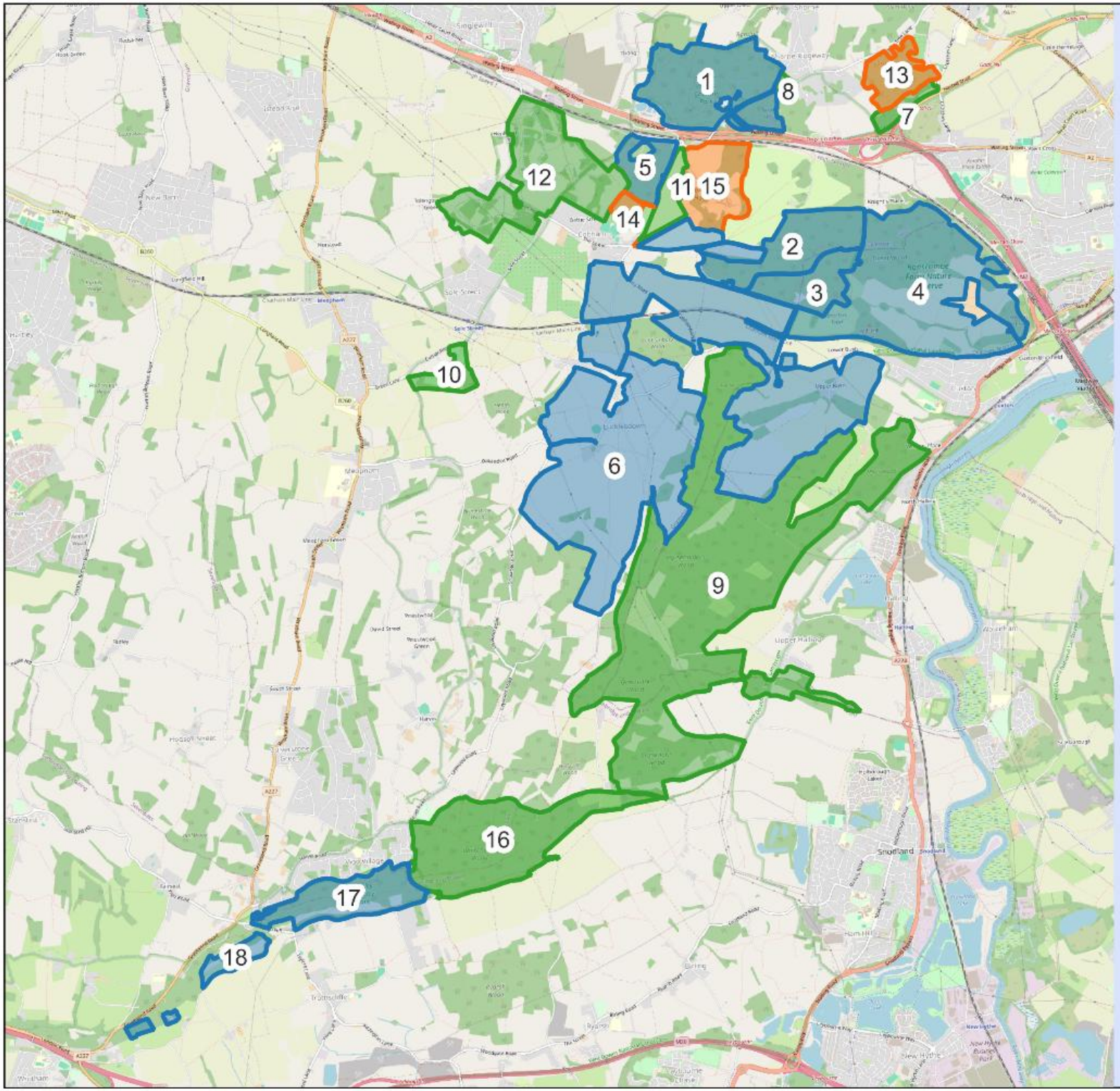
The possible sites included in the NNR are shown on the map below at Figure 1. This includes core, affiliate and potential affiliate sites.

Core sites (in blue in the map) are those sites that are part of the Natural England NNR declaration. They are included in government mapping; all organisations are Approved Bodies (they meet the standards for NNR management) and all sites meet both the Selection Principles[1] and the Management Standards[2] of the NNR series.

Affiliate sites (green) are those that are a full part of the NNR partnership but are not part of the legal declaration. The affiliate status may be a reflection that the land use is not primarily nature conservation or that the landowner or manager is not currently able to meet the management standard required for core site status. Although, as of 12th December 2024,

Overleaf - Figure 1 North Kent Woods and Downs NNR: possible sites (January 2025)

[1] NNR Selection Principles - https://publications.naturalengland.org.uk/file/6056632447139840
[2] NNR Management Standards - https://publications.naturalengland.org.uk/file/5889726813569024



North Kent Woods and Downs NNR

Possible NNR sites - Internal

- Core partners
- Probable affiliate partners
- Possible affiliate partners

1. Shorne Woods Country Park
2. Cobham Woods
3. The 'Leisure Plots'
4. Ranscombe Farm
5. Ashenbank Wood
6. Silverhand Estate
7. Crabbles Bottom
8. Shorne Common Rough
9. Holborough Woodlands
10. Camer Park
11. West Park
12. Jeskyns Community Woodland
13. Great Crabbles Wood
14. South Ashenbank Wood
15. Cobham Hall School
16. Birling Estate
17. Trosley Country Park
18. Wrotham Water

0 1 2 3 km

Kent Downs National Landscape

White Horse Ecology

these sites are not officially affiliated, the agreement in principle is in place and sites are assumed to be affiliated for the purposes of this report.

Potential additional affiliate sites are highlighted in orange in the map at Figure 1. These are sites where discussions about affiliate status are still ongoing.

2.3 Individual reports

Reports were produced for a wide range of taxa, from Fungi to Beetles and Mammals to Moths and Plants. These are:

Table 1 – Taxon reports and their authors

Species group	**Author**
Amphibians and reptiles	Lee Brady
Bats	Jim Labisko and Clair Thackray
Beetles	Tony Witts
Birds	Murray Orchard and Chas Holt
Botany (and habitat condition assessment)	Lesley Mason
Deadwood invertebrates	Wil Heeney
Flies, spiders and dragonflies	Chris Bentley and Luke Wallace
Fungi	Martin Allison
Lichens	David Hawksworth
Mosses, liverworts and hornworts	Des Callaghan
Moths and butterflies	Dave Shenton
Orthoptera, Dictyoptera, Dermaptera, Mollusca, Hemiptera, and Aculeate Hymenoptera	Richard Moyse
Terrestrial mammals	Ian Gray and Claire Munn

Whilst each report is unique, drawn up by local taxa experts, they all looked to provide information on the following key criteria:

- Species
- Management recommendations
- Further surveys and monitoring including key sites

Desk-based studies were the basis of each report. Several included a rapid literature search, of both published, peer-reviewed papers and ‘grey’ literature.

2.4 Fieldwork

In addition to desk-based research, many report authors also spent time on-site, undertaking a range of general habitat-based or more targeted species surveys.

3 Area-wide strategy

3.1 Woodland and land management

Priority actions and management

From the extensive list of management actions collated for this report a number have been identified by partners, land managers, and others as top priorities as part of the NNR's environmental strategy. These include:

- To more fully strategise and catalogue operations across the sites.
- Implement a grazing management plan including the potential to share stock equipment and invest in grazing infrastructure.
- Share contractors and knowledge – run coordinated veteran tree works across the area.
- Establish a shared tree nursery.
- Develop a tree health strategy and management plan.
- Veteranisation of trees to ensure continuity of supply of deadwood habitat.
- Develop hedgerow, pond, grassland restoration and other habitat connectivity projects.
- Re-wetting of woodland, use of 'leaky dams etc.
- Produce a tailored toolkit for grassland improvement/restoration
- Implement a detailed monitoring programme to review impact/progress of land management interventions.
- Plan for species migration e.g. cohesive land management plan for the NNR to ensure species can move across the landscape.
- Implement '3-zone ride' management for multiple benefits.
- Monitor and control invasive non-native species (INNS) e.g. rhododendron, cotoneaster, cherry laurel and *Crassula helmsii.*

Refer to Annex 1 for further information on these implementation plan priorities.

Sites of Special Scientific Interest (SSSIs)

These sites are nationally important for wildlife and/or geology. Natural England now monitors these sites based on the condition of the special features of each site.

The environmental and ecological strategy for the NNR has captured a wealth of evidence on the special features across the area, including those within and outside SSSIs. The strategy for the NNR will need to understand the pressures on these sites and the actions and management required to achieve and maintain them in favourable condition. Through collaboration, across the NNR, we will be able to put action plans into place that address both on-site and off-site pressures on SSSIs.

Using this evidence in planning will also help make a compelling case for further avenues of funding; sites may be eligible for agri-environment scheme funding or if ineligible for this, funding from the Conservation Enhancement Scheme (CES).

SSSIs in the NNR area

- Cobham Woods
- Great Crabbles Wood
- Halling to Trottiscliffe Escarpment
- Shorne and Ashenbank Woods

Some of the features for which these sites are notified are assessed as being in unfavourable condition. In addition, there are several features for which the condition is unknown.

Further details on the special features and their condition can be found in Annex 3.

In addition, there is the Houlder and Monarch Hill Pits Geological SSSI which is adjacent to the NNR area and is mentioned in several individual reports.

3.2 Access and engagement

A key part of any NNR is community engagement. The ecological and environmental features and priorities of the NNR provide the ideal opportunity for wider engagement with landowners and the wider public. This should include the following:

- Use the launch of the NNR to create a buzz around the concept. Ensure that publicity and materials are available to give to people on day one.
- Develop and agree unified approach to the wider area – how to make it feel like a unified landscape area.
- Identify champions within communities to promote the NNR sites and priority and flagship species.
- Local communities and landowners are encouraged to participate in conservation efforts and to manage their land in ways that benefit key habitats and species.
- Education and outreach programmes including guided walks and talks to raise awareness about the importance of grassland, woodland, and other habitats and the species that depend on them.
- Engagement program using, e.g. peer-reviewed publications, grey literature (reports), press articles, opinion pieces, organised walks.
- Encouraging local communities and landowners to participate in woodland conservation activities and to manage their land in ways that benefit the species on their land.
- Identify ‘flagship’ species for the NNR: don’t just go for the usual suspects. The Six-spotted Pot Beetle (*Cryptocephalus sexpunctatus)* and Liquorice Piercer (*Grapholita pallifrontana*) are strong examples that would lend themselves to scientific survey and community engagement. More details are provided in section 4.4.
- Create shared volunteering network.
- Engagement with public and local farming community to establish transects to monitor farmland bird assemblage and species of woodland interface.
- Organise an annual BioBlitz for the public with experts from across taxon groups on hand to help catalogue as much wildlife as possible in a day
- Identify opportunities for direct engagement with local schools

3.3 Surveys and monitoring

Landscape-scale projects must be underpinned by sound ecological research, with their design supported by high quality spatial data, and their effectiveness measured by a suitable monitoring system. The individual taxon reports have already made big advances in this.

However, further surveying and monitoring will be vital in developing a fully detailed understanding of the ecological significance of the NNR and allowing for further strategic planning and tailoring of priorities and actions across the area.

