CEH SCIENCE AREAS

- Biosphere-Atmosphere Interactions
- Ecological Processes & Resilience
- Monitoring & Observation Systems
- Natural Capital
- Natural Hazards
- Pollution & Environmental Risk
- Soil
- Sustainable Land Management
- Water Resources

SUMMARY

ENVIRONMENTAL INFORMATICS

Data management, tools and systems for science excellence and impact.

Context

Understanding today's environmental challenges requires the marshalling of world-wide information and data. Scientific, commercial and societal objectives depend on high quality data and analysis tools. CEH has decades of experience in collection, analysis and dissemination of environmental information. We possess unique long-term, large-scale datasets that describe the state of the environment and, together with modelling expertise, help to predict the future. CEH's Environmental Information Data Centre (EIDC) works with the terrestrial and freshwater sciences community to ensure these datasets are secure and accessible. Alongside our data management role, we are continually advancing our informatics capabilities to address major societal and environmental issues.

Our Research

CEH's standing as a world-class research centre requires world-class environmental information services. Such services support integrated analysis and assessment of environmental issues through access to high quality data and informatics tools. CEH has developed discipline-leading data management capabilities through its Environmental Information Data Centre (EIDC). Building on this, Environmental Informatics activities will underpin CEH's science excellence and impact by increasing capability to exploit available information and data.

Innovative ways to realise the potential of CEH-held data will be delivered through:

- producing a web-based Land Water Information System linking a range of spatial and time-series data with modelling and visualisation tools.
- aligning CEH's flagship data holdings (e.g. Biological Records Centre, Environmental Change Network, National River Flow Archive) to provide a unified research resource.
- integrating a range of environmental data to produce 1km maps of natural capital at national and regional scales.
- promoting service-oriented approaches in the development and dissemination of CEH's data, tools and services.
- applying web-based workflows to provide repeatable application of data, models and analytical tools on-demand.
- exploiting Big Data opportunities using cloud and high performance computing.
- leading environmental informatics internationally through our ontology and Linked Open Data work.
- supporting the NERC Environmental 'Omics Synthesis Centre and NERC Environmental Bioinformatics Centre (NEBC).
- exploiting mobile technologies to further citizen science in creation, dissemination and evaluation of environmental information.
- promoting best practice in data management across the terrestrial and freshwater sector.

Centre for Ecology & Hydrology
NATURAL ENVIRONMENT RESEARCH COUNCIL

enquiries@ceh.ac.uk
www.ceh.ac.uk

Science Excellence to Impact

<1990

1964: **Biological Records Centre** (BRC) established.

1978: First **Countryside Survey** dataset produced; expanded surveys in 1984, 1990, 1998 and 2007 allow assessment of change in UK countryside.

1978: Surface Water Archive of Great Britain (now National River Flow Archive) transfers to CEH (then the Institute of Hydrology).

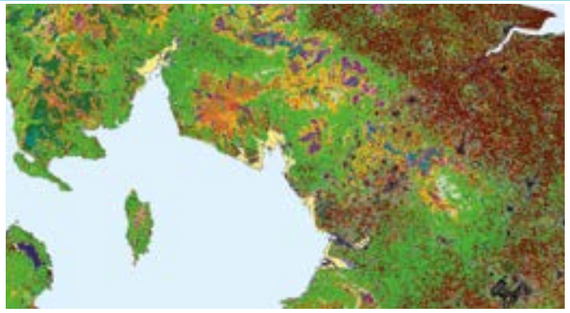
1985: CEH produces the **HYDATA** system for processing hydrometeorological data, by the 1990s it was the national surface water database system for >20 countries.

1990s

1990: First **Land Cover Map** for GB derived from satellite imagery produced, followed by LCM2000 and LCM2007.

1992: **Environmental Change Network** launched with CEH coordination, data management and dissemination.

1994: CEH starts to produce annual greenhouse gas emissions data for Land Use, Land Use Change and Forestry sectors for UK reporting to the EU and UN.



2000s

2000: The **National Biodiversity Network** is formed; CEH hosts and develops the NBN Gateway, which by 2013 holds over 90 million records.

2002: **NERC Environmental Bioinformatics Centre** established, providing informatics tools and data management services to NERC 'omics projects.

2006: **EIDC** established as a NERC Data Centre, for the UK terrestrial and freshwater sciences.

2006: CEH creates **NitroEurope** online database tools to share forest data between the 60 EU project partners investigating nitrogen cycle and greenhouse gas balance.

2007: An informatics appproach to **Countryside Survey 2007** enables reporting a year earlier than previous rounds, and an estimated saving of £700K.

2010s

2010: **CEH Information Gateway** provides access to environmental data held by CEH, and shares records with UK data.gov.uk and EC INSPIRE portal; it contains 288 records and has >2500 registered users.

2010: CEH co-lead the NERC **Environmental Virtual Observatory Pilot** to link multidisciplinary research with strategic science and policy questions using cloud computing.

2011: EIDC formalises its role in helping researchers meet journal, funder and legal requirements and begins to mint Digital Object Identifiers (DOIs) for deposited data sets, >100 datasets are fully documented and secured, and >50 datasets are citable and guaranteed available in perpetuity via DOIs.

2012: The BGS & CEH ***my*Soil** smartphone app shares soil datasets and can crowd source new data; by 2013 it has >12,000 users.

