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Forest Policy Issues Arising from a Legislation Review in Western Australia

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Abstract

The separation of commercial forestry from forest conservation and the subsequent end to old-growth logging in Western Australia, created fundamental problems for the Forest Products Commission, leading to a review of its functions in 2006. The FPC response to constraints on its viability contrasts with other States' approaches where carbon caps and water markets were used to place values on land uses. The effectiveness of the FPC's main policy approach to capitalise on the environmental value of forest establishment for salinity reduction is addressed in the Department of Agriculture and Food's submission to the FPC review. The value of this approach not supported by DAFWA hydrology work which concludes that benefits are highly site-specific and there is insufficient selection for forest location by the proponents of broad scale forestry investment in low rainfall areas.

Introduction

The Forrest Products Commission (FPC) was created in 1998 by the removal of the commercial tree growing function from the Department of Conservation and Land Management (CALM) to a separate commission, to address a perceived conflict with the department's main role as a protector of the environment. In 2006, the Government initiated a review of the legislation the *Forest Products Act 2000* (FPA) to determine what changes may be required to the organisational structure for the future function of the FPC.

In developing a submission to the statutory Review of the, the Department of Agriculture and Food (DAFWA) reviewed the achievements of the FPC for two years up to 2005 as well as other reports which were available and relevant to farm forestry issues. This paper presents some observations and comment on FPC activities that are closely related to DAFWA's policy role in industry development and natural resource management.

Background to the review

The FPC's approach to expanding the scope for increased investment in farm forestry contrasts with that of most other States where market mechanisms have

been used to develop more attractive values on land uses that provide for greater investor and landholder incentives to invest in forestry activities.

Without such mechanisms, there is limited scope for commercial forest investors to assess their involvement in forestry activities beyond the timber value from the plantation.

NSW State Forests has attracted private sector investment to planted forests in lower rainfall areas by developing new markets for the environmental services that these planted forests provide using an Environmental Benefits Index (EBI) to evaluate environmental outcomes from forestry projects. These environmental services include increasing local biodiversity and absorbing carbon dioxide from the atmosphere. Salinity control is another environmental service provided by planted forests.

Before a market can be developed for salinity or other environmental benefits, a policy framework is also needed in order to :

- specify the desired environmental outcome (as a target or a cap); and
- enable market-based approaches to be used to deliver the outcome in the most cost effective manner.

For NSW, this policy framework is provided by the NSW Salinity Strategy and the Murray-Darling Basin Salinity Management Strategy. Catchment Management Boards have set end-of-valley salinity targets and market-based approaches are suggested as a means of ensuring that these targets are met.

In Victoria forest policy appears to have also shifted away from small scale random plantings on farms with the development of their Plantation Incentives Strategy, a four year \$9 million State Government initiative which focuses on encouraging investment in larger scale plantations on land that will provide the most benefits to the grower and to the broader community. Previously, the private forestry program was aimed at encouraging small-scale farm based projects. The Strategy announces a new emphasis for investment of public funds in private forestry and identifies three key roles for Government in private forestry to:

1. manage barriers to investment decision making;
2. generate systems that increase environmental services from commercial plantations; and
3. enable the industry and government to invest in research development and extension to pursue productivity gains.

The Victorian trial "Sawlogs for Salinity" is a pilot project which will be testing the "Bush Tender" approach, which has received much positive feedback, and adapt that process to private forestry. In addition, the Department of Primary industry use the Catchment Analysis Tool (CAT) to select and prioritise the most environmentally beneficial areas for tree planting.

In Western Australian situations particularly Pannell (2005) has been circumspect about the use of economic instruments by identifying key parameters for their successful application:

“Incentive payments and other economic instruments (e.g. “market-based instruments” such as conservation auctions or tenders) need to be carefully applied. It is evident from some analysis that the positive incentives area is a relatively small sub-set of options available. Environmental managers need to take care to ensure that they are not applying incentives to inappropriate projects. There seems a high risk of environmental managers mis-using simple instruments like incentive payments (subsidies) unless they have very good information about both the public and private net benefits.”

