Forest Ecology and Management, 14 (1986) 133—140
Elsevier Science Publishers B.V., Amsterdam — Printed in The Netherlands

POLE CUTTING PRESSURE IN TANZANIAN FOREST

JOHN B. HALL[1,3] and W.A. RODGERS[2]

[1] *Division of Forestry, University of Dar es Salaam, Dar es Salaam (Tanzania)*
[2] *Department of Zoology, University of Dar es Salaam, Dar es Salaam (Tanzania)*
[3] Present address: Department of Forestry and Wood Science, University College of North Wales, Bangor, Gwynedd LL57 2UW, Great Britain.

(Accepted 12 August 1985)

ABSTRACT

Hall, J.B. and Rodgers, W.A., 1986. Pole cutting pressure in Tanzanian forest. *For. Ecol. Manage.*, 14: 133—140.

Surveys of pole cutting in the Kimboza, Pande and Pugu Forest Reserves revealed intensities reaching 50% of available poles in easily accessible areas. Pockets of severe pole destruction were associated with pit sawing practices. No conclusive evidence for species selection was found, but emergent, canopy and smaller tree species were all affected. The implications of the findings for the survival of isolated forest fragments in Tanzania's coastal belt are discussed and suggestions are made of measures to ease cutting pressure.

INTRODUCTION

The issue of tropical forest destruction has aroused much attention. In the past few years UNESCO (1978), Myers (1979) and FAO—UNEP (1981a, b) have ably reviewed present trends. Most published comment on the matter deals with the problems of large scale forest clearing due to agricultural encroachment or clearfelling. Much less attention has been given to internal changes in forest structure and composition caused by local people collecting what is often termed "minor forest produce", e.g. firewood, poles, fodder, medicinal plants. As human populations expand and the remaining forest areas become increasingly fragmented these local pressures will intensify on a diminishing resource base.

In the course of field work in small coastal forests in the early 1980s the high frequency of cut stems present attracted attention. Some quantitative assessments of cutting intensity were made subsequently but before a formalised study could be mounted both authors left Tanzania. In view of the lack of published information on the cutting of small stems in natural forest we believe our preliminary quantitative findings will be of interest. It is hoped this report will prompt local personnel to evaluate the situation in more detail.

0378-1127/86/$03.50

Major deforestation activities such as conversion for agriculture, clearfelling or even mechanised timber extraction if provision for replanting is neglected, even on a minor scale, are obvious to the casual observer. Localised cutting from within a forest is much more difficult to see but may exert such pressure on selected species and canopy regeneration that normal forest development is halted. Even the drastic changes wrought by pit sawing operations may be hidden by weedy regrowth within a few years. An existing canopy, together with a closed shrub layer and a few understorey trees conveys the image of an intact forest and this is what aerial photography will suggest to mappers.

SITES AND METHODS

Evidence of cutting activity was recorded in the Kimboza, Pande and Pugu Forest Reserves (Table 1). In these three forests, cutting of small stems is mainly for building materials: firewood cutting is of minor significance. Two forms of pole are cut, *nguzo* and *fito*. The first is a large, straight pole, 5—15 cm in diameter and at least 2.5 m long, which is used in house main frame construction. The second is about 2.5 cm in diameter and up to 2 m long, used to hold mud and thatch in place. In the Kimboza Forest Reserve pit sawing activity provided an opportunity to quantify the concentrated cutting directly associated with this tree felling technique, in addition to assessing the general intensity through the forest.

For ascertaining general cutting intensity, data recorded were frequencies of uncut stems, in the classes defined above, and stumps remaining after cutting, in belt transects 4 m wide. Initially (Kimboza) transects were of fixed length (200 m). In the other surveys, recording from a transect ceased

TABLE 1

General characteristics of three forest reserves in Tanzania where pole cutting intensity was assessed

	Forest reserves		
	Kimboza	Pande	Pugu
Location	7°00'S, 37°50'E	6°40'S, 39°00'E	7°00'S, 39°00'E
Elevation (m)	180—500	50—100	100—300
Area (ha)	400	1450	2650
Vegetation *sensu* White (1983)	Zanzibar—Inhambane lowland rainforest	Zanzibar—Inhambane undifferentiated forest	
Remarks	Logged under licence; no serious encroachment	Increasingly subject to encroachment and felling	

when the combined total of *nguzo* and *nguzo* stumps reached 50: all *fito* (cut and uncut) within the transect so defined were recorded.

