

## Improving methods for wilding conifer control in New Zealand

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**Summary** Three new control methods for the management of wilding conifers are described: ground based basal bark herbicide application; aerial bark herbicide application using a wand; and herbicide application using aerial boom spraying. We compare the previously used methods with these new methods. A range of operational staff using the new methods were interviewed regarding the savings being made and other advantages of using the new methods. Staff reported that significantly more area could be treated with the same level of funds.

**Keywords** Wilding conifer, control method.

### INTRODUCTION

Wilding conifers are a serious and expanding weed problem in New Zealand. Wilding conifers can replace extensively grazed farmland, impact water yields in water sensitive catchments, and can severely impact a range of native ecosystems. Invasive species such as *Pinus contorta* Douglas ex Loudon are able to grow at altitudes above the tree line formed by indigenous species putting alpine and subalpine ecosystems at risk (Froude 2011). In 2007, it was estimated that around 1.1 million hectares of land were affected by wilding conifers (Froude 2011). In the same year, the New Zealand Department of Conservation (DOC) spent an estimated \$3.5 million on wilding conifer control and this equated to approximately a third of its total weed control budget. That level of funding was deemed insufficient for effective long term control of wilding conifers. Thus, improving on existing control methods and developing new cost effective control methods was seen as paramount in the successful and ongoing control of wilding conifers in New Zealand. If the cost of control can be reduced by 50% or more, then significantly larger areas can be treated with the same amount of funding. As well as cost reductions, it was also important to increase the effectiveness of the control methods used and at the same time minimise the damage to non target species.

This paper describes three new wilding conifer control methods developed since 2006. The reviews of Raal (2005) and Raal (2006) detail the best practice methods for the use of herbicide and physical control of wilding conifers at that time and provide

recommendations for the direction research should take for further improvements. Since these reviews, further research and herbicide trials have been conducted. Two new methods (ground based basal bark herbicide application and aerial bark herbicide application using a wand) are described in a recent guideline (Raal 2013). The improved method of herbicide application using aerial boom spraying is described in a research publication (Gous *et al.* in prep.).

### MATERIALS AND METHODS

One of the authors, Keith Briden, conducted telephone interviews with a range of DOC staff located throughout New Zealand asking about the efficiencies and effectiveness of the new methods. The staff members, at the time of the interviews, were familiar with the previously used management methods and had at least two years experience using the new methods. Staff were asked how much additional area could now be treated using the same level of funding. Staff were also asked to describe other advantages they experienced when using the new methods. We used examples of three operational settings to make comparisons.

**Ground based basal bark herbicide application** In the first example we compared the new method of ground based basal bark herbicide application with the previous best practice methods of hand-pulling small seedlings, the use of axes, loppers and handsaws for stems up to 5 cm in diameter at ground level, and, the use of scrub bars and chainsaws for larger stems. For the operational setting we used *P. contorta* at high altitude tussock grasslands and regenerating shrublands in the North and South Island high country. Infestations levels were scattered to moderately dense and easily accessible by foot. The new method is described in full detail in a set of guidelines (Raal 2013) and uses the application of low volumes of an oil-based herbicide mixture to the base of the *P. contorta* stem (Figures 1 and 2). The herbicide mixture consists of one part triclopyr (600 g L<sup>-1</sup> as the butoxy ethyl ester) in four parts oil (e.g. canola based biodiesel). The oil acts as a carrier and moves the herbicide through the bark into the cambium and conductive vascular tissue for translocation throughout the plant. The stem is



Figure 1. Contractor applying herbicide.



Figure 2. Herbicide applied onto bark at the base of the stem. Herbicide is applied to an area twice the height of the stem diameter.

entirely encircled with the herbicide mixture so that it is translocated to all parts of the plant. The herbicide is applied with a low pressure sprayer to avoid spray mist and splatter. Trees up to 30 cm diameter at the base can be treated and greater than 98% of trees will be dead after one year.

