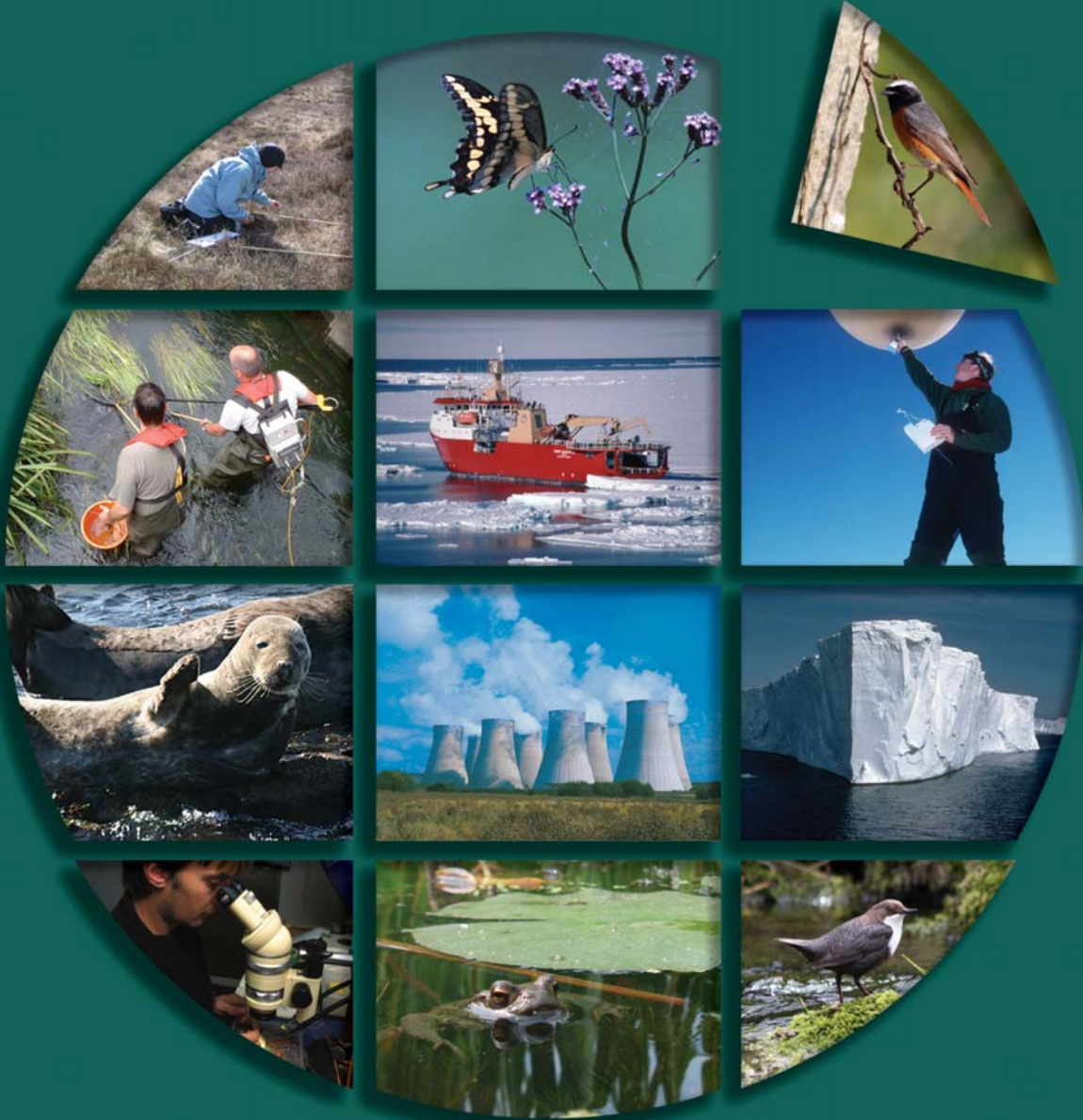


UK Environmental Observation Framework



A Vision for the UK's cultural shift in sharing environmental observation evidence

Version 4.0 – Summer 2010

Executive Summary

PLEASE NOTE THIS IS CORRECT AT SEPTEMBER 2010 AND MAY NEED TO BE REVISED WHEN THE IMPACTS OF THE EIF AND OTHER DATA INITIATIVES WHICH ENCOMPUS THE WORK AREAS ARE CLEAR.

The need for data sharing

The UK spends at least £300m per annum on environmental observations. In 2006 ERFF estimated that 80% of the output from observations is not shared and there are significant barriers to the awareness and discovery and use of data such as cultural and technical issues as well as licence constraints. Data management is often poorly resourced and managed as if it is an afterthought to contracts or projects. There is often little reward or incentive for the original collector to share data. However, there is an increasing need for improved data discovery and sharing capability at the UK, EU, and global levels.

The UK vision for data sharing

In 2008 The UK- EOF articulated the issues and produced a paper outlining the legal, institutional, cultural and technical aspects of data sharing. A Senior Governmental Think Tank was then run to discuss the issues and agree the vision for data so that:

People/organisations in "UK plc" actually share and reuse environmental observation data to inform policy decisions, expand knowledge, contribute to international activities, stimulate markets for innovation, improve operational capabilities and improve their responses to the changing environment.

Sharing Environmental Observation Data "Think Tank" 9th September 2008.

Since the Think Tank, the gap between the expected outcomes of the existing data initiatives and the vision has been explored and through continued consultation with data specialists, user organisations and publishers, potential solutions proposed.

Overall there needs to a cultural shift in the way that data is valued and therefore how it is managed and shared. Strong leadership and communication will be essential to initiate a number of interrelated projects across the broad and diverse community. The proposed actions have been grouped into 6 Work Areas:

- A. Tools for discovery- e.g. the Observation Activity Catalogue
- B. Suitability for re-use and quality assessment
- C. Assessing the status of the UK's ability to store, manage, and share data
- D. Providing a focal point for communications and coordination
- E. Changing behaviours through data management policies, contracts and citations
- F. Ensuring an appropriate UK technical Infrastructure and resources

The Work areas are deliberately ambitious and visionary. The actions required to enact the full UK vision could be achieved in a number of ways. However achieving the goals is reliant on the full cooperation of the community from funders to managers and users. Many EU, global and national initiatives are already working to standardise the methodologies for environmental data management. This Vision and Action Plan seeks to maximise the potential for collaboration and efficiency and to ensure

environmental observation information is accessible by those who need it, when they need it.

The role of the UK-EOF may be to undertake the work; let, manage or facilitate the work; or to encourage others to lead each area in part or in whole. In the first instance the UK-EOF will focus on work packages A and D. With the establishment of a Data Advisory Group and the online UK-EOF Environmental Observation Activities Catalogue, the Data Initiative project has progressed from initial planning into implementing actions in order to achieve the UK's vision.

Future Challenges for sharing knowledge and data

While significant progress has been made toward achieving the vision, there is still much to be done. Future challenges include:

- Dividing the work into tangible and realistic phases with measurable progress milestones. Working in a changing landscape. Some elements of the project will be outsourced on a formal commercial basis whilst others will be done in partnership with different organisations.
- Meeting the diverse needs of the stakeholder organisations that are at very different stages and abilities to supply data or to adopt best practice.
- Changing the culture within organisations at a time when budgets are shrinking, personnel are moving or leaving, and the overwhelming concern is likely to be 'just continuing to function' as before. In order to ensure that observation data is valued data management activities, which make data available for reuse, are essential and must be built into business plans, contracts and ways of working. This will take time, tenacity and cooperation from all parties, particularly senior staff who can highlight the benefits and rewards.
- Timely and complete updating of the information contained within the catalogue for accuracy - using international standards. It is crucial that supplying and maintaining the data in the catalogue requires minimal effort from each organisation.

Implementation of the UK-EOF Data Initiative is currently being refocused to incorporate necessary changes due to developments in data sharing technology and economic limitations. It forms part of the wider UK-EOF programme (see UK-EOF website (<http://www.UKEOF.org.uk/>)). It will therefore be influenced by, and its outcomes subject to, changes depending on the developments of the UK-EOF programme and the UK, EU, and global environmental observation and data sharing communities.

