The
UK Terrestrial Biodiversity Surveillance Strategy

Proposal for a Terrestrial Biodiversity Surveillance and Monitoring Strategy

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1. Background

1.1 In 2006 JNCC proposed a '*UK Strategy for surveillance, reporting and research for nature conservation*'[1] (JNCC 06 D02). The ideas were widely consulted on. This document takes the comments into account and develops the surveillance part of the original strategy proposal. Surveillance is used throughout as a shorthand for surveillance and/or monitoring. Both comprise repeat sampling of biodiversity, and practitioners variously label their sampling activities monitoring or surveillance.

1.2 The scope of this proposal is for surveillance that can provide evidence relevant to the biodiversity strategies of the countries and the UK, and its subject is land and freshwater (terrestrial) biodiversity. The strategy for marine biodiversity sampling is being developed separately from this proposal, but as an integral part of the UK Marine Monitoring and Assessment Strategy process.

1.3 The strategy is designed to contribute to the co-ordination of sampling at the scale of the environment *i.e.* across air, water, waste, land use *etc.* The Environmental Research Funders Forum (ERFF) has established a project board to deliver a joined-up environmental monitoring strategy - an 'Environmental Observation Framework'.

1.4 The strategy proposed here is designed to become the biodiversity component of the Environmental Observation Framework. The Framework will help users of biodiversity surveillance to gain access to data on variables (*e.g.* temperature, chemicals, land use change) that are needed to interpret the signal from biodiversity sampling. Another gain will be the ability to form partnerships with other sectors for analysis and modelling, and to spot synergies that will influence sampling design/cost, for example by integrating sampling into schemes that measure biodiversity and other environmental variables.

1.5 In this paper, the term sampling is used to mean a scheme of surveillance. This strategy proposal is for the many current investors, providers, and users of biodiversity sampling, and intends to provide ideas on how they might collaborate most effectively to achieve the objectives suggested by the strategy. The ultimate aim would be a stakeholder-owned strategy, but the immediate aim is a coherent proposal to allow stakeholders to judge the value of having a strategy, and help them decide how they would like to refine and then implement it.

[1] http://www.jncc.gov.uk/pdf/comm06D02.pdf

2. Purpose

2.1 The purpose of the strategy is to aid decisions by agencies, departments, specialist societies and NGOs and research bodies on the direction and coverage of the terrestrial and freshwater biodiversity[2] surveillance and monitoring that they support or undertake, in order to provide balanced support for the country and UK biodiversity strategies.

2.2 The strategy sets out a framework of surveillance to deliver the requirements of three surveillance objectives. This framework can then be used to assess the coverage of current surveillance, and to identify gaps and overlaps. There are already known to be persistent gaps in the information that current surveillance can provide, and there is an increasing need for evidence to support policy. The strategy provides a mechanism that will allow the gaps and overlaps in coverage to be addressed by an efficient adjustment to existing schemes, or, if there is no alternative, it can identify the additional surveillance which is required.

2.3 Currently, around 100 separate surveillance and monitoring schemes include biodiversity, and running the schemes involves around 30 bodies making an annual equivalent spend of approximately £11.5 million, with the value of volunteer effort at least three times this figure. Many of these schemes have been planned in isolation from one another, and the data generated may only be used within single reporting requirements.

2.4 The strategy provides a process for integrating the many separate requirements for biodiversity surveillance, compares this with the schemes in place, and with what can be achieved through realistic levels of adjustment, partnership and innovation. This process will provide the long term co-ordination needed to influence surveillance activities, as many of these cannot change quickly, and new requirements will need to be assessed. Work to develop the strategy has already identified some short term priorities for action to improve coverage.

2.5 The strategy aims to create flexible and fit for purpose surveillance and monitoring by a process of evolution and development of existing effort to meet the needs of:

- country and UK biodiversity strategies and their indicators;
- maintaining ecosystem services;
- SSSI condition;
- agri-environment biodiversity objectives;
- Habitats and Birds Directives;
- Biodiversity, Ramsar and other Conventions;
- Non-native species policy and implementation;
- climate change impact on biodiversity and adaptation;
- mitigating pollutant impacts on biodiversity; and
- Biodiversity Action Plan priority species and habitats.

