Appendix 1

Summary of Research and Development Projects on Maritime Pine

R Harper

1 INTRODUCTION

Objectives of the Maritime Pine research and development projects are to develop a system which allows the insertion of trees into farmland in the <600 mm rainfall zone.

This will be achieved by:

- optimizing the growth performance of trees by determining the best establishment techniques and best management practices
- determining the best distribution of trees to maximise their water use and thus salinity control.
- devising practical management strategies which optimize the profitability and sustainability of trees established on farmland.
- devising strategies which take into account present and future risks to farm forestry from pests and diseases.
- Developing a co-operative Western Australian approach to farm forestry R&D, developing joint funding proposals to prospective sources with partners from other institutions (e.g. Universities, Agric WA).

These projects are those which are specifically related to Maritime Pine. Thus, while CALM does not have currently have specific projects on topics such as pests and diseases or fire control, specialist scientists have research programs underway in these areas in the native forest and hardwood plantation programs.

2 TREE BREEDING AND GENETIC DEPLOYMENT

2.1 Tree breeding

Trevor Butcher

2.2 Development of Pinus pinaster *genetic deployment*

Project objectives:

- To develop reliable vegetative propagation methods for *P. pinaster*
- To develop an accelerated control pollination orchard for the production of high genetic value seed

- To establish field trials comparing seedlings with various vegetative propagation methods developed
- To monitor the growth and survival of these trials after planting and after one and two years of growth
- To continuously monitor the water relations for early signs of physiological stress created by the propagation method
- To observe the root structure of plants produced from the different propagation methods

3 SITE EVALUATION

3.1 Maritime pine yield study

Objective is to develop models to predict site quality, growth and yield of Maritime Pine on farmland in south-west Australia. Input variables (mostly obtained from field measurements on 180 study plots) are site conditions (climate, soils, landform) and management factors (planting layout, genetics, silviculture). (National Heritage Trust/CALM funding)

3.2 Site evaluation standards

Provision of objective physical resource (soil, geomorphological and hydrological) information to the Maritime pine project. This project has resulted in site selection methodology and standards for Maritime pine plantations. These are reviewed as necessary.

Assess value of remote sensing and geophysical techniques in predicting development of salinity and optimising tree placement. Small research projects that have taken place in this program include an evaluation of gamma-radiometrics to survey soils (with CSIRO Land & Water) and an evaluation of EM38 meters for salinity prediction (with Curtin University).

3.3 Regional evaluations

Estimates of areas of land suitable for maritime pine using regional data sets and Geographic Information Systems have been made with CALM Information Management Branch).

4 ESTABLISHMENT TECHNIQUES FOR *PINUS PINASTER*

4.1 Weed control

Project objectives:

- To develop a system to control broadleaved and grass weeds amongst trees that are newly planted on farmland.
- To develop a system to control weeds amongst trees in the season after planting.

4.2 One-pass planting system

Project objectives:

The main objective is to develop a system [1] (or systems) to establish deep-rooted perennial vegetation on cleared farmland at the lowest possible cost. The project aims to provide the incentive to individuals or organisations to develop a one-pass planting system within stipulated environmental and silvicultural specifications. Such a system should provide:

5 SILVICULTURAL SYSTEMS

5.1 Plant Nutrition and water use

Nutrient requirements and stand densities to optimize growth and survival. Develop an understanding of the interaction between stand density, fertilizer inputs and tree performance.

CALM has a range of fertilizer trials which are assessing the nutrient requirements of Maritime pine across the range of soils in the 400-600 mm rainfall zone.

Experiments include:

- 7 nitrogen x phosphorus x potassium
- 2 rates of nitrogen
- 1 rate of phosphorus
- 1 trace element rates

Four trials are assessing the interaction between fertilizer inputs, thinning regimes and water use. These have been established in a joint project with The University of Western Australia, with CALM and Australian Research Council Funding.

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[1] A system is likely to be a machine where options for different soil preparation methods, weed control methods, fertilising methods and planting capabilities are integrated such that only one visit to a site will be necessary to establish vegetation on cleared farmland.

One trial is assessing the use of heat pulse methodology to measure sap flow in pine spp to assess water use.

5.2 Ultra-short-rotation agroforestry (USRA) system, for low rainfall areas

Evaluation of an ultra-short-rotation agroforestry (USRA) system, for low rainfall areas, which de-waters landscapes at risk from salinity while producing commercial wood fibre. Outcomes will include a scoping study and a feasibility demonstration to landholders. The system will result in the utilization of a resource which is currently contributing to environmental problems and more sustainable agricultural systems. (Rural Industries Research & Development Corporation/CALM/CSIRO Land & Water/The University of WA).

5.3 Optimizing tree placement for tree performance and salinity control

Development of a system for integrating trees into farming systems in the <600 mm rainfall zone including that optimizes water use and profitability, via determination of the best planting locations and layouts. (National Heritage Trust/CALM/CSIRO Land & Water/The University of WA/Agriculture WA).

6 CARBON SEQUESTRATION STUDIES

6.1 Maritime Pine biomass and carbon study

Involves extensive destructive sampling of plots of Maritime Pine trees (tops, roots and litter) to measure stand biomass and stemwood volumes. Objectives are: (1) Develop allometric equations to reliably predict tree carbon content and from easily measured independent variables such as stem diameter and tree height; (2) Develop stand level empirical model of carbon sequestration by Maritime Pine on farmland.