Additional Information

This Additional Information page seeks to give some guidance as to the types of activities currently on-going within the COBWEB project. We hope this page will assist in giving people some ideas as to the types of activities that may be applicable/appropriate for the tendering process. We have also made available the PowerPoint Slides from the call for proposals preliminary meeting in Machynlleth on 20th May.

Thematic/Subject Areas

The COBWEB project proposal identified the three main subjects below as areas where rapid progress could be made at the outset of the project and where initial effort would be concentrated.

At the time of writing, prototype demonstrators are either at an advanced stage or have been completed in each of the 3 pilot case study areas.

1. Pilot case study One - Creation and validation of data products from Earth Observation data
2. Pilot case study Two – Biological monitoring
3. Pilot case study Three – Flooding

1. Pilot case study One: Creation and validation of data products from Earth Observation data

Earth Observation (EO) data, primarily from airborne and spaceborne data at resolutions ranging from <1 m to more than 1 km, aids the production of habitat and land cover extent and condition maps, which are a precursor to wider mapping of biodiversity, change and ecosystem goods and services. A fundamental requirement of products derived from EO data is statements on the accuracy of maps or retrieved information, eg, plant productivity, and hence their validity for various applications eg, habitat extent or change. EO-derived data also provide key inputs to species distribution models, which allow prediction of plant and animal species occurrences across landscapes.

Citizen-derived data will include observations of vegetation type and community composition (including plant species) as well as biophysical variables such as relative moisture content and proportions of green and senescent/dead material and dominant leaf type and phenological state. Data on the location, type and magnitude of change associated with both natural and human-induced events and processes will also be recorded. In each case, a date and time-stamp as well as latitude and longitude coordinates and direction of photographs taken will be provided. These data will be used to better understand the extent; condition and temporal/spatial dynamics of land cover and habitats and how these are manifested within EO data acquired by optical, radar and LIDAR sensors.

Citizen-collected data are also anticipated to provide time-critical and site-specific information when EO data or derived products are insufficient, eg, because of spatial resolution, or unavailable, eg, because of cloud cover. EO-derived data will also be used to verify and confirm the accuracy of the crowdsourced data. The EO data and derived inputs are key inputs for quantifying, modelling and monitoring biodiversity distributions.
and environmental processes, including those related to hydrological flows. Hence, these will form a key role in the other two case studies.

### 1.1 Current Status and Ideas for Expansion

COBWEB is interested in enabling users to collect information from their surrounding environment that will assist professionals in the earth observation industry to validate land cover models and habitat maps. Work has been done with students from Aberystwyth University where users collected geotagged photographs in the field and text descriptions of their surroundings to assist them in the classification of satellite imagery and the validation of their land cover models. Researchers from Nottingham University are interested in the range of words that people use to describe their surroundings and as such the functionality of free text descriptions in a mobile application is important. The UN Food and Agricultural Organisation (FAO) are interested in users collecting information about their surrounding environment using a range of descriptors and collecting this using the ‘Land Cover Meta Language’ Standard. As such, rather than COBWEB solely confining the user to choosing between pre-existing labels that best describe the land cover that they are in, the preferred option is to enable the user to freely describe the land cover using a range of simple descriptive elements.

COBWEB wants large volumes of data from volunteers/citizens who are willing to collect data that best describes the land cover that they are in, to take photographs, and/or even to best match the land cover they are in with pre-existing photographs or pre-existing descriptions. More detailed information on surrounding plant species and abiotic factors such as soil type and moisture content would provide useful information about the habitat. Other useful information would be on the slope or surrounding landform types, altitude, proportions of green and senescent/dead material, and dominant leaf type and phenological state. It is understood though that a lot of these data requirements involve specialist knowledge and/or equipment. All of this or any of this information would be useful ground-truthed and spatially referenced data that could be used to validate any number of earth observation products.

### 2. Pilot case study Two – Biological monitoring

Biological data contribute to a number of policy areas across Europe, including the Birds Directive and the Habitat Directive, and more general biodiversity monitoring indicators and climate change impacts. Whilst a large amount of biodiversity data exists, it is often insufficient in detail. It is also often the situation that numerous observations have been made but that these are not recorded digitally or stored centrally for wider use. This contributes significantly to the value of citizens being able to make observations of flora, fauna and habitats using mobile devices. Such information can then be used to better describe the composition of habitats and also their use by a variety of species (e.g., birds, mammals, invertebrates). The information will also provide key input that can be used in the development and validation of species distribution models, complementing other spatial information inputs, eg, EO-derived data. Another example of the value of crowdsourced biological monitoring information is its potential contribution towards EU Member State reporting obligations under Article 17 of the Habitats Directive on the Assessment of the Conservation Status of species and habitats.

