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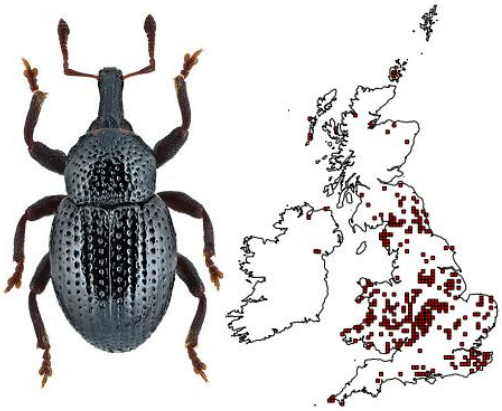
Biodiversity Auditing



Biodiversity supports the ecosystem services humans rely on for well-being and economic resources. Areas that have had an audit can make more effective use of ecological data to meet planning and conservation objectives for biodiversity. This POSTnote summarises the data sources used and the advantages of the audit approach for addressing biodiversity loss.

Overview

- Biodiversity auditing collates all the available data held by a range of local and national organisations to quantify the variety of habitats and species present in an area.
- Data from biodiversity audits can be used by Local Planning Authorities (LPAs) to meet core planning principles set out in the National Planning Policy Framework (NPPF) and associated planning guidance.
- Audits can also inform the planning and evaluation of conservation measures by identifying species and habitats that are priorities for action.
- Innovative auditing approaches can inform management of multiple species across habitats in an area; there have already been conservation gains in audited areas.

Background

Biodiversity, short for biological diversity, is the abundance and variety of species and their physical habitats.[1] Over the last 50 years, there has been destruction of large areas of semi-natural habitats and loss of species in England (POSTnote 429).[2] The Government has committed to halting UK biodiversity loss by 2020 and also intends to increase the number, size, quality and connectedness of wildlife sites.[3] Changes in biodiversity can influence the supply of ecosystem services (the benefits humans obtain from an ecosystem like food production, POSTnote 378). The UK National Ecosystem Assessment (UK NEA) set out the state, value (economic and social) and possible future of terrestrial, freshwater and marine ecosystems. The UK NEA Follow-on report provides further information and tools for understanding the wider value of ecosystem services.[4]

This POSTnote considers the sources of biodiversity data used for audits. It goes on to describe how audits can be used to inform planning and then how it can inform conservation approaches.

Sources of Biodiversity Data

The UK has one of the most extensive systems of biological recording in Europe (POSTnote 476). A biodiversity audit collates all available biological records from national or local organisations involved in cataloguing biodiversity data.

Audits require co-operation and consultation with natural history recording groups and taxonomic specialists to inform the collation of relevant species and habitat data. [5]

Species Data

Data on species distribution is held by the National Biodiversity Network (NBN). The NBN is a partnership of organisations that collect and use biodiversity data, which includes Local Environmental Record Centres (LERCs, Box 1) and national and county natural history societies. The NBN data management system is the NBN Gateway, although the constituent organisations of the NBN also hold datasets. Biological records can be submitted via a range of mechanisms, including via the different NBN organisations or directly by individuals to the Gateway. Much of the data are supplied by volunteers through the system of recorders for different groups of species, who are also involved in verifying records. For example, the Botanical Society of Britain & Ireland collates records of plant species through a national network of recorders.

While datasets for some species, such as bats, are collated by natural history groups at the county level and submitted to LERCs, others such as plant data, are collated nationally. The LERCs and some of the species monitoring schemes submit records to the NBN Gateway with support from the Biological Records Centre, based at the Centre for Ecology

Box 1. Local Environmental Record Centres

In England, LERCs were set up either from pre-existing county museum services by local natural history societies, directly by LPAs or by Wildlife Trusts. Scotland has a similar LERC system, but Wales has four regional record centres providing complete coverage of Wales, which are part funded by Natural Resource Wales. The Centre for Environmental Data and Recording is the sole Record Centre for Northern Ireland. LERCs charge commercial users for supplying biodiversity data searches, listing the species and habitats recorded in a locality. However, full searches for ecological surveys are only undertaken for a limited number of planning applications. For example, of the annual 90,000 planning applications in London, a full LERC search is only carried out for about 600. LAs can request an ecological survey if a development may have significant impacts,[6] but Environmental Impact Assessments are only required for specific types of development over certain thresholds (POSTnote 429).