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1. A UK vision for Environmental Data and information

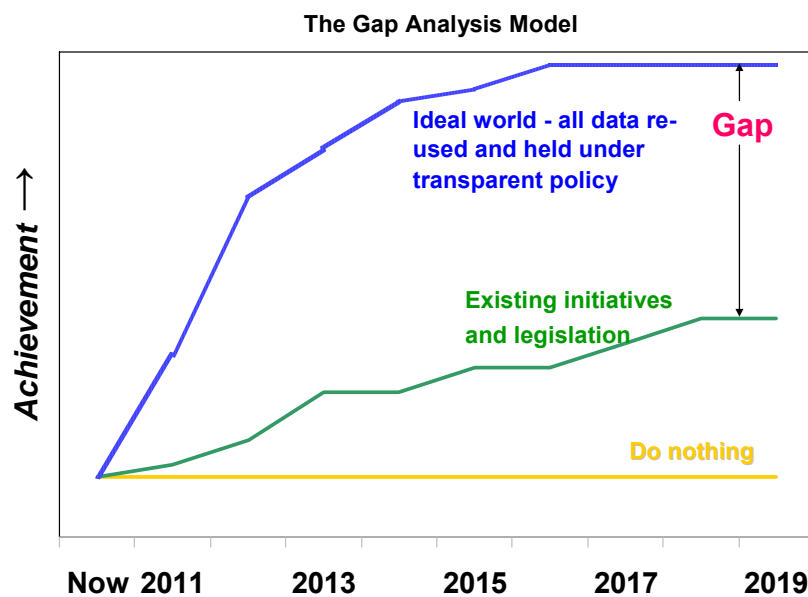
1.1 The Think Tank

In September 2008 the UK-EOF held a senior cross governmental Think Tank to debate a paper entitled 'Sharing Environmental Observation Data – the Issues' ([http://www.UK-EOF.org.uk/Sharing Environmental Data](http://www.UK-EOF.org.uk/Sharing_Environmental_Data)). The fundamental issues discussed were:

- Environmental observations are fundamental to increasing both scientific knowledge of, and decision making on, environmental change; and data plays a key role in innovation
- The lack of a high level strategic approach to data management in the public sector as a whole;
- The 2006 study (Strategic analysis of UK Environmental Monitoring Activity – ERFF Report 02) estimated that 80% of the output from observations, is not or cannot be reused by others. By implication, only 20% of all observation data is currently held under a governance policy which allows it to be used by third parties. This is a significant waste of resources and is frequently raised as a concern amongst users or funders of environmental studies;
- The other significant barriers such as awareness and discovery of data, cultural, and technical barriers as well as the various licence conditions; and poor resourcing and ineffective management of data;

A Gap Analysis Model (Figure 1) was presented to show a) the extent of the predicted achievements of existing initiatives and legislation (green) towards the vision and b) the step change needed in an ideal world (blue) for data sharing and re-use to be fully effective.

Figure 1: The Gap that the UK data providers need to address in order to reach the vision.



The Think Tank agreed a vision for successful environmental data management and sharing:

people/organisations in UK plc actually share and reuse environmental data to inform policy decisions, expand knowledge, improve their responses to a changing environment, contribute to international activities and stimulate markets for innovation.

To achieve this vision, the main criteria for success were agreed:

1. All data collectors adhere to best practice, or where standards exist, to those standards;
2. Each organisation has a transparent and well publicised data policy which balances open access with economic and societal pressures;
3. The data policy is underpinned by an infrastructure which allows data to be discovered simply and quickly. By following links to the data holder(s) included in the metadata, data should be viewable and downloadable where no access or reuse restrictions apply. Where they do apply, their terms should be clearly expressed.

The think tank concluded:

- Unanimous agreement at senior government level that there are complex and challenging problems across the UK in terms of data.
- Senior leadership is essential to change the culture and organisational data management issues.
- Existing / forthcoming legislation tackles only part of the story but the Location Programme, INSPIRE and SEIS will help.
- The UK-EOF is tasked with defining the gap between the ideal world and the existing initiatives and legislation regarding re-use of data and transparency¹.

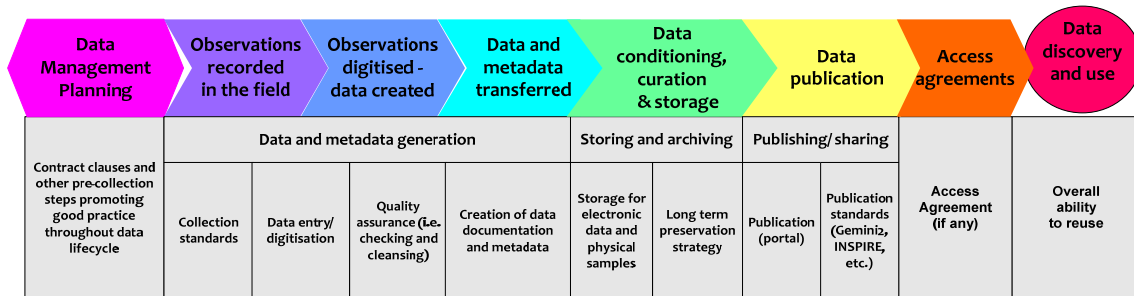
¹ This is not the same transparency as addressed by the Transparency Agenda of 2010. It refers to a transparent data sharing or reuse policy within each organisation.

1.2 Data Sharing and the Data Lifecycle

When thinking about data management it is helpful to think of the aspects that relate to all stages of its generation to its use. These stages are summarised in

Figure 2. Note that this may not always be a linear process and use of the information may be possible at any stage.

Figure 2: The Data Lifecycle



There are many views of what is meant by ‘data’. Is it the raw information collected or is it the information or product, such as a map, that is generated by data? For our purpose we have included all data, from that initially collected to a processed end product.

The UK needs to have an oversight of how data is managed throughout its entire data lifecycle from the funding contract through the point of collection to the publication and availability of datasets for others to use.

1.3 Road Map – Towards the Vision for the UK

1.3.1 Where do we need to be?

The key to success will be a change in attitude and behaviour at all stages of the data lifecycle. A change in culture is required, in which all parties recognise the benefit of making data and information (regarding environmental observation activities) accessible to all. This is an ambitious and long term project based on extensive research and feedback from stakeholders in the observation, data and environmental science communities.

1.4 Assessing the gap between existing initiatives and the data vision

Sharing data more effectively is the subject of numerous existing activities at subject, geographic, domain, national, international level. Some of the major initiatives are can be found at Annex 1.

While some initiatives address aspects of data discovery and sharing, they either focus on an aspect of data management, e.g. quality assurance or a place to store electronic data etc or they cover all the life cycle for a particular group of data – e.g. marine or air quality. No single organisation or initiative provides cross-environmental domain, full data lifecycle auditing (or indeed the necessary improvements needed at technical, organisational or cultural level to increase reuse).

Following the Think Tank, the UK-EOF sought to identify (on behalf of UKplc) what could and should be done to address data issues. The scope was defined as the full data lifecycle (see section 1.2) and possible solutions proposed in a number of areas.

A workshop was held, in June 2009, so that the wide community could consider these concepts and proposed solutions. There was much enthusiasm for the UK to move forward collectively; however **a major gap identified was the need for an overarching framework which covers all domains and aspects of data management across the data lifecycle.** As a result this Vision and Action Plan has been developed.

1.4.1 Agreement of the work areas and vision.

This Vision and Action Plan has evolved since the Think Tank. It has been considered on a number of occasions by the UK-EOF Management Group, Data Advisory Group (DAG) and the ERFF Main Board (now superseded by the LWEC Partners Board). An early version was discussed by 160 stakeholders at the Data Solutions workshop in June 2009. The fundamental plan has received full support from all parties. However, it is still a work in progress.

1.4.2 Measuring Success

For UK plc to measure success the criteria established at the Think Tank have been developed as follows:

1. All data collectors adhere to best practice, or where standards exist, to those standards;

For UK plc this means a culture change resulting in the use of good practices or standards across the entire data lifecycle. Where standards do not exist, they should be developed. This requires seeking out and sharing good practice examples as well as guidance for standards so that they can be adopted within organisations.

2. Each organisation has a transparent and well publicised data policy which balances open access with economic and societal pressures;

