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LAND UNIT MAPPING IN THE EAST KIMBERLEY REGION, WESTERN AUSTRALIA

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BACKGROUND

The main land resource dataset in the Kimberley is reconnaissance land systems mapping conducted at a scale of 1:250,000 by CSIRO in the 1950s. Land systems delineate areas of recurring patterns of topography, soils and vegetation, however distinctive components of the recurring pattern, known as land units, were not mapped. Subsequent detailed surveys have been restricted to small areas for specific needs (eg. suitability for irrigation). Land management and future land use planning across the Kimberley would benefit from consistent and well-attributed land unit mapping. Land unit mapping has traditionally been time-consuming and expensive, involving intensive fieldwork and air-photo interpretation, then transfer of data to spatial and attribute data sets. A new methodology has been developed to provide a simple way of fast-tracking capture of land unit mapping information whilst incorporating surveyor expertise, thus making it a cost-effective option for the Kimberley.

METHODOLOGY

Three methods were trialed for mapping land units in the Ord Catchment of the East Kimberley.

Disaggregating existing land systems mapping

Newly available digital datasets, especially high-resolution digital elevation models (DEMS) and geology were used to delineate the land units that were described, but not mapped, within the original land system survey. Two key problems were encountered: 1) not all land units that occur within a land system were described and; 2) the land system mapping was spatially inaccurate leading to high levels of mapping impurity. This method was thus abandoned.

Modelling

Our modelling approach used a method developed by CSIRO Land and Water for land resource mapping in the Murray-Darling Basin. This approach relied on a representative set of digital predictor datasets (geology, DEM, etc.) and training data to develop and test the models. This method was unsuccessful in the study area although valuable data were collected through this process and it precipitated the development of a third and successful method.

Hybrid approach combining traditional and new technologies

A new hybrid method was developed using a combination of all digital data (point, polygon and raster) projected into a common geographic space, with expert interpretation to guide the process of defining land units directly on screen. This method was considered superior to other methods as it captured the best of both the digital information available and requisite expert knowledge, and was thus adopted for the land unit mapping process.

The new method fast-tracked some of the traditional steps by using on-screen digitising where all available and relevant digital data were displayed in the same datum and projection. Microstation[®] SE 98 and Image Analyst[®] were used in parallel to display and overlay data, and to create linework to delineate land units. Various raster (image) and vector (shape) data sets were switched on or off and overlaid as required. Aerial photographs were used alongside the digital data, and expert interpretation was built into the land unit line-work as it was drawn. This is a novel approach for the region, as these data have never before been compiled into the same digital work-space.

Digital datasets used were: Geology (1:100,000 and 1:250,000), Digital Elevation Model (30m grid – outputs: sunshaded, slope, 10m contours), Landsat 7 TM (bands 321, 542 and 741), vegetation map (1:2,000,000), all available soil, land unit and systems mapping, field data (soil, landscape, geology, vegetation), climatic and vegetation data, air photographs, and other maps. Some derived data sets were created for defining and interpreting different land types; eg. a sunshaded 3D image (sun angle 45° above horizon, from a NE or NW direction) and a 10m contour map were generated from the DEM. Such data were particularly useful for identifying slope and relief, thus delineating rugged, hilly land types. Conversely, low relief plains landscapes were better identified through Landsat scenes, air photos and field information. By carefully selecting and combining various datasets that highlighted different landscapes, land units were more effectively identified and described.

The map is built in parallel with a database (Microsoft® Access 97) in which all land units are coded and defined. The output is a map of land unit polygons, each polygon with an identifying label linked to a database where properties of the polygon (land units) are described.

DISCUSSION

In the past, mapping has been carried out on unrectified air photos using other maps (eg. geology) to assist the process. This approach was slow and had limited accuracy due to the different maps not being aligned into a geo-referenced workspace. The new hybrid technique is estimated to at least double the rate at which landscapes can be mapped when compared with traditional methods. The technique has been successfully trialed by the Natural Resources Assessment Group within the Department of Agriculture WA to up-scale mapping in the agricultural south-west region of WA and thus far, for two pastoral leases in the East Kimberley.

Maintaining original land systems information in the land unit mapping was considered valuable, so the new, more detailed mapping was built into a labelling hierarchy that enabled land systems to be regenerated from the best available mapping. Therefore land units could be grouped (coloured the same) to generate a land systems map for a regional scale picture (refer our poster and Figure 1). This novel method successfully marries new and old datasets and technologies with expert knowledge, to produce a map of higher resolution and accuracy at a significantly lower cost than traditional mapping efforts.

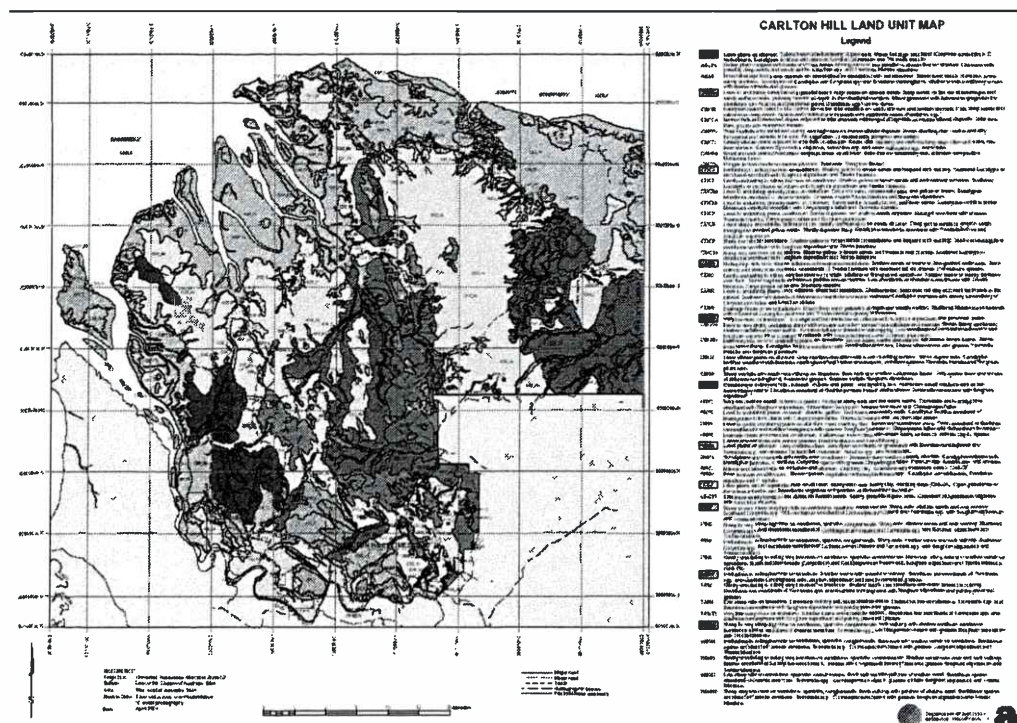


Figure 1: Map of land units (black line work) with units grouped to land systems (coloured), using a new method. The legend is built from a database query that combines the various map unit attributes.