Cost Effective Control of Dense Wilding Conifers in Abel Tasman National Park

Background

Wilding conifers are invading New Zealand's native forests and spreading at an estimated rate of 5% per year (1). Most native trees cannot compete with conifers and will eventually be succeeded by them, with significant negative impacts on native ecosystems and wildlife. Wilding conifers can impact ecosystems in other ways, such as negatively affecting water tables due to their high water consumption and increasing fire risk. Conifers are highly combustible and benefit from forest fires as some of their cones are serotinous (i.e. they remain closed until seeds are made available by high temperatures associated with fire). These seeds readily take over a burned area when conditions are ideal for seedlings.

Wildling conifers are prolific and can quickly overwhelm native landscapes. Maritime pines (*Pinus pinaster*), for example, can live up to 300 years and produce great amounts of seeds after reaching maturity at 18 years. This enormous productivity has led to an exponential increase in areas that are affected by wilding conifers during the last decades (fig. 1).

In the Abel Tasman National Park, wilding conifers such as radiata pine (*Pinus radiata*) and maritime pine were widespread, especially along the coastline and adjoining ridges. This distribution reflected their history of having been widely planted in association with early European settlement and farming ventures along the coast from the late 1800s through to the early 1900s. More recent plantings of radiata pine and Douglas fir (*Pseudotsuga menziesii*), found on private land within and adjoining the Park, primarily as commercial forestry plantations, may have introduced wilding conifers into the Park. At the peak, it is estimated that more than ~10,000 ha of the Park was infested by wilding conifers.

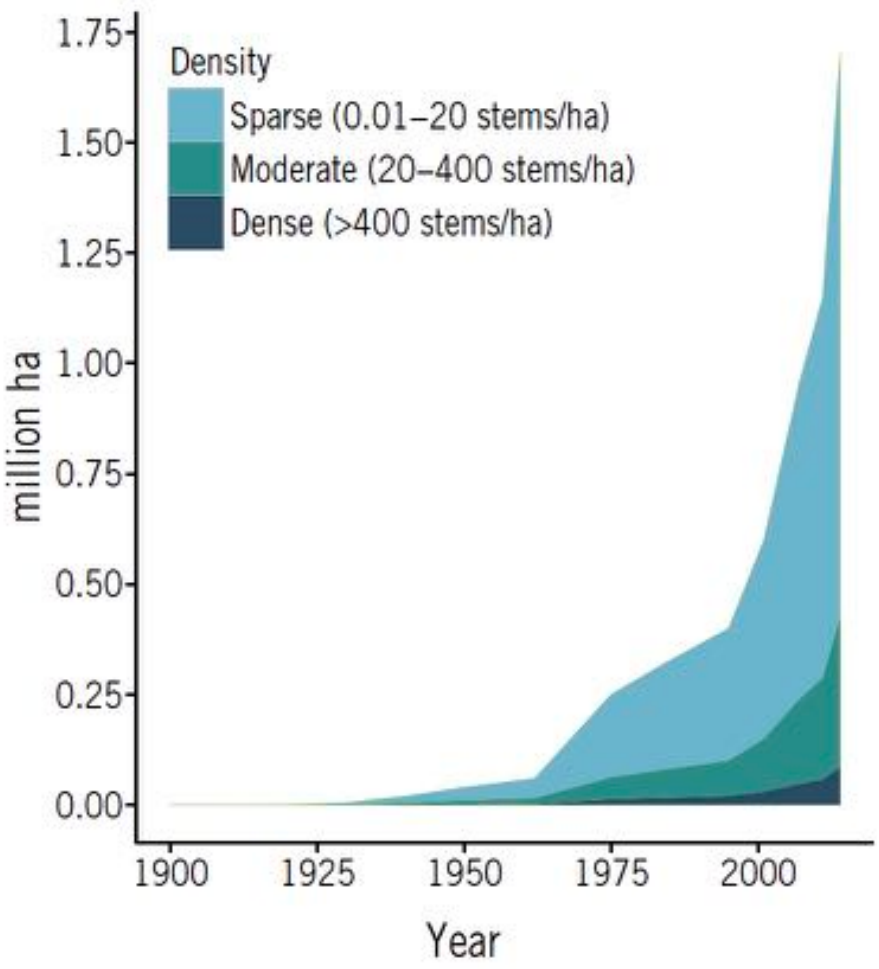

Figure 1: Increase in areas affected by wilding conifers from 1900–2014. Graph was modified after (1).