Not all LERCs are funded by LPAs, but those more recently set up, such as the Norfolk Biodiversity Information Service (NBIS), have engaged LAs as customers from the outset. However, the Association of Local Environmental Record Centres suggests that some LPAs lack the in-house ecological expertise to use the data. While LERCs are able to tailor products for LPAs,[7] the Association of Directors of Environment, Economy, Planning and Transport argue that LERC data are not well tailored LPA needs. Defra's network bodies, such as Natural England, may pay individual LERCs for specific services, but this is a relatively small proportion of funding. Defra and its bodies are working with all data providers to improve access to data for decision making. However, full release of species data to the NBN Gateway (Box 2) could undermine the funding model of some LERCs.

and Hydrology (CEH).[8] Individual recorders can also directly submit data to the NBN Gateway via the iRecord website,[9] or as a photograph via the iSpot website.[10]

Quality of Records

The NBN Gateway is seeking to improve the quality of its existing 106 million records, and a strategy will be published in 2015. Hard to identify species can result in misidentifications, but NBN organisations, such as LERCs, have established routines for verifying identification of species and validating record data to ensure the quality of collated data sent on to the Gateway. Records for hard to identify species are usually verified by a small number of expert recorders. The time needed for verification can be shortened through online systems (POSTnote 476). For the Breckland audit (described below), the relevant LERCs provided access to their local recorder network to help verify NBN species records and refine the record database.[5] Audits may also need to address issues of accessibility of records (Box 2) and under-recording of species (Box 3).

Habitat Data

Information from vegetation mapping is used in classifying what habitats are present at a site, such as unimproved grassland. The standard field survey tools for vegetation maps in the UK are the Phase 1 Habitat Survey and the National Vegetation Classification (NVC) for detailed surveys in protected or designated areas.[11] However, there are also previously gathered data using different classification approaches for biodiversity action plans (see below) and for Annex 1 of the Habitats Directive. Some LERCs hold records of the extent and location of different habitat types; for instance, Somerset Environmental Records Centre has created an Integrated Habitat System

Box 2. Accessibility of Records

Open, complete and accurate data at the right scale to meet all the requirements of an audit depends on the willingness of recording bodies to share data. The NBN Gateway is a tool for sharing biodiversity data via the internet but the data shared through the Gateway remains the intellectual property of the NBN data providers and access may be restricted.[7] For example, access is restricted for at least 36 million records for 87 datasets on the NBN Gateway and only 12 million are available at highest or full geographical resolution.[12] Some datasets have also yet to be incorporated into the NBN Gateway, such as data held by the Forestry Commission.

For an audit all the relevant recording organisations would be contacted to gain access to records. The process of asking organisations to share records can also address record holders' concerns about misinterpretation of records and gain additional ecological information that may not be held on databases. However, some data may not be easy to access. For instance, data from ecological consultants' input to planning applications (POSTnote 429) and from academic studies are rarely shared with the NBN.

to combine these disparate data sets.[13] Wales has a centrally created habitat inventory database, Gwylio, a freely available digital resource linked with species record data.[14]

Mapping of habitats and information on their condition is critical for auditing. Surveys of protected areas include standardised measures of habitat condition,[15] as these will affect what species are present (Box 4). Field surveys are costly and rely on the subjective judgements of surveyors,[16] and some counties have undertaken projects to map habitats using earth observation data.[17] Earth observation techniques can be more cost effective, but can only detect simple measures of habitat condition and need validation with field surveys.[18] Other remote sensing technologies, such as unmanned aerial vehicles (POSTnote 479), can provide more detailed information on habitat condition but currently have much higher costs per unit area.

Planning and Biodiversity Audits

Audits have been used by some LPAs to inform planning and to meet biodiversity objectives. LPAs are subject to a general duty 'to have regard to' conserving biodiversity under Section 40 of the Natural Environment and Rural Communities (NERC) Act (Box 4).[19] The National Planning Policy Framework (NPPF) and the associated planning guidance allow local authorities to decide on approaches to use when gathering evidence on ecology.[20] Planning guidance also highlights the need to develop and deliver improvement of the natural environment through local plans.[21] However, as set out in POSTnote 429, awareness and implementation of the Section 40 Duty varies considerably and in 2011 only 40% of LPAs had in-house expertise to address ecological issues.[22]

One example of where LPAs are using an audit to inform planning processes is Warwickshire. The audit was undertaken because of a decision in 1995 taken by the six Local Authorities within the County of Warwickshire, plus Solihull and Coventry unitary authorities, Natural England and the Environment Agency.[23] They established the Habitat Biodiversity Audit Partnership under the management of Warwickshire Wildlife Trust to meet the needs of planning authorities. The local authorities have

Box 3. Under-recording

Under-recording of species can be an impediment to audits. There is a lack of data for some groups of species that are difficult to record, such as soil invertebrates, or to identify, such as Phorid fly species. Some areas also have much higher numbers of records than others (geographic under-recording).[12]

