



Introduction

It might have been quiet as regards Newsletters, but it certainly has not been quiet in the Centre for Land Rehabilitation! Several new people have joined the Centre and interesting research projects are being carried out, a number of which are detailed below. The CLR was also the principal organizer of an international conference on Thresholds and Pattern Dynamics, which took place in Perth at the beginning of July this year. Please consult the conference website for abstracts and papers: <http://www.thresholds.segs.uwa.edu.au/>.

The CLR is organizing many more courses and events, some of which are detailed below, so do keep an eye on the website: <http://www.clr.uwa.edu.au/>.

New Staff in the Centre for Land Rehabilitation

Dr Natasha Banning joined the CLR to work on an ARC-ALCOA linkage grant investigating nutrient cycling and soil microbial diversity in native Jarrah forest and post-bauxite mining rehabilitation areas south of Perth, Western Australia. Outcomes of the project will be used to assess time-frames required for the re-establishment of soil processes and identify rehabilitation sites exhibiting self-sustainable ecosystem functions.

After completing her PhD in Environmental Microbiology in 2002, Dr Banning spent 18 months doing postdoctoral research at Cardiff University (Wales, UK) investigating the

community structure and the stable isotope biogeochemistry of methanogenesis in freshwater, estuarine and marine sediments. Her broad research interests are the molecular and ecological aspects of microbial biogeochemistry (i.e. relating the diversity of microorganisms to ecosystem function).

Annelies de Ruiter, who joined the CLR in April 2005, is responsible for organising the conferences, workshops and courses run by the CLR, as well as taking care of the Centre's general administration. Annelies completed a postgraduate diploma in advanced European economic studies and worked as an environmental policy officer within the Dutch Environment Ministry and the European Commission before coming to Australia.

Trudy Worthington is a graduate from The University of Western Australia, having completed an Environmental Science degree with majors in land and water management and zoology. Trudy completed her honours in zoology in 2002 before going on to do further studies in the area of applied entomology. She joined the CLR in June 2005 and is currently assisting on a range of projects related to mine site rehabilitation. These projects include a fertilizer trial and an assessment of seedling establishment at Worsley Alumina's Boddington bauxite mine.

How does Prescription Burning Influence the Resilience of Soil Microbial Community Structure and Function within Rehabilitated Bauxite Mines in Western Australia?

Using a multi-technique approach that combines both traditional biochemical methods as well as molecular based techniques, Briony Lalor, a PhD student

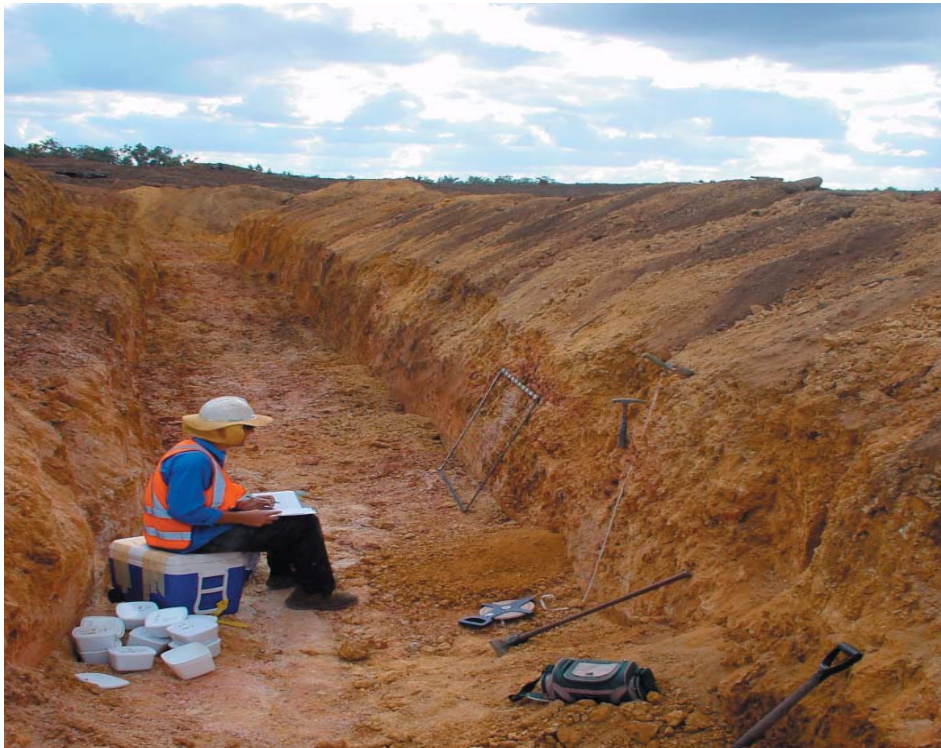
at The University of Western Australia, is carrying out a study which aims to provide an understanding of the influence of current prescription burning practices on microbial diversity and key microbially mediated soil functions including carbon and nitrogen cycling. Through this research, the study intends to broaden current knowledge of the role microbial diversity plays in the resilience of key soil functions in relation to the restoration of a self-sustaining (stable) jarrah forest ecosystem post mining. As a result the study will aid in the prediction of a timeframe for the integration of the rehabilitated forest sites into normal forest management practices. This project is jointly funded by ARC Linkage and Alcoa World Alumina Australia Limited.

CLR / Worsley Alumina Projects – September 2005

The CLR is currently involved in four projects with Worsley Alumina Pty Ltd investigating rehabilitation issues.

