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A TECHNIQUE FOR RAPID ACQUISITION OF SPATIAL ECOLOGICAL DATA

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INTRODUCTION

Ecological data retrieval in the field has been a component of rangeland research and monitoring for many years. Monitoring change is a common theme in rangeland research because the rangeland ecosystem is dynamic and changing states present challenges to land managers and scientists alike. The rapid and accurate acquisition of spatial ecological data to monitor these changes is a valuable tool in resource management.

A technique has been developed which enables two people, a driver and passenger, to collect multiple visual observations of a range of parameters from a moving vehicle. These observations are input directly into a notebook computer linked to a Global Positioning System (GPS). The technique, often referred to as Spider Mapping, was initially developed in Queensland for ground-truthing the spatial pasture production model GRASP (Hassett *et al.* 2000). Subsequently the technique has been used in other States by collaborators in the national Aussie GRASS project (Hall, *et al.* 1999) for calibration and validation of several pasture production models. In the southern Australian rangelands, staff from NSW Agriculture Trangie, Department of Land and Water Conservation Condobolin, and the SA Department of Environment Heritage and Aboriginal Affairs Adelaide, have revised and modified the technique to suit the specific physical and biological requirements of the southern rangelands.

METHODS

Field Procedure
Observations are made from a moving vehicle while travelling at speeds between 60 and 80 km/h. This varies depending on the quality of the road, the complexity of the variables being estimated and the confidence/skill levels of the observers. The passenger inputs observations from their side of the vehicle whilst also recording the drivers observations from the right hand side. Thus many observations are made on a whole range of ecological parameters over a short period of time. As an example, a field trip on 26 November 1999 recorded 2225 observations over a distance of 391 km on roads south of Broken Hill, giving an average of nearly 6 observations per kilometre.

All quantitative information, such as pasture biomass, chenopod density, and tree/shrub cover, is calibrated with pasture cuts and chenopod and tree/shrub transects. For each day of recording, pasture cuts are taken to represent the range of biomass levels traversed. In chenopod communities belt transects are used for calibration of sub-shrub densities. In areas with trees and shrubs, line transects are used to estimate canopy and foliage projective cover.

Equipment
The hardware used in the field is based around a Gateway Pentium II notebook computer. A Garmin 75 GPS is linked to the computer to give accurate map grid coordinates for all observations. The CIGS ©1998 GPS data acquisition application, developed by Geonautics International Brisbane Australia, is used. This software has the ability to display geo-referenced satellite images. Overlays of roads and creeks, land system boundaries, and the 10 km grid, each in a different colour, prepared by the Resource Information Unit of NSW Agriculture in Orange, are displayed over the image, either separately or in combination. As the vehicle is driven along the road a moving dot on the image depicts the current position. Each observation is recorded as a dot of a designated colour.

Data Input

All data, be it spatial or ecological, is input into the computer and recorded in an ASCII *log file* which includes the date, time and map coordinates for each observation (Figure 1). All data for one observation is included as one row of information. For ease of editing a different *log file* is created for each day.

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$CIGG,1998/11/14,8:50:56,574818.7145,6716650.2358,?,?,?,2,4,,,Pasture Yield,RR,107,,,
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Figure 1. Example of a log file into which data was input over a 3 minute period in November 1998 as part of the Aussie GRASS project. Each record in the comma-delimited file includes the date, time, northing, easting, variable, observer and data recorded.

The CIGS software allows for each function key on the computer to be dedicated to a particular variable and to be configured according to the variable being measured, the initials of the observer and the categories of data that are to be recorded. For example in chenopod areas the designated function key is configured to give four fields of data; field 1 is the dominant chenopod species (e.g. om = old man saltbush), field 2 gives the density of plants as three numbers (e.g. 100 = 10,000 plants/ha), field 3 indicates the standard bush being used (e.g. bb1) and field 4 the correction factor which reflects the relationship of the average size of individual plants relative to the standard bush.

In the Aussie GRASS project, the variables measured include *land condition, tree/shrub cover, runon/runoff, chenopod cover, range type, fire scar* and *pasture yield*. The type of data collected is only limited by the imagination of the user.

DISCUSSION AND CONCLUSION

The technique for rapid acquisition of spatial ecological data described in this paper is at present being used by NSW Agriculture and Department of Land and Water Conservation for calibration and validation of pasture growth models within the grazing lands of the Western Division and the Hay Plain. The technique provides the capacity to collect spatially located information on a large range of variables within a relatively short period of time. Previous methods, for the same coverage, would take much longer and not be spatially located. With the capacity of the software for configuration of each function key, information collected on any one variable is not restricted to one parameter. For example, in addition to recording pasture yield, experienced operators can record species composition.

Adaptation of this technique to other projects would be easy. Agencies such as Rural Fire Services, Rural Lands Protection Boards and Natural Resource Management departments could adapt it for spatial mapping of potential fire hazards, movement and area of grasshopper swarms, the spread of

invasive weed species along roadsides, or the mapping of nesting sites of endangered species. Land managers could find it an invaluable tool for mapping and monitoring property features that are important to their ongoing management program.

The accuracy of the technique has been significantly enhanced by the US government's removal, on the 1st of May 2000, of *selective availability* or SA (intentional degradation) from the GPS signal. With this removal, accuracies of 20 metres or better can be achieved.

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