THE BINALONG CARBON PROJECT

Carbon cycling and storage in a grazing landscape on the south-west slopes of NSW

INTRODUCTION

Carbon is the structural element of life, it is not a pollutant.

The right amount of carbon in the atmosphere makes the planet habitable. Too much triggers global warming and risks dangerous climate change.

The Binalong Landcare group wanted to know if their activities contribute to this risk: whether, on balance, they were emitting more carbon into the atmosphere, or taking more out through their farm management practices.

THE NATURAL CARBON BALANCE

Farming began in the Binalong area around 1830. Until that time carbon flows into and out of the Binalong landscape were relatively stable and like the rest of Australia was carbon neutral on average. Landscapes would have long adapted to the regular burning by Aboriginal people and periodic droughts.

Landscapes in the rest of the world, before industrialisation (beginning around 1750), were also carbon neutral: the amount of carbon taken out of the atmosphere by plants (through photosynthesis) approximately matched that released into the atmosphere through decomposition (respiration) and fire.

Industrialisation disturbed this balance by emitting too much carbon into the atmosphere through the burning of fossil fuels, land clearing and soil disturbance. At the same time agriculture reduced the capacity of the biosphere to take it out by changing the mix of plant species (favouring annuals over perennials) and draining wetlands.

This project analyses the carbon dynamics of the Binalong farming area against the background of the natural carbon dynamics. It focuses on the region's potential to minimise local emissions while boosting its capacity to contribute to the global effort to restore and maintain the overall carbon balance.

