Evaluating the magnitude, motivation and cause of funded and unfunded change in native vegetation cover: 1946–2007

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1: Rationale

Native vegetation plays a vital role in supporting biodiversity conservation and ecosystem services on a landscape scale. Private land owners have been increasingly encouraged to establish more native vegetation in order to achieve desired levels of landscape cover.

Despite years of government investment to improve native vegetation extent, there remains considerable uncertainty about the impact of these efforts. Landscapes have certainly changed, but what contribution has purposeful investment made to the amount of change in woody native vegetation cover, compared with other drivers?

Focusing on private land, our project combines ecological and social research methods to ask: *how much* change has occurred? *Where*, *when*, and *what kind* of changes were they? Under what kinds of land use and management have these changes occurred?

Answers to these questions should help management agencies understand their impact, and respond to current and likely future opportunities for native vegetation outcomes.

2: Case study areas

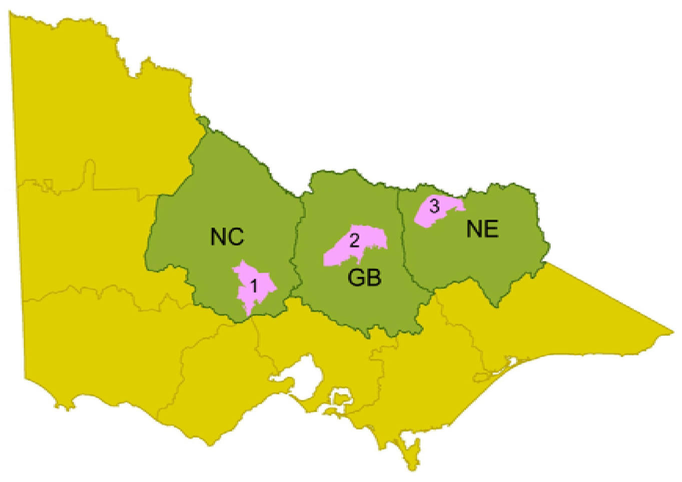


Figure 1. Location of three case study areas in northern Victoria. This poster reports data from area 2.

We have three case study areas (Fig. 1) in northern Victoria. These were selected on the basis of land use diversity, a history of investment in native vegetation management, fragmented remnant vegetation cover, and data availability.

This poster focuses on data collected from the Goulburn Broken Catchment. The dominant land uses in this area are grazing on improved pasture (41%), grazing unimproved pasture / grassland / open woodland (31%), and dryland cropping (20%).

There is a growing number of rural residential and hobby farm blocks, particularly near regional centres.

3: Mapping

We sampled the area using a lattice of 1.5 km radius circles deployed at 3 km intervals. The sampled area – 234 circles – accounted for almost 15% of the case study area.

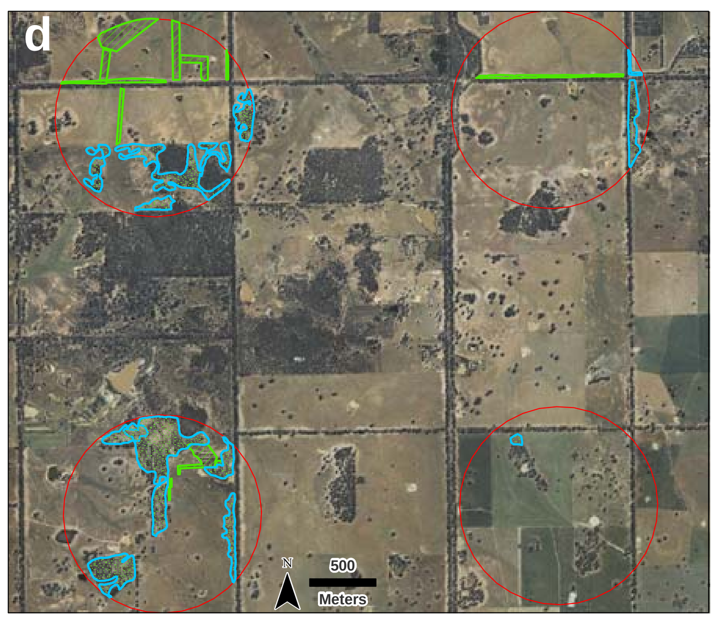
Within these circles we mapped:

A) historic native vegetation cover change from digitised, geo-rectified historical aerial photography (1946/47), and contemporary (2004–2008) aerial orthophotos (e.g. Fig 2a-c),

B) occurrences of indigenous revegetation and spontaneous regeneration from the contemporary imagery (e.g., Fig 2d). We assumed that the age-range of these zones was between 2–20 years old.

