Rehabilitation of Denuded Forest Lands in the Philippines using Bamboos

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Abstract

Bamubusa arundinacea, B. blumeana, B. philippinensis, B. vulgaris, Dendrocalamus merrillianus, D. asper, Gigantochloa levis and *Schizostachyum lumampao* were planted in 14 sites in the Philippines covering a total area of 2,100 ha to rehabilitate denuded forest lands, stabilize riverbanks, demonstrate appropriate soil rehabilitation technologies to the rural communities and improve the economic status of the pepole. Farmer cooperators were trained in bamboo plantation estabilshment and management. After 15 years of continuous research with the seemingly insurmountable problem of environmental degradation, in relation to the low rate of success in reforestation, the Filipinos today have come up with the intriguing new hope that the bamboo could be the lifesaver to restore the vegetative cover to the denuded lands, halt soil erosion and provide profitable crop to farmers. It can be a key ecological species to facilitate succession which is important for successful rehabilitation. Results showed that the bamboos are now extensively growing in study areas with stones and rocks exposed through erosion, in grasslands formerly covered with *Themeda triandra, Imperata cylindrica* and *Saccharum spontaneum* and in soils that shrink during dry seasons with many deep cracks. *Bambusa arundinacea* and *B. blumeana* gave the highest growth performance in the types of soils. They are easily propagated and maintained and require watering only during the first year while they are still in the nursery. New culms are produced year after year from the underground rhizomes unlike most trees which need replanting to obain another harvest. A clump of *B. philippinensis* produced 20 new culms in one year. Harvest was performed 3 years after planting with a yield of 15,000 culms/ha. Two years after the first cut, the second harvest yielded 25,000 culms/ha. The rhizomes and roots grew in all directions and formed a complex network within one meter depth under the ground which prevented soil erosion. Bamboos along the riverbanks slowed down the speed of water with their extended roots acting as filter plants by allowing water to flow and retaining gravel and coarse sediments in the culms. They produced enough leaf litter and were found to survive even after a forest fire.

Introduction

The philippines has a total land area of 30 million hectares, 17 million of which are coverd with forests and about three-fourths of the alienable land of 11 million hectares are markedly eroded. Most of the upland areas are subject to severe erosion during the rainy season owing to the high rainfall intensity, forest fires, destructive logging and shifting agriculture. The heavily eroded areas include Batangas and Cebu with about 80-85% of the total areas eroded, Marinduque, 75-80%; Ilocos and La Union, 60-70%; and Capiz, 50-60%. Erosion is also extensive in Panay, Cotabato, Negros, Zamboanga, Davao, Lanao, Bukidnon and Misamis Oriental. The rest of the country suffers less than 50% erosion losses. Reforesta-

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tion lags behind forest denudation which is proceeded at the rate of 84,000 ha per year. Although wide areas are initially planted to forest trees, a large percentage of the seedlings finally die. The causes include improper choice of species, pests and diseases, poor maintenance, etc. The giant ipil-ipil (*Leucaena leucocephala*) was attacked by psyllids in epidemic proportions. *Acacia mangium* trees are now being attacked in the stem by a kind of disease resulting in stunting in growth and finally drying up. Agoho (*Casuarina equisetifolia*) plantations in Albay, Philippines have been infested with gall disease. Much plantation of reforestation projects in Philippines was burned. The plantation could have survived after burning if bamboos had been planted instead of the trees. Where trees have failed due to the aforementioned causes bamboos can be grown on denuded lands and watersheds along the eroded riverbeds and hill slopes. Bamboos have not yet been observed to be attacked by pests and diseases. They are easily propagated and maintained and reqire watering only during the first year while they are still in the nursery. They survive forest fires by giving rise to new shoots from the rhizomes when the rains come. New culms are produced during the rainy season which provides harvest every year unlike most trees which need replanting to obtain another harvest. Bamboos along the eroded riverbanks slow down the speed of water with their extended roots and rhizomes acting as filter plants by allowing water to flow and retaining gravel and coarse sediments in the culms. The rhizomes and roots grow in all directions and form a complex network within one meter depth under the ground which prevents soil erosion. They provide enough leaf litter to the soil.