General approach and methods

- Encourage general invertebrate recording in less well-covered areas such as Silverhand Estate, Holborough Woodlands.
- Continue any existing surveys e.g., butterfly transects.
- Area-wide dead-wood surveys.
- Consider new butterfly transects at various sites where gaps exist.
- Establish constant effort light trapping at a minimum of 2-3 locations.
- Dusk visits to suitable habitat. These data can be supplemented by Audiomoth deployment aimed at informing and monitoring of bat assemblages across the NNR.
- Establish transects to monitor farmland bird assemblage and species of woodland interface.
- Bespoke surveys of woods focused on the downland escarpment.

Light trap survey for moths – Silverhand Estate, Summer 2024

Priority locations for future surveys

Several areas within the NNR were mentioned repeatedly as priority areas for further surveys. The most frequently listed areas were:

- Silverhand Estate
- Shorne Woods Country Park
- Various sites across the Holborough Woodlands complex

Taxon reports also identified several species that should be individually targeted through surveys and monitoring e.g.:

- Survey scrub edge and woodland rides (in particular hazel on western-facing slopes) for the Six-spotted Pot-beetle (*Cryptocephalus sexpunctatus).*
- Liquorice Piercer (*Grapholita pallifrontana*) at Ranscombe Farm and other sites with the larval food plant, wild liquorice (*Astragalus glycyphyllos*).
- Winter egg searches on elm to monitor White-letter Hairstreak (*Satyrium w-album*).
- Winter egg searches on blackthorn (*Prunus spinosa)* to monitor for the appearance of Brown Hairstreak (*Thecla betulae*).
- Further detailed saproxylic beetle surveys.
- Explore opportunities to engage local champions for long-term bat monitoring.
- Searches for *Hallodapus montandoni*, Sand-runner Shieldbug (*Sciocoris cursitans*) and Scarab Shieldbug (*Thyreocoris scarabaeoides*).

- Use of playback in suitable habitat across NNR area to determine the distribution of Marsh Tit (*Poecile palustris)* across the woodland network.
- Early spring fieldwork can enable a better understanding of Lesser Spotted Woodpecker (*Dryobates minor*) and Hawfinch (*Coccothraustes coccothraustes*) distribution.
- Vantage point surveys of key woodland areas to determine the presence of rare birds of prey e.g. Honey Buzzard (*Pernis apivorus)*, Goshawk (*Accipiter gentilis)* and Hobby (*Falco subbuteo).*
- Establish Hawfinch (*Coccothraustes coccothraustes*) ringing project.

3.4 Species management

Key recommendations:

- Develop a shared area management framework that takes account of relevant species targets.
- Implement deer management plan (fencing, exclusion plots, control etc.) and implement within first 2 years.
- Implement ancient and veteran trees management plan.
- Landscape-scale approach to configuration of mixed woodland growth stages.
- Habitat creation and enhancement to be informed by baseline surveys.
- Improve connectivity between and within sites including improvements to hedges and field margins in farmed areas.
- Less intensive woodland management to increase invertebrate abundance and diversity.
- Adopt suitable land management and farming practices and carry out works at an appropriate time of year to minimise impacts on wildlife.
- Seek out partnerships with conservation and local community groups and actively seek volunteer engagement.

3.5 Funding

Key recommendations:

- Develop funding bids and initiatives that involve partners outside the core candidate NNR partners.
- Take full/further advantage of the support that may be available through agri-environment schemes including the Sustainable Farming Incentive, Countryside Stewardship, FiPL and the various Defra woodland grants. The NNR may benefit from coordination in timing of such applications.
- Achieving/maintaining favourable condition for SSSIs – this is a key baseline target for the NNR.

- Explore the potential and feasibility for the suite of sites to apply to e.g. the Landscape Recovery scheme or Heritage Fund.
- Overarching management framework to include green and other future finance strategies.
- Apply for funding to work with underrepresented groups and create an events programme that creates opportunities for new audiences to experience the NNR.
- High priority to bring all Cuxton and Cobham Woodlands ('Leisure Plots') into unified ownership and management. Legal advice, CPO and expertise to assist, funding for this to be sought.

3.6 Towards implementation

Collaboration between all partners in the NNR will be key to successful implementation of many of these measures. This collaboration should begin in earnest with discussions and workshops for stakeholders and partners around the practical implementation of the many possible actions and measures recommended above.

To help facilitate these discussions an implementation plan has been produced based on the extensive list of actions and management recommendations (see Annex 1).

Discussion and collaboration between mangers and partners in the field

4 Findings: Ecological significance

The area has high ecological significance from both the habitats and species that are present.

4.1 Habitats summary

Several habitats of principal importance are present across the NNR sites. These were assessed in detail and reported in the Botanical and Habitat Survey report.

Arable field margins and Arable fields cultivated for annual flora
These habitats on chalk soils support an assemblage of rare arable plants and are amongst the most important habitats in the NNR.

Field rich in arable flora, Ranscombe Farm (2024)

Lowland calcareous grassland
This is the classic chalk grassland associated with the North Downs in Kent.

Lowland dry acid grassland
A rare habitat in Kent. Recorded at Shorne Woods Country Park, and Cobham Hall School.

Wood-pasture and parkland
This is a habitat complex including grassland and other habitats, usually in a historical context with parkland trees

Lowland beech and yew woodland
Mainly found within Holborough Woods.

Wet woodland – Alder wood on floodplains
Found in Shorne Woods Country Park.

Other lowland mixed deciduous woodland
An extensive, important habitat across multiple sites within the NNR.

Traditional orchard
Recorded at Crabbles Bottom, including features of veteran apple trees. Traditional orchard has also been recently established at Jeskyns Community Woodland.

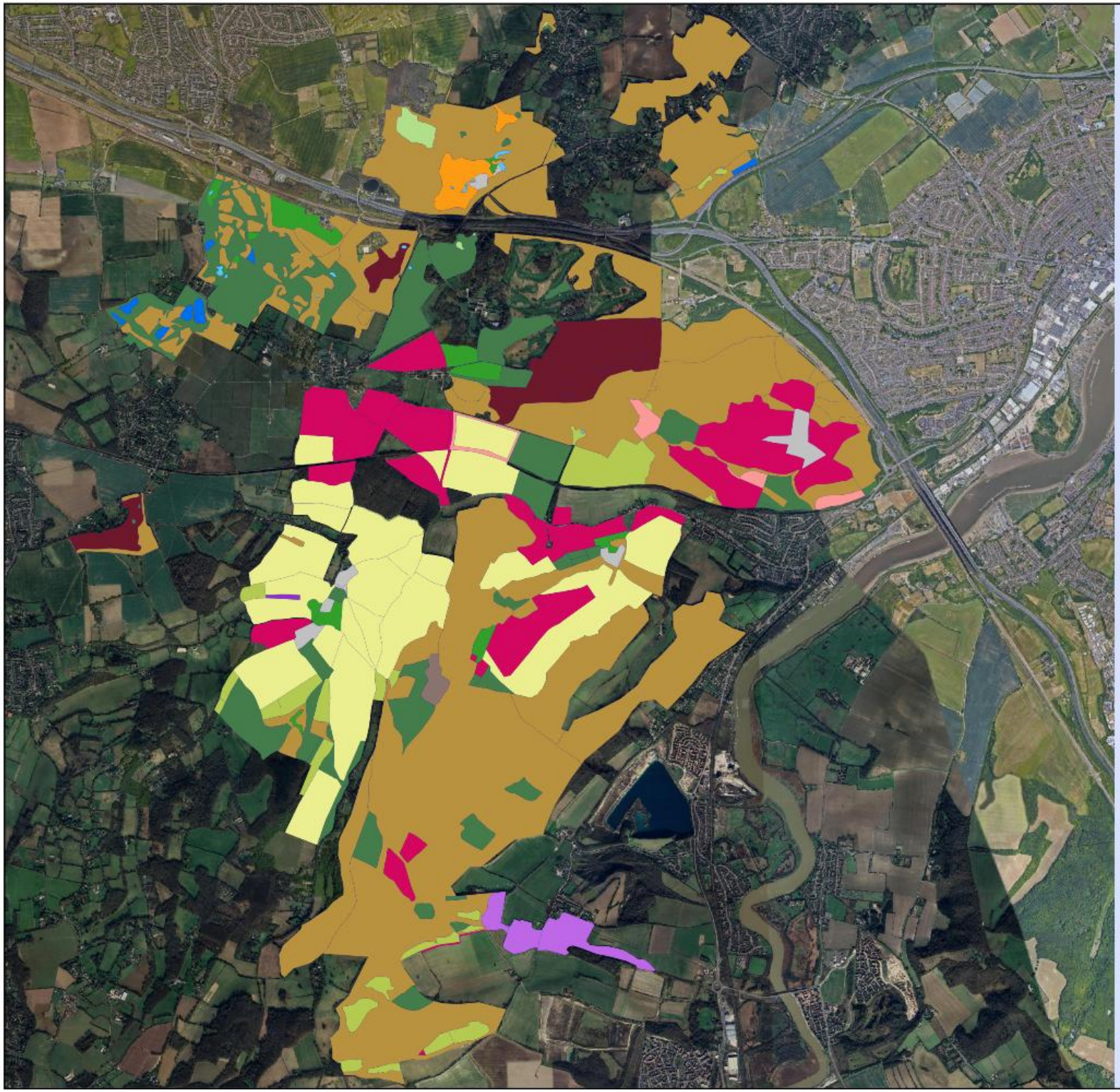
Crabbles Bottom orchard

Hedgerows
Native hedgerows and particularly species-rich native hedgerows are important habitats in their own right but also provide connectivity between other habitats.

Eutrophic standing water
These habitats support a range of other taxa including amphibians.

Scrub is another important habitat for many species including breeding birds, moths and butterflies but also a possible threat to other habitats if not managed appropriately.

Overleaf - Figure 2. Broad habitat classification of NNR sites



Broad Habitats

Site boundaries

Broad Habitat

- Chalk Grassland
- Acid Grassland
- Neutral Grassland
- Modified Grassland
- Quarry
- Broadleaved Woodland
- Coniferous Woodland
- Wet Woodland
- Wood Pasture
- Scrub
- Freshwater
- Arable Plants
- Vineyard
- Traditional Orchard
- Arable and Horticulture
- Built

0 0.5 1 1.5 2 2.5 km

Kent Downs National Landscape

White Horse Ecology

4.2 Species summary

The NNR area is home to many hundreds of species of note, with representation across all taxonomic groups. Several authors of individual reports have commented that there is a high likelihood that additional noteworthy species are present, and further surveys have been suggested to ascertain if this is the case.

Birds

A review of existing data shows that woodland sites in the NNR support several woodland birds that are national conservation priorities. For many species, the number of records in the database is low given the size of the area. This is an indication of relatively sparse coverage by birdwatchers and a need for further surveys to learn the status of key species.

The NNR is notable for a number of scarce species including woodland birds, birds of prey and an important farmland bird assemblage including Skylark (*Alauda arvensis*), Yellowhammer (*Emberiza citrinella)* and Corn Bunting (*Emberiza calandra*).

Coleoptera

Over 900 species of Coleoptera (the beetles) have been recorded in and around the NNR area. With just under 3000 species recorded from the whole of Kent, this area is significant for its beetle diversity.

