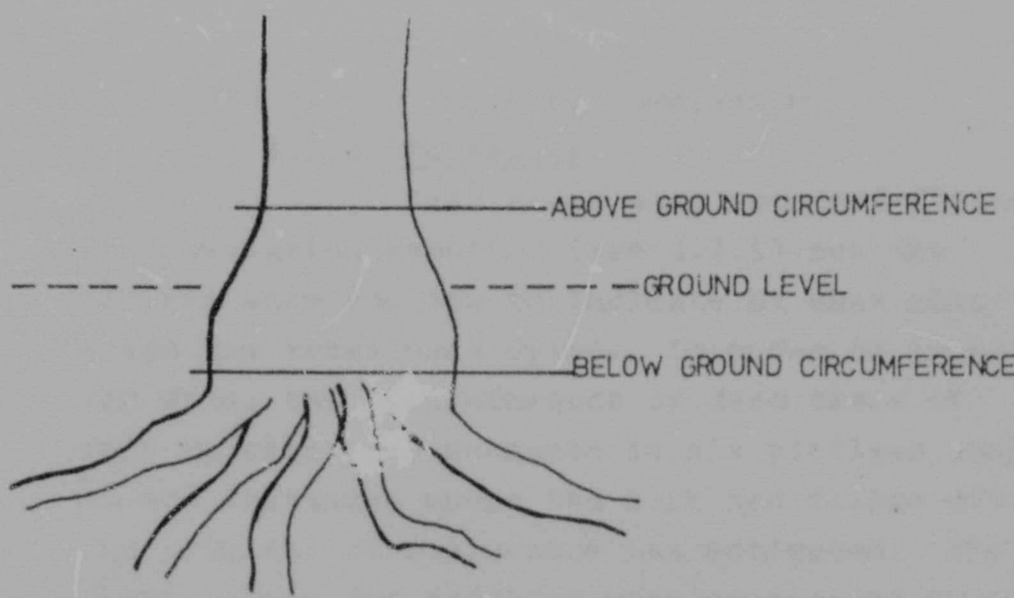


Fig. 4.2. Diagram showing positions of circumference measurements above and below ground.

Fig. 4.3. The use of weather resistant tapes for measuring the growth rates of trees.

available by the Forestry Commission.

4.2.3 Mortality

Dead trees were recorded during the population sampling (see 4.2.1) but the numbers were too low to indicate at what size/ stage the trees were dying. In order to improve the data, the circumference of dead trees of each species were measured in six plotless samples. In the instances where the bark had fallen off, the original circumference was estimated. The areas chosen for sampling were considered to be representative of a wide range of sizes for each species. Sample numbers varied from n = 85 to n = 150 according to the species.

4.2.4 Coppice Competition Experiment

A minor experiment was established to test the effect of interstem competition on the growth rate of B. plurijuga coppice. Ten fairly uniform clumps of 3m high coppiced B. plurijuga were selected from an area of regeneration near Caterpillar Pan (Fig. 4.4). In five clumps all but a single (the largest) stem were sawn off at ground level. The remaining five clumps were left untouched as controls. Tapes were fixed onto the single stems in the pruned clumps and onto the largest stems of the control clumps. Circumference changes were monitored at the same time as the other growth tapes.

4.3 RESULTS

4.3.1.1 Vegetation Composition

A summary of the vegetation of the five stands is given in Table 4.2. Stem area and density figures are for live trees only. The degree of coppicing of each species is shown in the percentage multistem category. Stem area and density per hectare give an indication of dominance, while average height reveals the

