ASSAY

A NEWSLETTER ABOUT ACID SULFATE SOILS

**Issue # 50** **December 2009**

# Welcome to the 50th edition of ASSAY!

As ASSAY's new editor, I am delighted to welcome you to a fantastic milestone - the 50th edition of ASSAY, the national acid sulfate soils newsletter. This has been made possible by the offer of funding support from the Department of Environment, Water, Heritage and the Arts to continue ASSAY to June 2010.

My name is Simon Walsh and I have been involved with acid sulfate soil management along coastal NSW for a number of years, mostly delivering on-ground works such as laser levelling, drain reshaping, wet pasture management and floodgate modifications to raise groundwater levels. I'm looking forward to editing ASSAY and staying abreast of developments in this dynamic field.

Former editor Chrisy Clay has taken up a new position at Southern Cross University, in Lismore NSW. Chrisy is now coordinating a series of acid sulfate soil training workshops. I know that her energy and passion will continue to contribute to the national acid sulfate soil arena into the future.

There are some terrific articles in this edition of ASSAY, from reports of severe acid damage on infrastructure in north Queensland, to the range of remediation works rising to meet the challenge of the desiccating Lower Lakes in South Australia.

*Happy reading... Simon*

## ASSAY goes electronic

Please note that this will be the last edition of ASSAY to be published with a hard copy option.

Future editions will only be available electronically to reduce production costs and enable the greater use of photographs and links to websites and research papers.

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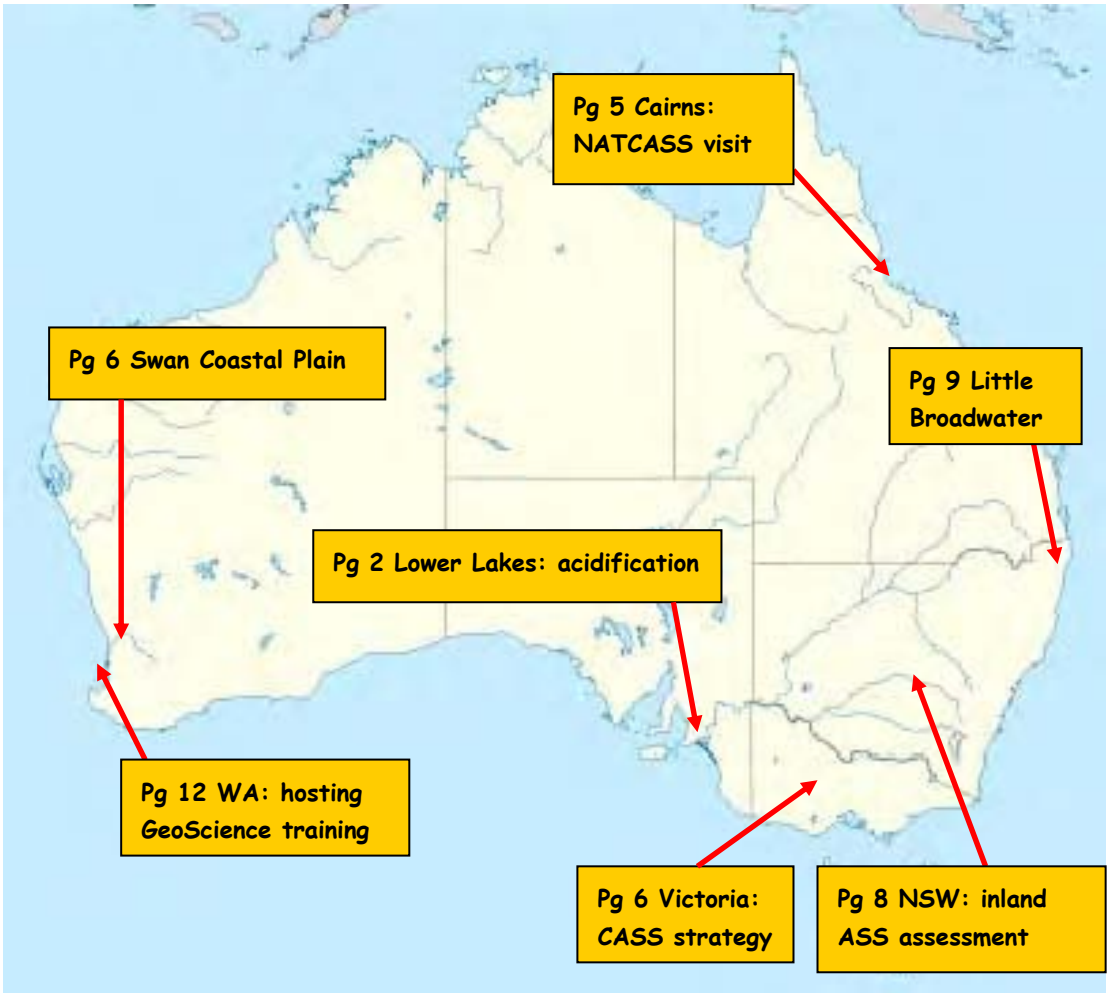
simon.walsh@industry.nsw.gov.au

