



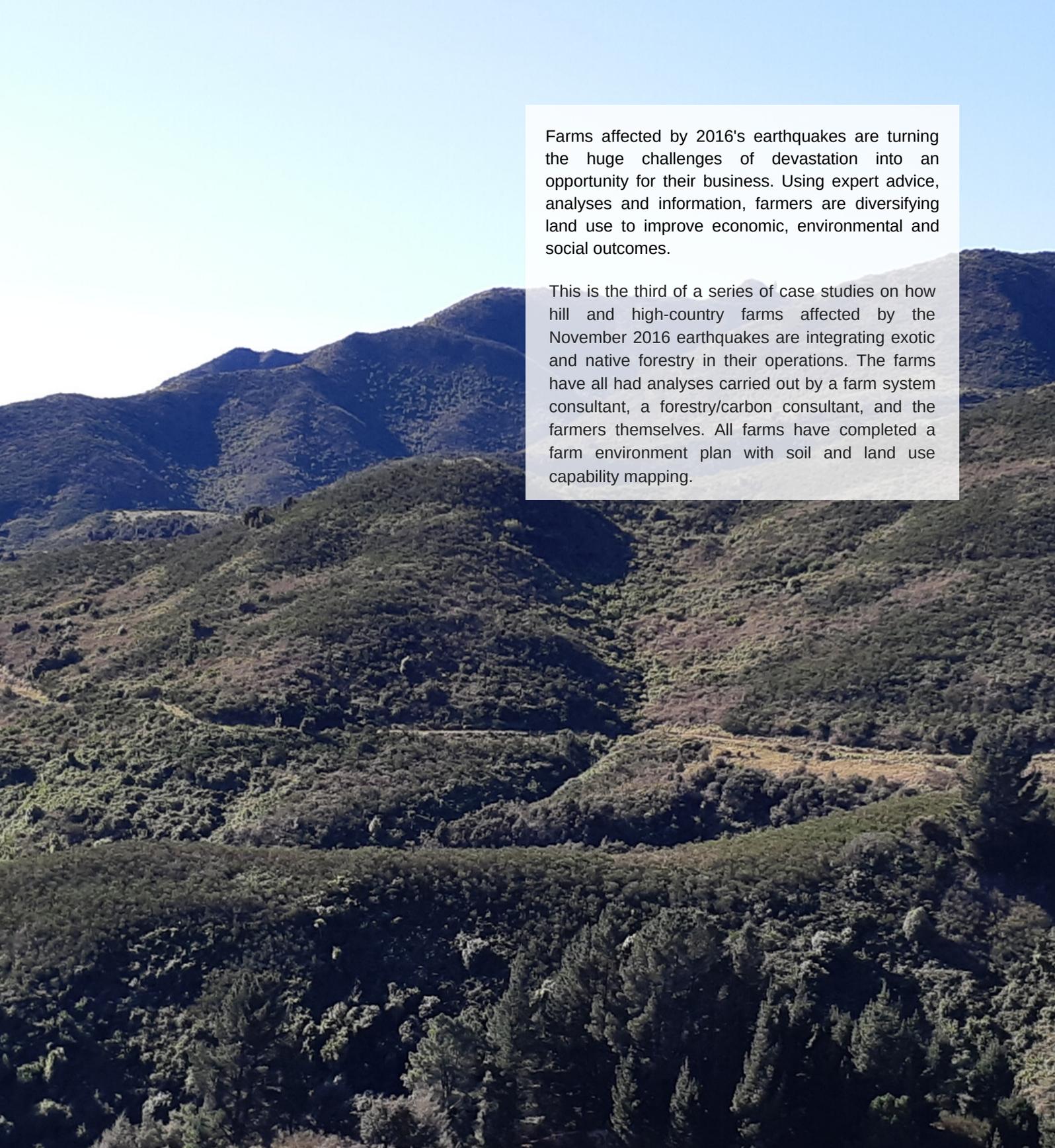
**POST  
QUAKE**  
FARMING



**Integrated Farming and Forestry Case Study**

**Hawkswood and Braemar, Parnassus**





Farms affected by 2016's earthquakes are turning the huge challenges of devastation into an opportunity for their business. Using expert advice, analyses and information, farmers are diversifying land use to improve economic, environmental and social outcomes.

This is the third of a series of case studies on how hill and high-country farms affected by the November 2016 earthquakes are integrating exotic and native forestry in their operations. The farms have all had analyses carried out by a farm system consultant, a forestry/carbon consultant, and the farmers themselves. All farms have completed a farm environment plan with soil and land use capability mapping.