All mapped objects were checked by a second observer, and doubtful assignments were verified by eye from the ground.

Figure 2. Sequence showing a) a 1946 image with sampling circles superimposed, b) the same area in 2007, c) the mapped interpretation of vegetation cover change from a > b; and d) indigenous revegetation and spontaneous regeneration mapped from 2007 imagery.



4: Results

Occurrences of vegetation gain or loss were common over the past 60 years. However, these changes were typically small in area and the bulk of the landscape has remained either cleared or wooded over this period. Thus, the period of gross land clearing predates the photo record.

Overall, changes from continuous canopy to cleared land were of the same magnitude as from cleared land to continuous canopy (Table 1). The most prevalent type of change was the clearing of scattered tree zones, which accounted for 2% of the sampled area. The reverse, thickening of canopy of areas either naturally sparse or formerly thinned, accounted for 1% of the area.

Table 1. Summary of native vegetation cover change 1946-2008

Changes 1946–2007		Present in % of circles	Cumul. area (ha)	Prop. of sampled area
Continuous canopy to cleared land	(red)	33	175	0.005
Scattered trees to cleared land	(yellow)	66	686	0.020
Cleared land to canopy	(green)	30	157	0.0045
Scattered trees to thicker canopy	(blue)	38	360	0.010

Table 2. Summary of revegetation / regeneration survey from 2007-8 imagery

Changes emerging in 2007 landscape		Present in % of circles	Cumul. area (ha)	Prop. of sampled area
Indigenous revegetation	(green hatched)	51	384	0.010
Spontaneous regeneration	(blue outline)	55	636	0.017

Revegetation areas accounted for about 1% (384 ha) of the sampled area. Official records of funded revegetation activity for the same area total about 100 ha. In comparison, our data reflect both a deeper time slice – official database records only exist post 2000 – and that considerable amounts of work have been completed outside of government programs.

Quick analysis of our landholder interviews found that the native vegetation works of almost 1/3 of respondents were completed without direct public investment.

Regeneration was more extensive than revegetation, occupying 1.7% of the sampled landscape. Most of these areas have trees only, or trees with simplified understorey. Regeneration typically occurs along roadsides and drainage lines, and where paddocks have been taken out of production.

5: Modeling

We made separate spatial models of the presence and absence of each historic change type, revegetation, and regeneration, using Boosted Regression Trees (BRT).

The response data were randomly drawn from within each sample circle. From each mapped polygon we drew 5 presence samples and for each circle we drew 20 absence samples.

These points were used to extract values from spatial raster datasets corresponding to the following predictor variables: temperature^{max}, soil texture$^{Th/K,\ Th/(1-K)}$, rainfall, terrain$^{position,\ wetness}$, distance to freshwater^{ln}, land tenure, land parcel size, land use/cover, distance to roads^{ln}, building density^{res_x_100}, distance to mature tree cover$^{ln\ (regeneration\ and\ revegetation\ models\ only)}$

Our spatial modeling of these data is work-in-progress. Here we give results for regeneration.

Results suggest that regeneration is improbable >50 m from existing mature trees, and is more likely on unproductive soils of uplands, as well as in drainage lines and adjacent to creeks, where landholders are strongly encouraged to control stock access.

It also both hints at, and partly obscures, the land use factors which control where regeneration is typically tolerated, or encouraged by landholders.

