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Australian Soil Club

Welcome

It seems that at long last soil biology is firmly on the agenda of Governments and our research bodies. Both **Land and Water Australia** and the **Grains Research and Development Corporation** have funding for healthy soils programs, with a strong emphasis on soil health and monitoring soil condition.

In December, a group of people from the soils community met in Canberra as part of Land and Water Australia's Healthy Soils for Sustainable Farms program.

The purpose of the meeting was to develop a soil 'state of play' for Land and Water Australia and define the soil knowledge asset that exists in Australia.

Work is being done to put this asset together and make it freely available to farmers and land managers.

Knowledge about the living, breathing nature of our soil is a critical part of this asset. The Australian Soil Club will be looking to further its involvement in the Healthy Soils program during 2006 through on-the-ground involvement at the regional level and in assisting to bring together information about soils. Please keep visiting the website – www.soils.org.au for updates.

In this issue:

Acid Sulfate Soils

Making Soils Sexy

Effective Riparian Buffers

Ground-breaking stuff

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Soil Health is recognised by the Federal Government

New initiatives by Land and Water Australia indicate revived interest in Soil Health across Australia

Land and Water Australia is a Commonwealth Funded Research and Development Corporation which takes a leading role in research about land and water issues nationally. Most recently this organization has taken the lead role in promoting increased awareness of issues related to soil health and is finalising major research projects in this area.

www.soil.org.au

The website on which the Australian Soil Club is hosted has been developed by The Regional Institute. The Regional Institute is an independent, not-for-profit publisher of research and educational information. Its mission is: "To make information on which to build individual and community knowledge and generate public debate on social, environmental and economic issues, freely available and accessible via the Internet."

A key feature of The Regional Institute is to build the capacity of people to self-publish and own content, while maximizing dissemination of the information to a wide audience. It is intended that the website www.soil.org.au has individual pages with information of relevance to soil generally. If you are interested in locating information about your soils or research on the website, please contact Lyn Abbott (labbott@cyllene.uwa.edu.au) to discuss options for doing this. The objective is to share information and promote knowledge of soil.

Soil Health: Recovering and Managing Acid Sulfate Soils

Research on this topic was conducted by N. Ward, L.A. Sullivan, and R.T. ('Sulfide oxidation in some acid sulfate soils') and was published in the *Australian Journal of Soil Research* in 2004 (Volume 42, pages 449-58)

Acid sulfate soils occur naturally on Australia's coastal plains, usually as waterlogged layers of soil containing the iron sulfide mineral pyrite. Although acid sulfate soils are generally harmless, when they are exposed to oxygen through excavation or drainage, large quantities of

continued on page 2

from page 1

Visit the Soil Health website at www.soilhealth.com

Left: David Moloney runs cattle on 200 hectares of backswamp adjacent Shark Creek on the Clarence River floodplain near Grafton and says NSW Agriculture science shows a 70 per cent reduction in acid export – a tremendous gain for water quality and fish life in the river estuary with productivity gains for his farm as well.

sulfuric acid are produced, causing contamination of soil and water systems with acid, metals or arsenic. The consequences of disturbing acid sulfate soils can be serious – causing fish kills, corroding infrastructure, and compromising wetland ecology, groundwater resources, and agricultural productivity.

Potentially harmful acid sulfate soils occur primarily in Australia's coastal flood plains, where escalating rates of drainage for agricultural and urban development have created increasing acidification problems. Important agricultural industries, such as dairy farming and sugar cane production, are especially vulnerable, as they are frequently situated on floodplains underlain by acid sulfate soils. Fuelling the acidification of coastal regions is the current drive to drain wetlands and convert them into productive agricultural land (NSW Department of Primary Industries website). Unfortunately, drainage of acid sulfate soils can instigate the acidification process, with dire consequences for farmland productivity and waterway health.

While acid sulfate soils have primarily created issues in coastal regions, it is not only coastal agriculture and settlements that have been affected. Inland agricultural areas can also be impacted, particularly those areas affected by rising water tables. In these areas, drainage efforts aimed at mitigating salinity can actually initiate problems with acid sulfate soils. Despite the consequences of draining acid sulfate soils, soil scientists still do not wholly understand the complex processes underpinning acidification. While many studies have concluded that oxidation of pyrite (FeS_2) by molecular oxygen (O_2) and ferric iron (Fe3+) are the primary contributors to soil acidification, other studies have observed acidification without detectible pyrite oxidation. There has, therefore, been some speculation that oxidation of other sulfur species may also contribute to soil acidification.

