



Measuring Change in the Countryside: New approaches to monitoring and data-sharing

Workshop Report

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Express by holiday inn London City, 275 Old Street, London, EC1V 9LN

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Measuring Change in the Countryside: New approaches to monitoring and data-sharing

Workshop Report

Objectives

Given the significant changes to our countryside and the developing policy agenda, it is timely to consider our approach to countryside monitoring. This LWEC workshop was organised in response to a request from DEFRA and NERC who are keen to gain ideas for the future of their investments in measuring change in the countryside, particularly in respect of Countryside Survey. However, the solutions to measuring change need to take into account the monitoring undertaken by public agencies and the very significant contribution of the voluntary sector.

There are pressures and opportunities to achieve efficiencies, to develop a more integrated approach, to develop a closer engagement with citizens, and to make use of the latest technology. There is also a need to increase the focus on ecosystems and the delivery of ecosystem services.

The emphasis at the workshop was to come up with outline solutions that could help us improve the way change is measured, or improve data access and analysis, in order to provide the best balance of evidence given the pressures we face. Specifically the workshop aimed to explore options and opportunities and practical solutions to the issues the UK faces by focussing on:

- Measuring change, e.g. through monitoring, surveillance and observations
- Exploring options and opportunities, not issues
- Exploring practical approaches to opportunities to reach tangible outcomes
- Focussing in on priorities
- Developing a shared sense of direction and taking ownership for the next steps
- Recognising the new emphasis and opportunities through the Big Society approach

Key outputs – Identifying and exploring options and opportunities

Small groups were asked to consider ideas and solutions to the following questions:

- How do we measure ecosystem change?
- What meaningful changes could we make to measuring change?

In small groups participants brainstormed options and opportunities (these are transcribed in Annex A) and were asked to prioritise these and select their top ideas that were then presented back to the wider group. These were then clustered into five main themes`.

1. Strategic approach
2. Concept
3. Data, databases and analysis
4. Process models
5. Operationalising Earth Observation (and other technologies)

General approaches to considering these opportunities were then considered in more detail and are given below.

1. Strategic approach

The UK needs a unified approach to ecosystem services that will allow us to measure change and meet policy, operational and research requirements (e.g. water quality, biodiversity directives). An agreed strategic approach, or framework, should identify a vision and consider how ecosystem services (including well-being) and the resilience of ecosystems, habitats and species might be evaluated through measuring change. This approach should capitalise on our existing investments and include a forum for knowledge exchange and expertise that will draw on and make more use of existing schemes, information and data sets and look for areas that could be modified (e.g. Countryside Survey) before identifying areas where new work is needed. Part of this will be developing a conceptual model (2).

General Approach: We will start from what information we need on change, in order to inform our policy, operational and research requirements. Then to map the links and dependencies between these information needs. Full use must be made of the existing analysis and products from the UKEOF.

The approach would explore the use of the National Ecosystem Assessment to frame these needs, identify the utility of existing measurements and identify gaps and redundancy. It will provide the structure for more detailed investigations of how measures of service (for example, crops, water supply) depend on components of the environment, and how measure of these will help assess resilience or improve service measures. An iterative process will then allow existing countryside change measurements to be adapted to improve service quantification and valuation. It will also require a move towards dealing with the whole landscape and its components so that choices can be made in relation to different ecosystem services. For example the approach should consider “saturation” of service delivery and trade-offs that might need to be made. This would require a move towards a more ecosystem function approach, for example the relationship between “pollinator function” and ecosystem structure. The approach should include understanding the links between biodiversity and ecosystem services, and at a more fundamental level the links between physical, chemical and biological measurements.

Advantages:

- A unifying framework to realign existing measurements
- Focus on recording things that matter in relation to measuring change and policy relevance
- More relevant to people from a range of sectors
- Greater understanding of cause and effect at both the local and global scales
- Make better use of existing environmental data and increase its influence. Able to target resources towards outcomes and therefore be more cost-effective
- Better links between the biological and physical measurements
- Enable the effect of different scenarios to be demonstrated
- Help meet international commitments

Challenges:

- Needs clear political commitment and leadership for the ecosystems approach (e.g. used by NEA)
- New and complex approach – how will this be carried out and communicated?
- Lack of understanding – priorities and values may change over time
- Implementing approach in a realistic timescale

- Cultural change required – see Concept (2)

Feasibility: Only feasible with strong leadership. Measurements can continue as they are with subsequent evolution and re-interpretation to fit the strategic approach. However, this will depend on the spatial scales being used and how we might want to compare measurements and set benchmarks.

