

Project Plan SP 2011-020

**Long-term stand dynamics of regrowth forest in
relation to site productivity and climate**

BCS Ecosystem Science

Project Core Team

X X **Supervising Scientist** Lachie Mccaw
Data Custodian

Project status as of Jan. 18, 2024, 3:21 p.m.

X X Update requested

Document endorsements and approvals as of Jan. 18, 2024, 3:21 p.m.

X X
Project Team granted
Program Leader granted
Directorate granted
Biometrician required
Herbarium Curator not required
Animal Ethics Committee not required

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Program

BCS Ecosystem Science

Departmental Service

Service 8: Implementation of the Forest Management Plan

Project Staff

X X X **Role Person Time allocation (FTE)**

Research Scientist Richard Mazanec 0.2

Related Science Projects

This plan has been developed to update previous silvicultural SPPs 1993-106 and 1993-107.

Proposed period of the project

None – None

Relevance and Outcomes

Background

This Science Project Plan will provide information to underpin the management of karri stands in the immature stage of development (25-120 years old). Immature stands regenerated following timber harvesting and bushfire comprise more than 50 000 ha and represent around one third of the area of karri forest managed by DEC. Significant areas of regenerated karri forest have been included in conservation reserves following changes in land tenure from State forest. Regenerated karri stands have important values for future timber production, biodiversity conservation and as a store of terrestrial carbon. There are a number of well designed experiments established under previous SPPs 1993-106 and 1993_107 that investigate the dynamics of naturally regenerated and planted stands managed at a range of stand densities. These experiments span a range of site productivity and climatic gradients in the karri forest, and have been measured repeatedly over a period of several decades (McCaw and Rayner 1995), providing important information to support and improve management practices (CALM 1997, DEC in prep.). This project will draw on existing comprehensive data sets and re-focus the work on emerging issues likely to be of growing importance in the next decade. These issues include: * climate change and declining groundwater levels interactions with current and emerging pests and pathogens (Robinson 2003, 2005; Robinson et al. 2004) * increased recognition of the role of forests in maintaining global carbon cycles * long-term ecological dynamics in silviculturally regenerated stands (McCaw 2006).

Aims

To quantify the response of immature karri stands to management practices that manipulate stand density at establishment or through intervention by thinning. Responses will be measured by tree and stand growth, tree health and other indicators as appropriate (eg. leaf water potential, leaf area index)

Expected outcome

Knowledge of stand dynamics and growth, water relations and forest health to underpin the development of management strategies for regenerated forests.

Opportunity for adaptive management in response to climate variability and potential threats to forest health, particularly Armillaria root disease.

Knowledge transfer

DEC Sustainable Forest Management Division. Conservation Commission of WA, and the broader community via the Forest Management Plan. Knowledge will be transferred by publication of important findings in scientific paper, technical reports and more popular forms including Landscape articles.

Tasks and Milestones

April 2012 – complete 5 yearly periodic re-measurement of growth and Armillaria root disease impact at Warren block experiment;

June 2012 – final draft of technical paper presenting results from initial espacement studies at Nairn and Wheatley;

December 2012 – design for second thinning of 6 plots at Warren block prepared, and necessary approvals gained for inclusion in the 2013 harvesting plan;

April 2013 – complete second thinning, and follow-up assessment;

April 2017 – 5 yearly periodic re-measurement of growth and Armillaria root disease impact at Warren block experiment

June 2018 – report on response to second thinning

References

CALM (1997). Enhancement of timber productivity in native forests. Report prepared by L. McCaw for the Regional Forest Agreement for Western Australia, October 1997.

DEC (in prep.) The karri forest of Western Australia. Silvicultural Reference Manual prepared by F.J. Bradshaw.

McCaw, W. L. (2006). *Asplenium aethiopicum* recolonises karri forest following timber harvesting and burning. *Journal of the Royal Society of Western Australia* 89: 119-122.

McCaw, L. and Rayner, M. (1995). Research for management of regrowth karri forest in Western Australia. *Institute of Foresters of Australia Newsletter* 36, 2-6.

Robinson, R.M. 2003. Short-term impact of thinning and fertilizer application on Armillaria root disease in regrowth karri (*Eucalyptus diversicolor* F. Muell.) in Western Australia. *Forest Ecology and Management* 176: 417-426.

Robinson, R. M. 2005. Volume loss in thinned karri regrowth infected by Armillaria luteobubalina in Western Australia. In: Manka M. and Lakony, P. (eds) *Proceedings of the 11th IUFRO International Conference on Root and Butt Rots of Forest Trees.*, Poznan and Bialowieza, Poland, August 16-22, 2004. The August Cieszkowski Agricultural University, Poznan, Poland: pp. 296-303.

Robinson, R.M., Williams, M.R. & Smith, R.H. 2004. Incidence of Armillaria root disease in karri regrowth forest is underestimated by surveys of above-ground symptoms. *Australian Forestry* 66: 273-278

Study design

Methodology

Initial experimental design was three thinning densities (200, 400, 600 stems ha⁻¹ retained, ± coppice control) and unthinned controls replicated four times. Total number of plots is 28. Each plot is 50 m x 50 m, with tree measurements within a 30 m x 30 m sub-plot. Standard measurements include stem diameter (dbhob), height, crown radii (N, E, S, W), and the extent and characteristics of Armillaria scarring on the stem.

