



The UK Terrestrial Biodiversity Surveillance Strategy

Surveillance Framework

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Surveillance Framework

This paper shows the way in which the overall objectives of the biodiversity surveillance strategy have been split into sampling requirements. It provides an analysis of existing cover against the requirements and identifies gaps and overlaps. Finally it suggests recommendations to tackle the gaps and overlaps. It supports section 6 of the main strategy document and is intended to provide a longer term tool for analysing requirements and coverage as needs and understanding change. It was provided to the Biodiversity Reporting and Information Group (BRIG) for information.

Objectives 1-3 are hierarchical. Objective 1 establishes the main surveillance needs by looking at strategy outcome i.e.: measuring biodiversity *state*, objective 2 determines how much the sampling in place for objective 1 can help provide evidence for policy/action to mitigate *pressures*, and determines what supplementary sampling is needed. Objective 3 looks at the legislative and policy commitments for biodiversity conservation, determines their sampling needs, how much they are met by sampling in place for objectives 1 and 2, or if not what supplement is needed.

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.*

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.*

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.*

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:

Objective 1 establishes the main framework of sampling, to a) determine if three key principles of the conservation strategies are working, b) identify problems early, and c) assess the contribution of responses (*e.g.* agri-environment, site protection, spatial planning). The three key principles are taken from the strategies using text adapted from *Conserving Biodiversity – The UK Approach*¹:

1. To maintain, create, and restore functional combinations of habitats that will provide ecosystem services and reduce the vulnerability of isolated habitats and species populations
2. To make sites more robust to environmental change by improving their quality and condition, reducing the impact of other pressures in the surrounding areas, buffering and where appropriate making them larger
3. To first halt the decline of species diversity, and then maintain it, allowing for climate adaptation. This outcome is delivered mainly by the first two principles and targeted action.

Strategies work on 3-6 year reporting and review cycles and use suites of indicators² which are compatible with indicator frameworks identified by the Convention on Biological Diversity (CBD) and European Council. However, current indicators are not wholly sufficient to measure the UK and country strategies outcome that biodiversity is retained as part of healthy functioning ecosystems. Whilst sampling should ensure effective indicators can be maintained, it must also provide more broadly based measures of strategy outcome that can be further interpreted to ensure strategy objectives are being achieved.

The UK and country strategies place a strong emphasis on public awareness and participation. Sampling biodiversity does not always result in awareness and participation, but objective 1 does take into account the need for biodiversity sampling to include components of biodiversity that have good public recognition, and can foster public understanding of biodiversity strategy outcomes.

The analysis of surveillance need table for objective 1 focuses on the cover of UK habitat, habitat quality, and species status.

Table 1. Analysis of sampling need, current coverage, gaps/overlaps and recommendations for improvements in surveillance relating to objective 1.

Requirement for Sampling	Current coverage	Gaps & Overlaps	Recommendations
<p>Do we have the functional combinations of semi natural habitat we require in the landscape and how is habitat changing?</p> <ul style="list-style-type: none"> • It is necessary to sample habitat pattern and conversion rates to obtain a representative picture at country and UK scales. In particular, to: <ul style="list-style-type: none"> ➢ Map or measure habitat area, distribution, patch size distribution (fragmentation) ➢ Measure rates of conversion between habitat types ➢ Measure heterogeneity and connectivity at landscape and regional scales 	<p>Overall coverage = insufficient and fragmentary</p> <ul style="list-style-type: none"> • Coverage is in greatest detail for the few broad habitats that are semi natural. • There are many mapping schemes (OS, Land Cover Map, Country Phase 1, National Forest Inventory (NFI), Scottish Woodlands, England BAP habitat inventories) • Limitations of many mapping schemes include the high cost of repetition, and if they are repeated, incomplete comparability with earlier versions (<i>e.g.</i> different versions of Land Cover Map) • Change in landscape structure (<i>e.g.</i> linear features and patch size), and broad habitat conversion rates are available from Countryside Survey (CS) 1 km sampling • Wales Phase 1 used in conjunction with Wales Satellite based phase 1 may provide measures of connectivity, heterogeneity, and possibly change below broad habitat level. 	<p>Gaps include:</p> <ul style="list-style-type: none"> • Repeat sampling that can provide evidence of change in habitat conversion, heterogeneity, area, patch size, and connectivity for most semi natural habitats, <i>i.e.</i>; priority habitat, other low intensity land use habitats. <p>Overlaps include:</p> <ul style="list-style-type: none"> • Local, habitat specific, OS, and satellite derived mapping efforts overlap, <i>i.e.</i> have to sample fresh and cannot benefit from each other. 	<ul style="list-style-type: none"> • Test whether advances in processing aerial and satellite remote sensing can provide a repeatable means of mapping and measuring change in the area and distribution of semi natural habitat, at appropriate scales, and in time to influence the next generation of habitat inventory and land cover mapping investments • Research how to link local mapping effort with national data sets <i>e.g.</i> through use of a common spatial framework

¹ Conserving Biodiversity – The UK Approach, Defra, 2007. Available from <http://www.defra.gov.uk/wildlife-countryside/pdf/biodiversity/conbiouk-102007.pdf>

² Biodiversity Indicators in your pocket <http://www.jncc.gov.uk/page-3921>, CBD framework <http://www.cbd.int/2010-target/framework/indicators.shtml>, Scotland Biodiversity indicators <http://www.scotland.gov.uk/Publications/2007/11/09155020/0>