## Places and stories in this issue…..




## Managing acid sulfate soils in South Australia's Lower Murray region

**Liz Barnett and Ann Marie Jolley, SA Department for Environment and Heritage**

***All photo credits: SADEH***

Record low inflows to the River Murray due to drought and over-allocation are having a significant impact on the Lower Lakes and Coorong region – a South Australian wetland of international importance.

Water levels are dropping, salinity levels are increasing and soils on the drying lakebeds and wetlands are acidifying. This situation is unprecedented.

The low water flows from the River Murray into the Lower Lakes over recent years have caused water levels to drop - exposing acid sulfate soils to the air. The impact of this was most noticeable in summer 2009, when soil acidification occurred over large areas of exposed lakebed in the region.

### Lower Lakes acid sulfate soil research

A detailed research program is being undertaken to learn more about the risks and options for managing acid sulfate soils in the Lower Lakes and Murray region. The research is being led by the South Australian Environment Protection Authority and the Department for Environment and Heritage.

The research program includes soil mapping, measuring acidity generation and flux rates, field and laboratory mobilisation experiments using both seawater and freshwater, and remediation trials.

The soil mapping focused on the spatial heterogeneity of acid sulfate soils to assess available and potential acidity in the Lower Lakes.

Approximately 350 sample sites were used in a geo-statistical program, which builds on existing research. The properties measured included net acidity, total actual acidity, acid neutralizing capacity and pH in water. For the acidity generation project, sulfide oxidation rates were measured as a function of moisture content and related to moisture content in the field.

***Exposed sulfate-rich sediment in Currency Creek (March 2009)***

Three piezometer transects measured groundwater quality and water levels to assess acidity transport processes. The seawater and freshwater mobilisation experiments measured the release of contaminants (acid, metals and nutrients) into overlying waters and the sulfidisation process to help determine whether seawater introduction is a viable management option. Remediation techniques have also been trialled over the past year, including revegetation and limestone treatment.

***Results of aerial seeding of 'bevy' cereal rye at Tolderol, Lake Alexandrina (September 2009)***

## Revegetation

Revegetation trials started in spring 2008 at Waltowa Swamp on Lake Albert, near Meningie. A range of reeds, seedlings and grasses were planted to assess best species for the area and analyse the potential benefits of revegetation for the management or mitigation of acid sulfate soils. The trials evaluated the use of native grass from seed and tubestock and natural regeneration. The growing habits of the various plants, especially their root systems and growing periods, were also studied. A key aim was to identify the species which establish well and protect the soil surface, but do not extract large amounts of water from the soil.

The results from the initial trials were used to undertake a broader revegetation trial, where 5000 ha of exposed lakebeds across the Lower Lakes region were seeded in autumn 2009. Up to 4500 ha were aerial-seeded using a cover crop (cereal rye) and *Puccinellia* sp., and 500 ha were machine-seeded. It was recognised that if nothing was done to stabilise the exposed acid sulfate soils further erosion of the lakebed would take place. In all over 20000 ha of lakebed were exposed when water levels were lowest in March to April.

## Limestone treatment

At low water levels (approximately -1.0 m AHD) large areas of Currency Creek, the Finniss River and the Goolwa Channel were exposed to the air, forming sulfuric materials from sulfide-rich soils generating acid.

