BUSH RESTORATION OF RIVERINE AREAS ON THE SEZELA M.C.P.

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Abstract

In the wake of the 1987–88 floods, a major re-afforestation programme has been initiated in the three major catchment areas on the Sezela estate. Cane has been eradicated from a total of 95 hectares of land within 10 metres of the streams in these areas, and replaced with indigenous trees in an attempt to reproduce an ecology which would naturally have occurred in the area. A 600 m^2 shadehouse has been constructed for the propagation of these indigenous trees. The costs of the programme are discussed and the merits of various precursor tree species are evaluated. Other subjects such as the removal of alien plants and the techniques of planting indigenous trees are discussed.

Introduction

A century ago Natal was well wooded. Today, although Natal has the richest tree flora in South Africa (Moll[2]), true forests have been greatly reduced, often to isolated fragments. In most cases, this has been a result of uncontrolled exploitation and bad management practices. The re-establishment of the habitats is not difficult and is a worthwhile exercise.

Riverine vegetation is fundamental to catchment areas and this is where re-afforestation should receive priority. The degradation of bush and forest areas usually occurs in two stages. First, the removal of flora species, and then the invasion by weeds, often vigorous aliens, in the disturbed area.

The aim of the bush restoration programme at Sezela is an attempt to remove alien invaders and then to plant indigenous material to restore ecological stability.

Catchment identification

To understand the magnitude of the project and the extent to which the Estate is vulnerable to soil erosion, one must assess the sizes of catchments, as well as the sizes of the streams and rivers that flow through them. Table 1 shows the number and sizes of rivers and streams on the Estate, and their classification into 3 catchment classes. This classification is based on their size in km^2, ranging from 0–2km^2, 2–5km^2 and more than 5km^2. The legal requirements as given in Section 7 of the Conservation of Agricultural Resources Act 1983 states:

"7. (1) no land user shall utilise the vegetation in a vlei, marsh or water sponge or within the flood area of a water course or within 10 metres horizontally outside such flood area in a manner that may cause the deterioration of the natural agricultural resources."

To meet this requirement, watercourses must satisfy two criteria: stability and capacity.

In Categories I and II (rivers and large streams, Table 1) soil disturbance within 10 metres of the rivers and streams must be minimized. This is achieved by planting indigenous trees amongst the present vegetation, thus promoting stabilisation of the banks. In the smaller stream catchment areas (Category III), where cane is presently planted up to the bank, minimum tillage is employed to eradicate the cane within 10 metres of the water. Indigenous trees are then planted amongst the crop residues. As a result of these conservation practices, 90 hectares of land will be taken out of cane. This represents approximately 1% of our cane land area. This figure is similar to that obtained by Paxton in his survey of the Sugar Industry in 1988 (unpublished).

Table 1

The length of rivers and streams (km) in the 3 catchment categories on the Estate, and the number of catchments

Section	Catchment category		
	I (5 km^2)	II (2–5 km^2)	III (2 km^2)
Sezela	11,1	–	5,7
Humberdale	8,2	2,9	8,7
Esperanza	8,1	2,1	16,0
Equeefa	18,1	3,7	5,5
Beneva	–	5,5	11,7
Lewisham	6,7	7,3	17,2
Mgayi	14,5	5,9	8,4
Ifafa	5,6	5,6	2,9
TOTAL	72,3	33,0	76,1 = 181,4
No. of catchments	10	7	81 = 98

Table 2

Costs of establishing and maintaining 1 km of riverine land on a Section

	*[1]Cost/mday (R)	Mdays	Materials (R)	Total Cost (R)
Bush clearing (temporary labourer)	6,00	120		720
Minimum tillage (1 ha) (1 × permanent labourer)	12,00	1	220	232
Planting of seedlings & maintenance (2 × permanent labourers)	12,00	624		7 488
Cost of seedlings (1 333/km) + 5 %*[2]			1 148	1 148
TOTAL				9 588

*[1] Cost/manday for permanent staff includes supervision, feeding, bonus and overheads e.g. pension and W.C.A.
*[2] Cost/seedling obtained from Table 3.

Scope of Project

(a) *Decentralisation*

In an attempt to stabilise stream and river beds, each of the 8 Sections on the Estate has undertaken to restore 1 km of riverine land every year. As a guide, it is recommended that 2 rows of trees are planted at 3 metre intervals on either side of rivers and streams. This amounts to 1 333 trees every 100 metres for 100 km over a 12 year period. The costs of establishing and maintaining 1 km or riverine land on a section are detailed in Table 2.

(b) *Design and cost of central nursery*

A centrally situated shadehouse was erected to satisfy the annual requirement of trees for all the Sections. The shadehouse is 600 m^2 in area and can accommodate 12 000 seedlings per annum. A 50% shadecloth was used to provide favourable conditions for the growth of the seedlings until ready to transplant. The costs incurred in construction of the shadehouse are detailed in Table 3.

(c) *Seed material*

The seed material used must be fresh and obtained locally. Seeds which are embedded in berries or soft fruits, for example *Syzygium cordatum* (Umdoni) are separated from the pulp and cleaned before sowing. Seeds are sown in trays placed outside the shadehouse, at a depth equal to the diameter of the seed (Nichols: personal communication). This is imperative to ensure a high germination rate.