Implementation requires top down commitment and strong leadership with the ability to re-focus existing investment to implement priorities. The NEA is providing a standard list of ecosystem services that will need to be agreed through consultation. Implementation will include:

- Building knowledge of what environmental components (processes) affect the scale and resilience of individual services and then identifying where existing monitoring systems can provide data or what modification or addition is needed
- Reinterpret existing surveillance in the light of process and ecological functions
- When indicators or measures of the ecosystem functions are clearly identified, finding the best way to implement them including identifying where this suits delivery by volunteers.
- Research and development into improved functional characteristics
- Develop better linked social and economic needs
- Greater support and encouragement of volunteer input

2. Concept

The concept needs to include building on and providing coordinated direction for volunteer or recorder capacity that will support the strategic approach and vision (1), for example through a better understanding of the measurements volunteer and professionals currently undertake. Consideration needs to be given to where resources (both professional and voluntary) can be shared. New technologies should be considered, for example, those associated with the internet, which can have a large impact on the integration and interaction with volunteers and take a significant cost out of data handling.

General Approach: To better understand how change might be detected, the strategic approach (1) should consider how a framework (surveillance and targeted measurements) might fit together and build on existing good practice. How could collaboration and sharing of resources make this happen while safeguarding the existing volunteer base and expanding citizen engagement? The concept centres on partnerships between professionals, volunteers and citizen activity to provide data on ecosystem services. An honest, clearly expressed approach, with identified benefits to public survey and engagement (separate from education and health) is needed that takes into account the full ecosystems approach. The aim will be to target volunteer effort and encourage the collection of data for its utility and, build capacity, trust and awareness.

Advantages:

- Recognises a UK framework for that provides a focus for collective action
- Brings together all current networks to jointly plan and share resources based on the most efficient delivery mechanism.
- Nested framework to include national and local surveillance
- Provides a steer for the Localism agenda
- Keeps and builds on existing highly skilled volunteers
- Develop pride in local area, social capital, physical and mental health

- More comprehensive spatial and temporal coverage of data (e.g. for water or soil) that will increase the likelihood of detecting change
- Engagement with the public to raise their awareness of their impact on the natural environment and what they can do to help.
- Cost effective – delivers more with less

Challenges:

- Barriers to sharing and open multiple use of public funded data
- Timing in relation to political decisions both in the UK and Europe
- Partnerships sometimes require long-term planning and governance to ensure resources and objectives are shared
- Attaining a “good enough” coverage of all aspects needed measuring – How to quality assure the data and ensure that it is used?
- Gaps in geographical coverage
- Engagement of additional citizens to provide a useful contribution to ecological monitoring
- Matching the value of what people are able or interested in measuring against what measurements are needed to address issues of change – competition with other activities
- Each domain (e.g. birds, plants) considered separately by volunteers
- Providing feedback to volunteers - documentation of experiences across volunteer sectors and learning from other schemes
- Health and safety constraints
- Influencing the pan-European approach to measuring change

Feasibility: High feasibility by building on existing good practice and being based on strategy (1). The conceptual framework would need to evolve to bring in more efficient protocols and ensure historical data is analysed. There may be trade-offs between professionals and volunteers in the assurance of quality of information needed, therefore there may need to be some quality control equivalence appropriate to the task across professional and non-professional bodies. Implementation will need to take into account generational constraints, for example in the use of technology and new electronic tools.

Implementation: Should identify and build on best practice and existing structures (both inside and outside UK), and invest in building capacity in under-represented areas. This will require a clear steer from policy based on strategy (1) – possibly with ministerial sign-up to the collaboration, but should clearly address bottom up, local needs. Focus should be around innovation and intervention planning. Initially implementation should start with pilot schemes that will enable:

- Surveillance framework where joint planning is possible
- Building on existing frameworks of volunteer sampling to deliver new or modified requirements
- Joint research and calibration to allow the transition of surveillance from traditionally professional to voluntary solutions
- Technical investment to improve the collection of samples or data by volunteers
- Partnerships between professional and voluntary organisations
- Identification of gaps which volunteers cannot fill

Consideration will need to be given to data issues (“dataland”) and statistical power. This may require structured biological recording schemes to become unstructured. Implementation should

consider the use of modern technology – for example a competition to develop a recording application for smart phones.