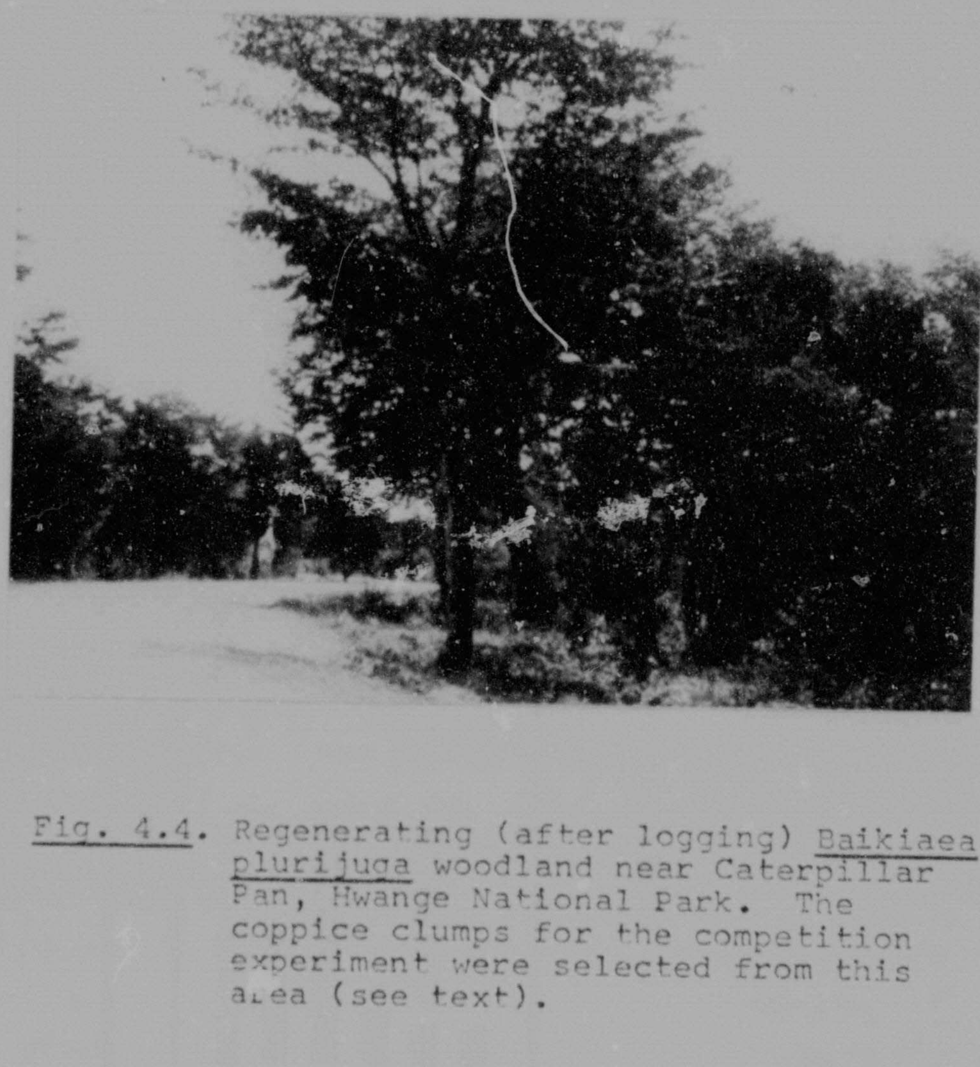


Fig. 4.4. Regenerating (after logging) *Baikiaea plurijuga* woodland near Caterpillar Pan, Hwange National Park. The coppice clumps for the competition experiment were selected from this area (see text).

TABLE 4.2. Vegetation Composition of the Five Stands

	Stem Density per ha					Mean Height (m)				
Species Stand:	Mit	Umt	Dopi	Sin	Shak	Mit	Umt	Dopi	Sin	Shak
Baikiaea plurijuga	240	161	449	40	-	10,9	4,4	4,0	3,7	-
Terminalia sericea	-	243	114	788	720	-	3,9	2,1	1,3	3,9
Guibourtia coleosperma	-	141	40	56	-	-	5,1	1,8	0,9	-
Burkea africana	-	81	193	272	188	-	4,0	3,0	1,5	2,4
Erythrophleum africanum	-	117	252	284	-	-	5,1	3,8	1,7	-
Ochna pulchra	-	772	394	392	160	-	2,2	1,8	1,2	2,2

Note:Stem height and density only refer to live trees.

physiognomy of the vegetation.

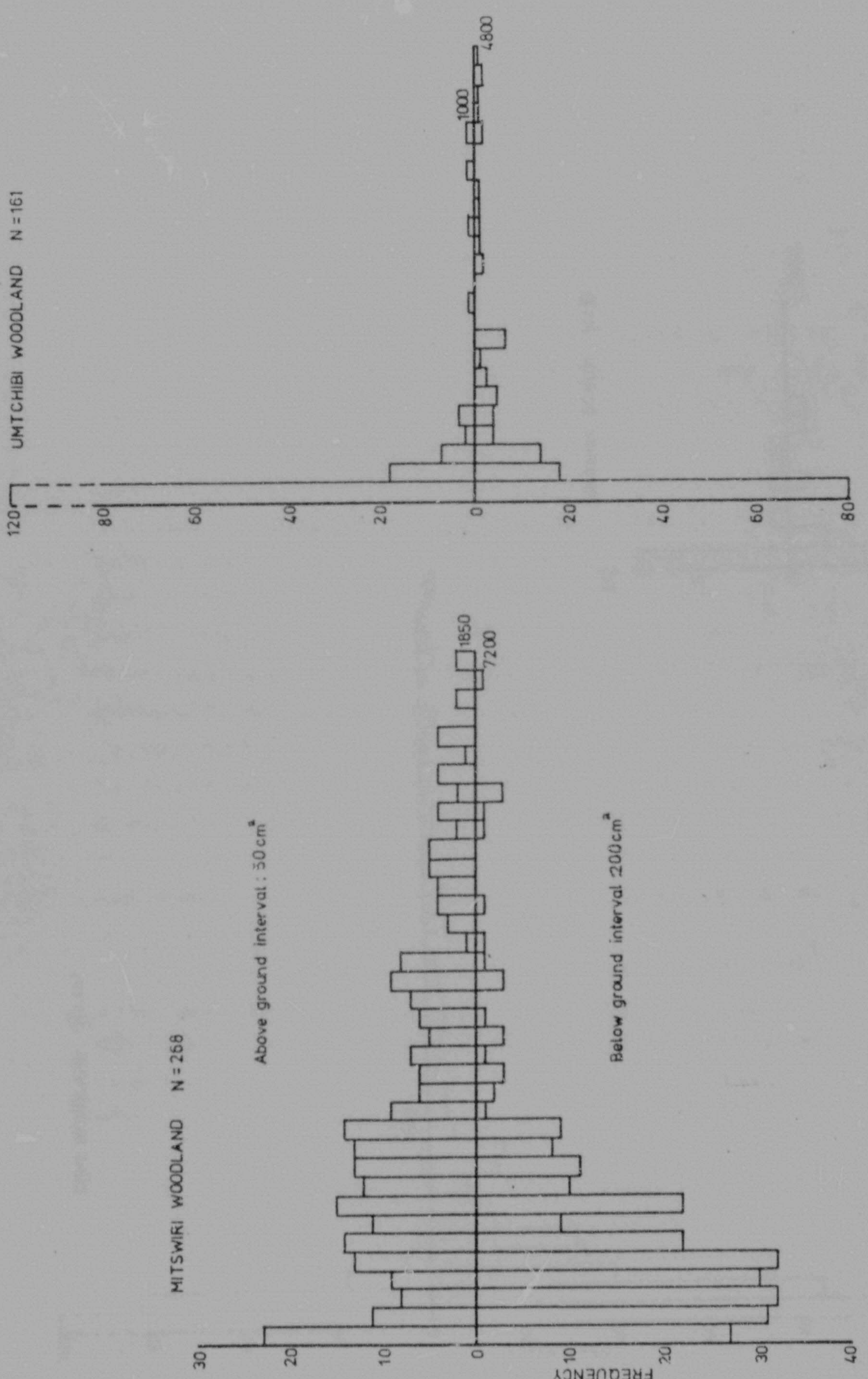
The species that show the highest proportion of coppice are G. coleosperma, B. plurijuga and E. africanum in the Sinanga scrub stand. This suggests that the Sinanga scrub is exposed to heavier disturbance than the other stands.