## A C K N O W L E D G E M E N T S

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Analysis for this case study was completed by Peter Bosworth, Bosworth Capital; Ollie Belton, Carbon Forest Services; Adam Forbes, Forbes Ecology Ltd, and Lachie Grant, LandVision Ltd.

Thanks to Charlie and Jo Macfarlane for sharing their experience to-date and analysis of their business with other farmers.

# MEET THE MACFARLANES

## INTEGRATED FARMING AND FORESTRY CASE STUDY: HAWKSWOOD AND BRAEMAR, PARNASSUS

### OVERVIEW

Hawkswood and Braemar are owned by Charlie and Jo Macfarlane.

Braemar is 1702ha with 160ha of improved downs or flats, and the remainder in steeper downs and hill country with a mixture of woody weeds, extensive pasture, and native regeneration.

Hawkswood is a 628ha farm, purchased back from the family in 2017. Of this, 280ha is in developed flats and improved downs and hill, the remainder is very weedy hill country. Both properties are collectively carrying around 7,200 stock units.



### MACFARLANES' OBJECTIVES

- Increase stock-carrying capacity to 8,000 stock units with approximately 75% sheep and 25% cattle.
- Continue improvements in stock performance, pasture species, soil fertility, infrastructure and access.
- Investigate forestry opportunities for the up to 1,200ha which is suitable for forestry.
- Investigate opportunities to acquire additional land and develop land.
- Investigate opportunities to diversify income through eco-tourism, irrigation and honey.
- Implement Farm Environment Plan to effectively gain knowledge and make better decisions around water quality and native biodiversity.
- Use forestry as a tool to support a fairer outcome for farm succession, while passing on a viable grazing unit.
- Reduce debt, take control of risks, and be better prepared for the future.

## CURRENT FARM SYSTEM

- 3,950 ewes and aiming for 135% lambing (130% 2018)
- 1,200 ewe hoggets and aiming for 60% lambing (only 140 in lamb 2018)
- 62 Hereford Angus-cross cows mated to Angus bull and 50 IC R2 heifers (30 purchased). Aiming for 90% calving
- 62 MS calves retained (from last year's 68 cows and R2 heifers)
- Some winter grazing of carryover cows on poorer hill
- 20% of lambs finished (targeting much higher) and all steers sold at 500 kgs (heifers mostly retained)
- Medium term target of 4000 ewes, 1000 hoggets, 200 cows and 180 calves
- Equates to around 8000 stock units producing 175,000 kgs meat and wool.

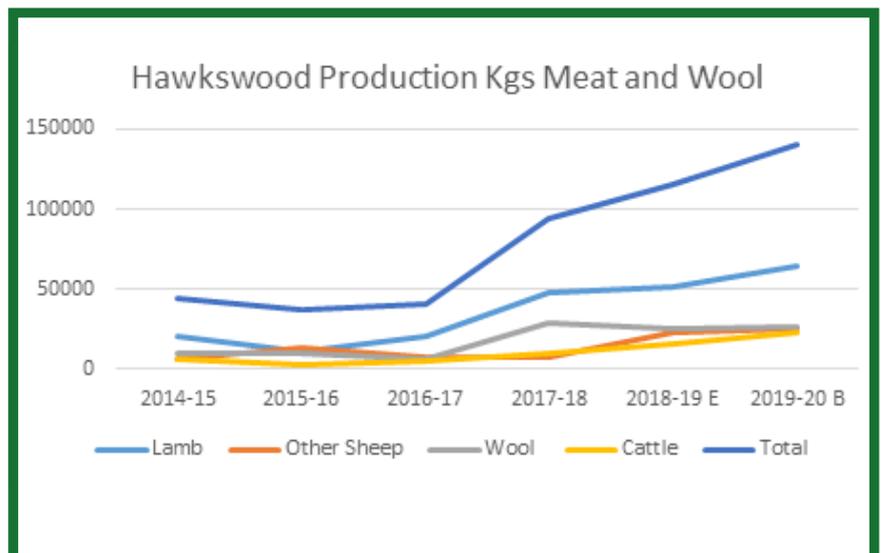
Land class	Area (ha)	%	SU/ha	EFS (\$40/su**) \$/ha
Flat and easy downs	450	63%	10.0	\$400
Downs semi-developed	150	14%	7.0	\$280
Steep hill semi-developed*	150	19%	4.0	\$160
Steep hill very weedy*	750	4%	1.2	\$48
Permanent Forest Sink*	150			
Other native (pre 1990) broom, gorse, waste*	680			
<b>Total</b>	<b>2330</b>	<b>100%</b>	<b>7050</b>	

\*All land classes with potential forestry options

\*\*Assumes \$40/ stock unit EFS (Net farm income less FWE and less capital/depreciation). Will not necessarily be the same across all classes of land.