3. Data, databases and data analysis

How do we share and analyse data more effectively (including with NGOs/citizens)? How can we use existing data to answer questions about ecosystem services? For example, can information on species traits provide a functional understanding of drivers of change?

General Approach: Concentrate on primary users and their knowledge of the range of data sets that can contribute to the analysis of measuring change – i.e. a focus on identifying the data and products needed to measure change. Consideration should be given to the techniques used in this analysis and their interpretational limits. The approach needs to identify blocks (including conflicting policies) to the access and sharing of data that is fit for purpose and relevant.

Advantages:

- Existing proposals at cabinet office level e.g. data.gov.uk initiative
- Can act together from the same information base
- Better environmental outcomes and value from public investment
- Refine the problem of accessing data down to a few key improvements such as collection, access, legal demands, etc...
- Provide evidence on the impact of change
- Analytically, more could be done to reduce the monitoring demand
- Could generate income if used by SMEs etc.

Challenges:

- Organisational IPR and data licence/charges – policy conflicts need resolving
- Not all government bodies are part of the cabinet office proposal
- Current arrangements do not include access by NGO's and equivalent
- Commercial data
- Need to breakdown procedural/cultural barriers (e.g. practitioners, lawyers and policy)
- Competitive relationships

Feasibility: Dependent on political will. Partnerships need to be implemented to improve data sharing with the short-term aim of gaining sight of the immediate gaps.

Implementation: Initially implementation should be via a small working group, with a small resource to document solution, a forum to enable people to talk to each other on how we might use existing data better, and to grow partnerships from existing agency-agency agreements. Links should be made to the EU “lifewatch” data infrastructure – for example CEH could develop “lifewatch” for the UK.

4. Process models

Understanding and using biological and natural processes is at the heart of this option. To do this, clarity is needed over what we are measuring and why. Consideration needs to be given to weather measurements can be linked to models under a single framework, how rates of change are

measure and how uncertainty can be analysed better. The overall aim would be for this to be expressed spatially so that the national change picture can be connected to where change is occurring locally.

General Approach: Interpret existing surveillance approaches in the light of processes that underpin ecosystem services e.g. nutrient flows, carbon flows and sequestration, water flows etc. The aim is to ensure that we are measuring the attributes that are critical to assessing change and impact. An example is our fixation on vegetation structure rather than measuring the physical attributes of ground temperature or gaps that allow plant life cycles to operate?

Advantages:

- More resilient and relevant measures used to assess change in the environment
- Better understanding of ecosystem functions with simple equipment (e.g. measuring decomposition)
- Develop models of how fast change is occurring and how variable change is
- Inform forecasting and enable better scenario evaluations

Challenges:

- Linking measurements and indicators to processes
- Links from process to products cost money – release of resources from other areas
- Lack of existing techniques and insufficient spatial resolution
- Instrumentation of large areas needed

Feasibility: Depends on the prioritisation and sharing of resources and agreement on key areas to model. The general approach will require a greater focus on integrated system models or model chains.

Implementation: Should initially be addressed by the application of existing knowledge derived from research based studies rather than a new programme of research. A wide range of organisations (Research Councils, Government Departments, agencies and NGOs) need to be included. Implementation should build on opportunities within large activities such as Biodiversity and Ecosystem Service Sustainability, National Ecosystem Assessment, Virtual Observatory and the Valuation Network. Specifically, implementation should:

- Build on a UK framework (1) that will balance “new” priorities (based on National Ecosystem Assessment and Foresight studies) against “existing” priorities
- Consider training of system modellers with ecological and biogeochemical expertise that can help underpin a resilient green economy
- Decrease the emphasis on non-functional measurements and indicators of change
- Research into aspects of positive change that can assess the effectiveness of mitigation and adaptation

5. Operationalising Earth Observations (and other technologies)

There is an opportunity here to tackle questions such as the equitable sharing of resources (e.g. remote sensing) as well as take advantage of technologies that will significantly improve our ability to measure change (e.g. Lidar, automated data collection, intelligent networks). There is a need for high resolution data to be included within sampling frameworks (e.g. of species) that will allow a wide range of habitats to be assessed for their extent and quality. The aim would be produce an integrated approach that will combine products from recording schemes (e.g. by volunteers) with

that of Earth Observation to produce a “land information system”. This approach will require links to Europe.

