

## **Mapping Ecosystem services – Interactive Sessions Ketso Mats**

### **Sheffield Town Hall**

November 2012

The following tables record the feedback of seminar attendees on current issues with ecosystem services mapping. These were discussed under four headings:

- Creating ES maps
- Applying ES maps
- Data
- Existing mapping tools

Ketso mats were used to collect ideas and opinions. Attendees were able to record their comments and also to vote for one issue they felt was the most important. The tables below summarise the response across all the groups.

An examination of the total numbers of comments posted against each topic (Table 2), and of the number of priority votes placed against each topic category (Table 1) gives an indication of which issues were considered most important by seminar attendees. The full range of responses are shown in Tables 3, 4 & 5 (NB. numbers do not fully tally between tables due to some attendees leaving at different points of the day).

#### **Creating ecosystem service maps**

Three attendees indicated “opportunities” in creating ecosystem service maps were their most important issue, whilst two attendees voted “limitations” in creating maps as the most important. Of the individual comments attendees noted the range of technology available to conducted mapping with open source GIS and ArcGIS being common responses in the “what is working now” topic. Under the “limitations” to creating maps attendees noted that the cost and time necessary to conduct mapping was a key concern, along with a lack of GIS staff or skills to carry out the works. Other comments related to a lack of consensus on methods and that there was currently duplication of approaches in how to map ecosystem services. In discussing “opportunities” there was strong agreement over the requirement to collaborate more and share ideas on service mapping. The need for affordable GIS training received several comments.

#### **Applying ecosystem service maps**

Five attendees tagged “what is working now” as their most important issue whilst “limitations” received two votes and “opportunities” four votes. Of the individual comments there was strong support in the “working now” theme for using ecosystem service maps in land use decisions and development planning. Additionally noted was the use of maps for stakeholder analysis and discussion. Another popular use was for biodiversity opportunity mapping / land restoration. In terms of identified “limitations” to applying maps the most noted comment was the clarity and interpretation of output maps and how they may be misunderstood by users due to their potentially complex nature. People also expressed a feeling that there are issues with the terminology and understanding of ES concepts and with the reliability and confidence of the data used in the mapping. In highlighting “opportunities” for applying maps attendees noted the need to raise awareness of ES mapping with communities, for better clarity and standardisation of mapping methods, and to ensure an interdisciplinary approach.

#### **Existing mapping tools**

Eight attendees voted for a topic within “opportunities” as their most important issue regarding existing mapping tools, with three voting for “limitations”. In terms of individual comments under the “working now” topic a range of available GIS software was highlighted, including ArcGIS, MapInfo, and open source GIS including GRASS and

Quantum GIS. Additionally the mapping work of EcoServ-GIS and POLYSCAPE were noted. In terms of “limitations” to using existing mapping tools a common response was the lack of time or funding to run the tools, along with a lack of GIS or analysis expertise or staff. Other comments included noting a lack of demonstration of the tools and the issue of lack of coordination in mapping approaches or between different tools. There was support under “opportunities” for future tool development to be undertaken in collaboration, with sharing of information, data and techniques online. Other comments noted the availability of free GIS training and support from websites such as ESRI’s ([www.esri.com](http://www.esri.com)) and highlighted the opportunities of working in partnerships with universities.

## Data

Nine attendees noted “limitations” with data as their most important topic. Two also noted important “opportunities”. Individual comments on data “working now” included the availability of local authority datasets, the Water Framework Directive (WFD) data from the Environment Agency (EA) and BAP data. The MAGIC website ([www.magic.gov.uk](http://www.magic.gov.uk)) was also highlighted, as was OS Mastermap data, EA floodmap data, and local record centres. In terms of data “limitations” there were very frequent comments on the cost (both time and money) of acquiring licenses for data, even when originally publicly commissioned. There were also concerns over the accuracy of data, especially across different scales. In examining data “opportunities” the need for increased collaboration over data was noted, along with calls for more funding of environmental record centres. The value of open data schemes was also highlighted.

## Summary

- In discussing ecosystem service mapping there was a wide range of awareness of the potential tools available, but also many comments concerning a lack of consensus or guidance over mapping methods and a deficit of trained GIS / analysis staff or project funding limiting the amount of ecosystem service mapping being undertaken.
- A wide range of uses were shown for ecosystem service mapping ranging from informing land use decisions to advising new Nature Improvement Areas or biodiversity offsetting.
- The full list of comment from attendees highlights a wide range of issues including several new potential data sources and methods for mapping that will be of use for practitioners to consider.