## RECENT HISTORY

- The farm development program of Braemar started in 2014, but drought slowed progress. The farm had been carrying 2,600-2,800 stock units.
- Change in sheep breed. Corriedales replaced with Romneys, and cow numbers increased.
- Hawkswood was purchased in 2017.
- 160 tonnes fertiliser and 700 tonnes lime applied in 2018-2019.
- The development programme and increased feed supply has meant animal performance has lifted significantly in recent years (see graph 1).

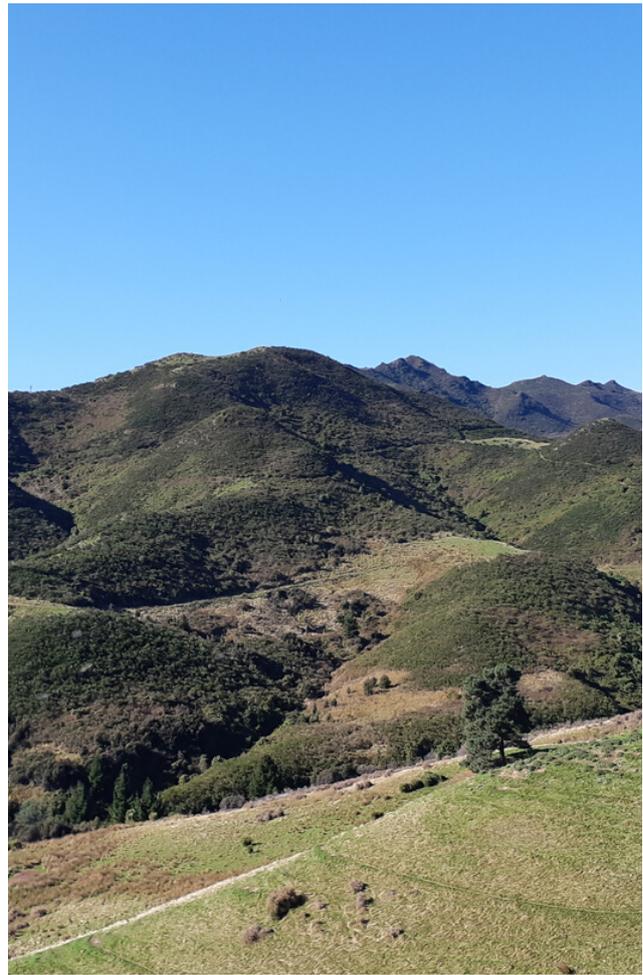


Graph 1: Animal performance

## LAND USE DECISIONS AND LAND USE CAPABILITY

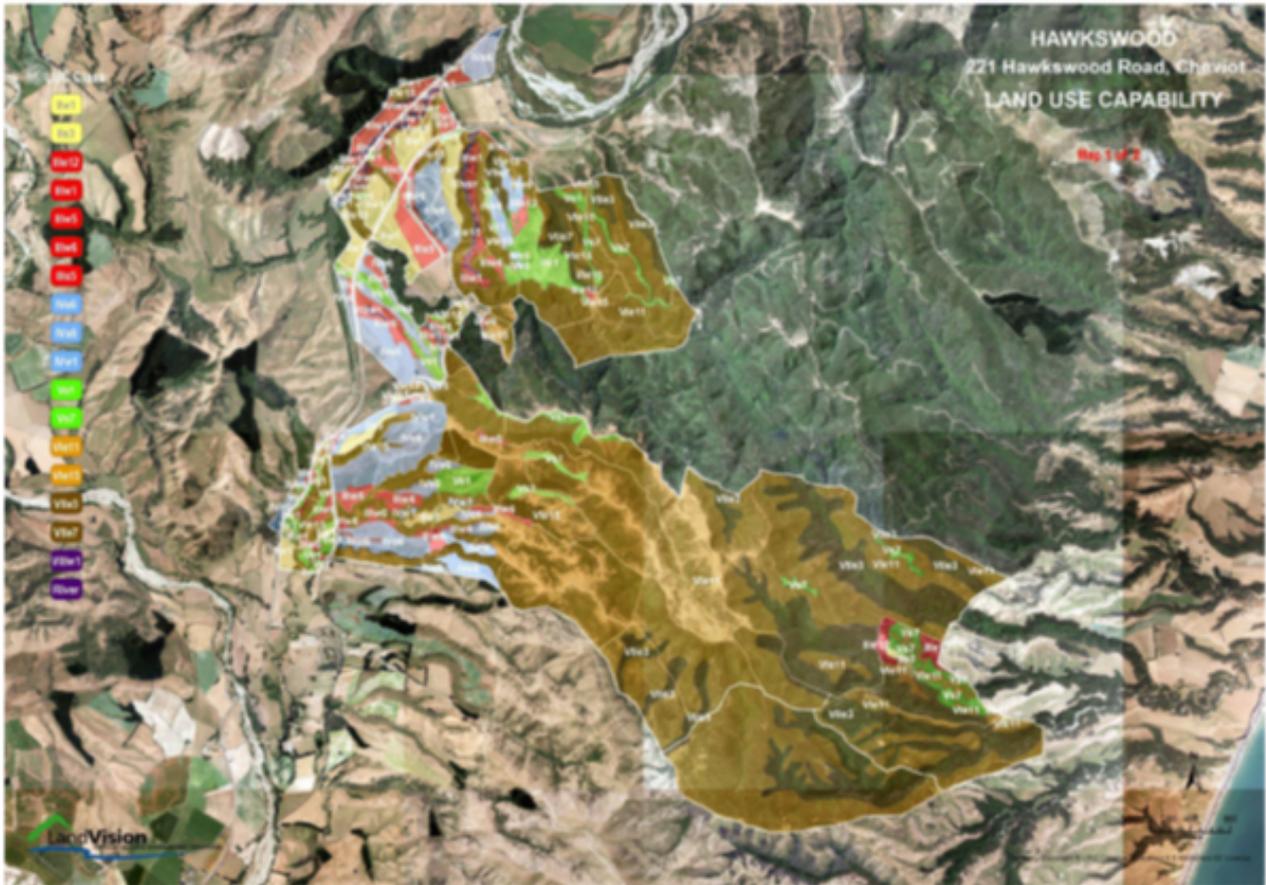
The Land Resource Inventory (LRI) system maps landscape units according to five inventory factors (rock type, soil unit, slope class, erosion type and severity, and vegetation). From the LRI the area was classified in Land Use Capability Units (LUC units), which further groups similar units according to their capacity for sustainable production under arable, pastoral, forestry or conservation uses across the region. The LUC code is broken down into three components, which show the general capability (I-VIII classes), the major limitations (four subclass limitations of wetness, erosion, soil and climate), and the capability unit, to link with regional classifications and known best management practices

