National Land & Water Resources Audit

An Initiative of the Natural Heritage Trust

NATURAL RESOURCE INFORMATION - GETTING IT ALL TOGETHER, ISSUES AND OPPORTUNITIES FOR INTEROPERABILITY - Discussion Paper 25/02/04

Natural Heritage Trust

Helping Communities Helping Australia

An Australian Government Initiative

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Natural Resource Information - Getting It All Together - Issues and opportunities for interoperability 25/2/2004

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Executive Summary

Interoperability is the ability of (spatial) information systems to access, display and analyse data from a number of distributed, linked sources, independent of stored data formats.

The benefits of interoperability to those who collect, manage and use natural resource information include -

- single point of truth, custodian managed data repositories
- a reduction in the need for duplicated data, coupled with increased effectiveness of expenditure on data capture programs
- increased two-way flow of data and information between government and community based natural resource managers and stakeholders
- improved support to information based decision making and planning
- improved communication and interaction

Current issues relating to the implementation of interoperable systems involve –

- **Technology.** Now matured to a point of being able to deliver and no longer a limiting factor. There is definition of notional systems architectures which support development of the ANZLIC endorsed Australian Spatial Data Infrastructure (ASDI)
- **Data and Information.** Large amounts of existing data require improved documentation and standardised access mechanisms to make them discoverable, available and accessible. Some key fundamental data required for NRM (and other applications such as Emergency Management and Health) are lacking in coverage, scale and/or timeliness. We need to ensure efficient use of data to maximise value for money from existing data assets.
- **Institutional arrangements.** NRM and other national priority issues are not usually confined within administrative boundaries such as states, regions or local government areas. We need to provide an operational infrastructure that allows easy, timely access to relevant data and information for all levels of government, community based regional NRM organisations and on-ground stakeholders.

The National Land and Water Resources Audit involvement and activity. The Audit provides information and nationwide assessments of Australia's land, water and biological resources. This can only be achieved through a synthesis of data and information which is collected and analysed across local, regional, jurisdictional and national levels. The development of open, linked data systems is an essential mechanism to allow timely, accurate, on-going reporting of monitored resource condition and trend indicators.

The Audit proposes to hold a workshop in early 2004 to –

- Develop a shared vision for national natural resource information interoperability
- Develop a task oriented work plan to facilitate future implementation
- Build synergies through ANZLIC- the Spatial Information Council and similar initiatives being undertaken by other information communities (e.g. Emergency Management, National Oceans Office, Australian Spatial Information Business Association demonstrator project, CRC- Spatial Information)

Your action is requested to –

- Consider the issues raised in this discussion paper.
- Circulate this paper to relevant information management policy and technical groups within your jurisdiction.
- Nominate 2 representatives from your jurisdiction to attend an Audit funded workshop to –
    - Present the current status of interoperability activity in your jurisdiction
    - Provide information management policy and technical input to the development of a national vision and work plan.

The Audit will soon make a further announcement regarding the workshop and extend an invitation to the workshop to representatives from each jurisdiction and key Australian Government departments. In the mean time any interest or discussion should be directed to Peter Wilson, the Audit's Data and Information Coordinator (peter.wilson@nlwra.gov.au).

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A vision for sharing Natural Resource Information in 2007

It is 2007 and in the relative comfort of her technology enriched office, Alex takes time-out to reflect on the incredible advancements in on-line data and information sharing that have been achieved over the past few years. Alex is a Catchment Management Authority (CMA) support officer in South Western NSW. Alex's responsibilities include regular publishing of salinity reports to the community, both in hardcopy and on the Internet.

For this purpose, Alex regularly needs to access key natural resource management data in the CMA area, relating to water management and salinity. She needs to analyse data and create maps, and copy them into a report. The data needed for these reports is collected and maintained by The Australian Government, the Murray Darling Basin Commission (MDBC), her own CMA, NSW Departments and many others.

Looking back, Alex realises that only a few years ago, she used the Audit's online tools, which were of limited use for her work. With the *MapMaker* she created and printed maps based on historical data. The information in the *Australian Natural Resource Atlas (ANRA)* was a broad scale snapshot only, collected from the custodians and centrally hosted by the Audit, and therefore not up to date. Similarly, much of the data that she found using the *Data Library*, although it was accessible on-line, suffered the same currency and scale problems. When she did get her hands on it, it needed laborious data conversions before the data could be used in Alex's desktop GIS, as it wasn't supplied in her GIS's native format.

Conversely, Alex's organisation collects near real-time water quality measurements, which they know other stakeholders need to use. Until recently, there was no easy online mechanism to enable the sharing of this type of data.