Transect location at Pande (six transects) and Pugu (six transects) took account of the criteria appropriate for reserve stratification — forest type and topography respectively. At Kimboza, where more time was spent, four groups of three transects each were located at intervals along a line running east—west across the widest part of the reserve. The Kimboza locations related to the extent of human activity: high (near the motor road serving the area), moderate (near the western boundary with farmland) and low (two groups of transects in wet, rocky terrain in the centre of the reserve). Data from transects within each location were pooled for summarisation.

Identification of poles was attempted only at Pande where uncut poles were also measured (diameter at breast height, dbh) and for each stump the corresponding value estimated.

At three pit sawing sites in Kimboza, the exploited tree was characterised by identity, dbh, approximate total height and length of pole utilized. The extent of the working clearing was estimated, indicating the impact area. All stumps or stems of cut or severely damaged trees (dbh $\geqslant$ 6 cm) in the vicinity were enumerated, measured (dbh) and, where possible, identified. No assessment of stems $<$ 6 cm dbh was made.

RESULTS

Considerable variations in cutting intensity were revealed (Table 2) and appear related to accessibility. In boundary areas and areas close to roads, the proportions of stems cut were markedly higher than in reserve interiors. The extent to which difficult terrain in central Kimboza intensifies or overrides the inaccessibility in reducing cutting is not clear. Similarly, the effects of accessibility and slope cannot be separated at Pugu.

Patterns of *nguzo* and *fito* gathering were not identical. At Pande no *fito* cutting was observed. At Kimboza the impact was less severe than cutting for *nguzo*. At Pugo *fito*-cutting intensity was higher than *nguzo*-cutting intensity near the road but similar elsewhere.

Only casual observations on the species affected by pole cutting were made at Kimboza and Pugu. Middle storey species cut at Kimboza include *Cola* spp., *Diospyros* spp., *Drypetes natalensis* (Harvey) Hutch. and *Scorodophloeus fischeri* (Taubert) J. Leonard: potentially emergent species include *Aningeria pseudoracemosa* J.H. Hemsley and *Terminalia sambesiaca* Engl. & Diels. None of the species noted cut at Pugu was a potential emergent. *Diospyros* spp., *Manilkara sansibarensis* (Engl.) Dubard and *Trilepisium madascariense* DC., however, commonly contribute to the forest canopy: *Angylocalyx braunii* Harms and *Mildbraedia carpinifolia* (Pax) Hutch, are more typical of the middle and lower storeys. Three of the species found cut at Pande (Table 3) (*Dialium holtzii* Harms, *Manilkara sansibarensis* and *Nesogordonia* sp.) are typical emergent canopy constituents whilst *Scoro-*

TABLE 2

Pole cutting intensity as percentages of pole category available in three Tanzanian forest reserves

Location		Pole categories[a]	
		nuguzo	*fito*
Kimboza	Boundary near motor road	44	32
	Boundary with farms	27	12
	Reserve centre (i)	2	7
	Reserve centre (ii)	1	1
Pande	Boundary *Scorodophloeus* forest	72	0
	Central *Scorodophloeus* forest	30	0
	Central *Manilkara* forest	26	0
Pegu	Valley bottom near road	50	58
	Steep slope away from road	24	17
	Ridge crest away from road	27	25

[a]*Nguzo*, pole 5—15 cm in diameter, ⩾ 2.5 m long; *fito*, pole about 2.5 m cm in diameter, ⩽ 2 m long.

TABLE 3

Pole cutting intensity, by species, as percentages of poles available in Pande Forest Reserve, Tanzania

Species	Poles available	Poles cut	Proportion of species cut
Dialium holtzii	16	17	67
Manilkara sansibarensis	6	9	100
Monanthotaxis sp.	9	13	82
Nesogordonia sp.	6	9	90
Scorodophloeus fischeri	63	52	49
	100	100	
Overal cutting percentage			38

dophloeus fischeri occasionally reaches the canopy: *Monanthotaxis* sp. is mainly an understorey tree. There was no conclusive evidence that conscious selection of species was taking place, the more abundant a species, the more poles cut were recorded. Although the most poorly represented of the species listed (Table 3) were cut at greater intensity, the low total numbers scored and the limited areas assessed warn against premature interpretation.