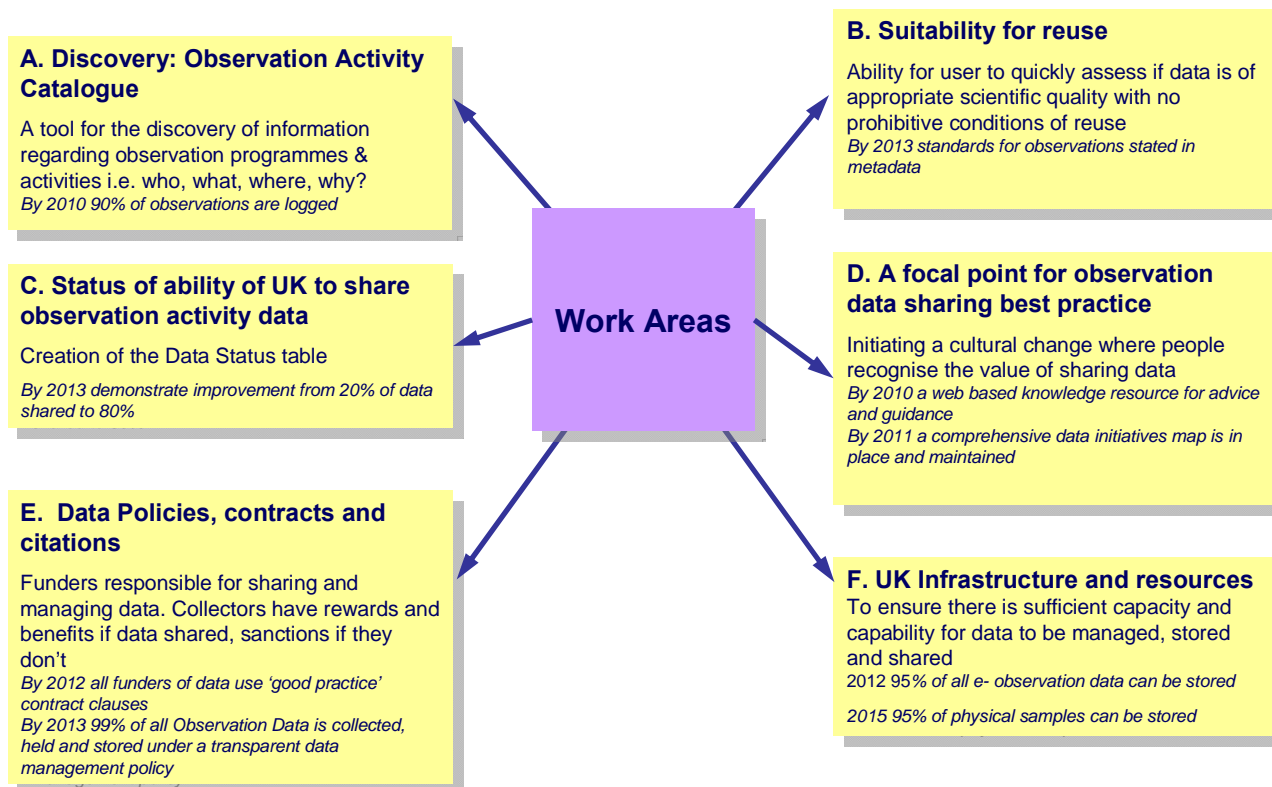
UK plc must value, share, and reuse data as much as is possible while observing the limitations that may be imposed by privacy, contractual or other binding restrictions consistent with the Transparency Agenda. The data status table can be used to show progress.

3. The data policy is underpinned by an infrastructure which allows data to be discovered and accessed simply and quickly with as little access or reuse restrictions as possible. Where restrictions apply, their terms should be clearly expressed.

UK plc organisations should adopt a consistent infrastructure that supports the discovery and sharing of data. Data should be viewable and downloadable with exception where access or reuse is prohibited due to restrictions. If any restrictions apply, their terms should be clearly expressed. Good practices and infrastructure requirements for data access and reuse as well as storage, should be identified and provided by member organisations thus enabling secure storage and curation in the long term. Basic infrastructure for metadata is supplied to the UK-EOF catalogue, which includes links to the data holder(s), and information on access and restrictions that may apply. The UK-EOF catalogue may be used as a template for the development of a catalogue of samples and storage, and becomes part of the environment.data.gov.uk or an alternate portal.

Cultural change in the community to increasingly value environmental observation data can be accomplished by meeting the goals of a number of work areas as shown in Figure 3.

Figure 3: Proposed Work Areas and their corresponding success criteria needed to achieve the UK's vision.



1.5 The work areas required to meet the vision

1.5.1 Work Area A: Improving Data Discovery- The UK-EOF Observation Activity Catalogue

A key first step in meeting the requirements for users (particularly user Type 1; see section 1.6) is to know what information exists and in what form i.e. to discover what available. .

For environmental observations the Observation Activity Catalogue (<http://www.ukeof.org.uk/catalogue/default.aspx>), provides for the first time, an easy search tool that allows users to discover and gain an insight into the observation activities undertaken by or for the UK. This can be upgraded over time as user requirements are defined (see section 2.3.1)

1.5.2 Work Area B: Suitability for Reuse: Quality and Access Standards

The three principal factors which prevent data reuse are

- not knowing the data exists,
- not knowing the quality of the data and which collection standards have been followed, and

- not knowing what licence conditions or costs will be applied.

The first of these is addressed under Work Area A. This work area will look at the issues of data quality and availability. Licensing issues are under the scope of Work Area E (Policy contacts and citations).

There are standards needed throughout the life cycle of data management. However, once a dataset has been found, the most significant barrier to reusing it is knowing the provenance and how it was collected. This can be overcome by the completion of a 'data quality' metadata field. Although subjective (by the collector) – the statement should articulate the collection standards such the quality can be judged by a potential user.

A field for known quality is included in the UK-EOF catalogue and is a non mandatory field for compliance with INSPIRE. If recorded at the time of collection this should not prove to be a burden. However it is recognised that a key challenge will be to change culture and practice to ensure that information on quality is added to metadata routinely. The funders of the original data collection could play a large part in the solution by insisting at the contractual stage that this information is provided. Work Area E includes the development of such contract clauses.

1.5.3 Work Area C: Status of ability of UK to Share (and therefore access) Data – Data Status Table.

In order to bridge the gap between the ideal and the existing conditions of data management there is a need to understand how effectively data is being managed across the entire data lifecycle. Auditing and reporting on data management, from planning through discovery and use could be done via a data status table (Figure 4). The status of data sharing and progress towards improvement would be recorded in the table, whose structure is based on the data lifecycle in Figure 2.

There are many possibilities for this table/ tool. It could provide either a simple summary or a wealth of information as an interactive search tool for the data or standards from each row, box or column.

Progress on how well the UK is able to share environmental observation data to meet user needs and obligations of the UK, EU, and global initiatives could, in the future, be provided in the Data Status Table. The Data Status Table could be populated using metadata from the UKEOF catalogue to provide a regular progress report.

Figure 4: Example Data Status Table (Work Area C) ---- Example for Illustration Only

Data set e.g.	Data and Metadata Generation				Storing & Archiving			Publishing/ Sharing		Access Agreements	Overall Ability to re-use
	Collection Standards	Data entry/ digitisation	Quality Assurance i.e. checking & Cleaning	Creation of data documentation & Metadata	Place to store physical samples	Place to store electronic data	Long term preservation strategy	Publication place e.g. portal	Publication standards e.g. GI or INSPIRE		
Atmospheric											
Surface precip	Green	Green	Red	Green	Yellow	Yellow	Yellow	Yellow	Red	Red	Yellow
Surface wind	Green	Green	Yellow	Yellow	Yellow	Yellow	Yellow	Green	Green	Red	Yellow
Oceanic											
SST	Green	Green	Yellow	Green	Green	Yellow	Yellow	Green	Red	Red	Green
Sea level	Green	Green	Red	Red	Red	Red	Yellow	Yellow	Red	Red	Red
Sea state	Green	Red	Red	Green	Yellow	Yellow	Green	Yellow	Red	Red	Red
Terrestrial											
Lake levels	Green	Green	Green	Green	Yellow	Yellow	Green	Green	Red	Red	Red
Snow cover	Red	Red	Red	Green	Yellow	Yellow	Yellow	Yellow	Red	Yellow	Yellow
Glaciers and ice-caps	Green	Green	Green	Yellow	Yellow	Yellow	Red	Red	Red	Yellow	Red
Soil moisture	Green	Green	Yellow	Green	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Red

Definitions of cell colour coding

Red	No collection standards followed	Un-acceptable	No strategy in place	Data not published	No publication standards followed	No access agreements	Data not reusable
Amber	Limited conformity with collection standards	Some issues to sort out	Limited strategy	Limited publication	Limited conformity with publication standards	Limited access agreements in place	Limited data reuse
Green	Full conformity with collection standards	Acceptable	Strategy in place	Data published via portal	Full conformity with publication standards	Access agreements in	Data reusable

The Data Status Table will allow collectors, users, organisations and agencies to track the level of completeness of various aspects of data and metadata. It offers a concise means of establishing not only the current status of data and metadata, but also of tracking progress over time in achieving completion of the requirements for cataloguing data and ensuring it is stored and available for reuse.

1.5.4 Work Area D: A focal point for data sharing (best practice).

It is recognised that there are a plethora of National and International (European and global) initiatives, looking to address the way in which data is collected, stored and published. Whilst some of the larger sponsors may not need advice, many smaller organisations seek support and understanding from a data sharing community.

Therefore a key element in moving towards the vision will be a hub for the community in interpreting the data sharing requirements and in providing advice and support in adhering to them (i.e. sharing best practice on data collection, storage and publication).

The UK-EOF have started progressing this Work Area. A 'Data Initiatives Map' has been developed (see Annex 1) to provide a comprehensive analysis of what the initiatives are doing, how they overlap and where the gaps exist in their coverage. The map includes information on who the initiatives apply to and what data is being collected. Especially important, but often forgotten, is what part of the data life cycle the initiatives apply to.