<p>Is the quality of semi natural habitat sufficient to maintain its function and species diversity, and how is this changing?</p> <ul style="list-style-type: none"> • Sample structural, functional and species composition measures of quality to obtain a representative picture by habitat, country, and UK scales • Measure habitat dependent combinations of vegetation composition, structure, and function • Supplement sampling to obtain a representative picture of the contribution of site and incentive measures³ • Supplement sampling to obtain local scale pictures for spatial planning and local sites • Target sampling as a feedback into the management of individual sites when needed • Select habitat and function measures that are relevant to quality and where possible can be linked to the delivery of ecosystem services • Include measures of soil function and trends within this because 1) soil biodiversity is an important component of biodiversity sampling, 2) understanding soil function may help to interpret other biodiversity trends, 3) soil function includes some important ecosystem services 	<p>Overall coverage = insufficient and partial</p> <ul style="list-style-type: none"> • Selected habitats in England are covered with representative sampling that can be repeated (<i>e.g.</i> for neutral grasslands, lowland heath) • SSSI habitats are sampled for condition using relevant attributes, but the attributes are not consistently retained to help determine causes of change. • Sampling for spatial planning at local sites provides a patchy coverage of additional sampling with relevant parameters but limited comparability. • The NFI initiative provides woodland change data and may include more priority/semi natural habitat measurements. Countryside Survey provides comparable measures in more intensively used habitat and provides coverage for the small number of broad habitats that are semi natural. • Countryside Survey includes measures of soil biodiversity and other soil parameters 	<p>Gaps include:</p> <ul style="list-style-type: none"> • Representative repeated sampling (<i>i.e.</i> of the whole habitat resource and at country level) for most habitats, particularly coastal ones. <p>Overlaps include:</p> <ul style="list-style-type: none"> • The Water Framework Directive (WFD), SSSI Site condition, local site, BAP habitat and Forestry sampling together visit much of the semi natural habitat in the UK but don't produce comparable change data. 	<ul style="list-style-type: none"> • Consider the implications of providing a single set of habitat specific (<i>e.g.</i> sand dune, salt marsh, neutral grassland) strategic (<i>i.e.</i> representative sample based) repeatable surveys to provide overall habitat status assessment (<i>e.g.</i> for BAP, Habitats Species Directive (HSD) and to identify SSSI condition, agri environments outcome. • Investigate whether much simpler/quicker assessments of condition/quality can be developed to help deliver site by site, scheme by scheme measures of condition as needed. • Investigate the balance of effort or synergy between stratified sampling of habitats and existing sample frameworks <i>i.e.</i> CS, NFI, WFD • Investigate the need to supplement the soil sampling included within the Countryside Survey
<p>Are species across ecosystem functions, and dependent on different scales of habitat (from micro habitat to migratory), being sustained within the landscape and how are their populations changing?</p> <ul style="list-style-type: none"> • Sample widespread species from different trophic levels to obtain a representative picture of distribution and population change at habitat, landscape, country and UK levels • Measure distribution and population trend of the selected species with sensitivity to moderate decline <i>e.g.</i> 25% in 25 years • Select species to be sampled that include a reasonable proportion that have good public recognition • Select species where we know or can build up quickly, good knowledge of their ecology 	<p>Overall coverage = moderate, insufficient for Scotland, Wales, Northern Ireland</p> <ul style="list-style-type: none"> • Breeding bird sampling (Breeding Bird Survey) provides migratory, landscape scale, and some habitat specialist species cover for the UK, and countries except Northern Ireland but with poor cover in uplands. • Selected mammal sampling (Tracking Mammals Partnership schemes) provides landscape scale species trends in the UK, predominantly in England, but some in Scotland. • Butterfly sampling provides (UK Butterfly Monitoring Scheme (UKBMS), Butterflies for the New Millennium) habitat specialist cover for UK England and Scotland, but with poor upland cover. Moth Sampling provides UK cover of species (Moths Count/ 	<p>Gaps include:</p> <ul style="list-style-type: none"> • Country level representative sampling, especially in Wales and Northern Ireland. Representative sampling in the uplands. • Short time period plant sampling that is representative of semi-natural habitat. • There is poor coverage of species involved in provisioning and regulating services <i>e.g.</i> plants, soil organisms, and selected invertebrates. <p>Overlaps include:</p> <ul style="list-style-type: none"> • Some plant/vegetation sampling is also covered as part of habitat sampling. 	<ul style="list-style-type: none"> • Investigate whether country and upland cover of species sampling can be improved across schemes by collaboration and professional/voluntary partnerships. • Investigate whether improved stratification of existing sampling or new methods can improve the habitat and landscape representation of butterflies and moths (without significantly increasing cost) • Research the best way of supplementing habitat vegetation sampling to give good coverage of plant trends.

³ Representative sampling of some habitats will also be representative of the habitats on sites, as the site networks contain a very high percentage of some habitats. So supplementing the overall habitat picture to determine if the quality within sites is as desired will not always be necessary.

<p>to help interpret the factors affecting range or population change</p> <ul style="list-style-type: none"> • Supplement sampling if necessary get a representative picture of the effect of incentive measures that aim to change management for biodiversity. 	<p>National Moth Recording Scheme) across more intensively used landscapes.</p> <ul style="list-style-type: none"> • Plant trends for widespread species for the UK are available on 15 year cycles (BSBI Monitoring Scheme), and many common species as part of CS plots every 8 years. • Recent advances in statistics are providing trend data mainly at UK level for a range of invertebrates (<i>e.g.</i> UKBMS) • There is a good cover of species with high public recognition (birds, mammals, butterflies, common plants) 		
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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.**

Analysis of the Objective:

Objective 2 uses the Millennium Ecosystem Approach categories of the main pressures affecting biodiversity to analyse whether the sampling needed for objective 1, combined with Environmental Observation Framework data, would provide a detection mechanism that the pressure was contributing to change in biodiversity. This is in order to provide evidence to support policies or actions to mitigate the pressures or influence their drivers. Analysis also identifies where objective 1 sampling would need to be supplemented to provide the evidence needed, either by further sampling, access to other non biodiversity data, or by linking to research.

