Measuring mulga biomass at Lorna Glen

A brief report on results of a field trip 1-4 October 2014

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L-R: Bradley, Shane, Paul, Grant, Rowan, Glen, Neil (rear) and Jeremy (front). Mo took the photo.

Introduction

In the absence of good fire management, the fire regime in spinifex-dominated grasslands of the Western Desert is one of moderate frequency large, intense, mostly summer wildfires. This study is part of a broader project funded by the Department of Environment's Indigenous Carbon Farming Fund and NAILSMA to determine the feasibility of reducing greenhouse gas emissions and increasing carbon sequestration in these vast landscapes through good fire management based on traditional Aboriginal patch-burning and fire science. An important component of this is to quantify the carbon pools so that reliable estimates of carbon flux under managed verses unmanaged fire regimes can be quantified. Under the appropriate fire regime, the fire sensitive but long lived mulga (*Acacia anuera*) has the potential to store significant quantities of carbon in these landscapes. Here we report on the results of field work at Lorna Glen (1-4 October 2013) to measure the biomass of individual mulga trees as part of the carbon pool in spinifex/mulga associations.

A mulga grove that survived a low-moderate intensity wildfire at Lorna Glen in 2002.

Methods

Forty mulga trees of varying dimensions were excavated by machine and the above and below ground biomass of 33 of these was measured in the field. The trees were pulled up using a large earth moving machine some 3-4 weeks before the plants were processed and weighed, so plants had partially dried. Tree height, crown width and stem diameter(s) at ground level was measured and stem basal area calculated. Above ground biomass, including foliage, branches, bark and stems was weighed 'green' in the field using a suspended clock-dial spring balance. The 'root plate' was cleaned, cut from the above ground part of the plant and weighed. During the machine extraction process, most of the root system within a 0.5-1.5m radius of the main stem(s) was recovered, but many roots beyond this distance were severed, with the severed root ends remaining in the soil. To estimate the biomass of root material remaining in the soil, the large end and small end diameter (point at which the root was severed) of recovered roots was measured, as was the distance between these dimensions. Roots >5 mm in diameter were placed into 1.0 cm

diameter classes and the number of roots in each class tallied. Finer roots left in the soil were deemed to add little to the total root biomass, so were ignored. Several larger lateral roots were excavated down to a small end diameter of about 10 mm. From these measurements, a root taper function was determined for each root diameter class, and assuming a conical root shape, an estimate of the volume of root material remaining in the soil was calculated.

The mean density of root material was determined from a sample of ten root sections, each about 8 cm long and of varying diameters. These sections were oven dried, weighed and their volumes calculated by assuming the sections were cylindrical with a diameter equal to the mid-point diameter of the sample and a height equal to the length of the sample. The density of wood in stems and main branches was calculated similarly.

To determine oven dry weight of above and below ground biomass, seven samples were taken each of roots, stems and branches (with attached foliage) and moisture content of these components determined by oven drying. Oven dry weight/biomass was calculated from green weight less moisture based on the sampled moisture contents.

Excavating a mulga root at Lorna Glen

Martu Ranger team cleaning soil from the root plate of extracted mulga trees

A cleaned, small mulga tree ready for processing. Note severed roots.

Weighing mulga

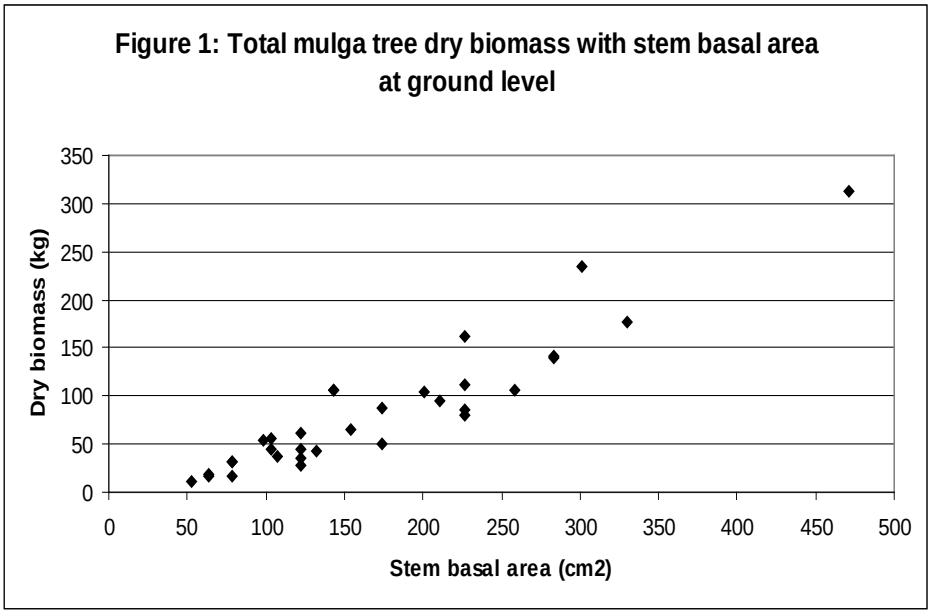
Growing stockpile of processed mulga roots and stems

