Sept 2009

NEW ZEALAND GRASSLAND ASSOCIATION INC

GRASSLAND NEWS

# View from the Lammerlaws

Pat Garden

**SPRING** is always an interesting time for those of us in the pastoral game -

what's the growing season going to be like, how will our production levels shape up, will El Nino come to visit, and what about the markets, what will our currency do?

Pitting one's skills against all these variables is what makes the game exciting for me – but perhaps this optimism is a reflection of the early spring we are experiencing here on the Lammerlaws in Central Otago!

Lime on the Lammerlaws

## Conference 3rd – 5th November Waitangi

If you have an interest in the pastoral industry as a farmer, as a scientist or you are in agribusiness, why not take a few days away from your job and catch up with the latest developments in the field, at the lab bench and in farm services.

Laurie Copland and his Northland Organising Committee have a great Conference lined up in Waitangi 3rd – 5th November! The theme "Northland is the Future – See it Here First!" reflects the potential impacts the rest of the country may be facing in terms of Climate Change. A diverse series of papers to be presented, two sessions devoted to Greenhouse Gases, Global Warming, Emissions and farming (guaranteed to be controversial), three farms to visit, plenty of socialising with a great bunch of people – and the unique historic and landscape values of the iconic Bay of Islands as a marvellous backdrop. The Conference is being run in conjunction with the NZ Association of Resource Managers who will be running a parallel programme on the Tuesday and Thursday.

What better way to take a few days away from the farm or the desk? For farmers, the silage contractors will handle the job without you, and there will be plenty of time to get the swedes in after you return home!

Check out the website – www.grassland.org.nz - where you can register on-line or print out the registration form included in this newsletter and post it off. (Direct credit to the bank is great for us if you can manage it.) On a final administrative note—if you have changed your postal or email address please let us know as we have quite a list of members we can no longer contact.

See you in Waitangi!

***Pat***

## In this Issue

# Executive Officer position

Marie has been a lifesaver taking up the job at such short notice but we now need to fill the position on a permanent basis. We have decided that the position - in the intermediate term at least - should be a part time one of around 20hrs/ week

Before we advertise the position through the media I thought I should canvas NZGA members in case there is a prospective applicant out there within our membership.

Do you know of someone who would enjoy the job and who could provide a good service to the Association?

We are looking for a range of skills including: - financial management, secretarial and communication ability.

1. ***Financial Management:*** Computer literacy with an accounting programme and an organised, methodical approach to book keeping would be an essential requirement of the position.
2. ***Communication:*** The position is the first point of contact for NZGA Grassland and an outgoing personality would be a huge asset. The newsletter provides an important contact with members and an ability to express one's self and prepare the script would be a real bonus.
3. ***Secretarial:*** This involves taking minutes, correspondence, reporting, and managing the status of members.

Our website development will streamline our processes particularly around the interface with members and will diminish much of the manual work previously associated with the position. The position does require some flexibility in hours worked. Some periods of the year require a concentrated effort to accomplish tasks such as the call for papers for the upcoming annual conference, membership invoicing and conference registration, while other periods are much quieter. It's a position that can be managed from home and as an extra bonus, I can assure you that the Executive is great to work with! (Couldn't possibly comment about the President.)

If you know of someone, encourage them to make an application citing their experience, skills and suitability for the role, and forwarding it to both:-

Pat Garden pat.marcelle@farmside.co.nz
Anders Crofoot anders@castlepoint.co.nz

# Biochar - stable soil carbon

*Jacqueline Rowarth, Marta Camps and Mike Hedley, Massey University*

Biochar is the new word, yet very old concept, for carbon sequestration. It is charcoal by another name – produced at high temperature without oxygen from plant material (biomass) such as wood or straw. The product is stable in that it doesn't break down, but not inert in that it can hold nutrients and water. A product like it – 'char'− has been identified as the reason for the remarkable ongoing fertility of the *terra preta* soils in South America.

Several thousand years ago, pre-Columbian indigenous farmers used 'slash and char' to bring soils into production. 'Slash and char' sequesters approximately 50% of the carbon in the vegetation whereas 'slash and burn', still practiced by some cultures today, sequesters only about 3% of the carbon. To create 'char', vegetation cleared from new areas was smouldered at moderate temperatures in the absence of oxygen. The result was then dug in to the soil. Food scraps and waste materials were also added with the result that the *terra preta* soils have not only high carbon (and are black) but also high fertility in comparison with adjacent char-free soils.