A study by Ward et al. (2004) published in the *Australian Journal of Soil Research* seeks to shed light on this issue by analyzing the complex chemical processes underpinning acidification. The authors took samples from two locations on the McLeods Creek coastal floodplain in northeastern New South Wales. These samples were incubated in the laboratory to simulate the natural oxidation process. Analysis of the samples was undertaken for 36 days postincubation to determine the fraction of 'acid volatile sulfur' (SAV) that could potentially contribute to acidification through its oxidation.

Both samples experienced significant acidification during the course of the study, with the pH of one sample decreasing from 6 to 4.3, and the pH of another sample decreasing from 8.3 to 7.5. Although the authors found that the fraction of SAV in both samples increased significantly during the first eight days of the study, and that its oxidation did coincide with some acidification, Ward et al. (2004) concluded that this process was not the primary cause of the acidification as the quantity of SAV oxidised was far less than the quantity of pyrite oxidised. The authors therefore concluded that pyrite oxidation was, indeed, the primary cause of acidification for the samples under consideration.

It can be extremely costly and difficult to rehabilitate soil and water systems once acidified; avoiding acidification via thorough soil mapping processes

continued on page 3

ASC Mission Statement
To provide information about soil that is relevant to all land users.

from page 2

is, therefore, by far the most effective management strategy. Mapping of acid sulfate soils, as well as the rehabilitation of acid affected land, hinge on an understanding of the complex chemical processes leading to acidification. It is therefore critical that planners and developers, farmers and land managers, in both urban and agricultural communities, have access to the implications of research into these processes – research that often remains only in academic circles.

While studies such as that undertaken by Ward et al. (2004) attempt to clarify some of the unknowns behind soil acidification, it is clear that further research is required to grapple with some of the less understood factors contributing to acidification. It is also imperative that research findings are better targeted towards land managers to help avoid and ameliorate the potential impacts of acid sulfate soils.

References:
Ward, N., Sullivan, L.A. & Bush, R.T. (2004) Sulfate oxidation in some acid sulfate soils. *Australian Journal of Soil Research* 42, 449 - 458

Ozestuaries website
http://www.ozestuaries.org/oracle/ozestuaries/index.htm

NSW Department of Primary Industries website
http://www.agric.nsw.gov.au/reader/8632

Making soils sexy

Rebecca Lines-Kelly and Abigail Jenkins, from NSW Department of Primary Industries Wollongbar Agricultural Institute, are seeking to stimulate NRM extension officers to excite and encourage people's interest in soils. "Extending information about soils is about making the invisible visible,helping people look beyond dusty, familiar surfaces into secret, hidden depths. It requires extension techniques that help us know and understand soil, 'see its life and beauty, smell its rich aroma, hear its voice' (Kirschenmann 1997). "Making soils sexy is about helping everyone realise how fascinating soils are in their own right, how alive they are, how important they are for survival of all species, and how much they need our love and attention."

Rebecca and Abigail's joint paper 'Making Soils Sexy,' outlining the work of the NSW DPI soils officer over the past 14 years, will be presented at the Australian Pacific Extension Network 2006 International Conference, March 3-6 at Beechworth in Victoria.

See The Regional Institute website for a copy of the paper. **www.regional.org.au/au/apen/2006**

What makes an effective riparian buffer?

Research on this topic was conducted by L.A. McKergow ('Performance of grass and rainforest riparian buffers in the wet tropics, Far North Queensland.') and was published in the *Australian Journal of Soil Research* in 2004 (Volume 42, pages 485-498)

Farm management can play an important role in protecting water systems. Land managers can help protect the health of our waterways by reducing export of nutrients to water systems. While good fertilizer practices are an important aspect of sustainable agricultural management, there are many other ways to protect our water systems.

Zones of vegetation surrounding a waterway, known as 'riparian buffers', are a particularly important way to minimize erosion and reduce transport of sediment to waterways. Riparian buffers work by slowing the movement of water through the buffer zone; as the water slows, infiltration into soil improves and deposition of sediment increases. This process can also assist to remove nutrients from run-off before it enters a waterway – infiltrating dissolved nutrients into soil, or depositing nutrients that are bundled with sediment particles.