The Abel Tasman Birdsong Trust started a wilding conifer control programme in the Park in 2012. In 2014, Project Janszoon began working alongside the Birdsong Trust with the goal of removing all mature wilding conifers from the Park by 2018.

One of the largest and most visible wilding conifer infestations in the Park was a 30ha stand of dense maritime pine (2, fig. 2) found at Bark Bay, which is a popular visitor site and camping area along the Abel Tasman Coastal Walk. The stand was established in the early 1900s by local settlers who subsequently abandoned their farms (3, 4). Since then, the stand has spread significantly around the fringes, with trees in the fringe reaching maturity (ca. 25 years old) and starting to disperse seeds. The pines were observed to establish successfully even under a moderate kanuka/manuka canopy (5), and modelling suggested the spread could potentially cover an area of more than 70 ha, almost three times the size of the original stand (fig. 3).

Figure 2: Maritime pine (*Pinus pinaster*) stand at Bark Bay in 2012 (credit D. Chisnall).

Two previous reports had recommended that the pines be maintained, mainly due to concerns about the costs of the operation (3, 4). However, with the evolution of improved wilding conifer control methods, in 2014 it was deemed viable to proceed with a control programme.

Figure 3: Size of the maritime pine (*Pinus pinaster*) stand at Bark Bay in 2013 (red). The potential spread area is marked in white (graphic adapted from (5)).

Method

The chosen method needed to be cost effective and appropriate for a site with large numbers of visitors. Current best practice for controlling dense, closed-canopy stands of wilding conifers is by aerial application of herbicides from a helicopter fitted with spray booms. However, this method was less attractive at this location because of its proximity to a high-use visitor area, risk to non-target native species in the understory, concerns about the dispersal of chemicals into air and water, and a desire to achieve high kill rates with a single treatment.

For these reasons, a ground-based control operation using herbicide injection (sometimes known as 'drill and fill') was selected and implemented in stages between 2014 and 2017. Holes were drilled using a petrol drill around the stem of each tree at a nominal 392 mm spacing (fig. 4). Each hole was 20 mm diameter and ca. 75 mm deep, on a 45° angle and filled up with herbicide (glyphosate). For large trees with a trunk diameter of one metre, eight holes were needed to complete the treatment.

Figure 4: Each pine is poisoned by manual herbicide injection (credit A. Macalister).

Results

Herbicide injection proved to be a very effective method to control wilding conifers. One treatment per tree was sufficient, with 100 % kill efficacy. The needles of poisoned trees turned brown and fell off within 12 months after treatment (fig. 5a).

Figure 5: Stands of poisoned pines along the coast of the Abel Tasman National Park. After one year dead pines lose their needles (top photo), allowing healthy native undergrowth to recover (bottom photo) (credit D. Chisnall (top) R. Bollongino (bottom)).

The total cost of herbicide injection was ~$1600/ ha, providing a very cost-efficient control method (fig. 6 shows the track logs of two years of pine control, giving an impression of the labour input). For comparison, the costs of boom-spraying were estimated at between $1,800 to $2,200/ ha.

The native understory remained unharmed by herbicide injection, whereas aerial boom spraying would have had non-target impacts. Re-growth of ferns, *Coprosma* spp., kanuka, mingimingi, kamahi and rimu was evident shortly after pine control as abundant light (fig. 7), moisture and nutrients become available that had been previously monopolised by the wilding pines. Large numbers of maritime pine seedlings were evident in places, particularly on ridge lines, and will require comprehensive follow-up control. No other exotic weed species have been encountered at the site following control.