The *terra preta* soils are thought to have formed over a relatively short time span – only 40-50 years. They range in depth from half a metre to two metres deep, and can contain as much as 250 tonnes of carbon per hectare in the first 30 cm and 500 tonnes per hectare up to one meter (but different authors have different values, indicating the difficulty of assessing soil carbon, as explained in the Grassland newsletter article by Parsons and Rowarth 2009). Unimproved soils from similar parent material have approximately 60% less carbon than the 'char-enriched' soils.

Fast Forward to the present century, and the Ministry of Agriculture and Forestry (MAF) has identified 'biochar' as a potential contributor to carbon trading. If New Zealand can offset emission by sequestering carbon, the country's liability is reduced. The recommendation from the Emissions Trading Scheme (ETS) Review Committee (August 31st, 2009) is that agriculture is included in any emissions trading scheme implemented by New Zealand. No recommendation has been made on timing, however, prompting increased discussion on mitigation and offsets.

Increasing soil carbon biologically has already been discussed in Grassland Association newsletters (Parsons and Rowarth, 2008; Parsons and Rowarth 2009) which are available from the Grassland website (www.grassland.org.nz).

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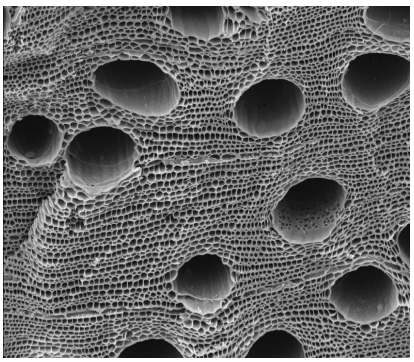
Soil carbon in the form of humus improves soil structure, water infiltration, moisture retention, nutrient exchange capacity, and microbial activity, all of which are good reasons to try and increase the amount. In the debate about carbon trading, however, long-term stability of soil carbon, and so whether it can be considered as 'sequestered', is in question.

One of the problems is that soil carbon is present in a wide range of chemical forms. These forms have different turnover times depending upon how easily soil micro-organisms can attack the structures, releasing carbon dioxide back to the atmosphere. Labile carbon (occurring, for example, in root exudates, relatively fresh litter and dung, and in the microbial biomass itself) is relatively simple in structure and has a turnover time of approximately 1-5 years. Humic carbon (what is left after the labile organic matter has decomposed – termed 'humus') is thought to turn over in decades, and char takes hundreds of years. Charcoal from volcanic eruptions has been dated at 20,000 years old; in *terra preta* soils char can be up to 5,000 years old.

*Biochar—charcoal by another name*

Humic materials contain nitrogen as well as carbon (the amount depends on the type of organic matter but a general range for C:N is 15-8:1, indicating between 15 and 8 times as much carbon as nitrogen in the material; humus is approximately 2% nitrogen. For comparison, wheat straw has a C:N of approximately 80:1 and is 0.5% nitrogen, and grass clippings 12:1 with 4.0% nitrogen. When humic materials breakdown, carbon dioxide ($CO_2$) is released (3.67 tonnes for every tonne of carbon lost from soil), as is nitrogen. The latter can be lost from the soil in drainage as nitrate or as the gaseous products of denitrification in the forms of nitrogen ($N_2$) or nitrous oxide ($N_2O$), a greenhouse gas (GHG). In contrast, char is 70-80% carbon (Massey University research has found C:N ranging from 9-322:1 depending on the feedstock) and is stable, taking hundreds of years to decompose because its aromatic nature is too difficult for microorganisms to attack.



***Scanning electron microscope view of Eucalyptus biochar***

Although stable, char is not inert – it can hold plant nutrients, including nitrogen, and often has useful supplies of potassium, sulphur and phosphate in the accompanying ash. It is probably this capacity that has resulted in reports that the addition of char resulted in a doubling of crop production in South America. The char was added with manure and food waste, as well as the 'ash' resulting from the charring process. The ash also has a liming effect, increasing soil pH. As the ash, manure and food waste was broken down by microorganisms, the nutrients released that weren't immediately immobilised (by micro-organisms) or taken up by plants, were retained by the char instead of being lost by leaching or, in the case of nitrogen, denitrification. Thus the char provided a source of nutrients that did not come from the char, but were plant available.

Biochar is similar to char formed during wild-fires or burning associated with clearing land but is manufactured by a process known as pyrolysis under high temperature and partial or complete oxygen exclusion. The manufactured biochar also has an aromatic ring chemical structure which makes it difficult for micro-organisms to break down.