Financial position of the FPC in WA

The Annual Reports of the FPC indicate a series of operating losses for the years 2005 (\$4.7M) and 2004 (\$5.5M) prior to interest and taxes. Loss from ordinary activities (before tax and movements in natural resource asset valuation) which include interest payments to Treasury (\$6M annually), is \$10.6M for 2005 and \$11.2M for 2004. Total Asset Base for FPC was \$399M (2005) and \$379M (2004).

The deteriorating financial performance of the FPC has been attributed to

- potential claims against the Commission by unsatisfied parties under the “Government’s Business Exit Scheme”;
- Shortfall and cost increase of harvesting capacity;
- Government’s “Protecting our Old Growth Forests” policy in the South West; and
- Impact of the strengthening Australian dollar for the arid forest segment

Major long term risks associated with future investments by the FPC.

- FPC suffered extensive wildfire damage to its resources at the Breaking, Carinyah and Greystone plantations. Potential environmental problems were addressed through the successful implementation of a recovery emergency plan.
- The Nursery and Seed Technologies experienced a significantly reduced maritime pine germination rate (37 per cent when expected germination rate is 70 per cent).

The review was empowered to address the declining viability of the FPC by examining a variety of mechanisms to improve revenue such as establishing property rights for environmental services, or by re-structuring the Commission and publicly fund its non-commercial activities of most importance to the State.

Environmental Achievements of FPC

Annual reports over several years highlight the environmental benefits to the State which emanate from the FPC activities and programs. These include the following:

- Monitoring of “Infinitree” plantations in the low and medium rainfall zones--bore-fields have been designed to monitor groundwater levels on two properties.

Removal of the 21,500 ha of pine plantations of Gnangara, Pinjar and Yanchep, which may assist in addressing the issue of ground water level decline.

- Carbon Sequestration research funded by CRC greenhouse accounting.
- Revegetation-use of treecrops for water table control, erosion control and biodiversity enhancement; one year priority project.
- Renewable Energy--Production of energy which use pine harvest residue--planning phase.
- Tree Breeding Program has concentrated on identifying genotypes among the maritime pine breeding population that will provide improved apical dominance.

The general character of these achievements is similar to those in other States and have largely been transferred from the previously integrated department. They represent essentially public goods associated with commercial forestry activities.

DAFWA's contribution to development of farm forestry activities

Farm forestry has established as a major land use in the higher rainfall areas of the south west of Western Australia. In these areas the tree industry is based on e. globulus (blue gums). The adoption of blue gums has been supported by considerable public R&D, external investments, a period of comparatively low rural commodity prices and coordinated industry development.

Farm forestry – largely based on experience with blue gums – has been perceived as a viable means of managing dryland and stream salinity. Experiments were established in the 1980s and 1990s in the Collie and similar catchments to test this hypothesis. Results indicated that the degree of tree cover required to achieve stream salinity control is greater than that able to be economically adopted by farmers.

In these catchments eg Denmark river, revegetation of up to 80-90% of a catchment was required to achieve water salinity control. To achieve land salinity control, approximately 50-80% tree cover is required. Hydrological response time to trees has been relatively fast (10 – 20 years) in these western catchments.

In addition to the impact of the loss of land under the trees, revegetation has also been responsible for a reduction in runoff and stream flow and thus has affected farm and community water resources (eg Frankland, Manjimup).

Forest industries being proposed by the FPC for the drier and more marginal timber production areas, include diversification into dryland species eg eucalypts, Pinus pinaster and sandalwood using up to \$64M of public funds under the "Infinittree" program. Much of the incentive for establishing these industries has been based on expectations that plantings will have a significant impact in reducing land and stream salinity. This expectation has been raised/created by both public institutions and private sector tree based industries requiring access to private land for trees.

However, unlike blue gums, which have been established on large areas of high rainfall, cleared land in responsive catchments, the new species are being targeted to the eastern margins of the blue gum target zones and the flat, dry areas of the wheatbelt, which will not produce similar off-site environmental benefits due to the one dimensional hydrology of the landscape.

During the past decade research undertaken by DAFWA in these eastern landscapes has shown that at levels of planting considered best practice, and current rates of adoption, neither the pinaster, sandalwood, eucalypts, nor the oil mallee industries are likely to significantly impact on the area of dryland salinity. Nor are these systems likely to reduce the land area at risk unless better targeted than presently proposed.

