

# Soil carbon response to management in the Clarke Creek district

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## Background

Seven businesses were engaged in an action learning group in the Clarke Creek district 150 km north-west of Rockhampton in October 2010. The group wished to investigate the link between management, land condition, soil carbon, soil health and vegetation carbon. Nineteen management comparisons were sampled across the seven properties in March 2011. Some businesses retested sites in November 2011 where there were unexpected results and an additional six sites tested. Four sets of comparisons are presented in this fact sheet.

## Remnant brigalow softwood scrub, regrowth and stick-raked buffel pasture

A comparison of remnant brigalow softwood scrub, regrowth and stick-raked buffel pasture was undertaken at Clarkwood (see photos). The remnant scrub is not grazed. The pastured sites were cleared in the mid 1970s and sown to buffel grass. Stick-raking occurred on the third site in 2006. Rotational grazing is used at Clarkwood to maintain pasture and land condition.

At each site a Stocktake pasture monitoring site was established and assessed, fifteen cores of surface soil (0–10 cm) were sampled for total soil carbon and microbial analysis and pasture biomass was measured.

The stick-raked country had 7034 kg/ha pasture biomass in March 2011 at the end of the growing season before any grazing had taken place. Eight months later in November 2011 after two grazing periods, pasture biomass was 3665 kg/ha. The regrowth site had 3566 kg/ha pasture biomass in March 2011 and 2881 kg/ha in November 2011 under the same grazing regime. These results indicate that much more pasture was



*Clarkwood remnant brigalow softwood scrub*



*Clarkwood cleared and stick-raked buffel pasture*



*Clarkwood regrowth with buffel pasture*

consumed by cattle in the stick-raked pasture. The remnant scrub site had a pasture biomass of less than 80 kg/ha.

The remnant scrub had a total soil carbon of 4.01 %, similar to the stick-raked site (4.24%). The landholder was very happy with the result as it indicated that his management of the stick-raked country maintained soil carbon comparable to the nearby remnant scrub. One of the key reasons this landholder was involved in the project was to test and demonstrate that 'good' grazing management can have minimal environmental impact with regard to soil health. The regrowth site had lower soil carbon (2.81%) which may be related to this site not growing as much pasture.

On another property Clive, buffel pasture and brigalow regrowth were also compared. At this site soil carbon was higher in the regrowth (2.71%) compared to the more open buffel pasture (1.98%) demonstrating that soil carbon response can be variable.

At all these sites, land condition was considered to be good and the microbial activity indicator (based on CO<sub>2</sub> evolution) was similar between soil type comparisons.

### Cultivation, buffel grass with regrowth and leucaena

Three different land uses for the softwood scrub country were compared at Yarandoo. Cultivation planted to sorghum was compared to leucaena established on previous cropping country and buffel grass with regrowth (see photos). The sites were originally cleared in the mid 1970s with farming of the cultivation and leucaena paddocks commencing in 1982. The leucaena was planted in 2001, grass has been slow to establish in the leucaena site. The buffel grass with regrowth had a total soil carbon of 2.59% and microbial activity indicator of 77. By comparison, the cultivation had low total soil carbon (1.65%) and poor soil microbial activity (34.8). The 10-year-old leucaena showed some improvement with total soil carbon of 1.9% and soil microbial activity of 54.8. The drip-line of the Leucaena plants and along the middle of the row was also sampled separately. The dripline had a higher microbial activity (55.8) and total soil carbon (1.94%) compared to the middle of the row (40.8 and 1.76% respectively).



*Yarandoo cultivation*



*Yarandoo buffel grass with regrowth*



*Yarandoo 10 year-old leucaena established on previous cultivation*



## Pasture biomass, soil carbon and microbial activity

The pasture biomass, total soil carbon and microbial activity results for six buffel grass pasture sites in the Clarke Creek district were compared to investigate any trends. Some caution is required in interpretation of differences as there will be some land type variation between sites. Overall the patterns of microbial activity, total soil carbon and pasture biomass are similar in that as pasture biomass falls so do microbial activity and total carbon (see graphs). However the variation in total soil carbon is more subtle with greater variation for pasture biomass and microbial activity. The similar pattern indicates that pasture productivity is linked to soil carbon. The more subtle pattern of the total soil carbon may be attributed to the fact that soil carbon levels change slowly in response to management differences.

## Fire and soil carbon

Two businesses tested the impact of fire on soil carbon and microbial activity. The paddocks were burnt with a moderate intensity fire (mature tree canopies not scorched) in October 2011 and the sites sampled in November 2011. Ironbark forest country was sampled at 'Clements Creek' (see photos). Both microbial activity (burnt 58.8, unburnt 57.6) and total soil carbon (burnt 1.6%, unburnt 1.41%) were similar. This finding that a single fire did not have an affect on soil microbial activity and soil carbon was replicated at the second site 'Brigalow'. The property 'Brigalow' assessed poplar box country with microbial activity (burnt 79.6, unburnt 77.8) and total soil carbon (burnt 1.24%, unburnt 1.32%) similar between burnt and unburnt sites.

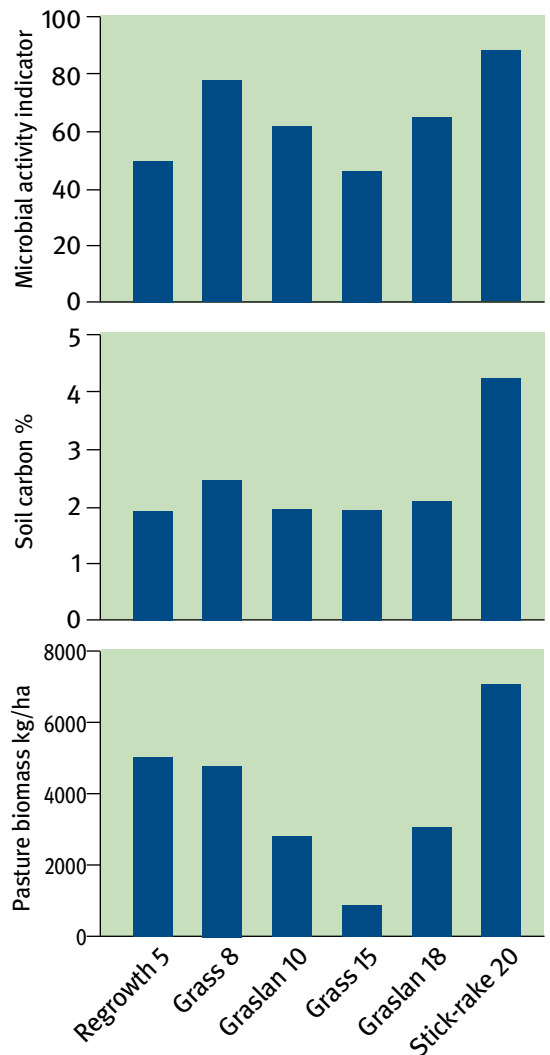
## Key findings

- Grazed pasture can be managed to maintain soil carbon and microbial activity similar to remnant vegetation.
- Cultivation and cropping can substantially reduce soil carbon and it can subsequently take many years to lift soil carbon levels once a pasture system is re-established.
- There is a general relationship between good land condition, pasture growth, soil carbon and microbial activity.
- A single moderate intensity fire event has little impact on soil carbon.
- Soil carbon response to management can be variable, therefore caution is required in undertaking a soil carbon trading project.

## For more information or enquiries contact

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Comparison of microbial activity, total soil carbon and pasture biomass at six buffel grass sites in the Clarke Creek district.



Burnt and unburnt ironbark forest country