B. plurijuga is obviously the dominant species in the Mitswiri woodland, and is the major species, both in stem area and density, in the Dopi woodland. T. sericea is the most important component of both scrub stands, with O. pulchra and E. africanum as lesser species. O. pulchra dominates (density-wise) the Umtchibi woodland; followed by B. plurijuga and G. coleosperma.

There is a gradation in height from the 11m high Mitswiri woodland through to the 1,7m high scrub at Sinanga. The slightly higher than average heights in Shakwanki scrub probably result from a low frequency of disturbance. This scrub falls into the lowest fire frequency class (see Fig. 5.23).

4.3.1.2 Size Structure

The above and below ground size structures for the six species in each stand are shown in Fig. 4.5. With all the species there is a shift in emphasis from above to below ground with an increase in disturbance. This is illustrated particularly well by B. plurijuga. In the undisturbed Mitswiri woodland there is an approximately equal distribution of above and below ground stem/rootstock area. The population is 'balanced' with wide range of size classes above and below ground. The Dopi population has a negatively skewed above ground size structure, with a great number of stems (259) in the first $50cm^2$ class (compare with Mitswiri). These are mostly coppice regrowth stems with very few seedlings. The below ground structure follows a



<u>Fig. 4.5(a)</u> Above and below ground size structures of <u>Baikiaea plurijuga</u> populations in two woodland stands. The size ranges are indicated by the numbers above and below the x axis.

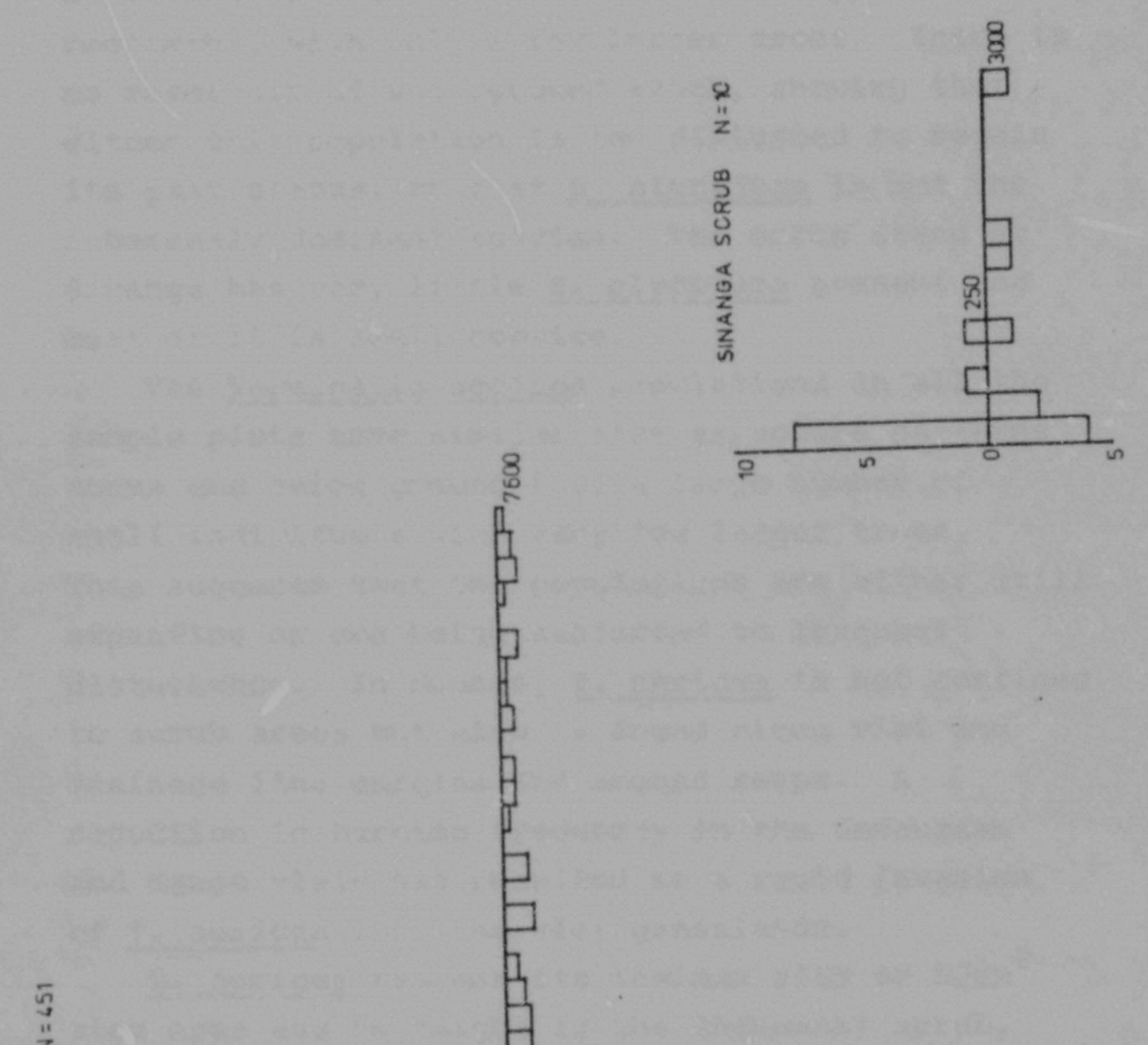


Fig 4.5(b) Above and below ground size structures of Baikiaea plurijuga populations in one woodland and one scrub stand. The size ranges are indicated by the numbers above and below the x axis.

similar pattern to that in Mitswiri and indicates that this woodland has retrogressed. It has the potential (established rootstocks) to develop to a Mitswiri type population. The trees in the Umtchibi stand also have the greatest number of stems in the smallest size classes (coppice regrowth), with only a few larger trees. There is no reservoir of underground stock, showing that either this population is too disturbed to regain its past status, or that B. plurijuga is not the inherently dominant species. The scrub stand at Sinanga has very little B. plurijuga present and most of it is small coppice.

The Terminalia sericea populations in all the sample plots have similar size structure patterns above and below ground i.e. a large number of small individuals with very few larger trees. This suggests that the populations are either still expanding or are being subjected to frequent disturbance. In Hwange, T. sericea is not confined to scrub areas but also is found along vlei and drainage line margins and around seeps. A reduction in burning frequency in the Umkauzaan and Manga vleis has resulted in a rapid invasion of T. sericea into the vlei grasslands.