A discussion of the pressure categories is given below. The analysis of surveillance need table for Objective 2 is sub-divided into these major categories of pressure used by the Millennium Ecosystem Assessment

Habitat transformation

Habitat transformation includes conversion *i.e.* switching between habitat types, often leading to the loss of semi natural habitat *e.g.* urbanisation, but also involving more subtle effects of changes in land management *e.g.* cessation of felling, grazing. Changes in management are probably the biggest driver of change for biodiversity, and the impacts will intensify as land management responds to climate change *e.g.* for mitigation (and also adaptation measures for non-biodiversity sectors) – bio-fuels, or as different types of agriculture become viable. The approach in the biodiversity strategies is to modify/help land use management changes in production lands to retain biodiversity, minimise conversion/fragmentation of semi-natural habitat to less diverse land uses, and create/restore semi-natural habitat where it will help retain biodiversity at landscape scales. The main role of sampling is to provide evidence of the scale of impact of different factors driving habitat transformation, in order to influence policy.

Climate Change

The approach of the biodiversity strategies is to help biodiversity to adapt to climate change, *e.g.* using the principles suggested for UK BAP by Hopkins *et al* 2007⁴: a) protection of existing biodiversity, including protected areas and other wildlife habitat of high value, b) reduction of other sources of harm (pollution, inappropriate management, over exploitation of resources, c) development of ecological resilient landscapes through establishment of ecological networks.

The main impact of climate change on biodiversity is likely to be through land use change (see habitat transformation above), but climate change is also predicted to affect species and habitat composition by (adapted from MONARCH⁵):

- Change in climate space – *i.e.* rainfall, temperature, storm event frequency
- Phenological change and knock on effects on interactions between species
- Changes in composition and structure of communities including invasive species
- Species capacity to adapt physiologically and behaviourally to climate change
- Effects of extreme weather events

The main role of surveillance (sampling) is to determine firstly if the adaptation outcomes *e.g.* ecological networks, are developing, and to detect what actually happens to biodiversity under climate change as a feedback into adaptation policy and management. In addition to adaptation measures, there is a need to understand the linkage between mitigation and biodiversity, and the impact of any mitigation measures on biodiversity. Mitigation policy requires the maintenance of good carbon sequestration by soils and vegetation. Other mitigation measures, such as wind farms, tidal barrages, growing of biofuels, *etc.*, will have more localised biodiversity impacts, and can be analysed under ‘habitat transformation’.

Pollution

Pollution includes air pollution for example, SO₂, NO_x, ammonia and ozone; and pollution from other chemicals, for example industrial point source chemicals, pesticides, and herbicides and nitrate and phosphate fertilisers. Air pollution has broad scale impacts, for example, eutrophication, and acidification. However, these impacts can also be caused by other sources of pollutants, for example, eutrophication can be caused by nitrates and phosphates leaching from fertilisers, and sometimes it is hard to distinguish the origin of the pollutants causing the effect. Acidification has become a less important issue than eutrophication in recent years because of a reduction in emissions of acidifying gases, but it still remains an issue in some areas. Reducing levels of air pollution has a significant economic cost and is achieved through complex regulation and policy. The effects of air pollutants on biodiversity are largely established through experimental research. The main requirement is to know the level of current impact to see if existing policy is adequate, or contribute to the case for further mitigation. Where localised effects occur, evidence of local damage (or likelihood of damage) is required for regulation of industry in the vicinity. The approach to determine the level of impact

⁴ Hopkins J.J., Allison H.M., Walmsley C.A., Gaywood M., and Thurgate G., 2007, Conserving Biodiversity in a changing climate: guidance on building capacity to adapt, Defra. <http://www.ukbap.org.uk/Library/BRIG/CBCCGuidance.pdf>

⁵ The MONARCH (Modelling Natural Resource Responses to Climate Change) a *synthesis for biodiversity conservation* (2007) report is the result of a seven-year partnership programme, lead by the government’s wildlife advisor Natural England. Available at http://www.ukcip.org.uk/index.php?option=com_content&task=view&id=331

and the role of sampling needs further investigation. For other pollutants such as industrial point source chemicals, a risk assessment approach has been proposed to help detect those approved chemicals that are beginning to create significant impacts on biodiversity. The aim is to provide evidence to allow re-examination of their approval. Risk assessment combines evaluations of chemical risk factors, actual usage, presence in the environment and relevant species, and population effects.

Exploitation

Exploitation is the direct/consumptive use of biodiversity *i.e.* of quarry species, wild harvested species, and accidental take of protected species. The goal is that both the use of biodiversity and the species populations are sustainable. Illegal take of species *e.g.* of birds of prey for falconry, is also direct exploitation but the goal is prevention/reducing the level of illegal activity.

Non natives

“*The Invasive Non-native Species Framework Strategy for GB*” strategy for the prevention of harmful impact of non natives on biodiversity in GB is based on CBD principles; i) prevention, ii) early detection iii) long term control. Prevention is achieved by bio-security measures aided by horizon scanning for non natives in Europe/along pathways, early detection feeds risk assessment and decisions on rapid control measures, whilst long term control is prioritised based on impact.

Table 2. Analysis of sampling need, current coverage, gaps/overlaps and recommendations for improvements in surveillance relating to objective 2.

