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Australian soil club

Welcome

The main articles in this issue are:

- *Catchment Knowledge Exchange*
- *Climate, pasture and soil health*
  - *A Survey of Australian Temperate Pastures in Summer and Winter Rainfall Zones*

FEATURED WEBSITE

Australian Government Agriculture Portal
http://www.agriculture.gov.au/index.cfm

This is an ever expanding catalogue of Australian, State and Territory Government information and services for the agricultural, fisheries, processed food and forestry industries.

The site has a designated section on resource management. From there, you can select areas of the website on a range of soil topics.

You can also to go directly to the following section of the website for ***soil erosion fact sheets***

http://www.agriculture.gov.au/nrm4.cfm?display2=Soil&display3=Soil%20erosion&display4=Fact%20sheets

However, it is easier to enter at the main website and find your way to the soil erosion factsheets.

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Introducing the Catchment Knowledge Exchange: Soil Knowledge Broker Service

A recent initiative provides an exciting opportunity to encourage the exchange of soil knowledge among those people interested in the better management of soils in Victoria. The Catchment Knowledge Exchange (CKE) is a three-year project being managed by the Victorian Catchment Management Council and funded by the National Action Plan for Salinity and Water Quality.

Knowledge brokering is gaining interest and acceptance across Australia. The objective of the CKE project is to test the case that a dedicated knowledge broker service will improve the availability and accessibility of knowledge for decision-making across Victoria's catchment management framework. Part of the project involves the trial of a Knowledge Broker Service in the area of soil health.

The SKBS will function to improve the flow of information and knowledge so that, across Victoria, we can work towards more sustainable management of our soil resources, using best available advice and information. To achieve this, the Soil Knowledge Broker Service will deal with a range of soil health topics, including soil management, capability, physical processes, measurement and inventory.

The two main features of the Soil Knowledge Broker Service are the website, at **www.catchmentknowledgeexchange.net.au** and the 'human' Soil Knowledge Broker.

The website provides a collection of soils-related resources and links relating to soils, as well as being a "portal" linking the soils community. It's easy to register and become a member of the community – you'll have access to high-quality, up-to-date soils information as well as be able to exchange information with others interested in soil health.

The Soil Knowledge Broker is Shawn Butters, whose role is to connect people to share and exchange knowledge across the catchment community. Shawn can be contacted: through the website, by e-mail (knowledgebroker@catchmentknowledgeexchange.net.au) or by telephone, 0437 988 137.

The website is not meant to be an exhaustive resource nor a centralised knowledge base, rather an interactive place for stimulating discussion, sharing, questioning and referring. The website is a "work-in-progress", designed to augment existing resources rather than replacing them. It draws together soils-related resources from around Australia and the rest of the world. Although there is a focus on Victorian resources and questions, anyone can participate by asking questions and sharing materials and information.

Climate, Pasture and Soil Health

Research on this topic was conducted by Stirling, G.R. and Lodge, G.M. (2005), 'A Survey of Australian Temperate Pastures in Summer and Winter Rainfall Zones: Soil Nematodes, Chemical and Biochemical Properties'

Australian Journal of Soil Research: 43, 887-904.

Visit the Soil Health website at www.soilhealth.com

Australia's most productive pastures occur in areas of relatively high rainfall. In fact, it has been estimated that 50% of Australian cattle sales and 40% of sheep sales occur in pastures that receive over 600mm of rain per year (Stirling and Lodge 2005). Given the importance of these high rainfall pasturelands to the Australian economy, it is critical that we ensure their productivity into the future by protecting soil health.

It is surprising therefore that very little broad-based research has occurred to illuminate the biological processes underpinning soil health in high rainfall pastoral regions. A recent study in the Australian Journal of Soil Research seeks to rectify this situation by investigating wide-ranging factors that play a role in maintaining soil health in two important pastoral regions of Australia (Stirling and Lodge 2005).

Stirling and Lodge chose to investigate 40 sites, all of which receive a relatively high per annum rainfall of between 675mm and 692mm. The sites chosen, however, occur in two quite different climatic regions. One of these regions, near Tamworth and Armidale in New South Wales, has a pattern of predominantly summer rainfall, while sites near Hamilton in Western Victoria and South Australia receive primarily winter rainfall.

