Economic Aspects of Plantation Forestry in Low Rainfall Areas of the New England-North West Region

Introduction

This leaflet provides some general information on the economic aspects of growing commercial plantations on farms in low rainfall areas of the New England - North West region. There is little commercial information available on this topic, and as such, the leaflet simply provides an overview of some existing data from a number of sources such as NSW Agriculture, the Rural Industries Research and Development Corporation, the Australian Greenhouse Office, and the Murray-Darling Basin Commission.

Commercial plantation forestry on a large scale is a relatively new concept in low rainfall areas of Australia, and is still very much an emerging industry. Recent interest has been driven by an increasing awareness of the effects of environmental degradation on productive rural lands, and the role that strategic broad-scale tree planting in conjunction with other land management measures can play in addressing such decline.

'Revegetation and land use change over large areas in the mid to low rainfall regions of southern Australia in the form of commercial forestry and agroforestry, is vital to sustained natural resource management'

Australian Greenhouse Office and Murray-Darling Basin Commission, 2001

Management regimes and production potential of commercial plantation forestry in low rainfall areas are likely to be significantly different to those carried out in the higher rainfall 'traditional' forestry regions of the coast and the tablelands.

Due to the infancy of the industry, there is uncertainty regarding growth rates, product yields, markets and prices. Productivity and profitability of commercial plantation forestry in the low rainfall areas are generally likely to be lower than 'traditional' plantations, primarily due to lower growth rates, a different range of species and products, a lack of established forestry processing infrastructure and often a further distance to markets. This situation may change, however, if a system of environmental credits is developed, whereby landholders are paid through government / community / investor initiatives to grow large areas of trees that will contribute towards a positive 'landscape' impact and environmental remediation.

The current situation and future potential in the New England

A large portion of the New England - North West region lies within the Murray-Darling Basin, and is potentially threatened by salinity and other associated environmental problems. A number of low rainfall plantation trials have been established by various organisations throughout the Murray Darling Basin, including the New England - North West. Greening Australia, the former New England Regional Plantation Committee (now the New England - North West Forestry Investment Group), NSW Agriculture, the Department of Land and Water Conservation and individual farmers have established a large number of small trial plots across the region investigating species suitability, establishment techniques, spacing and plantation configuration.

State Forests of New South Wales has led the larger-scale low rainfall plantation initiatives with three major programs. A 'pilot salinity control trade agreement' has been developed with Macquarie River Food & Fibre (MRFF), whereby State Forests is planting 100 hectares of trees in the Upper Macquarie catchment and MRFF pays a fee for the transpiration service provided by those trees. The trees are established on private land and landholders receive an annuity, while State Forests own the forestry and carbon rights. The pilot trade is one example of a simple market-based approach to addressing the problem of dryland salinity and water quality. This is only a small-scale example in the scheme of the problem, and this type of initiative would need to be implemented over a larger area to have a notable impact.

State Forests has also planted approximately 45 two hectare demonstration and species trial sites in key salinity-prone catchments of the Murray-Darling Basin. A number of these are in the New England - North West region. In addition, State Forests is in the process of planting 400 hectares of trees in the Liverpool Plains as an operational scale trial, funded under the *NSW Salinity Strategy*.

There are a number of species under investigation in the various trials being carried out, including:

Mugga ironbark *(E. sideroxylon)*
Queensland western white gum *(E. argophloia)*
River red gum *(E. camaldulensis)*
Spotted gum var. *(Corymbia variegata)*
Spotted gum var. *(C. maculata)*
Sugar gum *(E. cladocalyx)*
Yellow box *(E. melliodora)*
E. camaldulensis x E. grandis and
E. camaldulensis x E. globulus
Black wattle *(Acacia mearnsii)*
Maritime pine *(Pinus pinaster)*

Commercial production from plantations in low rainfall areas

A range of products that could potentially be sourced from plantations growing in low rainfall areas, including saw logs, composite wood products, environmental credits, carbon credits, firewood, biomass for energy production and liquid fuels, activated carbon, charcoal, eucalyptus oil, tannin, seeds and fodder.

Economic analyses carried out by a number of organisations have revealed that it is unlikely that plantation forestry in the low rainfall areas will be financially viable as a stand alone enterprise if established for the traditional purpose of wood production. It is expected that an integrated production approach is required whereby the financial benefits gained from the plantation are derived from the sale of a product as well as from another means such as environmental credit payments.

NSW Agriculture (2001) modelled an intensively managed one-hectare eucalypt plantation grown on the Liverpool Plains where a commercial thinning operation was undertaken in year 8 for firewood and a final harvest for sawlogs was carried out in year 30. Table 1 lists the key production parameters that were utilised in the modelling exercise.

