naturebank

A PROPOSAL FOR MANAGING KNOWLEDGE OF WESTERN AUSTRALIA'S BIOTA

Science Division

Department of Conservation & Land Management

"Conserving the nature of WA"

31 July 2002

Introduction

Oceans of data, rivers of understanding, streams of knowledge, drops of wisdom [source unknown]

As a consequence of more than 170 years of European settlement in Western Australia, there is a vast amount of facts available about the State's biodiversity and ecosystems. Although important concepts have helped arrange some of these facts into information, many remain isolated from others as a result of having been overlooked, forgotten or not published. The development of electronic computers in recent decades has, however, facilitated the organization and storage of 'oceans of data', far beyond the capacity of human brains. These data, whether numerical, observational, spatial or chronological, form the building blocks of hypotheses, theories and other knowledge systems.

Since the 1990s the Department of Conservation and Land Management has been moving towards being an online organization. The exemplar of this trend is the widely acclaimed and accepted FloraBase at http://florabase.calm.wa.gov.au/about.html FloraBase integrates WA plant names, images, specimen label data, distribution maps and species descriptions into a one stop shop, providing both a convenient and up to date source of knowledge about the WA flora.

naturebank is intended to build upon the success pioneered by FloraBase. It will be a warehouse and a clearing house and it will offer convenient public and agency access to factual information relating to *all* aspects of the biodiversity of Western Australia.

Strategic Setting

As a community, and as a conservation agency, we face serious challenges to our ability to protect the environment and to conserve the biodiversity of WA. These challenges will present in the form of climate change associated with global warming, human population growth and the environmental pressures that accompany it, resource development, land use conflicts, ongoing threats from exotic species, forecasted decline in economic growth, and limited resources to manage the conservation estate. All of these challenges will occur against a social backdrop of increasing environmental awareness and widespread acceptance of ecologically sustainable development.

Knowledge and how we manage it will be critical to how well we meet these challenges. Since the formation of the Department of Conservation and Land Management, millions of dollars have been spent by the Science Division alone in gathering data, interpreting these data under the guidance of current concepts and theories, understanding the significance of this information, and developing knowledge about the biota of WA. This knowledge is in the form of biophysical spatial data, biological and ecological information, and information about ecosystem processes. Similar levels of information have been gathered by other parts of the department and by other agencies. Collectively, we have

been very effective at gathering data, but we can vastly improve the ways in which we store, collate, share and use factual data.

The ***naturebank*** vision is of a system that provides a single entry point to knowledge about the State's biota relevant to the Department's charter. We need to develop better systems for warehousing, integrating, assembling, linking, packaging, value adding and disseminating data relevant to nature conservation if we are to meet the future challenges facing nature conservation in WA.

Timing and feasibility

In the 1990s five significant advances in ecology and computing technology emerged more or less concurrently. First, the importance of understanding and conserving ecological patterns and processes at the landscape scale became generally appreciated. Second, the development of a more holistic paradigm known as ecosystem management led to more explicit consideration of long-term ecological sustainability, particularly where natural products were extracted. Third, accurate recording of the location of data collected in the field became possible with the advent of GPS (global positioning system) technology. Fourth, direct entry of data newly collected in the field was facilitated by the invention of portable computers. Finally, GIS (geographical information systems), invented for collecting, storing, retrieving, transforming and displaying spatial data for a particular purpose, reached both a high level of sophistication and ease of use.

Coupled with these developments has been widespread recognition that improved application of new ecological knowledge and insights has been hindered by several factors linked with an academic approach to ecology. Elucidation of ecological processes by way of experimentation has necessitated collection of data along transects and in quadrats and plots, but the applicability of this knowledge to landscape scales is questionable. The publication of peer-reviewed papers in science journals has often been seen as an endpoint in itself, whereas few managers and decision-makers have the time (and interest) to read primary ecological literature. In the recent past, the data used as a basis of a scientific paper were invariably discarded once publication eventuated. Some scientists have not followed through with data analysis, with the unfortunate outcome that some data sets have either made no contribution to knowledge or are now unusable because metadata are lacking. Several senior staff in Science Division are likely to retire in the next five years and there is a risk that some data collected by them will not be adequately preserved. Finally some scientists are reluctant to accept that data collected by them are public property, not their own.

The Western Australian Regional Forest Agreement process, which involved the discovery, integration, and interpretation of data sets in order to provide information to underpin new policies, exposed the shortcomings in traditional management of scientific information. Departmental scientists were sometimes unwilling to make relevant spatial information (e.g. distributional data) available for integration with other sets. Many specimens held in the herbarium and museum lack accurate

locational data. These databases also contain distributional and taxonomic gaps. Some data sets had been retained in paper form in less than ideal archival conditions, with the result that dampness and insect activity had physically destroyed records. Finally, data that had been archived on magnetic tape or on disc could no longer be accessed as the requisite technology had been superseded.