As part of the emergency response to manage acid sulfate soils in this area, the SA Government trialled the application of limestone to the lakebeds and water in the Finniss River and Currency Creek tributaries.

Following rains in late April 2009, limestone was added to water in Currency Creek and the Finniss River to neutralize some of the acid entering the water from exposed soils prevent acid being transported down the system into the Goolwa Channel. Four different methods of limestone application were trialled including: aerial dosing, mounding, barriers and slurry. In particular, aerial dosing into acidified or low alkalinity pools was most effective in managing acidification in the area and avoiding large-scale ecological impacts.

Water quality monitoring within the Goolwa Channel region was intensified to assess the level of risk and monitor the effectiveness of the limestone dosing http://www.epa.sa.gov.au/xstd_files/Water/Report/currency_jul09_4.pdf.

***Limestone aerial dosing in Currency Creek (June 2009)***

## Goolwa Channel water level management project

In addition to limestone treatment, the SA Government constructed a temporary regulator across Goolwa Channel near Clayton and pumped 26.5 gigalitres of water from Lake Alexandrina. The aim was to raise water levels between the regulator and Goolwa Barrage to 0.7 metres above sea level, with levels to be maintained by the natural inflows from Currency Creek and Finniss River (Eastern Mount Lofty Ranges).


***Net acidity levels above -1.0 m (AHD) in the Goolwa Channel, Currency Creek and Finniss River, August 2009 (Source: CSIRO and SA Department for Environment and Heritage).***

Another temporary regulator was constructed across Currency Creek to reduce the risks posed by acid sulfate soil in case water levels drop to extremely low levels in the coming summer. The South Australian Government is committed to a fresh water solution for the Coorong, Lower Lakes and Murray Mouth region, and the temporary regulators will be removed when conditions improve.

For more information about the work underway in the Coorong, Lower Lakes and Murray Mouth region, please visit the SADEH website.

http://www.environment.sa.gov.au/cllmm/index.html

***Limestone barrier in Currency Creek (September 2009)***

## NatCASS team visits North Queensland

**Jeremy Manders (Qld Department of Environment and Resource Management)**

***Acid-damaged pylon*** ***Photo: Jeremy Manders***

NatCASS members and local stakeholders met in Cairns to tour local ASS 'hotspots' at Yorkeys Creek and Trinity Inlet during late October 2009. Highlights included graphic examples of acidic impacts on relatively new concrete infrastructure, as well as remediation efforts using a combination of lime application and tidal flushing.

The morning stop included a visit to an acid scald at Yorkeys Creek (north of Cairns, identified during the Cairns acid sulfate soil mapping project by DERM. The site has been tidally restricted for more than 40 years to protect sugarcane lands from tidal inundation, and pH readings in the creek in October 2008 were 2.6 to 3.5 with dissolved iron concentrations ranging from 50 to 100 mg/L.

The field visit included a gouge auger operation at the site and the visual indications of a limed and ripped acid scald, dead mangroves, MBO at the culvert, corrosion and loss of structural integrity of the nearby road culverts (only four years old).

Remediation works so far include surface liming in October 2008 before the 2008/2009 wet season, along with additional liming and ripping into the bare areas before the site visit in October 2009.

Water quality has been monitored with the installation of a station at the downstream flood gates. Future remediation work will include the installation of adjustable floodgates.

The visitors returned to Cairns for presentations on the Cairns acid sulfate soil mapping by Jeremy Manders (DERM), acid sulfate soil water quality improvement plans for Far North Queensland by Bernie Powell, and East Trinity presentations on site history and remediation works by Doug Smith (DERM), fish and crustacean studies by John Russell (DEEDI). Richard Bush, Scott Johnston and Annabelle Keene SCU (CRC CARE) presented an overview of the latest research on ASS remediation.

Lunch was followed by a bus tour of the East Trinity national demonstration site for acid sulfate soil remediation. Scott Johnston discussed the tidal hydrology and changes in geochemistry in re-establishing reducing conditions at the CRC CARE study site, Firewood Ck, East Trinity.