Recording is often not done systematically. For example, rare species are more likely to be given specific grid references than common species. This can be addressed by a structured survey approach,[24] where the same sites are repeatedly surveyed to provide information. Software has also been developed to reduce uncertainties due to under-recording.[25] If the under-recording is of particular species in a specific habitat, extra recording effort can be undertaken for the audit. New technologies could also allow rapid identification of difficult to record or identify species. For example, DNA metabarcoding combines DNA based identification and high-throughput DNA sequencing for mass collections of organisms or environmental DNA (which is released into the environment via excretions, POSTnote 476). [26] However, the amount of data generated may pose challenges in evaluating, analysing and using it (POSTnote 468), and a library of barcoded specimens is needed to link barcodes to species.

funded the audit since its inception, enabling every planning decision to be informed by data down to the field and hedge level. They consider that having the appropriate data has proved useful to:

- avoid the costs of judicial reviews and minimise planning appeals on biodiversity grounds
- implement the objectives set out in the NPPF
- implement biodiversity offsetting (POSTnote 369)[27]
- inform a sub-regional Green Infrastructure Strategy (POSTnote 448).[28]

Biodiversity Action Plans 1994-2011

Following the introduction of the 1994 UK Biodiversity Action Plan (UK BAP), a requirement was placed on Local Authorities to undertake Local Biodiversity Action Plans (LBAPs), set out a strategy and a set of objectives produced in consultation with a range of stakeholders. Between 1995 and 2000 a number of audits were carried out to inform LBAPs, such as the Ryedale audit.[29] However, only 24% of species restricted to or mainly found in a given region were subject to UK BAPs.[30]

Planning Ecological Networks

The UK BAPs and LBAPs were replaced in 2011 by the Biodiversity 2020 strategy for England and the creation of Local Nature Partnerships (LNPs). Habitats and species of national importance are still listed under the NERC Act (see Box 4).The NPPF requires that planning policies should consider biodiversity at the 'landscape scale' (using National Character Areas,[31] see below) and 'identify and map components of local ecological networks'.

Associated planning guidance sets out relevant evidence needs for identifying and mapping networks (POSTnote 300), which includes the distribution of protected and priority habitats and species.[32] Warwickshire County Council is also seeking to use data from its biodiversity audit in planning ecological networks. The Norfolk Biodiversity Information Service (NBIS) has also used data from audits to provide innovative data products to inform the planning of ecological networks by LPAs.[33] LNPs have a role in coordinating the creation of networks, but an Environmental Audit Committee Report has highlighted their mixed performance and funding problems.[38]

Box 4. Public Body Biodiversity Duty

Under Section 40 of the 2006 NERC Act, in England public bodies are required to 'have regard…to the purpose of conserving biodiversity'; this extends beyond just conserving existing biodiversity to actions that may also restore or enhance biodiversity. Listed under Section 41 of the Act are habitats and species of principal importance for the conservation of biodiversity, which currently includes 56 habitats and 943 species, to guide public bodies when implementing their duty. The habitats and species of national conservation importance listed under section 41 should inform conservation measures implemented locally. There are more than 40,000 local sites, which are non-statutory local designations that include both local wildlife sites (designated for significant biodiversity value) and local geological sites (designated for their significant geological value).

The single data list (SDL) is a list of all the datasets that local government must submit to central government. Under SDL 160-00, LAs submit data on the proportion of local sites where conservation measures are being implemented.[34] Some LERCs (Box 1), such as Hampshire Biodiversity Information Centre, monitor sites on behalf of LAs. In 2013-14, 47% of sites were in positive conservation management, but 26% of LAs did not supply data, many citing insufficient staff.[35] Planning guidance notes the importance of local wildlife sites,[36] but of 11% of 6,590 sites monitored by wildlife trusts in the period 2009-2013 were lost or damaged.[37]

Conservation and Biodiversity Audits

Knowledge of the biodiversity at given point in time in a particular area can provide a frame of reference (or baseline) against which to evaluate conservation efforts (POSTnote 427).[39] A biodiversity audit provides a baseline by identifying or confirming the species and habitats present as well as identifying priority species and habitats for conservation action. Between 2010 and 2012, biodiversity audits of the Broads, Fenlands and Breckland suggested that the numbers of different species present in these regions have been underestimated by one or two orders of magnitude (ten or a hundred times).[5]

For the Broads audit, 11,067 species of plants, insects, birds, fish and mammals were recorded, of which 1,519 species were priorities for conservation (because they were legally designated or rare species that occur in the region). In the Fenlands, 13,747 were recorded, with 1,932 priorities for conservation. In the Breckland, 12,845 species were recorded, with 2,097 priorities for conservation.[40] Previously, only 146 species in the Broads, 305 in the Fenlands and 45 in Breckland were considered priorities.