There are twelve species of high conservation status in the area, including the Devil's-bit Jewel Beetle (*Trachys troglodytes)*, the ground beetle *Scybalicus oblongiusculus* and the oil beetle, Spanish Fly *(Lytta vesicatoria).*

Saproxylic (dead wood) invertebrates

A Saproxylic Quality Index (SQI), and an Index of Ecological Continuity (IEC), has been produced for each woodland surveyed (see detailed report for full details), individually and as a combined survey area. Lastly, all desk study data combined with the authors for the combined survey area.

The SQI for the entire survey area based on data gathered and utilising existing species data, is 488, based on 208 species. This places the proposed National Nature Reserve at 43rd by this metric.

The IEC for the entire survey area based on data gathered and utilising existing species data, is 93. This places the proposed National Nature Reserve at 15th, and the best site in Kent for saproxylic beetles.

Considering the SQI and IEC, it is unquestionable that the survey area combined is at least nationally important for saproxylic invertebrates, especially saproxylic beetles. It could be regarded as a site of international importance for saproxylic beetles.

Mammals (excl. Bats)

Four key mammal species are found in the NNR area: Hazel Dormouse (*Muscardinus avellanarius),* Harvest Mouse (*Micromys minutus),* Brown Hare (*Lepus europaeus)* and Hedgehog (*Erinaceus europaeus)*. Water Vole (*Arvicola amphibius*) and Water Shrew (*Neomys fodiens*) are listed as other key species of interest.

Bats

From a mixture of historic records and ground-truthing surveys, it was confirmed that 12 bat species are recorded across the NNR. Of these 12 species, 6 – Brown Long-eared (*Plecotus auritus)*; Leisler's (*Nyctalus leisleri);* Nathusius' Pipistrelle (*Pipistrellus nathusii*); Noctule (*Nyctalus noctula*); Serotine (*Eptesicus serotinus*); and Soprano Pipistrelle (*Pipistrellus pygmaeus)* – are of conservation concern.

Myotis spp. and *Nyctalus* spp. species groups were also noted as they contain species identified to genus level only and comprise species of conservation concern.

Bats should be prioritised further detailed survey and monitoring across all these species.

Lepidoptera

Moths and butterflies are well represented across the whole NNR. Over 1500 moth species have been recorded and with just over 2500 species recorded from the whole of the UK, this area is clearly very significant for its moth diversity. While many are common and widespread the area is also home to numerous rare and or threatened species including 64 Section 41 priority species.

Noteworthy species include Liquorice Piercer (*Grapholita pallifrontana*), Rest Harrow (*Aplasta ononaria*), Figure of Eight (*Diloba caeruleocephala*), Lace Border (*Scopula ornata*), Gold Cloak (*Phtheochroa schreibersiana*), Pale Eggar (*Trichiura crataegi*), Chalk Carpet (*Scotopteryx bipunctaria*) and Scabious Leaf-miner (*Phyllonorycter scabiosella*).

A large proportion of the butterfly species present in Kent have been recorded within the NNR sites. These include 7 Section 41 butterfly species: Small Heath (*Coenonympha pamphilus*), Small Blue (*Cupido minimus)*, Dingy Skipper (*Erynnis tages*), Grizzled Skipper (*Pyrgus malvae*), Wall (*Lasiommata megera*), White Admiral (*Limenitis camilla*), and White Letter Hairstreak (*Satyrium w-album*).

In addition to the Section 41 species, the nationally scarce Adonis Blue (*Polyommatus bellargus*) is also of note. It is listed as a key feature within the Halling to Trottiscliffe Escarpment SSSI.

Herpetofauna

Five species of native amphibian are present within the study area: Common Frog (*Rana temporaria)*, Common Toad (*Bufo bufo*), Smooth Newt (*Lissotriton vulgaris)*, Palmate Newt (*Lissotriton helveticus),* and Great Crested Newt (*Triturus cristatus*).

Four species of native reptile are present within the study area: Viviparous Lizard (Z*ootoca vivipara*), Slowworm (Anguis fragilis), Grass Snake (*Natrix helvetica*), and Adder (*Vipera berus*).

Aranea, Diptera and Odonata

Many notable Diptera and Araneae, some of which are considered nationally rare and threatened, are present at one or more of the NNR sites. However, notable Odonata records were completely absent from the data available.

The large number of notable species are fully detailed in the accompanying report but include spiders such as the nationally rare and endangered *Gonatium paradoxum* and the Section 41 priority species *Ozyptila claveata.* For the flies (Diptera), notable species include the False Slender-footed Robberfly (*Leptarthrus vitripennis*).

Orthoptera

The key species currently known to be present is Rufous Grasshopper (*Gomphocerippus rufus*).

Dictyoptera

The key species currently known to be present is the Tawny Cockroach (*Ectobius pallidus).*

Hemiptera

Six species of true bug with records within the study area appear to be of note. These are:

- *Iassus scutellaris*, a Nationally Rare leafhopper associated with Elm.
- *Asiraca clavicornis*, a Nationally Scarce leafhopper.
- Cryptic Leatherbug (*Bathysolen nubilis)*, which is Nationally Scarce and with a localised distribution.
- Slender-horned Leatherbug (*Ceraleptus lividus)*, a Nationally Scarce but possibly increasing species.
- Scarce Tortoise Shieldbug (*Eurygaster maura)*, a Nationally Scarce species.
- *Hebrus pusillus*, a Nationally Scarce, semi-aquatic bug.

Aculeate Hymenoptera

Three Section 41 Species of Principal Importance for Conservation have been recently recorded within the study area. These are:

- Four-banded Weevil-wasp (*Cerceris quadricincta)*
- Black-headed Mason Wasp (*Odynerus melanocephalus)*
- Brown-banded Carder Bee (*Bombus humilis)*

Molluscs

Six species of mollusc could be considered key species. These are:

- Roman Snail (*Helix pomatia*)
- *Backeljaia gigaxii*

- Heath Snail (*Helicella itala)*
- Lapidary Snail (*Helicigona lapicida)*
- Ash-black Slug (*Limax cinereoniger)*
- Smooth Jet Slug (*Milax gigates)*

Plants

An extensive list of plants of varying degrees of importance is presented in the botanical report. Some of the plants listed include rough marsh-mallow (*Malva setigera),* considered a 'Kent Heritage Plant', chalk eyebright (*Euphrasia pseudokerneri)*, common juniper (*Juniperus communis ssp. communis*), white helleborine (*Cephalanthera damasonium)* and corncockle (*Agrostemma githago)*.

Fungi

There are uncommon to rare waxcap species present, including toasted waxcap (*Cuphophyllus colemannianus)* at Cobham Park Wood and pink waxcap (*Porpolomopsis calyptriformis)* at Shorne Woods Country Park.

One important oak species found at Cobham Park Wood is tufted bracket (Fuscoporia (Phellinus) torulosa), with around just 20 UK records.

From the hedgehog or toothed fungi, only zoned tooth (*Hydnellum concrescens)* was considered a valid record in the area.

Lichens

All are assessed as of Least Concern apart from two which merit confirmation, but 14 are categorized as endangered, rare or vulnerable in the Kent Red Data Book, including several *Alyxoria* and *Physconia* species.

Bryophytes

Three nationally scarce species are known to occur in Holborough Woodlands, including *Campylophyllopsis calcarea, Herzogiella seligeri* and *Sematophyllum substrumulosum*. The nationally rare *Ephemerum cohaerens* (NERC section 41) occurs in an arable field at Ranscombe Farm.

4.3 Priority species for action across the NNR

The species mentioned in this section represent a shortlist of the most important species and the ones that should be the priorities for one or more of the following:

- Site/landscape scale management
- Surveys and monitoring
- Funding applications

As part of further work, landscape-scale planning for actions across the NNR to address the needs of these key species is vital to ensure a cohesive environmental strategy can be delivered. Where possible, these priority species have been chosen to match those in the Kent Local Nature Recovery Strategy, whilst retaining the local priorities.

The species listed below in table 2 represent an initial proposed list of priority species. The NNR partnership will finalise this list.

Table 2: Initial shortlist of priority species

Birds	**Aculeate Hymenoptera**
Honey Buzzard	Maidstone Mining Bee
Goshawk	Fringe-horned Mason Bee
Hobby	**Herpetofauna**
Lesser Spotted Woodpecker	Common Toad
Hawfinch	Great Crested Newt
Long-eared Owl	Adder
Mammals	**Plants**
Hazel Dormouse	Ground Pine
Hedgehog	Musk Orchid
Harvest Mouse	Lady Orchid
Brown Hare	Broad-leaved Cudweed
Lepidoptera	Basil Thyme
Liquorice Piercer	Meadow Clary
Straw Belle	**Fungi (as communities)**
Rest Harrow	Waxcap grassland community
Chalk Carpet	Oak-associated dead wood fungi
Scabious Leaf-miner	Hedgehog or Toothed fungi
White Letter Hairstreak	**Bats (as an assemblage)**
White Admiral	Brown Long-eared
Adonis Blue	Leisler's
Brown Hairstreak	Nathusius' Pipistrelle
Coleoptera	Noctule
Six-spotted Pot Beetle	Serotine
Saproxylic beetles (assemblage)	Soprano Pipistrelle
Ischnodes sanguinicollis	Myotis spp.
Triplax lacordairii	**Orthoptera, Dictyoptera and Dermaptera**
Hypulus quercinus	Short-winged Earwig
Hemiptera	Lesne's Earwig
Iassus scutellaris	Woodland Grasshopper
Asiraca clavicornis	Rufous Grasshopper
Cryptic Leatherbug	**Molluscs**
	Roman Snail
	Backeljaia gigaxii

Birds

Three birds of prey are a top priority for the NNR to attempt to understand their distribution: Honey Buzzard (*Pernis apivorus*), Goshawk (*Accipiter gentilis*) and Hobby (*Falco subbuteo*).

Lesser Spotted Woodpecker (*Dryobates minor*), Hawfinch (*Coccothraustes coccothraustes*) and Long-eared Owl (*Asio otus*) would also be priorities for focussed survey effort to determine their range and breeding status.

Mammals

Of the six mammal species of note found in the NNR area, Hazel Dormouse (*Muscardinus avellanarius),* Harvest Mouse (*Micromys minutus),* Brown Hare (*Lepus europaeus)* and Hedgehog (*Erinaceus europaeus)* should be the focus of priority action.

Lepidoptera

Priority species of moth include Liquorice Piercer (*Grapholita pallifrontana*), Straw Belle (*Aspitates gilvaria*), Rest Harrow (*Aplasta ononaria*), Chalk Carpet (*Scotopteryx bipunctaria*) and Scabious Leaf-miner (*Phyllonorycter scabiosella*).

Priority butterfly species include White Letter Hairstreak (*Satyrium w-album*), White Admiral (*Limenitis camilla*), and Adonis Blue (*Polyommatus bellargus*).

Brown Hairstreak (*Thecla betulae)* is not yet recorded from any of the NNR sites, but it is expanding its range in Kent. This is a species that is likely to turn up in the area and should be a focus for surveying effort.

Coleoptera

The most significant Coleoptera species in the NNR is the Six-spotted Pot Beetle (*Cryptocephalus sexpunctatus*) (see section 4.4).

