Putting a value on the benefits of planted forests

Planted forests provide many benefits beyond timber, fuel and fibre.

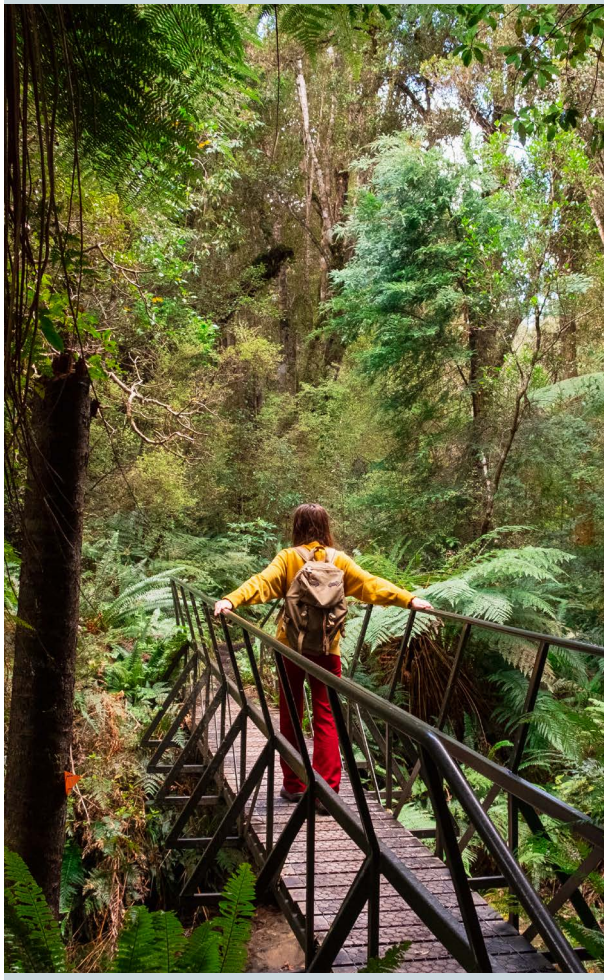
Forests also:

- capture and store carbon dioxide from the atmosphere (this is called carbon sequestration)
- have roots that bind the soil together, making it less likely to wash away (helping to control erosion)
- soak up rainwater, preventing runoff and damage from flooding
- help improve water quality by minimising soil erosion, reducing sediment, and absorbing polluting chemicals
- help improve biodiversity
- provide physical and mental health benefits
- provide recreational resources.

Together, the benefits people get from the environment are known as ecosystem services. Many of the ecosystem services that forests provide don't have a market value.

This means benefits like avoided erosion are less understood or appreciated compared to timber values.

Research by Scion in 2019 used a tool called the Forest Investment Framework (FIF) to put a number on the broader value of potential forests on erodible land in the Hawke's Bay. This research calculated the costs for forest establishment, estimated the value of the timber produced, and indicated the value of benefits like nutrient mitigation and avoided erosion.



It's important to note this research was undertaken in 2019, and pricing and value assumptions were made at that time. Current prices and values may be very different.

Approximate costs to establish, maintain and harvest a forest

Ballpark forest establishment costs

The cost of establishing a new plantation forest includes buying and planting the tree crop, along with weed control to maximise tree growth while the trees are establishing. The assumptions used in 2019 in developing the cost estimates were:

- labour cost: $38 per hour
- preparation base time: 3.5 hours per hectare
- planting operations base time: 8 hours per hectare
- tree stock: $500 per thousand seedlings
- herbicides: $100 per hectare
- mechanical preparation (cultivation or management of leftovers from harvesting): $520 per ha, applied to 7% of the total area to be established.

Costs were adjusted to account for:

- additional effort needed as slopes get steeper
- how difficult it was to travel across a site because of obstacles like vegetation and slash (leftovers after logging).

Table 1 shows establishment costs per hectare calculated in 2019 for years 1, 2, and 3 for trees to be used for structural/framing timber.

Ballpark plantation landing and road costs

Once trees are ready to harvest, you need:

- a landing – a clearing where logs are sorted and loaded onto trucks for shipment to a processing plant
- roads so trucks can move in and out and get your logs to ports or processing plants.

These costs were calculated taking into account different:

- slopes
- soil classes (to help figure out how hard it would be to do earthworks and create roads and landings).

Estimated costs for a landing as at 2019, according to soil class and slope, are shown in **Table 2**.

Table 1: Cost of plantation forest establishment for a structural (framing) regime established at 900 stems per hectare (NZ$)

Planting regime at 900 spha				
Slope	Description	Year 1 ($ha^{-1})	Year 2 ($ha^{-1})	Year 3 ($ha^{-1})
0–5	Flat	1330.22	261.99	261.99
5–15	Rolling	1372.01	274.71	274.71
15–25	Steep	1460.81	301.73	301.73
>25	Very steep	1706.33	376.46	376.46

Table 2: Estimated costs (NZ$) associated with the establishment of landings assigned by slope and soil class

	Slope°		
Soil class	Flat (0–10)	Moderate (10–20)	Steep (>20)
Easy	$2,079	$2,673	$3,564
Moderate	$3,564	$4,158	$4,752
Hard	$4,752	$5,940	$9,504

Estimated costs as at 2019 for road construction, taking into account slope and the likelihood of erosion are shown in **Table 3**.