T. sericea reaches its maximum size of 50cm^2 stem area and 9m height in the Shakwanki scrub, but these individuals are small compared to some trees growing in the Zingweni Vlei, a Kalahari Sand - Gneiss contact zone (Lockett, 1979) outside the Park.

Guibourtia coleosperma has a similar sized population to B. plurijuga in the Umtchibi plot. There are a few large trees present, but most of the population falls into the smallest size classes. This points again to a retrogression of the species. In the Dopi woodland all the stems

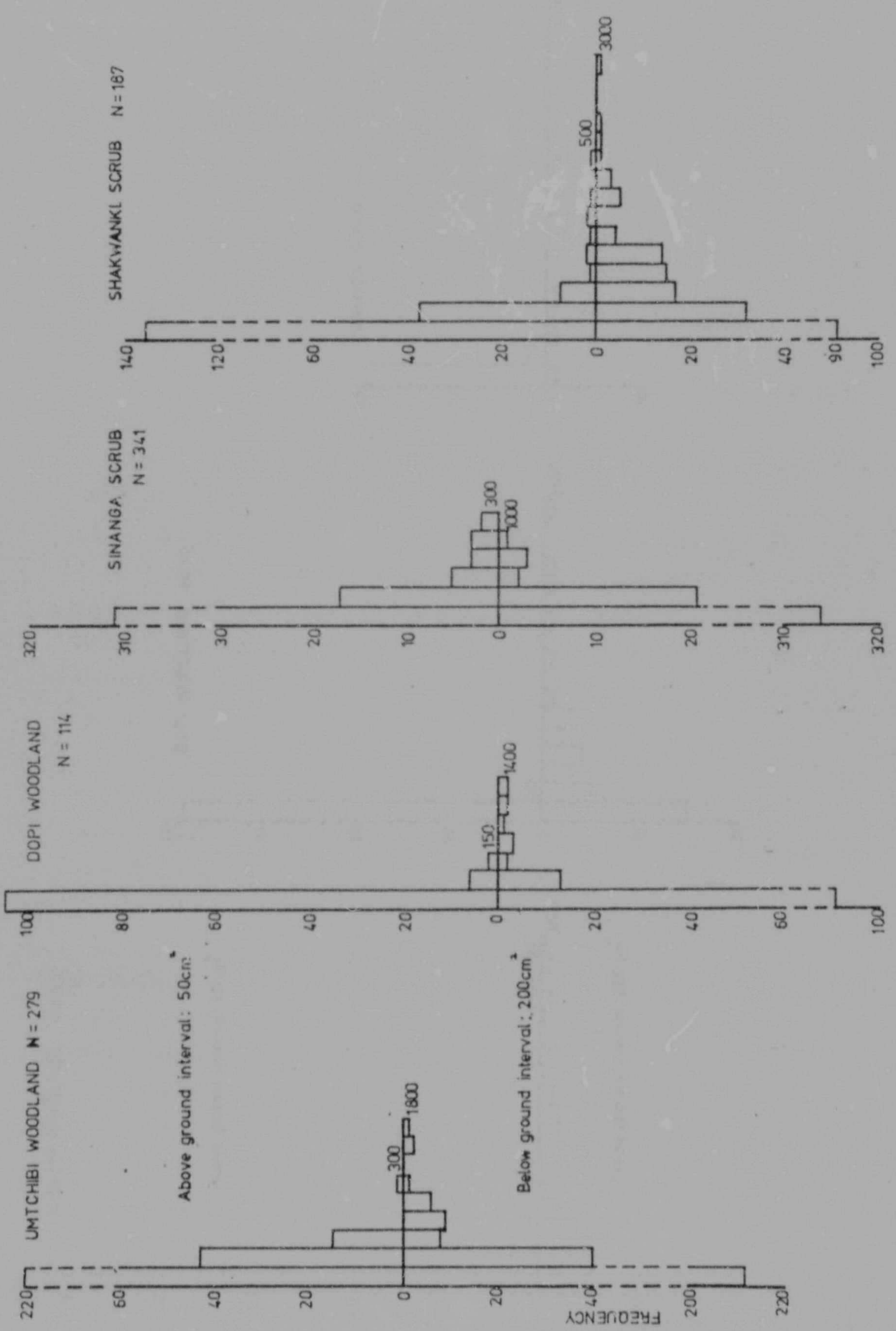


Fig. 4.5(c) Above and below ground size structures of *Terminalia sericea* populations in two woodland and two scrub stands. The size ranges are indicated by the numbers above and below the x axis.