How much easier things are this day in 2007! Now Alex can use the new "Natural Resources Information Portal" as the one-stop shop to access digital maps and data about natural resources from many organisations Australia-wide. She searches by region, keyword and/or topic, and can preview, download data or make maps via the search results. Even better: the data is no longer centrally hosted, all custodians host and maintain the data and related metadata themselves. Alex knows that she can access the latest as well as historical information. Thanks to the consistent use of Open GIS standards and ASDI guidelines, all data can be accessed and used irrespective of the GIS formats or software it is stored in.

Alex's organisation has set up a web service that automatically publishes the area's water quality measurements online, within 30 minutes of the actual reading. More than 20 other organisations are using this web service to create their own online maps and to feed into environmental monitoring

systems. The portal statistics show that Alex's Water quality web service is found and accessed by hundreds of portal users each month, sometimes as far away as Egypt and Sweden.

Alex reminisces on the efforts of the past years that have achieved this capability. A lot of energy has been expended in overcoming the barriers to sharing spatial information. As it turned out, in 2003 most of the technological problems were solved. Most of the effort went into overcoming institutional barriers: making sure that all stakeholders worked together. That meant raising awareness and understanding through continuous consultation. The groundwork for this process was laid in a very successful workshop held in early 2004. Alex remembers it well. After some initial stagefright, the workshop participants worked together very constructively to define common visions and objectives, functional and business requirements, and come up with a joint implementation plan.

Alex realises that the success of this workshop laid the foundation for the success of the new information-sharing world she was now a part of. A lot of men and women put their hearts and souls into it, and scores of people are now reaping the benefits.

1. Introduction

The vision illustrated by Alex's story is by no means simple to achieve, but is certainly feasible. It is in fact one vision of "Natural Resource Information Interoperability" being considered by the National Land and Water Resources Audit.

This paper discusses some issues and opportunities for interoperability: what it involves, why we should care about it, and how it can be achieved. It explains the benefits for all stakeholders, identifies the main issues that lie on the road to achievement and provides food for thought for participants at a proposed national workshop to be held in Canberra in early 2004. The workshop will bring together key natural resource policy, information management and technical staff from Australian natural resource management agencies with the aim of developing a shared vision for natural resource information interoperability and a task oriented implementation plan to allow forward development.

This discussion paper does not provide a full overview or discussion of the issues to be addressed at this Workshop.

The Audit will soon make a further announcement for the workshop and request for representation from each jurisdiction and key Australian Government departments. In the mean time any interest or discussion should be directed to Peter Wilson, the Audit's Data and Information Coordinator (peter.wilson@nlwra.gov.au).

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2. Natural Resources Information Interoperability: What is it?

2.1 A Vision of Interoperability

For more responsive and targeted decision making there is a need to develop an information architecture that is flexible enough to deliver appropriate datasets from multiple heterogeneous sources, avoiding the time and scale penalties imposed by the current approach which involves off-line data collation and centralised data management.

There are two main components in this vision:

1) An online portal that is the one-stop shop for access to natural resource maps and data in Australia; and
2) The implementation of a shared technology framework that enables the portal and information sharing functionality for all participants.

As Alex's experiences show, there are two important steps to be taken to achieve the sharing of NRM data and information and making it easily accessible. These are the implementation of *Point of Truth Custodianship* and *Interoperability.*

Point of Truth Custodianship is the concept of maintenance, hosting and serving of NRM data by the organisation responsible for collecting and publishing it, rather than the centralised storage systems that we see now. Hosting, serving and maintenance by the custodian means currency and quality of the data are maximised by having a single authoritative point of truth.

Interoperability is the ability to find data, information and processing tools no matter where they are physically located, and to understand and employ the discovered information and tools, no matter what type of computer system is being used, whether local or remote.

We all take interoperability for granted in our stereo equipment, where we happily plug together CD players, amplifiers and loudspeakers from different vendors, fully expecting them to work as one. Spatial interoperability does the same thing for GIS data and services, using the Internet for connectivity.

To achieve this, Interoperability is needed on multiple levels, which are not solely technical. These levels are illustrated in the table below.

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- **Table 1: Parameters for Interoperability**[1]

Interoperability Level	Prerequisite for Interoperability	Status
Institutional *"I will share my services with you"*	Willingness to interoperate Partnerships and agreements	Varied and unspecified
Information models / Semantics *"My concept of 'Lake' = Your concept of 'Waterbody'"*	Formalisation of data descriptions & semantics (e.g. ontologies) Standard Vocabularies	Early stages of development
Data and metadata schema *"We agree on attribute names and types"*	Adoption of shared data models	Vary depending on sector
Data exchange *"My machine talks the same gibberish as yours"*	Industry-standard connection-interfaces and encodings	Available and expanding
Networks *"We are connected"*	Standard network protocols Internet and virtual private networks	Well established

2.2 The role of OpenGIS

An important player in the field of spatial interoperability is the Open GIS Consortium (OGC). OGC is an international industry consortium of more than 230 companies, government agencies and universities participating in a consensus process to develop publicly available geoprocessing specifications.

