SHELTERBELT PLANTING IN THE PILBARA REGION OF WESTERN AUSTRALIA

by

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INTRODUCTION

The Pilbara is one of the most highly mineralised regions on earth. The key mineral in the dramatic development of this region in recent years is iron ore and, by early 1970, exports were worth some $400 million per year. Reserves of 120,000 million tons of iron ore have been estimated and long term contracts already signed cover the sale of some $4,000 million worth of ore, mainly to Japan.

One result of this massive development has been that towns which previously had populations only numbered by a few score or hundred are rapidly growing into towns of several thousand people. In addition, a few new centres are being established. These towns are of two types, the "company" town and the "open" towns developed under normal Government guidance and administered by a Local Authority.

The more important of these "open" towns are the developments at South Hedland and at Karratha. A few years ago, Port Hedland was a small port with a population of a few hundred people. Now, as the port for the ore from both the Newman and Goldsworthy operations, it has grown to about 7,000 inhabitants. It is estimated that a population of 25,000 to 30,000 will be achieved by 1980. Almost all of this new development will be confined to the satellite township of South Hedland.

Karratha is situated near Roebourne and the erection of the first homes was commenced in 1969. It is estimated that its ultimate population is likely to approach 25,000 people. It is envisaged that whereas Port Hedland will become the industrial centre of the Pilbara, Karratha will become its administrative centre. Both towns are being developed largely by the State Housing Commission.

In this semi arid region, trees and shrubs play an important role in providing shade and shelter, in improving the aesthetic appeal of residential and recreational areas and in assisting in the control of wind blown dust. The "North West tree scheme" commenced in 1964 with the appointment of a Tree Adviser whose specific task has been to encourage Local Authorities and individual residents to plant suitable trees in streets, reserves and home gardens.

During 1970, the Chairman of the North West Planning Authority requested advice from the Conservator of Forests with respect to the establishment of shelter-belts around the towns of Karratha and South Hedland. During September of that year, two officers of the Forest Department, Messrs. W.H. Eastman and F.E. Batini visited the Pilbara region accompanied by the current tree adviser, Mr. F. Lullfitz. In that week, the following localities were visited: Port Hedland, Mt. Newman, Roebourne, Cape Lambert, Karratha, Dampier and Mill Stream.

CLIMATE

The area south of Port Hedland is in the arid zone with the exception of a small area at the highest altitudes. The annual rainfall is low, 8 to 11 inches, and the variability of the rainfall is the highest in Australia.

The mean rainfall at Port Hedland (68 years) is 12.28 inches on a mean of 21 rain days. The bulk of this rain (10.81 inches) falls in the months from January to June. Potential evaporation from a free water surface is between 90 and 105 inches a year, indicating a theoretical deficiency of some 80 to 90 inches a year. Combined with low rainfall and high evaporation are very high temperatures. The coastal towns have mean maxima of the hottest month of about 95°F, whilst inland temperatures are often much higher. The mean maximum in even the coolest month is around 80°F.

In these areas, the rain is often associated with thunderstorm activity and the heaviest falls are often associated with tropical cyclones. The most likely region for these cyclones to move inland is between Derby and Carnarvon. The storms are extremely violent (winds in excess of 120 miles per hour have been measured), and some towns have been completely wrecked by them. One cyclone in 1939 almost destroyed Port Hedland. The average number of cyclones is two to three a year, usually in the period November to April. Experienced local residents indicated that the prevailing winds in both Karratha and South Hedland were strong easterlies and westerlies. Both can cause considerable dust problems. The westerlies tend to predominate in the summer and the easterlies in the winter months.

VEGETATION

The flat plain around South Hedland is dominated by spinifex (Triodia species). Wattles (Acacia sp.) form a minor component of the ground and shrub layer. On the sandy ridges which cross this plain, wattles and native walnut (Owenia reticulata) are present. Other species include Hakeas and Codonocarpus (native poplars).

In the shallow depressions, E.camaldulensis (river gum), E.microtheca (blackheart) and E. clavigera occur. Cajeput (Melaleuca leucadendron), corkbark (Sesbania grandiflora) and river gums are found in the dry beds of the Turner and Yule rivers.

Karratha presents a very similar picture to Port Hedland. If anything, the vegetation in this area was rather more depleted by grazing. In the "crab hole" areas susceptible to subsidence, buffel grass replaced spinifex as the dominant ground flora. Some scattered bloodwoods (E. dichromophloia), Kurrajongs (Brachichyton sp.) and species of Terminalia grow in the hills which form a backdrop to this town.

SOIL

The soils at both localities can be described as "Pindan" sands. The profile consists of a red to reddish brown sandy loam overlying a reddish clayey hardpan at

a depth of 18" to 36". These soils are relatively infertile, very low in organic matter and the clayey nature of the subsoil may compound salt problems if watering with saline bore water is carried out.

WATER SUPPLIES

The provision of water supplies to the "open" towns is under the control of the Public Works Department. "Company" towns make their own provision for adequate supplies. At present, Port Hedland is supplied with water pumped from the bed of the Turner River and an extension to the Yule River is planned. Karratha will be supplied from the large acquifer at Millstream. Provision of adequate supplies is vital to the development of this area.

Alternative supplies of water which were considered were bore water and sewage effluent. Salt levels in the former are very high by most standards and there is also great variability between bores depending on their proximity to the main drainage lines. Figures provided by the M.W.S. indicate that a town of 25,000 people could provide some 1,000,000 gallons of treated effluent per day.