General Approach: The first priority is to mobilise existing data and technology for operational uses. There already exists a wealth of routines and studies that show how EO, airborne and ship-based data can be used for wider purposes but this needs elaboration into the day to day needs of real coal face users. This requires serious exchange of ideas between the users and the technologists.

Advantages:

- Can look at the land surface (including lakes and coastal)
- Can equally look at the seabed and underwater features
- Possible continuous change detection
- Multiple scales can be addressed, from coarse to fine, by integrating satellite data, LIDAR and digital photos with spatial datasets that are object orientated and aircraft data.
- Provide an up to date and current time series
- Add value through combining data
- Partnership and cooperation is needed (including from Ordnance Survey)
- Open access data
- Can lead to better models and predictions of change

Challenges:

- Joining up technology specialists with coal face users – no good to say “we have created all these products how can you use them”
- How to deal with the data streaming and data access issues
- Needs to be a paradigm shift in data management and design of systems
- Bringing data together (under objects)
- Data validation – quality assurance and quality control
- EU context, collaboration and sharing

Feasibility: There are already examples of this, for example sharing access to data. However, in other areas more work might be needed (e.g. instrumenting commercial vehicles). This may be possible if implemented in modules that would bring together HPC, Aircraft, Satellites, near ground proofing (which could also provide a focus for ground surveys), and link landscape features with processes.

Implementation: Will initially consider re-examining how we measure change currently to see where Earth Observational data can be processed to meet the needs whilst also identifying where further innovation in EO is likely to have benefits medium and longer term. Looking at how data from multiple sources can be combined (eg: HPC, aircraft, satellites and other sources eg: master map) to meeting needs. A modularised plan will need to be put in place and tested, for example, in ecological restoration zones. Implementation will require both national and international collaboration and be INSPIRE compliant. It will need to include an informatics component.

Next steps

The advisory group¹ want to encourage participants to discuss their own activities and take forward workshop actions together. The advisory group will then take a shared responsibility for hosting a forum for participants to inform and share their activities, and will help provide ideas and discuss suggestions to take forward. This will build on and use existing frameworks and responsibilities (e.g. the LWEC Directorate and Ecosystems Challenge Steering Group; UKEOF) and link with other initiatives.

Action needed on each of the identified areas

1. Strategic approach

- Link with marine monitoring, international activity, better communications and sharing of tools/info through UKEOF.
- Identify a series of analytical steps that we might undertake to develop a clear and agreed vision or framework for countryside change sampling in the UK as an aid to country and specific monitoring initiative reviews.

2. Concept – shared planning of change measurement between agencies, research and with NGOs

- Initiatives encouraged at a variety of scales (local, country, UK, bilateral and multilateral).
- NGO involvement in re-designing the frameworks to meeting policy and research needs and their adaptation to support ecosystem service measurement.

3. Databases and analysis

- Coordination and linking of data relating to measuring change is needed. Once established clear links need to be made with the Environmental Information Framework (EIF) and other data initiatives such as “my environment” website and the Biological Records Centre.
- Advisory group will keep a watching brief in this area and actions will be developed once new initiatives such as the EIF have been established.

4. Process models

- There are a number of areas here that need to be explored in more detail e.g.:
 - Efficiencies in the number of models that can link science into practice
 - Prioritisation of models that will enable change to be measured
 - How will models be evaluated?
 - Identification areas at risk of change (or “hot spots”)
 - Role of intensive study sites, issues of scaling up and linkages
 - How do annual measurement relate to longer term change?
- Suggest small review and another focused workshop in this area.

5. Operationalising Earth Observation (and other technologies)

¹ Peter Costigan (Defra), Mark Bailey (CEH), Terry Parr (CEH), Lawrence Way (JNCC), Keith Porter (NE) , Dan Osborn (NERC), Nichola Badcock (LWEC) / Lizzie Jones (NERC)

- CEH, NCEO, EA, JNCC and operational agencies to collaborate to identify key opportunities to deliver country side change measurements at an operational scale more cost effectively through EO.

Annex A. Attendees

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