The stable properties of char have been understood for some time, but biochar as a soil amendment for crop production is still being investigated, and results so far are not conclusive. Differences in results reflect:

1. type of feedstock for biochar and the temperature and time of pyrolysis. Biochars produced under certain conditions can have a detrimental effect on plant growth.
2. Differences in soil types. Positive effects on plant growth tend to be recorded from highly-degraded and nutrient-depleted soils. Application of biochar to fertile soils has not been shown to increase plant growth.

Identifying appropriate material for turning into biochar (e.g., forest residues, fast-growing vegetation, crop residues, urban green waste, sewage sludge), and the time-temperature needed to create 'safe' biochar efficiently, is the subject of research in various places in New Zealand. The MAF-funded New Zealand Biochar Centre at Massey University is working on pyrolysis, char chemistry, agronomic evaluation and the GHG footprint for biochar technologies.

Differences in soil type are also being investigated. Research in Sweden indicates that on fertile, carbon-rich soils, addition of biochar can result in a decrease in soil fertility, possibly because decomposition of existing organic matter is increased; whether the increase in microorganism activity can be attributed to addition of carbon or of change in soil pH is still the subject of investigation. In contrast, in highly weathered, low nutrient-status soils, addition of biochar can result in increased crop yield and decrease carbon turnover. Addition of fertiliser with biochar increased carbon turnover (although it was still considerably lower than the control of no fertiliser or biochar) suggesting that without added fertiliser the microbial biomass increase was limited by lack of available nutrients, possibly because the nutrients had been adsorbed by the biochar. Adsorption reduces the likelihood of loss of nutrients due to leaching, but if they aren't available to plants, crop yield won't be increased.

Small biochar particles can be ingested by worms, and have been found excreted with coatings of organic compounds which then provide food for other microorganisms. Microorganisms are able to colonise biochar relatively rapidly, and have been found growing on particles within a month of application. Four different mechanisms for interaction of biochar and microorganisms have been proposed: biochar changes nutrient availability; biochar affects the activity of different soil microorganisms in different ways, allowing some to flourish; biochar alters the signalling dynamics between plants and microorganisms; biochar serves as a refuge for colonising fungi and bacteria. The Bioprotection Centre at Lincoln University is examining biochar and soil microorganism activity partially funded by AGMARDT.

A further use of biochar could be in remediation of contaminated soils. Plant growth has been shown to increase in contaminated soils when biochar is added, suggesting that biochar has potential to assist in rehabilitation of soils and waterways.

*(Continued on page 4)*

Similarly, biochar applied to soils has been shown to reduce nitrous oxide emissions significantly (with the added benefit of reducing nitrogen fertiliser requirements). As nitrous oxide is approximately 320 times more effective as a GHG than carbon dioxide, biochar could be very important in mitigating emissions. The mechanisms and quantities involved are still being investigated.

Yet another area being studied is that of energy balance and GHG footprinting. Life Cycle Assessment (LCA) is needed to calculate full energy costs and gains, as well as the carbon balance.

Scale of operation, distance of feedstock from pyrolyser, location of suitable soil and incorporation method all have costs associated which must be assessed.

In theory biochar can be a carbon sink, but the practicalities have yet to be investigated. MAF has funded research in LCA at Massey University, as it has in Biochar and Pyrolysis; the three programmes interact closely.

***Biochar—willow pruning***

Transfer of knowledge on New Zealand research and technology developments is being provided by the New Zealand Biochar Research Network (Sustainable Farming Fund for industry liaison), which also offers a forum for discussion on biochar issues and stakeholders needs. Another valuable network is that formed by Australasian scientists – the Australia and New Zealand biochar research network. The network provides an excellent opportunity for collaborative research with the final aim of advancing the understanding of biochar properties for soil amendment and carbon sequestration.

Including biochar in a carbon trading scheme is relatively straightforward in comparison with trying to include soil carbon (which is fraught with the difficulties explained by Parsons and Rowarth 2009). The manufacture of biochar and its incorporation into soil can be monitored easily and soil analysis can be used for verification if required in any trading scheme. No base-line of soil organic matter is required – adding biochar is like planting trees, without the problem of waiting for growth and penalty at harvest.

