

Pines as a Nurse Crop to Establish Natives

This handout provides a high-level outline of the management plan and economics to use pines as a nurse crop to establish natives. An indicative comparison is provided with planting natives, pines as production forestry, and sheep and beef farming.

The government is currently consulting on a number of changes to the ETS (including transitional forestry) and has a research program underway to review the yield tables used to determine sequestration of natives (currently based on Manuka/Kanuka dominated scrub). This paper is based on current legislation as at August 2023.

Pines to Natives – ETS averaging accounting

A generic plan is outlined based on current knowledge. A site-specific management plan and site-specific costings are recommended. Costs such as enrichment planting, fencing, pest and weed control can vary greatly depending on site factors.

Pine Tree Management

Management Program	Indicative Costing
Fence block to ensure that livestock are excluded.	Costs will be specific to each site, indicative cost of \$500/ha included in this assessment ¹
Establish pine trees at a spacing of 3.15 m or 1008 stems/ha.	\$2,500/ha which includes seedlings, planting, blanking, and first release.
Start browser pest control in year 1 and continue every year. Annual costs are likely to reduce after initial control is achieved but ongoing maintenance is important to prevent numbers increasing.	Costs will vary depending of type of browser pests present and control methods used. Indicative cost of \$100/ha used.
Register block under Emissions Trading Scheme (ETS).	\$4,000 total for a forestry management company to register the block ²
Registration cost in year 1, then annual fees to maintain account and to claim carbon credits.	\$200/yr total ongoing costs to maintain account ²
Year 2 release spray of pines, if required. No further weed control after this point until enrichment planting begins in year 12 ³	\$250/ha for release spray for pines

Block is registered in the Emissions Trading Scheme (ETS) in year 1, under average accounting, carbon is claimed to year 16.

Points to note:

¹ Fencing can also be used to control browser pests, for small blocks if contour allows deer fencing may be a more cost-effective method.

² 10ha block size is assumed to provide per ha ETS costs.

³ After initial planting of pines it is assumed weeds are under control, if there is an existing incursion additional ongoing control under pines will be needed.

Enrichment planting of natives

To assist with the transition to natives the management plan includes selective poisoning of pine trees coupled with planting of mature native canopy species to ensure that each gap contains species capable of taking up a position in the canopy (e.g. Totara, Rewarewa and others). The need for enrichment planting will depend on a number of site factors such as the proximity and composition of adjacent seed sources, the availability of seed dispersing birds, the climate and level of browser pressure.

The treatment program creates circular gaps in the pine canopy, created by stem poisoning a 6.8 m radius or 144 m² which equates to approximately 10 pines poisoned per gap. The poisoned trees are left to rot and fall down naturally. The first half of the gaps created are enrichment planted. In some circumstances there would be no need (and this is assumed here) for the second half of gaps to be planted as by that point there is sufficient native trees for seed dispersal to fill in the remaining areas.

Management Program	Indicative Costing
<p>Year 12 poison 11 gaps per ha, followed a year later by planting native canopy species at 2 m spacing or 36 stems per gap.</p> <p>Year 17 poison 11 gaps per ha, followed a year later by planting native canopy species at 2 m spacing or 36 stems per gap.</p> <p>Year 22 poison 11 gaps per ha, followed a year later by planting native canopy species at 2 m spacing or 36 stems per gap.</p> <p>48% of area is now treated.</p>	<p>Poisoning of pine trees at \$2.50/tree or \$25 per gap or \$275/ha per treatment year.</p> <p>Enrichment planting at \$5/seedling (seedling, planting, releasing and blanking) or \$180/gap or \$1,980/ha per treatment year.</p>
<p>Year 28 poison 11 gaps per ha.</p> <p>Year 33 poison 11 gaps per ha.</p> <p>Year 38 – poison all remaining pine trees (remaining 20%).</p> <p>No further enrichment planting of gaps is undertaken as it is assumed there is a sufficient seedbank from the first 48% planted. This requires monitoring in the longer term to ensure adequate natural recruitment.</p>	<p>Poisoning of pine trees at \$2.50/tree or \$25 per gap or \$275/ha per treatment year.</p>
<p>Pest Control to continue every year.</p>	<p>Costs will vary depending of type of predators present and control methods used. Indicative cost of \$100/ha used.</p>
<p>Weed control, focused on gap areas and native canopy species planted, control undertaken for first 7 years while trees are establishing, then lower level ongoing control.</p>	<p>Equivalent of \$150/ha/yr focused on gap areas for enrichment planted areas, then continued control of \$50/ha over entire block from year 25 onwards.</p>
<p>ETS annual fees.</p>	<p>\$200/yr total ongoing costs to maintain account or \$20/ha.</p> <p>Note these fees cease when the forestry moves to the permanent category.</p>