***Acid scald and dead mangroves at Yorkeys Creek before liming.*** ***Photo: Jeremy Manders***

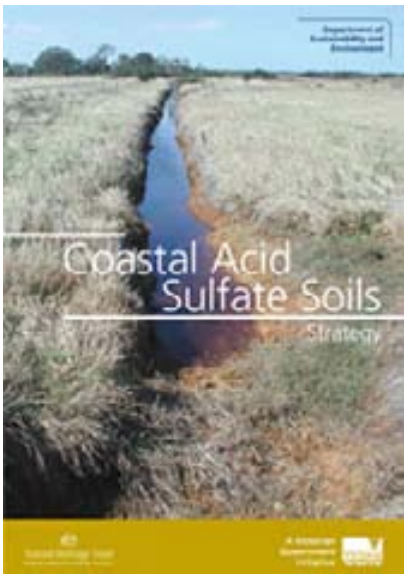
***Acid sulfate soil remediation using controlled tidal exchange at East Trinity*** ***Photo: Steve Wilbraham***

Those who made the tour a resounding success included Col Ahern, Doug Smith, Steve Wilbraham, Bernie Powell, David Morrison, Jeremy Manders, Brendan Malone, (all of DERM), John Russell (DEEDI), Richard Bush and Scott Johnston and Annabelle Keene (all of SCU).

For further information please contact Jeremy Manders on 07 3896 9265 or via email.

Jeremy.manders@derm.qld.gov.au

## Victorian Coastal Acid Sulfate Soil Strategy released




The Victorian Government's new CASS explains why CASS is a management issue in Victoria and promotes a risk identification and assessment process. It aims to build the capacity of land owners and land and water managers to identify areas where disturbance of CASS is best avoided. It includes

- areas with the potential to contain CASS
- decision-making principles and actions for managing CASS in Victoria
- roles and responsibilities of government, agencies and individuals
- identification and risk assessment processes to assist land managers and decision-makers

Coastal Acid Sulfate Soils Strategy (PDF - 3.0 MB).

## ARC linkage project for Swan coastal plain

**Clare Nixon, WA Department of Environment and Conservation**

Over the next three years, WA scientists will try to unravel the processes that control acidity storage and discharge on the Swan coastal plain.

The Department of Environment and Conservation (DEC), Department of Water (DoW), University of Western Australia (UWA), Water Corporation, Australian Laboratory Services (ALS) and environmental consulting group RPS will work together in ARC Linkage project.

DEC's acid sulfate soils manager Stephen Wong said the project would benefit agencies responsible for management of vulnerable groundwater resources linked to sensitive wetlands, such as those that occurred on the Swan coastal plain.

"Increased groundwater extraction and drainage for new urban developments coupled with decreased rainfall have exposed overlying soil layers to oxygen," he said.

"This, in turn, has caused oxidation of reduced Fe and S minerals, generating acidity and increased acidity of the soil and groundwater, resulting in degradation of groundwater-dependent ecosystems, potable water supply and infrastructure."

Mr Wong said it was not enough to simply assess the current occurrence and severity of ASS.

"Knowledge of the factors that can exacerbate the acidity footprint on the Swan coastal plain is required, so that timely preventative measures can be undertaken," he said.

"This information must be used to assess the current ASS hazard and model the risk of temporal and spatial formation and spread of ASS, especially in sandy aquifers.

***Photo: Contaminated Sites Branch, DEC***

"The knowledge will be used in assessing proposed urban and peri-urban development and for management of wetlands, drinking water catchments and other sensitive areas."

DEC's senior hydrologist, Dr Steve Appleyard, said the pace of urban development in the last decade in areas with poorly buffered soils on the Swan coastal plain around Perth appeared greater than in other Australian regions experiencing ASS formation.

"This is particularly evident in naturally acidic Bassendean sands with poor acid-neutralising capacity," he said.

"A decrease in groundwater pH from around 5 to 3 in an urban development in an Upper Swan catchment has occurred, literally, within weeks."

Dr Appleyard said a key component in this project was to study the processes that lead to the generation and attenuation of acidity on the coastal plain.

The research will combine reactive transport modelling with detailed laboratory studies and analysis of field data.

"It is important that decisions on groundwater abstraction, urban development and wastewater treatment are based on a scientific understanding of ASS formation and its environmental impact," said Dr Appleyard.