2.6 Complementary and supporting work on data access and reporting will be

[2] The strategy for marine biodiversity surveillance and monitoring is being developed as part of the UK Marine Monitoring and Assessment Process.

essential. The value of datasets will be enhanced by efficient mechanisms for sharing and integrating the data.

3. Introduction

3.1 The challenges for delivering biodiversity as a component of healthy and functioning ecosystems include:

i. measuring progress in creating ecological networks and achieving habitat quality and maintaining species diversity;
ii. anticipating the effect on biodiversity of policy proposals, economic or other environmental change;
iii. identifying the changes in biodiversity that need to be addressed;
iv. understanding the drivers of these changes;
v. developing responses to maintain biodiversity that are cost-effective to employ.

3.2 Surveillance is a fundamental tool for providing evidence to help with these challenges since it is, through its long-term nature, very effective at picking out significant change in biodiversity from the background of natural fluctuations. It is also the starting point for understanding the reasons for change through correlation with other variables, and through knowledge of the different ecological requirements of the biodiversity being sampled. Finally, it has a role in prediction. It provides a rich source of data to calibrate the relationships between biodiversity and the environment in order to feed the modelling needed for prediction.

3.3 Ensuring that long-term sampling fulfils these functions effectively requires careful, fit-for-purpose design. Long-term sampling has a long lead time (6+ years) before it is useful, but, once established, can remain valuable for decades. The key to its value is far-sighted planning that takes into account current needs, but makes sure sampling will pick up changes to biodiversity under a wide range of future scenarios of land management and variations in environmental parameters. The aim of the planning is to produce a flexible suite of sampling that provides the first cut of evidence for most policy questions when they occur. Similarly, having a suite of sampling in place should mean that indicators can be drawn out of the sampling when they are needed to illustrate the drivers for policy, and show progress against targets. Value for money is achieved through the re-use of the same suite of sampling to provide evidence for a wide range of policy questions, rather than commissioning separate solutions for each policy question as they occur.

4. Users of the Strategy

4.1 The strategy is to help the country and UK stakeholders in surveillance and monitoring (policy makers, operational agencies, NGOs, providers of sampling, volunteers) meet their specific objectives within a joined-up cost-effective suite of long-term sampling activities that, collectively, deliver against the strategy objectives.

4.2 Policy makers are not direct users of sampling or engaged with the detail of the strategy for it. However, if the strategy is working well they would find that evidence derived from sampling under the strategy was relevant to their questions through time. In addition, the strategy should respond to reviews of the evidence needs for their policies, and adjust the suite of sampling as necessary. The main gain of the strategy to policy makers is its focus on sampling that will pick up the interactions between biodiversity and the pressures on the environment. This will ensure that there is evidence relevant to the challenges of using the environment sustainably.

4.3 Agencies and NGOs can use the strategy as a tool for deciding where to make the most of their own investments in sampling to meet their priority needs. They should be able to use the strategy to identify the coverage of existing sampling; what it is delivering; the opportunities for synergy; and the outstanding gaps in coverage. The main gains are helping ensure value for money, increased possibilities for partnership or multipurpose solutions, and being able to add sampling that contributes most to the overall picture, or stop or re-direct sampling that contributes least.

4.4 The many individual schemes will benefit from increased cross-cutting analysis of sampling to meet evidence needs, and hence a greater user base for their sampling. The strategy should also provide a better picture of user needs, and so, if schemes choose, they can adjust their sampling to contribute.

4.5 The aim of the strategy is to get better coverage for the limited public, NGO and volunteer time resources available. It does not intend to prohibit voluntary sampling that can add to the objectives, but which may not be essential given the other sampling already in place. However, it should serve to guide public investment into areas of most need.

5. Objectives

5.1 The strategy has three hierarchical objectives. The first objective establishes the broad framework of surveillance schemes needed to meet requirements for delivering the country and UK biodiversity strategies. The second and third objectives identify the most effective ways of supplementing the framework to help mitigate pressures on biodiversity and to meet reporting needs. The objectives allow new needs for surveillance to be integrated by adjustment or supplement to the framework of schemes, rather than creating separate solutions for each new requirement.