Also, the NNR combined is at least nationally important for saproxylic invertebrates, especially saproxylic beetles and could be regarded as a site of international importance for the latter. As such this group are a top priority.

Herpetofauna

For amphibians, Common Toad (*Bufo bufo*) and Great Crested Newt (*Triturus cristatus*) have the highest level of conservation importance. For reptiles, Adder (*Vipera berus*) has the highest level of conservation importance.

Plants

These include Ground Pine, Musk Orchid, Lady Orchid, Broad-leaved Cudweed, Basil Thyme and Meadow Clary.

Fungi

Important indicator species were found across three key fungal communities which are a priority across the NNR: the waxcap grassland community, beech (*Fagus sylvatica*) and oak (*Quercus robur & Q. petraea*) associated dead wood fungi, and stipitate hydnoid (hedgehog or toothed) fungi.

4.4 Flagship species

A range of criteria were used to determine the list of potential flagship species in consultation with NNR partners:

- Has a 'unique selling point' (USP) for this NNR
- Has a great story
- Likely to be encountered by many
- Easily recognisable (including with associated promotion, engagement etc)
- Does not have to be formally recognised as a Priority species (e.g. S41 etc)
- Could be aspirational i.e. not currently widespread here but would be a measure of success for the NNR

See Table 3 for the shortlist. The original long list of potential flagship species can be found in Annex 4. The species listed below represent an initial proposed list of flagship species. The NNR partnership will finalise this list.

Table 3: Initial shortlist of flagship species

Six-spotted Pot Beetle	Common Pipistrelle (bat)
Stag Beetle	Common Lizard
Liquorice Piercer (moth)	Great Crested Newt
Straw Belle (moth)	Bluebell
White-letter Hairstreak (butterfly)	Corncockle
Maidstone Mining Bee	Ground Pine
Barn Owl	Hornbeam
Nightingale	Meadow Clary
Skylark	Musk Orchid
Hazel Dormouse	Oak
Hedgehog	

Details on these species can be found in the corresponding taxon report, a few are detailed below.

Plants

Several plant species were identified as potential flagship species as part of the detailed botanical report and in discussions with land managers. Several orchid species were suggested, with Musk Orchid being considered the best candidate for the shortlist.

Six-spotted Pot Beetle (*Cryptocephalus sexpunctatus*)

This is the most significant individual Coleoptera species in the NNR, discovered at Crabbles Bottom in 2022. This attractive species is also present on the other side of the Medway Valley at Borstal, its only other known Kent locality.

This beetle may be a strong candidate for funding from the NE Species Recovery Fund and would be an ideal flagship species for the NNR.

Liquorice Piercer (*Grapholita pallifrontana*)

Given its status and scarcity, in Kent and across the UK, this is a key species that the candidate NNR sites could help to support – through habitat management, monitoring efforts, and awareness raising and engagement with the public. This would be an ideal 'flagship' priority species for the NNR.

Maidstone Mining Bee *(Andrena polita)*

Originally known only from a chalkpit in Northfleet and Cuxton Warren in Upper Halling, where it was last recorded in 1934. Considered extinct until rediscovered at Trosley Country Park in 2020. There may be value in this as a flagship species to encourage surveys for this species in suitable habitat and to raise awareness of such a scarce species, one which is unique to the NNR.

Mammals

Of the four key mammal species found in the NNR area Hazel Dormouse (*Muscardinus avellanarius)* and Hedgehog (*Erinaceus europaeus)* best fulfil the criteria set out above.

White-letter Hairstreak (*Satyrium w-album*)

The White-letter Hairstreak primarily inhabits areas where habitats include woodland edges, hedgerows, parklands, and urban areas where elm trees – the larval food plant – have survived or where Dutch Elm disease-resistant cultivars have been planted. This species is currently the flagship species for plans to plant more Dutch Elm disease-resistant elm (*Ulmus*) cultivars in Kent.

5 Climate change vulnerability assessment

5.1 Climate change challenges and impacts in the NNR

The North Kent Woods and Downs NNR area is at the forefront of many climate change impacts and faces a wide range of challenges from this. There are also many opportunities for adaptation and to help build resilience across the area, particularly where actions are taken in a coordinated and collaborative way. Some of the potential impacts across the area are set out in brief below:

Biodiversity and Ecosystems

- Habitat changes and loss
- Species at risk
- Species shifts
- Invasive species

Agricultural Impacts

- Crop viability
- Water stress

Soil Health and Land Management

- Soil erosion
- Land degradation

Water Resources

- Aquifer recharge and water availability
- Water quality

Flooding

- Increased flood risk

Human and Economic Impacts

- Tourism
- Property and infrastructure

Cultural Heritage

- Impact on historical sites

5.2 Climate change adaptation

Given the scale of such challenges, adaptation measures are needed to conserve biodiversity and its associated ecosystem services across the NNR.

Adaptation can be distilled into five key principles (Defra, 2008), all of which are writ large in the proposed activities across the North Kent Woods and Downs NNR:

- Take practical action now.
- Maintain and increase ecological resilience.
- Accommodate change.
- Develop knowledge and plan strategically.
- Integrate action across partners and sectors.

Important practical actions at landscape-scale, across the NNR to conserve biodiversity in a changing climate include:

- Conserving existing biodiversity – future biodiversity will adapt and evolve from that of today.
- Eliminating pressures not linked to climate change – biodiversity will adapt more successfully to climate change if other impacts are reduced, as climate change is likely to worsen them.
- Maintaining large populations in diverse habitats – large population sizes in diverse habitats allow species to maintain maximum genetic diversity, which is critical to adapt and evolve to climate change.
- Promoting dispersal – for a species to respond and move to a suitable climate, it needs increased habitat availability and connectivity.
- Addressing uncertainty – planning action needs to accept uncertainty and to address the full range of variation in projected changes and their impacts. In addition, long-term studies and monitoring of species and habitats are essential to improve knowledge of the impact of climate change, the more complex responses to adaptation measures and to inform decisions of policy makers and managers.

Beyond adapting to protect biodiversity itself, measures to support biodiversity also contribute to adaptation efforts across various sectors. It's crucial to implement adaptation measures that simultaneously address biodiversity loss and climate change, creating benefits for both society and the environment.

The ideal approach is to find solutions that offer advantages for adaptation, mitigation, and the preservation of biodiversity and its associated ecosystem services. The impact of biodiversity loss on the delivery of essential services highlights the need for adaptation policies that involve all relevant sectors. Halting biodiversity loss is impossible without tackling climate change, and conversely, adapting to climate change cannot be achieved without addressing biodiversity loss.

Designation of this area as an NNR should provide a catalyst and increased opportunity across all sectors for actions that address all the above and could therefore play a major role in climate change adaptation in Kent.

5.3 Climate change vulnerability

Vulnerability to climate change can be defined as areas of landscape where there is:

- a high degree of exposure to climate change
- a low adaptive capacity and
- the presence of potentially sensitive habitats.

England's existing National Nature Reserves have high levels of climate vulnerability, and it appears from the evidence that this is also the case for the North Kent Woods and Downs NNR.

- Current adaptation focuses on actions that build ecological resilience.
- Supporting the persistence of existing biodiversity is currently the main driver.
- Practitioner input helps the understanding of risk and informs and promotes action.
- There is an increasing need to plan for and manage change to protected areas.

See, for example, Duffield *et al (*2021) Climate change vulnerability and the state of adaptation on England's National Nature Reserves - ScienceDirect

Key Adaptation Strategies could include:

- Habitat Restoration and Connectivity:
  - Restoring and Expanding Natural Habitats
  - Creating Wildlife Corridors

- Conserving and Managing Water Resources:
  - Wetland Conservation
  - Sustainable Water Management

- Species Monitoring and Management:
  - Monitoring Species and Habitats
  - Assisted Migration and Species Management

- Community Involvement and Education:
  - Engaging Local Communities
  - Citizen Science Programs

- Policy and Planning
  - Integrating Climate Adaptation into Local Planning
  - Conservation Policy Enforcement

- Resilient Agricultural Practices:

- Sustainable Farming Practices

Using the Climate Change Vulnerability Assessment (CCVA) process will allow partners, land managers, and others to identify the practical actions on the ground, at landscape scale, and on individual sites across the NNR. These will form the responses to climate change in this area.

It is important to note that this is just a start in this process and the matrix will need to be revisited and revised accordingly as the NNR environmental strategy develops further and moves towards implementation.

5.4 Approach to the assessment

The research carried out for the ecological and environmental assessment of the NNR, and other background information collated throughout the project provided the essential baseline on the assets of the area, predominantly habitats and species, but also heritage and landscape character. It is against these assets that the level of vulnerability is assessed.

In completing the climate change vulnerability assessment for the NNR we followed Natural England's process for embedding climate change into NNR management planning.

The basic outline of this is as follows:

- Climate change projections
  - To determine what is likely to change using the most up to date projections of climate change in the UK.
- Impacts
  - To understand the likely impacts of climate change on features of importance in the local area.
- Vulnerability assessment
  - Degree of vulnerability of the key features of interest, the assets of the NNR
- Responses
  - The identification of appropriate responses; adaptation
  - Including the Resist – Accept – Direct (RAD) Decision Framework

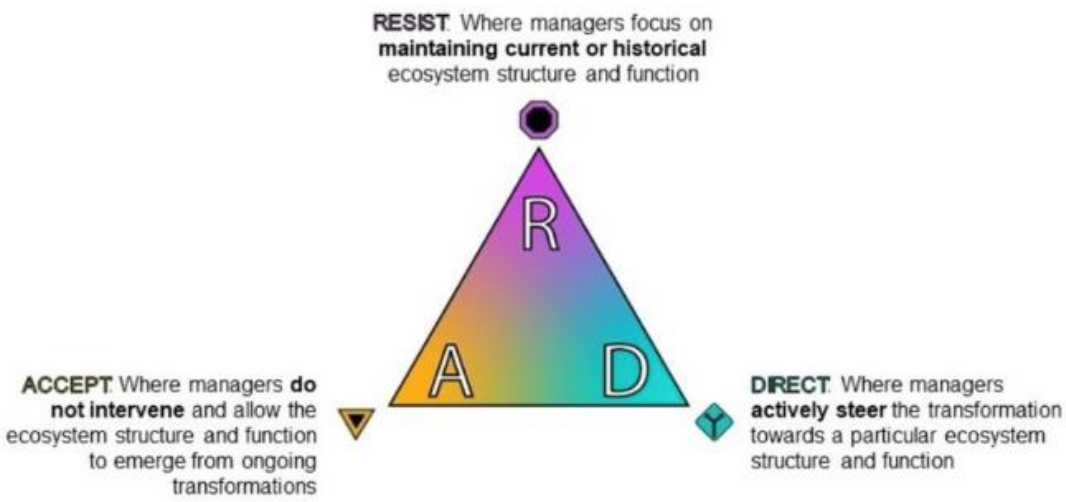


Figure 3. The Resist, Accept, Direct decision framework

The RAD framework lays out three approaches for making management decisions for systems undergoing ecosystem transformation:

- Resist – where land managers work to maintain or restore ecosystem composition, structure, processes or functions on the basis of historical or acceptable current conditions.

- Accept – where managers allow ecosystem composition, structure, processes or functions to change autonomously.

- Direct – where mangers actively shape ecosystem composition, structure, processes or functions toward preferred new conditions.