1.5.5 Work Area E: Data Policy, Contracts and Citations (changing organisational culture)

The agreed vision is that all data is able to be reused and held under a transparent data policy.

There are a number of issues to address including:

- agreeing within the community what such a data policy should address;
- providing a check list that senior management in each organisation can follow to ensure the policies are proactively used;
- making it easy to understand the legal landscape around data use and what can be done to improve licensing and access;
- Asking funders of new data collection activities to adopt a contract clause which ensures that best practice is implemented. This implies that the terms of access for each dataset must be defined in advance so that there can be rapid access to the datasets when needed. It also implies that the data will be held in an archive (and hence the need for the infrastructure to support this).

Central to changing culture is making sure the science and academic communities have a reward for sharing data. There should be encouragement to the British Library and the Research Councils to develop a citation process for datasets. This work will require consultation with many stakeholders such as academic institutions and their funders, journals and publishers.

Licensing is being addressed from the point of view of both making people aware as to whether there are restrictions, as well as assessing whether there are ways in which such restrictions can be removed. The impact of the Transparency Agenda is changing the landscape - generally leading to fewer restrictions on access and reuse. An overall licence has been developed but there are many who are unaware of this or who will have internal organisational barriers to adopting it.

1.5.6 Work Area F: Infrastructure and Resources

A sustainable future proof infrastructure is required to ensure that all collectors have somewhere that their data can be stored and managed into the long term. This work area is not looking to build big new IT or data warehouses but ensure that there is capacity for all datasets in the long term within the UK.

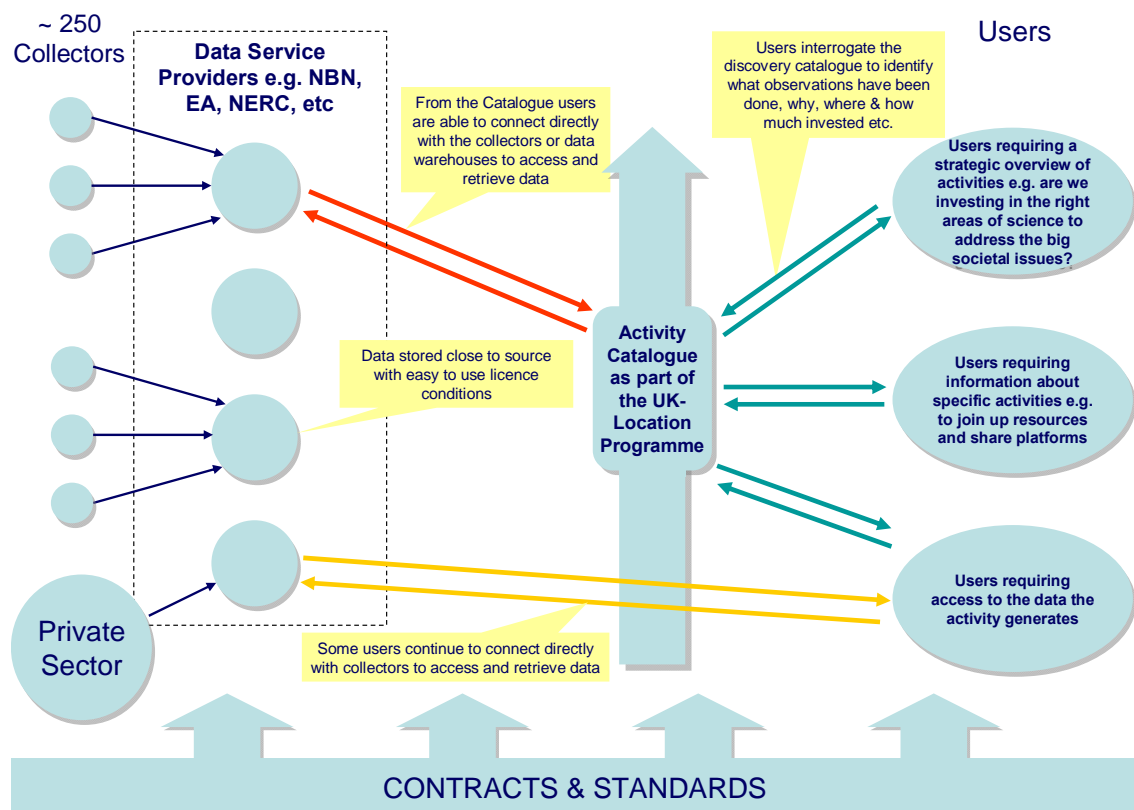
Managing data including securely storing and sharing it requires physical places for both electronic data and physical samples. The work will need to begin with identifying where and how all the various types of environmental data could be held. There are a number of existing repositories for environmental data, some funded by NERC and ESRC. Others may be less secure or, less formal. All data centres are vital to the success of the vision but have operated independently. Therefore joining up the activities of the data centres and ensuring that the data within each is described and accessed in similar (interoperable) ways is important to ensure secure storage is available for data from all collectors.

Current and future requirements for infrastructure includes where and how to support the Observation Activity Catalogue. It will be essential that this work is led and influenced by those such as NERC who already fund some of the major environmental data archives, and the Location Programme who are establishing a spatial data infrastructure for the UK and Defra.

Requirements for the storage of physical samples was scoped by CEH (http://www.ukEOF.org.uk/documents/CEH_physical_samples_scoping_study_2010.pdf). It is clear that specialised infrastructure will be required, but a phased approach of delivery is possible.

A possible concept for the Infrastructure (Figure 5) is where the multiple collectors of data, have a suitable archive to store the information. This is then made available to search facilities and underpinned by standards and vocabulary.

Figure 5: Potential future basic infrastructure needed to enable data sharing



1.6 Users and Benefits

The benefits will be experienced at a number of different levels affecting different stakeholders. Three specific user categories have been identified:

- **Type 1 Users** requiring a strategic overview of activities (i.e. are we investing in the right areas of science to address the big societal issues?)
- **Type 2 Users** requiring information about specific activities (i.e. to join up resources and share platforms)
- **Type 3 Users** requiring access to the data or outputs the activity generates

1.6.1 Type 1 Meta Data Users: Policy Makers and funders

These are the stakeholders requiring a strategic overview of activities (e.g. are we investing in the right areas of science to address the big societal issues)? The output of Work Area A will improve discoverability and provide information at a UK level about the programmes and activities with their costs. This general information will allow funding decisions to be taken in the knowledge of what is already being collected and therefore efficient use of existing data and avoidance of recollecting are direct benefits. The benefits of improving access to the breath of information collected across the UK can be articulated as:

- Improvements in the evidence used and therefore the quality of the environmental management decisions made;
- Improvements in the evidence used to set policy;
- More effective use and management of public money;
- Increased access to publicly funded data meeting the requirements of government initiatives such as the Transparency Agenda and data.gov to ensure wider access to government data.

1.6.2 Type 2 Meta Data users: Project Managers and funders

These are the users requiring information about specific activities, in order to share resources and platforms. The information available will ensure that duplication or repetition can be avoided and that the outcomes of new activities can be available for reuse. The benefits can be articulated as:

- Reduction in duplication of activities leading to cost savings,
- Synergies will be realised through combining methodologies and outputs;
- New contacts established.

Essential to this group of users is information on scientific data quality and access conditions.

1.6.3 Type 3 Data Users: Data (Scientists, researchers etc.)

These are the users who require access to the data and information the activity generates. The reasons for this data need are vast but include making informed decisions for example, about the impact of climate change. The benefits are:

- Recognition and rewards. By having a method for internationally recognised data citation, data collectors will be able to use the citations as a means of demonstrating the impact of their work. More frequent citations in literature could enhance their ability to obtain future funding. It could also raise their credibility amongst their peers and the wider scientific and environmental communities;
- Data becomes valued – when a data set is cited or referenced when used, data collectors will see that their data becomes a valued commodity.

- Information is easier to reuse. When consistent standards are used there will be greater interoperability of the data arising from all the activities. This will enhance compliance with INSPIRE, SEIS, GEO etc and enable the data to be reused more easily and rapidly.
- Coordination will save money. Cost savings will be realised when organisations only have to publish their information in one way and this can automatically be translated into the formats required for other initiatives; Best practice can be shared across domains and across expert areas such that methods of recording, storing and making data available does not have to be reinvented.
- The costs and time spent on searching for data will be reduced thereby freeing up resources to undertake the analysis, interpretation and developing new knowledge.
- Scientists will be able to share data leading to more opportunities for working collaboratively and making new discoveries. ultimately contributing to an improved understanding of the environment and how it can be protected;

1.7 Costs

The costs of implementing the vision (packages A-F) are not yet known. They will be variable depending on who and how they are implemented and over what timescales.