5.2 **Objective 1 To measure status and trends of a framework of habitats, species, and their ecosystem functions, sufficient to inform the delivery of the outcomes required by UK and country biodiversity strategies.**

- *This is in order to identify problems, measure the effectiveness of interventions, and enable priorities to be established for future action.*

5.3 Objective 2 To detect the impacts of pressures affecting biodiversity by interpreting objective 1 trends using pressures data within the Environmental Observation Framework, or, if necessary, by supplementing the framework of objective 1 schemes.

- *This is in order to provide evidence to support policies or actions to mitigate the pressures or influence their drivers.*

5.4 Objective 3 To assess the status of species and habitats covered by legislation and policy, by supplementing the framework of objective 1 and 2 schemes where it does not already include them.

- *This is in order to ensure that the reporting obligations of legislation and international commitments can be met.*

6. Current contribution of surveillance to the objectives: gaps and recommendations

6.1 Most of the current set of approximately 100 surveillance or monitoring schemes include activities relevant to the scope of the strategy. In order to determine how well these schemes collectively meet the needs of the objectives, a rapid review has been undertaken. The review identifies the surveillance requirements of each objective and then determines the current cover from existing surveillance schemes. The next step is to identify the key gaps and overlaps, and finally consider potential solutions.

6.2 A summary of this rapid review is provided below.

6.3 Objective 1 To measure status and trends of a framework of habitats, species, and their ecosystem functions, sufficient to inform the delivery of the outcomes required by UK and country biodiversity strategies.

Analysis of the objective

The biodiversity outcome that country and UK biodiversity strategies are working towards is in essence: a) To maintain, create, and restore functional combinations of habitats that will provide ecosystem services and reduce the vulnerability of isolated habitats and species populations; b) Within these ecological networks to make sites more robust to environmental change by improving their quality and condition, and by reducing the impact of other pressures in the surrounding areas; c) Finally, to first halt the decline of species diversity, and then maintain it, allowing for climate adaptation.

Surveillance Requirement

To determine if this outcome is being achieved, the requirement is for: a) representative surveillance of semi natural habitat pattern and conversion rates, b) within habitats, representative surveillance of structural, functional and species composition measures of quality, and c) to sample widespread species dependent on different landscape scales from micro-habitat to migratory species. Since the surveillance has to inform conservation delivery, the requirement is also to know how interventions such as agri-environment schemes are contributing to these outcomes.

Current coverage

Coverage is partial for habitats and moderate for species, and provides support for current country/UK indicators. Important schemes delivering relevant information for objective 1 include:

- Countryside Survey including Land Cover Mapping;
- Common Standards Monitoring, Agri-environment Monitoring;
- Stratified surveys of habitats (currently only a few, and England only);
- Breeding Bird Survey;
- Wetland Birds Survey;
- UK Butterfly Monitoring Scheme and moth schemes;

- Tracking Mammals Partnership schemes;
- Recording Schemes and Atlases, including Biological Records Centre support to schemes.

Gaps

The main gaps are:

- proven methods for repeated measurement of habitats at the landscape scale (*e.g.* area, patch-size, pattern, conversion rates);
- repeated representative surveillance within each habitat type and widespread validated rapid assessment methods for condition;
- sensitive (in time) surveillance of a more balanced set of species [3];
- fully comprehensive ability of survey schemes to provide country and regional-level information;
- coverage of species within uplands and possibly also freshwaters.

Overlaps

The main overlap is that surveillance of local site, agri-environment and SSSI condition all visit a proportion of habitats. However, despite this they do not, collectively, provide a representative picture of change across all habitats at country/national scales.

Recommendations

i. improve data collation and access to data for site surveillance schemes; confirm that overlaps are minimised and ensure that they collectively provide representative coverage of habitat quality and change;

ii. exploit advances in processing aerial and satellite remote sensing data to create methods that can measure change in area, distribution and pattern of semi-natural habitat;

iii. improve coverage of existing species schemes to provide country-level and upland information;

iv. investigate the potential for a more balanced set of species recording schemes to provide regular repeat surveillance; species groups for which it may be possible to improve coverage include moths and plants.