A paddock-scale Land Use Capability (LUC) and Land Resource Inventory (LRI) survey was undertaken on the property. Eighteen LUCs, predominantly class III to VII, and sixteen dominant soil types, were identified. The underlying parent rock material consists of a range of sedimentary rocks including strongly and weakly indurated conglomerate, sandstone and greywacke. The flats and rolling downs are derived from loess, colluvium, alluvium, alluvial gravels and peat. Table 2 below shows the composition of the LUC units for the property, and this is also shown on map 1.



LUC Class	Area (ha)	%	LUC Unit	Area (ha)	%
Class II	87.1	3.7	IIw1	76.8	3.3
			IIs3	10.3	0.4
Class III	147.9	6.4	IIIe12	17.9	0.8
			IIIs5	20.1	0.9
			IIIw1	52.1	2.2
			IIIw5	1.8	0.1
			IIIw6	56.0	2.4
			IVe6	181.6	7.9
Class IV	199.1	8.6	IVs6	12.2	0.5
			IVw1	5.3	0.2
			Ve1	83.1	3.6
Class V	139.4	6.0	Vs7	56.3	2.4
			VIIe11	961.7	41.2
Class VI	1,352.2	58.0	VIIe15	390.5	16.8
			VIIe3	360.9	15.5
Class VII	387.9	16.7	VIIe7	27.0	1.2
			VIIIe12	13.7	0.6
Class VIII	14.6	0.6	VIIIw1	0.9	<0.1
			<b>Total</b>	<b>2,328.2</b>	<b>100</b>

Table 2: LUC units



Map 1: LUC units

The majority of the property is Class VI which is suitable for sheep and beef grazing, or woody vegetation cover, depending on other risks such as erosion, of which Hawkswood has a high risk. Given this and the existing woody weed cover on a high proportion of the land, regeneration or planting regimes are likely to generate greater returns than breaking this land in for pastoral use. The total area of the property is 2328.2 ha of which approximately 11% is flat to undulating, 10% is rolling to strongly rolling, 33% is moderately steep hill country and 46% is steep to very steep hill slopes, gorges and gully systems.

The vegetative cover consists of approximately 774.1 ha of effective pasture; 33% of the total farm area.

For the non-effective areas, 24.6 ha are in exotic forestry woodlots, 955.7 ha are in consolidated mixed scrub, 508.8 ha are in native bush, 44.6 ha are in gorse and blackberry, 10.7 ha are in erosion control trees, 5.9 ha are steep predominantly unvegetated faces and 2.9 ha is retired pasture. The remaining 0.9 ha is a dam.