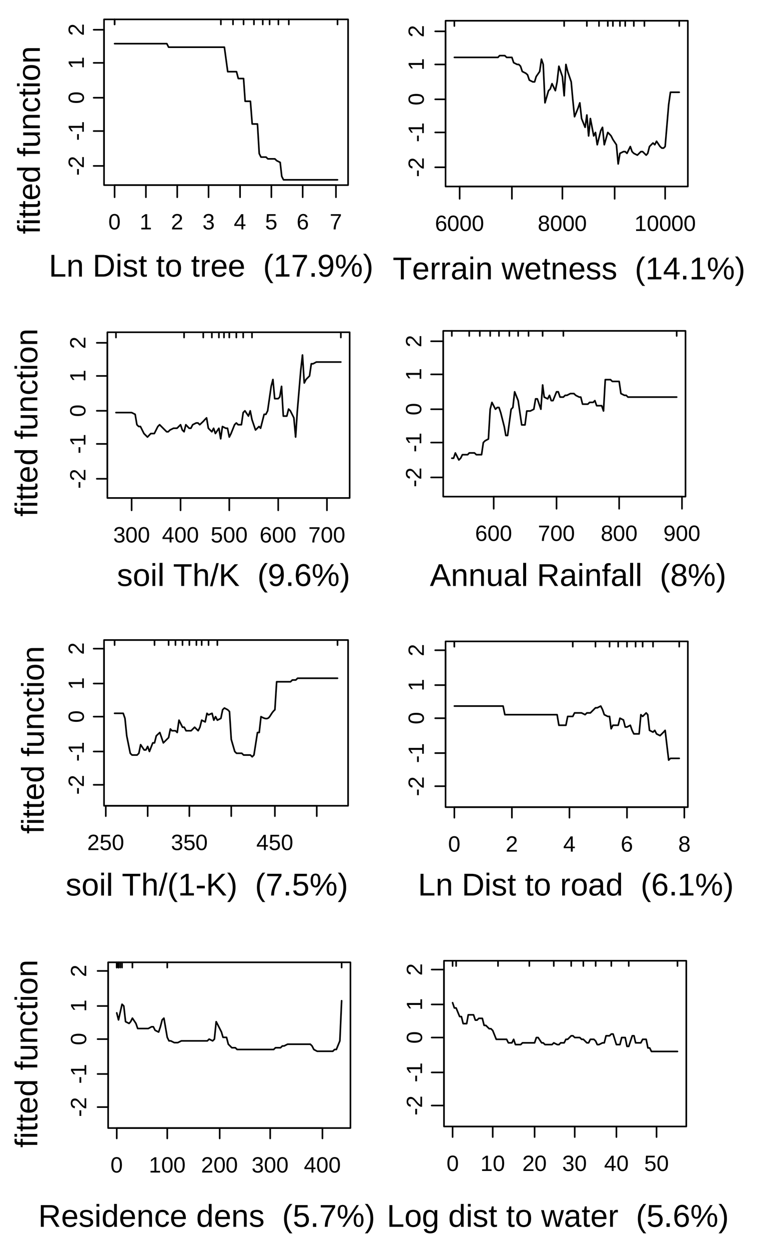


Figure 3. Fitted functions for the most important 8 predictor variables from a BRT of regeneration using ca 8300 regression trees. The BRT had a tree complexity of 5, learning rate of 0.02 and a bag fraction of 0.5.

This is an iterative modeling process that will develop as we include our data from all areas, our landholder interview data, and refine the land use data for our study areas.

6: Next steps

We have acquired imagery for 1989/90 which will be mapped to add an inflection point into the historic change story.

Data for the other two study areas are yet to be included.

They have higher remnant vegetation cover, more variable soils and topography

The key drivers of revegetation and regeneration will be integrated within a Bayesian Belief Network model for decision support purposes.

7: Key points

This case study area was heavily cleared prior to 1946. Since then, over 90% of the landscape has seen little change in wooded native vegetation cover.

The biggest change over 60 years was clearing of scattered tree zones, leaving behind a more binary landscape.

The area revegetated with native trees and shrubs over the last ca. 20 years exceeds the area of mature canopy cleared since 1946.

Regeneration – a cheaper option – accounts for far more area than revegetation

Assuming no further losses, landscape cover in wooded native vegetation may see a net increase within a decade or so as new revegetation plantings and regeneration mature.

Does a net increase in wooded native cover represent a net benefit for native species habitat and ecological function? This depends on the complementary habitat value of replanted vegetation and simplified natural regeneration.

For biodiversity conservation in this landscape, the biggest concerns are for those species that depend on habitat types already lost, grassy dominated systems which are still being converted to more intensive use, and the interaction of habitat fragmentation, land use and changing climate.

State Government Victoria | Department of Sustainability and Environment

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