6.4 Objective 2 To detect the impacts of pressures affecting biodiversity by interpreting objective 1 trends using pressures data within the Environmental Observation Framework, or, if necessary, by supplementing the framework of objective 1 schemes.

[3] Balance in terms of species depending on different scales of feature in the landscape, representing different functions and representing public value/interest in biodiversity.

Analysis of the objective

The Millennium Ecosystem Assessment provides useful categories for the main pressures affecting biodiversity: i) habitat transformation, ii) exploitation, iii) non-natives, iv) climate change, v) pollution. For each of these pressures there are specific needs for information, but the surveillance activity needed to provide it may have some elements in common with other objectives. To help deliver objective 2, surveillance needs to: i) help determine the social/economic drivers of habitat change, ii) help ensure hunting/harvesting of biodiversity is at sustainable levels, iii) help with early detection and response for non-natives, iv) provide feedback into climate adaptation measures, v) show the scale of biodiversity impact of diffuse pollutants, and assist with biodiversity risk assessment of ecotoxological chemicals.

Surveillance Requirement

For habitat transformation and climate change, improving objective 1 surveillance is key to allow comparison with Environmental Observation Framework data on land use change, *e.g.* crop type change. It will detect change in habitats, measure the status of ecologically resilient networks, and provide actual rather than predicted change in species distribution due to climate space shift. For non-natives, the requirement is for wide taxonomic cover, and where relevant, targeting surveillance around likely pathways. For pollutants the requirement is to know the level of current impact to see if existing policy is adequate. For the directly exploited species, the requirement is for regular assessment of population trends.

Current coverage

Coverage is good for some pressures, *e.g.* exploitation, but partial for most. The main schemes in addition to those identified in Objective 1 are:

- Environmental Change Network
- Goose and Swan monitoring

Gaps

The main gaps, in addition to those for objective 1, are:

- a good knowledge of the functional roles performed by the species in existing surveillance schemes;
- a good understanding of the policy questions and the levels of confidence needed in evidence to answer them;
- cross-cutting analysis drawing on data from many schemes, together with better access to Environmental Observation Framework data;
- access to biodiversity data across Europe and many countries have low levels of surveillance[4];

[4] Data across Europe can help with understanding climate impacts, pollution impacts, and invasive non-native risk

- early detection and alert systems for invasive non-native species across all schemes and identification of likely pathways;
- regular assessment of population trends of exploited plants and fungi;
- risk-based methods triggering assessment of eco-toxological chemical impact on biodiversity and strategic support to tissue collection schemes.

Overlaps

The main overlaps are:

- duplication between one-off research, long term measurement against a range of variables, and analysis comparing biodiversity and other schemes to determine likely causes of change;
- analyses undertaken many times by different research teams/agencies, for specific purposes, with the data and results not sufficiently shared.

Recommendations

i. collate research to identify the ecosystem functions measured by existing species surveillance, and identify the species which can address the main gaps, whilst being cost-effective to sample;

ii. make best use of existing surveillance and research results to answer policy questions through cross-cutting analysis projects *e.g.* BICCONET[5];

iii. use these projects to identify the priorities for adjusting surveillance, and the best balance and linkage of this work with other research;

iv. continue to improve support to schemes to detect and report non-native species data through NBN;

v. engage proactively in efforts to improve the accessibility of biodiversity data across Europe using initiatives such as the Global Biodiversity Information Facility (GBIF), and promote comparable surveillance without increasing the reporting burden through Global Monitoring for Environment and Security (GMES), voluntary networks, and the European Environment Agency (EEA).

6.5 Objective 3 To assess the status of species and habitats covered by legislation and policy, by supplementing the framework of objective 1 and 2 schemes where it does not already include them.