Through this approach, the impact of change on the distribution patterns and numerical measures of biodiversity (e.g., abundance) can be better established and validated through citizen data. For each observation, standard data (e.g., date, time, geographical coordinates and photograph information) will be
collected. The information will be used to provide a better understanding of how biodiversity is distributed within and around protected sites and how these are also used temporally (e.g., during bird migration). Such information is anticipated to significantly increase understanding of how plant and animal species utilise landscapes and how these vary as a function of seasonality and in response to human and natural impacts.

2.1 Current Status and Ideas for Expansion

COBWEB is interested in enabling users and organisations who are willing to collect biological data to do so through the use of Mobile App’s. To date COBWEB is incredibly grateful for the work done in this area already by Dyfi Woodlands, Outward Bound and Ysgol Bro Dyfi. These 3 organisations have used FieldTrip GB (http://fieldtripgb.blogs.edina.ac.uk/) as a tool for creating customised forms which allow them to collect biological data in the field. The app’s have been used to collect data on a variety of animal species and tree species through the Dyfi Biosphere.

COBWEB’s key objective in this area is to facilitate the collection of large amounts of user generated data. We welcome ideas and projects in the Dyfi area which seek to collect valuable biological data for policy or management use. Alongside the actual collection of data we also hope to work with citizens and organisations to help us better understand how technology and ‘App’s’ can help facilitate the data collection process.

3. Pilot case study Three – Flooding

Flooding has enormous environmental, social and economic consequences and there is growing recognition across Europe of the need to improve techniques for flood prediction, flood prevention and mapping the spatial extent of flood hazard and risk. Severe flooding events in recent years have focused both public and political attention on the shortcomings in planning and building control policies in relation to development on floodplains in Europe. Furthermore, climate-based predictions suggest that both the magnitude and frequency of flood events are likely to increase in the future, this has given additional impetus for a reassessment of how national government policies might affect the floodplain planning and enhance the decision making process in these areas.

Although existing flood risk maps, prepared by in-country regulatory agencies (e.g. the UK Environment Agency, Federal States in Germany), are used to predict the likely incidence of flooding based on floods of a given return period (e.g. 1% annual exceedance probability flood or the so called ‘1 in 100 year flood’), they do have some significant deficiencies:

1. The estimates of what constitutes a 100-year flood event are often based on short-duration gauging records of generally less than 50 years.
2. They may take little or no account of predicted 21st Century climate changes and therefore their use in the context of medium to long term land use planning is limited.
3. The apparent fine-scale flood risk maps are often based on relatively coarse-scale hydraulic models that do not always fully take into account local factors affecting flood routing and inundation extent, depth and duration.
4. They give no indication of water quality and therefore neglect the important role of floodwater as a vector of suspended sediment and sediment-associated contaminants.
Issues 3 and 4, and to a lesser extent issue 2, are related to the fact that flood inundation maps rarely incorporate fine-resolution spatial and temporal data. The development of crowdsourced data capture in the COBWEB project, however, affords a hitherto unavailable opportunity to capture real time and high-resolution data relating to flood extent and water quality. Flooding-related citizen-derived data generated in the COBWEB project will include:

- Geo- and time-tagged photographs of flood limits that will be used to calibrate and validate flood hydraulic models.
- Geo- and time-tagged photographs of flood water colour (these will be calibrated to a semi-quantitative measure of suspended sediment concentration using a colour image-processing app) to estimate river sediment loads, which will be used to quantify catchment erosion and sediment delivery patterns.

Furthermore, these crowdsourced datastreams will be used in conjunction with EO data captured in case study 1 (e.g. aerial photography, LiDAR, satellite imagery) to validate flood extents and water routing pathways derived from hydraulic flood models.

Crowdsourced data capture will provide real-time data on mobile devices that will be of benefit to (i) individuals and communities, giving them an early warning of possible road and bridge closures, (ii) farmers, providing them with landscape level visualisations of field flooding, giving them time to move livestock to higher ground, and (iii) environmental managers who require information on erosion hotspots within catchments. The ability to receive virtually immediate confirmation of flooding extent and areas of erosion via COBWEB will improve both the reliability and accuracy of flood risk maps and provide enormous economic and social benefits for flood prediction and flood prevention.

### 3.1 Current Status and Ideas for Expansion

The Flood App has been designed to collect data to improve our understanding of flood risks within a region. The design of the App is not solely to capture images of flooding when it occurs but also aid in flood prevention and document the consequences also. Below is an overview of some of the ways the App can be used.

