

# NRM BRIEF

## Regolith Science in Natural Resource Management

September 2006 Edition No 1



Welcome to the first edition of the NRM Brief, a quarterly newsletter that highlights regolith geoscience research outcomes from the Cooperative Research Centre for Landscape Environments and Mineral Exploration (LEME) that provide breakthroughs in natural resource management. Regolith is the blanket of soil and sediment that covers the earth's surface.

For those who may be unfamiliar with LEME, we are a Commonwealth Government funded research organisation made up of eight Core Parties, the Australian National University, Adelaide University, Curtin University, CSIRO's Land and Water, and Exploration and Mining Divisions, Geoscience Australia, the Minerals Council of Australia, the NSW Department of Primary Industries and the Department of Primary Industries and Resources of South Australia.

We combine our multidisciplinary expertise in regolith geoscience to undertake specialised research into major national resource management problems such as salinity, sodicity, inland and floodplain Acid Sulfate Soils (ASS) formation and acid groundwater. This publication highlights some of the Centre's more recent research outcomes into addressing these issues. I hope you enjoy our first edition.

Steve Rogers  
CRC LEME Chief Executive Officer

### Balloon photography allows scientists to get a bird's eye view

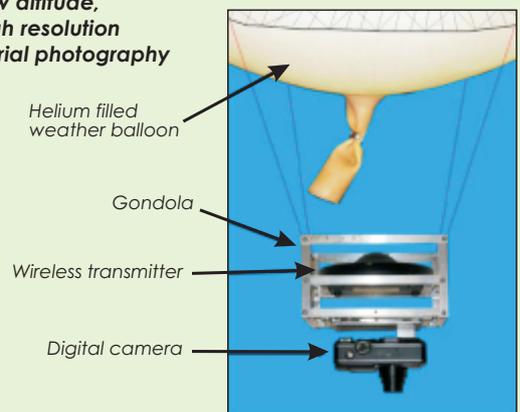
A high-resolution aerial photography technique involving a digital camera mounted on a weather balloon is proving to be a useful tool for LEME researchers working in the Adelaide Hills of South Australia.

Most aerial photography is usually taken from an aeroplane and because of the high altitudes involved, these photos are typically used to help map large regional features such as rivers, irrigation channels and geology. To get higher-resolution (close up) aerial imagery, you need to find some way of getting closer to the ground while staying still enough to take a clear photo.

Taking up this challenge is LEME PhD student Andrew Baker who has constructed a rig attached to a helium-filled weather balloon that holds a 7.1 megapixel camera and a wireless video transmitter specifically designed to take low-altitude aerial photos. Once released, the camera's field of view is relayed

to a handheld LCD screen with an infrared remote used to control the shutter.

### Low altitude, high resolution aerial photography



A side view of the high-resolution aerial photography rig designed by LEME's Andrew Baker.

"We have used the balloon to acquire five sets of high-resolution aerial photography during a 12-month period over a catchment area in the Adelaide Hills," Andrew said.

"One pixel captured by the digital camera image represents two actual centimetres on the ground, so you get to see a lot of detail such as subtle changes in soil and vegetation."

By allowing the balloon to slowly ascend to a maximum height of 50m, a series of photographs were taken over specific GPS-located sample points along transects 20m apart. To help with the digital rectification of the images, theodolite surveyed, painted wooden stakes were driven into the ground.

The resulting photographs were combined digitally with other data into an Arcmap GIS database used to help interpret discreet soil landscape patterns created by erosion, salinity and waterlogging.

Andrew's supervisor, Dr Rob Fitzpatrick (CSIRO Land and Water), recognised the potential relevance of this technique to forensic science and in April this year presented a paper at the International Workshop on Criminal and Environmental Soil Forensics in Perth, Western Australia.

Copies of the paper's abstract entitled 'Magnetic Susceptibility and Low Altitude Aerial Photography using a Helium balloon: Applications to Forensic Soil Examinations' can be downloaded from the LEME website ([www.crclme.org.au](http://www.crclme.org.au)) under the News and Events section.

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### Petroleum exploration technology searches for groundwater

A geophysical technique traditionally used by the petroleum industry has been able to determine where saline groundwater aquifers occur near the Western Australian Wheatbelt town of Moora, 172 kilometres north of Perth.

The technique known as seismic reflection has been used to locate sub surface features such as faults, folds and geological boundaries measured by bouncing sound waves off contacts between different rock types.