There is a good balance of topography across the effective area of the property with around 247.1 ha (32%) flat and having little or no effects from aspect, 280.2 ha (36%) warm north-facing slopes (including NE, N, NW, W aspects) and 246.8 ha (32%) cooler south-facing slopes (includes E, SE, S and SW). Approximately 426.7 ha or 55% of the effective pastoral area is suitable for cultivation.

# FUTURE FOR THE FARM BUSINESS

## FORESTRY

A large area of land on Hawkswood and Braemar has a heavy infestation of brush weeds. This area, most of which is not able to be cultivated, is difficult to farm and has a low profitability per hectare.

Development of these areas into trees provides one possible solution for this class of land. Whether the Macfarlanes complete this development on their own or form some of joint venture is being investigated.

## WHY FORESTRY?

For the Macfarlanes, forestry will help with achieving their farm succession goals, control erosion, and create a more appealing place to farm.



*Swapping weeds for trees,  
whether native or exotic.*

A range of forestry options have been considered for the Macfarlanes. The land use capability assessment shows that a large area of the farm is suitable for woody vegetation and less so for pastoral farming. The range of species considered cover 657ha and are shown below, with areas shown on the map. These recommendations were made based on the site conditions (i.e. potential suitable species for each location), and access also determined whether to plant a timber crop, or focus on a permanent carbon forest. Diversity of species across the property will illustrate different regimes, including native forest restoration.

## EUCALYPTUS-PERMANENT CARBON (86 HA)

Areas with poor access for harvest are considered more suitable for permanent carbon forest for eucalypts. A small experimental mixed eucalypt stand within the block planted in the 1980s by Forest Research shows the potential for reasonable growth rates. Eucalypt species such as *E. Nitens* and *E. Fastigata* are favoured for carbon forestry as they can grow at comparable rates to radiata pine (i.e. earn carbon credits fast), are durable hardwoods (i.e. retain carbon longer if die) and can live well over 100 years. Depending on species, they can also provide safe nesting habitat and food for native birds.

### Cost breakdown

- Broom- Spray/Burn
- Plant @ 833 stems /ha
- 1BT Grant \$1500/ha (landowner 100% credits)
- Year 1 & 2 cost \$2500/ha

## REDWOOD-PERMANENT CARBON (123 HA)

A major redwood plantation just north of the property shows this locality is suitable for redwoods. A natural fit for long lived carbon forests, the average age of redwoods in their native California is 500 to 800 years. There is also the possibility of selective timber harvesting as an ongoing sustainable income to complement carbon. While Redwoods do not grow as fast as radiata pine, their growth is more consistent and sustained overtime.

### Cost breakdown

- Broom- Spray only
- Plant @ 500 stems /ha
- 1BT Grant \$1500/ha (landowner 100% credits)
- Year 1 & 2 cost \$3500/ha

## NATIVE BEECH/TOTARA/ KANUKA- PERMANENT CARBON (223 HA)

Areas selected for native forestry are heavily affected by broom and some parts are already naturally reverting to native vegetation. Not only are these areas inaccessible and unsuitable for plantation timber forestry, but the Macfarlanes want to have more indigenous forestry.

### Cost breakdown

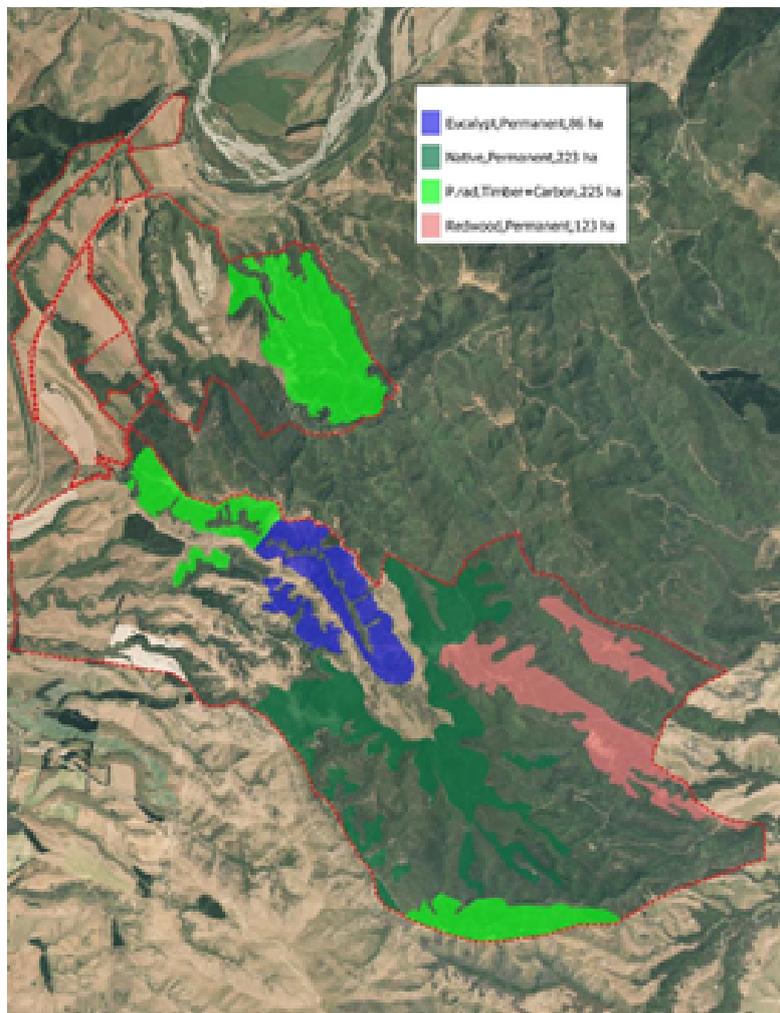
- Broom- Spray only
- Plant 1000 stems /ha 50/50 mix
- 1BT Grant \$4000/ha (landowner 1005 credits)
- Year 1 & 2 cost \$5,500/ha