From the site-specific to large landscape or seascape scale, the Resist-Accept-Direct framework is a useful tool that can support conversations within, and across management units.

5.5 Findings

A wide range of measures and actions were identified during the CCVA workshop with partners. These were discussed in detail and all outputs captured in the initial CCVA matrix. The matrix is presented in Annex 2. A few highlights from the list include:

- Targeted water management to alleviate issues of erosion, channelling etc.
- Apply creative solutions and experimentation with regards to grazing livestock on all grasslands.
- Save some trees by moving them to more suitable areas, using tree spade.

- Continue to plant local *Quercus robur* as those growing in the new conditions may be more adapted to the changed climate.
- Plant a versatile, wide range of tree species including conifers.
- Explore/trial other ways to create annual disturbance required by many rare arable plants - find more sustainable or more suitable options under a changed climate.
- Exploit opportunities to pass on our learning/experience about the impacts of climate change and implications for the NNR and land and woodland management.

Table 4 below, shows the headline climate change risk assessment on a High, Medium or Low basis against key climate change threats from changes to rainfall, temperature, and extreme events.

Table 4. Climate change vulnerability assessment – High, Medium, Low

Feature no.	Feature name	Rainfall	Temperature	Extreme Events	In Combination	Reasoning
Habitats						
1	Grasslands - Lowland calcareous grassland, acid and neutral grassland	H	H	M	H	Extended periods of flooding or drought significantly negatively affect habitat and species dependent upon them. Potential for changes to existing grazing regimes and suitability of different livestock.
2	Lowland mixed deciduous woodland	H	H	H	H	Extended periods of flooding and drought and increased storminess substantially negatively affect habitat and species dependent upon them.

Feature no.	Feature name	Rainfall	Temperature	Extreme Events	In Combination	Reasoning
3	Lowland wood-pasture and parkland	H	H	H	H	Extended periods of flooding or drought significantly negatively affect habitat and species dependent upon them. Potential for changes to existing grazing regimes.
4	Arable land inc. with rare flora	H	H	M	H	Extended periods of flooding and drought significantly negatively affect habitat and species dependent upon them. Could also see impacts from changes to cropping/management.
5	Vascular plant assemblage	H	H	M	H	Extended periods of flooding and drought and increased storminess significantly negatively affect habitat and species dependent upon them.
6	Hedgerows and shaws	H	H	H	H	Extended periods of flooding and drought and increased storminess significantly negatively affect habitat and species dependent upon them.

Feature no.	Feature name	Rainfall	Temperature	Extreme Events	In Combination	Reasoning
7	Roadside verges	M	M	H	M	Extended periods of flooding and drought significantly negatively affect habitat and species dependent upon them. Fire risk when very dry.
8	Streams, ditches and dykes	H	H	H	H	Affected by flooding and drought and high water temperatures
9	Open water, ponds and lakes	M	H	M	M	Continuous drought may have an impact, some vulnerability to high water temperatures.
10	Flushes, springs and issues	H	H	H	H	Particularly vulnerable to drought conditions.
Species						
	General	H	H	H	H	Affected by flooding, drought and high temperatures. Vulnerable to extreme events cold springs, wet summers or excessively hot, dry summers.
11	Overwintering birds	M	M	H	H	Affected by flooding and drought and storm conditions
12	Migratory birds	M	M	H	H	Affected by flooding and drought and storm conditions
13	Breeding birds: mixed assemblage, scrub and woodland	H	H	H	H	Affected by flooding and drought and storm conditions
14	Other breeding birds	H	H	H	H	Affected by flooding and drought and storm conditions

Feature no.	Feature name	Rainfall	Temperature	Extreme Events	In Combination	Reasoning
15	New colonists - range of taxa	M	M	H	M	More robust as have colonised these locations as pioneer species moving their ranges north.
16	Bats	M	M	H	M	Adaptable species can move in the landscape
17	Mammals	M	M	M	M	Adaptable species can move in the landscape, although could lose burrows/holts etc making them more vulnerable to predation.
18	Amphibians/ Reptiles	H	M	H	H	Vulnerable to extreme events cold springs, wet summers or excessively hot, dry summers.
19	Invert assemblage: open freshwater on disturbed sediments	H	H	H	H	Affected by drought and high temperatures.
20	Invert. assemblage: bare sand & chalk	H	H	H	H	Affected by drought and high temperatures.
21	Invert. assemblage: open short sward	H	H	H	H	Affected by drought and high temperatures.
22	Other invertebrates	H	H	H	H	Affected by flooding, drought and high temperatures. Vulnerable to extreme events cold springs, wet summers or excessively hot, dry summers.

Feature no.	Feature name	Rainfall	Temperature	Extreme Events	In Combination	Reasoning
Landscape, heritage and others						
23	Landscape area NCA119 (North Downs)	H	H	H	H	Flooding, drought, extreme events e.g. storms will all bring substantial impacts. Will also effect agriculture/viticulture/tourism/rural access
24	Landscape area NCA113 (N Kent Plain)	H	H	H	H	Flooding, drought, extreme events e.g. storms, sea level rise and effect on coastal processes will all bring substantial impacts. Will also effect agriculture/viticulture/tourism/rural access
25	Buried archaeology	H	H	H	H	Vulnerable to drought conditions and erosion.
26	Heritage	M	M	M	M	A wide variety of assets, each would need to be considered on its individual merits.
27	Geological and paleontological deposits inc. SSSI feature 'Quaternary of SE England'	M	M	M	M	Risk from increased storm damage, erosion. Effective monitoring of feature needs to be in place.

Feature no.	Feature name	Rainfall	Temperature	Extreme Events	In Combination	Reasoning
28	Public access	M	M	M	M	Risk from flooding, rising sea levels, extreme events and extended periods of high temperatures. Increased fire risk from accidental events during hot, dry periods. Increased risk to the public from falling trees during storm events.
29	Community involvement	L	L	L	L	Communities can still get involved regardless of changes. Changes will be limited.
30	Education	L	L	L	L	Can still occur regardless of changes. Number of opportunities available.
31	Research	L	L	L	L	Can still occur regardless of changes. May increase research opportunities as sites can be used to investigate these changes and how we mitigate and adapt.

Feature no.	Feature name	Rainfall	Temperature	Extreme Events	In Combination	Reasoning
32	Demonstration	L	L	L	L	Can still occur regardless of changes, may increase opportunities as site can be used to demonstrate these changes and how we cope with them.
33	Economic use	H	H	H	H	Impacts on farming/rural access/tourism.
34	NNR infrastructure	M	M	H	H	Risk from flood and storm damage, erosion.

5.6 NNR area-wide working and benefits for Climate Change adaptation

The CCVA matrix also provides a wealth of information to inform development of the overall management framework for the NNR. Working in collaboration will be essential for the environmental strategy to succeed and to deliver against the Lawton principles.

The need for land managers to work collaboratively across different ownership boundaries is more pressing today than ever before (Carter *et al.* 2020). Effective conservation, particularly in an age of swift and extensive ecosystem changes, relies on cooperation among managers and stakeholders to establish, align on, and pursue shared goals. This approach acknowledges the connection between societal values, stakeholder expectations, and management decisions (Doyle-Capitman and Decker 2018; Doyle-Capitman *et al.* 2018).

A common decision-making framework can serve as a foundation for these essential discussions.

6 Wider environmental factors

6.1 Air Pollution

Air pollution in the NNR area has significant environmental impacts, primarily driven by transportation, industrial activities, and agriculture. Key sources of air pollution:

- **Transport**: Vehicle emissions are a dominant source of pollutants such as nitrogen dioxide (NO_2), particulate matter (PM_{10} and $PM_{2.5}$), and carbon monoxide. Traffic congestion amplifies these emissions.
- **Industry**: Industrial processes contribute to the release of sulphur dioxide (SO_2), NO_2, and fine particulates.
- **Agriculture**: Farming activities, including fertilizer use and livestock production, emit ammonia and methane, contributing to poor air quality and greenhouse gas accumulation.

Below are some key environmental effects of noise pollution:

- **Ecosystem degradation:** Ozone (a secondary pollutant formed from vehicle and industrial emissions) harms crops, woodland, and other natural vegetation, particularly in rural areas. Acidic deposition from SO_2 and NO_2 also affects soil and water systems.
- **Reduced Biodiversity**: Airborne particulates and pollutants can damage sensitive ecosystems, particularly in areas such as the Kent Downs, affecting species that depend on these habitats. Lichens across the NNR area are likely to be significantly impacted.
- **Climate Implications**: Methane and other greenhouse gases exacerbate global warming. In Kent, localized effects are seen in changes to vegetation and weather patterns.
- **Pollution of Waterways**: Ammonia from agriculture and deposition of particulates lead to nutrient enrichment of water bodies, resulting in algal blooms and reduced oxygen levels

Significant new transport links, including the potential Lower Thames Crossing, will have an impact on local air quality. The NNR and its management plan should consider how to mitigate for these impacts.

Efforts in Kent, such as the monitoring and management programs by KentAir[3] and air quality action plans by local councils, aim to mitigate these impacts through cleaner transport policies, promoting renewable energy, and regulating emissions from industries.

[3] KentAir: Reporting Air Quality in Kent and Medway https://www.kentair.org.uk/

6.2 Light Pollution

Ecological light pollution includes both long-term, chronic impacts and shorter-term unexpected changes in illumination and glare.

Animals are affected in many, often complex ways: they may have increased orientation or disorientation, depending on the species concerned or they may see greater attraction to or repulsion from lighting and glare. All of which affects reproduction, foraging, communication, navigation and other essential behaviours.

Disruption to wildlife

- **Nocturnal Animals:** Artificial lighting interferes with nocturnal species' feeding, mating, and migration patterns.
- **Insects:** Many insects are attracted to lights, leading to exhaustion or predation. This reduces insect populations, which affects food chains and pollination.
- **Aquatic Life:** Artificial lighting near water sources can disrupt the behaviours of fish, amphibians, and other aquatic organisms.

Ecosystem Imbalance

- Light pollution disrupts predator-prey relationships, as it can give some species (like predators) an advantage while disadvantaging others.
- It can alter plant growth cycles, affecting photosynthesis and flowering in plants that rely on natural light patterns.

Loss of Dark Skies

- Kent's rural areas, including parts of the Kent Downs Area of Outstanding Natural Beauty, face encroaching skyglow, which spreads into the countryside from urban centres. This diminishes the intrinsic value of dark skies and the natural aesthetic they provide.

6.3 Noise pollution

Noise pollution has diverse environmental and social implications, especially given the predominantly rural characteristics of the NNR and proximity to several urban centres and transport routes. Major sources include road traffic, railways, and industrial activities.

Below are some key environmental effects of noise pollution:

- **Wildlife Disturbance**: Noise pollution interferes with animal communication, particularly among species like birds and bats. These disruptions can affect breeding, feeding, and territorial behaviours. Persistent noise from transportation corridors in North Kent impacts sensitive ecosystems in rural and suburban areas.

- **Decreased Biodiversity**: Noise disrupts the balance of ecosystems by forcing sensitive species to relocate, thereby reducing local biodiversity, especially in areas near urban fringes.

