Carbon stock assessment under rehabilitated and native land ecosystems

Stuart Irvine-Brown

Research tasks and objectives achieved with the use of 2009 NCCARF terrestrial biodiversity funding grant and the subsequent results of collaborative work with CSIRO Land, Water and Biodiversity SA.

Facilitated by NCCARF grant funding the collaboration between myself as a PhD student of the Centre for Mined Land Rehabilitation (CMLR) of the Sustainable Minerals Institute (SMI) at The University of Queensland (UQ) and the scientific research staff of CSIRO Land, Water and Biodiversity, Urrbrae, South Australia has been positively successful. Ultimately this opportunity has provided me with enhanced skills in working with the soil organic carbon turnover model 'RothC'. This conceptual model has played a founding part in the incorporation of soil organic carbon (SOC) stocks into a National Carbon Accounting System (NCAS) framework through the matching of real and measurable soil organic carbon fractions with a conceptual modelling process via the capabilities of mid infra-red (MIR) instrumentation. From this visit I have gained a firsthand understanding of Roth C and its capability and applicability to modelling soil organic carbon stock change within a variety of terrestrial biodiversity situations and in particular Central Queensland vegetation types.

Therefore through increasing my knowledge base and personal networks in this area and under the guidance of highly reputable CSIRO advisers I now have a significant advantage in working in this scientific field of climate change adaptation and evaluation and conservation of soil organic carbon stocks. This is especially so in relation to the purpose of supporting the resilience and proliferation of terrestrial biodiversity. These skills I may not otherwise have to been able to develop at my host institution. NCCARF research funding has provided me with the opportunity to apply this knowledge in the direction of better SOC quantification and prediction in landscapes that are currently a focal point of the science of carbon sequestration and climate change mitigation in Australia.

In the recent past there have been large improvements in the way in which conceptual SOC modelling has been associated with actual measured field samples. The Mid Infra-Red spectrometer, a machine which has the capacity to measure the soil organic carbon fractions of a desired soil sample, can provide determinations of SOC which can be related to the soil carbon pools of the RothC model. This allows more rapid and precise determination of SOC stocks at a more affordable rate than was previously available. The CSIRO Land, Water and Biodiversity SA, has an Infrared Soil Analysis Service which has the capacity to provide accurate determinations on soil organic carbon above and beyond that which is possible of the University of Queensland's Earth Sciences department. During my time learning from

CSIRO scientists at the Waite Institute I gained familiarity of the specifics behind how such MIR research technology works and how through novel approach by CSIRO scientists it enabled RothC to be calibrated to Australian conditions for repeatable SOC quantification. Additionally this collaborative visit highlighted necessary research gaps in how various forms of vegetative terrestrial biodiversity affect decomposition rates, the conversion of soil organic matter into humic compounds and subsequent accumulation of SOC. This has steered my research project towards assessing quantity of organic inputs and in particular the quality of biomass contributions made by different vegetation community types within the threatened Central Queensland Brigalow Belt bioregion towards SOC stock accumulation. Therefore NCCARF funding on this project has facilitated my academic journey towards the assessment of terrestrial biodiversity and vegetation community types for better conservation outcomes and evaluation of SOC sequestration to improve mined land rehabilitation strategies.