All costs associated with the scoping and development of this data programme itself are covered within existing resources of the UK-EOF. However, in order to achieve the vision collaboration and support from sponsors and other environmental data collectors and users is essential. This collaboration will allow the UK-EOF to focus spend on aspects for which no other resources exist. The UK-EOF itself has a budget in the region of £500k a year. This is roughly 0.1% of the estimated £500 million currently spent on collecting environmental observations.

1.7.1 Stakeholder costs

Whilst it is anticipated that, in order to adhere to the standards and protocols, additional costs may be incurred by organisations engaged in the different stages of the data lifecycle - it is likely that the greatest burden will be on data collectors. There will be resource requirements to data collectors in terms of:

- Implementing data management practices. This could include modifying existing data handling and storage processes to ensure that it is compliant with data policies and standards as well as the creation of the metadata providing detail on the activity and the data itself
- Ensuring that metadata is collected and configured correctly. In many instances however these will be nominal one-off costs.
- Based on the results of a preliminary assessment there is a clear need for both education within organisations about the need to collect metadata and for an assessment of what metadata and data management policy changes are required to comply with current initiatives including the Transparency Agenda.

The ongoing costs for good data management could be included within the initial data collection contract. This requires a cultural shift toward proactive data

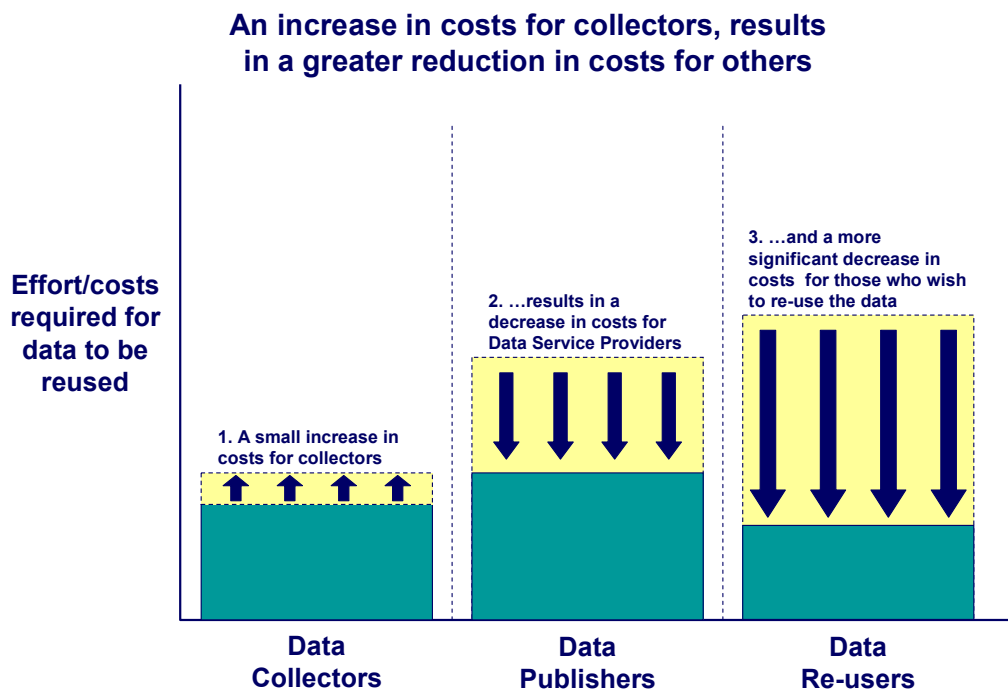
management practices. The use of contract clauses at the funding stage which specify data management requirements can help change the culture.

The costs may be offset against the resources already needed to implement INSPIRE and SEIS.

In addition the costs incurred at the data collection stage will result in a significant saving for data service providers and the potential users of the data at a later stage—effectively shifting costs to the earlier phases of the data lifecycle will result in overall cost and time savings when compared with current practices. This is shown in Figure 6.

A small initial investment will yield a high level of benefits in the short and long term. It will also result in more data actually being reusable, an increase in the efficiency and effectiveness of collection.

Figure 6: Costs for collectors versus benefits at the reuse of information end. These benefits may be by other or may be realised by the original data funder.



2. The UK-EOF & its role in achieving the UK's Vision for Data

2.1 Living with Environmental Change (LWEC)

The UK-EOF originated as a project/programme of the Environment Research Funders Forum (ERFF). Created in 2002, the ERFF aimed to make the best possible use of public funding for environmental research, monitoring (observation) and survey, and associated policy, regulation and training. It sought to achieve this by fostering cooperation between the UK's major public sector sponsors of environmental science enabling them to make more effective use of funding than they could separately.

In June 2010, ERFF merged with Living with Environmental Change (LWEC). For more information on LWEC please see <http://www.lwec.org.uk/>.

2.2 UK Environmental Observation Framework - Overview

It was recognised in 2006 that the UK monitoring community is large, diverse and fragmented across the public sector including policy makers, regulators and scientists as well as industry, the general public and volunteer groups. Their needs for observations arise from many scales of concern from local issues to regional natural disasters and global environmental problems. Therefore they require very diverse measurements and technologies to capture the necessary observations.

The UK-Environmental Observation Framework (UK-EOF) was launched in July 2008 with the overall aim of shaping the UK's capability to:

facilitate the ongoing environmental evidence required to understand the changing natural environment, thus guiding current and future environmental management, policy, science and innovation priorities for economic benefit and quality of life. ERFF Report 05 (<http://www.lwec.org.uk/publications/reports/2008-05-uk-eof.aspx>)

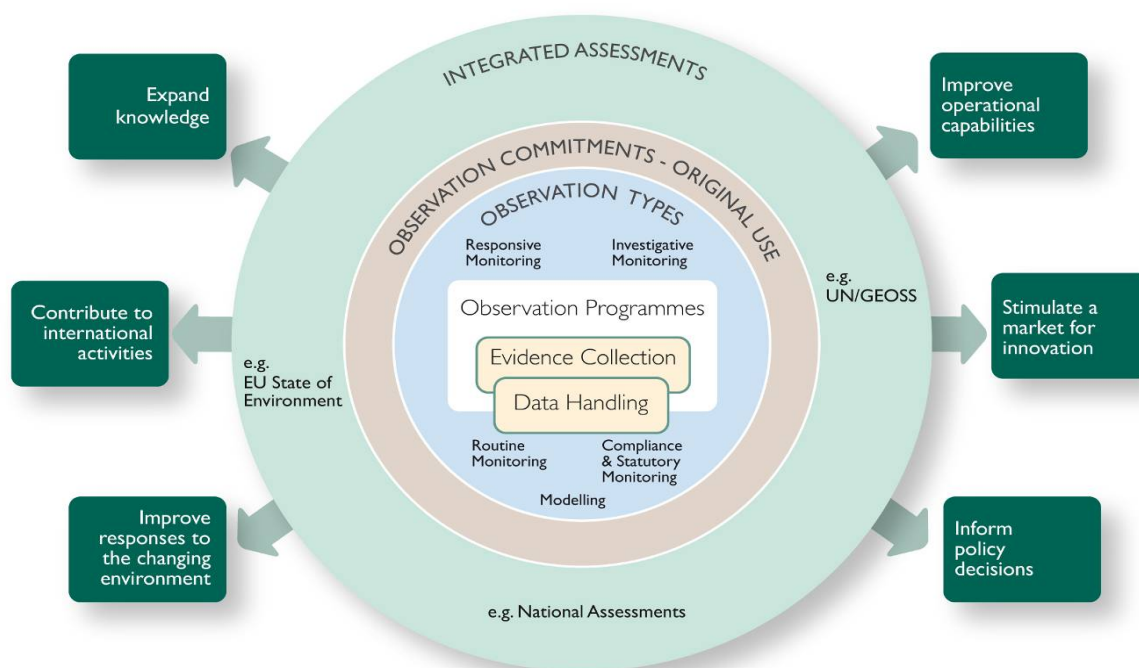
UK-EOF was charged with identifying and addressing the issues surrounding environmental observations made for or by the UK, including ensuring that these observations are valued as a vital contribution to our evidence base and that observation data is collected once, but used many times.

UK-EOF seeks to provide a cost effective mechanism to work in partnership across government, the devolved administrations, agencies and the voluntary sector to make best use of expertise and resources. It seeks to value and facilitate a sustainable flow of data and information regarding environmental observations from collectors to users in order to provide the long term evidence required to support national and international goals

The overall UK-EOF concept is illustrated in Figure 7. At the heart of the concept are efficient and, where appropriate, sustained observation programmes and the mantra 'collect once, use many times'. Information generated by these programmes is needed by the numerous end users and one observation can be used by multiple stakeholders (scientists, policymakers, volunteers, industry and/or the public).

A principal deliverable of the UK-EOF is the facilitation and development of the knowledge and tools required to change the way the UK perceives, values, archives and uses information from long-term environmental observations.