Attempts to grow bamboos in the Philippines were made by several workers. Chinte (1965) established plantations of *Bambusa vulgaris* and *Dendrocalamus asper* with yields of 5,991 to 6,900kg/ha, respectively 3-4 years after planting while *Bambusa blumeana* failed to grow. Other plantations were established by Bumarlong (1981), Suzuki (1982), Ramoran (1989), Alfonso and Caasi (1982).

Materials and methods

Species and study sites

The bamboo species used with their corresponding locations are:

1) *Bambusa blumeana* – Daraitan, Tanay, Rizal and Pililia Rizal
2) *Dendrocalamus asper* – Malaybalay, Bukidnon and Llavac, Real, Quezon
3) *Bambusa philippinensis* – Davao del Norte

Tanay and Pililia, Rizal belong to climatic type I with two pronounced seasons, dry from November to April and wet during the rest of the year. Llavac, Real, Quezon belongs to climatic type II without dry season and a very pronounced maximum rain period from November to January. Malaybalay, Bukidnon and Davao del Norte belong to climatic type IV with rainfall more or less distributed throughout the year. Figure 1 shows the study area in Daraitan, Tanay, Rizal along the riverbank while in Figure 2 the study area on a hillside. Figure 3 shows the plantation site of *Bambusa blumeana* in Pililia, Rizal.

Bambusa blumeana was either directly planted in on the field using two nodes or nursey-raised for one year using one-node one-year-old cuttings. In Malaybalay, Bukidnon, *Dendrocalamus asper* was planted directly in the field during the rainy season using 2-node cuttings planted horizontally at 10cm depth. *D. asper* in Llavac, Real, Quezon was nursey-raised before field planting. *B. philippinensis* was propagated using one-node section with 2-node branch and a full-grown bud. These were potted in 8″×12″ polyethylene plastic bags and then outplanted 45-60 days after potting.