**Table 1 – Issues voted as “most important” by attendees across each category (1 vote per attendee)**

Topic	Working now	Limitations	Opportunities	Totals
Creating ES maps	0	2	3	5
Applying ES maps	5	2	4	11
Existing tools	0	3	8	11
Data	0	9	2	11
Totals	5	18	17	

**Table 2- Total numbers of recorded comments in each category**

Topic	Working now	Limitations	Opportunities	Totals
Creating ES maps	28	46	47	121
Applying ES maps	53	53	44	150
Existing tools	46	48	31	125
Data	67	60	37	164
Totals	194	207	159	

**Table 3 - Creating Ecosystem service Maps – participants comments**

Red numbers in square brackets indicate votes by attendees as their most important topic. Numbers in round brackets indicate the number of times a comment was recorded.

What Ecosystem service mapping issues are working now	Limitations	Opportunities
<ul style="list-style-type: none"> <li>• Open source or free GIS software (5)</li> <li>• ArcGIS software (4)</li> <li>• MapInfo (2)</li> <li>• Available staff with expertise (2)</li> <li>• Present outputs in Google maps / earth (2)</li>   <li>• Lots of mapping methods and approaches are being developed</li> <li>• Participatory GIS</li> <li>• WFD and other data via Environment Agency</li> <li>• Scientific research and evidence</li> <li>• Remote sensing data</li> <li>• Including both supply and demand maps</li> <li>• Becoming more user friendly</li> <li>• Map axiophytes to landscape description units and LCU</li> <li>• Landscape connectivity modelling</li> <li>• Local habitat opportunity maps</li> <li>• Cloud GIS</li> <li>• Magic.gov.uk</li> <li>• FME</li> </ul>	<ul style="list-style-type: none"> <li>• Cost / time to run the tools / maps (6) [1]</li> <li>• Appropriate to target audience and purpose (3) [1]</li>   <li>• GIS staff or expertise to produce maps (7)</li> <li>• Expertise required by end users of tools / maps (3)</li> <li>• No clear GIS methods or mapping guidance (3)</li> <li>• Clarity, usability of the output maps (3)</li> <li>• Duplication of work / conflict of approaches, no consensus of method (3)</li> <li>• Lack of access to scientific journals (3)</li> <li>• Uncertainty and complexity of maps (3)</li> <li>• Cost of GIS (2)</li>   <li>• Understanding of visual language</li> <li>• Lack of coordination</li> <li>• Map creation is an art and is very difficult</li> <li>• Lack of confidence in using the maps</li> <li>• Mapping definitive maps is not realistic</li> <li>• Lack of local authority engagement</li> <li>• No national government commitment</li> <li>• Clarity of terminology</li> <li>• Can be subjective assessment</li> <li>• Access to academic datasets</li> </ul>	<ul style="list-style-type: none"> <li>• Need to collaborate / link / share (9) [1]</li> <li>• Redirect funding / resources towards mapping (2)[1]</li> <li>• Develop the user community [1]</li>   <li>• GIS training and knowledge (affordable) (6)</li> <li>• Involve stakeholders / users from the beginning (2)</li> <li>• Keep method simple, may end up with the same answers anyway (2)</li>   <li>• Open access datasets</li> <li>• Open access to journals</li> <li>• Use fuzzy boundaries for mapping</li> <li>• Encourage greater local authority engagement</li> <li>• Use of volunteers</li> <li>• Apply a levy on developers to fund the map creation</li> <li>• Better communication of maps / mapping</li> <li>• Honorary fellowships with universities</li> <li>• Partnerships with universities</li> <li>• UK CIP 09 data</li> <li>• Use steering group advice</li> <li>• Ensure clear presentation / legends / keys</li> <li>• Ensure recognition and acceptance</li> <li>• Use peer reviewed data</li> <li>• Link to local studies</li> <li>• Apply models to reduce time needed</li> <li>• Ensure GIS methods in academic literature are clear and repeatable</li> <li>• More public maps</li> <li>• Use freely available platforms (eg GIS)</li> <li>• Capture citizen knowledge</li> <li>• Mapping workshops / training sessions</li> <li>• Cheaper mapping technology</li> <li>• Use new technology to rapidly map and present information sooner</li> <li>• Reduce cost</li> <li>• Interactive mapping – crowd sourced data</li> </ul>

**Table 4 - Applying Ecosystem service maps / mapping – participant comments**

Red numbers in square brackets indicate votes by attendees as their most important topic. Numbers in round brackets indicate the number of times a comment was recorded.