Figure 7: The concept model for the UK Environmental Observation Framework



The UK-EOF programme is funded by the major sponsors of environmental observations in the UK (See Annex 3 for a list of funding members and details on governance). The programme is comprised of multiple work areas. Many dependencies exist between them and therefore constant dialogue, community involvement and direction from the Management Group is vital for successful implementation and to achieve the overall goals.

The UK-EOF programme will provide the means to allow all UK organisations to work collaboratively towards optimising their investments and the environmental observation measurements made. UK-EOF works with the Location Programme, data.gov.uk, the National Ecosystem Assessment and other organisations to ensure efficiency and consistency of effort.

2.3 What will UK-EOF do towards the Data Vision Road Map?

The vision and action plan is intended to be ambitious and a UK wide initiative. The actions and activities needed to implement the vision must be undertaken by a variety of organisations and via many existing and new activities. Through the full set of work packages, the Data Initiative will enable the UK to ensure that observation data is collected, stored and published according to good practice and agreed standards. All organisations, but in particular smaller third sector, private and public sector groups will be able to turn to the focal point of the vision for guidance and advice.

The UK-EOF Management Group prioritised two work areas on which the UK-EOF resources should focus in 2010/2011, the Catalogue (Work Area A) and the Focal Point (Work Area D) with the addition of the contract clause portion of E (contracts, citations). The other aspects of Work Area E will be on hold whilst the Location Information Interoperability Board (INSPIRE focussed) and GEO consider their policies. Some work on data suitability (Work Area B) was scoped in 2009 and the

future catalogue fields will reflect these needs. Other options for meeting the needs of UK-EOF sponsors and users are being scoped. They will be presented to the Data Advisory Group for recommendation and the Management Group for a decision on which option to pursue.

2.3.1 The Observation Activity Catalogue

The 2008 Think Tank agreed that the most immediate need to improve data sharing in the UK was to allow discovery of what activities (and hence data) already exists. The need to understand what programmes and activities generate observation data is at the core of the UK-EOF Data Initiative.

The first phase of the Environmental Observation Activity Catalogue was built and launched in August 2009 to begin to respond to this need. In its first year there were over 1000 unique visitors to the catalogue site (<http://www.ukeof.org.uk/catalogue/default.aspx>).

The Catalogue provides for the first time an easily searched tool which enables users to get a general overview of all the environmental observation activities undertaken by or for the UK. It currently holds information on over 1100 activities ranging across environmental domains and themes². It has general search facilities but does not currently meet the anticipated requirements of initiatives such as SEIS and INSPIRE.

The activities stored in the catalogue include activities funded for basic science, legislation, data collection, direct environmental management and many other reasons. They indicate that over 220 organisations are involved in observations in some way.

Stage 2 of the catalogue was originally planned to extend the features of the catalogue to include:

- improved search,
- geographic coordinates of monitoring sites,
- funding and quality assurance / fitness for purpose information,
- accommodation of time series data and full compliance with INSPIRE.

However, with the development of other programmes such as data.gov.uk, the necessity for stage 2 of the catalogue may be changing. The UK-EOF Data Initiative is working with data.gov.uk and other initiatives to ensure the full range of user needs will be met, via complementary features rather than duplication. The situation is being reassessed during 2010 in collaboration with Defra and other key organisations.

In time the catalogue may become part of the UK Location Programme portal, data.gov.uk, or another portal. Any decision about the future of the catalogue will consider current and anticipated future needs for discovery, access, and reuse of data.

Regardless of the technology, the information held in the catalogue has to be maintained and updated as much as possible. A major update of the information was instigated in August 2010 for completion by December. Additional fields for data suitability were included in the 2010 update request to ensure immediate availability of the information even though the full capabilities of Stage 2 are not yet available.

² An environmental domain is the media in which the observations are collected for example freshwater or atmosphere. A theme is the type of issue or question that is being addressed for example, Climate Change or Pollution.

A major driver for the unique catalogue is the need for public sector funders and other key stakeholders to have an overview of the information on what observation activities are being carried out, why, where and at what cost. This will enable funders to make informed decisions and ensure greater transparency in what is funded. It is also a starting point for data users to find the data they need and may help activity managers to reduce duplication of effort and make efficiencies in their own programmes. This information is also required as a UK input to the European SEIS initiative and could be used by global and international fora as a window on the breath and scope of UK observation activities.

The UK-EOF released a catalogue 2009 however this was only the first step. The next phases should be:

- Improving the quality and quantity of the contents of the catalogue. Although most of the ongoing activities have been included in some way, there are numerous fields which are not fully populated or have not been checked/updated since 2005. Indeed some of the search fields are as little as 50% complete. The information contained within the catalogue needs to be accurate, up-to-date and complete. The 2010 update process has been planned to address this.
- The development of a maintenance plan which will look at how the information in the database is to be kept up to date with minimal burden on each contributing organisation. This plan will need to be revised based on the selected option for the future of the catalogue;
- Developing the functionality and capability of the catalogue to provide additional fields, sustainable methods for inputting activity information, easy extraction of the information (e.g. perhaps via a map/geographic search) and links to the data and outputs generated from the activity. Any improvements are strongly dependant on developments in the wider data sharing landscape and therefore many of the other work areas. The purpose-driven technology architecture for a stage 2 catalogue should evolve and develop over time.
- Potential merger with Data.gov.uk - the designated portal for UK public sector information. The UK-EOF catalogue is eventually expected to become part of data.gov.uk, through the environment.data.gov.uk portal.

Socio-Economic Data

The initial scope of the UK-EOF was natural environmental observations. However, in November 2009, this was broadened to include *relevant* social and economic data. This expansion of the scope of the catalogue is currently being assessed for impacts on the work of the Data Initiative.

2.3.2 The Focal Point

During 2010/11 the second focus for the UK-EOF will be on providing an information conduit between organisations and initiatives (the Focal point of the Data Initiative).

The growing number of initiatives and opportunities for collaborative work between groups was noted and encouraged by the sponsors of UK-EOF. There will be some organisations that are able to conform to the requirements of the standards across the data lifecycle sooner than others. Of the more than 220 organisations responsible for collecting environmental observation data, there are a number of large organisations (e.g. NERC, the Environment Agency and networks such as the National Biodiversity Network) which have existing standards, data policies and mechanisms for sharing data with other organisations and individuals in place.

However there are many other organisations which do not have such mechanisms in place or the resources to pursue them on their own. Therefore these organisations have limited prospects for change without assistance. Whilst the UK-EOF will focus on assisting these smaller and less organised institutions, it will continue to work with the larger organisations to ensure that there is consistency across all areas and that all aspects of the this part of the Data Initiative are addressed.

UK-EOF has identified a framework of activities around data to help coordinate the efforts of the different organisations and sectors through the cultural shift process. At a community level the UK-EOF aims to develop a common vocabulary across the data lifecycle

Many of the issues, such as data policies and funding, are not exclusive to the UK. In addition, many of the drivers of the environmental observation aspects of the initiatives pertinent to the work of UK-EOF are international, so UK-EOF will need to engage with their representatives as well as UK-based users of observation data. Close collaboration between UK-EOF and other initiatives such as INSPIRE, SEIS, GMES and GEO is required.

These direct interactions will be backed up by the UK-EOF website. Relevant guidance, good practice and standards around data sharing and the compliance requirements of the various initiatives are being added to the website during 2011³.

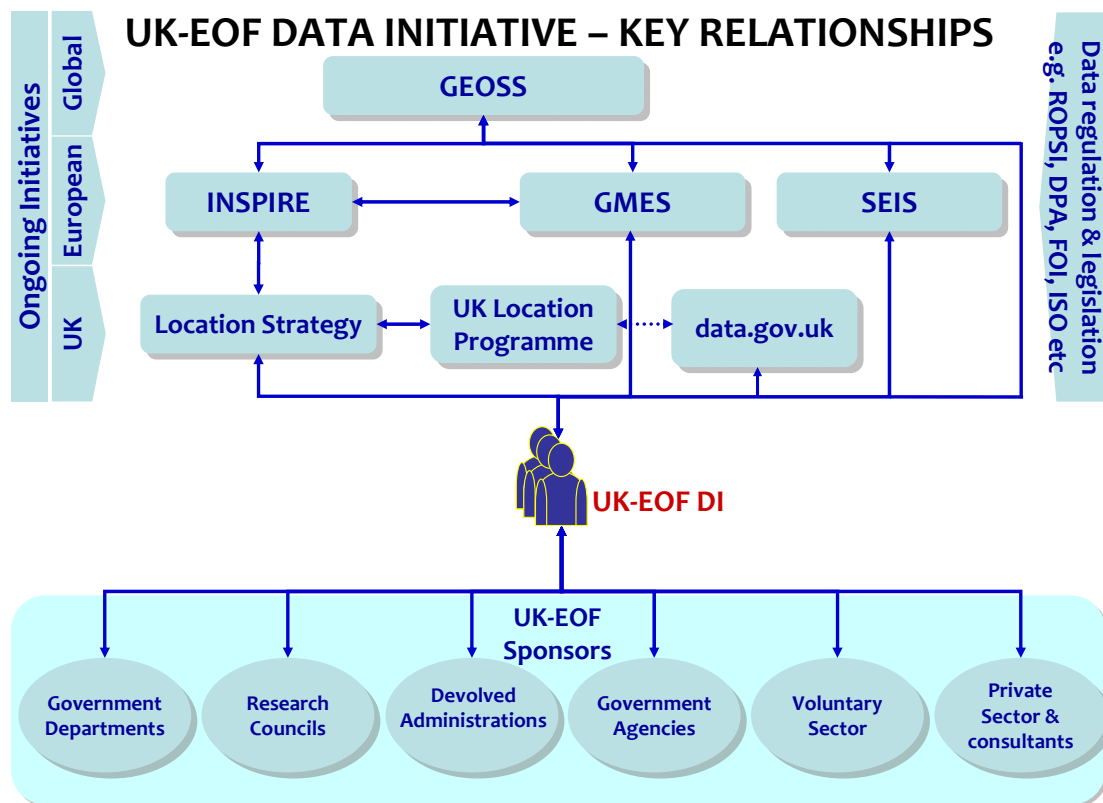
As part of the information exchange, UK-EOF will provide a UK focal point for input into the GEOSS Data Sharing Task Force, GMES, SEIS and other initiatives at the UK, EU and global levels where appropriate. Figure 8 summarises the relationship of the Focal Point to organisations and initiatives.