The Pande assessments of stems cut in relation to size (Table 4) suggest fairly uniform demand for a range of sizes up to about 11 cm dbh. The greater numbers present of poles < 6 cm dbh mean that many are left, but pressure on stems 6—11 cm dbh is heavy; numbers cut seem limited by numbers available rather than demand.

The examination of the pit sawing areas (Fig. 1), on which four trees (all *Rhodognaphalon schumannianum* A. Robyns) were exploited, revealed a combined destructive impact on about 0.25 ha for a removal of about 30 m^3 of wood. Cutting to facilitate felling extended indiscriminately to

TABLE 4

Pole cutting intensity, by size category, as percentages of poles available in Pande Forest Reserve, Tanzania

Size categories (cm diameter)[a]	Poles available	Poles cut	Proportion of class cut
5—6.5	38	20	34
6.5—8	21	26	77
8—9.5	12	18	100
9.5—11	15	20	89
11—12.5	4	7	100
>12.5	10	10	63
	100	100	
Overall cutting percentage			38

[a]Approximate, converted from original 5-cm girth class data.

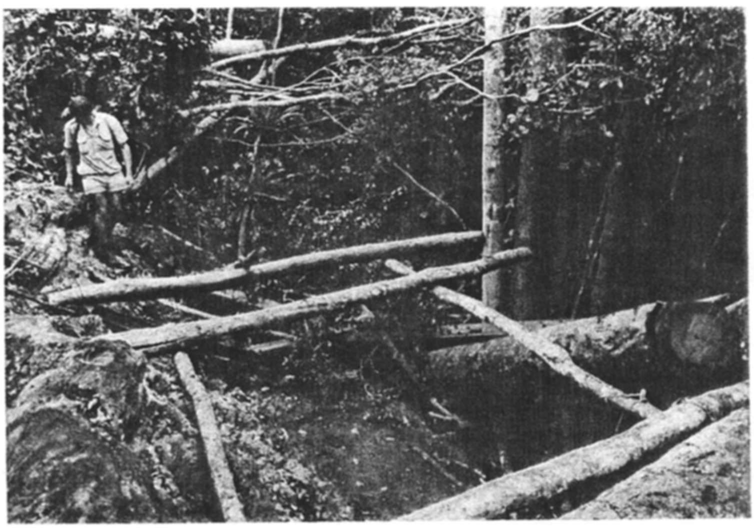

Fig. 1. A pit-sawing site in Kimboza Forest Reserve, Tanzania: the framework of large poles supported the tree (*Rhodognaphalon schumannianum*) while it was sawn into planks.

trees in the area reaching 40 cm dbh, regardless of species. Any reasonably formed stem can serve as a roller for moving logs, even if, for platforms, levers and props, species of attested strength are preferred. Over 0.1 ha, 40 stems $\geqslant$ 6 cm dbh, 20—25% of those present, typically are destroyed.

DISCUSSION

Evidently, pole cutting intensity can be high, accounting locally for the removal of half or even more of the stems available. Accessibility appears to increase intensity. No conclusion was reached concerning species preferences but in addition to the recruitment of lower storey trees that of emergent and canopy species is at risk. There can be little doubt that a stocking too depleted to sustain annual cutting, at present intensities, is left in accessible areas. Cutters are obliged to advance progressively into the hitherto less severely affected cores of the forests, auguring further deterioration of forest status. Whilst many species may respond to cutting by coppicing, repeated exploitation may weaken the stools. Individuals of canopy and emergent species cut again and again before the crown is well exposed may never enter the reproductive phase: this often is characteristic of large individuals (Longman and Jenik, 1974). In relation to canopy composition this means that as the present constituents die, or are felled, conspecific replacement will be less likely — particularly where the forest is small and isolated. The canopy will change in species, in diversity, in stature (as more strongly decurrent trees take the place of the excurrent trees which make good poles) and perhaps even in continuity.

Pit sawing already spreads these risks into the reserve interiors as pockets of high intensity pole cutting. Depending on successional rates, a decade of ineffectively controlled pit sawing could extensively change the nature of a forest: no enrichment activities are undertaken after felling and no guidelines keep pit sawing intensity low enough to prevent canopy destruction outpacing canopy regeneration.