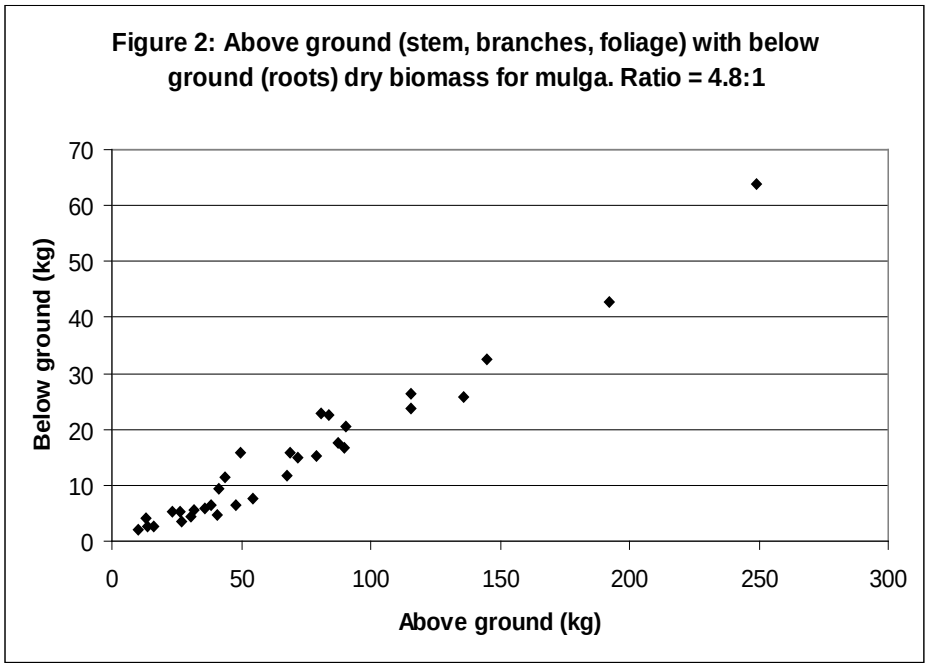
Results

The mulga root system comprised a dense network of radiating lateral roots, with no obvious tap root. Roots were mostly 10-25 cm below the soil surface. The largest roots were up to 40 mm in diameter (measured near the stem) and up to 12 m long. The oven dry density of mulga roots and above ground stem wood was calculated as 757 kg/m^3 and 1,120 kg/m^3 respectively.

The mostly multi-stemmed mulga trees ranged in height from 2.4 m – 6.0 m with stem basal areas ranging from 52.7 cm^2 – 471.1 cm^2. There was little difference between the moisture content of branch wood, stem wood and root material, which averaged 22.5% of oven dry weight. Having been pulled from the ground 3-4 weeks prior to processing and left in the open, the plants had dried to some extent.

The relationships between total oven dry biomass of mulga, stem basal area and crown width are shown in Figures 1 and 2. The mean shoot (above ground):root (below ground) weight ratio for the mulga trees sampled here was 4.8:1, which is similar to many other tree species (5:1 – 6:1). Overall, the amount of root material calculated to have been left in the soil when the plants were extracted was about 7% of the total root biomass.