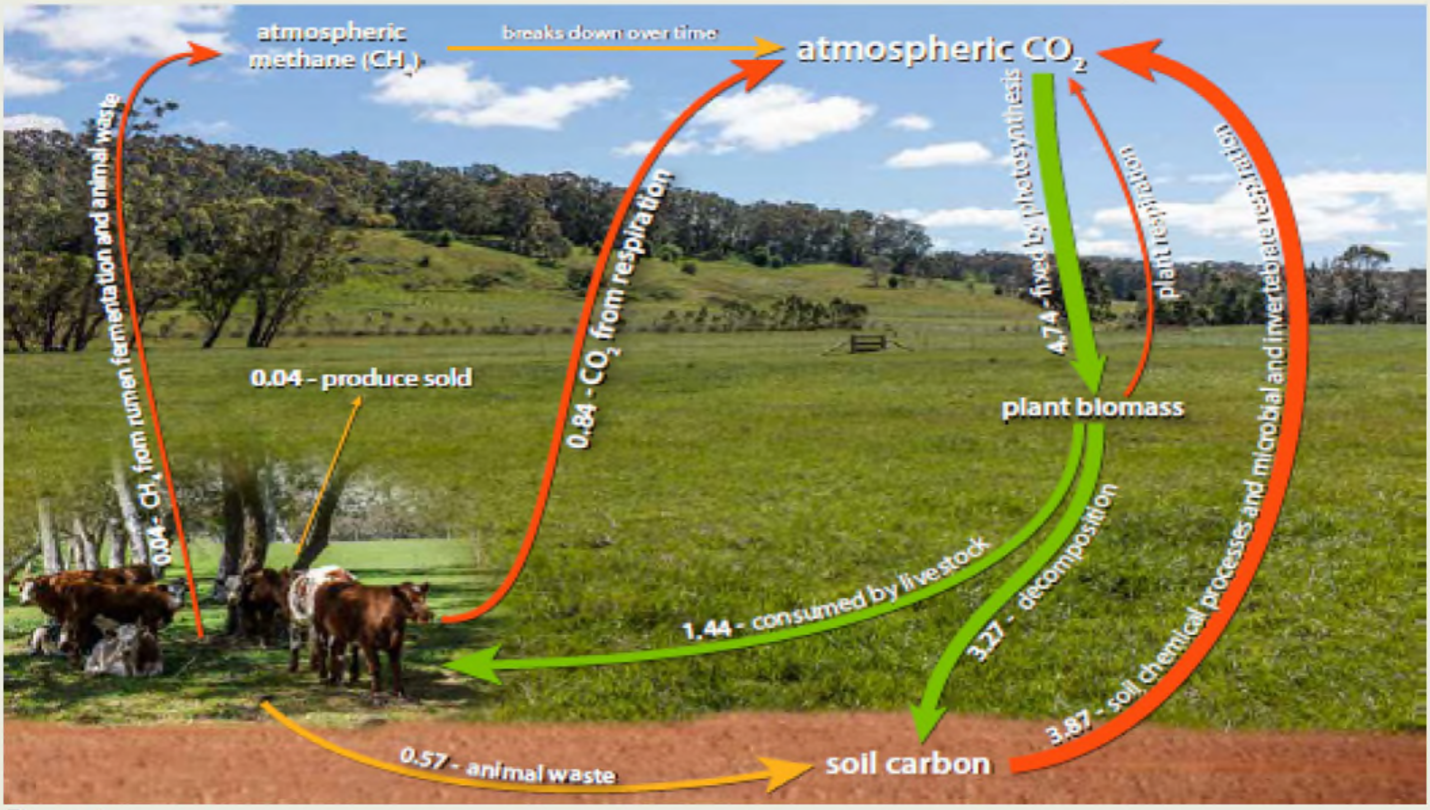

Figure 1:

Carbon flows in the Binalong Landscape resulting from human activities. The numbers are in tonnes carbon perhectare per year (tC/ha/yr)