The UWA research team of Professor Zed Rengel, Dr Christoph Hinz, Dr Andrew Rate and Dr Ursula Salmon will be supported by ongoing DEC and DoW programs on regional-scale mapping of soil acidity and groundwater quality.

The project falls within the national research priority *An Environmentally Sustainable Australia* which deals with *Water – a critical resource, Overcoming soil acidity* and *Responding to climate change and variability.*

For more information contact Clare Nixon at clare.nixon@dec.wa.gov.au

# NSW inland wetlands assessed for ASS

**Mitch Tulau, NSW Department of Environment Climate Change and Water**

***Photos: Mitch Tulau***

Assessment of 420 NSW inland wetlands has found acid sulfate sediments along the length of the Murray River from Albury to near the SA border, and in some parts of the Darling and Murrumbidgee systems. Downstream, soil and water sulfate and EC values generally increased although incubated pH values in the upper Murray also declined as low as pH 2.

***A severely degraded acid sulfate site on Merran Creek on the Wakool***

Wetlands in the Mildura area formed on former lake basin sediments, such as Boeill Creek and Bottle Bend, were highly sulfuric. The Wakool-Niemur River system between Deniliquin and Balranald is of particular concern. There, sulfuric and sulfidic sediments formed in incised channels that were invariably associated with deep layers of monosulfidic black oozes overlain with a halite crust, with extensive death and dieback of river red gums and black box.

Teams from the NSW Department of Environment, Climate Change and Water (DECCW) carried out much of the work, with CMAs, the private sector and the Murray-Darling Freshwater Research Centre also contracted to assist. Southern Cross University and CSIRO undertook laboratory soil and water samples.

The assessments are part of an ASS risk assessment project co-ordinated by the Murray Darling Basin Authority to assess acid sulfate soils at priority wetlands in the Murray River system, Ramsar wetlands and other key environmental sites in the Murray-Darling Basin and identify and assess management and mitigation options.

The NSW sites were ranked according to the field and laboratory test results, using evaluation criteria set out by a scientific reference panel. A range of contextual and environmental variables were also taken into account, such as whether the wetland is near a town water supply off-take, whether it is relied on for stock and domestic water supplies, and whether the wetland is listed on the Directory of Important Wetlands in Australia.

The next phase of work involves detailed assessment of selected sites and the preparation of mitigation and management options.

For more information contact Glenn Atkinson or Mitch Tulau at DECCW.

Glenn.Atkinson@environment.nsw.gov.au

Mitch.Tulau@environment.nsw.gov.au

***A severely degraded site with a thick salt crust underlain by monosulfidic black ooze at a creek on the Wakool***

## Water quality & hydrology research - Little Broadwater, Clarence River

**Nicole White, Clarence Valley Council**

Little Broadwater is a Clarence floodplain wetland underlain by acid sulfate soils, which was historically drained to increase grazing potential. While grazing improved in the short term, the wetland has degraded over time due to ASS oxidation and associated poor water quality, scalds and loss of vegetation.