Many seeds of indigenous trees germinate slowly. For example *Podocarpus falcatus* (Yellowood) can take 6 months or more to germinate. When seedlings are about 100 mm high they are transplanted into 5 litre soil bags and placed in the shadehouse, where they must remain until they are at least 700 mm in height, at which time they are transplanted along the riverine areas.

The time taken for each species to reach the transplanting stage varies (see Table 4).

Table 4
Time taken for some indigenous species to reach final transplant stage

Species	Date sown	Date transplanted	Number months	Height (cm)
Albizia adianthifolia	June 88	November 88	5	40
Celtis africana	April 88	February 89	10	80
Croton sylvaticus	May 88	February 89	9	70
Millettia grandis	May 88	November 88	6	70
Syzygium cordatum	May 88	February 89	9	70
Trema orientalis	April 88	November 88	7	80
Trichilia dregeana	May 88	January 89	8	60

Selection of species

Precursors

Bearing in mind that the aim is to reproduce a plant community which would have occurred naturally in the area, the "natural" way to establish a forest is to plant those species which would colonise cleared land first i.e. precursor species. All precursors are fast-growing and can tolerate full sun when young. They fruit at an early stage and attract fruit-eating birds from adjacent forests. These birds introduce seeds of other tree species which can germinate in the partial shade created by the precursors. Once established, these imports will overtake the short-lived precursors (6–10 years).

Trema orientalis is the most vigorous forest precursor. It can attain a height of 7 metres within 1 year. Other good precursors in the South Coast area of Natal are *Bridelia micrantha* (Mitzeerie) and *Antidesma venosum* (Tassel berry). These 3 species are thus planted extensively in the initial years of the project.

Erosion protectors

- *B. micrantha* will be concentrated in areas of greatest erosion hazard. These are pressure points along streams and rivers where water is most likely to, or already has damaged banks.

Table 3
Costs of running a 12 000 seedling nursery for 1 year

	Cost/mday (R)	Mdays	Materials/ Machinery (R)	Total Cost (R)
Capital Costs				
Shade cloth			2 700	2 700
Poles			100	100
Gravelling and levelling			550	550
Construction (permanent labourer)	12,00	260		3 120
TOTAL				6 470
Operating Costs				
Labour (2 × temporary labourer)	6,00	624		3 744
(1 × permanent labourer)	12,00	312		3 744
Equipment - bags, etc			1 200	1 200
Soil transport (40 m^3) *1			320	320
Depreciation (8 years) $\frac{R6\,470}{8}$ = 809				809
				9 817

Cost/seedling = $\frac{R9\,817}{12\,000}$ = R0.82/seedling.

*1 12 000 seedlings require 40 m^3

- *Voacanga thouarsii* (Wild frangipani) thrives in very wet areas and even develops air roots when planted in swamp areas.
- *Phoenix reclinata* (Wild date palm), occurs extensively in the South Coast area and adapts to a wide range of conditions. *P. reclinata* is an adequate replacement for *Rafia australis* (Kosi palm) which has been used for erosion control in the Mtunzini area for some years (Coates Palgrave[2]) (Garland).

The extensive rooting network of these trees forms root-weirs across streams, creating small waterfalls, which increase water turbulence. This is an important contribution to the microsystem as it reduces organic matter oxidised by bacteria.

Leguminous species

Other indigenous species are planted slightly further away from the waterlines as their functions do not include direct erosion prevention.

Cordyla africana (Wild Mango), Albizia adianthifolia (Flat Crown), *Acacia karoo* (Sweet thorn) and *Millettia grandis* (Umzimbeet) are all leguminous plants with wide canopies. The shade that they provide and their nitrogen-fixing ability are favourable for growth of new seedlings.

Commercial value

Some indigenous species have great economic value: *P. falcatus* timber sells at R5 000/m^3. (It also has an excellent root system). *Olea africana* (Wild Olive) produces close grained and very hard wood which takes a fine finish, and is most suitable for high class furniture.

Medicinal value

B. micrantha, Trichilia dregeana (Forest Natal Mahogany), *Bersama lucens* (Glossy bersama), *Croton sylvaticus* (Forest croton) and *A. adianthifolia* are some of the most popular indigenous trees used for medicinal purposes. From some trees the bark is peeled off and used in concoctions. Protection in this case is simple since bark hunters ignore bark that has been contaminated with paint (Nichols: personal communication). The leaf sap and roots of *B. micrantha* are also used to treat ailments (ranging from gastric ulcers to headaches).

Although the commercial and medicinal values of indigenous trees are incidental to the project, they cannot be ignored.

Future

Constant evaluation of newly planted areas should provide a clearer understanding of riverine forest ecosystems. The progress of the project is being closely monitored, in conjunction with the Natal Parks Board. Fixed-point photographs and accurate measurements of planting density will help monitor the survival of planted pioneer trees and the regeneration of successor species.

Conclusion

It would be a significant achievement if in time the newly afforested river lines and banks at Sezela serve as a starting point and vegetative link for the surrounding network of streams, rivers and vleis in Natal.

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