Whilst these industries may eventually have economic merit and aid regional development, this benefit should not be confused with their potential to reclaim or prevent further salinisation at the scale of the industries proposed.

Commercial tree cropping in low rainfall areas

The oil mallee industry is the only one of the new tree options being established for rainfall areas of < 500 mm/year capable of covering significant areas. This industry is new, and R&D issues are still emerging as it is tested and seeks to establish alongside older industries, eg grain growing and grazing. In addition to markets, the issues of water requirements, competition with crops, and scale of adoption are currently three major controls on its development and probability of impact.

Modelling by Cooper, Olsen and Bartle, 2005 of 'base case' conditions indicates that in the three rainfall zones investigated (<400, 400-500, >500 mm/yr), for oil mallees:

- (i) yields of 15.9 to 42 dry tonnes per hectare, equivalent to a water use of 1062 to 2747 mm/yr, are required to break even with mainstream land uses. A value of 1000 mm is considered a maximum water use;
- (ii) water deficits were more than twice that of a system capable of breaking even with current cropping systems;
- (iii) even with enhanced belt configurations, the water deficit for the lower rainfall zones at short and long haulage distances was 18% to 75% of that required;
- (iv) the maximum area of mallees on suitable soils, in each transport horizon in the low and high rainfall zones, was modelled to be 0.4%-1.2%, and 1.7-7.2%;
- (v) only within 150 km of a processing plant in the higher rainfall zone, and 75 km in the medium zone, were woody crops feasible. They were not feasible in low rainfall areas under base case conditions; and
- (vi) either extra water needs to be made available to the trees, higher yields per unit biomass obtained, or a significant increase in market price received, for the industry to succeed.

While Cooper et al (2005) note that caution is required in interpreting this analysis, and that economics may improve the commercial case, they present little evidence to suggest likely improvements for salinity control.

An understated tension also exists between trees and crops. In particular, work by Sudmeyer and Flugge (2005), indicates at all sites assessed, tree competition with crops was significant (10-32 m laterally from trees), especially in duplex soils and in drier years. Management by root pruning, while reducing the competition for the crops, reduced tree yield by 14-43%, thus reducing viability further.

DAFWA hydrologists maintain that without a much greater effort towards site selection the \$30 million investment proposed with the “Infinitree” program will result in the establishment of an additional 8,570 ha of trees, but these will have an insignificant effect on land or stream salinity.

Reducing dryland salinity

Hydrological studies based on measurements at sites where trees have been established, and use of models at various scales, indicate that to be successful at *reducing salinity*, trees need to occupy large areas of the landscape. In the western areas (>500 mm yr rainfall), planting areas of >50% can reduce the area of land salinity. However, to achieve an impact on stream salinity, over 80-90% of catchments must be effectively planted. In eastern areas, the area planted must be greater to achieve the same level of impact.

At a sub-catchment to farm scale, research indicates groundwater is lowered, and dryland salinity reduced to a greater degree, when trees are targeted:

- to cover large proportions of the catchment (> 50%);
- where slopes exceed 4%;
- Where there are discrete areas of highly permeable soils;
- Where clearing has recently occurred (areas of high rates of water table rise and disequilibrium); and
- Where regolith (depth to bedrock) is shallow (< 5 m or brackish [<1000 mS/m] groundwater exists).

Modelling indicates that in lower rainfall areas, trees have the greatest chance of impact when they can be established to prevent, or slow watertable rise. At levels of assumed recharge reduction of 50% (which assumes <50m between alleys), trees may reduce time to impact by up to 50 years. However at 50m, the crop impact is severe and likely uneconomical for the farmer.

The scale of the influence is limited by the area planted. The Integrated Wood Processing plant (IWP) being trialled at Narrogin needs a feed stock of 266,000 tons/yr which could come from only 13,000 ha of mallees. Given a 10% planting system (100 m alleys) only 130,000 ha would be required from within a 200 km radius (assumed 20 dry tons/yr). If Western Power establishes a profitable IWP system, a further 5-7 plants may be established, yielding a total area planted of < 100,000 ha. Note that some \$15 million has been spent on the IWP plant at Narrogin and it is still not operational.

Cooper et al (2005) suggest that at a regional scale, woody crops producing break even yields would occupy less than 7% of the suitable soils of their transport zone.