The relationships between total plant biomass and tree height and crown width are shown in Figures 3 and 4. Measures of tree size (stem basal area, tree height and crown width) were proportional to tree biomass, but stem basal area at ground level was the single most reliable measure. More sophisticated analysis will be done later to develop allometric models of tree biomass with a view to estimating biomass from remotely sensed imagery.

Figure 3: Relationship between crown width and total dry biomass for mulga

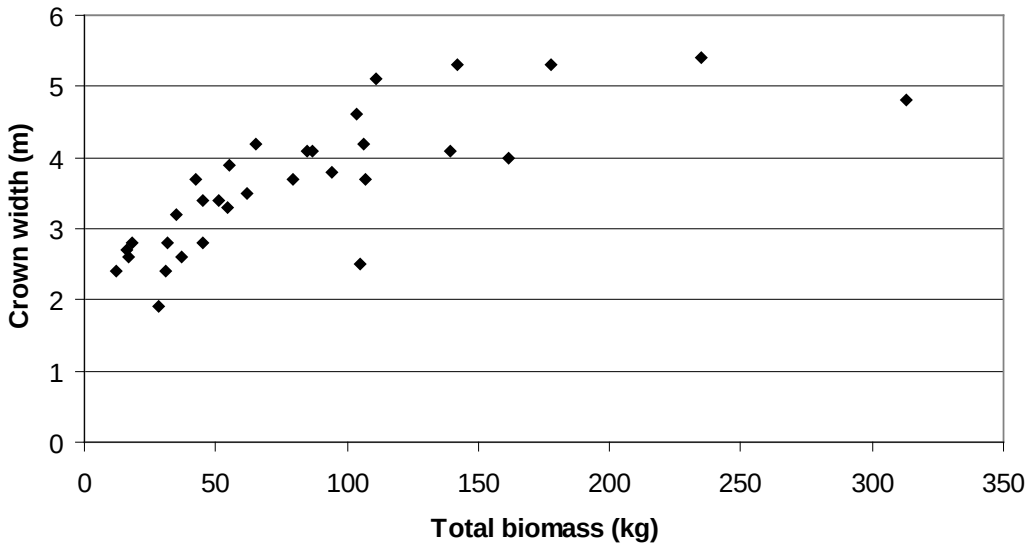
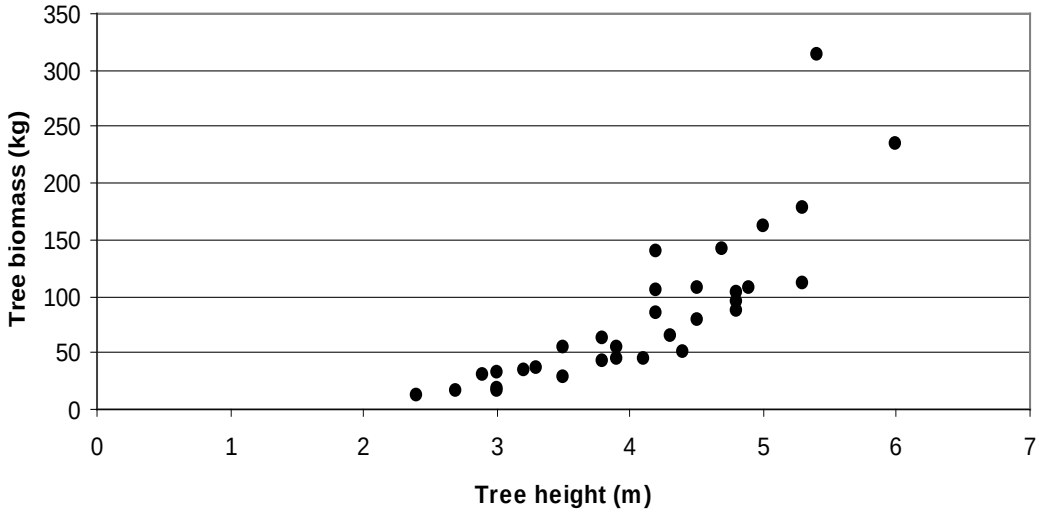


Figure 4: Total tree dry biomass with tree height.



Thanks to the Martu Ranger team from Wiluna who assisted with this project. Once again, Mo is missing!