Requirement for sampling	Current coverage	Gaps and Overlaps	Recommendations
<p>Habitat Transformation What are the types and rates of habitat conversion? What are the changes within habitats in structure and species composition that are linked to management change?</p> <ul style="list-style-type: none"> Habitat conversion and habitat structure/composition change is measured by objective 1 and no supplement is needed for objective 2. <p>What are the economic or policy drivers of this change?</p> <ul style="list-style-type: none"> To determine the economic or policy drivers for the observed change in habitats, analysis is needed before considering sampling <p>Has research established a link between the type of observed change, and factors driving land use change?</p> <p>Are the available social economic or conservation measure data able, through correlation, to establish likely factors driving change?</p> <p>Does the character of the observed change help target research or further sampling?</p> <p>If analysis and research cannot explain the change what is most economic way of adding co-variable sampling? (<i>i.e.</i> habitat/species and economic/land management sampling at the same locations)</p>	<p>Overall Coverage = moderate</p> <ul style="list-style-type: none"> See objective 1 for coverage of habitat conversion and habitat structure composition change Grazing effects, woodland management effects, and agricultural land management effects as cropping changes, have all been identified as drivers of change by interpreting species or habitat long term data (<i>e.g.</i> by grouping species trends by habitat – farmland/woodland birds, repeat habitat samples), and more precise relationships established by subsequent targeted research. Large scale agricultural land use data sets, land cover map increasingly used to help interpret sampling results. 	<p>Gaps include:</p> <ul style="list-style-type: none"> Good coverage of scale habitat land use change data, <i>i.e.</i> objective 1, to help interpret species/habitat population/condition trend data Easy access to agricultural, social, economic data sets for co-analysis 	<ul style="list-style-type: none"> Implement recommendations for objective 1 Promote open access to environmental, social and economic data sets and multi disciplinary analysis of data within the Environment Research Funder’s Forum (ERFF) Environmental Observation Framework (EOF).
<p>Climate Change Are land use changes linked to climate change actually effecting biodiversity (<i>e.g.</i> switches in crop types, increases in flood prevention)?</p>	<p>Overall coverage = moderate</p> <ul style="list-style-type: none"> Meteorological data is in use to help interpret existing objective 1 sampling. European context -Mechanisms are in 	<p>Gaps include:</p> <ul style="list-style-type: none"> Means of sampling connectivity/heterogeneity (<i>i.e.</i> growth of ecological networks) 	<ul style="list-style-type: none"> Implement objective 1 recommendations Establish whether the UK can be influential in improving European data

<ul style="list-style-type: none"> The measures of habitat change in objective 1 are adequate to quantify change, no supplement is needed. The steps above for determining the factors driving habitat transformation should pick up the climate driven factors. <p>Are the developing ecological networks helping biodiversity adapt to climate change (<i>i.e.</i> move, sustain populations)?</p> <ul style="list-style-type: none"> Habitat pattern at landscape scales is being measured by objective 1 Improving knowledge of the requirements of different species <i>e.g.</i> dispersal, may change what it is worth measuring to judge network effectiveness and growth, but the first step is to see if the measurements can be determined using existing sampling. <p>Are species and habitats moving as predicted within their climate space and what are the likely factors restricting them?</p> <ul style="list-style-type: none"> The combined habitat and species sampling for objective 1 will measure range change within UK To determine how this correlates with climate space change, the first step is to determine if co-analysis with available meteorological data helps explain change or develop better predictive models of change <p>Is the change across the whole range of the species and habitats (<i>e.g.</i> across Europe) different from within the UK so changing our relative responsibility for them</p> <ul style="list-style-type: none"> Access to sample data throughout the range of species (<i>e.g.</i> Europe) will help with modelling/predicting change, and is needed to pick up how change across the range influences within UK priority. <p>Are extreme weather events and phenological effects between species significant drivers of the observed change that need to be taken into account in adaptation/management plans?</p> <ul style="list-style-type: none"> Extreme weather event data are available as part of meteorological data. Picking out their effect emphasises the need for a proportion of objective 1 sampling to be based on annual time series. For phenological effects between species – measure phenological events across multiple species of different trophic levels at an experimental scale (<i>i.e.</i> intensive sampling at a small number of locations) <p>Is carbon sequestration by natural habitats increasing or decreasing?</p>	<p>place that can make sample data available across Europe <i>e.g.</i> Global Biodiversity Information Facility (GBIF), and growing networks of species sampling across Europe exist <i>e.g.</i> European breeding birds, butterflies.</p> <ul style="list-style-type: none"> Some regular time series monitoring programs exist, <i>e.g.</i> UKBMS Carbon content of soil is recorded by National Soils Inventory monitoring programme, and the Countryside Survey. Some research on phenological effects by the UK Phenology Network. 	<ul style="list-style-type: none"> Data accessibility at European scale is poor – need to establish a culture of data sharing to get the benefits of improvements like GBIF Means of encouraging comparable sampling across Europe 	<p>access/comparable sampling without increasing the reporting burdens.</p>
<p>Pollution Air pollutants (and nitrogen pollution from other sources) What are the impacts of nitrogen deposition and other diffuse pollutants with chronic effects on biodiversity and is more/better regulation/mitigation required?</p> <ul style="list-style-type: none"> Evidence of impact is required both broadly on change to biodiversity in the wider countryside and narrowly on 	<p>Overall coverage = partial</p> <ul style="list-style-type: none"> Research scale sampling in place to show impacts of pollutants, and distinguish it from other change, includes Environmental Change Network (ECN) and other small-scale research. There is a proposed expansion of the ECN to improve detection 	<p>Gaps include:</p> <ul style="list-style-type: none"> Representative sampling of ozone impacts, and possibly other pollutants Setting wider countryside effects in the context of air pollution, including both spatial and temporal aspects Identifying a signal clearly attributable 	<ul style="list-style-type: none"> Use results from research and small scale sampling to assess the need for representative sampling of additional pollutants Collation of evidence at different scales, including both research and wider countryside sampling to identify