OGC specifications enable spatial interoperability over the Internet. Some well-known OGC specifications are Web Map Service (WMS) for the query of Map Images, Web Feature Service (WFS) for the query of spatial data objects and the Geographic Markup Language (GML) for encoding of geographic features. OGC also provides specifications for service discovery, standardisation of data and metadata schemas, map symbology, etc.

ANZLIC, the Spatial Information Council, recommends OpenGIS specifications as the cornerstone for the development of the Australian Spatial Data Infrastructure (ASDI)[2].

[1] Modified from: Levinsohn, Allen (2003), "Geospatial Interoperability: The Holy Grail of GIS". Online: http://www.geoplace.com/gw/2000/1000/1000data.asp. Accessed 19 November 2003.

[2] ANZLIC (2003), "ASDI Distribution Network: The Internet Framework Technical Architecture (v2.6)". Online: http://www.anzlic.org.au/publications.html. Accessed 17 February 2004.

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3. Natural Resources Information Interoperability: Why do we care?

As the Australian Environment Minister, Dr. Kemp said last October: "Any resource manager will tell you that one of the fundamental tools for environmental and resource management is the knowledge of the extent and value of what you are managing. This knowledge provides the certainty land owners need to give them the confidence to invest in the most sustainable management practices."

Natural Resources Information Interoperability will help you, as a Natural Resource Manager:

- get access to up to date information, maps, data and tools from a wide range of systems to support your decision making;
- work more efficiently;
- generate better information products, and
- easily share your own organisation's information with other stakeholders.

It will ensure data and information about natural resource condition - the state of our native fauna and flora, salinity, and water and soil quality - in catchments and regions, is collected and presented in an integrateable form for all States and Territories.

Natural resource managers will be able to use data about region and catchment condition and trends to better target activities aimed at environmental rehabilitation and improving the sustainability of land use.

Data that is collected and presented consistently by all jurisdictions and regional groups ensures valid natural resource management comparisons can be made on a broad scale.

In short, you care because interoperability will drive your costs down and your productivity up. How many hours does it take to transform, translate and understand that “free” data you downloaded from the web? Are you even certain it is “fresh” after all that processing? Implementing and promoting Natural Resource Information Interoperability will deliver many of the Audit's recommendations for NRM after 2002.[3]

[3]See: Commonwealth of Australia (2002): "Australia's Natural Resources: 1997 – 2002 and beyond", recommendations 6-9. Online: http://audit.ea.gov.au/ANRA/docs/final_report/final_report_looking_ahead.cfm. Accessed 16 January 2004.

4. Natural Resources Information Interoperability: How do we get there?

4.1 The Audit's role in the NRM Information Community

Interoperability requires institutional cooperation as well as technical enablement. Groups of stakeholders coming together and agreeing on a standards framework for data sharing are called Information Communities. An Information Community will for instance agree on OGC specifications to apply, metadata models, shared vocabularies, map symbology, pricing policies etc.

The Audit currently has four main strategic directions, which include facilitating theme-based fundamental data collections, national reporting on resource condition and trend, the development of linked data and information systems and fostering partnerships and cooperation. For the Australian NRM Information Community, the Audit is developing a leadership role in the interoperability arena, leading by example and building on the good work that is being done in many other jurisdictions.

Until now, the Audit operated on the principle of data harvesting (collecting pre-existing data) from national, jusridictional and regional data and information sources. Data and information suited to national assessments has been collated into centralised publicly accessible repositories. The key web based information products and tools that are delivered by the Audit are:

- The Australian Natural Resources Atlas (ANRA), and
- The Australian Natural Resources Data Library.

These tools provide data and information online [4] to assist in improved Natural Resource Management (NRM) decision making.

The main benefit of the work done so far, is the availability of central, authoritative repositories for national NRM data and information. It relies heavily on a close and cooperative partnership between all levels of the natural resource community, from local on-ground land managers and regional bodies, through to local, state and territory government and Australian Government NRM agencies.

The Audit is committed to extending its leadership role to further implement Natural Resources Information Interoperability Australia-wide.

[4] See: www.nlwra.gov.au/atlas and http://adl.brs.gov.au/ADLsearch respectively

4.2 Issues to address

On the road to delivering Natural Resources Information Interoperability a number of issues that lie in the way of a successful result will need to be addressed. These are technical issues, institutional issues and data issues, as illustrated in Table 1.