The exercise demonstrated that even in the best case modelled scenario (when growth rates and prices are highest and costs are lowest), farm forestry carried out in isolation to any other enterprise is only marginally profitable with a net present value (NPV) of $135/ha. In the base case and worst case scenarios, the NPV is negative, indicating that farm forestry makes a loss under these conditions. It must be noted that farm forestry can offer the grower a range of other benefits not captured in the analysis including windbreak, shade and shelter benefits, as well as inherent environmental benefits such as salinity and erosion control. Here the opportunity to trade in environmental credits (such as carbon, biodiversity and salinity credits) is emerging (as in the State Forests and MRFF example). This could increase the profitability of growing plantations in low rainfall areas.

Table 1 – Production parameters for modelled firewood/sawlog eucalypt plantation on the Liverpool Plains

(source: adapted from Hean and Signor, 2001)

SCENARIOS	Worst case	Base case	Best case
Discount rate (%)	5	5	5
Species	*Eucalyptus*	*Eucalyptus*	*Eucalyptus*
Plantation size (ha)	1	1	1
Initial planting density (trees/ha)	1000	1000	1000
Non-commercial thinning	Year 4	Year 4	Year 4
Commercial thinning (firewood)	Year 8	Year 8	Year 8
Final stand density (trees/ha)	100	100	100
Pruning	Years 3, 5, 8	Years 3, 5, 8	Years 3, 5, 8
Final harvest	Year 30	Year 30	Year 30
Growth – firewood (m^3/ha/yr)	4	7	10
Growth – sawlogs (m^3/ha/yr)	3	5	8
Mill door price – sawlogs ($/$m^3$)	55	65	75
Establishment costs ($/ha)	2000	1500	1000
Haulage costs ($/$m^3$)	30	20	10
Stumpage – firewood ($/$m^3$)	5	5	5
Plantation maintenance costs ($/ha/yr)	50	50	50
Pruning costs ($/ha per lift)	250	250	250
Thinning costs ($/ha)	100	100	100
Fall/snig/load costs ($/$m^3$)	20	20	20
Proportion thinned for firewood (%)	25	25	25
Net Present Value ($/ha)	-3301	-2017	135

In a project funded under the Joint Venture Agroforestry Program (a partnership between the Rural Industries Research and Development Corporation, the Land and Water Resources Research and Development Corporation and the Forest and Wood Products Research and Development Corporation), a number of potential tree crop industries were examined and a report compiled on the commercial prospects for low rainfall forestry.

The industries examined included sawn timber, wood panel products, posts/poles, biomass for electricity production, biomass for liquid fuel, domestic firewood, charcoal and activated carbon, eucalyptus oil, fodder and a range of other

'boutique' product forms such as sandalwood, tannin, flowers and bushfoods.

The report identified several promising plantation forestry opportunities for the low rainfall (400-600mm) zone based on a number of assessment criteria (technical feasibility, climatic zone suitability, suitability to land and soil types, integration with existing farming systems, market size, potential to penetrate market, commercial profitability, long-term financial sustainability, societal benefits, riskiness, flexible product potential, potential extent of enterprise) The findings are summarised in Table 2.

Table 2 - Potential products from low rainfall plantations

(source: adapted from Zorzetto and Chudleigh, 1999)

PRODUCT	COMMENTS
Fodder species	Good prospects, particularly species with dual purposes.
Eucalyptus oil	Production from coppiced mallee species targeted at pharmaceutical and industrial markets. Long term viability, particularly integrated production whereby woody residues are also used.
Biomass for electricity production	Good prospects where sufficient biomass is produced in an area to sustain an electricity production plant, and by products such as steam are utilised.
Biomass for ethanol production	Unlikely to be viable while oil prices remain low or the cost of biomass production remains at current estimated levels.
Sawn hardwood timber	Unlikely to be economically viable, unless the end products are of high value such as furniture. Most likely to be small scale production.
Softwood sawn timber	Some softwood species such as *Pinus pinaster* are showing good potential growth rates in low rainfall areas. Product differentiation (from mass produced *P. radiata*) will be required to avoid direct price competition.
Laminated flooring from young eucalypts	Potential markets exist, however the scale and cost of production need to be examined more closely.
Charcoal and activated carbon production	Technology for production exists, and production would suit integration into another forestry/industry enterprise to utilise logging residues and wood wastes.
Firewood	A push from the environmental movement towards restricted access to firewood being collected from native forest areas could increase plantation production, however some analyses have shown that 'stand alone' firewood plantations are unlikely to be financially viable.
Round an split posts	Posts can be produced as a result of thinning operations.
'Boutique' products	Some potential exists for products such as carob, jojoba, olives, sandalwood and some other essential oils.

Detailed economic analyses of four potential enterprises (sawn timber, firewood, biomass for electricity production and eucalyptus oil production) were presented in the *Commercial Prospects for Low Rainfall Forestry* report. Appendix A details the production parameters for each of the four enterprises examined.