## RADIATA- TIMBER AND CARBON (225 HA)

Radiata pine as a timber crop was chosen for the more accessible areas of the property. These areas are also weed infested, which could prove an issue for other species such as eucalyptus that are less effective at weed suppression. Nearby plantings on similar weed-infested sites are doing extremely well. Under the new carbon ETS averaging regime proposed by Government, carbon credits are earned for around the first 17 years on forests with a harvest age of 28 years. Thereafter no carbon is earned, but no carbon is required to be repaid at harvest. Averaging and the removal of the carbon liability makes a timber + carbon regime very attractive for small scale harvest forests.

### Cost breakdown

- Broom /Gorse- Spray/Burn
- Plant @ 1000 stems /ha
- 1BT Grant \$1500/ha (Crown first 6yrs carbon credits)
- Year 1 & 2 cost \$2000/ha framing regime.
- Harvest 28yrs (\$20,000/ha stumpage)



Map 2: Tree choices

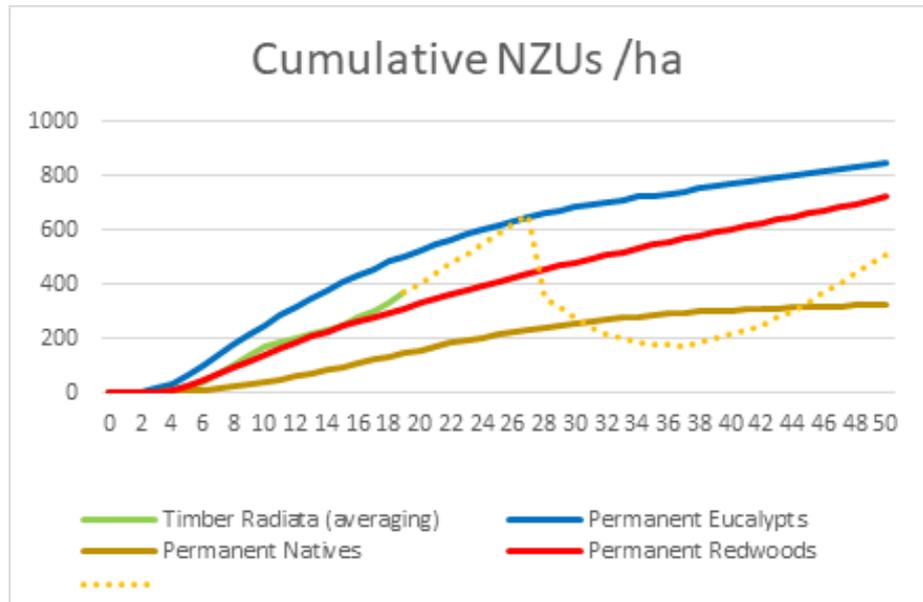
## FORESTY INCOME

Table 3 below shows the economics of different forestry options for Hawkswood.