Natives – ETS stock change accounting (permanent)

Natives are registered under the permanent category of the ETS, same initial registration costs as pines to natives, no annual fees. Carbon is claimed from year 1 through to year 50 (as far as the MPI lookup tables go).

Establishment costs consist of:

- Natives planted at 1.5m x 1.5m spacing or 4,444 stems/ha at a cost of \$5/seedling (seedling, planting, releasing and blanking), total cost to establish natives is \$22,220/ha.
- Fencing at \$500/ha in year 1.
- Browser pest control of \$100/ha/yr are the same as the pines to natives scenario.
- Weed control based on \$150/ha/yr for the first 7 years then \$50/ha thereafter.

Pines Production – ETS averaging accounting

Under a Pine production forestry with a pruned silviculture program it is assumed 500 m³/ha of pruned logs is produced at year 28, valued at \$125/t. Harvest costs are \$40/m³ and cartage of \$35/t. This provides a net \$25,000/ha return at harvest.

Establishment costs consist of:

- Seedlings, planting and first release spray at \$2,500/ha.
- Second release spray in year 3 of \$250/ha.
- Spraying for Dothistroma five times in the first 15 years at \$20/ha/application.
- Prune at years 4-6 at \$3,000/ha.
- Thinning at year 10 at \$1,200/ha.
- Browser pest control of \$100/ha/yr limited to the first 3 years.
- Installation of roading prior to harvest at \$500/ha.

Sheep and Beef Farming

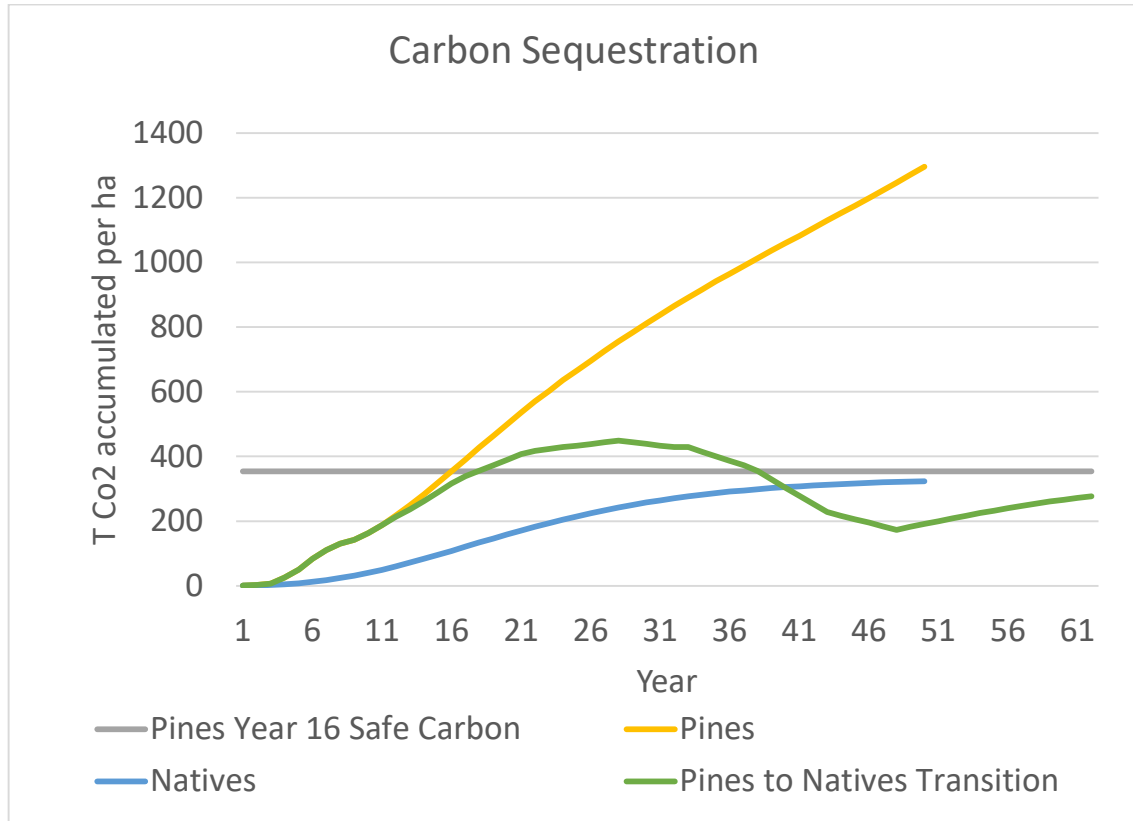
B+LNZ Northern North Island Class 4 Hill Country land 2022/2023 forecast budget used as a baseline.