<p>change to areas considered to be of high biodiversity value</p> <ul style="list-style-type: none"> ○ In the wider countryside, evidence of impact should ideally be linked to loss of ecosystem services, or transforming effects. Forecasting could be important. ○ High biodiversity value areas require a site-based assessment, possibly using indicators as well as modelling. <ul style="list-style-type: none"> • Is there evidence of a change over time attributable to nitrogen deposition and other air pollutants and does this provide evidence of recovery, stability (<i>status quo</i>) or decline? • Much of the current policy work utilises critical load/level exceedance mapping, and sampling is required to support the predictions of air pollution impact <p>Are specific point sources of pollutants, <i>e.g.</i> ammonia, having an impact on the condition of a specific site/sites or area of habitat so that evidence is available to support mitigation or reduction of pollution through regulation?</p> <ul style="list-style-type: none"> • Sampling at the site level using diagnostic tools for detecting both the pollutant and assessing bio-indicators of its effect is required 	<p>and attribution of pollutant and climate effects</p> <ul style="list-style-type: none"> • Interpretation of habitat/vegetation sampling can attribute change to eutrophication and in some instances more clearly to air pollution impacts • Bio-indicators for some pollutants established or under development (<i>e.g.</i> Ellenberg values for plants and epiphytic bryo/lichen sampling for airborne nitrogen compounds) • Some surveys currently underway looking at impacts close to major ammonia point sources to inform regulation. • Site-based sampling of point-source impacts currently sufficient as a result of ongoing programme. New requirements will be addressed as needed through response to casework 	<p>to critical load exceedance</p> <ul style="list-style-type: none"> • Clear attribution rather than correlation is often considered a gap, particularly given the potential for climate change impacts to have a similar signature. This needs to be reconsidered once a fuller collation has been completed 	<p>aspects where evidence is insufficient</p>
<p>Other chemical pollutants</p> <p>What is the evidence of the actual level of impact or potential impact for chemicals where a risk assessment for the chemical is triggered by any one factor <i>e.g.</i> research, usage levels, chemical risk, unexplained biodiversity declines?</p> <ul style="list-style-type: none"> • The majority of the parameters for risk assessment are provided by non biodiversity research or sampling. <i>E.g.</i> usage, chemical risk factors, direct measures of the chemical in the environment. • Objective 1 provides long term species sampling, and the chemical risk assessment process emphasise the need for this to contain higher food chain organisms (for bioaccumulating chemicals) and a range of other trophic levels, to have populations that will respond to other chemical impacts <i>e.g.</i> chemicals affecting plant reproduction. The difficulty in predicting which chemicals will pose a risk after approval means that it is not worth supplementing objective 1 sampling with possible target organisms for different pollutants. • For bioaccumulative chemicals there is a particular case for a tissue bank accumulating material for selected high food chain species, with samples having good temporal and geographical representation. This allows risk assessments to hind cast, <i>i.e.</i> see at the point of risk assessment the profile of accumulation and sub lethal effects. 	<ul style="list-style-type: none"> • The risk assessment approach for chemicals is established as a concept • Species population sampling is probably adequate (objective 1) as it provides robust long term trends of high food chain birds/mammals and trends for a wide range of other species that could be affected by non accumulating chemicals. • Long term tissue banks exist (Predatory Bird Monitoring Scheme) 	<ul style="list-style-type: none"> • An implemented risk assessment process • Secure long term programme of tissue collection 	<ul style="list-style-type: none"> • Establish cost and implementation options for the risk assessment process and support to long term tissue collection.

<p>Exploitation</p> <p>Sustainable exploitation</p> <ul style="list-style-type: none"> The first need is for sampling to determine population size/range change. No additional parameters are needed for species with stable exploitation and stable or increasing populations. For declining species or species where exploitation levels respond to availability/abundance, sampling of further population parameters is needed to determine a population model, and calculate a sustainable level of take and provide feedback into management measures. 	<p>Sustainable exploitation</p> <ul style="list-style-type: none"> The Environment Agency monitors the populations of freshwater fish. We need to investigate what monitoring is already in place for other exploited species, and decide whether this needs to be supplemented. 	<p>Gaps include:</p> <ul style="list-style-type: none"> Likely to be a few but for a tiny number of species 	
<p>Non natives</p> <p>Prevention</p> <ul style="list-style-type: none"> No within UK sampling requirement, but a need to connect to European and Global tracking and risk assessment of non-natives to focus prevention efforts <p>Early detection</p> <ul style="list-style-type: none"> The role of sampling is to trigger/feed risk assessments Bio security activities need to report interceptions Some pathways are predictable and sampling effort can be focussed around them to increase the chance of early detection It is not possible to predict all pathways or all points of arrival, so a very widespread detection effort capable of identifying non natives is needed across the geography of GB <p>Long term control</p> <ul style="list-style-type: none"> Judging the scale of impact of established species involves research/targeted sampling, but some relevant information will come if non natives are sampled as part of surveillance to determine the status and change of native biodiversity Long term control is mainly a locally delivered land management activity, and the sampling needed to target effort and measure success will be most cost effective if part of the control effort. 	<p>Prevention</p> <ul style="list-style-type: none"> European co-ordination <i>e.g.</i> The Delivering Alien Invasive Species Inventories for Europe (DAISIE) project has no sustainable basis as it is a research project. GBIF provides a mechanism to track and model non native spread. The mechanism works if other countries use it to provide access to their own sampling, but data supply by countries is very patchy. <p>Early detection</p> <ul style="list-style-type: none"> Interception information exists but is not collated and available for risk assessment alongside other early detection sources. Some pathways <i>e.g.</i> via horticultural industry, are recognised and more work is needed to see if voluntary or periodic professional effort could be targeted to improve early detection. The existing ‘hours in the field’ by volunteers and professionals for other sampling activities is high and provides a good early detection effort. The main gap is ‘turning on’ the quick reporting of their findings, providing professional and voluntary schemes with the capacity/means to report their data via the National Biodiversity Network, and the capacity of schemes sampling invertebrates to change from very long period reporting (decades). <p>Long term control</p> <ul style="list-style-type: none"> There is good coverage of non natives in the schemes designed to detect general change/status for birds, mammals, plants. 	<p>Gaps include:</p> <ul style="list-style-type: none"> Availability of global/European data Switching on rapid reporting and awareness across all existing sampling Sufficient resources to allow plant, invertebrate sampling to collate and report their observations quickly. Sufficient monitoring of soil organisms for non-natives. 	<ul style="list-style-type: none"> Provide a co-ordination, collation and interpretation mechanism that helps voluntary schemes report their observations quickly and target effort when necessary Provide this as an integral part of the mechanism recommended under objective 3 for BAP species.