	Timber radiata	Permanent eucalyptus	Permanent redwoods	Permanent mixed natives
Area	225ha	86ha	123ha	223ha
Forest cost year 1 /ha	\$1,800	\$2,000	\$3,000	\$4,500
Forest cost year 2 /ha	\$200	\$500	\$500	\$1,000
Forest cost year 9 /ha	\$800	\$0	\$0	\$500
Annual forest cost /ha	\$50	\$50	\$50	\$50
ETS cost year 1 /ha	\$5	\$5	\$5	\$5
Annual ETS cost /ha	\$2	\$2	\$2	\$2
5-yearly carbon measurement cost	\$30	\$30	\$30	\$30
One Billion Trees Grant year 1 /ha	\$450	\$450	\$540	\$1,200
One Billion Trees Grant year 2 /ha	\$750	\$750	\$900	\$1,000
One Billion Trees Grant year 3 /ha	\$300	\$300	\$360	\$800
Estimated stumpage income (after 28 years)	\$20,000			
Carbon years	12	50	50	50
Carbon income average per year (@\$25/NZU)	\$485	\$420	\$355	\$160

Table 3: Economic options

The graph below shows the cumulative carbon benefit which generates New Zealand Units (NZUs) over the rotation of a forest.



Graph 2: Carbon benefit

## ONE BILLION TREE FUNDING

The One Billion Trees grants make it more appealing to progress the long-term plan and plant additional areas of the property in forestry. The base rate grant available for these plantings is \$1,500/ha for the pines and eucalyptus, \$1,800/ha for the Redwoods, and \$3,000/ha for the natives. There is a further \$500/ha for erosion-prone land.

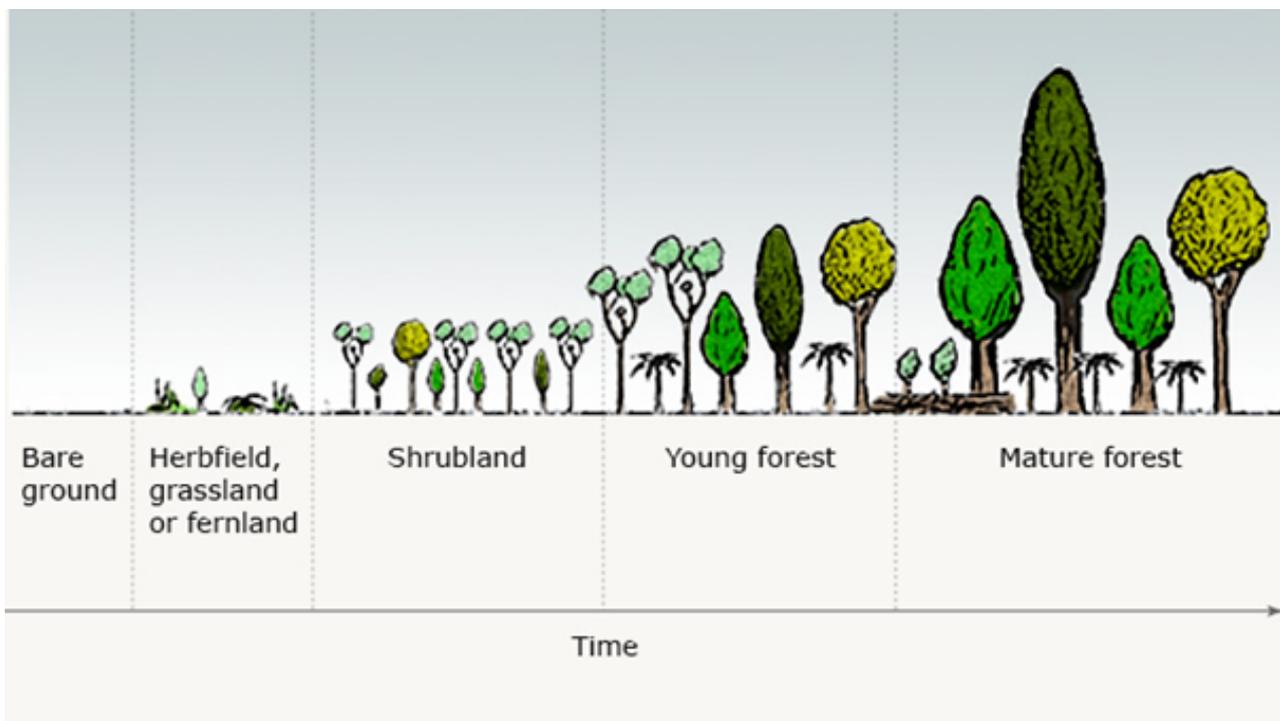
## INDIGENOUS FORESTRY INTEGRATION

Many farmers are interested in forestry options for their properties but want to work with native forest if possible, especially areas which are already in woody cover and which can be managed to achieve a natural forest succession. There is over 200 ha of land like this on Hawkswood, which accumulates carbon credits under the Permanent Forest Sink Initiative.

Healthy forest regeneration is critical to allow for rapid forest succession. Succession of indigenous forestry is illustrated in this image from Te Ara, the Encyclopaedia of New Zealand. Normally shrub-hardwoods succeed to conifers, then to angiosperms. On Hawkswood Range, gorse and broom succeeds to Māhoe, and Māhoe/Pigeonwood succeeds to Totara.