Without realistic controls over utilization pressures, the survival of the forest fragments within Tanzania's intensively farmed coastal belt is, at best, uncertain. The inadvertent destruction, through complacency, of these fragments would deprive the local people of little-publicised, but nevertheless vital, self-sufficiency in a variety of forest products ranging from medicinal plants and leafy and tuberous vegetables to woods of qualities traditionally associated with particular uses and fauna hunted for protein. The loss of the last vestiges of a vegetation type which has aroused considerable interest because of the implications of affinities with forest in western Africa (Moll and White, 1978) and the occurrences of endemic species (Polhill, 1968) would also be scientifically regrettable. Further degradation would almost certainly culminate in conversion to farmland but, as the area involved is so small that its contribution to agricultural production in the country would be quite insignificant, such a development also would be senseless.

The impact of pit sawing which, in any case, does not supply timber to the immediate vicinity, can be reduced with little difficulty: an appropriate review of licencing policy would suffice. Reducing pole cutting intensity is another matter, since the poles are essential for every day village life. However, Tanzania's current drive to produce village self-sufficiency in tree growing offers a solution. Village forestry projects in the form of agrisilviculture, woodlots or amenity planting can readily produce poles of the quality desired. In coastal areas, *Cassia siamea* Lam., *Eucalyptus tereticornis* Sm., *Tectona grandis* L.f. and multipurpose soil improving species such as *Leucaena leucocephala* (Lam.) De Wit all have potential. Planted as a buffer zone against the reserve boundary the high productivity permits rotations as short as 3 years and offers a much less labour intensive alternative for acquiring poles. Extending such planting to initiatives with indigenous species would provide an opportunity to explore their potential in planned village forestry. Among species native to the coastal area several have aroused interest from forestry in recent years although systematic formal studies await implementation. Thus *Sorindeia madagascariensis* Thouars and *Vitex doniana* Sweet have been publicised as fruit trees (Silviculture Research Institute, 1983). *Trema orientalis* (L.) Blume attracts attention (Forest Division, 1984) as a means of combining pole production with land rehabilitation and *Albizia*, represented by various species — including several known to nodulate (Brenan, 1970) — and regarded (NAS, 1979) as a genus rich in multipurpose trees. With convenient pole sources outside relieving pressures within, the survival prospects for the forests will improve greatly — as will those for their constituent species, whether primarily of scientific interest (such as Pugu's *Millettia puguensis* Gillett) or of economic value (such as Kimboza's *Rhodognaphalon schumannianum*).

ACKNOWLEDGEMENTS

We thank Leonard Mwasumbi (Botany Department) and Messrs. Maige and Malima, past students (Zoology Department) of the University of Dar es Salaam for field assistance.

REFERENCES

Brenan, J.P.M., 1970. Leguminosae: Mimosoideae. Flora Zambesiaca, 3: 1—153.

FAO—UNEP, 1981a. Tropical Forest Resources Assessment Project: forest resources of tropical Africa. I. Regional synthesis. FAO, Rome, 108 pp.

FAO—UNEP, 1981b. Tropical Forest Resources Assessment Project: forest resources of tropical Africa. II. Country briefs. FAO, Rome, 586 pp.

Forest Division, 1984. Trees for village forestry. Ministry of Lands, Natural Resources and Tourism, Dar es Salaam, 125 pp.

Longman, K.A. and Jenik, J., 1974. Tropical Forest and Its Environment. Longman, London, 196 pp.

Moll, E.J. and White, F., 1978. The Indian Ocean coastal belt. In: M.J.A. Werger (Editor), Biogeography and Ecology of Southern Africa. Junk, The Hague, pp. 561—598.

Myers, N., 1979. The Sinking Ark. Pergamon, Oxford, 307 pp.
NAS, 1979. Tropical legumes: resources for the future. National Academy of Sciences, Washington, DC, 331 pp.
Polhill, R.M., 1968. Tanzania. Acta Phytogeogr. Suec., 54: 166—178.
Silviculture Research Institute, 1983. Food and fruit-bearing forest species. 1. Examples from eastern Africa. FAO For. Pap., 44(1): 1—172.
UNESCO, 1978. Tropical forest ecosystems. Nat. Resour. Res., 14: 1—683.
White, F., 1983. The vegetation of Africa. Nat. Resour. Res., 20: 1—356.