Accessibility of databases

Several reviews conducted by independent scientists of research frameworks pertaining to the south-west forests have made recommendations about databases; these could be extended to other biomes. The Forest Monitoring and Research Committee Working Group of Scientists (chaired by Assoc. Prof. B. Dell, 1999) made the following recommendation:

*'**Consolidation of databases***
CALM should move towards making biota-based data bases more accessible, e.g. available on the Internet. It is desirable that flora and fauna databases be developed to facilitate exchange of information between organisations conducting flora and fauna monitoring and research in the forests. As a minimum, better links need to be developed between the databases of CALM, the WA Museum, and other organisations such as Alcoa of Australia Limited, Worsley Alumina Pty Ltd, Water Corporation of Western Australia and Water and Rivers Commission.'

The Regional Forest Agreement (1999) identified the following priority area of research, relevant to ***naturebank***:

'Develop and co-ordinate the inventory of systematic, geographic and habitat data concerning biota and ecosystems.

The Ferguson Committee of 2001 made the following recommendation:

'Biodiversity Databases
The Conservation Commission should commit to the maintenance of databases for biodiversity on a 'whole of forest basis' as a prerequisite for Ecologically Sustainable Forest Management on areas available for timber production and elsewhere.'

In 2001, the Australian Labor Party formed government in Western Australia. The relevant policy was stated as:

'Labor will establish an on-line Environmental One Stop Information and Resource site. This site would make it easier for the public to access the relevant information when faced with a development proposal…'

In 2001, the Australian and New Zealand Environment & Conservation Council (ANZECC) identified the development of biodiversity data and information systems as a priority research area. Highest priority research was stated to be:

'Establish mechanisms to upgrade, update and fill gaps in critical information systems, including national datasets, containing biodiversity and related physical and biophysical data.

Review, organise, store and link biodiversity data and information so that it can be readily retrieved for a range of reporting areas including local shires, catchments and bioregions.'

In 2002, the Premier's Science Council made the following recommendation:

'Establish a central State Government agency environmental knowledge database.
Although information systems allowing the collation and sharing of knowledge derived from environmental research are in place they are limited in scope and value to decision makers and not accessible by the broader community. In addition to supporting existing efforts to centralise environmental data the Government should examine the feasibility of establishing a central knowledge database for environmental research data from all agencies and relevant external researchers. This database should be located in a high capacity computer facility.'

The Royal Society of Western Australia held a workshop in 2002 to discuss the development of a co-ordinated and integrated database of terrestrial fauna survey results for Western Australia.

The WA State Sustainability Strategy (draft 2002) commits the Government to develop a state system for monitoring, data analysis and reporting on sustainability:

'Establish a "sustainability On-line" website which will be an atlas of Western Australian resources combining and integrating economic, environmental and social information. Sustainability Online will be an internet-based system, designed to make information easily accessible to government, community and industry. This system will service many uses at a range of scales and provide the most up to date available.'

Scope

The effective management and co-ordination of data, knowledge and information in the Science Division is an integral part of its Mission to provide up-to-date and scientifically sound information to uphold effective conservation in Western Australia. It is the means by which research information, generated at significant cost to the taxpayer, is secured and made available in useful ways to stakeholders, particularly output purchasers, managers, operations and policy staff, and the public. There is a need for Science Division to become more proactive in making data, knowledge and information more readily available using modern technology.

Objectives

1. To assemble physical and biological data into central databases so that data will be both better preserved and more accessible to stakeholders, including planners.
2. To identify strategic gaps in knowledge.
3. To provide a convenient directory, via electronic links and metadatabases, to other relevant knowledge and information held elsewhere.
4. To facilitate efficient access to knowledge and information by a range of stakeholders.
5. To value-add to data by interlinking available data sets so that more holistic understanding is possible.
6. To facilitate the application of predictive models about distributions of species and communities, and ecological processes.
7. To contribute to science priority setting and reserve acquisition by conducting gap analyses.
8. To contribute to the production of science-based educational materials.
9. To communicate interpreted data more effectively to stakeholders by way of internet, CD, e-science journal etc.