The following expenses are removed to provide a fair comparison- administration expenses, insurance, rates, managerial salaries, interest and rent. These expenses are not accounted for under the forestry scenarios so for the purpose of a fair comparison are removed from a sheep and beef land use as well.

The budget shows an adjusted profit of \$515/ha.

Carbon Accumulation

The graph shows the cumulate amount of carbon sequestered extending out to year 50 for pines and natives, and year 60 for the pines to natives transition.



Key points of pines to natives transition:

Year 1-11	Carbon sequestration increases rapidly through the growth of pine trees.
Year 12-28	Selective poisoning of pines begins in year 12, poisoning and sequestration rates slow. Carbon sequestration peaks at year 28.
Year 28-48	Sequestration is negative as carbon losses (rotting of pines trees over a 10 year period) exceeds the sequestration rates of natives. From year 48 all pine trees are assumed to be removed.
Year 48+	Sequestration slowly increases through growth of natives.
Year 103	The native plantation reaches the same level of carbon as pines at year 16. This assumes a straight line sequestration from year 50, there is no guidance provided on accumulation rates post year 50 from the MPI lookup tables.

- In theory the pines to natives scenario takes 103 years to reach the same amount of carbon sequestered as pines to year 16.
- There is likely to be a carbon penalty, when the basal area of the natives exceed that of pines the forest will change to be defined as indigenous, and begin using stock change accounting.

Key points of other land use options:

- Natives- carbon sequestration increases gradually as natives grow from year 1, but are a lot slower than pines.
- Pines- a permanent pine plantation where all carbon is claimed to year 50. If the block is to transition to natives in the future this shows there will be a large liability of carbon to be paid back. This is not recommended and is not included in the economic analysis
- Pines year 16 safe carbon- shows the total safe carbon which can be claimed under a pine plantation using averaging accounting
- Carbon sequestration is based on MPI lookup tables, pines are Waikato/Taupo area.