Students undertake a geophysical log at Moora, Western Australia as part of LEME's involvement in the Rural Towns - Liquid Assets Initiative.

LEME scientist Paul Wilkes and his colleagues at the Department of Geophysics, Curtin University, are using this proven technology to investigate regolith patterns to work out the location of saline groundwater.

"The data we have acquired at the Moora site is at a very high resolution," Paul Wilkes said.

"We've had a few problems with noise from passing vehicles and trains. Despite this, the images generated have provided us with important clues about groundwater location in the area."

In late 2005, three 100 metre north-south lines were completed at 300 metre intervals east of a section of railway line located near the town's centre. After filtering out seismic noise, the imaging revealed six distinct geophysical intervals.

"The data imaging has enabled us to tell the different between the impermeable clay layers from the sand-rich zones conducive to groundwater flow," Paul Wilkes said.

"It now can be combined with drill and bore hole data to further define the near surface hydrogeology of the area, which will assist in developing new strategies to manage Moora's groundwater."

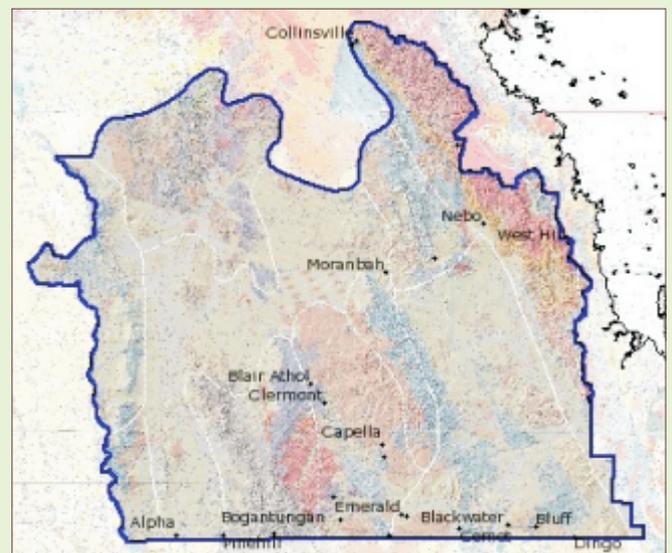
The project forms part of LEME's involvement in the Rural Towns - Liquid Assets Initiative convened by the Western Australian Department of Agriculture and Food. Rural Towns - Liquid Assets aims to develop effective salinity controls by turning locally sourced saline groundwater into a resource. The three-year project is currently working in 16 of the most salt affected towns in Western Australia.

CRC LEME is a partner in the overall project with Curtin University, CSIRO, including the Water for a Healthy Country Flagship, Department of Agriculture and Food WA, WA Chemistry Centre, the University of Western Australia, the WA Water Corporation and 16 Western Australian shire councils.

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### Online information for central Queensland natural resource managers now available

Central Queensland natural resource managers have a new way to find geoscientific information about the Upper Burdekin-Fitzroy Catchment following the release of an online interactive map. Known as the Burdekin-Fitzroy Project Web Mapping System, the online map was created as part of the National Geoscience Agreement with the Queensland Department of Natural Resources and Mines (QDNRM) and LEME, through its Core Party, Geoscience Australia.



The Burdekin-Fitzroy Project Web Mapping System defines the Upper Burdekin-Fitzroy catchment area in blue.

Containing a multitude of spatial topographic, infrastructure, geological and hydrographic data and other information, the online map was specifically designed to help natural resource managers make quick and rational decisions. It has also identified key knowledge gaps that exist in the catchment.

Geoscience Australia's Colin Pain said the aim of the project was to make all the available geoscience information and other spatial data for the region freely available on the Internet.

"There is a lot of relevant geoscientific information available from Geoscience Australia, State and Territory-based geological surveys that hasn't been looked at from a NRM perspective," Dr Pain said.

"One of the best ways to help realise the NRM potential of geoscientific data is to incorporate it into collaborative and multidisciplinary projects such as the Burdekin-Fitzroy Project Web Mapping System."

A soon to be released report on the project will provide brief summaries on datasets from the region compiled from sources including QDNRM, Geoscience Australia, CSIRO and private companies. Some of the information is confidential and can be obtained through the appropriate custodians. The map also contains a comprehensive bibliography and provides examples of how to integrate the data for NRM investigations.