While the UK-EOF will serve as a point of interface between initiatives and organisations, it is not the only point of contact available, especially to the larger organisations such as Defra, NERC, and EA. The multiple pathways for communication will require close coordination and is also part of the Focal Point. In addition, as the importance of the availability of data for sharing is more widely recognised, newer initiatives such as data.gov.uk will impact the Data plan and offer new opportunities for collaboration. During 2010/11 the focus will be to become a hive of knowledge for best practices and support for the community on data collection, storage and publication. With key stakeholders the UK-EOF Data Initiative will develop and disseminate very simple tools (such as the standard contract clauses) so that best practice is disseminated. Examples of best practice are given in Annex 2.

UK-EOF is in a strong position to represent the community when a UK or environmental view is needed such as input to the INSPIRE, Location Programme, SEIS, GMES, GEOSS, data.gov.uk, etc. Some of these initiatives provide guidance and standards that are required to be met for the collection, storage and publication of environmental data.

³ It will remain the responsibility of the data collectors to manage their own data or ensure it is hosted in a suitable archive.

Figure 8: UK-EOF Data Initiatives and Organisations Map



A comprehensive Data Initiatives Map has been developed. This identifies the various data sharing initiatives, as well as the potential overlaps and gaps between what is currently being addressed and what is needed to bridge the gaps and eliminate overlaps.

2.4 Costs to UK-EOF

With current staffing, Work packages A and D have 1 FTE from the secretariat. If Stage 2 of the Catalogue proceeds (see section 2.3.1) between £100k and £150k may be needed for the proposed IT build.

Assumptions and constraints as well as Risks on the UK-EOF can be found at Annexes 4 & 5 respectively.

3. What Next?

The landscape of data management and data sharing is likely to continue to change as efficiency measures drive amendments in practice and initiatives. Already on the horizon is compliance with the INSPIRE Directive (with metadata required by 2013). Data.gov.uk is expected to offer a portal to environmental information, and in conjunction with the UK Location Programme, to provide the implementation of INSPIRE for the UK. This will require that metadata conforms to the standard of INSPIRE, Gemini II.

Currently, metadata in the UK-EOF catalogue is not fully compliant with Gemini II. The catalogue metadata is intended to provide more than compliance with INSPIRE. It includes fields for SEIS-BASIS and for use by UK-EOF sponsors and funders.

Some organisations are having difficulty in supplying the entire set of metadata requested for the catalogue. Much of the difficulty apparently arises from the culture in which data management is not highly prioritised. Accomplishing culture change is therefore key to ensuring the metadata required for compliance with INSPIRE is available.

To facilitate this culture change assistance in educating organisations about good data management practices and tracking of the initiatives as they develop to assist with planning and resource allocation is needed.

OCTOBER 2010 Update:

LWEC have begun a strategy and implementation plan for a UK Environmental Information Framework, ensuring that decision makers have the evidence they need by going to one place and enabling data collectors to 'publish' once, reducing duplication of effort and investment in infrastructure. An informal agreement exists between Defra, NERC, EA, Met Office and the British Library to collaborate on a high level implementation plan for the May 2011 LWEC Board.

The implications for this Vision and Action Plan are not yet clear but much of the concepts are likely to be transferred to the new EIF.

Annex 2: Good practice examples across the data lifecycle

1. Data Management Planning
 - a. Funding contracts include clauses requiring collection and sharing of metadata and storage of data in appropriate locations and formats
 - b. Contract terms are verified and enforced
 - c. Data management is incorporated in organisational culture as a vital part of each stage of the data lifecycle
2. Observations recorded in the field
 - a. Metadata is recorded with data
 - b. Recorded observations meet identified needs and are collected according to appropriate standards or accepted good practice
3. Observations digitised/data created
 - a. Metadata is digitised or created with data
 - b. Accepted good practice or standards followed and documented for data entry
4. Data and Metadata transferred
 - a. Data checking and cleansing (internal quality assurance) is routinely performed
 - b. Formal quality assurance practice or standards are routinely applied to all data and metadata
5. Data conditioning, curation, and storage
 - a. Secure locations for storage of physical samples and electronic data are in place with appropriate backup facilities
 - b. A long term preservation strategy is in place for data and sample storage
6. Data Publication
 - a. A data publication portal or other scheme is in place, accessible and regularly used by data collectors
 - b. Data publication standards such as Gemini2 are applied to all published data
7. Access agreements
 - a. Any access agreement requirements are clearly identified
 - b. Any restrictions on data access or reuse consider the accepted balance between economic requirements and societal pressures for readily available publicly funded data and comply with rules such as the Transparency Agenda
8. Data discovery and use/reuse
 - a. All available data can be discovered easily through metadata
 - b. All available data can be reused with only reasonable restrictions or requirements imposed

Annex 3: UK-EOF Governance Sponsors, Advisors and Other Relationships

The vision and action plan is intended to be ambitious and a UK wide initiative. The actions and activities needed to implement the vision need to be undertaken by a variety of organisations and though many existing and new activities. The key external organisational dependencies for the Data Vision are the relationships with the UK Location Programme, data.gov.uk, and other key organisations such as NERC's Information Strategy Group, Natural England's own database of activities, and on the work of the Defra Data Sharing Group. With the addition of socio-economic data into the remit of UK-EOF, guidance from other experts may become relevant.

UKEOF governance and steering.

The Senior Responsible Owner for the UK-EOF programme is Professor Bob Watson, Defra's Chief Scientific Advisor. The UK-EOF Management Group is made up of the following organisations who sponsor the UK-EOF financially or in-kind:

NERC	Defra	EA	SEPA	NE	SG
DOENI	FC	JNCC	SNH	CCW	Met Office
WAG	DECC	BNSC	EEA	ESRC	

The UK-EOF programme became part of the LWEC Programme when ERFF and LWEC merged In June 2010. The UK-EOF secretariat, led by a Programme Manager, has been driving forward the programme across the 5 workstreams. NERC host the secretariat and the Observation Activity Catalogue.

In order to meet the needs of the diverse group requiring observations, the vision for UK-EOF depends on regular input from many organisations including funders of observations as well as funders of UK-EOF. This regular strategic input is obtained through meetings with the UK-EOF Management Group.

Data Advisory Group

This Data Advisory Group (DAG), chaired by the UKEOF meets quarterly to assist in planning developing the knowledge base of environmental observations and tackle issues surrounding data sharing and reuse.

In relation to Work Package A [the catalogue], the role of the advisory group is to:

- Provide technical expertise and advice in all areas of data management at a UK, European and international level in order to guide the UK-EOF in how to build and populate the catalogue.
- Act as a conduit (business owner) for the information (metadata) input from each organisation.

In relation to Work Package D [Focal Point], the role of the data advisory group is to:

- Serve as a key forum for co-ordination of data sharing initiatives that impact the environmental observation community, thus providing the links and expertise necessary to enable the most effect use of UK resources to service and respond to the emerging requirements.
- Advise and provide information on best practice in data sharing and management across the environmental observations community at UK, European and international level such that a wider community can be made aware.