Technical issues comprise, but are not limited to:

- Interoperability issues: selecting the appropriate standards to implement;
- Availability of interoperability standards and specifications in mainstream software components;
- Individual organisation's capabilities to adopt and implement; and
- Network capacity and performance;

Institutional issues are e.g.:

- Identifying the business drivers: what are the benefits for participants, and how do we make sure these are satisfied;
- Resourcing: labour, hard- and software, skills and knowledge. How much is required and is it available?
- Cost recovery: should cost of collection and publishing be recovered, and if so: how?
- Overcoming silo mentalities: "it's my data!" and the “if it's not invented here, it can't be good” syndrome;
- Privacy and Security: how do we ensure appropriate use by authorised people; and
- Regional community involvement: how to engage, raise awareness and provide tools;

Data issues that need to be resolved include:

- Identification and prioritisation of data requirements;
- Identification of available data and custodians;
- Gap analysis (topical, spatial, temporal);
- Data capture, processing, symbolisation and classification standards (best practice, quality control);
- Definition of common data and metadata models, classification schemas and terminologies;
- Quality assurance and security; and
- Centralised vs. distributed: what fundamental data (if any) should be hosted centrally.

Identifying, prioritising and solving these issues in close collaboration with all stakeholders is a major, very important deliverable of Natural Resources Information Interoperability.

4.3 Don't reinvent the wheel

The Audit, through its leadership role in the NRM Interoperability arena in Australia, will be building upon, rather than reinventing, the good work that is being done in other jurisdictions and abroad. A few examples of such initiatives and tools are:

- Intergraph's WMS viewer (www.wmsviewer.com).

  This is a lightweight tool to combine and display map layers from multiple OGC compliant (WMS-) services. For instance, to add NLWRA data layers to your map, click on "Edit Servers", then "Add New: and enter this URL: "http://audit.ea.gov.au/ogcwms?ServiceName=Map_maker" in the WMS URL field.

- The NSW Natural Resources Atlas, developed under the CANRI program (www.canri.nsw.gov.au)

  A new portal is to be launched in early 2004 that provides interoperable access to maps and data from 10 Natural Resources agencies in NSW

- The WA "Landgate" site (WA Department of Land Information, http://www.landgate.com.au)

  Enables you to view Western Australia's most up to date land and property information, aerial imagery, land parcel/survey and street directory data.

- Victoria's Natural Resources Online (Vic DPI, http://www.dpi.vic.gov.au/web/root/Domino/vro/vrosite.nsf/pages/naturalresources-home)

  The gateway to a wide range of natural resource maps and associated information. You can access this information at both State and Regional levels across Victoria.

- Geocommunicator (USA: http://www.geocommunicator.gov)

  The GeoCommunicator is a "one-stop shop" where people can go to:

  - Publish geographic data and activities they wish to share.
  - Communicate land-related information, requests, and activities.
  - Search and access geographic data, references, services, and activities.
  - Subscribe to a geographic area and receive notification of new or updated data.

- Geospatial One Stop Portal Initiative (GOS-PI: http://www.geo-one-stop.gov/)

  This portal provides you with the ability to access geographic information content across the United States and around the world. Through this Portal, you can:

- Discover, access, share and organize geospatial information and content.
- Publish your own geospatial information and content for others to use.
- Develop or use your own applications and toolkits to access portal services

Other OGC compliant Natural Resource Information Interoperability initiatives are under development by the National Oceans Office and the Queensland Department of Natural Resources and Mines as well as through other information communities such as emergency management and health. The Audit will work closely with ANZLIC to facilitate sharing and building on synergies.

5. A Way Forward

To achieve all this, the Audit will follow two important guidelines: to engage stakeholders at all times, and to avoid reinventing the wheel. No amount of technology will move us forward unless we are all working towards common goals.

The overall objective covers the period from 2004 to 2007, and should include defining the stakeholders involved ("Natural Resource Geographic Information Community"), the business requirements, specification development, and a phased task oriented implementation and dissemination plan.

The Audit is looking for your input in further developing these plans, helping define and prioritise issues, business and data requirements, capacity and capability.

The first step in this process is a two-day workshop to be held in Canberra in early 2004, which will bring together some of the key natural resource information management and OpenGIS representatives from the Australian Government, jurisdictions and major spatial information bodies.

The main aims of the workshop will be to:

- Develop a shared vision for a national, linked, distributed natural resource information system;
- Raise awareness and understanding of OpenGIS and Interoperability;
- Discuss and demonstrate current implementations and similar initiatives;
- Form a recognised authoritative Natural Resource Geographic Information Community;
- Discuss and prioritise the requirements for national Natural Resources Information Interoperability; and
- Develop a detailed workplan to allow the implementation of Natural Resources Information Interoperability.

The Audit is looking for input into this workshop. It is an opportunity to help define a national agenda for Natural Resources Information Interoperability, to ensure your requirements are satisfied and define your involvement.

A Workshop proposal including an agenda and points for discussion will be circulated soon through the Audit Advisory Council. Initial interest and discussion can be directed to Peter Wilson the Audit's Data and Information Coordinator (peter.wilson@nlwra.gov.au).