Analysis of the objective

Objective 3 considers the legislative and policy commitments for biodiversity conservation, determines their evidence needs, how much they are met by surveillance in place for objectives 1 and 2, or if not what supplement is needed. Commitments largely focus on species or habitats that have undergone significant decline, or are vulnerable due to small population size or limited distribution.

[5] 'Biodiversity Impacts of Climate Change Observation Network', a Defra project to provide synthesis of climate impacts and adaptation across schemes and related research.

Such species and habitats are always difficult to pick up in surveillance that meets other objectives and will need particular targeting. However given they do not help measure other objectives the surveillance effort needs to be proportionate. Ideally, the long-term surveillance for objectives 1 and 2 would provide the evidence for action necessary to prevent species or habitats reaching this state. In practice, it will take considerable time to restore some legislative/policy species and habitats so that they are self-sustaining, and surveillance can help target action and provide measures of progress.

Surveillance Requirement

The Habitats Directive places a legal requirement for surveillance to determine the status of habitats and species of Community Interest, and to monitor incidental capture and kill of Annex IV species. For the Biodiversity Action Plan priority species, the requirement is for surveillance where this helps to inform action, and, ultimately, to measure achievement of the outcome-based success criteria for each species or habitat. The Wildlife and Countryside Act Schedules 5 and 8 are intended to prevent direct human impacts on threatened species, *e.g.* egg collecting, removal of wild plants for horticulture, and disturbance. Here the requirement is for information on levels of exploitation activity, rather than just surveillance of biodiversity itself. It is particularly important to detect new drivers for exploitation, in order to identify emerging problems where the protection offered under the schedules will be needed. The emerging European requirement to identify High Nature Value land contrasts with other obligations, as it will probably focus on widespread species indicative of extensive, low input farming/forestry practice. These will be appropriate for incorporation under objective 1 of this strategy.

Current coverage

Coverage is good for the Birds Directive, moderate for species and poor for habitats covered by the Habitats Directive, and poor for habitats and some species groups included in the Biodiversity Action Plan (see Appendix 1). The main schemes not already identified in objectives 1 and 2 include:

- many single habitat and species surveillance schemes, *e.g.* for mammals (*e.g.* dormouse), invertebrates (*e.g.* greater stag beetle, noble chafer), and birds (BTO studies);
- mechanisms that group separate targeted species surveys (*e.g.* Plantlife's Back from the Brink scheme, and Statutory Conservation Agencies/RSPB Annual Breeding Bird Scheme (SCARABBS);
- mechanisms the target volunteer effort across several species, *e.g.* Scottish Raptor Group, Rare Breeding Birds Panel;
- Habitat inventory work underway by Scottish Natural Heritage and Natural England.

Gaps

The main gaps in addition to those identified for objectives 1 and 2 are:

- the frequency of surveillance for plants, lichen, bryophytes, fungi and invertebrate species;
- targeted periodic surveys for a relatively small proportion of other obligation species and habitats.

Overlaps

The main overlaps are:

- The same habitat is visited numerous times in different single species surveys, where advances in methods would allow multiple species and habitat features to be measured at one time.

Recommendations

i. identify coverage and gaps in the repeat sampling of species by ensuring that all Local Records Centre, Agency and Society-collated recording data is available through the NBN;

ii. adopt a risk-based method for surveillance rather than aiming for completeness within each reporting cycle;

iii. increase support for plant, lichen, bryophyte and invertebrate surveillance in order that they can supplement existing sampling most effectively, and adopt the risk based approach;

iv. incorporate methods that can realistically be undertaken at the same time into targeted periodic surveys to improve surveying efficiency;

v. adjust frequency of current surveys for particular habitats and species to allow consistent and appropriate reporting.

7. Early implementation tasks

7.1 In order to make real progress with the Terrestrial Surveillance Strategy a number of key tasks have been identified which are recommended for early delivery. These are listed below and are mainly research tasks to help existing schemes improve coverage whilst controlling cost.