Returning value for investment of public funds

Significant investments in new industries have been made with expectation of salinity benefit.

The oil mallee industry and the Department of Conservation and Land Management (CALM) have to date spent over \$50M (Bartle 2006, *pers comm.*) establishing the fledgling oil mallee industry. More recently FPC have developed a \$64M program to establish *up to* 18,000 ha of trees (*pinaster*, sandalwood, eucalypts) with an advertised benefit of salinity control. This project is currently funded within the National Action Plan for Salinity and Water Quality. It provides direct subsidy to farmers for land access, plants trees and later, pays a crop share of any final product. Sums of \$1200¹/ha upfront, in addition to establishment costs of up to \$2000/ha, are provided. Given an expected planting area of 18,000 ha, and a project cost of \$64M, a total of \$3500/ha is implied.

DAFWA analysis indicates that an area of 18,000 ha of land planted would be insufficient to manage salinity in a single typically large, wheatbelt catchment. Similarly, while the industry scale proposed for oil mallees is 7% of select areas (Cooper et al, 2005), it can be argued that little benefit will accrue to existing areas of salinity. To obtain maximum benefit, a systematic approach to planting is required. This is currently missing from both schemes, where planting is driven by hectares per year targets without reference to biophysical, or investment return tests.

The Salinity Investment Framework (SIF) developed by Ridley and Pannell, 2005 indicates that trees (and other perennials) have the greatest potential to alleviate salinity (land and water) and have highest public value, in water resource recovery catchments, which include the following catchments:

1. Collie;
2. Tone – Warren;
3. Denmark; and
4. Kent.

SIF also identified that less, but significant, public benefit may also accrue in protecting nature conservation by investing in biodiversity recovery catchments. Target landscapes in the FPC target area may include catchments such as:

1. South West (Muir-Unicup);
2. South Coast (Warden system);
3. Proposed additional CALM biodiversity catchments; and
4. Other catchments which contain key Reserves.

Further benefit may accrue if vegetation is targeted to infrastructure assets such as towns, rail and roads.

¹ 2006 Infinitree sharefarming package payments based on contract length (25-40 years), area (20-100 ha), soil types and rainfall zones (Lower rainfall; >400 mm/yr = \$200-800/ha, High rainfall >500 mm/yr = \$350-1500/ha)

Without a strategy based on an analysis of the location of plantings and impact, the effect of the 18,000 ha proposed will be at best localised, and at worst will be highly unlikely to meet NAP and community expectations.

Analysis of potential area for Industry development

DAFWA's soil database has been interrogated to indicate areas of land suitable for tree crops. A preliminary analysis of land suitable indicates that for most of the wheatbelt, available land area is not likely to restrict industry growth. Depending on the methodology, between 0.7 M and 3.2 M ha is available for pines, sandalwood, eucalypts and oil mallees in each rainfall zone. What is needed is a commercially viable industry – this does not exist and prospects of developing one in the lower rainfall areas appear limited.

Future Forest Industry development

The FPC has continued to provide the institutional arrangements for government intervention to support the development of the timber industry in Western Australia. In order to expand plantations on private land, the FPC needs to offer higher returns to landholders than alternative agricultural activities, and private forest investors, or purchase farmland in its own right.

FPC may be more limited in access to capital markets on equivalent terms to private timber companies and has consequently had to seek forestry investment funds from partnerships ("Infinitree") with regional catchment groups under the National Action Plan for Salinity and water Management (NAP). However in offering environmental benefits to regional groups under the NAP the FPC uses a public funding source to deliver what are essentially private landholder benefits, unless off site salinity or water quality benefits can be clearly demonstrated.

DAFWA research over the past decade and demonstrated that the portfolio of options including drainage, Oil Mallee and Tree Plantations are only likely to be achieved under very specific conditions which need to be carefully planned.

Other studies have reinforced the importance of this approach, as reported in Petersen, 2004 which provides an indication of the measure that should be pursued with public funding in order to achieve environmental benefits for the state. This includes a framework for setting funding priorities for sustainable land management options on the South Coast of Western Australia using Multicriteria Analysis reveals much about the value of different forms of government intervention aimed at achieving environmental benefits. (see table 1 below)

A separate Multicriteria Analysis was conducted for the six subregions of the South Coast: Kent-Frankland, Albany Hinterland, North Stirling Pallinup, Fitzgerald Biosphere, Esperance Sandplain and Esperance Mallee. Sustainable land management options (termed strategic actions) were compared using a set of eleven environmental, social and economic criteria.

