Research request: Quantifying impact and effectiveness of basal bark spray application of herbicide on invasive alien pine trees

Background

Invasive alien pine trees constitute one of the major threats to the indigenous biota of the Cape floristic region through overcrowding/competition, alteration of fire and water regimes and their very extensive invasion over this region. There are ongoing control operations for this group of trees that primarily consist of mechanical methods such as felling. However there is an urgent need to improve the rate and efficiency of control measures to achieve success in mitigating this threat (van Wilgen et al. 2013, McConnachie et al. 2012). There are many areas in the Western Cape, particularly in the Cape Fold Mountains where small numbers of pines in difficult to access sites supply a continuous supply of new seeds, leading to reinvasion of cleared areas and invasion of new areas.

Improvement in control efficiency and effectivity has been achieved in New Zealand (Gous et al. 2014) through the application of herbicide to the bark of pines which can be applied from either helicopters and ground-crew equipped with backpacks with herbicide applicators. These methods are very time efficient as all that is required to kill a pine tree is a single spray of herbicide and by using an extended wand from a helicopter difficult to access trees become accessible for control (Gous et al. 2014). CapeNature has conducted a preliminary trial to assess this method and found that a formal research project on this method is warranted for application in South Africa. The results of this research will allow the Department of Environmental Affairs to consider licensing the herbicide/s for aerial application for the control of pines and will allow CapeNature to evaluate the relative effectiveness and impact on indigenous biodiversity and set operational guidelines for the applicability and use of this method. For this research a minimum of two seasons of field data are required.

To this end CapeNature requests that research be undertaken to formally assess this method by answering the research questions posed below.

Research questions

What is the effect of aerial and ground-based application of a directed stream of herbicide (with triclopyr butoxyethyl ester as an active ingredient) on pines, in particular the species *Pinus pinaster* and *Pinus radiata*?

What are the optimum dosages and for effective control? In other words, does the recommended 20% triclopyr concentration (120g/l) as per the New Zealand Department of Conservation Basal Bark Application guidelines (New Zealand Department of Conservation 2012) suffice and if so can it be reliably reduced?

What are the effects of these treatments on indigenous flora around the pines? This will require monitoring plots of vegetation before and after the treatment of pines to measure effect on individual plant health and species composition.

How much time do these basal bark spraying methods take?

Equipment and support

The following equipment and services will be supplied by CapeNature and WWF's Table Mountain Fund:

Helicopter with a minimum of a 300 litre herbicide tank with pilot and flying time.

Extended application wand to allow spraying from helicopter.

Backpack with pressurised herbicide container and application wand.

New Zealand Department of Conservation guidelines on basal bark spraying methods.

CapeNature will assist the researcher/s to access study sites.

The Department of Agriculture, Forestry and Fisheries Herbicide Trials Guidelines and the New Zealand Department of Conservation Best Practice Guidelines for Basal Bark Spraying & Aerial Basal Bark Application using Triclopyr are available on request. Additional reading on this methods and its application elsewhere can be found on the New Zealand Department of Conservation website http://www.doc.govt.nz/ and http://www.wildingconifers.org.nz/.

Funding

CapeNature has sourced funding through the TMF to cover four hours of flying time. If additional flying time becomes necessary during the course of the study CapeNature will make additional applications to cover such cost up to a maximum of another 2 hours flying time. This means that preparation before flying needs to be meticulously planned and the helicopter-based trials executed in the most efficient manner possible.

Sample sites

It is estimated that a minimum of fifteen trees need to be subjected to each treatment. If three different concentrations of one herbicide brand are applied this would translate to 15 * 3 * 2 * 1 = 90 trees. Half of these would require aerial treatment which gives 240 min/45 = a maximum available time of 5 minutes and 20 seconds per tree. Consideration should be given to increasing sample sizes if time and budget allow.

Time lines

Given the requirement for two seasons of data this research should fit with the standard timelines of an MSc project. The project should commence as soon as possible in 2017. The final research findings in the form of a manuscript suitable for publication in an applied scientific journal and a summary report to CapeNature management should be delivered within two years of the study commencing.

References

Gous, S., Raal, P. and Watt, M.S. 2014. Aerial spot treatment using an oil carrier to apply ester based herbicides for control of *Pinus contorta* and *P. nigra* in New Zealand. New Zealand Journal of Forestry Science 44:23. doi:10.1186/s40490-014-0023-6

McConnachie, M.M., Cowling, R.M., van Wilgen, B.W. , McConnachie, D.A. 2012. Evaluating the cost-effectiveness of invasive alien plant clearing: A case study from South Africa. Conservation Biology: 155: 128–135.

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CapeNature Contacts

Dr Andrew Turner

e-mail: aaturner@capenature.co.za

tel: 021 866 8000