What Ecosystem service mapping issues are working now	Limitations	Opportunities
<ul style="list-style-type: none"> <li>• Land use decisions / Local development location planning / UDP's etc (9) [1]</li> <li>• Stakeholder negotiation / analysis (4) [1]</li> <li>• Future land use scenarios and sustainable development planning (2) [1]</li> <li>• Identify new NIA locations (2) [1]</li> <li>• Biodiversity offsetting [1]</li>   <li>• Land restoration / biodiversity opportunity maps (6)</li> <li>• EA flood maps / flood alleviation / mitigation (3)</li> <li>• Awareness raising and engagement (inc cross sector) (3)</li> <li>• EA catchment pilots – outcome mapping / priorities (2)</li> <li>• Natural resource management decision making / reserve management (2)</li> <li>• Informing Agri environment agreement options (2)</li>   <li>• Community infrastructure levy</li> <li>• EA and Forest research river shading work</li> <li>• Local site designations</li> <li>• Valuation</li> <li>• LEP local enterprise partnerships</li> <li>• Payments for ecosystem services</li> <li>• UK NEA follow on project</li> <li>• Case studies</li> <li>• EAI, SIA studies</li> <li>• Application by health boards</li> <li>• Research questions</li> <li>• Lots of potential uses by different organisations</li> <li>• Forming policy options</li> <li>• Interactive websites / portals</li> <li>• Phase 1 surveys</li> <li>• MEDIN</li> <li>• Investment planning decisions</li> </ul>	<ul style="list-style-type: none"> <li>• Maps being misunderstood / interpretation /clarity (9) [1]</li> <li>• Understanding / terminology of ES concept (4) [1]</li>   <li>• Confidence / reliability of data and methods used (4)</li> <li>• Lack of engagement with stakeholders / decision makers / users (3)</li>   <li>• Data without metadata standards eg MEDIN (2)</li> <li>• How to ensure results are built into high level policy and guidance? (2)</li> <li>• Lack of economic valuation (2)</li> <li>• What method to use / Pros and cons of different mapping approaches (2)</li> <li>• Lack of funding for mapping / cost (2)</li>   <li>• Problem that GDP is economics not ES based</li> <li>• Lack of interdisciplinarity</li> <li>• Problems in defining scenarios</li> <li>• Lack of challenge to the method and rigour</li> <li>• Administrative boundaries</li> <li>• Maps can be taken out of context</li> <li>• CAP reform / agri – env payments</li> <li>• Knowledge needed to interpret maps</li> <li>• Colour blindness – re legends</li> <li>• Access to audiences</li> <li>• Changing political climate</li> <li>• Dealing with trade offs</li> <li>• No ability to map change in ES provision</li> <li>• Does not work at a local scale</li> <li>• Do partnerships and end users for the maps exist?</li> <li>• Too protected landscape focussed</li> <li>• Problem of trying to apply “values” when not possible yet</li> <li>• Lack of policy support for mapping</li> <li>• Ensure to apply only to questions appropriate to</li> </ul>	<ul style="list-style-type: none"> <li>• Better clarity and standardised methods [1]</li> <li>• Ensure interdisciplinarity [1]</li> <li>• Included valuation / money [1]</li> <li>• Regular focus group meetings [1]</li>   <li>• Raise awareness of ES mapping across communities / public engagement (3)</li>   <li>• Start from scratch</li> <li>• Scale of map is important to its application</li> <li>• Clearly describe the datasets used</li> <li>• Accurately explain the constraints to mapping</li> <li>• Always debate the relative weighting / prioritisation used in methods</li> <li>• Community infrastructure levy</li> <li>• Targeted mapping to locate actions</li> <li>• LEPs and LNPs</li> <li>• ES analysis at multiple landscape scales</li> <li>• Embed use of maps in planning at parish level</li> <li>• Increase availability of remote sensed data, e.g. NOVI</li> <li>• Include tool to identify tipping points in weighting models</li> <li>• Run maps / models as best as can be done now, then refine</li> <li>• Perseverance</li> <li>• Local studies</li> <li>• Standardise display</li> <li>• Improve dataset accuracy</li> <li>• Increase partnerships with local authorities</li> <li>• Partnerships with new sectors e.g. health boards</li> <li>• Applying economics survey results</li> <li>• Local nature partnerships</li> <li>• Facilitate “incredible edible” and value the results</li> <li>• Ecosystem services offsetting</li> <li>• Recognition and celebration of ES providers</li> <li>• Work with partners to clearly define what the focus of</li> </ul>