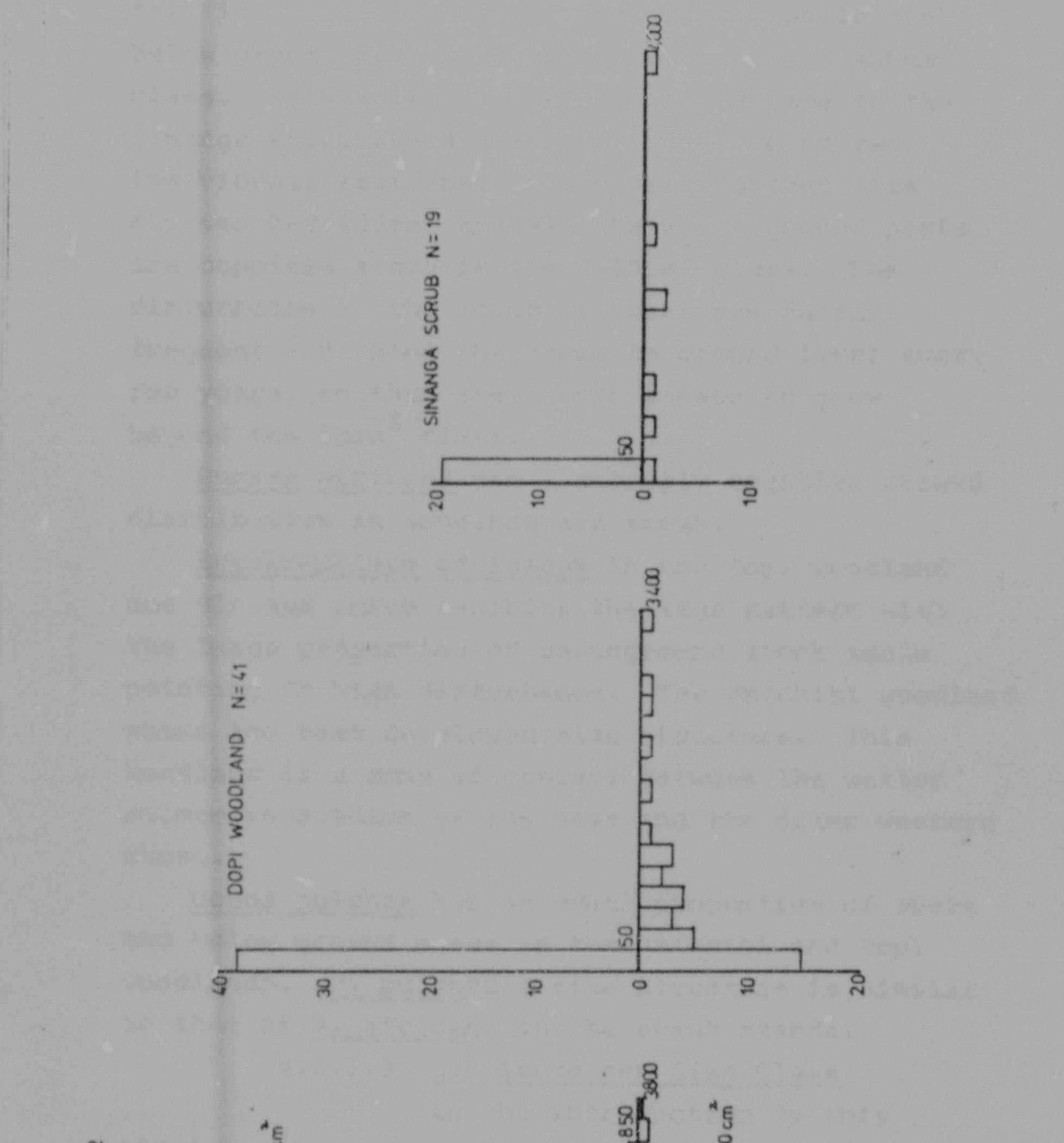


Fig. 4.5(d) Above and below ground size structures of *Guibourtia coleosperma* populations in two woodland and one scrub stand. The size ranges are indicated by the numbers above and below the x axis.

fall into the first 50cm^2 size class, while the below ground areas are spread up to the 3 400cm^2 class. This shift is taken to an extreme in the Sinanga scrub where there are only one or two individuals scattered in the below ground size classes 0-3 800cm^2 and all the above ground parts are coppiced stems in the 0-50cm^2 class. The disturbance in the scrub is therefore fairly frequent - pruning the stems to ground level every few years, so that they never manage to grow beyond the 50cm^2 class.

Burkea africana has a strongly negative skewed distribution in woodland and scrub.

Erythrophleum africanum in the Dopi woodland and Sinanga scrub exhibits the same pattern with the large proportion of underground stock again pointing to high disturbance. The Umtchibi woodland shows the best developed size structure. This woodland is a zone of contact between the wetter miombo vegetation of the east and the drier western mkusi.

Ochna pulchra has an equal proportion of above and below ground areas in the Umtchibi and Dopi woodlands. O. pulchra's size structure is similar to that of B. africana in the scrub stands.

4.3.1.3 Quotients per Size Class

In the introduction to this chapter, the concept of a balanced size distribution, where the quotients of numbers in successive size classes approach a constant value, was mentioned. For the six species, the quotients were only calculated for the below ground circumferences as these extend over a wide range of classes (Fig. 4.6).

Baikiaea plurijuga (Fig. 4.6 (a)). In the undisturbed woodland plot (Mitswiri) there is little variation in quotient values except in the 2 000 -