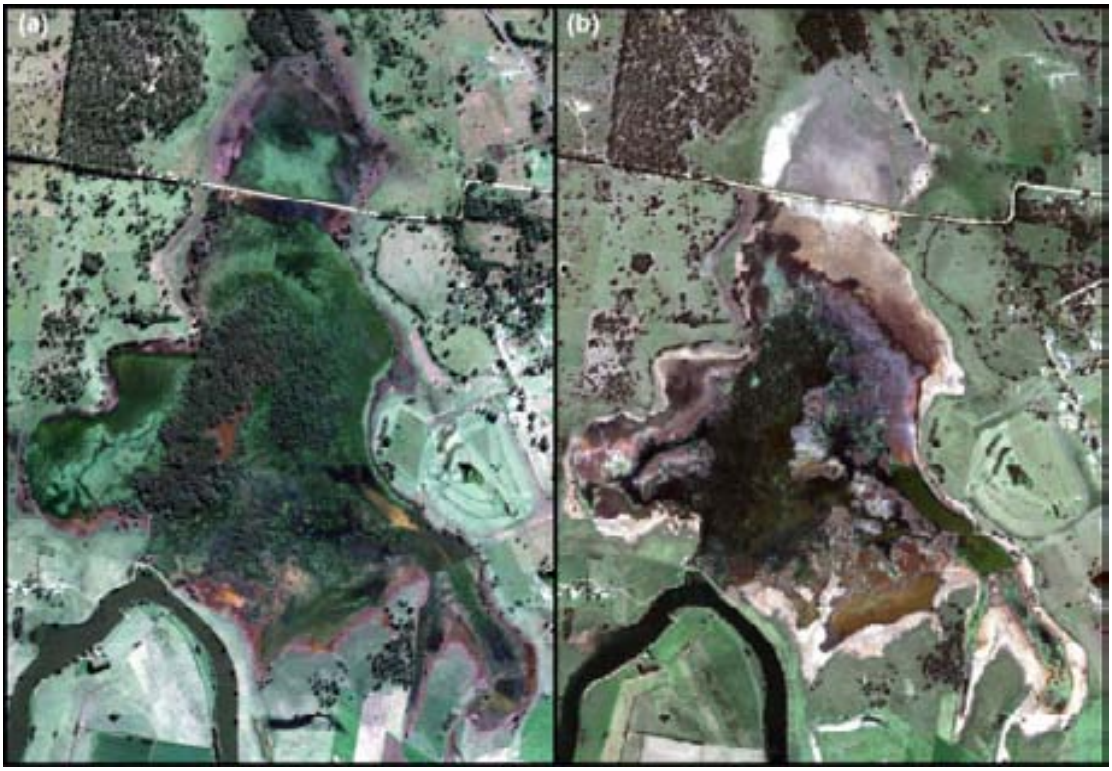
In June 2003, a combination of tidal exchange and ponding was restored to Little Broadwater as the start of a rehabilitation trial. Nicole White completed a PhD research project to investigate the hydrology and changes in water quality characteristics during the re-establishment of tidal exchange at the wetland, from November 2004 to February 2007.

The initial rehabilitation trial was with brackish to saline water exchange, however the continuing presence of large scalds and hypersaline water in the far reaches of the wetland necessitated a change to freshwater exchange. However, associated with freshwater management is an increased risk of desiccation over the drier winter and spring periods.

### Trial results

Comparison of drain water pH before and after rehabilitation began indicated that there was a substantial reduction in the duration, severity and frequency of acidic discharge associated with large rainfall events (from

an average pH of 4 which lasted 3 months before rehabilitation, to an average pH of 5.5 which lasted only 2 weeks). This was primarily due to reduced oxidation of ASS and dilution of drainage waters through inundation of ASS, and increased exchange. However, there were still regions within Little Broadwater which were acidic for the majority of the study, and poor circulation within the wetland resulted in these acidic waters remaining ponded. Statistical analysis revealed significant spatial zonation of water quality within the wetland which was primarily due to variation in salts, followed by ASS products and then nutrients. Poor circulation within the wetland was the major factor accounting for this spatial variation.




***Photos: University of New England***

***Above left: Little Broadwater during a freshwater period when vegetation thrives. Above right: During the dry season scalds may occur due to the lack of tidal exchange with the adjoining saline creek water. While Little Broadwater is under private ownership, freshwater management is necessary to maintain agricultural viability.***

## Groundwater

Although reflooding the wetland raised the watertable above the ASS layer, very acidic (average pH < 4) deep groundwater with very high concentrations of aluminium and iron was recorded along the eastern boundary of the wetland. However, the presence of a semi-confining layer indicated that this deeper groundwater did not influence surface water quality within the wetland. Rather, the shallow groundwater and sediments above the semi-confining layer, influenced wetland water quality through direct exchange and the dissolution of acidic salts (on the sediment surface) by rainfall.

## Vegetation

Changes in vegetation cover reflected both the quality and quantity of water within the wetland, which was a function of seasonal rainfall and management. The variation in vegetation cover contributed to the spatial and temporal changes in evapotranspiration of groundwater and capillary rise of acidic salts to the sediment surface, causing scalds and further reducing vegetation cover. In addition, vegetation type and density often influenced the range of bird species that utilised the wetland, while selective grazing of areas by swans and cattle opened up surface water flow paths and influenced the wetlands hydrology.