We can take action to improve the rate and type of succession. Ungulates can cause damage to seedlings and also preferentially graze, which means they can alter the species composition. Control of ungulate pests is beneficial. Seed dispersal can be improved by reducing the distance between, or increasing the areas of bush.

There is also a growing body of work demonstrating that underplanting existing secondary, degraded or weedy vegetation with natives can support indigenous forest restoration. This is being trialed on the Hawkswood Range by Dr Adam Forbes. The trial will look at species selection and site attributes, and hopes to identify the critical variables which are thought to be species choice, gap ratio, seedling height at planting, and the level of browsing from herbivores. It is possible to use exotic forestry as a nursery crop for indigenous forestry and Dr Forbes is undertaking a project to demonstrate how this can be done.



Graph 3: Indigenous forestry

## THE FUTURE

Over the next five to ten years, the Macfarlanes will focus on:

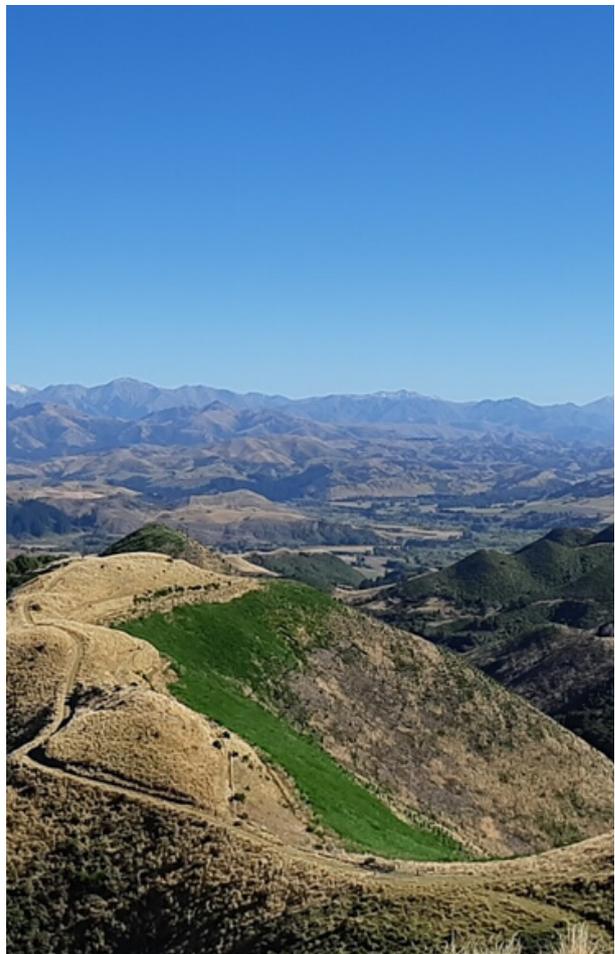
- Continuing to develop the farm and improve soil fertility, pastures species and infrastructure like stock water, fencing and tracking.
- A high-performing sheep flock and cattle herd finishing a high percentage of the young stock.
- Planting a high percentage of the difficult and weedy hill country in trees for either carbon or timber. This will require reviewing the carrying capacity on the farm and the land use capability report will be used to assist decision making on what changes, if any, will be required.
- Consider other land acquisition opportunities or irrigation development to provide for further growth.
- Grow the farm business to provide succession opportunities for the family.

## KEY POINTS

- A diverse landscape, land use, and open minds, have created an opportunity for diversifying income, improving current productive performance, and progressing the Macfarlane's succession goals.
- A detailed assessment of the base resource in the form of land use, and land use capability analysis, with accompanying soil conservation recommendations of works is a useful, objective way of assessing the farm and different land use options.
- A diverse range of tree species helps to create different sources of income from carbon and timber at different times and spreads the risk of relying on one market.
- It is possible to generate an income from regenerating bush and is also possible to improve the rate of regeneration. It is also possible to use exotic forestry to support the regeneration of native vegetation.
- Matching land use to the land resource without pushing natural limits allows financial and environmental goals to be realised.

## LESSONS

- Develop a long-term plan based on your vision and aspirations for the next five to ten years
- Seek good advice and ensure the plan is well executed, on time, and within budget.
- Be realistic about what you can achieve but ensure you continue to have stretch goal.
- Continue to monitor and review your performance because things change and so do business risks.
- Remain positive despite encountering the odd roadblock beyond your control.
- Involve all of the family and staff because the next generation sees life through different eyes.
- Celebrate milestones and achievements regularly.
- Fix mistakes quickly so they don't become big mistakes





## C O N T A C T U S

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