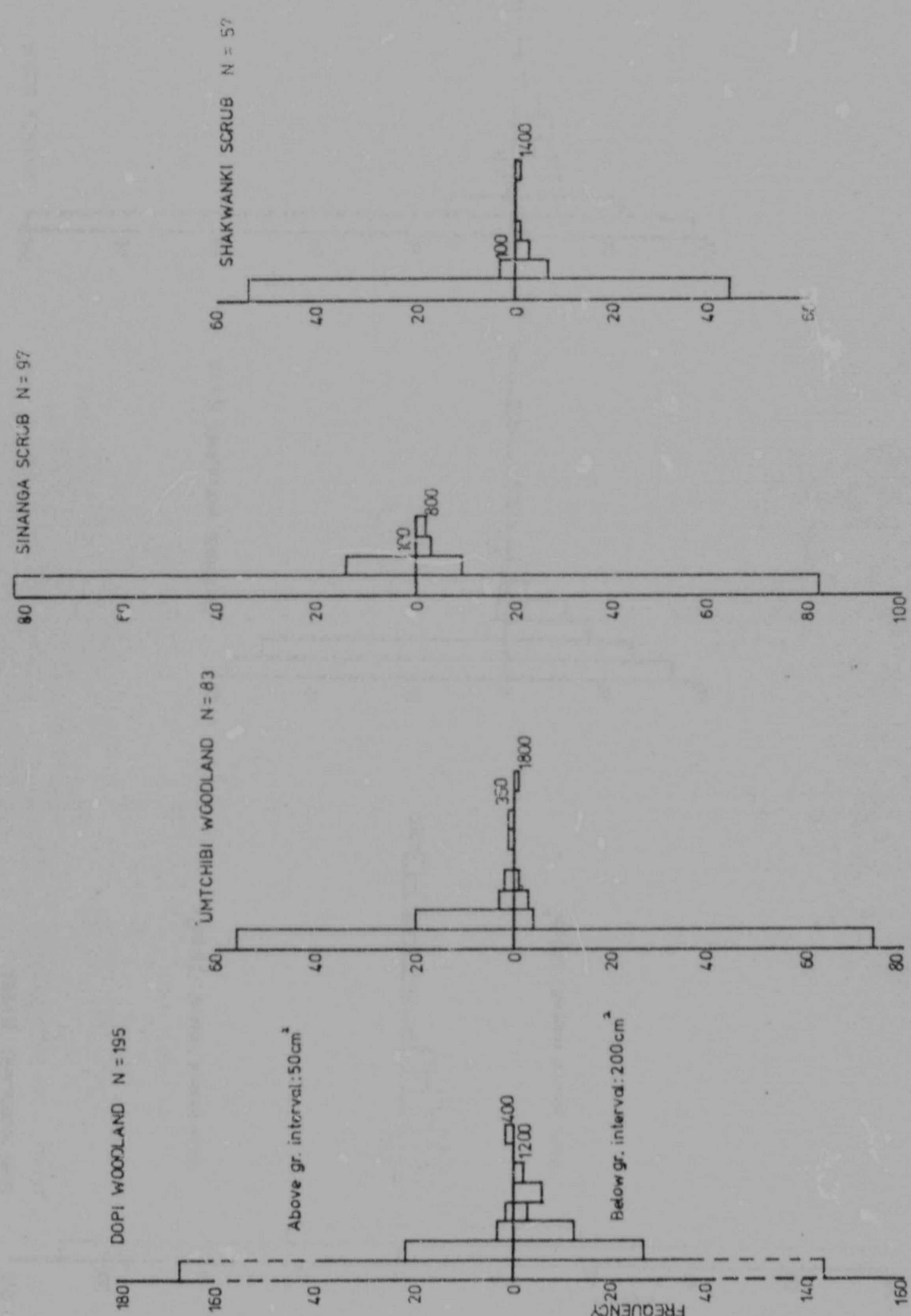


Fig. 4.5(e) Above and below ground size structures of *Burkea africana* populations in two woodland and two scrub stands. The size ranges are indicated by the numbers above and below the x axis.

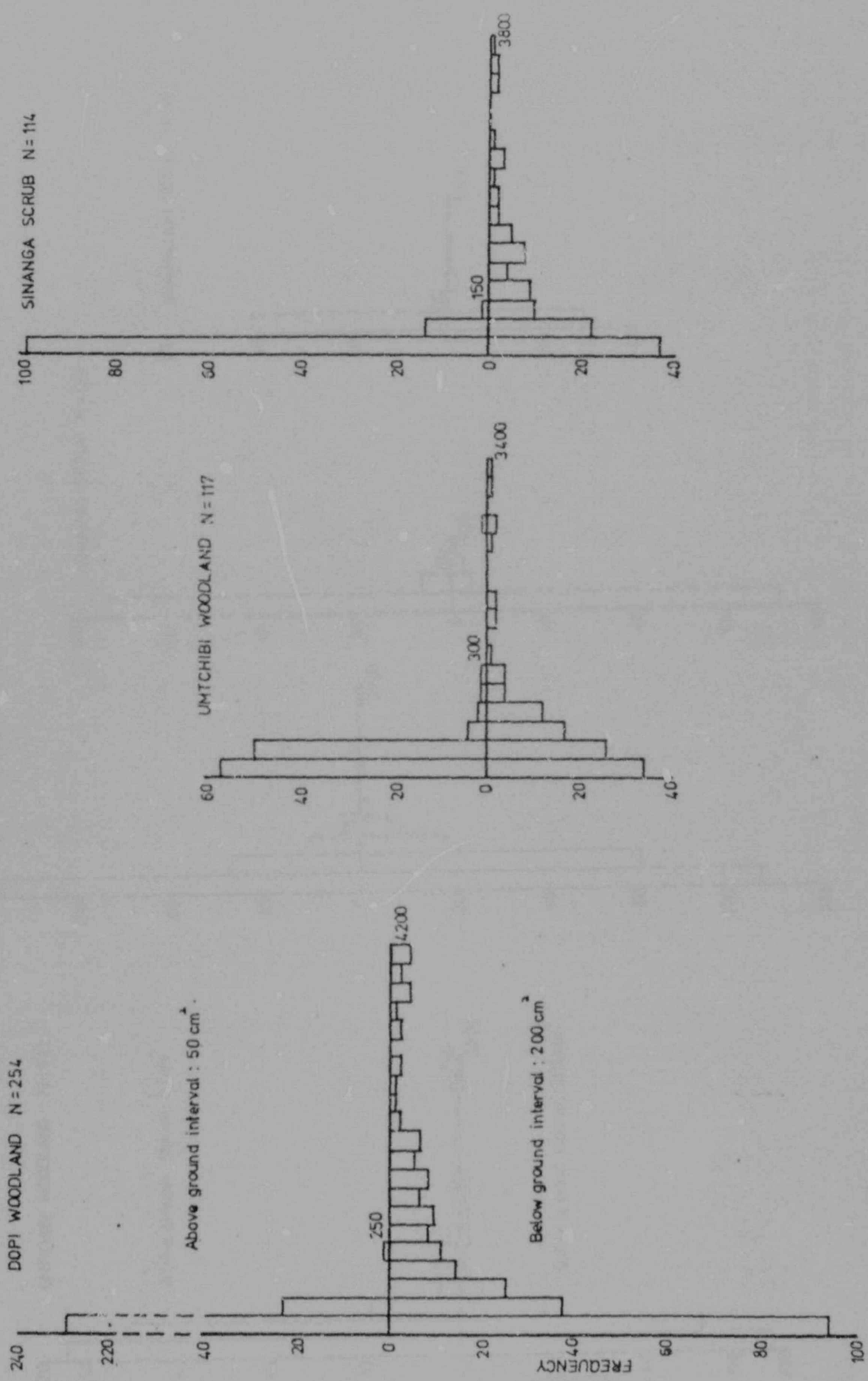


Fig. 4.5(f) Above and below ground size structures of Erythrophleum africanum populations in two woodland and one scrub stand. The size ranges are indicated by the numbers above and below the x axis.