Annex 4: Assumptions and Constraints

Assumptions:

Description of Assumption	Proposed Action	Consequences if assumption is not correct
The interim observation activity catalogue will be used and maintained by data providers. It will provide value to potential users.	Promotion of catalogue use. Data collectors need to be encouraged to add information regarding their activities; update requests need to consider the ability of organisations to supply metadata.	Benefits will not be realised in the short term and the community may not recognise the longer term value that can be provided from an observation activity catalogue.
Support and funding for the UK-EOF will remain in place;	Continue to respond to sponsor needs effectively and report regularly on the value of the UK-EOF Programme.	Data Initiative will have to be de-scoped or slow down further.
Additional funding will be provided if required;	Scope and plan work to minimise the need for additional funds and provide persuasive arguments to convince sponsors of the value of any additional work required.	The element requiring additional funding will have to be cancelled or postponed with potential impacts on the rest of the UK-EOF work.
In the event of a budget cut requiring a slow down or de-scoping, the Data Initiative will adapt plans and methods of working to meet changed needs.	Adopt a risk-based proactive strategic response plan focussed on adaptability and rapid reaction to changing circumstances.	The Data Initiative will have to be slowed down or de-scoped reactively, or postponed or cancelled.
The measures being introduced for encouraging all parties to adhere to the standards/good practice will be adopted by the community.	Work with the community to ensure the proposed measures are acceptable and effective by identifying where similar steps have been taken elsewhere and learn the lessons.	If the measures proposed are not applied and effective then reuse of data will not increase and data management practices will not improve across UK plc.
Steps being taken to change the culture and behaviour within organisations responsible for collecting, storing and publishing data/metadata will be effective;	The Data Initiative will work with the community to ensure that the educational support for culture change is provided, the measures being introduced are effective and that sufficient reinforcement is maintained.	If the measures proposed are not applied and effective in practice then observation activity information and the associated data will not be reused and the benefits of the project will not be realised.

Constraints:

Description of Constraint	Proposed Action	Consequences if action is wrong or constraint changes
Current level of funding and lack of resources constrain the project from delivering in the timescales originally anticipated and to the full scope.	Scope novel ways to meet project goals and timeframes. Review, refocus and revise business case for the project progressing.	Project will have to be de-scoped, timescales changed.
INSPIRE, Location Programme, GMES, GEOSS, SEIS and other initiatives are not as far advanced as UK-EOF and therefore not able to provide the input required to the Data Initiative.	UK-EOF will maintain an ongoing dialogue with the other initiatives, helping to shape and influence these initiatives as appropriate.	Duplication of effort through lack of coordination and collaboration resulting in waste of resources, time etc. Alternatively, elements could fall between the initiatives resulting in some things not being covered.

Annex 5: Risks Register – Draft

ID	Risk Description	Consequence	Current likelihood 1-4	Current Impact 1-4	Current risk rating (L x I)	Countermeasure	Residual risk i.e. revised (L x I)	Risk Owner	Action due date	Contingency	Status
1	Sponsor/s withdraw funding for the UK-EOF Programme	Progress slows down or stops. Benefits cannot be realised	3	4	12	Use co-founders agreement to confirm commitment from sponsors	8 (2x4)	Prog Mgr		Seek alternative funds. De-scope the project or deliver over a longer time frame	Live
2	Sponsor/s withdraw support for the DI	DI is not able to gain approval to move into the delivery stage. Project stops	2	3	6	Maintain dialogue with sponsors to ensure continuing buy-in	3 (1x3)			Understand why support withdrawn and address concerns.	Live
3	Sponsors require major changes to the project scope	Project delayed, costs increase	2	3	6	Ensure all sponsors requirements are fully understood & captured. Sponsors to understand the effect any changes will have	3 (1x3)			Ensure buy-in from sponsors and community, re-scope, change delivery time and cost plan	Live
4	Central Government put a hold on all non-essential programmes & it projects)	Project has to reprioritise, requirements may not be met or met on time; team disbands	4	4	16	Ensure stakeholders maintain support for the project and the case for continuing is robust	6				Live

5	Government data sharing initiative undermines or supersedes work of the UK-EOF Data Initiative	The project has to be re-planned in the light of the new requirements	2	3	6	UK-EOF to continue dialogue with the data sharing initiative to influence their thinking.	2 (1x2)				Live
6	Timescales for delivery are too tight	Delivery of outcomes delayed	2	3	6	Ensure project is properly planned and delivery team buy-in to the timescales	4 (2x2)			Re-plan the project and manage stakeholder expectations	Live
7	Lack of cooperation or constructive input from the DAG	Lack of support undermines credibility and prevents take up of the measures being rolled out	1	3	3	Continue to work closely with DAG members and ensure their concerns are addressed	3 (1x3)			Ensure Management Group and senior stakeholders are on board and can support DAG members	Live
8	Inability to recruit suitable team members	Reprioritise implementation of the 6 work packages	1	4	4	Take steps to ensure suitable candidates can be appointed	4 (1x4)			Continue with current team members	Live
9	Programme Manager leaves or unavailable due to illness	Programme loses leadership and direction	2	4	8	Programme Manager shares progress with Project Manager.	6 (2x3)			Project manager maintains links to Management Group, DAG and Appoint interim PM until return or new appointee in place	Live
10	Other team members leave e.g. project	Project is delayed until replacement appointed	2	3	6	Team share progress and ensure all have access to documents.	4			Slow project down and/or appoint interim until new staff member in	Live

	manager					Identify succession plan	(2x2)			post. Ensure speedy recruitment process	
11	Other initiatives duplicate work of UK-EOF DI	Wasted resources and reputation of UK-EOF undermined	3	2	6	Maintain strong links with other initiatives in particular the Location Programme, GEO, SEIS & NERC	4 (2x2)			UK-EOF DI need to be flexible to adapt and change to avoid duplication and ensure adds value	Live
12	Lack of coordination between initiatives alienates the community	The community do not adhere to standards and protocols as they are confused and feel alienated. Data cannot be reused	2	4	8	Maintain a key role in helping to bring the initiatives together and ensuring consistency. UK-EOF acts as an enabler	3 (1x3)	Project Mgr		Act to identify where there is a breakdown in the interface and coordination between initiatives. Work with community to clarify requirements and resolve concerns	Live
13	Requirements for new infrastructure too expensive/ unachievable	If infrastructure is not in place, some data will not be archived for future use and therefore will be lost	1	3	3	Identify other means of storing the data rather than additional infrastructure e.g. using existing facilities operated by the larger data service providers	3 (1x3)			Scope the scale of the shortfall in infrastructure and seek additional funding, alternative solutions	Live
14	Interim catalogue not used	Benefits of accessing information on activities not realised. Community not able to see the value it provides	1	3	3	Ensure awareness levels are maintained and reinforced. Keep catalogue up to date and ensure content managed and checked regularly	3 (1x3)			Seek help from DAG and other key stakeholders to publicising it	Live

15	Catalogue becomes corrupted	Content of the database lost, users get the wrong information. Credibility of the catalogue & UK-EOF undermined, collectors and users don't use the catalogue	1	4	4	Ensure sufficient resilience to ensure that the database cannot be corrupted. Ensure back up can be brought online quickly	4 (1x4)		Rectify the issue as soon as possible by installing the un-corrupt back up. Reassure users and those affected that contingency plan has been effective and that problem resolved.	Live
16	Inability to integrate the catalogue with the Location Programme portal	Catalogue cannot become part of the Location Programme offering providing the depth of content provided by the partnership with the Location Programme	1	2	2	Through the Location Programme Interoperability Board, and regular interface meetings work together to ensure the benefits of collaboration are realised	3 (1x3)		Scope of the Location programme expanded to include Environmental Observations	Live
17	Lack of buy-in from the observation community	Community don't adhere to standards, data is 'lost' and unable to be re-used	3	3	9	Maintain dialogue with the community both through regular meetings e.g. Management Group & DAG, but also through regular bulletins and indirect communication	6 (2x3)		Identify cause and activate members of the DAG and Management Group to act as liaison with the community to ensure buy-in	Live
18	Resources not available for some collectors to create metadata	collectors do not create the metadata which creates extra cost burden on data service providers.	3	2	6	Identify which collectors could experience difficulties and help them to understand the benefits of data sharing. Identify ways of making	2		Provide support and encouragement to data collectors experiencing	Live

		Some data potentially not re-usable				it easier for these collectors to create the required metadata	(2x1)		difficulties	
19	Data collectors don't follow standards	Data is not collected and managed properly leading to lost opportunity with data not able to be reused	3	2	6	Identify potential areas where data collectors might not be willing/able to adhere to standards	4 (2x2)		Take action to address those who are not following the correct standards	Live
20	Data Policy, Citation process and contract clauses fail to change behaviour	Data is not collected and managed properly leading to lost opportunity with data not able to be reused	2	2	4	Identify potential areas where data collectors might not be willing/able to adhere to standards	3 (1x3)		Take action to address those who are not following the correct standards	Live

Key to Risk Register

4	Medium	High	Very High	Very High
3	Medium	Medium	High	Very High
2	Low	Medium	Medium	High
1	Low	Low	Medium	Medium
	1	2	3	4