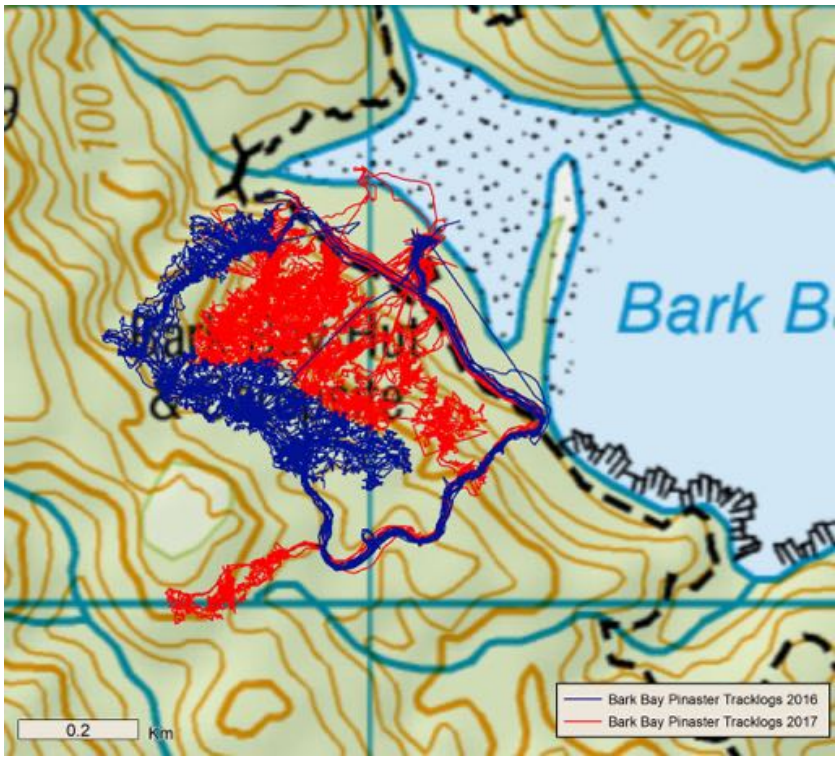

Figure 6: Track logs of pine control teams in 2016 (blue) and 2017 (red) (credit D. Chisnall).

Figure 7: Native seedlings are unharmed by the selective control of pines (credit A. Macalister).

The dead trees have been left standing, except for some that were felled because they posed a health and safety risk to users of public tracks and huts. Concerns that that dead pines, which may take 15+ years to disappear, would constitute an eyesore for visitors in one of New Zealand's most iconic landscapes did not eventuate. On the contrary, no complaints have been received and it seems the public perceive the dead pines as a visible feature of the successful ecological change that was being made in the park.

In summary, ground-based herbicide injection was found to be an efficient and environmentally-friendly method to control wilding conifers, and was cost-effective even for the treatment of dense stands of wildings.

Synopsis

- Ground control of large and dense infestations of wilding conifers is possible and cost effective (NZD 1600/ha vs NZD 2000/ha with boom-spraying).
- The target-specific treatment of wilding conifers prevents non-target poisoning of native flora and enhances natural native forest recovery.
- Target specific injection of toxins prevents landscape wide application of herbicides.
- Dead conifers are positively perceived as a symbol of ecological change towards a native forest.
- Ground control of wilding pines is also suitable for areas with high visitor numbers

Acknowledgements

This project was carried out with the support and initiative of the Abel Tasman Birdsong Trust. Special thanks to Andrew Macalister (R&D Environmental Ltd) and Dan Chisnall (Department of Conservation (DOC) Motueka District Office), who lead the project and field work and provided the data for this article. Ian Cox (DOC Motueka District Office) and David MacGibbon from Adama Ltd, Nelson are kindly acknowledged for their support. Bruce Vander Lee and Andrew

Macalister made valuable comments on the manuscript. The project was funded by Abel Tasman Birdsong Trust and Project Janszoon.

Dr. Ruth Bollongino, scientific advisor for Project Janszoon

June 2018

References

1) Ministry for Primary Industries (2014) The right tree in the right place – New Zealand Wilding Conifer Management Strategy 2015–2030. ISBN: 978-0-477-10510-1 (online).
2) Macalister, AC (2011) Management Strategy: The Control of Wilding Conifers in Abel Tasman National Park. Unpublished report for the Abel Tasman Birdsong Trust.
3) Sanson, L.V., 1978. Invasion of Maritime pine in Abel Tasman National Park. Unpublished B. For. Sc. dissertation, School of Forestry, University of Canterbury.
4) Ledgard, N.J., 2005. Wilding Spread and Management in Abel Tasman National Park. Department of Conservation.
5) Macalister AC (2013) A review of the management options for *Pinus pinaster* at Bark Bay, Abel Tasman National Park. Unpublished report for Project Janszoon.