To ensure that New Zealand makes the most of the biochar potential, research is needed to identify the most efficient methods of production, and the conditions under which adding biochar will be beneficial to soils and plant growth. The ETS Review Committee recommended that "the agricultural sector be included in the NZ ETS with the long-term goal being that the point of obligation is placed at farm level, once issues relating to the number of participants and the ability to verify farm-level information are resolved". The report noted that there was disagreement about when the agriculture sector should be brought in to the scheme, and, while noting that the ETS had potential to impact on competitive pricing of agricultural products, recommended "significant ongoing investment be made to reduce agricultural emissions and improve efficiency of pastoral systems". The report also stated that "soil carbon sequestration is considered to be an important area for research. Specifically, there is a need to determine its advantages with a thorough and impartial assessment based on relevant New Zealand science".

Researchers in New Zealand are part of an increasing effort to understand the role that biochar might play in the future. Specifically, we are investigating New Zealand's unique combination of waste materials, soils and environment to ensure that carbon sequestration through biochar will benefit soils at the same time as allowing carbon credits to be gained. It has been suggested that understanding biochar and using it appropriately is comparable to the effort that was needed to develop fertilisers last century. That being the case, and given the unintended consequences associated with fertiliser use – it is commendable that the effort is being made.

## Conference Registration

Included in this newsletter is the Conference Registration form that can be mailed or faxed to the address details below.

This year we are trying a new online registration system for internet savvy members. We are interested to see if it reduces the rather large workload around conference registration. The advantages for members are immediate receipt of an invoice with all your registration details as well as the ability to make changes to your own registration.

**Please either post your registration to address below or FAX to: 09 459 5405**

NZGA Conference
C/- PO Box 4135
Kamo
Whangarei 0141
NORTHLAND

Grassland News is published by the New Zealand Grassland Association Inc, Telephone +643 4770712 (0800 GRASSLAND—NZ only)
Membership is open to all those with an interest in pastoral agriculture—reduced rates for students and retired professionals.
Visit our website www.grassland.org.nz.
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**71 YEARS OF INVOLVEMENT IN NEW ZEALAND GRASSLAND FARMING**

# New Zealand Grassland Association Incorporated

***in conjunction with New Zealand Association of Resource Management***

## 71st Annual Conference
## Registration Form

| DELEGATE INFORMATION | | | | |
|---|---|---|---|---|
| Title: | | Preferred name: | | |
| First Name: | | NZGA Member: | Yes | No |
| Last Name: | | NZARM Member: | Yes | No |
| Company/Farm: | | | | |
| Postal Address: | | | | |
| City: | | Postcode: | | |
| Phone: | | Email: | | |

| REGISTRATION INFORMATION | | | |
|---|---|---|---|
| ***Full conference (includes field trips and gst)*** | ***Earlybird (received before 1 Oct 09)*** | ***Standard (received 1 Oct 09 or later)*** | ***Subtotal*** |
| NZGA/NZARM Members (circle one) | $275 | $325 | |
| Non-members (circle one) | $355 | $405 | |
| Students (circle one) | $180 | $230 | |

| ***Day pass - Tues 3 Nov (includes field trip & gst)*** | ***Earlybird*** | ***Standard*** | ***Subtotal*** |
|---|---|---|---|
| Members and non-members (circle one) | $75 | | |
| Students (circle one) | $60 | | |

| ***Day pass - Weds 4 Nov (includes field trip & gst)*** | ***Earlybird*** | ***Standard*** | ***Subtotal*** |
|---|---|---|---|
| Members (circle one) | $150 | $180 | |
| Non-members (circle one) | $180 | $210 | |
| Students (circle one) | $60 | $60 | |

| ***Day pass - Thurs 5 Nov (includes field trip & gst)*** | ***Earlybird*** | ***Standard*** | ***Subtotal*** |
|---|---|---|---|
| Members (circle one) | $90 | $120 | |
| Non-members (circle one) | $120 | $150 | |
| Students (circle one) | $60 | $60 | |

| ***Conference Dinner - $50 per person*** | ***No required*** | ***Subtotal*** |
|---|---|---|
| Delegates, partners and guests welcome | | |

| | |
|---|---|
| NZGA Subscription - $70 per year | |
| NZARM Subscription - $50 per year | |

| | |
|---|---|
| ***TOTAL PAYMENT DUE*** | |
| ***See next page for payment and postage information*** | |

**PAYMENT INFORMATION (please tick one)**

agresearch Lead Sponsor

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Credit card: (Card type circle one): Visa / Mastercard

Name on Card: _____

Card number: _____ Expiry Date: _____

Cheque enclosed ☐ Please tick if you require a tax invoice/receipt ☐

**PRIVACY:** Please tick if you do not want your name to appear in the list of delegates ☐