**Flood prevention:**

- State of rivers and waterways: This could include for example photographing debris which has fallen in river or river bank erosion.
- Road surfaces: The drainage system in place on roads may struggle during rainfall events or be blocked by fallen debris such as litter and/or fallen leaves. Photographs of overflowing drains or such blockages would be a useful resource.
- Blockages in Culverts or Bridges: Debris can cause significant problems to features designed to allow water to flow through them and some recent flood events have been attributed to blocked culverts.
- River Levels: It is not feasible to have river gauges at numerous points along the river so capturing river level information using the App will help gauge the behaviour of the river and could aid in prediction of flood events.
- Land saturation: How waterlogged is the surrounding land in your vicinity.
Flood events:
- Flood Extents: If safe to do so, capturing photographic data of flood waters using the App can provide us with valuable, detailed insight into how and why flooding occurs within a region.
- Water Colour: Photographic data of flood waters can provide an indication as to the amount of sediment.
- Flood Damage: Estimates of the level flood damage can be derived from photographic evidence.

Post flood:
- Trash-line or Tidelines: After a flood event there is often water marks on side of building or walls and/or defined lines of debris on the ground. These lines reveal the approximate depths of flood waters.
- Debris and Flood damage: Flood events can lead to significant damage to infrastructure and result the in accumulation of debris. Documenting this will provide valuable information that can be utilised to plan appropriate responses to aid in recovery.
- Land/River bank erosion: Relating to that of flood damage, it is possible via the App to capture/document changes to the natural landscape after flooding.

We are looking for groups in localised regions within the Dyfi to start collecting data to build up a greater understanding of how the Dyfi Biosphere responds to flood events whilst also seeking to reduce its impacts on the communities that reside within.

With the App still being in the prototype stage there is still some room for expansion on what other information would be useful to capture and we welcome input in this regard. For instance in the context of flooding impacts, the app is currently focussed upon effects on human populations and infrastructure. One possible area of interest not looked at yet could be the impact on local flora and fauna and their responses to these events this could cross over into other areas of COBWEB such as Biological Monitoring.

Case Studies
Since the COBWEB project started a number of individuals/organisations with the Dyfi Biosphere Reserve area have been interviewed and the results written up as “case studies”. These were used by the COBWEB consortium to derive user requirements which in turn were used to guide development of the technical architecture and the associated demonstrator applications. This work is ongoing and full copies of the case study documents will be published towards the end of 2014.

The following are brief summaries of the case studies collected so far:

Pollinators:
Outward Bound have been contributing to this case study by equipping young people with photographs of pollinators to look out for in the natural environment as well as information on the kinds of habitats that they prefer. The young people are then tasked with identifying and photographing the pollinators. After the session, maps showing where the young people went during the activities and the locations of points of interest along the way are used to assist discussion on environmental issues.
FP7 BIO_SOS:
This case study initially concentrated on data requirements for one specific classification system. Work has evolved now so that the type of data collected on the surrounding environment can be adapted to work with any number of classification systems and simply requires the user to collect simple descriptive elements associated with the land cover and habitat type at each observation location. This case study has effectively been absorbed into the more general work of the validation of EO projects case study below.

Validation of EO Products (Gwylio):
Initial focus for COBWEB with regards to ‘Earth Observation products’ is land cover and habitat maps. COBWEB wants to harness the potential that collecting large volumes of on-the-ground data from willing volunteers has to contribute important data to the process of creating land cover and habitat maps and validating those products. As such, it is important that contributors in this area collect as much data as the project allows the time for about their surrounding environment. This includes photographs that have been labelled/tagged appropriately if possible and for example, information about the surrounding vegetation lifeforms. Lifeform can include for example, whether it is mostly trees or shrubs or grasses and, where possible, the identification of plant species would be ideal. Information on percentage cover of these components is required as well as whether or not the vegetation exists in layers or strata. Data on land use can also be valuable for example grazing or crop rotation as well as information on the soils in the area and the amount of dead vegetation versus green vegetation. Many of the earth observation products are based on satellite imagery where each pixel represents a relatively large area on the ground. As such, some generalisation is preferred in addition to the more detailed information provided.

Outward Bound:
Staff from the Outward Bound Centre, Aberdovey, have been out in the field with young people trialling the use of mobile applications in the outdoors. The time spent to date has mostly been used to get staff familiar with the use of smart technology in their work and to test out the practicalities of working with these devices with young people in an outdoor environment. During this time, staff have participated in two internal workshops which generated strong buy-in from staff and management and generated a number of ideas of how the mobile devices could be used in specific projects such as those for the John Muir Award. Many of the ideas that were brought forward would suit the purposes of the COBWEB biological monitoring study theme in particular. Some resources were provided by the Welsh Government to support some trial work in the area of pollinators. This work is all on-going but includes finding areas in the local environment where pollinators are abundant and can be identified or counted and this data recorded and mapped. Other work has included spotting the location of good stands of bog cotton grass and taking photos of these. NRW have specifically requested more information on the location of this species as it indicates the location of intact blanket bogs which are very sensitive habitat types.