**Aerial bark herbicide application using a wand** In the second example we compared the new method of aerial bark herbicide application using a wand compared with the previous best practice of skid hopping. For the operational setting we used *P. contorta* on steep high altitude tussock grasslands and regenerating shrubland in the North and South Island high country. In this setting the trees were widely scattered outliers and the terrain was often difficult to access on foot. This method is described in full detail in a set of guidelines (Raal 2013). The new method involves applying herbicide from a helicopter with an operator using a wand located beneath the helicopter to apply the herbicide (Figure 3). The herbicide used is the same mixture that is used for ground based basal bark

herbicide application. The herbicide is applied to the bark and upper stem branches in sufficient quantity so that it runs down the trunk to the ground. Due to precision placement and herbicides used, very little damage is caused to the surrounding vegetation. This method works best on *P. contorta* under 10 m in height but will kill trees of any size if sufficient herbicide is applied (Raal 2013).

**Herbicide application using aerial boom spraying** In the third example we compared the new herbicide formulation applied by aerial boom spraying (Figure 4) with the previous best practice of clear felling with chainsaws. For the operational setting we used dense stands of mature *P. contorta* with a canopy closure greater than 80%. The herbicide formulation is a combination of triclopyr, dicamba and picloram applied at 400 L ha<sup>-1</sup> and a droplet size of 350 microns. The formulation combines translocating herbicides with added oil to remove the pine needle waxy cuticle to enable entry of the herbicides. It is important to apply the correct droplet size and quantity of herbicide. This method is described in full detail by (Gous *et al.* in prep).



Figure 3. Aerial application of herbicide using a wand.



Figure 4. Aerial boom spraying a dense stand of wilding conifers.

## RESULTS AND DISCUSSION

**Ground based basal bark herbicide application**

Staff reported they can now cover two to five times the area treated with the new method in suitable areas compared to the previous methods that were employed. Depending on tree density, staff can now apply herbicide to three to ten times the number of trees when compared to previous methods. In the past using traditional physical control methods it took between 60 and 300 seconds to treat an individual tree, it now takes less than 20 seconds. Those applying the ground based basal bark herbicide applications reported that they do not become as fatigued as they did when using the traditional control methods which were more physically demanding. This contributed to improved productivity. In one operation near Twizel (Central South Island high country) a 30 hectare area was treated using the new basal bark method. It took contractors two and a half days to complete the work. With the same number of contractors using traditional methods this work was estimated to take greater than ten days to complete. Most staff are now using a pre mixed herbicide formulation called X-Tree Basal™ marketed by ETEC Crop Solutions Ltd. This saved time as well as eliminating the need for staff to mix their own herbicide formulations.

**Aerial bark herbicide application using a wand**

Staff reported they can now cover two to seven times the area treated with the new method compared to the previous method of skid hopping. Staff commented that aerial spot treatment of trees was less dangerous than skid hopping. This was because staff did not have to get out of and back into the helicopter with equipment such as chainsaws. This activity often occurred in difficult terrain and with the helicopter hovering close to ground level.

**Herbicide application using aerial boom spraying**

Staff reported they can cover two to five times the area treated using boom spraying compared to previous method of felling trees, given the same funding. The cost of herbicide application was estimated to be approximately \$2000 ha<sup>-1</sup>. In comparison staff estimated the cost of removing *P. contorta* using clear felling ranged from \$4000 ha<sup>-1</sup> on easier sites and up to \$10,000 ha<sup>-1</sup> on difficult sites. Staff commented that they now had a reliable control method that provides consistently good kill rates of 90%. A single follow-up spot spray two to three years after the boom spray operation was all that was required to kill any remaining trees. Another advantage reported was that large operational areas could now be treated in very short time periods. For example, the time

taken to boom spray a hectare of wilding conifers takes less than 10 minutes. By comparison, using chainsaw felling (\$6000 ha<sup>-1</sup> and a contractor rate of \$40 an hour) it would take approximately 150 hours to complete the work.

## CONCLUSION

The development of three new innovative techniques for wilding conifer control has proven to be remarkably effective in terms of cost, time, safety, and impact on the environment. The development of the new methods was needed to allow the ongoing control of wilding conifers in New Zealand to be sustainable in the short and long term. Managers funding wilding conifer control will be more confident in allocating resources to wilding conifer control work. Aerial boom spraying now provides a reliable method for removing large seed source infestations that were previously too expensive to remove. These methods will continue to be used and refined in the successful management of wilding conifers in New Zealand.

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