Profitability

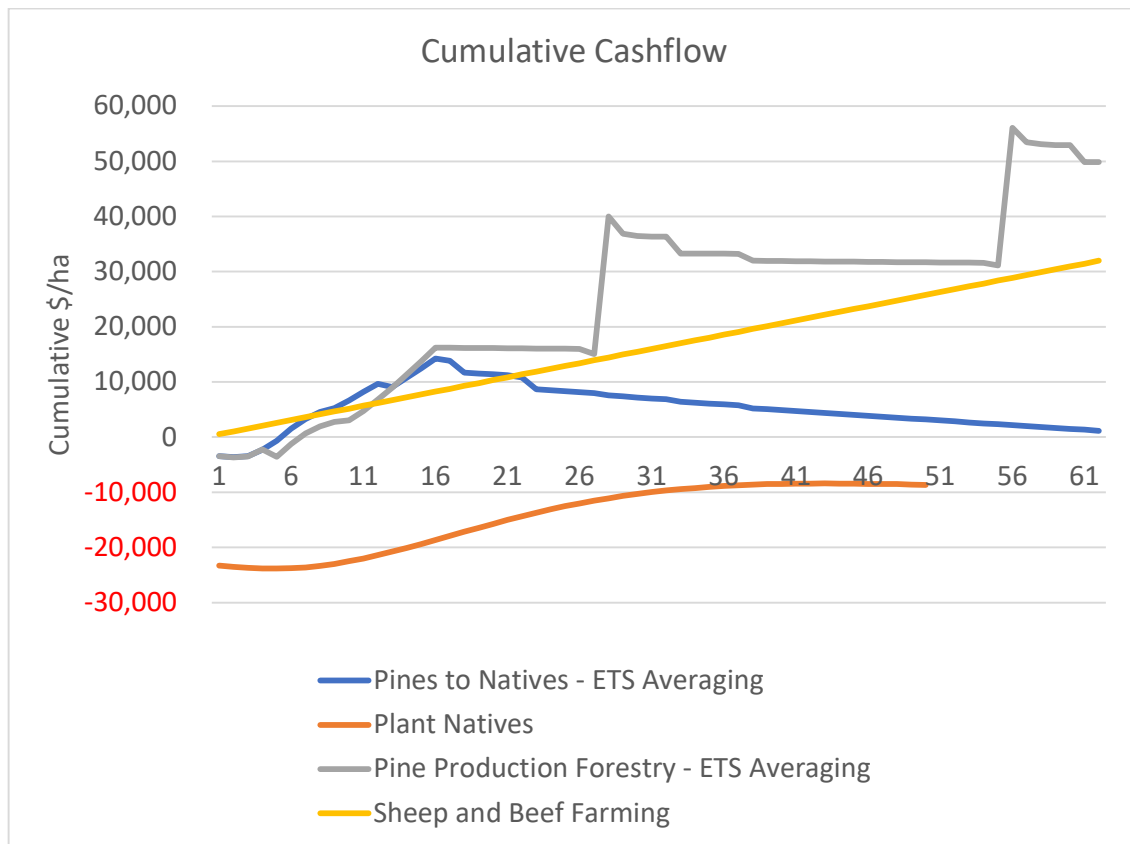
The graph below shows the cumulative cashflow of the three forestry options, plus a comparison to sheep and beef farming. Carbon pricing is based on \$70/t which is an average of the last two years' actual carbon price.

Key points of pines to natives transition:

- Cumulative cashflow becomes positive in year 6, i.e. income from carbon has repaid establishment costs.
- Cumulative cashflow continues to build until year 16 due to income from carbon (claimed under averaging accounting).
- From year 17 onwards cumulative cashflow declines, there is no longer any income, costs continue for enrichment planting and weed/pest control.
- Cumulative cashflow reaches 0 at year 69.

Key points of other land use options:

- Planting natives in year 1 carries a large upfront cost, while there is income from carbon every year, this is insufficient to pay back the initial cost by year 50.
- Pine production forestry is the most profitable land use option for the first cycle due to income from both ETS and wood totalling \$39,981/ha. For the second production cycle the total cumulative return reduces substantially to \$16,090/ha.
- Sheep and beef farming provides steady annual returns and totals \$14,436/ha over 28 years, slightly behind pines in the second rotation. Note this is based on average returns for NI hill country, retired areas are generally less productive so profitability is also less than the farm average.



Net Present Value

The net present value (NPV) recognises the time value of money which is especially important when income and expenses do not occur in the same year, e.g. production forestry. A discount rate of 6% is assumed over a 50 year timeframe, this shows:

- Pines as production forestry is still the most profitable option in the first cycle when combined with carbon, however in the second cycle once carbon is removed sheep and beef farming is the most profitable.
- Natives have a negative NPV as income from carbon is insufficient to cover expenses.
- Pines as production forestry in the second cycle has a negative return. This shows that discounting the revenue at harvest back to a value today is insufficient to cover establishment costs. A 4.5% discount rate is at breakeven.
- Pines to natives provide a positive NPV due to the majority of expenses and all of the revenue occurring in the earlier stages of the forestry.

	Net Present Value (\$/ha)
Pines to Natives	+\$4,547
Natives	-\$17,365
Pines production first cycle	+\$10,343 (+\$11,621 first 28yr cycle) (-\$1,778 second 28yr cycle)
Sheep and beef	+\$8,127