While there is a range of laboratory studies that have examined the effectiveness of riparian buffers, to date there has been little quantitative data collected under natural conditions in the field. Field-based research is particularly important to land managers, as experimental designs may not incorporate the range of variables influencing buffer capacity at 'real-life' farming properties.

A recent study undertaken by McKergow et al. (2004) seeks to rectify this situation. Using two banana-farming properties in the Johnstone River Catchment, a region of far north Queensland where erosion has become a significant issue, the study investigated the capacity of four 'real-life' riparian buffers to cope with extremely high rainfall on intensively cropped land. Over a period of four years, the study investigated the effectiveness of a variety of vegetation types and landscape forms to trap sediment and nutrients.

So what factors helped the buffers effectively trap

continued on page 4

from page 3

pollutants? From the results of the 2004 study, it appears that, in general, dense signal grass buffers are able to trap a significant amount of bedload eroded from cropped land during rainfall. In fact, McKergow et al. found that, even on slopes with high erosion levels, dense grass buffers were able to trap over 80% of the incoming bedload. However, McKergow et al's research indicates that placing buffers on slopes converging toward waterways may compromise their effectiveness. In particular, during the 2004 study, channelling of run-off toward a waterway was observed at a buffer placed on a converging slope. During an extreme rainfall event, a scour through this buffer was created that transported significant sediment into the waterway. McKergow et al. recommend that, to prevent scouring on converging slopes, farmers should ensure that buffers begin as far up-slope as possible, where sediment loads are low and gradients are mild.

Although McKergow et al. stress the importance of native vegetation in maintaining the health of water systems, the results of the 2004 study indicate that rainforest may not be the most effective riparian buffer. In particular, a remnant rainforest buffer investigated during the 2004 study was not successful in trapping sediment. McKergow et al surmise that the lack of under-story in the rainforest buffer hindered its effectiveness – allowing some transport of sediment to the waterway. During heavy rainfall in the rainforest buffer, a series of little channels, or "rills", formed around tree buttresses – increasing sediment transport to the waterway. In addition, nutrient levels in run-off increased while in the remnant rainforest, indicating that there was a nutrient source within the buffer itself – possibly leaf litter or sediment.

Although a significant amount of bedload deposited in the rainforest was permanently trapped, sediment often ended up being transported to the waterway in subsequent rainfall. By way of contrast, couch grass quickly took seed in sediment deposited in the signal grass buffers. These sediment deposits were, therefore, quickly stabilized and not transported to waterways in subsequent rain events. To maximize the benefits of rainforest buffers, McKergow et al. recommend that grass buffers should be planted upslope to trap as much sediment as possible before run-off enters rainforest.

While the results of the 2004 study show that dense grass buffers can be extremely effective in conditions of extreme rainfall and significant erosion, McKergow et al. stress that buffering should only be considered as one element in an integrated approach to water system protection. Crop erosion controls and nutrient management practices are also essential aspects of waterway protection. In addition, while the study reveals some important factors to consider when designing riparian buffers, many of its results are specific to farming conditions in far north Queensland. It is important that field based studies are conducted in a broad range of conditions so that the farming community can ensure that the buffer they employ will be as effective as possible under conditions specific to their region.

Reference: McKergow, L.A. (2004) Performance of grass and rainforest riparian buffers in the wet tropics, Far North Queensland. *Australian Journal of Soil Research* 42, 485-498

Ground-breaking stuff

13th Aust. Society for Agronomy Conference

The Australian Society of Agronomy is holding its 13th national Conference, "Ground-breaking Stuff" in Perth from 10-14 September 2006. The theme draws on our foundations in the soil, implies a strong relevance to practical agriculture and, at the same time, smacks of scientific breakthrough and application. There are six plenary sessions, each with invited and volunteered papers and posters and two special features: A Young Researchers and Farmers Forum and the Donald Oration, recognising an eminent contribution from a senior member of our profession. There are 10 invited speakers, including Professor M S Swaminathan, who was acclaimed by TIME magazine as one of the twenty most influential Asians of the 20th century and one of the only three from India, the other two being Mahatma Gandhi and Rabindranath Tagore. Prof. Swaminathan has been described by the UN Environment Programme as "the Father of Economic Ecology" for his role in bringing the Green Revolution to India and by the Secretary General of the United Nations, as "a living legend who will go into the annals of history as a world scientist of rare distinction".

Please visit the Agronomy Society website

www.agronomy.org.au/events/2006

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