The environmental criteria include changes in quality and quantity of water exported, vegetation condition connectivity, and biosecurity. Social criteria include changes in community capacity, recreational opportunities, aesthetic condition of private land

and regional employment opportunities. Economic criteria include changes in farm profit, land value, income variability and additional investment generated.

Technical specialists within the DAFWA and Forest Products Commission have developed impact measures for each option against selected criteria.

Table 1. Rankings of priorities on benefits per dollar of catalytic funding required

Priority	N. Stirlings Pallinup	Fitzgerald Biosphere			Esp. Sandplain
		Group 1	Group 2	NRM group average	
1	Catch for sust	Catch for sust	Catch for sust	Catch for sust	Land potential
2	Perennials	Perennials	Perennials	Perennials	Perennials
3	Land potential	Land potential	Land potential	Land potential	Biosecurity
4	Manage change	Better soils	Manage change	Better soils	Catch for sust
5	Better soils	Manage change	Better soils	Manage change	Better soils
6	Biosecurity	Biosecurity	Biosecurity	Biosecurity	Manage change
7	Other Divers.	Sust. product	Sust. product	Sust. product	Farm forestry
8	Sust. product	Other Divers.	Other Divers.	Other Divers.	Sust. product
9	Farm forestry	Farm forestry	Farm forestry	Farm forestry	Other Divers.

“The ranking of each of the sustainable land management options was not significantly sensitive to changes in catalytic funding requirements, criteria weights or individual impact measures. However, the ranking did change significantly when changes were made to all impact measures of an individual strategic action. Increasing the accuracy of these estimates - perhaps through further modeling and/or quantitative data collection, especially for the top ranking options - would result in more robust results.”

This summary in Petersen, 2004 on the findings of the MCA, highlights the need for expertise and resources in hydrology and economics to improve effectiveness of planning for government intervention that is more effective in achieving positive NRM outcomes.

A summary of this report makes the following points:

- Profitable perennials' (an option aimed at targeting the development and adoption of woody perennials and perennial pastures) requires a relatively small amount of catalytic funding to implement, and provided the greatest environmental benefit per dollar of catalytic funding in most subregions.
- The second best return on public investment, in most subregions was 'Better soils' (a skills development and learning option with the object of improving land managers' knowledge and adoption of soil management practices that reduce or control on-site and off-site soil and land degradation).
- Catchments for sustainability' (an option aimed at developing and implementing risk containment strategies for salinity, water resources, nutrients, chemicals and sediments) provided greatest benefits for all subregions, but requires a relatively large amount of public catalytic funding to implement compared with all other options.

- 'Profitable perennials' ranked second for most regions in terms of benefits alone.
- The ranking of each of the sustainable land management options was not significantly sensitive to changes in catalytic funding requirements, criteria weights or individual impact measures. However, the ranking did change significantly when changes were made to all impact measures of an individual strategic action. Increasing the accuracy of these estimates - perhaps through further modeling and/or quantitative data collection, especially for the top ranking options - would result in more robust results.

Other models to manage Government's role in forest industries

Analysis of the public and private investment opportunities would be facilitated by separation of the policy and funding functions from the commercial aspects of the FPC's current functions. Specifically it means that the public funding of NRM activities should be considered independently from the commercial provider, so that the State's objectives in environmental outcomes can be balanced objectively across all relevant landuse activities.

R&D provision for forest industries could be improved by reference to models in the agricultural sector where the rate of adoption of public good information on varieties and environments is made freely available (agronomic systems, variety comparisons) because it is largely industry funded, and only commercial material such as new varieties (grains, Pink lady apples) are protected for commercial development, by private agents. These arrangements maximise the public benefits of common property resources while enabling private investment in as many areas as possible. The FPC in contrast often protects much of the common forestry information it generates (trial results, new varieties) for its own commercial advantage thereby enhancing its financial returns to the disadvantage of the overall industry.