Photos: CEH

Future Research Objectives

Making data accessible, understandable and exploitable.

By 2019, we will:

- *enable the safeguarding, citation and sharing of data to emerging journal and Open Data Initiative standards.*
- *deliver a new web-based software tool to enable natural capital maps to be generated on-demand through statistical analysis of site-based and national datasets.*
- *produce a Land Water Information System to deliver a wide range of data linked to analysis and visualisation tools.*

Bringing together measurements and observation across datasets and locations.

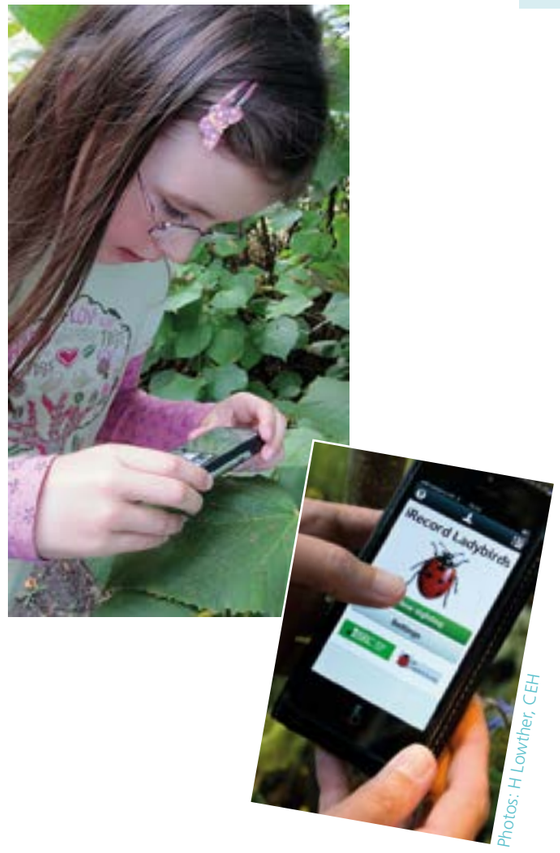
By 2019, we will:

- *deliver web tools to provide access to field measurements and observations in international standard formats.*
- *develop new controlled vocabularies, data dictionaries and thesauri to support the description of data generated by the new Science Areas (e.g. Soils, Natural Capital).*
- *produce web tools and mobile apps, to enable creation, access and updates to data in the field, and the automatic capture of invaluable metadata at the point of data collection.*
- *use common dictionaries and data formats to present major monitoring data as a unified resource, enabling questions such as "show me data in this catchment with measurements relevant to Dissolved Organic Carbon".*

Deriving valuable information and knowledge from available data.

By 2019, we will:

- *deliver cloud-based web tools to enable users to determine the best predictions by assessing the uncertainty estimates from different analytical workflow runs.*
- *provide interoperable long-term monitoring data and analysis tools that will facilitate questions such as, "show me all locations where Dissolved Organic Carbon levels have increased by 5% since 2003."*



Photos: H Lowther, CEH

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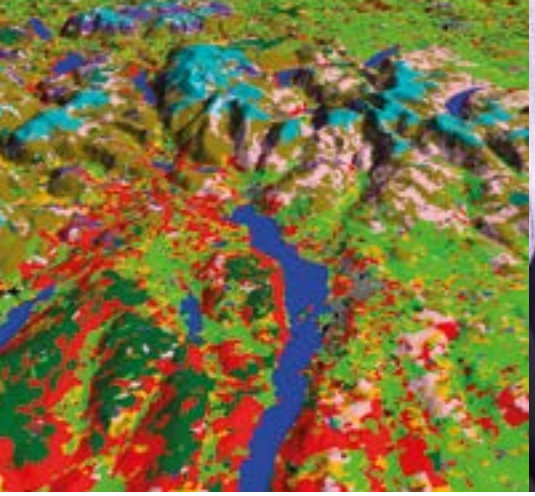

Partnerships

Environmental Informatics activities will involve CEH staff from all disciplines and will underpin developments in all Science Areas. We will ensure alignment with similar initiatives elsewhere in CEH, NERC and Research Councils UK, the HEI sector and JISC. We will work with government departments, agencies and devolved administrations across the UK, and will build links with the third sector. Much of our work will be conducted with organisations overseas (e.g. Partnership for European Environmental Research, the US Geological Survey, and CSIRO in Australia), relevant EU and UN agencies, international programmes (e.g. Global Earth Obersvation System of Systems, Copernicus, Belmont Forum), and international standards organisations. We also see opportunity to derive greater impact from our data and informatics capabilities through the development of strategic alliances with key businesses (e.g. ESRI, Microsoft Research) and via the Environmental Science to Services Partnership.

Environmental Information Data Centre (EIDC)

EIDC is the NERC Data Centre for the Terrestrial and Freshwater Sciences.

You can deposit datasets with the EIDC so they are secure, accessible and citable.

- We can help you document and format your data so it can be made secure for future re-use.
- We can issue DOIs for datasets so your data can be cited.
- We can share your data through many portals to maximise its impact.

You can access, view and download datasets from the CEH Information Gateway: **gateway.ceh.ac.uk**

Contact

Director, Environmental Informatics
Gwyn Rees. hgrees@ceh.ac.uk

Business Development Manager
Colin Mackechnie. cmackechnie@ceh.ac.uk

Science Coordinator
Anita Weatherby. anita@ceh.ac.uk

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