What Ecosystem service mapping issues are working now	Limitations	Opportunities
	<p>level of data input</p> <ul style="list-style-type: none"> <li>• Need better understanding of psychology of visual language</li> <li>• Translation of data into the correct format</li> <li>• Double counting of ES services</li> <li>• Maps are static only</li> </ul>	<p>the mapping activity is</p> <ul style="list-style-type: none"> <li>• Clear guidance for different map users / FAQ</li> <li>• Demonstrate solutions that cross policy agendas</li> <li>• green deal type loans to pay for ES, paid for by beneficiaries</li> <li>• planning guidance / better integration</li> <li>• PES - payments for ecosystem services</li> <li>• Stakeholder collaboration</li> <li>• Marine Map , SeaSketch</li> <li>• More evidence / data = easier / more thorough decision process??</li> <li>• EKN to host a mapping services forum</li> <li>• Open access to data sets</li> <li>• Interactive PDFs of the maps</li> <li>• Be more innovative</li> </ul>

**Table 5 - Existing tools for ecosystem services mapping – participant comments**

Red numbers in square brackets indicate votes by attendees as their most important topic. Numbers in round brackets indicate the number of times a comment was recorded.

What Ecosystem service mapping issues are working now	Limitations	Opportunities
<ul style="list-style-type: none"> <li>• ArcGIS software (6)</li> <li>• Open source GIS (e.g. Grass GIS, Quantum GIS) (3)</li> <li>• EcoServ-GIS (Durham DWT) (2)</li> <li>• Google maps and Google earth (2)</li> <li>• Mapinfo (2)</li> <li>• POLYSCAPE (2)</li>   <li>• EKN ecosystem knowledge network</li> <li>• Games based on maps</li> <li>• Spotfire data visualisation tool</li> <li>• Ecosystem service partnerships (<a href="http://www.es-partnership.org">www.es-partnership.org</a>)</li> <li>• GI valuation toolkit</li> <li>• ARCH habitat connectivity tool (in development)</li> <li>• Think LAB Salford uni</li> <li>• Ecocities</li> <li>• I Tree</li> <li>• LEDE toolkit</li> <li>• InVEST</li> <li>• Mersey Forest Mapping method</li> <li>• Waterworld (kings college policy tool)</li> <li>• Costing nature (kings college policy tool)</li> <li>• Regresion models, e.g. land sue regression (LUR)</li> <li>• Geostat tools (Geostat, Model Environ, Stats etc)</li> <li>• Knowledge sharing</li> <li>• Groundwater modelling</li> <li>• Testing</li> <li>• UK NEA Stage II</li> <li>• Climate change vulnerability mapping</li> <li>• Economic valuation</li> <li>• GLUD</li> <li>• CORINE habitat data</li> <li>• Online interactive mapper</li> <li>• Map servers</li> <li>• JNCC framework</li> <li>• Mapping green infrastructure toolkit</li> <li>• MaRS (crown estate)</li> </ul>	<ul style="list-style-type: none"> <li>• Lack of funding or time to run the tools (7) [1]</li> <li>• Language used [1]</li> <li>• Lack of suitable mapping method for key ES categories eg cultural [1]</li>   <li>• Lack of GIS /analysis expertise / training (9)</li> <li>• Lack of demonstration of the tools (4)</li> <li>• Consistency of tools / collaboration (3)</li> <li>• Many tool but no consensus (3)</li> <li>• Dependency on ArcGIS, many use MapInfo (2)</li> <li>•</li> <li>• Needs coordination across spatial scales</li> <li>• Lack of data</li> <li>• Are the tools fit for purpose?</li> <li>• Availability of tools</li> <li>• Data processing needed prior to use</li> <li>• Capturing value of non monetised services</li> <li>• Climate change impacts inclusion</li> <li>• Assumptions within the model methods</li> <li>• LNP or NIA boundaries (cross boundary issues)</li> <li>• Lack of transparency</li> <li>• Redundancy (telling what we already know)</li> <li>• Need to develop tools to interpret social and cultural data</li> <li>• Computer processing power and out of date software</li> <li>• Terrestrial focussed</li> <li>• Too prescriptive</li> <li>• Too static</li> <li>• Lack of ArcGIS software</li> </ul>	<ul style="list-style-type: none"> <li>• Future tool development in collaboration, online sharing, internet forum, data techniques etc. [4] (2)</li> <li>• case studies and lessons learnt [1]</li> <li>• more funding for EcoServ-GIS [1]</li> <li>• adaptability of tools [1]</li> <li>• more local cultural ES surveys, social geography questionnaires [1]</li>   <li>• Free training resources e.g. on ESRI.com (3)</li> <li>• Work in partnerships e.g. with universities (2)</li>   <li>• ArcGIS now available at reduced rate for charities</li> <li>• Open access GIS software</li> <li>• PSMA mapping agreement to work with local authorities</li> <li>• Training</li> <li>• No blame culture</li> <li>• Need feedback to allow refinement</li> <li>• standardised consistent language</li> <li>• European experience</li> <li>• Prioritisation of services with stakeholders</li> <li>• Ground truthing of ES maps</li> <li>• Advice from projects around the country</li> <li>• Dive in</li> <li>• Consult the experts</li> <li>• Transparency</li> <li>• Use to convince other people (re ES values)</li> <li>• Continue network events</li> <li>• Technical training events</li> <li>• Increase government funding for ES mapping</li> <li>• Provide training for EcoServ-GIS</li> <li>• Measuring national wellbeing</li> <li>• Funding to invest in hardware software / GIS</li> </ul>