## Model

A conceptual model of wetland function was developed for Little Broadwater, which simplified the complexity of interactions between ecosystem components and indicated the implications of changing one or a number of components for future management. While the model was developed for ongoing management of Little Broadwater, observations of similar patterns in water quality in other coastal floodplain wetlands on the Clarence River indicated the broader applicability of the conceptual model. Furthermore, the nature of the model allows for comparisons of processes within individual zones of the wetland.

Little Broadwater ***Photo: Simon Walsh***

Current management of Little Broadwater is based on the outcomes of the rehabilitation trial, although the ability to convert the system back to a natural regime is limited due to the current private agricultural land use and flood mitigation structures.

For more information contact Peter Wilson at Clarence Valley Council on (02) 6641 7350.

# New research centre to focus on a wide range of geosciences interests

**Chrisy Clay , Southern Cross University**

***Photos: Geoscience, SCU***

Last year Southern Cross GeoScience, a new specialist research centre, was established at Southern Cross University. Building upon the internationally recognised success of the University's Centre for Acid Sulfate Soil Research (CASSR), founding directors Prof. Leigh Sullivan and Prof. Richard Bush, lead an energetic team with a wide range of geoscience research interests.

The team, whose vision is to be world leaders into land and water processes that are both regionally relevant and globally significant, includes:

- A/Prof Andrew Rose ARC QEII Research Grant Recipient with expertise in the interface between organisms and their geochemical environment.
- Dr Ed Burton ARC Post-Doctoral Research Fellow with expertise in iron, sulfur and trace element geochemistry.
- Dr Scott Johnston Research Associate with expertise in the hydrology and biogeochemistry of coastal floodplains.
- Dr Annabelle Keene Research Associate with expertise in the geomorphology, biogeochemistry and hydrology of riverine and floodplain landscapes.
- Dr Jeffery Parr ARC Postdoctoral Research Fellow with expertise in the relationship between phytoliths and carbon sequestration.
- Dr Nick Ward Postdoctoral Project Officer examining the risk acid sulfate soil materials pose.
- Dr Kym Watling Research Associate with expertise in the acid neutralising capacity of acid sulfate soils and sulfur speciation.
- Dr Vanessa Wong Research Associate with expertise in floodplain biogeochemical processes and soil organic matter dynamics under the influence of climate variability and climate change.

Southern Cross GeoScience also includes eleven PhD students, five laboratory staff and four administrative staff.



Southern Cross GeoScience's current research activities span a wide range of important land and water issues including: acid sulfate soils, salinity, surface and groundwater interactions, wetland and floodplain management, inland salinity and soil carbon sequestration. Across those fields, the Centre has been very successful in undertaking both fundamental research and applied industry-linked land and water research in coastal and riverine landscapes.

To assist in producing the best science possible, the Centre features specialist laboratory facilities for the study of redox sensitive soils and sediments. The newly developed laboratory complex includes a phytolith laboratory, a new Mossbauer laboratory for specialised iron mineral research, a state of the art X-ray diffraction laboratory for advanced mineralogical analysis as well as three general environmental chemistry/soil research laboratories.

For further information on Southern Cross GeoScience, visit the centre's website.

www.scu.edu.au/geoscience

## WA to host next GeoScience acid sulfate soil training program

**Chrisy Clay, Southern Cross University**

The next Southern Cross Geoscience acid sulfate soil training course will be held in Mandurah WA, from the 2nd to the 4th of March 2010 and organisers predict places at the course will be in high demand. The professional training course is specifically designed for those involved with either the development or assessment of acid sulfate soil management plans, as part of the development approval process.

"We are looking forward to the course running in Mandurah,' says Stephen Wong, WA Department of Environment and Conservation. "Western Australia has progressively introduced planning controls, policies and guidelines to ensure the disturbance of acid sulfate soils is properly managed, but many stakeholders are unsure of current best management practices. This course will help raise the current knowledge and skills of people involved with the development approval process, resulting in better environmental outcomes."

GeoScience's professional short course on acid sulfate soils will be delivered across the country with assistance of Caring for our Country. The course, which has been previously run in both northern NSW and Brisbane, will run at least once in every State and territory by June 2011. Upcoming courses are planned for Queensland in April/May and Hobart in June.