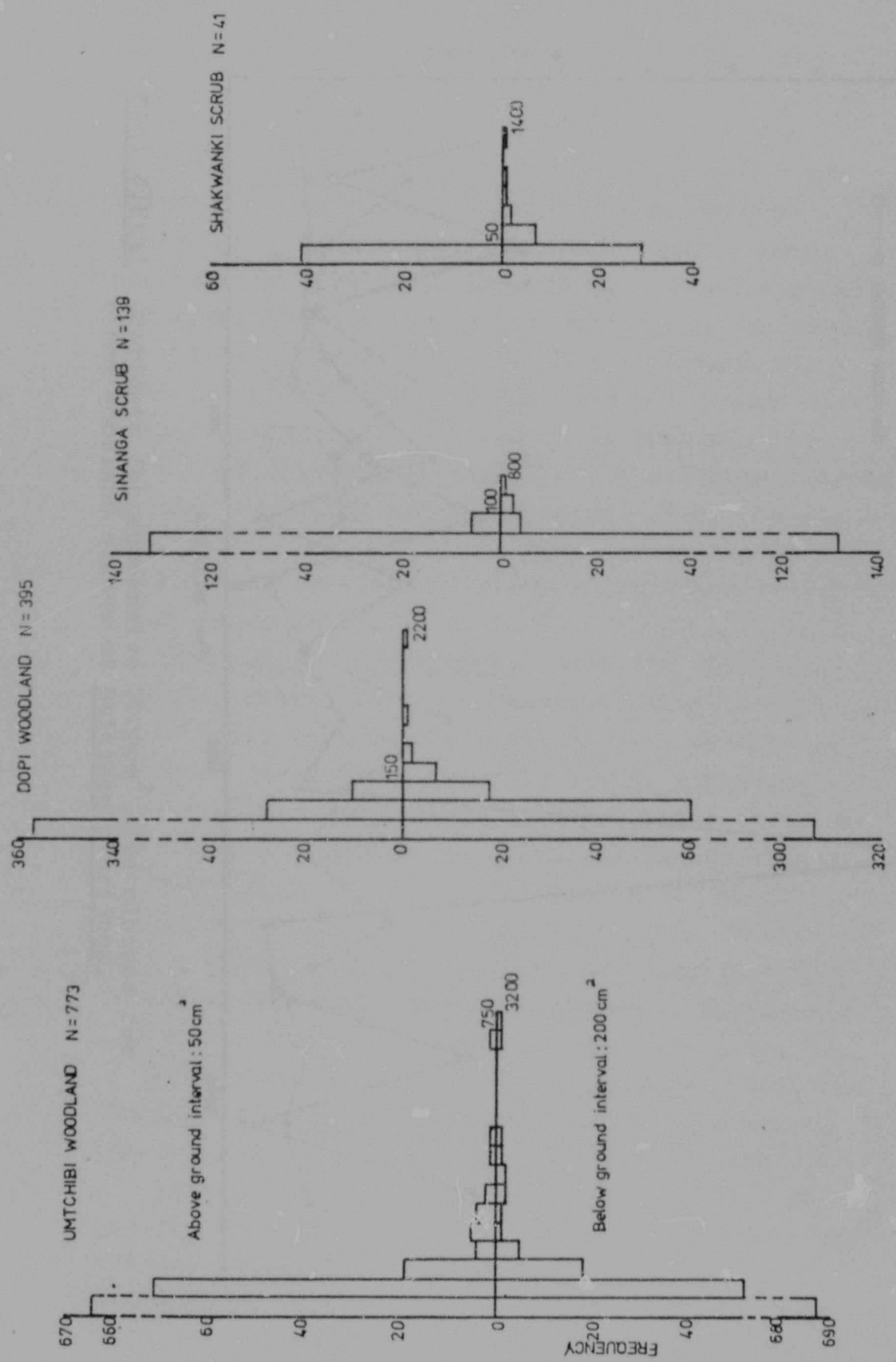


Fig. 4.5(g) Above and below ground size structures of Ochna pulchra populations in two woodland and two scrub stands. The size ranges are indicated by the numbers above and below the x axis.