There are also several more human-focussed impacts from noise pollution including the loss of quiet areas and negative health consequences.
Efforts to address noise pollution include implementing "quiet zones," better urban planning, and adopting noise action plans under local and national frameworks. These measures aim to minimize noise impacts on both ecosystems and human health. Any evidence collected across the NNR in this respect could help to influence these measures to ensure a positive outcome for the NNR and wider area.

6.4 Further considerations and NNR strategy

There is already a wealth of published information available, in both peer-reviewed and 'grey' literature, on the potential environmental impacts of air, light and noise, from which to extrapolate. However, further investigation into the possible effects at a local level, across the NNR, would be beneficial. The findings of such work will be especially useful in further targeting and tailoring action and management across the area to help mitigate for these impacts and in response to any future development in the area.

As more local information is obtained, the NNR could look to work closely with local councils to adopt policies ensuring better lighting design, including shielding lights and limiting brightness. This could also result in financial and environmental savings by decreasing unnecessary energy use.

7 Discussion

7.1 Area-wide approach

The environmental strategy should be very effective at the landscape scale, but careful targeting of management, both across the site network and within each site, is essential to maximise the chances of success. The combination of these would likely be optimised through the opportunities and benefits that NNR designation would bring. Landscape-scale conservation and projects focused on a single species will benefit a wide range of other taxa that have broadly similar habitat requirements.

To be successful, landscape-scale conservation needs to involve partnership working, where this is developed through a shared vision and action on the ground. NNR designation would be a real catalyst for this with landscape scale benefits likely to exceed the sum of the actions that may be undertaken on individual sites if managed in isolation.

In terms of implementation of the wide range of habitat enhancement and other measures identified in the environmental and ecological strategy, a collaborative approach between all NNR landowners will yield the best results; all site-specific management plans should look to stem from and feed into an overall NNR Management Framework. This will support landowners in delivering the suite of common objectives and ensure that the requirements of all taxa and other opportunities such as for landscape and heritage, can be maximised across the NNR.

Such an approach would satisfy many of the Lawton principles (Lawton, 2010), which emphasise the need for a strategic approach to conservation, moving beyond isolated sites to create a coherent and resilient ecological network. The goal is to ensure that wildlife can thrive and adapt to changes, such as climate change, by having access to a range of habitats and resources across the landscape. As an NNR consisting of a number of core and affiliate sites, management across these sites should be of low intensity and be able to be carried out in rotation, to ensure there is a mosaic of habitats available at any one time, as this brings clear benefits for a wide range of species (e.g. Bubova *et al*, 2015).

7.2 Climate change

A changing climate brings both challenges and opportunities. The primary challenges include balancing development pressures with conservation needs, addressing the impacts of invasive species, and securing funding for long-term conservation initiatives.

Key opportunities lie in increasing public awareness, leveraging government and NGO support for conservation projects, and using the area's rich natural heritage as a basis for sustainable tourism and education.

Overall, the approach to climate change adaptation for biodiversity needs to be holistic, involving habitat management, species conservation, community engagement, and policy integration, all aimed at ensuring that the area's rich biodiversity is resilient to the challenges posed by climate change.

This approach is embedded in this ecological and environmental strategy for the North Kent Woods and Downs NNR.

7.3 Surveys

It is clear from the work on the ecological and environmental strategy that:

- Survey work is another key area where a holistic, NNR-wide strategy is vital.
- Desk-based work, as included in many taxon reports, can help provide the historic baseline.
- Up-to-date and ongoing surveys of as many species as possible are invaluable in updating our understanding and help to identify priorities for action.
- Survey work can be a great way to engage a wider audience.
- More detailed surveys are required for all taxon groups, especially in the less frequently monitored areas of the NNR.

In more agriculturally dominated landscapes or urban/peri-urban environments, both of which are represented across the NNR area, in-depth surveys are usually considered unattractive and, therefore, receive little attention. However, assessing a range of taxa in these areas of the NNR is just as important as in more natural habitats. Not least because they are likely to support a different species assemblage but also because these sites are a key part of the landscape and understanding them will allow consideration of any barriers to species movement or opportunities to provide stepping stones across the landscape. In this context, the "joined" element of the 'Lawton Principles' (Lawton, 2010) – enhancing connectivity between sites - is most pertinent.

Several such surveys have started in various parts of the NNR area, and these are already proving the worth of such surveys. It is a strong recommendation that surveys should take part in all areas and must not just focus on more natural habitats or SSSIs.

Where surveys of a range of taxa are not feasible or possible, it is noted from the literature review that surveying for certain groups is more illustrative of the wider situation and some can more easily be extrapolated to other taxa. For example, the importance of surveying moths and the benefits this brings to wider taxa – effectively the 'canary in the coal mine' – has been highlighted in several papers e.g. Hrubešova *et al*. (2023).

7.4 Engagement

Engagement with a wide audience is an important objective for NNRs. It brings so many possibilities for positive outcomes for the NNR as a whole and for the many and varied features that are present across the NNR area. It has been identified in all taxon reports as a key element in the development of the NNR.

With respect to engagement with local communities and the wider public, the environmental and ecological strategy has identified many and varied opportunities. These range from identifying flagship species to organising surveys and bioblitzes and joining up with local schools, all activities which will help develop the profile of the area and champion the objectives of the NNR.

A managed programme of engagement activities should be developed as a priority for the area. This will help preparations ahead of the formal launch and announcements of the NNR designation.

8 Recommendations

Integrated Strategy for Management and Future Planning

A full list of management recommendations can be found in the accompanying management framework. These include direct land and woodland management interventions, as well as non-management opportunities such as funding avenues, surveys, and public engagement. The recommendations and conclusions of this report converge around five key themes that underpin the environmental strategy, as set out below.

8.1 Biodiversity and Habitat Restoration

- Enhance connectivity between ecosystems to create ecological corridors linking key habitats.
- Focus on habitat restoration and species-specific management (e.g., hedgerows, grasslands, and ponds), including surveys of invertebrates, fungi, bats, and other rare or endangered species.
- Implement a rotational programme of woodland management to maintain and extend these habitats across the NNR area.
- Conduct scrub clearance, including permanent removal of some patches of scrub rather than simply cutting back growth, as resources and equipment allow.
- Consider a seeding programme, such as the spreading of green hay from local donor sites rich in yellow rattle, to increase plant species diversity.

8.2 Collaboration and Partnership

- Engage with stakeholders, including local communities, government, and conservation organizations, to ensure a cohesive approach.
- Implement shared management frameworks, including collective branding initiatives and coordinated site stewardship.
- Promote education, volunteer engagement, and citizen science projects to strengthen community involvement and long-term conservation efforts.

8.3 Sustainable Land and Resource Management

- Implement sustainable grazing practices, deer control measures, and veteran tree management strategies to ensure ecosystem resilience.
- Prepare sites for climate change adaptation by monitoring long-term ecological trends and choosing resilient tree species.
- Encourage efficient land management through shared equipment, expertise, and resources.
- Address tree health and invasive species to maintain biodiversity.

8.4 Funding and Strategic Planning

- Develop long-term management frameworks, finance strategies, and governance structures to ensure sustainability.
- Prioritise conservation projects based on long-term impact, feasibility, and strategic alignment with funding opportunities.
- Secure financial resources through various funding streams, including:
    - **National Highways**, including potential contributions from the Lower Thames Crossing project (pending decision).
    - **National Lottery Heritage Fund**, particularly the Landscape Connections programme.
    - **Natural England's Species Recovery Programme** and the **Species Survival Fund**.
    - **Agri-environment schemes**, such as the Sustainable Farming Incentive, Countryside Stewardship, and FiPL (if extended), as well as various Defra woodland grants.
    - **Exploration of the Landscape Recovery scheme**, drawing on lessons learned from the Darenth Valley project.

8.5 Public Access and Visitor Experience

- Improve infrastructure, signage, and accessibility to encourage greater public interaction with conservation efforts.
- Enhance visitor engagement through events, guided walks, and educational nature hubs.

- Increase accessibility and engagement opportunities for underrepresented groups, including those with limited mobility or less familiarity with nature reserves.

These themes and recommendations highlight the need for an integrated approach to natural asset management. By balancing conservation with public engagement and ensuring ecological and financial sustainability, the successful designation and long-term stewardship of the NNR can be achieved. This strategy provides a roadmap for biodiversity restoration, collaborative management, and financial viability, creating a resilient and thriving landscape for future generations.

8.6 Conclusion

The NNR designation presents a unique opportunity to integrate conservation, community engagement, and sustainable land management. By following a structured approach, grounded in scientific research, stakeholder collaboration, and strategic funding, this initiative will help secure long-term environmental and ecological resilience for the North Kent Woods and Downs.

Overall, these findings strongly support the case for the designation of the North Kent Woods and Downs NNR as these actions align very well with the NNR Management Standards in England, (NESTND029, Natural England, 2023b) including the following:

1. **The NNR series will seek to represent the best places for England's biodiversity and geodiversity**.
    - The role of the series is to look after the best examples of those features that rely on conservation action and/or to provide places where good management practice is developed and demonstrated to others.

2. **A management plan for the NNR will be kept up-to-date and will reflect the requirements of this standard.**
    - Proper management planning is an essential basis for exemplary management and for integrating and meeting all relevant aspects of the NNR standards.

3. **The management of designated features and the wider reserve is exemplary.**
    - The primary management of the NNR should reflect its status as being amongst the country's most important sites for nature conservation.
    - It should consider potential impacts on features due to climate change and any adaptive measures required.

4. **The NNR contributes to safeguarding and restoring ecosystems beyond its boundaries**
   - As core wildlife sites, NNRs have an important function in restoring ecosystems at a wider scale than the site itself, notably biodiversity, and in building resilience to climate change.
   - The management of an NNR will take account of its function in providing and supporting the restoration of ecosystems beyond the site and adaptation to climate change.

5. **The management of the NNR provides opportunities for public enjoyment,**

   quiet recreation and engagement.

   - Audiences should be able to find out why an NNR is of special significance and have an opportunity to learn about and, wherever possible, directly experience these features.
   - The management plan for the NNR should encourage opportunities to engage with a wide range of visitors consistent with the species and habitat objectives in the management plan.

6. **Research into the natural environment at an NNR is promoted and knowledge is shared.**
   - NNRs are often highly regarded as locations for research and study, especially in relation to the special features of the site. Information gathered from NNRs, including land management records, can contribute greatly to our understanding of the natural environment and how it is changing.
   - Opportunities and requests for monitoring, research and study into the natural environment should be positively considered.

7. **Communities and stakeholders are involved in the management of the NNR.**
   - Public participation in the management of a site, such as through volunteering, can be very effective in building public understanding and support for the natural environment.
   - Management of an NNR should have regard to the views of stakeholders, particularly neighbours and local communities.
   - Local communities and stakeholders should be given the opportunity to contribute to how the objectives of the management plan are achieved and to the direct management of the NNR.

8. **NNR managers will work collaboratively to promote the NNR series and wider goals.**

- The collective contribution of NNRs to fulfil statutory purposes and wider policy goals is far greater than the individual contribution from each site. Sharing good management practice, scientific evidence and other information is beneficial and is encouraged.

9. NNRs will support opportunities to demonstrate exemplary conservation management to others

- NNRs provide opportunities for innovating and demonstrating environmental land management techniques that can help build skills and knowledge more widely amongst the sector and other land managers.
- The sites themselves can also act as 'reference points', providing examples of habitats at or exceeding favourable condition.
- The effectiveness of management interventions should be assessed and the results communicated.