Scope of Future Role

There is a need to re-assess Government's on-going involvement in the industry, with a view to directing its resources toward those areas where the highest public benefits can be achieved, primarily in medium and low rainfall areas, which are currently largely non-commercial for plantations and farm forestry, but which would benefit greatly from the environmental services and longer term regional development outcomes the industry can provide. With regard to high rainfall areas where plantations and farm forestry are now demonstrably profitable, the Government's involvement should be in assisting the private sector with issues related to planning, infrastructure development, regulation and monitoring. Direct commercial considerations are yet to play a major role in promoting farm forestry in the medium to lower rainfall zones in the south west. Only 10% of farmers in the wheat-sheep zone planted trees to produce wood products for sale. Tree plantations for aesthetic values are unlikely to be a major impetus for large scale farm forestry plantations.

In the high rainfall regions close to appropriate markets there are good opportunities for growing trees for profit and investors are willing to provide capital finance for plantations. Low and medium rainfall areas do not currently attract such

investments. A substantial bluegum industry has grown since the early 1990's, with approximately 260,000 hectares established in the State's high rainfall areas. These are all privately owned, mainly by investment management firms and companies linked to international pulp and paper interests. Much of the growth has been driven by Managed Investment Schemes taking advantage of tax arrangements initially developed for primary producers.

A number of obstacles are inhibiting the growth of commercial forestry in the low and medium rainfall zones.

- Inability to measure and capture non-market values, such as biodiversity protection, catchment integration, landscape aesthetics or CO2 sequestration.
- Confusing roles and responsibilities across spheres of government and between agencies creates policy confusion, as do inconsistencies and irregularities in local government land-use planning.
- Many practical questions of science and technology remain unanswered, including a capacity to quantify the flow-on benefits of different farm forestry options. Many farmers have poor technical skills in relation to farm forestry.

There has been much recent exploration of how farmers can capture financial returns from the 'services' of farm forestry, such as via carbon, salinity and biodiversity credits. However, many of the environmental services of farm forestry are complex and are still to translate into direct payments to individual landholders.

Conclusion

Many of the FPC's current problems have arisen due to incremental policy changes and institutional changes which have sought to separate public and private responsibilities. The structure of FPC as a State Trading Enterprise does not sit comfortably with its social and environmental functions which are atypical for a government department. In other words, FPC in its current form has overlapping public and private objectives. For example, when it attempts to develop proposals under NAP it is not clear whether it is pursuing a public function, industry development or a commercial operation. The Government's response to the review is likely to be the formation of a comprehensive forest policy establishing FPC's future role in terms of development of forestry in high, medium and low rainfall zones in Western Australia.

References

Centre for International Economics (CIE), AACM International Pty. Ltd., and Forestry Technical Services (1996) *Contribution to Farm Forestry to Australia - a quantitative assessment*. Rural Industries Research and Development Corporation: Canberra, ACT.

Dames & Moore (1999) Integrating Farm Forestry and Biodiversity, RIRDC Publications 66/166, Canberra.

Flugge F and Schilizzi S (2003), Alternative Policies with Complementary Benefits: Targeting Greenhouse Emissions or Water Recharge on Farming Systems? International Farm Management Conference, Perth, 10-15 August.

FPC annual report 2005, available on the internet site www.fpc.gov.au.

George R., DAFWA, pers.comm.

Kingwell R *et al.* (2003), Economic Evaluation of Salinity Management Options in Cropping Regions of Australia, GRDC and NDSP.

Petersen, E.H. (2004) Multicriteria Analysis Of Sustainable Land Management Priorities For The South Coast Of Western Australia. A report to the Cooperative Research Centre for Plant-based Management of Dryland Salinity and the Western Australian Department of Agriculture.

Ridley AM and Pannell DJ (2005). SIF3: An investment framework for managing dryland salinity in Australia. SEA Working paper 1901. CRC for Plant-based Management of Dryland Salinity, University of Western Australia, Perth.

SALINITY INVESTMENT FRAMEWORK - INTERIM REPORT prepared by Resource Science Division Department of Environment. DEPARTMENT OF ENVIRONMENT
SALINITY AND LAND USE IMPACTS REPORT No SLUI 32 OCTOBER 2003

Zorzetto, A. and Chudleigh, P. (1999) Commercial prospects for low rainfall agroforestry. Canberra: Rural Industries Research and Development Corporation.