**Table 6 – Data – participant comments**

Red numbers in square brackets indicate votes by attendees as their most important topic. Numbers in round brackets indicate the number of times a comment was recorded.

What Ecosystem service mapping issues are working now	Limitations	Opportunities
<ul style="list-style-type: none"> <li>• Local authority datasets / data observatories (4)</li> <li>• WFD (water framework directive) classifications (4)</li> <li>• BAP data / single habitat layers (4)</li> <li>• Magic.gov.uk (3)</li> <li>• OS Mastermap (3)</li> <li>• Countryside survey data / network (2)</li> <li>• Local records centres (2)</li> <li>• EA data / flood risk data (2)</li> <li>• County based habitat maps from local site data (2)</li>   <li>• Native woodland survey of Scotland</li> <li>• National soil map and soilscales</li> <li>• Integrated habitat map eg marine</li> <li>• Land cover map 2007</li> <li>• Data from university studies</li> <li>• Green Infrastructure mapping</li> <li>• Measured data versus assumed / modelled outcomes</li> <li>• NBN gateway</li> <li>• Office National Statistics (ONS) socioeconomic data</li> <li>• York uni / dr Prian White re Humberhead levels</li> <li>• National tree map (bluesky)</li> <li>• OS data</li> <li>• LIDAR</li> <li>• Keeping rivers cool data (EA pilot climate change project)</li> <li>• Evidence being gathered at a catchment scale</li> <li>• NGO landscape scale partnership projects</li> <li>• Wetland vision study (and further local studies)</li> <li>• Soil maps</li> <li>• Data from partnerships as proxies</li> <li>• Visitor surveys at sites</li> <li>• Census data</li> <li>• Environmental stewardship data</li> <li>• WGS data</li> <li>• PSMA (public service mapping agreement)</li> <li>• Online available GIS datasets</li> <li>• Designated sites (SSI, SAC etc)</li> </ul>	<ul style="list-style-type: none"> <li>• License costs (both in money and time) and availability restrictions (even for publicly commissioned data) (13) [3]</li> <li>• Accuracy of data [3]</li> <li>• Knowing what data exists or what data to use [1]</li> <li>• Lack of high quality data in case of some services [1]</li> <li>• Lack of available GIS layers [1]</li>   <li>• Data impenetrable or difficult to understand (2)</li> <li>• Data size and storage (2)</li>   <li>• Academic research / data not useable or relevant</li> <li>• Resolution of datasets needs to match the complexity of the landscape</li> <li>• Data on habitat condition (quality) is lacking</li> <li>• Data resolution and coverage</li> <li>• Quality control of the data</li> <li>• Uncertainty within data</li> <li>• Lack of long term datasets</li> <li>• Spatial scale of data</li> <li>• Cross border incompatibility</li> <li>• Access to data / choice of number of different datasets</li> <li>• Data not up to date / keeping up to date</li> <li>• EA data needs unpicking to reflect ES</li> <li>• Stakeholder buy in</li> <li>• Lack of local data</li> <li>• Proxies may seem inadequate, people get sidetracked</li> <li>• Data from local authorities can be difficult to access (not standardised)</li> <li>• Issues of data interoperability</li> <li>• Gaps in information exchange</li> <li>• Data validity changes</li> <li>• Incompatibility across boundaries</li> </ul>	<ul style="list-style-type: none"> <li>• Resources for ERC's (environment record centres) to map habitat areas to comparable levels across the country [1]</li> <li>• Increased collaboration [1]</li>   <li>• Open data schemes (2)</li>   <li>• Good demonstration projects</li> <li>• ES partnerships</li> <li>• PMSA - public service mapping agreement</li> <li>• EA work on WFD and ecosystem services</li> <li>• Show opportunities for investing in ES</li> <li>• Simplified / single route for data access / sharing</li> <li>• Good METADATA ensure good use of resulting data</li> <li>• Need to show the actual value of spending on ES - eg benefits</li> <li>• Promote data sharing</li> <li>• Established and consistent systems of data validation and verification</li> <li>• Complete metadata to assess data quality</li> <li>• Request publicly funded data</li> <li>• Cross border partnerships</li> <li>• Metadata</li> <li>• Faster computers</li> <li>• Partnership working</li> <li>• Looking at case studies and networking</li> <li>• Local authority data should be collated and analysed nationally and re-released centrally</li> <li>• Applying international data standards</li> <li>• Keep accurate Metadata</li> <li>• Data sets need to be frequently updated</li> <li>• Standardise data formats</li> <li>• Ensure data at different scales are compatible - eg parish to landscape scale data collection should be integrated and complimentary</li> <li>• Gameification, crowd-sourcing of data collection</li> </ul>