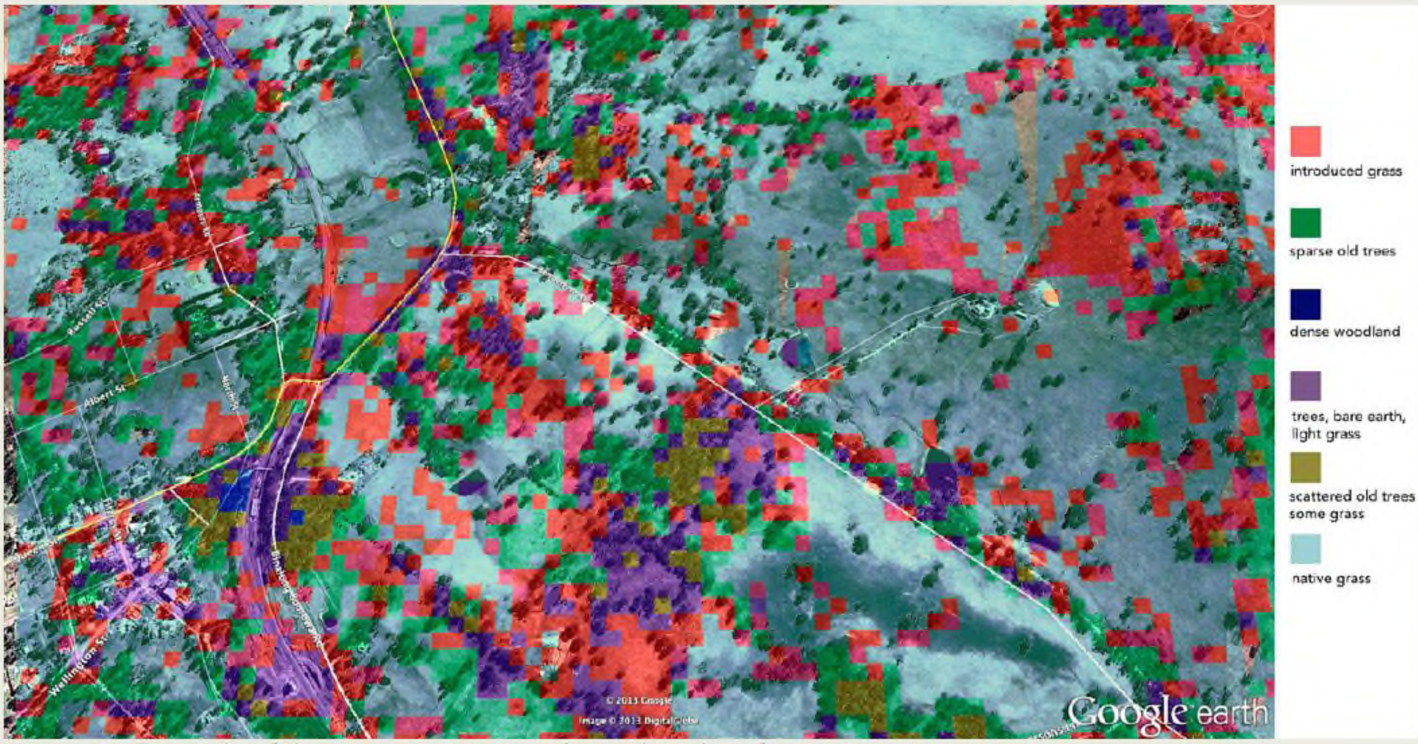

Figure 2: Example of the mapping approach used to classify vegetation types.

THE BINALONG LANDCARE AREA

In 1997 Binalong Landcare asked the then NSW Department of Land and Water Conservation to develop a management plan for its area. The plan documented the vegetation cover and productive capacity at that time. It also proposed remedial action to address soil degradation (salinity and acidification) and erosion. The 1997 work provided a baseline for this project.

Binalong Landcare is a sub-group of Harden Murrumburrah Landcare. It covers 41,171.5 ha of the south-west slopes of NSW, with a population of 270 including about 50 farming enterprises.

The agricultural activities of the area include grazing (sheep and cattle) with a small amount of cropping and horticulture. There are no intensive livestock operations.

The natural ecology of the region is classified as grassy box woodland. Rainfall averages 640 mm per year, ranging from under 300 mm in a dry year to over 900 mm in a wet one. Between 2003 and 2009 the area experienced sustained drought (Figure 3).

METHOD

A self-selected sample of 10 land managers, including many who participated in the 1997 work, offered to participate. Altogether they were responsible for 7,366 ha or 18% of the Binalong area and represented 20% of the farming population.

Freely available radiometric data collected by the American Landsat satellite system was downloaded for November 1997 and November 2011 for three spectral bands: green, red and near infrared and these were computer enhanced into 40 vegetation classes and mapped.

In mid 2013 the maps were taken into the field and the original 40 classes were reduced to seven on the basis of their vegetative characteristics:

1. Dense woodland, no grass (grey)
2. Scattered old trees some grass (brown)
3. Trees, bare earth, light grass (purple)
4. Sparse old trees (green)
5. Grass, occasional tree (pink)
6. Introduced grass (red)
7. Native pasture (light blue)

The 7 classes were further checked by superimposing them onto Google Earth images for the area (Figure 2). There was a close fit between the Google Earth images of 2013 and the radiative satellite data for 2011. With Google maps for 1997, the earlier study on vegetative cover was used to validate the radiometric data for that year.

To estimate soil carbon content, soil samples were taken at two depths, 0-10 cm and 20-30 cm for each of the seven vegetation types. The participating farmers were interviewed by an independent researcher and the interview data collated to remove any identifying characteristics.

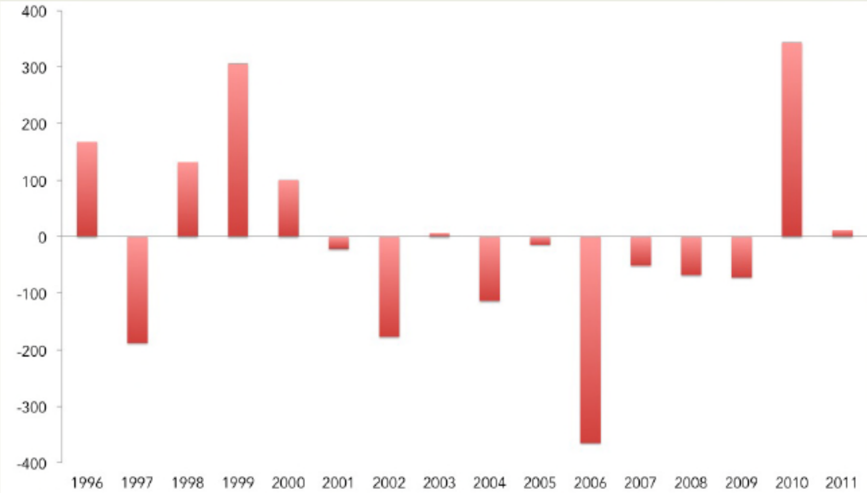

Figure 3: Rainfall deviation from mean (648 mm) over the study period (mm per year).

