Forward Look

The world in which we live doesn't stand still and our science and evidence needs are constantly evolving. This section looks ahead at the context within which we will need to deliver our science and evidence programme over the next few years. Our scientific work will be influenced by the forward looking strategies and plans of Defra, other government departments and, in particular, **Conservation 21: Natural England's conservation strategy for the 21st century**.

The conservation strategy will shape the way we work, the way we make decisions and work with others. It sets out an ambition to shift our focus to a larger scale to create resilient landscapes and seas, to put people at the heart of the environment and to embrace the concept of natural capital. This will help us better understand the benefits we get from the natural world and to move away from 'renting' outcomes, to securing long-term investment that ensures long-term returns for nature, society and the economy.

The themes of the strategy raise important science and evidence questions for us. We have identified six main topics, each of which contains a range of potential issues and questions:

Restoring ecological connectivity in our landscapes

The Lawton Review, Making Space for Nature, concluded that England needs more, bigger, better and joined up sites to ensure we have a resilient ecological network which is fit for the future. Facilitating the natural movement and gene flow of species will reduce the risks of decline and extinction, alongside the restoration and creation of habitat to support species. We need to understand what this means in practice - where networks should be, the benefits they provide to people, how to take account of climate change, what the best management is in different situations, including the potential role of rewilding, and how to measure success.

The characteristics of a 'healthy' ecosystem and the path towards recovery through management

As we shift the focus of our conservation work to a broader ecosystem scale, with a focus on defining and enhancing environmental resilience, our traditional methods of describing favourable condition of individual habitats and species must also change. Our new approach will integrate the needs of different features and address all aspects of ecosystem structure and function. As a result there will be clarity about what management techniques are required to produce a fully functioning ecosystem, and what progress towards this objective might involve and how long it might take. We need to use our science and evidence to identify examples of good condition that can act as reference points for recovery elsewhere, create simple descriptions of different states of recovery, and identify what subsequent management, including effective methods of adaptive management, is needed to progress to the next step.

Better ways of managing our land and seas in order to secure resilient ecosystems into the future

Many of our priority habitats and species rely upon management practices derived from traditional, extensive forms of agriculture and forestry that may not sit well with modern and potentially emerging land and marine use businesses. Changes in management practices,

new restoration techniques and approaches such as land sparing and rewilding could present cost effective ways of managing ecosystems for the future. These new ecosystems can contain the niches necessary to support our conservation priorities and other species whilst also being resilient to climate change and delivering enhanced ecosystem services and valued landscapes. We need to understand the potential implications of new and emerging land and marine management technologies and practices.

Monitoring and measuring the natural environment

To assess progress towards better ecological networks and more resilient ecosystems, we will need to measure a broader range of aspects of our natural environment. As well as continuing to record the quantity, quality and spatial configuration of a range of protected areas, habitats, species and landscape character, we also want to understand the natural environment in terms of ecosystem processes, natural capital, ecosystem services, and health and wellbeing benefits to society. This would allow us to set new objectives for the condition of the natural environment and the pressures and drivers causing environmental change.

Using new genetic and remote sensing technologies in describing and measuring ecosystems and their structure and function

Traditionally, we have been restricted in what we could record on a protected area or site; we focussed on relatively few taxa of species and treated habitats as an end in their own right. Some species were regarded as surrogates for all biodiversity and we used proxy measures to describe habitat structure and niche. Using molecular approaches to species detection creates the possibility of looking at mixed taxa assemblages and genetics of species. Laser, radar and multispectral technologies allow us to assess structure, wetness, and similar attributes as more direct measures of habitat structure and diversity. The use of these new technologies requires us to reassess what attributes will tell us most about good condition of the natural environment.

Coquet Valley

The effects of changes to the natural environment and ecosystem services on people's health and wellbeing

Our natural environment is changing: climate change, invasive species, new vector borne diseases, and disruption to ecosystem services that affect air and water quality are all affecting people and wildlife. These changes already have an effect on the health and wellbeing (both positive and negative) of people in rural and urban areas. Societal responses to these changes could profoundly affect biodiversity.

Mobile technology pilot: user testing a mobile app on a rugged tablet device that will replace the paper based elements of our Integrated Site Assessment monitoring process. This is expected to reduce the time taken processing assessments by 20-25% with savings to the tax payer of up to £150k each year.

By drawing together existing evidence and filling the gaps we will be in a position to design environmental interventions that will optimise benefits to people and nature at landscape scale, and reduce risks to health and wellbeing and associated economic impact.

As noted above, we can take advantage of new technologies for monitoring and managing the natural environment. In recent years Unmanned Aerial Vehicles (UAV) or drones have become a valuable tool for our work – from filming footage for sections of the coast path to mapping for scrub clearance on National Nature Reserves. Using DNA based techniques we are now able to detect species or species groups in water, soils, deadwood, coastal mud and other environments. The most well established use of environmental DNA is to find traces of great crested newts as our Woking pilot in section 4 of this report shows. With advances in mobile technology, citizen science is becoming an important source of environmental data, especially for monitoring bird and insect populations.

We are likely to see a wider application of DNA and UAV technology. We may get to the point where we are able to collect, analyse and get results in the field with a fully mobile analyser. UAV technology can already perform physical activities, for example, UAV mounted lasers targeting weeds in crops. Add in advancements in artificial intelligence and robotics and we could have 'precision conservation' where we use technology to target specific problems such as invasive species.

Further advances in data processing and sensor technologies could provide new sources of evidence, for example, from sound recordings, odour samples and pattern recognition. Many of these new technologies are likely to use artificial intelligence to sort and analyse data. We will need to monitor how these new technologies develop through our horizon scanning work, and pilot the technologies we think could be most beneficial to our science and conservation work.

To address all the issues above we will need a broad cross-disciplinary approach to science, evidence and specialist expertise. Combining natural and social sciences will enable us to better understand the social and economic context in which environmental management takes place and develop integrated conservation solutions.

We know that we cannot achieve our ambitions for the natural environment alone. We will need to work with a wide range of partners, including closer collaborations with universities and research funders. In this way we will be better able to understand the context of the places in which we work and to understand what works in practice and, crucially, why. We look forward to working with all our current partners, and building new partnerships, to meet this challenge.