Community woodlands:
In 2013, Coetiroedd Dyfi Woodlands produced a Woodland Management Plan for Coed Ty Gwyn, an area of woodland near Machynlleth owned by NRW and already used for educational purposes. This case study considers the potential of COBWEB to support the process of developing a Woodland Management Plan for a community woodland. Specifically, in wildlife surveys undertaken by volunteers that feed in to such a plan,
mobile apps could be used in place of paper-based surveys, and the results displayed in an interactive online map.

**Ecotourism**

Ecodyfi is exploring potential case studies related to Sustainable Tourism in the Dyfi Biosphere area. Possibilities include visitors contributing data as part of an environmental activity, piggybacking on digital tourism marketing and interpretation projects, and looking at visitor numbers and visitor flow as data in their own right.

**Education**

COBWEB is currently working closely with Ysgol Bro Dyfi. Teachers and pupils are currently using the FieldTrip GB app to create forms, which can be completed, in situ by students on mobile devices. The first activity has already occurred with students mapping the tree species within the school grounds along with other information including: tree height, bark colour, leaf shape etc. The next proposed activity is a Key Stage 3 activity to the Ynshir RSPB reserve in July 2014. An activity has already been designed for students and has incorporated learning outcomes from Science, ICT and Geography.

Feedback thus far from teachers has been very positive with teachers commenting on the potential for use in the Science, Geography and ICT curricula.

COBWEB also wishes to engage in the ‘informal learning’ sector. These are citizens who are outside of formal education (schools, Universities etc), and can be from any demographic. Some work in this area is currently ongoing with Outward Bound who are using educational materials which are not necessarily curriculum relevant.

**Flooding**

This case study is currently working with a group called the TalyBont Floodies. We are attempting to create mobile app’s which can help local residents and indeed environmental and government agencies better plan and understand the potential and impact of flooding. Work is progressing rapidly with an initial prototype due in July 2014. COBWEB is very keen to hear from other citizens or groups who would like to be involved or have ideas about potential app’s which could be of use.

**Smart Citizen**

The basic objective of the use case is to extend the data collection scope undertaken by a COBWEB participant in order to also collect environmental data on temperature, humidity, ambient light, noise, CO and NO2 in the direct neighbourhood where active observations are collected from the smartphone i.e. we record ambient environmental conditions as recorded by supplementary sensors.

The idea is to leverage the capability of SmartCitizen. The Smart Citizen [http://smartcitizen.me](http://smartcitizen.me) project out of Barcelona, Spain introduces the idea that citizens purchase (in this instance COBWEB on behalf of the citizen) a (primitive) hardware board, called the “Smart Citizen Kit” for “Crowdsourced Environmental Monitoring” and deploy that in their Wi-Fi at home. With registration at their website, the owner provides metadata such as the location of the sensor board. From that moment, the measurements of the board’s sensors get read and displayed periodically on a mapping application: [http://test.smartcitizen.me](http://test.smartcitizen.me). The sensor board itself is equipped with sensors to measure temperature, humidity, ambient light, noise, CO, NO2.
Powerpoint Presentations from call for proposals preliminary meeting (Y Plas, Machynleth, May 20th May)

Introduction and Overview by Chris Higgins (download here)
Helping to map vegetation by Dr Crona Hodges (University of Aberystwyth) (download here)
Coetiroedd Dyfi Woodlands by Kirsten Manley (download here)
Talybont Flood Group by Mick Fothergill (download here)
Ysgol Bro Ddyfi by Tomi Rowlands (download here)
Outward Bound by James Hodges (download here)

Data identified as being of interest for policy formation and delivery

Welsh Government are particularly interested in collecting information on the following themes:

Pollinators - either pollinating species themselves or nectaring plant species that serve as a food resource for pollinators. Welsh Government would be keen to extend and support the existing work already in place within the project looking at connectivity of plant resources for pollinators with the aim of testing whether collected information can be used to target appropriate interventions (e.g. planting, changes to mowing, cutting exercises etc) and validate a pollinator resource model that has been produced for the Dyfi Biosphere.

Invasive and Non-Native Species - Mapping the distribution of a range of invasive plant or animal species that are currently in existence in the biosphere (e.g. Himalayan Balsam, Japanese Knotweed, Giant Hogweed, Buddleja/Buddleia, Grey Squirrel Damage to woodland).

Non-Woodland Trees - mapping the distribution of trees that exist outside of woodland blocks - either single trees or as part of hedgerows. This is a known evidence gap within our current understanding of our national stock of trees.

Woodland constituents - Testing the constituents of woodland areas e.g. dead wood is good indicator of sustainable woodland management. The collected data may help refine statistical input into the National Forest Inventory.