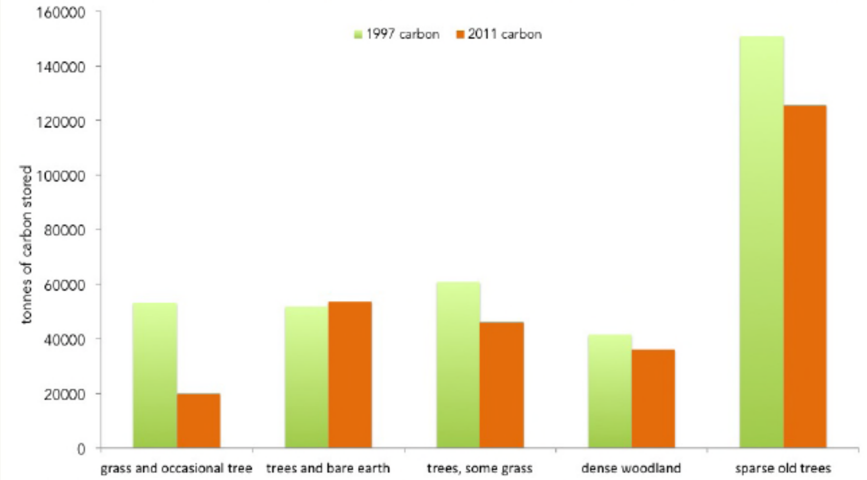

Figure 4: Changes in carbon stored in trees between 1997 and 2011 (tonnes of carbon).

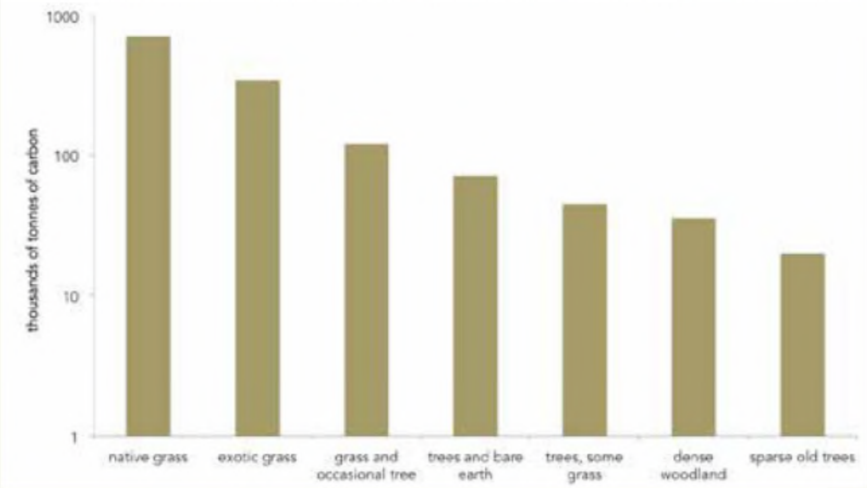

Figure 5: Tonnes of carbon stored in soil in 2011, broken down by vegetation type.

CHANGES IN STOCKS

Interviewed farmers put considerable effort into tree planting. While some of this effort was unsuccessful, most were successful for salinity control, windbreaks, or gully restoration.

Google Earth images in 2013 confirmed the widespread planting effort. Based on changes in the area of grassland between 1997 and 2011 these new plantings are estimated to contain around 5,449.7 tC.

This addition to the area's carbon stock represented a tiny offset to the overall decline of 76,857 tC (from 358,243 tC in 1997 to 281,385 tC in 2011) stored in trees: a decline undoubtedly the result of the prolonged drought, a natural occurrence in Australia (Figure 4).