7.2 *Re - Objective 1*

i. Identify a stratified sampling frame capable of enabling the sufficient surveillance[6] of a range of priority habitats. Identify the options for achieving effective coverage frame through existing schemes. Cost £50k.

ii. Using new satellite and aerial data processing methods, pilot surveillance for a selected priority habitat to assess how it can make habitat surveillance more cost effective or viable, including its contribution to inventory creation, establishing the sampling frame, and measuring change in quality and area. Evaluate the implications for existing scheme methods. Cost £50k pa for 3 years.

7.3 *Re - Objective 2*

iii. Identify the capability of existing surveillance schemes to reflect trends in pressures and ecosystem services, and determine whether changes to plant/vegetation and moth surveillance could fill important gaps in this. Cost £70k.

iv. Determine whether existing European data and co-ordination mechanisms (*e.g.* EEA, GBIF, NGO networks *etc*.) are capable of providing data that can improve UK identification of species' responses to pressures such as climate change and pollution, and the spread and impact of non-native species. Cost £30k.

7.4 *Re - Objective 3*

v. Provide support to risk-based (*i.e.* prioritised) enhanced surveillance of lichen, bryophyte, vascular plant and invertebrate species listed on the UK BAP, Habitats Directive, and SSSI selection guidelines, through relevant specialist schemes, for a pilot 3 year period and evaluate results. Cost £120k pa for 3 years.

7.5 The habitat surveillance pilot recommendations, referred to in paragraph 7.2.ii above, would, if successful, be rolled out to the other habitats through modification of existing surveillance mechanisms (*e.g.* habitat inventories, habitat surveys underpinning Common Standards Monitoring, Countryside Survey). The species surveillance enhancement, referred to in paragraph 7.4.v above, would, if successful, be continued and refined as necessary.

[6] Sufficient to provide a representative measure of condition, and detect change given likely scales of impact from land use, and climate.

7.6 It is recommended that a Surveillance Implementation Group be established to determine how best the above actions can be implemented and financed.

8. Implementation approach

8.1 The strategy will mainly be implemented by the adjustment of existing surveillance schemes to fit more closely with the strategy objectives and help cover identified gaps although some new surveillance will be needed.

8.2 The recommendations made in section 7 are mainly investigative tasks aimed at providing credible options before major review milestones arise in existing major schemes.

8.3 The surveillance strategy is effectively a long-term mechanism for adjusting surveillance to fit current biodiversity strategy (conservation delivery) better, and to allow further modifications, as needs change. It will work best where investors in surveillance regularly review the scope of their schemes.

8.4 To provide a change mechanism, the strategy periodically needs to revisit one or more of the following steps:

- Update the overview of surveillance activity, and encourage stakeholders to use it as a starting point for devising solutions to meet their needs.
- Work with data owners, and through ERFF, to establish open access to surveillance/monitoring data sets, to encourage their re-use in meeting multiple needs, or in multi-disciplinary analysis.
- Check the objectives and refine their requirements. Model desired surveillance using current best practice in surveillance design, and compare against available surveillance. Identify options for change.
- Identify scientific or technological change that could make alternative ways of meeting the requirements viably, or that could reduce cost. Raise awareness and encourage adoption of new approaches.
- Facilitate greater adoption of Evidence Based policy best practice – in particular, for new evidence needs, encourage cross cutting analysis of existing surveillance to determine how much it can contribute, refine ideas on the quality and type of evidence needed, and to help identify where the priority gaps are.

9. Version

0.1	1/10/2007	First Draft for QA by JNCC surveillance programme
0.2	4/10/2007	Revision based on JNCC surveillance team QA
0.3	12/01/2008	Revision based on second QA by JNCC science group and comments from Ed Mackey, SNH
0.4	25/02/2008	Revision based meeting with Natural England, Comments from A.Stott and M.Vincent and JNCC surveillance programme meeting.
0.5	26/03/2008	Revision including edits from C.Cheffings, Paul Rose, Keith Porter and feedback from BRIG on the clarity of the objectives
0.6	7/04/2008	Revision including edits from A.Stott
0.7	4/07/2008	Revision for website incorporating extra sections from earlier versions that have not been superseded – intention to have a long but complete document
0.7b	25/09/08	Revision incorporating minor changes by A.Robinson
0.7c	11/02/09	Revision incorporating minor changes by A.Robinson