Stirling and Lodge investigated a wide array of indicators in order to gain a broad-brush understanding of soil health in the two climatic regions, including the influence of pasture type and climate on soil biological processes. The authors chose to investigate soil processes under four common pastures: subterranean clover, lucerne, phalaris and, in the winter zone only, perennial ryegrass. Samples were taken from several sites in each zone under each pasture type.

In the laboratory, a range of measurements were taken for each sample as indicators of soil health. Total organic nitrogen and carbon were assessed as a measure of the resources available to maintain the soil ecology, while labile carbon was measured to provide an indication of carbon readily available as a food source for the soil biota (in the form of amino acids, sugars or organic acids). Microbial biomass provided the authors with an indication of the total size of the soil microbial community, while the activity of this community was also investigated using a measure of enzyme activity. Finally, the number and variety of soil nematodes in each sample was measured to provide an indication of soil nutrient availability, soil structure, and soil decomposition channel.

Plant Parasitic Nematodes

Stirling and Lodge found that several species of plant parasitic nematodes, especially lesion nematodes, were wide-spread across both climatic zones and all pasture types. However, levels of these nematodes were not high enough to pose a problem for pasture growth, as they often do for cereal crops. The authors concluded that pasture species or pasture management practices may be less advantageous to lesion nematodes than some crop species or crop management practices.

Free-Living Nematodes

Stirling and Lodge also assessed levels of free-living nematodes to provide an indication of soil biological health across three indexes: enrichment index (EI), a measure of soil nutrients available as a resource for the soil biota; structure index (SI), a measure of the degree of soil structure; and channel index (CI), a measure of the soil's primary channel of decomposition.

EI was found to be highest in the winter zone, particularly under lucerne and subterranean clover. In particular, the existence of the bacterial feeding nematode family Rhabditidae indicated a large bacterial population at the winter sites as a food source for these nematodes. By way of contrast, Rhabditidae was rarely found in any of the summer rainfall sites. EI was found to be particularly low in the subterranean clover and lucerne pastures of this climatic zone. The authors concluded that low

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numbers of Rhabditidae in this zone may have been the result of low soil moisture content at the time of sampling – Rhabditidae feeds on bacteria living in films of moisture and is therefore only supported in soil with high moisture content.

SI was used as a measure of soil structure, and was indicated by the presence of an omnivorous nematode that is sensitive to soil disturbance by cultivation, heavy metals, arsenic, acid or nitrogen fertilizer. Unlike agricultural soils, pastoral soils are not often subject to disturbance and could therefore be expected to have good soil structure. Contrary to this prediction, only two pastoral types in the winter zone (perennial ryegrass and phalaris) were demonstrated to have a high SI. In fact, the summer zone had a significant proportion of sites with poor soil structure: these sites were often acidic, planted with lucerne or subterranean clover, and had low soil moisture content of only 5-11%.

Climatic zone appeared to be a strong determining factor for the decomposition channel (CI) of each site. In the summer zone, fungal decomposition predominated, while bacterial composition prevailed in the winter zone (as indicated by differences in the ratio of bacterial to fungal feeding nematodes). In consuming bacteria, 'microbivorous' nematodes take in more nitrogen than necessary for their body structure. This excess nitrogen is excreted as ammonia, available as nitrogen in the soil for uptake by plants and bacteria (Ferris 1998). Stirling and Lodge surmise that the two climatic zones therefore experience very different patterns of nutrient cycling.

Soil Organic Matter and Microbial Communities

Climatic zone played a strong influence on the level of nitrogen as well as the level of total organic carbon at each site. In the winter zone, levels of carbon and nitrogen, as well as levels of labile carbon, were found to be significantly higher than in the summer zone. As a consequence of this larger available food source, sites in the winter zone were also shown to support significantly higher bacterial populations. The authors conclude that predictable rainfall in the winter zone facilitates higher levels of pasture growth, which in turn generates a higher degree of soil organic matter in this zone. Bacterial populations and microbial activity were found to be particularly low in lucerne pastures in the summer zone (as also reflected by the low EI at these sites).