Strategies

- Gain the support of Corporate Executive to quickly build capacity of a small and efficient unit, based on the concurrent establishment of three new positions, Data Manager, GIS Research Scientist, and Biological Modeller.
- Develop closer links and data sharing facilities with other agencies such as the WA Museum and Water & Rivers Commission.
- Avoid duplication of activities performed by Information Management Branch (IMB) and seek opportunities for collaboration with IMB and ready access to corporate data sets managed by IMB.
- Share where possible hardware and software available at IMB.
- Determine the needs of clients within and outside the Department.
- Communicate the eventual benefits of this information system (as a one-stop-shop) in the first instance to Regional Managers, District Managers and other Departmental staff.
- House staff at Kensington Research Centre, close to the Manager of the unit, the WA Herbarium and IMB in order to facilitate fruitful interaction.

Tasks

Data Manager (Project Officer)

- Develop a Divisional database directory (consistent with ANZLIC metadata standards) and warehouse all databases that exist in Science Division (Refer to Guideline # 16) on an internal server or archive medium, and maintain selected data sets on the corporate server.
- Manage and keep up to date all corporate databases in Science Division so that they can be accessed readily by stakeholders, respecting IP sensitivities.
- Publicize the benefits of ***naturebank*** to Departmental staff and other interested parties.
- Train staff in correct maintenance of custodial data sets.
- Ensure that database requirements have been adequately addressed before Science Project Plans are approved.
- Negotiate, in collaboration with Information Management Branch, linkages with custodians of fundamental data sets held outside Science Division (e.g. geology, geomorphology, soils, climate, vegetation maps, biological survey data, Western Australian Museum fauna data, Water & Rivers Commission stream data, tenure data, management history of nature reserves, national parks, state forests).
- Ensure that the Division's obligations with respect to the State Records Act (2001) are complied with.
- Supervise development of GIS applications relevant to Science Division.

GIS Research Scientist

- Produce visualized biological and physical spatial data.
- Provide management information to the Department for conservation policy development and management planning.
- Publicize the benefits of ***naturebank*** to Departmental staff and other interested parties.
- Facilitate appropriate access to all relevant data and information pertaining to a particular parcel of land. Data would be stratified as geological, landform, soil, climate, tenure, land use, location of research sites, survey sites, monitoring sites, vegetation structure, floristics, WABIOTA, FloraBase, bibliography of reports and publications, management, threatening processes etc.
- Ensure that GIS requirements have been adequately addressed before Science Project Plans and grant applications are approved.
- Train staff in efficient and effective use of GIS, and provide GIS support for trained staff.
- Carry out application customization.

Biological Modeller (Research Scientist)

- Interact with scientists in developing models about geographical distributions of species and ecological communities, habitat maps, responses to threatening processes, and ecological processes such as growth and fire mosaics.
- Address large and small space/time scales (e.g. regions, decades; hectares, days) as required.
- Develop decision support systems.

- Advise on priorities for collecting new data to produce more accurate models.
- Develop models of impacts of climate change on selected species and ecosystems.

Costs

These are estimated as follows:

1. Data Manager (Project Officer) Level 5 $55K
2. GIS Research Scientist Level 2/4 $48K
3. Biological Modeller (Project Officer) Level 5 $55K
4. Hardware: 3 high level PCs @ $6K each = $18K (Note: Spatial Data Server and software are being funded [c. $250K] by Corporate Services Division)
5. Software: Arcview @ $3K = $9K; ArcInfo (already licensed), pro rata contribution of c. $3K p.a.; ANUCLIM licence $5K (estimate)
6. Local Science Division server (NT) $20-30K
7. Tape back up system (AIT) $10K
8. Annualized operating costs – replacement of PCs, Science Division server & tape back-up system every 3 years $20K from year 3 (annualized at $7K)
9. Upgrade of ArcView 3.2 licences to 8.1 $2K from year 3 (annualized at $700)
10. Contribution to annual maintenance cost of Spatial Data Server $10K (estimate)

Milestones

Year	Data Manager	GIS research scientist	Biological Modeller
1	Expression of interest called. Accommodated at Kensington Research Centre Convene workshop & locate & archive all databases in Science Division	Expression of interest called. Accommodated at Kensington Research Centre Convene workshop & bring together existing biological spatial data within CALM Initiate pilot study with several regions	Expression of interest called. Accommodated at Kensington Research Centre Convene workshop & determine priorities (modelling of impacts of climate change on the WA biota is favoured as top priority)
2	Negotiate with database custodians outside Science Division (within CALM, outside CALM)	Negotiate with GIS custodians outside Science Division (within CALM, outside CALM)	
3			

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Potential users

Early users of ***naturebank*** are most likely to include Regional Leaders Nature Conservation, Land for Wildlife Officers, Regional Ecologists, Fire Planners, and Area Management Planners,