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 is to assess the status of species and habitats covered by legislation and policy, in order to ensure that the reporting obligations of legislation and international commitments can be met. It determines their sampling needs, how much they are met by sampling in place for objectives 1 and 2, or if not what supplement is needed. Commitments largely focus priority on species or habitats that have undergone significant decline, or are vulnerable due to small population size or limited distribution. Ideally in the long term sampling for objectives 1 and 2 would provide the evidence for action that prevented 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 viable, and sampling can help target action and provide measures of progress.

The Wildlife & Countryside Act, The Habitats Directive, The Birds Directive, The Biodiversity Action Plan (and related Countryside Rights of Way act section 74 lists) collectively identify well over a thousand species and nearly a hundred habitats that have a legal or policy status. The Habitats Directive, through the Habitats Regulations, is alone in placing a specific requirement for surveillance of the conservation status of its listed species and habitats. However each legislative/policy mechanism includes a reporting or revision cycle, and an implicit surveillance need in order to be able to report.

Legislation has reduced direct pressures such as killing and disturbance on groups of species *e.g.* birds, bats, and plants, and some of the protected species covered are widespread and or common with healthy populations. As such they may have a role as the subject of sampling for objectives 1 and 2. Similarly some of the BAP species and habitats are widespread but declining and may also contribute to objectives 1 and 2. However the BAP process, and the Habitats and Birds Directives listings, were constructed using criteria that focused on vulnerable species or habitats *i.e.* typically small population size/area, or species or habitats that had undergone substantial declines so they are now scarce or rare. The sampling of restricted, rare and scarce species does not usually provide information for objectives 1 and 2, as by their nature rare/scare species/habitats represent a very small percentage of land area, often buffered from the pressures affecting the majority. Sampling vulnerable and declining biodiversity is however important as it provides a measure of progress against the World Summit on Sustainable Development (WSSD) target to "*significantly reduce the current rate of biodiversity loss by 2010*" and the Gothenburg target to halt biodiversity loss within the EU by 2010. It may therefore be necessary to supplement sampling of objectives 1 and 2.

Whilst the surveillance framework identifies gaps in surveillance that need to be filled, the frequency and scale of surveillance needs to be prioritised using a risk-based approach, and additional sampling should focus on species/habitats where a management response is possible, in order to make the best use of limited financial resources. For a fuller discussion of prioritisation of surveillance using a risk-based approach please visit <http://www.jncc.gov.uk/page-1775>.

The analysis of surveillance need table for Objective 2 is sub-divided into the different legislation and policies that have reporting obligations.

Table 3. Analysis of sampling need, current coverage, gaps/overlaps and recommendations for improvements in surveillance relating to objective 3

Analysis of sampling requirements	Principles for meeting the requirement	Current coverage	Gaps and overlaps	Recommendations
<p>Habitats Directive/Habitats Regulations</p> <ul style="list-style-type: none"> The Habitats Directive explicitly requires member States to implement surveillance of the conservation status of habitats and species of Community Interest, and to monitor incidental capture and kill of Annex IV species. The parameters for assessing conservation status are detailed in Article 1. For species these are population dynamics, natural range and habitat parameters; for habitats these are natural range and extent, structure and function, and conservation status of typical species for that habitat. The reporting time scale for the Directive is every 6 years (Article 17), but this does not mean that all parameters for all species and habitats must be sampled at this frequency. The directive does not specify the sensitivity, frequency or spatial scale of surveillance. <p>Summary of transposition The Habitats Directive is transposed into UK law by four sets of regulations, ‘The Conservation (Natural Habitats, &c.) (England and Wales) (Scotland) and (Northern Ireland) Regulations, as Amended in 1994, 2007, and 2009, and also by the Offshore Marine Conservation (Natural Habitats, &c) Regulations 2007 (as amended in 2009).</p> <p>Surveillance and Monitoring requirements</p> <ul style="list-style-type: none"> Article 11 of the Directive states: “Member States shall undertake surveillance of the conservation status of the natural habitats and species referred to in Article 2 with 	<p>Article 11</p> <ul style="list-style-type: none"> Identify all those Annex II, IV or V species and Annex I habitats which already have sufficient coverage of all parameters, either as species already sampled because of their value in providing a sensitive and representative measure of biodiversity status (Objective 1) or as an indicator species to help analyse pressures on biodiversity (Objective 2). Supplement the sampling in order to cover the remainder of species and habitats, using a risk-based approach to identify the appropriate scale (temporal and spatial) for sampling. Extra sampling will focus on species and habitats that are both at greatest risk and for which there may be a management response. Not all parameters need to be surveyed at the same frequency; the parameters that are most relevant and tractable (e.g. population dynamics) should be sampled with the greatest frequency. <p>Article 12.4</p> <ul style="list-style-type: none"> Identify those species in Annex IV that may be subject to incidental capture and killing (e.g. widespread, not found in just protected sites). Identify the means of incidental capture or killing. Monitor, whilst continuing to identify the scale of the problem and mitigating measures. The rigour of monitoring of incidental kill needs to be 	<p>This details the current coverage, gaps and overlaps, and recommendations identified by a JNCC overview completed in January 2009, and needs to be checked and revised by Country and Offshore analysis by the bodies now responsible under the regulation. Assessment of surveillance need is now the responsibility of CCW (Wales) NE (England), SNH (Scotland), DoE(NI) (Northern Ireland) and JNCC (Offshore only).</p> <p>Article 11</p> <ul style="list-style-type: none"> There are 70 terrestrial and freshwater habitat types listed under Annex I of the Habitats Directive that occur in the UK. 23 habitats have sufficient surveillance through Common Standards Monitoring with minor adjustments. This provides 6 year repeat cover for habitats substantially within protected sites. A further 3 habitats in GB (7 in NI) have sufficient coverage through Countryside Survey 1km samples and vegetation plots (but the lowland ecotypes of heathland in GB are not sufficiently covered). 5 woodland habitats in GB through the National Forest Inventory initiative on a timescale of 8-10 years. There are 74 terrestrial and freshwater species that are ordinarily resident in the UK and which occur on Annexes II, IV and V. 69 species have sufficient range surveillance (this includes 12 fish species which probably have sufficient range surveillance), 67 have sufficient population surveillance and 66 have sufficient habitat surveillance. 	<p>Provisional gaps will be subject to assessment of surveillance requirement at country level by the relevant conservation body.</p> <p>Article 11 Gaps include:</p> <ul style="list-style-type: none"> Sufficient coverage for 39 habitat types within the Annexes to the Directive. Sufficient range surveillance for 5 species, sufficient population surveillance for 7 species, and sufficient habitat surveillance for 8 species within the Annexes to the Directive. Knowledge of which Annex IV species are at risk from incidental capture and killing (and designing/ implementing additional surveillance to address these). <p>Overlaps include:</p> <ul style="list-style-type: none"> For some habitats where the imposition of different classifications can lead to overlaps and possibly ‘double counting’, e.g. the various scree types, it may be more appropriate to identify accurately the broad class with the capacity to sub-categorise where necessary (perhaps at a lower level of accuracy). 	<p>Article 11 Habitats</p> <ul style="list-style-type: none"> For the 39 habitat types with insufficient coverage, improve the inventories of their location, and devising a rolling programme of a representative sample of the resource for widespread habitats; or targeted surveillance of the overall resource for the rarest and most restricted Habitats Directive habitats, with a frequency that is appropriate to the level of threat and the ability to respond with conservation measures. Many of the habitat gaps could be addressed through the improvements to habitat surveillance suggested under Objective 1. The habitats surveillance framework is best designed holistically within Objective 1. <p>Species</p> <ul style="list-style-type: none"> Plan a rolling programme of surveillance for species with adequate current coverage (i.e. the next generation of targeted survey) using a risk-based approach and deciding where sampling would most help in directing conservation action. Adding to the rolling programme those species that do not have sufficient current surveillance

