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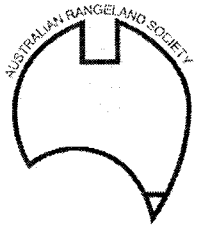

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IMPROVING RESOURCE MAPPING IN THE RANGELANDS OF WESTERN AUSTRALIA

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BACKGROUND

Aerial photography has been used for resource mapping in the Western Australian rangelands since the 1950's. In the most recent surveys purpose flown black and white aerial photography at a scale of 1:50000 (2cm = 1km) was used to map land systems and for navigation in the field. The rangeland survey team is very comfortable using aerial photos and they are like a security blanket to navigators. The team was wary of any change in a system which has served them well for many years.

As each regional survey area covers about 90,000 km2 well over 1500 aerial photos are required to be marked up with topographical features (for navigation purposes) and interpreted for land systems. Each photo is re-interpreted at the end of the field work, then scanned and geo-referenced so the land system boundaries and topographical information can be captured digitally. This multiple handling of so many photos means the process is very time consuming. The use of satellite imagery, together with a computer mapping system, to replace aerial photography for land system mapping in the current survey area, the Western Nullarbor, was investigated.

INVESTIGATIONS

Landsat imagery was determined to be the most readily available and cost effective satellite system with an appropriate scale for navigation and land system interpretation.

There are several significant advantages of satellite imagery over aerial photography. These include:

- Satellite imagery provides a regional view; one manageable Landsat scene shows the same area as 46 aerial photographs.
- The scale of satellite imagery is consistent across images while scale across runs of aerial photos can change up to 10%.
- Satellite imagery is available digitally. The use of a digital system means that other layers of information can be loaded onto a notebook computer for use in the field along with the satellite imagery.
- Satellite imagery is geo-referenced where only the centre point of each aerial photo is geo-referenced. A minimum of three reasonably spaced reference points are required for each aerial photo, however, on the Nullarbor there are very few readily identifiable reference points.
- Satellite imagery provides the ability to enhance selected aspects such as geology, soil and vegetation using colour. We are more responsive to changes in colour and can distinguish many more colours than grey scales.
- Satellite imagery is available at least every 16 days whilst an area may only be flown for aerial photography every ten years.

The disadvantages of satellite imagery can be overcome or minimised:

- 1:50,000 aerial photography has a resolution of about 1.5 metres while Landsat's resolution is 30m, so it is possible to distinguish much smaller and fainter ground features such as individual trees and very faint tracks. This is not a significant problem where a GPS linked to a digital system is used as this will locate your ground position accurately.
- Aerial photos can be viewed in three dimensions while satellite imagery can not. This was considered to be a major restriction in the past, however, is much less important on the very flat landscape of the Nullarbor. There are now mapping tools available to drape contour lines over images to give an impression of height. These will be used for the limited areas which have differential relief; the coastal cliffs and Hampton Scarp on the southern edge of the Nullarbor Plain.

- Field computer mapping systems are susceptible to environmental conditions and system failure. A back-up system of minimal paper maps can be carried to cover these risks.

The use of satellite imagery with a computer mapping system for land system interpretation and navigation was tested on the Nullarbor in June 2001. Land systems were interpreted onto analog Landsat images. These were digitised and loaded onto a notebook computer. The interpretation and digitising of two 1:250000 map sheets took four days. Interpretation onto aerial photos may have taken up to ten days, and the boundaries would not be captured digitally. The land systems on the Nullarbor are unusual in that, compared to other regions, there are few and they are very extensive. In previous surveys there were often two or more land systems changes per photo whereas on the Nullarbor you may not see any change over a large number of photos. The regional overview provided by satellite imagery was found to be more compatible with the broader scale of mapping required for the Nullarbor. The land system boundary changes on the Nullarbor are fuzzy rather than the first order boundaries which often occur in other regions. It is therefore more important to have a larger overall view to allow a boundary to be placed consistently within transition zones.

The interpreted boundaries were ground-truthed in the field and were found to suitably represent the changes in country type seen the on the ground. The digital satellite imagery was used to navigate through the survey area and to locate pre-selected inventory sites. In the past sites have been selected on aerial photos and the navigator is required to navigate to that point. With the use of digital imagery and a mapping software package linked to the GPS the point could be accurately located without the need for precise, time consuming measurement from identifiable ground features.

An unexpected benefit of satellite imagery and the use of a digital system was the response to the system by the land managers, in particular by the younger generation managers. They were impressed with the technology, and more importantly could relate to the information on the computer screen. Often work completed by researchers in the office is not immediately available to land managers but with the use of this portable technology it can be easily achieved.

CONCLUSION

It was found to be much quicker to interpret satellite imagery than aerial photographs, and the regional view provided by the imagery was particularly appropriate for the extensive land systems on the Nullarbor. The use of satellite imagery, combined with a computer mapping system, was also found to be effective and quicker than using aerial photographs in the field. The disadvantages of satellite imagery over aerial photos are limited and can be largely overcome.

The digital system requires a high speed notebook computer with a high quality screen at a cost of about $5000. The computer mapping package OziExplorer was purchased at a cost of $99 and ArcView, a Geographic Information System, was used to link the digital maps and the Global Positioning System.

The use of a technologically advanced system was found to motivate team members, in particular members who are already comfortable with the use of digital technology. The other team members were very impressed with what could be done in the field and their apprehension of changing from a long-used reliable analog system was overcome.

Satellite imagery was found to be useable for both land system interpretation and mapping, and for navigation in the field. The use of a computer mapping system enabled these aspects to be done in significantly less time. This system will be used for resource mapping in the Western Nullarbor.