- Effects of deep ripping on pit floor materials at Boddington Bauxite Mine.
- Effect of timing and method of application of fertiliser to native forest rehabilitation at Boddington Bauxite Mine.
- Quantifying the rate of seedling establishment for native species used at Boddington Bauxite Mine.
- Methods of embankment stability at the Worsley Refinery.

For further information please contact Research Officer Matthew Braimbridge at mbraimbr@segs.uwa.edu.au.



Fourth Year student Jeff Sanson investigating soil profile characteristics at Boddington Bauxite Mine

The Use of the Stable Isotopes of Water in Assessing the Success of Jarrah Trees after Bauxite Mining in South-West Western Australia

In association with Alcoa and the CLR, Rachel Warner, a student at The University of Western Australia, is investigating the potential use of measurements of the naturally occurring stable isotopes of hydrogen and oxygen to assess the success of jarrah trees after bauxite mining in the south-west of Western Australia. The aim of the study is to ascertain whether the values of δD and $\delta^{18}O$ are different for rainfall, surface soil water and groundwater at rehabilitated and undisturbed sites within Alcoa's mining lease at the end of summer and in the middle of winter. If so, measurements of the isotopic concentration of xylem water from twigs will be compared with that of the possible sources to determine when jarrah trees at rehabilitated

sites utilise groundwater and whether it is at the same time as undisturbed sites. Such a result will be considered one measure of success in the rehabilitation process. The simplicity of the stable isotope technique would greatly benefit land managers of this region.



The ability of some trees to redistribute soil water may hamper attempts to accurately trace water sources. Complementing the

field component, glasshouse experiments will attempt to determine whether hydraulic redistribution occurs within jarrah seedlings and if the process is independent of soil moisture. To date, it has not been determined if this process occurs in jarrah. If it does occur, then the ability of the rehabilitated trees to access groundwater at the same time as those in an undisturbed environment becomes an increasingly important success criterion.

In addition, the influence of this process on the isotopic profile of a site will provide important information that has not yet been investigated. It is hoped that the results obtained will contribute to a better understanding of the hydrological processes related to jarrah trees and lay the foundations for future field experiments in the south-west forests of Western Australia that have been affected by bauxite mining.

Barriers to Old Field Restoration

Abandoned old-fields in the wheatbelt are not naturally regenerating back to the native vegetation. A number of possible barriers have been identified including the lack of mycorrhizas. Mycorrhiza interactions are mutualistic associations between soil fungi and plant roots. This symbiosis is of particular importance to Australian native plants, as it allows access to otherwise unavailable phosphorus. Research carried out by Brad Stokes, a student at The University of Western Australia, aims to bridge this gap and discover the role that mycorrhizas have in the natural regeneration of old-fields and the implications this has for their restoration.

The experiment is based on three properties in the Kellerberin Shire with paddocks that have been farmed and then abandoned for differing periods of time (main reason for abandoning the paddocks was the dominance of rocks). One of the properties has field trials set up which, after harvested, will provide answers on actual mycorrhizal colonization of native species in old-field conditions. Brad also has a glasshouse experiment running which is testing the impact of different phosphorus concentrations on mycorrhizal colonization and consequently growth of four native species (York Gum, Sheoak, Raspberry Jam Wattle, Hakea).

The results Brad obtains will be a novel contribution to this gap on a number of counts (i) by confirming the mycorrhizal association for the focal species (ii) displaying the impact of past land-use on mycorrhizal colonization and (iii) by discovering what the impact of P levels are on mycorrhizal symbiosis.

Recent Visitors

The following people visited the CLR in recent months:

- Dr Colin Campbell, Macauley Institute, Aberdeen, Scotland
- Dr Chris Walker, Royal Botanic Gardens, Edinburgh, Scotland
- Dr Brent Clothier, HortResearch, Palmerston North, New Zealand

Upcoming Events

Free seminars on a range of topics are held every Tuesday afternoon from 4-5 pm in the Agriculture Lecture Theatre at The University of Western Australia. For a programme for the second semester of 2005, please consult the CLR website: http://www.clr.uwa.edu.au/education_and_training.

On 15th December 2005, the CLR will host a workshop entitled Hydrological Monitoring of Cover Systems on Mine Wastes – Soil Science, Engineering Principles and Pragmatics. The workshop will focus on the engineering principles of final cover systems for mining wastes and will be particularly relevant to mining companies. Further information and a registration form can be found on the CLR website: <http://www.clr.uwa.edu.au/events>.

On 12th September 2006, the CLR will organise a Biology and Cover Design Workshop which will take place at The University of Western Australia. This workshop will deal specifically with improving the design of covers by considering their biological components. For further information please contact Mark Tibbett at Mark.Tibbett@uwa.edu.au.

The Australian Centre for Geomechanics in association with the Centre for Land Rehabilitation will host the First International Seminar on Mine Closure in Perth from 13-15 September 2006. The seminar will provide a forum for legislators, mine owners and

throughout the world to exchange views on how best to ensure that future closure of mine sites is achieved at minimum cost, whilst ensuring that future environmental and social impacts are minimised. For further information, please consult the seminar's website: <http://www.mineclosure2006.org>.

Keep an eye on the CLR website (<http://www.clr.uwa.edu.au/>) for further events for 2006, such as courses on mining and environmental management; hydrology and modelling; mycorrhizas and much more!

For further information about CLR staff, activities, publications and future events, please consult the CLR website (<http://www.clr.uwa.edu.au/>) or contact CLR Administration at 08 6488 3827 or clradmin@cyllene.uwa.edu.au.