<p><i>particular regard to priority natural habitat types and priority species”</i></p> <p>All 4 sets of regulations require “an assessment of how, and to what extent, surveillance of the conservation status of each relevant habitat and species needs to be carried out, having regard to (i) whether a habitat or species is a priority natural habitat type or priority species; and (ii) the conservation status of the habitat or species.”</p> <ul style="list-style-type: none"> • Article 12.4 of the Directive concerns monitoring in relation to accidental capture and killing: <i>“Member states shall establish a system to monitor the accidental capture and killing of the animal species listed in Annex IV. In light of the information gathered, Member States shall take further research or conservation measures as required to ensure that incidental capture and killing does not have a significant negative impact on the species concerned.”</i> <p>All 4 sets of regulations require the risks of incidental capture and killing of species to be identified (and the activities giving rise to those risks), records of incidental capture and kill to be maintained, and an assessment to be made concerning the extent of monitoring of incidental capture and killing that is needed. Assessments need to take into account the risks and recorded instances of incidental capture and killing, whether species are priority species, and the conservation status of the species.</p> <p>The responsibility for both these assessment lies with Natural England (NE) (England), Countryside Council for Wales (CCW) (Wales), Scottish Natural Heritage (SNH) (Scotland), the Department of the Environment (N. Ireland) (DoE(NI)) (Northern Ireland) and JNCC (Offshore), as specified in the relevant regulation.</p>	<p>proportionate to the risk to the species, so that for those that are declining (where the factors are not known), or those that are vulnerable or priority species, the monitoring of incidental kill is a priority.</p> <p>Article 14.2</p> <ul style="list-style-type: none"> • Annex V species are included within the Article 11 surveillance, and hence their conservation status is monitored in line with the principles set out above. • Currently no Annex V species are considered to require additional surveillance beyond that provided for under Article 11 	<p>Article 12.4</p> <ul style="list-style-type: none"> • There are 27 Annex IV terrestrial and freshwater animal species in the UK, of which 6 out of 27 species are at Favourable Conservation Status (9 unknown), and thus unlikely to need special conservation measures to reduce incidental capture and kill. • The mechanisms for detecting incidental kill of all species due to chemical use on non-target- species are satisfactory (Wildlife Incident Investigation Scheme). • The Mammals on Roads scheme effectively detects road vehicle collision incidental kill, and there is an otter post-mortem tissue examination scheme, • There is a proposed project in England monitoring wind turbine impacts on local bat populations through incidental killing, together with work on mitigation. 	<p>Article 12.4</p> <p>For the Annex IV species identified as being at risk from incidental capture and killing, no gaps in monitoring coverage has been identified, although schemes could be extended or improved. There are no overlaps in monitoring for this article.</p>	<ul style="list-style-type: none"> • Adjusting the species component of some existing schemes (<i>e.g.</i> CSM, and where needed targeted surveillance), so that the protocols are clear, and the data is collated and published in easily accessible ways <i>e.g.</i> through the National Biodiversity Network. <p>Article 12.4</p> <ul style="list-style-type: none"> • The mechanism for detecting road vehicle collision incidental kill could be modified slightly to deal better with identifying where there is a higher likelihood of local population effects.
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<p>NE, JNCC, and CCW use the assessment to provide advice on surveillance need to the Secretary of State and the Welsh Ministers, who ensure that the necessary surveillance is carried out. For Scotland and Northern Ireland, SNH and DoE(NI) are responsible for ensuring surveillance is carried out in addition to assessing the surveillance need.</p> <ul style="list-style-type: none"> • Article 14 places a requirement for further surveillance of exploited species of flora and fauna listed in Annex V. Where necessary, Member States must take measures to ensure that any taking or exploitation is compatible with maintaining favourable conservation status. Article 14.2. <i>“Where such measures are deemed necessary, they shall include a continuation of the surveillance provided for in Article 11.”</i> <p>All 4 regulations require that in the light of surveillance carried out pursuant to Article 11, further arrangements must be made to continue surveillance to establish whether taking and exploitation of wild Annex V species is compatible with them being maintained at favourable conservation status. Arrangements must be made by the Secretary of State (England and Offshore), Welsh Ministers (Wales), Scottish Ministers (Scotland), and the DoE(NI) (Northern Ireland).</p>				
<p>Wildlife and Countryside Act Schedules 1-8 These Schedules regulate the ways in which species are exploited and provide strict protection to certain species. Strict protection is focussed (although not exclusively) on threatened species for which direct human collection or destruction poses a threat. There is no explicit requirement for surveillance of biodiversity. Schedules 5 and 8 are reviewed at 5-yearly intervals, and evidence of species declines or threats from human activity are taken into account.</p>	<p>There is no requirement for surveillance of the species that are currently on the schedules, as there is no associated reporting mechanism. When the schedules are reviewed, evidence from all relevant surveillance activities are taken into account.</p>	<p>Coverage is sufficient to make recommendations whenever the schedules are reviewed.</p>	<p>There are no surveillance gaps. General surveillance under Objective 1 and special reporting of threats from human collection are sufficient.</p>	<p>No changes required.</p>
<p>Birds Directive The Birds Directive has a mixture of explicit</p>	<p>To be completed.</p>	<p>Analysis of coverage needs to be completed</p>	<p>Analysis of gaps and overlaps needs to be completed.</p>	<p>Recommendations need to be completed.</p>