Cropping or Pasture

In general, the investigation demonstrated that pastures in both climatic zones were relatively healthy – especially when compared to land used for cropping. In a previous study, total carbon levels in the summer rainfall zone were found to be 44% lower in cropped land than in adjacent pastures (Lefroy et al 1993). Supporting the results of this previous study, levels of microbial activity in the pastures investigated by Stirling and Lodge were found to be much higher than levels observed in cropped soil in the northern grain-growing region (Bell et al unpublished). By way of explanation, the authors concluded that pastoral land benefits from relatively little disturbance as well as the enhancement of grass or legume growth.

References

Ferris, H. (1998), 'The Role of Nematodes in Soil Fertility', website: http://plpnemweb.ucdavis.edu/Nematplex/Ecology/fertil.htm

Stirling, G.R. and Lodge, G.M.(2005), 'A Survey of Australian Temperate Pastures in Summer and Winter Rainfall Zones: Soil Nematodes, Chemical and Biochemical Properties', *Australian Journal of Soil Research*: 43, 887-904.

Conclusion:

Given the relative health of pastoral soils in comparison to cropped soils, Stirling and Lodge suggest that pastoral areas might be chosen as ecological reference sites for agricultural management. While it is tempting to draw other conclusions for management practices from the results of this study, the authors provide a note of caution. In particular, they point out that the study did not include an objective measure of soil texture of herbage mass as a factor in the investigation. Given the variability of results within each pasture type, including sometimes significant variability within a single site with the same soil texture and grazing regime, there are obviously still many unknowns influencing the health of Australia's pastoral soils.

In general, however, Stirling and Lodge's study illuminates important differences between biological processes under a range of pastures in two different climatic zones. The study also provides land managers with an array of indicators that could be used as measures of soil health in pastoral regions. It is vital that robust indicators of soil health are continually developed and refined by scientists as well as assessed and monitored by land managers to ensure that we maintain and improve the productivity and health of an important economic asset into the future.

Soil Health Forum in Victoria

A Soil Health Forum was held in Bendigo, Victoria in June 2006. Participants shared information and experiences. The Forum was run as a collaborative event by the North Central Catchment Management Authority and the Victorian Catchment Management Council.

Participants at the Soil Health Forum above and Dr Pauline Mele (DPI Rutherglen), Dr Michael Crawford (PIRVic Bendigo) and Tom Davison (LWA)

You are encouraged to get involved with the Soil Knowledge Broker initiative described on Page 1 of this Newsletter. You can register to use the site, participate in a forum discussion, provide feedback, and e-mail or phone the Knowledge Broker with any soils-related questions that you may have from anywhere in Australia.

Correction: Website error

ASC Newsletter Vol 2 No 3 2006: The website for the Draft WA State of the Environment Report is

www.soe.wa.gov.au

The deadline for comments on the draft report has closed and the revised report will be available at a future date. In the meanwhile, the draft report is still available on this website.

ASSSI - ASPAC - ACMS National Soils Conference

Adelaide - December 2006

This is the Australian national conference on soils. An explanation of the participants is as follows:

ASSSI: The Australian Society of Soil Science Incorporated was founded in 1955 to work towards the advancement of soil science in the professional, academic and technical fields. It has a federal council and seven branches throughout Australia. ASSSI has accredited professional members involved in all aspects of Soil Science. If you are looking for professional advice on soil matters, remember only ASSSI members can be Certified Professional Soil Scientists.

ASPAC: The Australasian Soil and Plant Analysis Council is an independent international organisation consisting of individuals, laboratories, research and commercial organisations involved in soil and plant analysis. It promotes the adoption of appropriate field sampling protocols, uniform and reliable soil and plant analytical method, sound interpretation guidelines, and the most reliable and appropriate advice to clients. ASPAC also brings together individuals and groups from industry, public institutions and independent laboratories in Australia, New Zealand and nearby overseas countries to share information and technology on soil and plant analysis.

ACMS: is the Australian Clay Minerals Society. The ACMS is a scientific society whose aim is to further the study of clay minerals and allied substances by facilitating the exchange of information among members of the Society,and others interested in clay minerals, by (i) providing facilities for reading and discussion of papers on the methods and results of research on clay minerals and allied topics, (ii) stimulating interest in clay mineralogy and (iii) encouraging the practical applications of clay mineral research.

Further information about the conference will be included in the next ASC Newsletter.

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