A further thinning is proposed for the 6 plots located north of Barker Rd which includes 2 replicates of each retained density. Second thinning will follow Silvicultural Guideline 1/92 karri thinning which species retention of 24 m² ha⁻¹ for stands with a codominant height of 45-50 m. This will result in percentage reductions in basal area of approximately 45% in the 200 stems ha⁻¹ plots, 55% in the 400 stems ha⁻¹ treatment, and 65% in the 600 stems ha⁻¹ treatment. Growth responses will be compared with plots on the southern side of Barker Rd which include unthinned controls and plots thinned once at age 13. Expression of Armillaria root disease will monitored annually in the second thinned plots to determine whether there is a change in response to thinning. A sample of stumps and trees felled and removed during second thinning will be examined in detail to assess the extent of scarring and level of infection by Armillaria.

Second thinning will provide the opportunity to compare leaf water potential and other measures of tree physiological condition in relation to stand density. This will be contingent on collaboration from external scientists from universities or CSIRO with expertise in these disciplines.

Sutton and Treen thinning experiments

The Treen Brook experiment was established in 1985 in even-aged karri forest regenerated in 1933. The experimental design has four thinning densities (10 m² ha⁻¹, 15 m² ha⁻¹, 20 m² ha⁻¹ and 30 m² ha⁻¹ retained) each replicated six times, and five unthinned controls. Total number of plots is 29. Each plot is 50 m x 50 m, with tree measurements within a 30 m x 30 m sub-plot. Standard measurements include stem diameter (dbhob), height, crown radii (N, E, S, W). All plots were measured in 1985, 1988, 1990 and 1995.

The Sutton experiment was established in 1991 in even-aged karri-marri-jarrah forest regenerated in 1969 on a site at the lower rainfall margin of the karri distribution. The experimental design has five thinning densities in karri dominant plots ($7 \text{ m}^2 \text{ ha}^{-1}$, $10 \text{ m}^2 \text{ ha}^{-1}$, $13 \text{ m}^2 \text{ ha}^{-1}$, $16 \text{ m}^2 \text{ ha}^{-1}$ and $20 \text{ m}^2 \text{ ha}^{-1}$ retained, \pm coppice control) and unthinned controls each replicated twice. Treatments in marri dominant plots are $10 \text{ m}^2 \text{ ha}^{-1}$, $15 \text{ m}^2 \text{ ha}^{-1}$ and $20 \text{ m}^2 \text{ ha}^{-1}$ retained (all with coppice control) and unthinned controls each replicated twice. Total number of plots is 27. Each plot is $50 \text{ m} \times 50 \text{ m}$, with tree measurements within a $30 \text{ m} \times 30 \text{ m}$ sub-plot. Standard measurements include stem diameter (dbhob), height, crown radii (N, E, S, W). Detailed vegetation species composition and soil data were collected at the time of establishment. All plots were measured annually between 1991 and 1997, and again in 2002 and 2010.

Results from periodic assessments at both sites have been collated and initial analysis undertaken. It is proposed that results from these trials will be analysed jointly and a technical report with management recommendations prepared. The need for ongoing measurement and further treatment of these experiments will be decided on this analysis is complete. The Sutton experiment has potential to provide important long term information about stand dynamics and ecological interactions in mixed species stands that are likely to be experiencing drought stress following the current extended period of below average rainfall.

Nairn and Wheatley spacing trials

The Nairn trial was established in 1982 with four initial planting densities (2500, 1250, 825, 500 stems ha^{-1}) each replicated twice in two blocks. The Wheatley trial was established in 1991 and uses a Scotch Plaid design with nine initial planting densities (5000, 4000, 3333, 2500, 2000, 1667, 1250, 1000, 833 stems ha^{-1}) each replicated once in four blocks. Standard measurements include stem diameter (dbhob), height, branching, and bole length.

Results from periodic assessments at both sites have been collated and initial analysis undertaken. It is proposed that results from these trials will be analysed jointly and a technical report with management recommendations prepared. The need for ongoing measurement of these trials will be decided on this analysis is complete.

Biometrician's Endorsement

required

Data management

No. specimens

Herbarium Curator's Endorsement

not required

Animal Ethics Committee's Endorsement

not required

Data management

Data will be managed as part of the silvicultural records held at the Manjimup Research Centre. Hard copy records held at: Manjimup Research Centre. Electronic data stored on: manj-file-013\T\532-Forest & Tree Crops Group\Shared Data\Lachies data\Silviculture. Backup copy stored at: manj-file-015\532-Forest & Tree Crops Group\Shared Data\Lachies data\Silviculture.

Budget

Consolidated Funds

to | X | X | X | X |
Source Year 1 Year 2 Year 3

FTE Scientist

FTE Technical

Equipment

Vehicle

Travel

Other

Total

External Funds

to | X | X | X | X |

Source Year 1 Year 2 Year 3

Salaries, Wages, Overtime

Overheads

Equipment

Vehicle

Travel

Other

Total