Carbon stored in grassland is ephemeral. In the Binalong area it ranges from almost nothing above ground as a result of drought, fire, or over-grazing, to 300mm or higher after good rain. Using the 'Prograze' relationship between pasture height and herbage mass, it was estimated that the average carbon stored in Binalong's pastures in 1997 was around 87,703 tC and around 86,495 tC in 2011, a decrease of 1,208 tC.

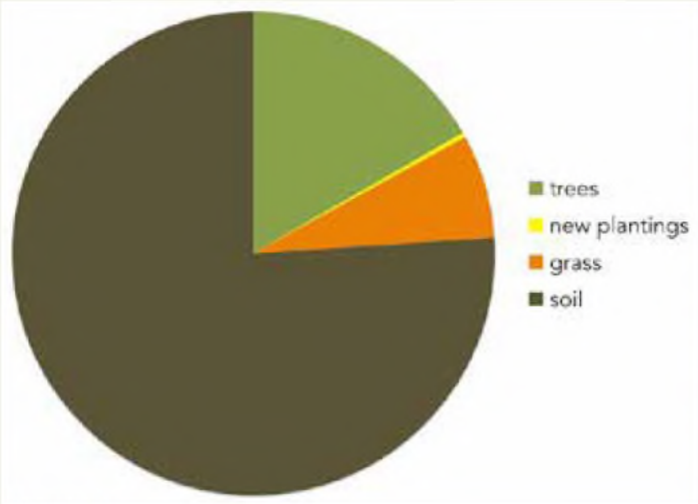

Figure 6:
Tonnes of carbon stored in soil and vegetation in 2011

Soil carbon was measured for each vegetation type in October 2013 and totalled 1,281,577 tC (figure 5). Therewere no soil carbon measurements taken in 1997, but as management practices were reported as similar over the period it unlikely that soil carbon levels would have changed. Figure 6 summarises the total carbon stocks in 2011.

FLOWS

Carbon flows directly attributable to human activities include emissions due to fossil fuel burning, soil disturbance (including fertiliser use), land clearing and the typical consumption patterns associated with the Australian life style. Sequestrations include the removal of atmospheric carbon in crops and products, and the carbon in any additional net biomass resulting from tree planting and the building of soil carbon.

Figure 6 sets out the flows of carbon into and out of the atmosphere due to human activities in the Binalong area.

CARBON MANAGEMENT

Sustainable farming practices work to enhance natural systemswhile economically producing the food and fibre people need. From a carbon point of view this is best achieved through farming methods which aim to maximise photosynthesis (to increase biomass) while minimising disturbance to avoid the loss of stored biomass and soil carbon.

Farmers should be recognised and paid for the carbon they have taken out of the atmosphere through their produce, additional biomass and soil carbon sequestered.

Food and fibre produced in industrialised processes (feedlots, intensive piggeries, poultry sheds and the like, are food processing enterprises and not part of the natural primary production system. They are net emitters of carbon, and like other large scale industrial emitters need to meet their externality costs.

Accounting for enteric emissions is controversial. Grasslands have co-evolved with herbivores. They need each other to function optimally. While goats, sheep, cattle and so on emit methane, when raised within the carrying capacity of natural grasslands, these emissions are part of the natural system. Their manure is essential to cycling nutrients within that system. In Binalong, before European farming, termites, grasshoppers and kangaroos provided that service as part of maintaining the natural balance.

CONCLUSIONS

This project supports the idea that land managers are central to the climate debate. They provide essential food and clothing, protect vital eco-system services, and are in the best position to manage vegetation to restore and, in due course, maintain the carbon balance.

A carbon balance approach is non-prescriptive, uses the same units of measurement for both emissions and sequestrations and gives governments a set of policy options that, like the balance of trade, can be managed.

It will never be possible for all the known deposits of fossil fuel to be burned off. But a carbon balance approach gives a flexible framework for going forward and farmers have an essential and positive role to play in that process.

ACKNOWLEDGEMENTS

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HMLG Harden Murrumburrah Landcare Group

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