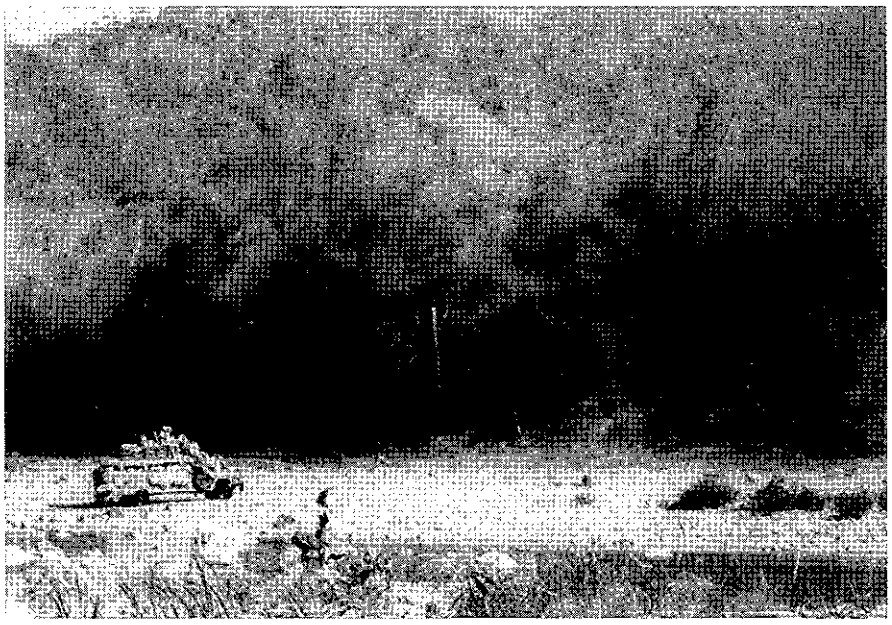

Fig. 1 The study site at Tanay, Rizal along a riverbank

Fig. 2 *Bambusa blumeana* on a hillside site at Tanay, Rizal

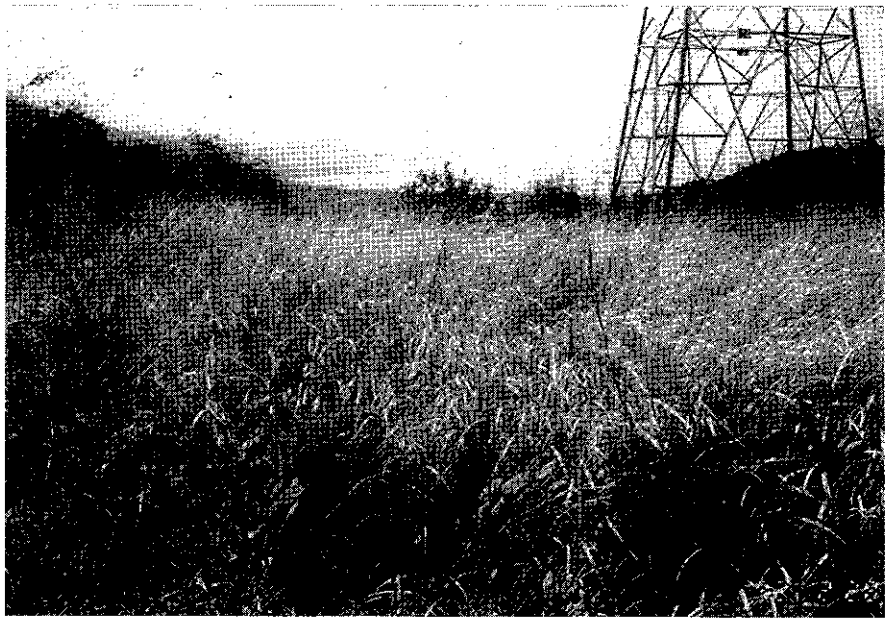

Fig. 3 Study site at Pililia, Rizal.

Results and discussion

1 ***Bambusa blumeana*** **(Tanay, Rizal)**

As shown in table 1, the average culm production of *B. blumeana* was 1.60 in the first year and it increased sharply in the third year which indicates that it takes 3 years to establish a clump of *B. blumeana* along riverbanks. It continued to increase rapidly up to the seventh year and reached an average value of 30.10. It can be expected that the first harvest will take place 6 years after planting and yearly thereafter. Figure 4 shows the 7-year old plantation of *Bambusa blumeana* in Daraitan, Tanay, Rizal.

Table 1 Yearly growth performance of a 7-year-old *B. blumeana* at Daraitan, Tanay, Rizal, Philippines (Ramoran, 1989)

Parameter	Yearly growth performance						
	1	2	3	4	5	6	7
Average number of shoots	2.33	3.00	3.33	3.34	5.00	4.30	5.50
Average number of culms	1.60	2.52	8.00	12.40	13.66	24.10	30.10
Average total height (m)	4.44	8.59	10.59	13.20	15.90	17.30	18.00

Growth performance of *B. blumeana* on hill sides was relatively lower than that of the bomboos planted along the riverbank probably due to the water supply. The results showed an average of 60% survival of two-node culm cuttings directly planted on hill side.

The 10-year old *B. blumeana* plantation at Pililia, Raizal showed a remarkable growth performance as indicated in Table 2.

Teble 3 shows the chemical properties of the soils at the bamboo plantation in Pililia, Rizal. The soil pH ranged from 4.8 to 5.2. The area was once cogonal and trees did not grow well until the bamboos were planted successfully (Fig. 5).

Fig. 4 Seven-year-old *Bambusa blumeana* in Tanay, Rizal

Table 2 Growth performance of *B. blumeana* in Pililia, Rizal

Average number of culms/clump	11
Average number of culms per hectare	4400
Average height (m)	14.60m
Average number of internodes/clump	44
Average diameter (cm)	10

Table 3 Chemical properties of soils in Pililia, Rizal.

Horizon	pH	P ppm	%OC	%OM	CEC sum
A	5.5	3.3	1.64	2.82	51.0
B	5.3	3.5	1.03	1.77	46.4
C	5.1	2.5	0.54	0.93	55.9

2 *Dendrocalamus asper*

The giant bamboo diretly planted the field in Can-ayan, Malaybalay, Bukidnon showed a 59% survival and replanting by potted cuttings was necessary but the nursery-raised one-node giant bamboo cuttings outplanted in Llavac, Real, Quezon showed a 100% survival. It is therfore important to raise the bamboo cuttings in the nursery before field planting.

Fig. 5

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