Carbon cycling in the Australian landscape - utilising land use/land cover change data

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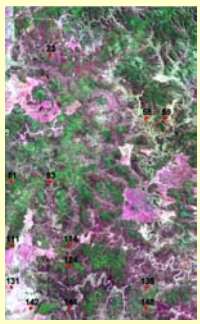
1. Introduction

This poster describes the acquisition and analysis of data to create land use and land cover change data as inputs into carbon models.

This poster presents results from a collaborative project which seeks to develop a landscape-scale carbon budget for a managed open-woodland landscape in south-central Queensland, Australia.The project links remote-sensing technologies with spatially-explicit historical records of land-use activity and empirical measurements of carbon in the major terrestrial pools of living biomass, litter and soil.

2.1 Study area

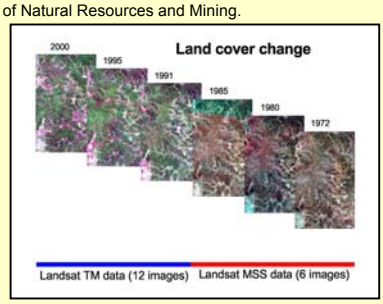


Field sites overlain onto satellite imagery, where green represents woody vegetation and white/pink cleared pastures

The Injune study landscape covers an area of approximately 2150 km^2, and comprises a mosaic of open woodland communities, soils types, and land-use histories. Fourteen permanent plots (50m x 50m), which had previously been studied by Lidar remote sensing and field surveys for biomass, were surveyed for soil carbon, litter and coarse woody debris.

2.2 Data sets

Data included land cover and land cover change data from the SLATS program and 18 raw Landsat images sourced from Australian Greenhouse Office and Queensland Department of Natural Resources and Mining.



Land use data was based on the following ancillary data:

- Vegetation
- Soils
- Geology
- Climate
- Roads
- Rivers
- 1:100,000 topographic maps
- Field sites
- Tenure
- Farm boundaries
- State forests

These data were captured and analysed in a desktop ArcMap/ArcView environment. Validation used aerial photography from the Queensland archives.

2.3. Data analysis

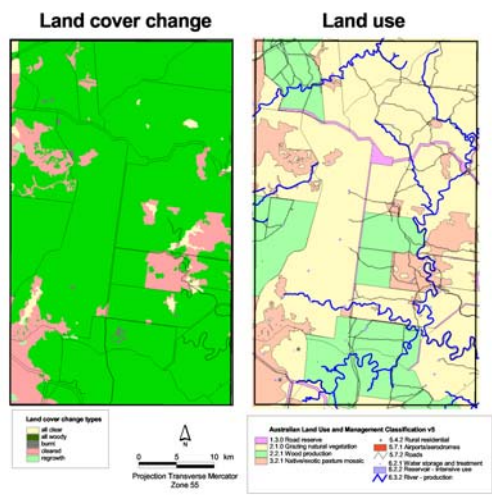
Land cover change

Starting with the most recent images, visual interpretation of clearing and intact woody vegetation was carried out. This was compared to the next oldest image, where any change was recorded with its previous land use and possible clearing practice.

Land use

Land uses were compiled from ancillary data overlaid onto the most recent satellite imagery. Grazing native pastures was considered the default. Land use was classified according to the Australian Land Use and Management classification.

Both datasets were validated by farmer interview and fieldwork.



3. Results

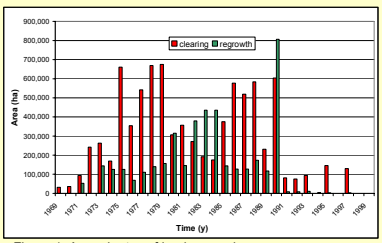


Figure 1. Annual rates of land cover change

Table 1. Area of land uses

Land use	Area (ha)	%
1.3.0 Minimal use	5,040	2.34%
2.1.0 Grazing native pastures	59,931	53.92%
2.2.1 Forestry	64,970	30.13%
3.2.1 Native and exotic pasture mosiac	28,859	13.38%
5.7.1 Airstrips	22	0.01%
5.7.2 Roads	267	0.12%
6.2.2 Reservoir - intensive use	36	0.02%
6.3.2 Rivers - intensive use	162	0.08%
	215,613	**100.00%**

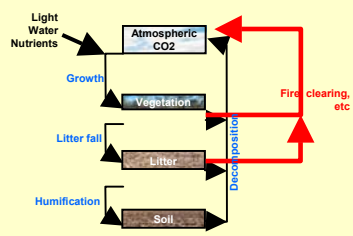
Figure 1 shows the annual rates of clearing occurred in two pulses: the late 1970s and the late 1980s. Regrowth peaked in 1983/4 and 1991 – up to 5 years after clearing. Farmers tend to clear the vegetation using chaining, sometimes followed by burning when sufficient pasture biomass is present to sustain a burn. Other clearing practices included stem injection which is suitable for sparser vegetation, such as poplar box. Ring-barking was a popular method up to the 1960s. In terms of regrowth vegetation, chaining and in the case of brigalow regrowth, blade-ploughing are standard methods of clearing. Three areas of regrowth in the SE of the study area are brigalow regrowth of 2m and thick cover.

The land use data gives information on type and extent of current land management practices. In Table 1 the area and proportion of the land uses in the study area shows that cattle grazing (includes the grazing, multiple use forestry and pasture classes) covers over 97% of the study area.

4. Implications

A major challenge in greenhouse accounting is the quantification of land-use activities, and how these activities impact on the stocks and fluxes of carbon in terrestrial ecosystems. In the Injune study (130kms north of Mitchell), these activities include clearing of woody vegetation by a variety of methods such as chaining, blade ploughing, stem injection and ring barking. Subsequent land management is primarily cattle grazing, with intermittent burning to increase grass production, and cultivation of fodder crops, particularly in the SE of the study area. The impact of these different activities on carbon dynamics is being investigated using 33 field plots on 13 sites, where detailed measurements of current tree biomass, litter and coarse woody debris as well as soil carbon have been collected. These are currently being extrapolated to the rest of the study. Combining these measurements with the land cover histories for each plot provides a unique dataset for assessing the potential carbon impacts of different land-use activities, and provides essential data for use in modelling the carbon dynamics of these managed ecosystems.

Generic carbon budget model



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