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Annex 1 – Implementation Plan

To be discussed in detail and refined by partners and stakeholders as part of the development of the Management Framework. These implementation plan ideas have been based on the following guiding principles and expected outcomes:

- Enhanced biodiversity and habitat connectivity.
- Improved public awareness and community involvement in conservation.
- Robust data-driven decision-making for species and land management.
- A cohesive, resilient landscape supporting both nature and people.

A. Headline actions and management

A1. Strategize and Catalogue Operations Across Sites

- **Action**: Establish a centralized database to record and track site-specific activities and management plans.
- **Timeline**: Start within 1 month, completion in 6 months.
- **Resources**: Software for cataloguing, staff training.
- **Outcome**: Comprehensive overview of operations to enhance coordination.

A2. Grazing Management Plan (already produced)

- **Action**:
  - Develop a shared stock equipment plan and invest in necessary infrastructure (fencing, water systems).
- **Timeline**: 6–12 months.
- **Resources**: Shared funding for any equipment.
- **Outcome**: Improved grazing efficiency and grassland habitat condition.

A3. Implement Deer Management Plan (already produced)

- **Action**:
  - Implement deer control measures (fencing, exclusion plots, population management) to protect woodlands and understorey vegetation.
- **Timeline**: Within the first 2 years.
- **Resources**: Wildlife managers, fencing materials.
- **Outcome**: Reduced deer impact, enhanced regeneration.

A4. Ancient and Veteran Tree Management

- **Action**:
  - Implement a management plan to protect and enhance ancient and veteran trees.
  - Conduct surveys to identify veteran trees for future preservation efforts.
- **Timeline**: Survey within 6 months, management plan in 12 months.

- **Resources**: Arborists, mapping tools.
- **Outcome**: Preservation of tree heritage and associated biodiversity.

A5. Landscape-Scale Woodland Management

- **Action**:
  - Design a configuration strategy for mixed woodland growth stages across the NNR.
  - Implement less-intensive woodland management practices to boost invertebrate populations and overall biodiversity.
- **Timeline**: Strategy within 12 months, implementation ongoing.
- **Resources**: Forestry specialists, local contractors.
- **Outcome**: Balanced woodland composition and improved ecosystem health.

A6. Coordinated Contractor Use and Knowledge Sharing

- **Action**:
  - Organize knowledge-sharing workshops for stakeholders.
  - Schedule co-ordinated veteran tree works.
- **Timeline**: Start within 3 months, ongoing.
- **Resources**: Shared contractor agreements, workshop venues.
- **Outcome**: Cost-effective operations and strengthened expertise.

A7. Establish a Shared Tree Nursery

- **Action**:
  - Identify suitable sites for the nursery.
  - Secure funding and begin propagation of selected species[1].
- **Timeline**: 12–18 months.
- **Resources**: Staff, tools, seeds/seedlings, and land.
- **Outcome**: Sustainable supply of trees for restoration projects.

A8. Develop a Tree Health Strategy

- **Action**:
  - Conduct a tree health survey.
  - Draft and implement a management plan to address pests, diseases, and resilience.
- **Timeline**: 6 months for the survey, 12 months for the plan.
- **Resources**: Tree health specialists, monitoring tools.
- **Outcome**: Improved tree health and resilience.

A9. Veteranisation of Trees

- **Action**: Select and manage specific trees for deadwood habitat creation.
- **Timeline**: Ongoing.
- **Resources**: Arborists, guidelines for veteranisation.

- **Outcome**: Sustained deadwood habitat for biodiversity, especially the significant population of dead wood beetles.

A10. Habitat Connectivity, Enhancement and Restoration Projects

- **Action**:
  - Identify areas needing enhanced connectivity.
  - Develop and implement hedgerow, pond, and grassland restoration plans.
  - Improve hedgerows, field margins, and corridors to increase site connectivity.
  - Design habitat enhancement projects informed by baseline survey data.
- **Timeline**: Start planning within 6 months, project completion in 2–5 years.
- **Resources**: Ecologists, restoration materials, volunteers.
- **Outcome**: Improved habitat connectivity and biodiversity.

A11. Tailored Grassland Toolkit

- **Action**: Create a practical guide for grassland improvement/restoration.
- **Timeline**: 12 months.
- **Resources**: Research staff, design team.
- **Outcome**: Easy-to-use toolkit for land managers.

A12. Detailed Monitoring Programme

- **Action**:
  - Set measurable indicators for interventions.
  - Conduct annual surveys and evaluations.
- **Timeline**: Initiate within 6 months, ongoing.
- **Resources**: Monitoring equipment, trained personnel.
- **Outcome**: Data-driven evaluation of management impact.

A13. Species Migration Planning (refer to A10 above)

- **Action**:
  - Develop a cohesive management plan for the NNR to support species movement.
  - Address barriers to species movement and migration.
- **Timeline**: 12 months.
- **Resources**: Landscape ecologists, GIS mapping tools.
- **Outcome**: Enhanced species adaptation to environmental changes e.g. from climate change.

A14. 3-Zone Ride Management

- **Action**: Implement ride management zones (core, transition, and edge) for biodiversity, recreation, and aesthetics.
- **Timeline**: 3–12 months, ongoing.
- **Resources**: Field staff, machinery.
- **Outcome**: Multiple ecological and community benefits.

A15. Invasive Non-Native Species (INNS) Monitoring and Control

- **Action**: Map and prioritize invasive non-native species. Develop and implement control strategies.
- **Timeline**: Immediate start, ongoing.
- **Resources**: Specialists, herbicides, equipment.
- **Outcome**: Reduced spread of invasive species.

A16. Flagship Species and Scientific Surveys

- **Action**:
  - Finalize a list of flagship species, including less-known species like the Six-spotted Pot Beetle and Liquorice Piercer.
  - Conduct scientific surveys and create public engagement campaigns focussed on these species.
- **Timeline**: 6–12 months.
- **Resources**: Ecologists, species experts.
- **Outcome**: Highlighted conservation importance and community involvement.

B. Supplementary Implementation Plan

B1. Unified Landscape Approach

- **Action**:
  - Facilitate workshops with stakeholders to agree on a vision and strategies for a unified landscape identity.
  - Develop branding for the area (logos, signage, messaging).
- **Timeline**: 3 months, pre-launch.
- **Resources**: Stakeholder coordination, branding experts.
- **Outcome**: Cohesive identity across sites, fostering unity.

B2. Launch and Publicity for the NNR

- **Action**:
  - Develop publicity materials (flyers, posters, videos) to promote the NNR launch.
  - Organize a launch event with guided tours, keynote speeches, and materials for distribution.
- **Timeline**: as agreed with Natural England.
- **Resources**: Marketing team, graphic designers, printing budget.
- **Outcome**: Increased awareness and excitement for the NNR.

B3. Volunteer Engagement and Partnerships

- **Action**:

    - Develop partnerships with conservation and community groups to increase volunteer participation.
    - Organize training programs and provide resources for effective volunteer contributions.
- **Timeline**: Start within 3–6 months.
- **Resources**: Volunteer coordinators, training materials.
- **Outcome**: Strong volunteer network and community involvement.

B4. Community Champions

- **Action**:
    - Identify and train local champions to advocate for NNR sites and flagship species.
    - Provide champions with materials and resources for outreach.
- **Timeline**: 3 months for recruitment, ongoing.
- **Resources**: Volunteer management team, outreach kits.
- **Outcome**: Grassroots support for conservation efforts.

B5. Local Community and Landowner Engagement

- **Action**:
    - Host workshops and one-on-one meetings to encourage sustainable land management.
    - Provide guidance and incentives for conservation practices.
- **Timeline**: Ongoing, with initial workshops within 3 months.
- **Resources**: Conservation experts, incentive programs.
- **Outcome**: Broader participation in conservation activities.

B6. Education and Outreach Programmes

- **Action**:
    - Organize guided walks and talks focused on key habitats and species.
    - Develop educational resources for local schools, including lesson plans and field trip opportunities.
- **Timeline**: Initiate within 6 months, ongoing.
- **Resources**: Naturalists, educators, funding for materials.
- **Outcome**: Increased public awareness and youth engagement.

B7. Shared Volunteering Network

- **Action**:
    - Establish a centralized system to recruit, train, and coordinate volunteers across the NNR.
    - Promote opportunities via local groups and online platforms.
- **Timeline**: 6 months.
- **Resources**: Volunteer management software, coordinators.
- **Outcome**: Strengthened volunteer support for activities.

B8. Annual BioBlitz

- **Action**:
  - Organize an inclusive BioBlitz event with experts across taxonomic groups.
  - Encourage public participation and provide identification tools.
- **Timeline**: Annual, first event within 12 months.
- **Resources**: Field guides, biodiversity experts, community volunteers.
- **Outcome**: Enhanced community involvement and biodiversity data collection.

B9. Direct School Engagement

- **Action**:
  - Collaborate with schools to design field trips and classroom activities related to the NNR.
  - Provide educational kits and workshops for teachers.
- **Timeline**: Start within 6 months.
- **Resources**: Educators, materials, transportation funding.
- **Outcome**: Increased youth participation in conservation.

B10. Engagement Programs

- **Action**:
  - Publish articles, reports, and opinion pieces to raise awareness about the NNR and its importance.
  - Organize public engagement events, such as panel discussions or walks with experts.
- **Timeline**: Immediate start, ongoing.
- **Resources**: Communication specialists, local media.
- **Outcome**: Broader community awareness and scientific engagement.

C.Detailed ecological survey implementation plan

C1. Species Management Framework

- **Action**:
  - Develop a shared area management framework to align with species-specific conservation targets.
  - Incorporate findings from surveys and monitoring programs to inform management.
- **Timeline**: Within 12 months.
- **Resources**: Conservation planners, species experts.
- **Outcome**: Unified management plan ensuring species protection.

C2. General Invertebrate Recording and Surveys

- **Action**:
    - Promote recording efforts in under-covered areas like Silverhand Estate and Holborough Woodlands.
    - Continue existing surveys, e.g., butterfly transects, while identifying and establishing new transects where needed.
    - Conduct area-wide deadwood surveys and detailed saproxylic beetle studies.
    - Deploy constant-effort light traps at 2–3 locations for nocturnal insect monitoring.
- **Timeline**: Begin within 3 months, ongoing.
- **Resources**: Entomologists, community volunteers, light and interception trapping equipment.
- **Outcome**: Improved understanding of invertebrate populations and distribution gaps.

C3. Farmland Bird and Rare Bird Monitoring

- **Action**:
    - Engage farmers and communities to set up monitoring transects for farmland birds.
    - Establish and monitor transects for farmland bird assemblages and woodland interface species.
    - Train volunteers to assist in data collection.
    - Conduct vantage point surveys in key woodland areas to detect rare birds of prey like Honey Buzzard, Goshawk, and Hobby.
    - Launch an early spring fieldwork program to map Lesser Spotted Woodpecker and Hawfinch distributions.
    - Implement a Hawfinch ringing project.
- **Timeline**: Bird transects within 6 months, vantage surveys and ringing projects within 12 months. Ongoing.
- **Resources**: Ornithologists, bird monitoring kits.
- **Outcome**: Enhanced understanding of bird populations and habitat use and needs.