<p>and implicit monitoring obligations that relate to maintaining the status of all native wild-living bird species.</p> <p>Analysis of monitoring requirements needs to be completed.</p>				
<p>Water Framework Directive Member States shall ensure the establishment of programmes for the monitoring of water status in order to establish a coherent and comprehensive overview of water status within each river basin district:</p> <ul style="list-style-type: none"> for surface waters such programmes shall cover: <ul style="list-style-type: none"> (i) the volume and level or rate of flow to the extent relevant for ecological and chemical status and ecological potential, and (ii) the ecological and chemical status and ecological potential; for groundwaters such programmes shall cover monitoring of the chemical and quantitative status, for protected areas the above programmes shall be supplemented by those specifications contained in Community legislation under which the individual protected areas have been established. 	<ul style="list-style-type: none"> The UK is obliged to produce an integrated monitoring programme that conforms with the detailed requirements included in the Annexes to the Directive. The Surveillance Strategy work needs to analyse the UK plans for WFD monitoring, and consider how they integrate with other surveillance included in the framework. 	<p>Analysis of coverage needs to be completed</p>	<p>Analysis of gaps and overlaps needs to be completed.</p>	<p>Recommendations need to be completed.</p>
<p>Biodiversity Action Plan priority species and habitats</p> <ul style="list-style-type: none"> The UK Biodiversity Action Plan scheme was the UK's response to the Convention on Biological Diversity, signed in Rio de Janeiro in 1992. <p>CBD Article 7: "Identification and Monitoring Each Contracting Party shall, as far as possible and appropriate, in particular for the purposes of Articles 8-10:</p> <ol style="list-style-type: none"> Identify components of biological diversity important for its conservation and sustainable use having regard to the indicative list of categories set down in Annex I; Monitor, through sampling and other techniques, the 	<ul style="list-style-type: none"> Survey BAP priority species and habitats to determine if the targets and ultimate success criteria are met. Ensure sampling takes place regularly to meet the reporting/review cycles of 3-6 years. Note that this will not be possible for every species and habitat. 	<p>BAP priority species and habitats</p> <ul style="list-style-type: none"> 302 of 1061 species have adequate surveillance coverage for UK BAP reporting with sampling that can measure targets/success criteria within 6 years (N.b. adequacy number does not include fish as it has not been assessed). Coverage best for Birds, Mammals, Butterflies (Breeding Birds Survey, UKBMS, Tracking Mammals Partnership schemes) 9 of 42 habitats have adequate surveillance coverage for UK BAP reporting with sampling that can measure success criteria but within 8-10 years (Countryside Survey) 	<p>Gaps include:</p> <ul style="list-style-type: none"> Surveillance of species – the majority of plants, bryophytes, lichens and invertebrates. <p>Overlaps include:</p> <ul style="list-style-type: none"> Covered species tend to be good candidates for objective 1 sampling as widespread and economic to sample Sampling the gaps species every 6 years would in many cases divert a limited voluntary expert resource from advising on how to deliver the targets for the species <i>e.g.</i> advising habitat plans. 	<p>Species</p> <ul style="list-style-type: none"> Provide a co-ordination, collation and interpretation mechanism that help the voluntary experts in plant, lichen, bryophyte and invertebrate groups: <ul style="list-style-type: none"> Adopt a risk based method of deciding where sampling would help most in directing conservation action Plan coverage of species over a longer timescale <i>e.g.</i> 15 years (success criteria are long term goals) Collate the available sampling and provide access to it through NBN Provide the best advice on where urgent sampling needs can only

<p>components of biological diversity identified pursuant to subparagraph (a) above, paying particular attention to those requiring urgent conservation measures and those which offer the greatest potential for sustainable use.”</p> <ul style="list-style-type: none"> • The UK biodiversity action plan priority species and habitats have associated outcome related targets (<i>e.g.</i> population, extent condition), and currently success criteria are being designed for the point at which they no longer need priority attention, again defined by outcome measures • Reporting will be a country led process; the time table of each country strategy differing but reporting/review cycles are typically 3-6 years. 				<p>be met by professional supplement.</p> <p>This mechanism would also meet the needs for detection and reporting of non natives across the same species groups, for HSD gap species, and should also be used to deliver assessment of SSSI condition assessment to relevant species features.</p> <p>Habitats</p> <ul style="list-style-type: none"> • The gaps should be addressed within the recommendations for improving habitat surveillance within Objective 1.
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