The sawn timber scenario involved a 47 year rotation, and was found to be uneconomic (net present value of -$16,710 and internal rate of return of 2.7%). The 10 hectare, 17-year rotation 'stand alone' firewood plantation was also found to be uneconomic (net present value -$25,620 and a negative internal rate of return). However, it was acknowledged that particular locations in the low

rainfall area might be able to produce firewood for high price city markets in close proximity. Biomass production from a 30-year rotation plantation for electricity generation was found to be viable if a zero cost of biomass was assumed, however was uneconomic if the full cost of producing the biomass was incorporated. Eucalyptus oil production was economically viable (based on large scale production from mallee species in Western Australia), showing the most promise of all the options investigated.

Conclusions

There has been a recent increased interest in low rainfall plantations, fuelled by a greater recognition of the benefits of integrating widespread tree planting into environmental remediation programs. However, commercial production from plantations in low rainfall areas is a relatively new concept. A number of 'unknowns' exist for low rainfall forestry, which could affect the economic viability of such enterprises. It is important to note that this type of production system is unlikely to be as economically attractive as similar enterprises in the high rainfall zones due to lower growth rates, lack of established infrastructure and greater distances to markets in low rainfall areas. The production of more than one product from a low rainfall plantation, or the receipt of 'environmental credit' payments is likely to increase economic viability.

At the time of writing, there was still considerable uncertainty surrounding the development of markets for environmental credits. For example, a well established market for carbon credits has not evolved, though a number of trades have been struck between large international firms and State Forests of NSW. It is important to note that the current 'rules' relating to carbon credit payments and tree planting only apply to plantations that are planted post-1990 on essentially cleared land. Removing large areas of native vegetation to establish such plantations is not considered valid as it may actually lead to a net increase in carbon emissions.

Considerable research is under-way to investigate various market mechanisms aimed at improving environmental outcomes. It is likely that whatever mechanism are analysed, they will have to confer some benefit to the landholder. This may occur via direct income, demonstrated and significant positive impacts on existing farm enterprises or via improved market access.

References and further reading

Australian Greenhouse Office and Murray Darling Basin Commission. 2001. The Contribution of Mid to Low Rainfall Forestry and Agroforestry to Greenhouse and Natural Resource Management Outcomes – Overview and Analysis of Opportunities. Commonwealth of Australia, Canberra.

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State Forests of New South Wales. 2002. Developing Markets for Salinity Control. http://www.forest.nsw.gov.au/_navigation/active_frame.asp?/publication/forest_facts/dev_markets_salinity_control/Default.asp.

Zorzetto, A. and Chudleigh, P. 1999. Commercial Prospects for Low Rainfall Agroforestry. RIRDC Publication no. 99/152. Project no. AGT-4A. RIRDC, Canberra.

Appendix A - Production parameters for four different modelled low rainfall plantation enterprises

(source: adapted from Zorzetto and Chudleigh, 1999)

VARIABLE	SAWN TIMBER	FIREWOOD	BIOMASS FOR ELECTRICITY PRODUCTION	EUCALYPTUS OIL
ENTERPRISE MANAGEMENT DETAILS				
enterprise timeframe (years)	45	15		30
Species	Spotted gum (*C. maculata*)	River redgum (*E. camaldulensis*)		Mallee *Eucalyptus* spp
plantation area (ha)	1	10		23,000
planting density (trees/ha)	1000	1000		
growth rate (m^3/ha/yr)	5	5		
thinning (year)	15, 30			
trees harvested at first thinning (%)	70			
remaining trees harvested at second thinning (%)	50			
firewood drying time (years)		1		
harvesting interval (years)				3
ESTABLISHMENT				
establishment costs ($/tree)	0.90	0.67		0.48
HARVEST, SNIG, LOAD, TRANSPORT				
thinning costs ($/$m^3$)	10			
harvest, load, haulage costs ($/$m^3$)	28	29		
leaf harvesting & transport costs ($/day)				1080
harvesting , processing and transport capital costs ($)				750,000
PROCESSING				
mill, dry, dress, transport costs ($/$m^3$ sawn timber)	408			
firewood split, load, store, transport costs ($/$m^3$)		42.01		
green biomass costs for electricity production ($/tonne)			0	
wood gasifier, engine and generator capital costs ($)			750,000	
gasification & electricity generation operating costs ($/year)			169,875	
distillation operating cost ($/kg oil)				0.72
YIELDS				
total sawlog yield (m^3/ha)	123.75			
dry firewood yield at harvest (tonne/ha)		37.5		
eucalyptus leaf oil yield at each harvest (kg oil/tree)				0.175
PRICES				
wholesale seasoned and graded timber price ($/$m^3$)	1500			
firewood price ($/tonne)		45		
electricity retail price ($/kWh)			0.12	
industrial oil price (US $/kg)				1.50
pharmaceutical oil price (US $/kg)				3.60

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DISCLAIMER

There are a number of variables that affect commercial timber production and each individual situation will differ. The figures presented in the leaflet are intended to present a general picture of potential growth, production and financial scenarios associated with commercial timber production on farms, and do not necessarily represent actual realised production or returns. It is recommended that prospective growers and producers seek professional advice before commencing a forestry program on their farm.