Increasing success of tree establishment by using seasonal climate forecasts

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Location: ACT, QLD, VIC, NSW, SA, WA

Principal investigator

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The need

Over the last 20 years, Australia has seen considerable effort in tree planting for natural resource management outcomes and economic gain. Despite this, little data or information has been rigorously collected on the success or failure of tree plantings, especially within the first six to 12 months. In the same period of time that tree plantings became more popular, seasonal climate forecasts have developed significantly and have proved useful for agriculture. Climate variability also has the potential to influence risk of failure in the revegetation industry, through drought, frost, and other factors. This project is addressing the question: can revegetation success be improved through the use of climate information?

How this project fits with MCV objectives

This project is aligned with the MCV objective to increase adoption of climate risk management in natural resource management. If we find that seasonal climate forecasts and climate change information are useful for improving the success of revegetation outcomes, we will develop products to assist revegetation practitioners and landholders in their tree establishment decisions. We will develop these products in conjunction with practitioners and landholders to ensure that the products are tailored to meet their needs.

Project objectives

The overall objective is to assess whether incorporating climate information into tree planting decisions will improve on-the-ground establishment outcomes. Sub-objectives are to:

1. develop relationships between climate-related factors and tree establishment success based on both empirical and modelling data
2. use these relationships to predict occurrence of conditions that are conducive to successful establishment and vice versa
3. reassess functional groupings of tree species and their utility for planning
4. use a range of climate change projections to explore the potential impacts of climate change on future establishment strategies and species choice
5. if appropriate, develop strategies to reduce risk of establishment failure from climate-related factors and provide simple and effective tools for their implementation
6. engage with revegetation practitioners to identify barriers and synergies, and develop pathways for adoption

Methods

1. Conduct intensive field experiments in the ACT and QLD to develop a coherent data set on survival and growth of eucalypts in response to soil moisture limitations
2. Collect climate and management data on revegetation activities in north-west Victoria, south-west WA, north-east NSW and south-west SA

3. Analyse the ACT and QLD data to further develop the relationships between success and climate-related stress developed during the CVAP project. This data will be used to develop a tree establishment module in CSIRO's Agricultural Production Systems Simulator (APSIM). The data from Victoria, WA, NSW and SA is expected to be used to validate the model.
4. Use APSIM to assess the potential benefit of using various statistical climate forecasting systems for tree planting decisions
5. 'Road-test' the results with revegetation and forestry practitioners to: assess the credibility and the utility of this information; identify barriers to incorporating this information into regional NRM decisions; identify how they would incorporate this information into planning and to improve decision-making
6. If appropriate, develop a simple decision-support tool to assist planning the timing, extent and management of revegetation projects given specific seasonal climate forecasts
7. Develop further the guidelines previously developed under CVAP if stakeholders consider them useful
8. Analyse the potential impacts of climate change on establishment success using APSIM
9. Apply new parameters and findings to the national prototype map of establishment risk developed during the CVAP project
10. Communicate the results

Desired outcomes

> To contribute to the development of tree survival and growth models by developing a model on early seedling establishment (i.e. less than one year), based on the data collected above, as this is an area which has been largely overlooked in existing models

> To assist on-the-ground tree planting outcomes by developing a tool that landholders, revegetation and forestry practitioners can use to ascertain the impact of likely future climatic conditions on their tree establishment projects so that they are able to make more informed decisions

Achievements to date

The intensive field experiment in the ACT has provided data that will be useful in describing some simple relationships between seedling establishment in the field and soil moisture levels.

The significance of a soil profile full of water at planting was greater than expected, and its importance for ensuring establishment success will be further tested in later experiments.

The experiment has also showed that even relatively minor differences in rainfall and, hence, soil moisture stress, can influence at least the health, if not the mortality, of eucalypt seedlings. Soil moisture stress also influenced seedling growth, biomass and allometry; however, it is important to note that the extent of this impact depended upon the species and the parameter being examined. Species choice is a fundamentally important determinant of seedling establishment success.

What is left to do?

The intensive experiment in Toowoomba has just begun (seedlings were planted on 20 February 2005) with monitoring of the seedlings to be conducted over the coming months.