Developed in conjunction with the relevant regulatory authorities, the course provides a unique opportunity for both proponents and assessors to discuss different aspects of managing acid sulfate soils. The course aims to provide a common knowledge base to those who write and manage management acid sulfate soil management plans and those who assess and approve these plans.

For further information or to register for the course at Mandurah, visit the SCU Geoscience website (see the link above) and follow the links. To express an interest in any future courses, contact the course project officer Chrisy Clay on 02 6620 3095 or email chrisy.clay@scu.edu.au

## Selected recent journal articles


Anda M, Siswanto AB, Subandiono RE (2009) Properties of organic and acid sulfate soils and water of a reclaimed tidal backswamp in Central Kalimantan, Indonesia. *Geoderma* **149**, 54-65.

Denmead OT, Macdonald BCT*, et al.* Emissions of methane and nitrous oxide from Australian sugarcane soils. *Agricultural and Forest Meteorology* **In Press, Corrected Proof**.

Fanning DS, Rabenhorst MC, Balduff DM, Wagner DP, Orr RS, Zurheide PK An acid sulfate perspective on landscape/seascape soil mineralogy in the U.S. Mid-Atlantic region. G*eoderma* **In Press, Corrected Proof**.

Farrand WH, Glotch TD, Rice Jr JW, Hurowitz JA, Swayze GA (2009) Discovery of jarosite within the Mawrth Vallis region of Mars: Implications for the geologic history of the region. *Icarus* **204**, 478-488.

Fernández S, Santín C, Marquínez J, Álvarez MA Saltmarsh soil evolution after land reclamation in Atlantic estuaries (Bay of Biscay, North coast of Spain). *Geomorphology* **In Press, Corrected Proof**.

Golab AN, Peterson MA, Indraratna B (2009) Selection of permeable reactive barrier materials for treating acidic groundwater in acid sulfate soil terrains based on laboratory column tests. *Environmental Earth Sciences* **59**, 241-254.

Johnston SG, Bush RT*, et al.* (2009) Changes in water quality following tidal inundation of coastal lowland acid sulfate soil landscapes. *Estuarine, Coastal and Shelf Science* **81**, 257-266.

Johnston SG, Hirst P, Slavich PG, Bush RT, Aaso T (2009) Saturated hydraulic conductivity of sulfuric horizons in coastal floodplain acid sulfate soils: Variability and implications. *Geoderma* **151**, 387-394.

Johnston SG, Keene AF, Bush RT, Burton ED, Sullivan LA, Smith D, McElnea AE, Martens MA, Wilbraham S (2009) Contemporary pedogenesis of severely degraded tropical acid sulfate soils after introduction of regular tidal inundation. *Geoderma* **149**, 335-346.

Ljung K, Maley F, Cook A, Weinstein P (2009) Acid sulfate soils and human health--A Millennium Ecosystem Assessment. *Environment International* **35**, 1234-1242.

Macdonald BCT, Reynolds JK, Kinsela AS, Reilly RJ, van Oploo P, Waite TD, White I (2009) Critical coagulation in sulfidic sediments from an east-coast Australian acid sulfate landscape. *Applied Clay Science* **46**, 166-175.

Smiles DE (2009) Quantifying carbon and sulfate loss in drained acid sulfate soils. *European Journal of Soil Science* **60**, 64-70.

## New publication: Design options for water control structures

***Corrosion-resistant vinyl sheet piling being used to retain groundwater***

***(Photo: Stuart Murphy, Clarence Valley Council)***

Industry & Investment NSW (formerly NSW Department of Primary Industries) has completed a review of water control structures to help landholders, councils, agencies and others to maintain high groundwater levels in acid sulfate soil areas. The review describes and compares a number of different water control structures. http://www.dpi.nsw.gov.au/__data/assets/pdf_file/0003/302583/Water-Control-Structure-Review.pdf

For more information, contact ben.rampano@industry.nsw.gov.au

## ASSAY contact details

**ASSAY is a quarterly newsletter about acid sulfate soils around Australia, and is available to all people interested in this issue.**

**It is produced by Industry & Investment NSW with funding from the Department of Environment, Water, Heritage and the Arts.**

**To subscribe, email the editor, Simon Walsh with "Subscribe ASSAY" in the subject line:**

simon.walsh@industry.nsw.gov.au

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