What Ecosystem service mapping issues are working now	Limitations	Opportunities
<ul style="list-style-type: none"> <li>• LWS / local non designated sites</li> <li>• Use axiophytes and axiobiota as a proxy for biodiversity and habitats</li> <li>• Data rich and data poor</li> <li>• Scientific underpinning of the data used - practice is ahead of theory</li> <li>• Georeferenced social media analysis eg foursquare</li> <li>• New technology producing more data (eg apps)</li> <li>• Data mining</li> <li>• National Inventory of woodland and trees (NIWT)</li> <li>• Water catchment areas</li> <li>• Wildlife trusts data</li> <li>• Habitat / feature / type / condition</li> <li>• Aerial photography</li> <li>• Broad scale habitat maps - marine</li> <li>• INSPIRE</li> <li>• Web mapping services</li> </ul>	<ul style="list-style-type: none"> <li>• Quality control of data sets</li> <li>• Patchiness of data resolution</li> <li>• Quality / resolution / age of data</li> <li>• Low resolution of much data, eg 50% of data at 2km m x 2km scale</li> <li>• Knowing what data to use for what purpose</li> <li>• Scientific complexity</li> <li>• Acquisition of baseline data is expensive but crucial for buy-in</li> <li>• Data availability / accessibility</li> <li>• Time span between when data collected</li> <li>• Metadata generally poor</li> <li>• Obtaining data - access issues between data sources and data needs</li> <li>• Obtaining baseline data</li> <li>• Keeping data up to date</li> <li>• Confidence in modelled data</li> <li>• Resolution of marine data</li> <li>• Web feature services</li> <li>• PSMA only goes so far, DATA SHARE</li> </ul>	<p style="margin-left: 20px;">and feedback</p> <ul style="list-style-type: none"> <li>• Standard country wide ground survey</li> <li>• Survey of ecosystem services by drone with cheap connected sensors</li> <li>• Access / availability of data and tools</li> <li>• Making data more accessible on-line</li> <li>• Share data via MOU's</li> <li>• Sharing and networking</li> <li>• Value added data</li> <li>• Hope</li> <li>• Shared data repositories</li> </ul>