Ballpark costs of thinning

Labour costs for the thinning operations were assumed to be $45 per hour in 2019 (including the costs of chainsaws, fuel, protective clothing, transport and overheads). Costs vary according to the slope of the land – see **Table 4**.

Ballpark costs of logging and transport

Cost of logging per tonne were calculated using the AgriHQ value associated with harvesting costs (see **Table 5**).

Harvesting cost was calculated using *H* cost = Yield * AgriHQ value

Transport costs from the forest location to its destination (port or processing plant) was done on a per kilometre basis, and estimated to be $0.22 per km in 2019.

Estimating the value of ecosystem services

Scion also calculated the value of:

- carbon dioxide stored in the forests (rather than being released into the atmosphere)
- avoided nutrient runoff
- avoided sediment runoff
- biodiversity conservation benefits.

Returns from forestry on erodible land

In 2019, Scion estimated that radiata pine grown on highly erodible sites could return between $330 and $640 per hectare per year.

With a 28-year forestry rotation (time from planting to harvesting), they estimated that:

- the highest avoided erosion values were greater than $200 per hectare per year for land currently in livestock. This was calculated as the potential volume of sediment movement that can be avoided by planting target sites.
- the highest avoided nitrogen values were greater than $240 per hectare per year for land currently used for dairy.

In many cases, the annual value of the non-timber ecosystem services like avoided soil erosion and avoided contamination can be greater than timber. Much of the Hawke's Bay region provides ecosystem services: timber ratios between 1:1.50–2. These numbers suggest that for every dollar in annual profit provided by the new forests, the value of non-market ecosystem services is at least one and a half times more.

The value of non-market ecosystem services is greatest in steep or very erodible land currently in livestock.

Table 3: Construction costs (NZ$) associated with the construction of internal roads within potential future forests assigned by class slope and ESC

	Erosion Susceptibility Classifaction (ESC)			
Slope°	Low	Moderate	High	Very high
0–5	39,427	40,621	43,011	47,790
5–15	46,595	57,348	66,101	74,074
>15	75,269	84,827	93,190	119,475

Table 4: Cost of thinning for a structural (framing) regime with an initial stocking of 900 spha and thinned to 600 spha at age 7

	Structural (framing) regime	
Slope°	Description	Year 7 ($ha^{-1})
0–5	Flat	700
5–15	Rolling	750
15–25	Steep	800
>25	Very steep	900

Table 5: Estimated logging cost ($ per tonne) for the North Island by terrain/system and location

Slope°	Extraction	Agrifax value ($)
0–10	Flat ground-based	19
10–15	Tracked ground-based	21
15–20	Steep tracked	31
>20	Hauler	38

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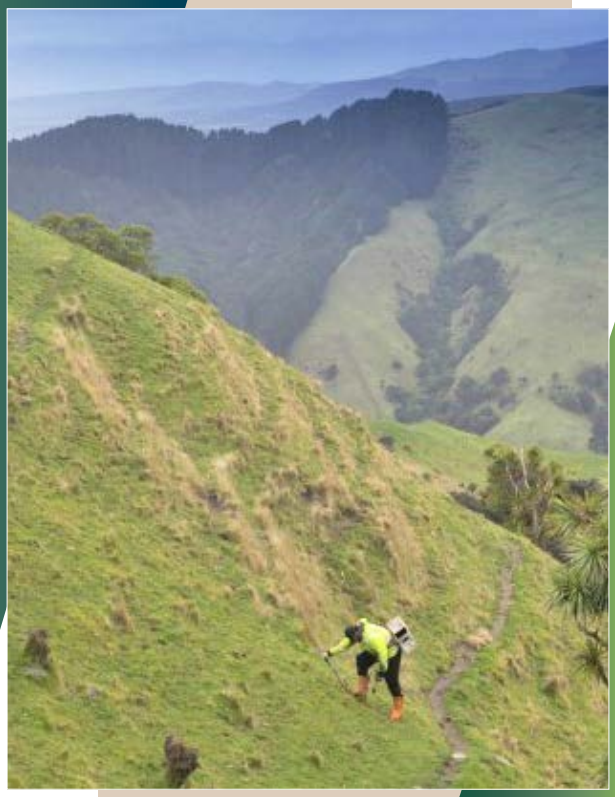
Converting land from agriculture to forestry

If you are thinking of converting some of your land currently used for livestock to forest, there are some important things to consider:

- Tree planting should target highly erosion prone areas, which tend to be steeper, more exposed and with poorer soils, rather than blanket afforestation of entire farms including productive land.
- Many farmers overestimate the returns from farming on their poorest land. In many instances, these poorest performing areas could benefit from planting, allowing resources to be focused more intensely on farming the better performing land classes.
- A complementary approach where less productive land is planted in forest, and higher quality land is managed more intensively can lead to higher overall farm returns. It can also benefit the community and environment more than whole property conversions.
- Landowners unsure about farm forestry should seek detailed information about the land classes on their farms to identify high performing areas, and other areas that could be planted.



Want more information?

Read the Summary report – **Planting eroding hill country in the Hawke's Bay region**

See p63 in the Technical report – **Planting eroding hill country in the Hawke's Bay region: Right tree, right place, right purpose**

Tirohanga Ngahere | Canopy: **www.canopy.govt.nz**

One Billion Trees: **www.mpi.govt.nz/1BT**

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