Targeted Conservation Measures

For these audits, data on species presence was interpreted alongside information on their ecological requirements (Box 5); this understanding of why species are where they are is critical to inform effective conservation measures (Box 6). In man-made landscapes, the focus of conservation effort is the maintenance of semi-natural habitat. This is often through agri-environment schemes that mimic traditional land use practices, such as hedgerow management (POSTnote 418). Studies suggest that such generic agri-environment measures provide biodiversity benefits.[41] However, targeted measures that provide the habitat conditions needed by species will be more successful.[42]

Box 5. Ecological Requirements of Species

There are good ecological data available to support the recovery of some individual species. For example, the large blue butterfly requires short sward and ant-rich limestone grassland that contains thyme plants. This is achieved through grazing to manage taller plants,[43] such as Tor-grass. However, other rare invertebrate species, such as leaf-hopper bugs and wart biter cricket, require taller vegetation. It possible to manage habitats as a varied mosaic to support the recovery of groups of species, but the evidence on requirements is much less well developed.[5]

Existing datasets include ecological requirements, but the data are not systematised, ~13,000 different types occur in biological records. The CEH Biological Records Centre is working to create a standardised set of 10-30 requirements for groups of species. For example, the new invertebrate database Pantheon, consisting of two applications Isis and Osiris, will assist analysis of groups of invertebrates present at a site and their requirements.[44] However, providing best practice for management may require a combination of approaches (Box 6).

For example, species may require resources arising from complexity of habitats, such as patches of bare ground, short vegetation, shrubs and trees in close proximity. This involves managing habitat to be a varied 'mosaic' that provides the full range of resources.

Meeting the Needs of Groups of Species

Some nature reserves are managed to provide the conditions required by two or three species, but in general targeted interventions for multiple species are not well studied (Box 5). One study was an audit of ground dwelling invertebrates (fly, spider and beetle fauna) in exposed riverine sediments (sand, silt and gravel banks within channels) at 100 sites across England and Wales.[45] Its objective was to establish associations between the fauna and environmental variation, such as the timing of flood events. The results suggested any in-channel operation that reduced the complexity of the habitat would cause biodiversity loss.[46]

The Breckland, Broads and Fenland audits defined guilds, which are groups of species with similar resource requirements (Box 6). These can be managed through interventions, such as 'physically disturbed ungrazed' (such as rotovation).[47] For instance, the Breckland audit showed that species assumed to be restricted to undisturbed protected sites actually occurred in greater numbers in the margins of arable fields with high levels of physical disturbance.[47] Following the audits, subsequent changes to agri-environment schemes led directly to conservation gains. The audits found that only a few species were restricted to one type of habitat type, such as heathland.

Auditing at Ecological Scales

The Breckland, Broads and Fenland audits were carried out at ecological scales, using national character area profiles defined through physical, environmental and cultural features, including river catchments, soil and geological characteristics.[31] This ensures that management recommendations are coherent and reduces conflicting conservation priorities at the regional level. Such an approach often involves working across local authority boundaries.

Box 6. Integrated Management Across Multiple Species

The approach developed by recent audits seeks to link guilds – groups of species with similar requirements – to ecological processes for prescribing management actions.[47] To classify management guilds for the Breckland audit, species were classified into a matrix of categories using two gradients: open to wooded and dry to aquatic. Species were also assessed for any association with 27 broad habitat types and within these associations with small scale structures or 'micro-habitats', such as deadwood or bare ground, and with processes that modify these, such as physical disturbance. Fifty-one guilds were defined, 24 of which were associated with dry terrestrial landscape elements, 21 with wetland landscape elements, with two requiring damp conditions. The four remaining management guilds comprised species that occurred across landscapes, such as birds and mammals, whose ecological requirements need to be considered across a wider area. The associations with small scale structures (micro-habitats) and processes were used to formulate management options for the guilds. On the basis of the audits, Norfolk Biodiversity Information Service is assessing how to develop guild-based indicators to determine if site habitat conditions are appropriate.

Resilient Approaches to Conservation

The 2011 Natural Environment White Paper set out measures to increase the coherence and resilience of the network of protected areas, including increasing the number, size, quality and connectedness of wildlife sites. The biodiversity audit approach is based in the wildlife recording tradition of knowing what species is where and why. A 'coherent' network requires understanding of which species are likely to use a particular landscape and the types, amount and configuration of habitat resources (Box 6). Audit data can also be used as a baseline against which to suggest how future change will effect species. For instance, data from the Broads audit has been used to suggest how projected changes in salinity and hydrology will affect species that are priorities for conservation.[48] To be 'resilient' to environmental change, protected areas in any network need to be both biologically and structurally complex to support ecosystem processes and levels of species diversity, which can be informed and evaluated by auditing. These areas are more likely to support ecosystem services provision, although understanding of the links between biodiversity and ecosystem services remains limited.[49]

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