FUTURE FORESTS RESEARCH

RADIATA MANAGEMENT TECHNICAL NOTE

Site Productivity

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Understanding and Managing Weed Risks: Progress To Date

Summary

Research implemented to date for Objective 1 of the new vegetation management programme is described. This work includes trials designed to define the parameters of weed growth models for broom and buddleia that are sensitive to current and alternative (FSC-compliant) vegetation management strategies.

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Introduction

Two objectives drive research in the vegetation management programme:

Objective 1: *Understanding & Managing Weed Risks*. Determine the effect of management systems on the development of weed population dynamics in the short and long term.

Objective 2: *Sustainable Weed Control Treatments.* Provide forest managers with cost-effective, environmentally sensitive and scientifically robust weed control options.

This technical note briefly describes the research planned and implemented to date to meet Objective 1. The current focus is on the development of models to understand population dynamics of difficult-to-control weeds, particularly broom and buddleia. Terbuthylazine and hexazinone, the most commonly used herbicides in New Zealand forestry, are banned by FSC due to their leaching potential. Derogations are in place to 2010, after which alternative methods of vegetation control will have to be used. The models will be sensitive to the effects of current and alternative (FSC-compliant) herbicides, over-sowing and biocontrol on growth and development of broom and buddleia.

Management of Buddleia

Buddleia davidii is a major weed of exotic and indigenous forests in New Zealand. Rapid, early growth of *B. davidii* allows it to suppress newly planted *P. radiata,* causing growth loss and mortality. Alternative management strategies for the control of buddleia include the use of biocontrol and over-sowing.

Cleopus japonicus, a leaf-feeding weevil, was released in September 2006 for biocontrol of *B. davidii*.

Successful control of *B. davidii* by *C. japonicus* could lead to a reduction in the use of herbicides. This would help forestry companies to comply with current requirements for FSC certification, and may also reduce vegetation management costs. Potential benefits from the weevil will be largely determined by its ability to colonise the site following tree planting. To be useful to forestry, *C. japonicus* need not eliminate *B. davidii*, because simply reducing the vigour of *B. davidii* may provide a competitive advantage to the trees. Several field trials have been established by Michelle Watson (Scion) during 2008 and 2009 to assess the effect of *C. japonicus* on *B. davidii* seedling growth. These trials are designed to test:

- The rate at which *C. japonicus* moves from mature buddleia to juvenile host plants in recently felled compartments, and the distance covered within a season.
- The effect of *C. japonicus* on *B. davidii* growth rate.
- Whether *C. japonicus* reduces the negative effects of *B. davidii* on early tree growth.
- The effect of herbicides on survival of *C. japonicus* larvae and adults.

Two field trials will be implemented in 2009 to investigate the impact of over-sowing with Yorkshire fog grass on buddleia regeneration. The aim of the over-sowing trials will be to quantify the specific effects of over-sowing on buddleia regeneration and growth rate (as well as its effectiveness as a vegetation management tool) over a two-year period.

A basic population dynamics model for buddleia that accounts for interactions with *C. japonicus,* has been developed (Kriticos *et al*., 2009). The model indicates that while *C. japonicus* is likely to have significant impacts on *B. davidii* population growth, climate could affect the severity of impact. Reduced impacts are predicted at cooler sites, such as Taupo or in the South Island. The model will be upgraded to include the effect of management, and the rate at which *C.japonicus* disperses into the forest, as the results from the over-sowing and biocontrol trials become available.

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Management of Broom

Trials have also been implemented to define the parameters of a population dynamics model sensitive to the effects of current and alternative management regimes on broom development and spread. Two dose-response trials were implemented in September 2008 to investigate the efficacy of Versatill (active ingredient clopyralid) and Tordon Brushkiller XT (active ingredients triclopyr, picloram and aminopyralid) for the control of broom (Watt, 2009). Clopyralid, picloram, triclopyr and aminopyralid are all systemic, effective against a range of broadleaf weeds, and are not currently banned by FSC. Treatments were structured to test the effect of both the rate and timing of application of the herbicides on tree and weed (broom) growth following planting and up to canopy closure.

Results obtained four months after treatment indicate that a mixture of Versatill and Tordon Brushkiller XT applied at between 50-75% of the full operational rate of 5.0 L/ha Versatill and 0.5 L/ha Tordon Brushkiller XT (with 0.5L/ha Pulse) provides suitable control of broom with minimal phytotoxicity to newly established radiata pine. However, at the full operational rate of 5.0 L/ha Versatill and 0.5 L/ha Tordon Brushkiller XT, tree growth was significantly reduced to below that of the most widely used treatment (Valzine applied at 20 L/ha). Given that the operational strength Versatill/Tordon combination was most effective at killing broom, this result suggests that the operational strength mix has a phytotoxic effect on the trees. Dose-response experiments are currently under way and will be analysed in the near future to determine if this particular herbicide has phytotoxic effects on the trees at operationally applied strengths.

If continued monitoring of field trials confirms that the Versatill/Tordon combination is an effective alternative to Valzine for controlling broom, there will need to be further research to ensure that this treatment can be broadly applied. As this herbicide combination does not control grasses, a suitable herbicide for the control of grasses that is FSC approved will need to be added and tested.

Research has also been undertaken to identify alternatives to herbicide application for control of broom. An over-sowing trial was implemented in 2008 at Massey University by the doctoral student Hop Tran, using a range of different grasses sown at varying rates during both autumn and spring. Latest results obtained during April 2009 indicate that over-sowing is not an effective means of controlling broom when grass is sown as the same time as the broom. However, results clearly show that if broom is sown 6 months after the grasses, the over-sowing completely prevents broom germination. This result may have management implications, and further work will be conducted to determine if a cost-effective management treatment can be formulated and tested.

Research is also being undertaken by Hop Tran to identify the role the seed bank plays in the establishment of broom following clearfelling. At the Tree Farm near Bulls, the viability of broom seed in adjacent stands aged 2, 9 and 30 years was assessed. Results showed there were approximately 1700 seeds/m^2 in the 2-year-old stand, which rose to approximately 11,800 and 9,600 viable seeds/m^2 respectively in the 9- and 30-year-old stands. These results suggest that rotation length cannot be used as an effective means of reducing broom competition in subsequent rotations. However, further research will need to be undertaken to confirm that this result applies to wetter sites, where seed decomposition is likely to be more rapid.

Concluding Comments

If successful, the current and planned trials will provide both valuable understanding of the key issues underpinning the development of models as well as practical, effective, alternative vegetation management strategies. We encourage members of the forest industry to keep in touch with the researchers involved so that the trials remain applicable to current operational practices, and provide a practical and environmentally sound way forward.

References

Kriticos, D.J. *et al* (2009). Modelling the likely impacts of a weed biological control agent. IUFRO International Forest Biosecurity Conference 16-20 March, Rotorua. Popular Summaries, Scion, New Zealand.

Watt, M. (2009). Weed competition research. Results presented at FFR Radiata Management Theme Members Meeting, Christchurch. Future Forests Research.