C4. Species-Specific Surveys

- **Action**:
    - Focus on key target species like Six-spotted Pot-beetle, Liquorice Piercer, Maidstone Mining Bee and assemblages of bats.
    - Conduct winter egg searches for hairstreak butterflies on Elm and Blackthorn.
    - Survey scrub edges, woodland rides, and hazel-rich slopes for beetles and shieldbugs.
- **Timeline**: Initiate seasonal surveys within 3–6 months.
- **Resources**: Specialists in relevant taxa, survey equipment.
- **Outcome**: Increased data on rare and flagship species for conservation action.

C5. Priority Survey Locations

- **Action**:

    - Focus survey efforts on frequently identified priority areas:
        - Silverhand Estate
        - Shorne Woods Country Park
        - Holborough Woodlands Complex
    - Use findings to prioritize conservation interventions.
- **Timeline**: Surveys initiated within 3 months.
- **Resources**: Survey teams, local volunteers.
- **Outcome**: Baseline data to inform targeted conservation actions.

C6. Audiomoth Deployment and Bat Assemblage Monitoring

- **Action**:
    - Conduct dusk visits and deploy Audiomoth devices across the NNR to gather bat activity data.
    - Engage local champions for ongoing bat monitoring programs.
- **Timeline**: Deploy devices within 3–6 months, ongoing monitoring.
- **Resources**: Audiomoth devices, bat specialists, local volunteers.
- **Outcome**: Comprehensive bat assemblage data across key habitats.

Annex 2 – Climate Change Vulnerability Matrix

Climate Change Vulnerability Matrix: Resist, Accept Direct and management responses

	Feature name	Response - RAD	Responses - details
Habitats			
1	Grasslands - Lowland calcareous grassland, acid and neutral grassland	Resist	SSSI rules. These must be updated, as they were formulated in a different climatic period. Need to be more flexible and responsive in face of climate change.
		Direct	Increase availability of fire response equipment - bowsers, beaters etc - to deal with increased risk of wildfires
		Direct	Creative solutions and experimentation with regards to grazing livestock on all grasslands.
		Direct	Tailored toolkit for grassland improvement/restoration
		Direct	Expand grassland areas - creation - to increase resilience
		Direct	Target grassland restoration/creation at more naturally free-draining areas (e.g. valleys). Also consider aspect i.e. north vs. south facing slopes
		Direct	Improve condition of grassland areas - restoration - to increase resilience
		Direct	Targeted water management to alleviate issues of erosion, channelling etc
		Mixed	Monitor throughout - to be able to adapt management in an uncertain climate and assess efficacy of various management interventions
		Direct	Design and implement an adaptable grazing schedule
		Direct	Greater use of green hay spreading
2	Lowland mixed deciduous woodland	Accept	Some trees. especially of certain species e.g. Ash, Oak, will die
		Direct	Use new tree species when planting, those more suited to climate
		Resist	Save some trees by relocating them to more suitable areas, using tree spade
		Direct	Ongoing monitoring and review progress, success periodically
		Direct	Continue to plant local *Q. robur* as those growing in the new conditions may be more adapted to the changed climate
		Accept	Different species may become more prevalent e.g. Hazel, Hornbeam, Field Maple may thrive
		Resist	SSSI conditions force 'antagonistic management'
		Resist	NNR-wide Deer culling programme
		Direct	Stay up to date with other measures of control e.g. contraception, sterilisation
		Direct	Design woodland to have smaller trees at woodland edges, more resistant to wind throw
		Resist	Haloing of trees to ensure their survival
		Direct	Plant versatile, wide range of tree species including conifers
		Direct	Veteranisation of trees to ensure continuity of supply of deadwood habitat

		Direct	Use latest research/info e.g. FC Ecological Site Classification tool
		Resist	Intensive watering programme for newly planted trees
3	Lowland wood-pasture and parkland	Mixed	Cohesive management - treat woodland and grassland habitats as one
4	Arable land inc. with rare flora	Direct	Seed bed testing through use of e.g. AE option AB11 (cultivated margins) to see what's there. Encourage experimentation without reliance on AES funding too.
		Resist	Adaptive farming, rotation changes
		Accept	Genetic modification, seeds etc
		Accept	Adopt water retention practices
		Direct	Greater use of bio-control measures
		Direct	Adopt technology to deal with climate change impacts
		Direct	Encourage greater uptake of AES, and particularly cultivated margin option (AB11) for rare arable flora
		Direct	Explore/trial other ways to create annual disturbance required by many rare arable plants - identify more sustainable or more suitable options under a changed climate
		Mixed	Support land managers with advice provision e.g. deal with 'Thistle Panic' which can occur in early years of certain activities
		Mixed	Monitor throughout - to be able to adapt management in an uncertain climate and assess efficacy of various management interventions
		Mixed	Encourage experimentation
8	Streams, ditches and dykes	Direct	Carry out targeted programme of riparian buffer planting - provides shade and reduces heating of water courses (e.g. refer to Keeping Rivers Cool data layer)
9	Open water, ponds and lakes	Resist	Retain more water in ponds
		Direct	Create new pond network, across the NNR
		Direct	Restore, deepen and dam existing ponds
Species			
	General	Direct	Plan for species migration e.g. cohesive plan for the NNR to ensure species can move across the landscape.
		Direct	Use micro-herbivore to control C. helmsii
		Resist	SSSI statutory obligations
		Resist	Intensive management - pulling of invasives, use of herbicides
		Resist	Control/eradicate new, invasive species
		Accept	Identify sites where new species could be allowed to establish and be managed accordingly
		Mixed	Monitor, assess, review and act - ongoing
		Direct	Increase planting of trees where regeneration fails/is unsuitable
		Direct	carry out actions to minimise habitat disturbance for sensitive species by appropriate timing of management activities, managing public access etc - e.g. ground nesting birds
15	New colonists - range of taxa	Direct	Replace (Introduce) species to fill niche if others can't survive under changed climate
17	Mammals	Direct	Aspirational aim to make area suitable for Pine Marten reintroduction
18	Amphibians/ Reptiles	Direct	Create larger pond network

		Accept	Allow some ponds to dry out, succeed to woodland
		Direct	Create more suitable habitat, improve connectivity and provide more refugia
Landscape, heritage and others			
23	Landscape area NCA119 (North Downs)	Direct	Consider impact on landscape when planning design of woodlands and other habitats
24	Landscape area NCA113 (N Kent Plain)	Direct	As above
25	Buried archaeology	Accept	Prioritise archaeological excavations/projects on sites identified as at high risk from erosion
		Resist	Adapt management to maintain and safeguard certain areas e.g. Randall Manor
		Accept	Some trees to be retained on arch. sites as removal would lead to a much greater risk from erosion
		Direct	Use latest research and monitor sites.
28	Public access	Direct	Implement 3-zone ride management - multiple benefits e.g. limit path erosion, fire breaks, habitat mosaic
		Direct	Provide formal, surfaced paths to limit effect of increased/more concentrated footfall
		Mixed	Ongoing monitoring of access, footpath use and desire line impacts
		Direct	Provide EV charging points to encourage use of EV's by visitors
		Direct	Tree planting near footpaths to provide shade
		Direct	Encourage landowners to maintain existing and create additional permissive access routes
29	Community involvement	Direct	Develop messaging considering climate change
		Direct	Implement and encourage community food growing opportunities
		Direct	Encourage and engage proactively with social prescribing, promote NNR in this regard
		Direct	Identify opportunities for forest bathing
		Direct	Provide opportunities for people to train in new skills/maintain existing skills
30	Education	Direct	Adapt training for NGO's, partners etc considering climate change impacts and responses
		Direct	NNR group produce reels (short videos) to explain about CC and its impacts
		Direct	We will exploit opportunities to pass on our learning/experience about the impacts of CC and implications for the NNR and land and woodland management
		Direct	Deliver training e.g. for next generation, on dealing with and adapting to climate change
		Direct	Teach visitors about the risks from CC e.g. wildfires, exhaustion etc
33	Economic use	Mixed	See in the above e.g. changes to cropping patterns, use of inputs etc
		Resist	Maintain culture/skills of coppicing by hand
		Direct	Research and trail and share best practice esp. of small-scale, economically viable businesses.

34	NNR infrastructure	Resist	Informed resistance' to development by commenting on Local Plan/planning applications
		Mixed	Monitor impacts of infrastructure developments, share lessons
		Direct	Install barns/shelters for livestock
		Direct	Install longer lasting fencing
		Direct	Block ditches e.g. leaky dams to retain water and 'slow the flow'
		Direct	Install green bridges during infrastructure projects to prevent habitat fragmentation impacts on species

Annex 3 – SSSI features and condition

SSSI	Feature	Condition
Great Crabbles Wood	Lowland mixed deciduous woodland	Unfavourable - No change
Great Crabbles Wood	Vascular plant assemblage	Unfavourable - No change
Cobham Woods	Assemblages of breeding birds - Mixed: Scrub, Woodland	Unfavourable - Recovering
Cobham Woods	Lowland mixed deciduous woodland	Unfavourable - Recovering
Cobham Woods	Lowland wood-pasture and parkland	Unfavourable - Recovering
Cobham Woods	Population of Schedule 8 plant - *Ajuga chamaepitys*, Ground-pine	Favourable
Cobham Woods	Population of Schedule 8 plant - *Althaea hirsuta*, Rough Marsh-mallow	Favourable
Cobham Woods	Population of Schedule 8 plant - *Filago pyramidata*, Broad-leaved Cudweed	Favourable
Cobham Woods	Population of Schedule 8 plant - *Salvia pratensis*, Meadow Clary	Favourable
Shorne and Ashenbank Woods	Invert. assemblage W211 open water on disturbed sediments	Favourable
Shorne and Ashenbank Woods	Lowland mixed deciduous woodland	Unfavourable - No change
Halling to Trottiscliffe Escarpment	Invert. assemblage F111 bare sand & chalk	Not Recorded

Halling to Trottiscliffe Escarpment	Invert. assemblage F112 open short sward	Not Recorded
Halling to Trottiscliffe Escarpment	Lowland calcareous grassland (CG2)	Not Recorded
Halling to Trottiscliffe Escarpment	Lowland calcareous grassland (CG3-5)	Not Recorded
Halling to Trottiscliffe Escarpment	Lowland mixed deciduous woodland	Unfavourable - No change
Halling to Trottiscliffe Escarpment	Population of nationally scarce butterfly species - *Polyommatus bellargus*, Adonis Blue	Not Recorded
Halling to Trottiscliffe Escarpment	Vascular plant assemblage	Not Recorded
Houlder and Monarch Hill Pits, Upper Halling	ED - Quaternary of South-East England	Unfavourable - Declining

Annex 4 – Initial long list of flagship species

Six-spotted Pot Beetle	Hazel Dormouse
Stag Beetle	A bat species
Liquorice Piercer	Bluebell
White-letter Hairstreak	Skylark
Marsh Tit	Corn Bunting
Nightingale	Hornbeam
Straw Belle Moth	Oak
Hawfinch	Wood anemone
Hedgehog	Musk orchid
Great crested newt	Broad-leaved Cudweed
Purple Emperor	Common Poppy
Corncockle	Meadow Clary
White Admiral	Red Kite
Common Lizard	Barn Owl
Basil Thyme	Ground Pine