"The Burdekin-Fitzroy Project Web Mapping System is not designed as a planning tool, but rather as an online catalogue for available data and information," Dr Pain said.

"Users can't directly download the data, but are instead directed to websites where the information can be accessed."

To access the Upper Burdekin-Fitzroy Project Web mapping System, go to <http://www.ga.gov.au/map/burdekin-fitzroy/>. The associated atlas can be downloaded as a PDF for free from <http://crclme.org.au>. A hard copy version can be purchased for \$72 (incl GST), plus P&P.

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### **Airborne geophysics plays an important role in assessing salinity-risk along Murray River floodplains**

Geophysical data collected over the Chowilla Floodplain of South Australia has located where saline groundwater from the plain is entering the Murray River.

By measuring and mapping the electrical conductivity of the soils and geology beneath the floodplain, LEME researchers are working with colleagues from CSIRO Land and Water and the South Australian Department of Land Water and Biodiversity Conservation (LWBC) to determine where the more saline groundwaters occur on the floodplain.

LEME scientist Dr Tim Munday (CSIRO) said the use of airborne geophysics is a cost effective way to determine the extent of areas prone to salinity, as well as providing a map of salinity variations in groundwater.



*River gums under threat at the Chowilla Floodplain, South Australia.*

"Mapping an area's electrical conductivity helps us define the characteristics of the sub-surface and soil, and identify areas affected by or prone to salinity. The results also assist us in locating where saline groundwaters are entering the river," Dr Munday said.

The Chowilla Floodplain is one of the six significant ecological areas targeted by the Murray Darling Basin Commission's (MDBC) Living Murray Initiative. Degradation of the floodplain and associated wetlands has occurred through a reduction in flooding events, overgrazing and the introduction of exotic plants and animals to the area.

"Having good electrical conductivity data over the Chowilla Floodplain will provide baseline data to help define strategies to reduce saline groundwater discharges into the river," Dr Munday said.

Near surface data collected by LEME in mid 2005 correlates well with water recharge maps developed from satellite data and vegetation mapping, while deeper conductivity data has mapped variations in the porosity of local sand.

"This kind of information has direct implication to the siting of bores for salt interception and ecological protection schemes," Dr Munday said.

The three-dimensional data generated by this project showing the distribution of salinity in saturated and unsaturated zones within the floodplain will be incorporated into larger models to assess future management strategies for the Chowilla Floodplain.

### **Research News**

#### **Acid Sulfate Soil identification kit developed for Loxton**

A user-friendly 'Soil identification Key' to allow the identification of various Acid Sulfate Soils (ASS) along the SIS Pipeline near Loxton has been developed.

High levels of selenium have been found in salt efflorescence along the Loxton Salt Interception

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### Research News (continued)

Scheme (SIS) Pipeline Corridor near Loxton, located 255 kilometres east of Adelaide on the banks of the Murray River.

Some soils in the corridor were also found to contain slightly elevated concentrations of chromium.

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### New data layers developed for the MDBC Groundwater Flow Systems Products

LEME has developed a range of products at different scales for the salinity management in upland/erosional catchments. The products add value to Groundwater Flow System (GFS) products with improved quality of soil, regolith and bedrock geology data. The data layers can be used as stand alone products or incorporated in existing hydrological models.

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### LEME Technology transfer

#### Upcoming presentations:

- 18-20 September 2006 - 10th Murray-Darling Basin Groundwater Workshop, Canberra, ACT
- 27 September 2006 - ASEG Environmental Geoscience Seminar Day, Perth, WA
- November 2007 - ASEG 19th International Geophysical Conference and Exhibition, Perth, WA
- February 2008 - Australia New Zealand Geomorphology Group Conference, Queenstown, Tas
- 30 March - 4 April - 2008 - International Salinity Forum, Adelaide, SA

#### Recent Publications

(available via our web site <http://crclleme.org.au>):

- OFR 170 - A Geoscience Atlas for Natural Resource Management in the Upper Burdekin and Fitzroy Catchments, Queensland Australia (M.E. Lech, M. C. Gray, C. F. Pain and Y. Miezitis).

Past issues of the NRM Brief can be downloaded from:  
<http://crclleme.org.au/Pubs/index.html>

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CRC LEME is the cooperative research centre for regolith geoscience with some 130 contributing researchers from eight Core Parties around Australia. We generate and apply regolith knowledge for mineral exploration and environmental management.



Your organisation can benefit from CRC LEME expertise.

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