# Applying Occam's razor to carbon forestry in NZ

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Occam's razor is the well-known problem-solving principle that simpler explanations and solutions are generally better than more complex ones. It was so-called because it shaved the fuzzy and overly-complex arguments of the medieval scholars who were William of Occam's contemporaries.

Here I attempt to apply Occam's razor to the complex topic of carbon forestry within the New Zealand Emissions Trading Scheme. Fortunately, I have a sharp blade handy in the form of a submission to the Productivity Commission in 2017 by my colleagues at Te Kura Ngahere|School of Forestry, David Evison and Euan Mason (see www.productivity.govt.nz/assets/Submission-Documents/8468ef412c/Sub-027-David-Evison-and-Euan-Mason.pdf). Their submission asked, 'How do we contribute to reducing global greenhouse gases through a genuine reduction in New Zealand's emissions?'

Note that between 2008–2012, New Zealand had annual gross carbon emissions of 75 million tonnes $CO_2$ equivalent and annual net carbon emissions (gross emissions minus carbon sequestered by new planted forests) of 60 million tonnes $CO_2$. It will not be easy to get this down to zero. Time is needed!

Starting from 2018, Evison and Mason assumed an ambitious strategy where New Zealand's gross emissions reached zero by 2080 (i.e. it would take 60 years to make the technological, infrastructural and social changes needed to transition to a zero gross carbon emissions economy). The transition was brought forward from 2080 to 2050 using carbon sequestration, where $CO_2$ is actively removed from the atmosphere, thus reducing our positive gross emissions to a zero net emissions figure by 2050.

This is where forestry comes in. New technologies for carbon sequestration may be available beyond 2050, but for the next 30 years planting new forests is our only feasible method. Evison and Mason proposed planting large areas between 2018 and 2050 – over 1 million ha of new commercial forests, with a further 400,000 ha of permanent (unharvested) forests. Importantly, they assumed that all planting was done with radiata pine – a fast-growth, cheap-to-establish species capable of sequestering large amounts of $CO_2$ within a few decades.

Their strategy recognised that new forest planting has a drawback as a carbon sequestration tool. A new forest will sequester carbon only until the forest is clearfelled (for commercial forests) or until forest biomass reaches the site's carrying capacity (for permanent forests). This is not a problem in the strategy proposed by Evison and Mason since their proposed planting programme only needs to provide enough carbon sequestration to get New Zealand to net zero emissions by 2050 and maintain this level until zero gross emissions are reached in 2080. After that, no further sequestration should be needed.

This strategy is feasible, since it uses a proven species with known growth rates. The entire planting programme could be funded by a charge of $1.58/tonne $CO_2$ on gross emissions between 2018 and 2050. What could possibly go wrong? As it happens, plenty. Perhaps the most important barriers right now are public attitudes and perceptions. The public generally does not accept the benefits of planted fast-growth forests, and some landowners and their community representatives are opposed to large-scale commercial carbon forests. Recently, the mayor of a South Island local authority spoke of farm properties in his district being purchased and 'carpet-bombed' with pines. Publicity like that you just cannot buy.

Planting with indigenous species may be more acceptable. Research by Mark Kimberley, David Bergin and Warwick Silvester has shown that planted indigenous forests can sequester carbon at up to half the rate of radiata pine over 50 years. However, while encouraging, the key metric here is not carbon sequestration over 50 years because by then the role of planted forests as carbon sinks needs to become almost negligible. It is a high sequestration rate within the next 30 years that is needed – and only radiata pine and other fast-growth exotic species have that capacity.

Another consequence of slower sequestration by planted indigenous forests is that to achieve the same amount of sequestration as a radiata pine forest it will take twice the planted area. An objection to carbon forestry is that agricultural production is reduced when farmland is converted to forest, and farming communities dependent on that production are lost. Therefore, carbon forests should be land-efficient – sequestering the maximum amount of carbon per hectare over the next 60 years.

So, to achieve zero net carbon emissions for New Zealand by 2050, we need to plant about 1 million ha of new commercial and another 400,000 ha of new permanent forests. They need to be fast-growing, cheap to establish, and (for commercial forests) have markets for the wood that will be harvested. If we do this, we will achieve our goals for zero carbon emissions at least cost and least land area converted from farming while doubling the time available for New Zealand to make a transition to zero gross emissions. Hopefully, William of Occam would approve.

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