EXISTING PLANTINGS

Within the existing towns, various degrees of tree planting have been carried out. The best examples were seen at Dampier and at the Port Hedland Caravan Park. In the former case, the trees and shrubs are provided free of charge to the householder and the weekly rent of $6 covers all water used. Naturally, the householders are not loathe to use copious amounts on their trees and lawns. Planting is strongly encouraged by the Company. In the latter case, the planted trees provide good amenity value to the rather permanent residents of the caravan park. As such, their value is expressed in tangible terms to the owner and he is naturally keen to ensure their continued success.

At the extreme opposite are the plantings carried out by the local Shires and residents of S.H.C. homes at Port Hedland. To the Shire and householders these trees represent an appreciable cost for an intangible amenity. As such, trees have to compete with other amenities - roads, swimming pools and sports grounds in the case of the Shire and air conditioning, swimming pools and holidays in the case of the householder. The local water costs 40 cents/1000 gallons and most seedlings have to be purchased - often at inflated prices. These problems are not insurmountable, but are very real. Both the Shire and the householder are making some efforts, but their reticence can be readily appreciated.

Under normal conditions, growth rates are quite rapid particularly with species such as E. camaldulensis (12 to 16 feet in 2 years) and S. grandiflora (9 to 12 feet in 18 months).

PROPOSALS

The growing of trees on the areas surrounding the towns of Karratha and South Hedland would provide a dust barrier and a visual amelioration of the harsh landscape. They would not provide shade for the town area and would not be grown for the commercial production of timber or forest products. Due to the direction of the prevailing winds, the belts should be orientated in a north-south direction. A shelterbelt should be provided both to the east and to the west of each of the proposed townsites. Each of the four main shelterbelt areas should be between 2 and 2½ miles in length to provide adequate protection. At a later stage, plantings to the north and south of South Hedland should also be considered. These could take the form of shorter shelterbelts and group or clump plantings on the more suitable sites.

Since the shelterbelts are needed to ameliorate the dust problem, they will necessarily have to be relatively broad (at least 40 chains to 80 chains). This does not mean that a dense tree cover is necessary over all of this area, in fact, vegetative cover could be provided by four main species types.

(1.) ground cover: a low ground cover some 12-18" in height can be adequately provided by the existing spinifex (Triodia sp.). In fact, regeneration of spinifex and other such species should be encouraged within the shelterbelt areas and these areas should thus be fenced to exclude both stock and vermin.

(11) existing semi-prostrate species of wattle can provide a slightly higher cover (1-3 feet in height and 8 feet spread). This species was only patchily distributed in the South Hedland area and its regeneration in the shelterbelts should be encouraged by ripping and seeding where necessary.

(111) existing species of wattle occur at both Hedland and Karratha and could provide an adequate shrub understorey of some 6 to 9 feet in height. In both sites specimens of these species were rather scattered but vigorous germination of wattles was observed in areas which had received some disturbance. These species should be encouraged to establish in the shelterbelt areas by ripping and hand seeding where necessary. Seed could probably be collected by native labour on a contract basis. At least three species of Acacia and one species each of Hakea and Codonocarpus should be suitable.

(1V) multiple tree belts should be planted within the main shelterbelt areas. Assuming a top height of about 35 feet and an adequate reduction in wind speed to 15H, the distance between shelterbelts would then be approximately 8 chains. This would then indicate 4 to 5 belts of trees for a 40 chain shelterbelt and possibly 9 or 10 for a belt 80 chains wide. Two or three rows of trees could constitute each belt and these could be planted at about 30' spacing.

Number of trees/mile of belt would vary from 1408 (2 rows x 4 belts) to 5280 (3 rows x 10 belts). The total number of trees to be established in the four shelterbelts could thus range from approximately 14,000 to 53,000.

Although trials should be commencing at the earliest opportunity to test the type of watering regimes which are required, the shelterbelts should be planned on the assumption that the trees will require relatively heavy waterings at regular periods throughout their lives.

During the early establishment of trees at Woomera, the annual supply of water provided was of the order of 400 gallons/tree/year. After considerable experimental work, this was subsequently reduced to approximately 160 gallons in twenty two equal waterings. If water to the Pilbara plantings were to be supplied at the rate of about 500 gallons/tree/year the total consumption of water for either Karratha or South Headland would range from approximately 3,500,000 to 13,000,000 gallons/year. A town of some 25,000 people can produce some 1,000,000 gallons of sewage effluent per day and could very readily cope with this watering problem. The balance of the supply could be used to water trees and lawns within the town boundaries. If "shandying" with bore water is used, the supply from sewage effluent could easily be increased by between 50 and 100 percent. The main problem in this case would thus appear to be not so much the availability of water as perhaps the cost of tending and watering of these shelterbelts.

The manual cost component could be greatly reduced by the use of the trickle system of irrigation and trials into the feasibility of this system have been commenced at both localities.

The species chosen for the shelterbelt plantings should be those recommended by the tree adviser as being the most suitable for the site. At the same time, it would be desirable to establish some large arboreta in the Karratha and South Hedland sites in order to test the potential of a much wider range of species.

Probably the best examples of successful tree planting and shelterbelt schemes in the arid region of Australia were those carried out at Woomera and at Broken Hill. These stand before us as examples of what

can be done if the responsible parties have the vision to foresee the benefits, the willingness to undertake the problem and the money to finance the venture. In the former case, the necessary moneys were paid by the Commonwealth and in the latter by a private company. Surely the same vision, willingness and financial resources are available within the State Government of Western Australia.