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Development and implementation of a field based data entry system (FDE) used in land condition monitoring of pastoral leases in the South Australian rangelands.

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Abstract: In an effort to streamline the monitoring of pastoral leases in South Australia the Department of Environment, Water and Natural Resources (DEWNR) Pastoral Unit has developed and implemented the use of a field based data entry system (FDE). The system comprises specifically designed software and field rugged hardware, significantly reducing time taken in the field for Pastoral Lease Assessments and Inspections and eliminating the laborious task of office data entry. Additional benefits include reduced reporting times, greater accuracy through validation of data at the site, greater accuracy and timeliness of map edits, considerable time saving in navigation and site relocation and significant reduction in paper used. It also means scientific staff spending a greater proportion of their time doing what they have trained for and less time on administrative level tasks.

Introduction

The South Australian Pastoral Land Management and Conservation Act 1989 covers 48 million hectares of land held under Pastoral Leases in South Australian rangelands and covers around half of the state in area. Amongst its objects is to “provide for the effective monitoring of the condition of pastoral land”. The Act includes a requirement that all leases be assessed for land condition at intervals of not more than 14 years and must be conducted in accordance with recognised scientific principles. To satisfy these requirements, the lease assessment process includes collection of a range of data from permanent photopoint sites, the description of paddocks and any issues therein and the calculation of the Land Condition Index (LCI) by Pastoral Unit staff (Gould et al. 2001). In addition there is a program of more regular lease inspections that incorporate largely the same monitoring methods. All data, including mapping of infrastructure and land systems is held in the Arid Land Information System (ALIS) database

Previously data was collected in the field and recorded on a series of paper datasheets downloaded from ALIS. This data was then manually entered into the system on return from the field trip. Photographs taken as part of the assessment were individually uploaded into ALIS and the mapping component of the database was laboriously updated from notes and GPS data collected in the field.

The Field Data Entry system (FDE) software was developed by what is now the Information Unit in Science Monitoring and Information Division DEWNR. The specification of the design was to develop a system that maximised simplicity and time savings. Close collaboration between users and developers produced a product that was easy to use and interfaced seamlessly with ALIS, a very complex and comprehensive information system.

The result is that the FDE has significantly and measurably reduced staff time in data handling, increased quality of data in the database, made navigation and mapping easier and greatly reduced the amount of paper used in the assessment process.

Discussion

The FDE consists of software designed to be used for field based data collection and to automatically and simultaneously upload collected data, photographs and GIS mapping information into the ALIS database. The FDE is used on GETAC E100 rugged tablets which feature an incorporated GPS which is used by the software for mapping and real-time tracking. While the primary function of the FDE is to replace paper datasheets and eliminate manual data entry it has other features that have proven beneficial in field and office work.

The GPS and mapping capabilities of the system allow real-time tracking in the field, with a display of the lease map superimposed with the current position and past tracking of the unit available for field staff. The spatial information contained in ALIS including pastoral tracks and infrastructure, land systems and photopoints are all available as selectable layers to be displayed.

The live tracking function in the FDE has proved of great use in the field as it has aided site relocation and navigation. As some photopoints are only visited every 14 years, tracks around waters can fade, and some photopoints can be difficult to relocate. Accurate real-time tracking overlaid on the station map has made these activities faster and easier.

The ability to modify spatial and infrastructure data has reduced the time that was needed to prepare data from GPS units to be used to update maps. The mapping function in the FDE also allows staff to check the accuracy of spatial data in the field and avoid collecting unnecessary spatial data by re-marking correctly mapped infrastructure.

At permanent photopoint monitoring sites, staff record a species list, including scores of abundance for each species, ratings for active erosion, indicators of animal presence, the dominant species in the plant community, overall condition rating and observer comments. Information keys describing specific measures and codes are available to be selected at data entry points on screen. All data is validated on entry to comply with standard formats or to identify if essential fields have not been filled. Touch screens using stylus and cordless keyboards aid the entry of this data and anyone who has tried to record data on paper on a wet and windy day will be able to relate to benefits of a tablet.

Plant species are entered from a searchable database maintained by the State Herbarium of South Australia, updated every time the unit is uploaded. Any part of a species or common name can be entered and a list of options is available. This eliminates issues related to spelling and also the entry of 'non-current' species names. A file containing scanned images of herbarium voucher specimens is also available on the hard drive of the tablets to further assist in identification of species.

A 400m² belt transect is carried out at some sites to sample the long-lived perennial plant density. Data is recorded in 10 x 2m quadrats, and where multiple species are recorded there was a risk of errors in recording data in the wrong boxes of the data sheet. The FDE has simplified the recording of this data and includes a simple counting function in this section.

Determining the LCI involves recording the pasture type and a condition score at random stopping points along a predetermined traverse of the lease. Photos are also taken at these sites and location recorded for possible future reference. Referencing of photos and GPS capability of the FDE greatly improve the recording of this data and time taken to process.

Photos are taken as a reference at all permanent monitoring sites and at the LCI sample locations. This results in a large number of photos to be uploaded and managed during an assessment. Before the FDE was used all photographs taken as part of the assessment process had to be individually uploaded into the ALIS database, which is laborious and with hundreds of photos taken in some of the larger stations took considerable amounts of time. The FDE is used to record unique photo numbers at all relevant sites, and the photos are then automatically uploaded when the data is loaded into the ALIS database.

The integrated photo management function of the FDE has reduced the need for individual photo handling, and all photo management can be carried out in batch processes.

The removal of the need to manually enter data has removed the possibility of transcription errors. Data entry consumed a significant portion of staff time in producing assessment and inspection reports. Typical sites previously could take up to one hour to enter with additional time to upload photos in the office. In addition time taken for recording data in the field has also decreased to some degree. As large leases may contain more than 50 sites, this is a significant time saving for the program. There is also a time saving in preparing for assessment field work with the system removing the need to prepare and print large numbers of data sheets.

An important part of the lease assessment process is communication between field staff, land holders and the Pastoral Board. There can be considerable time between on ground discussions with land holders and production of the assessment report for their comments before submission to the Pastoral Board. Incorporation of the use of the FDE has enabled these turnaround times to be considerably reduced.

Importantly the FDE has reduced the repetitive, difficult and frustrating aspects of work for Pastoral Unit staff. The proportion of time taken by scientific staff to carry out laborious administrative duties has been greatly reduced, leaving greater use of their specific skill sets to increase the delivery of lease assessments and inspections. Staff job satisfaction has increased and stress has been reduced as what was seen as the least rewarding aspects of the reporting process have been greatly reduced or eliminated

Gould, P., Lay, B., Tynan, R. and Watson, I., (2001) **Rangeland monitoring, resource inventory, condition assessment and lease inspection activities in South Australia conducted by Primary Industries and Resources SA**. Report prepared for the Rangeland Theme of the National Land and Water Resources Audit, Natural Heritage Trust