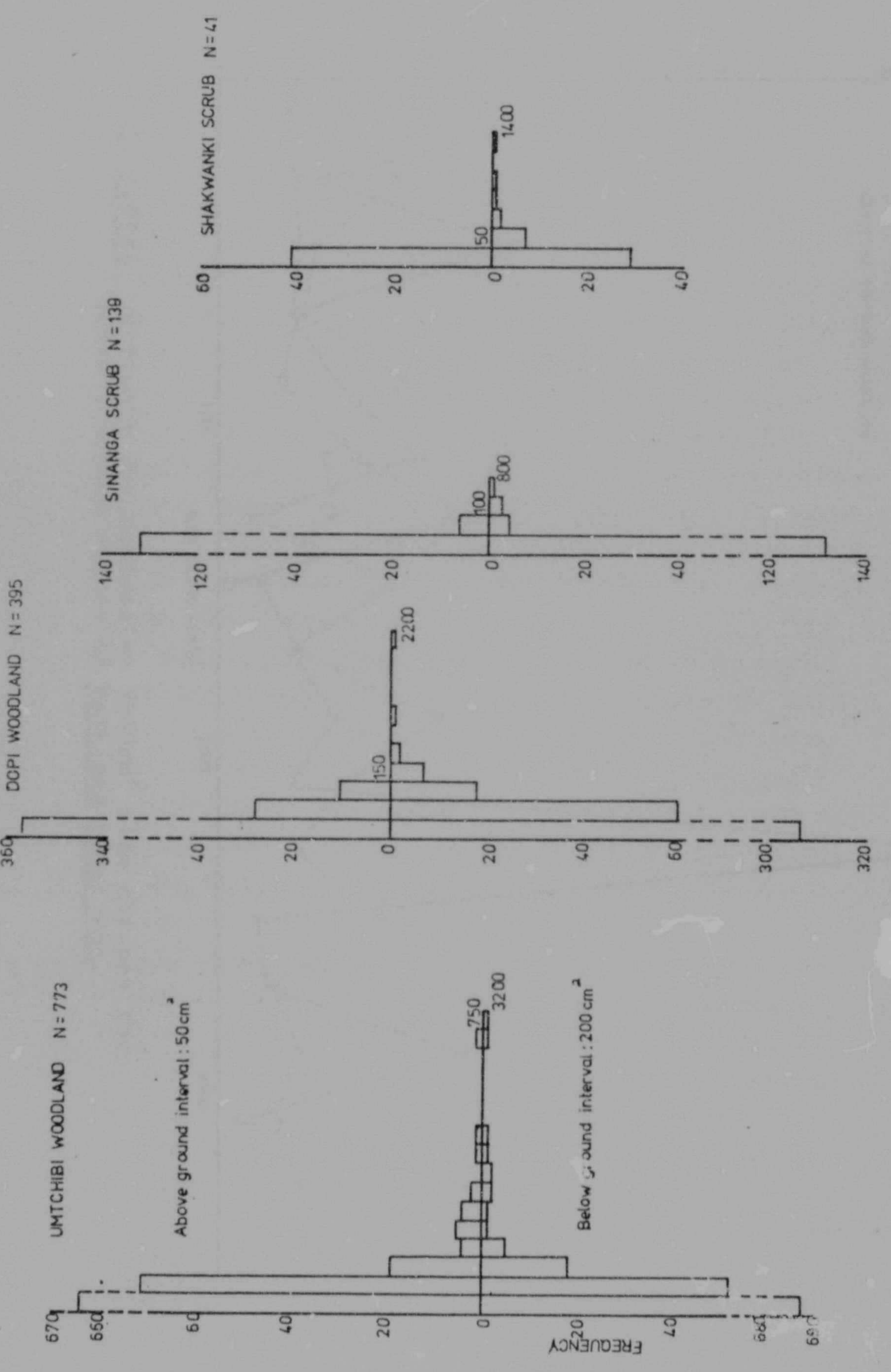


Fig. 4.5(g) Above and below ground size structures of Ochna pulchra populations in two woodland and two scrub stands. The size ranges are indicated by the numbers above and below the x axis.

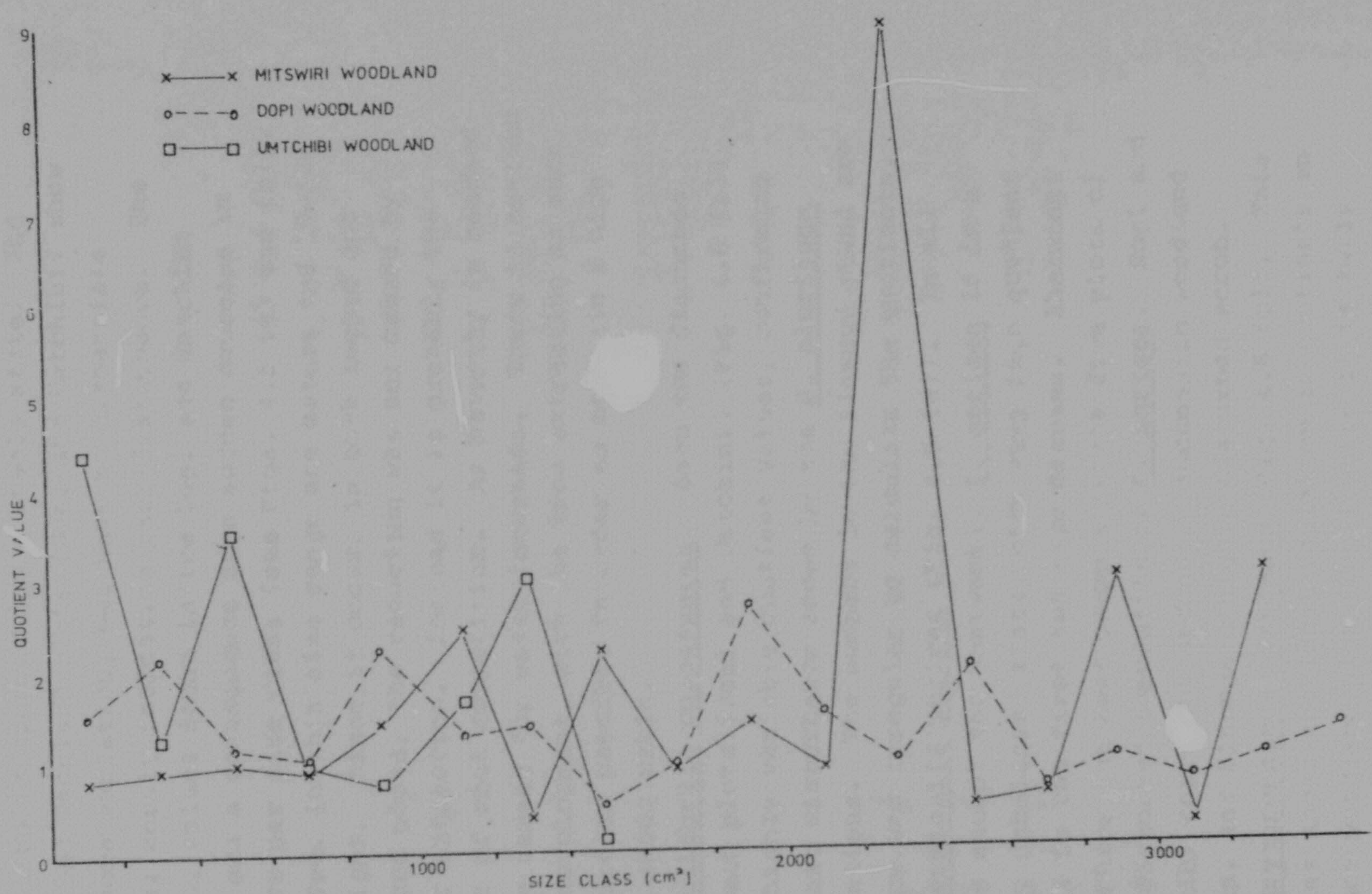


Fig. 4.6(a) Quotients for successive 2000cm^2 size classes for three woodland stands of *Baikiaea plurijuga*.

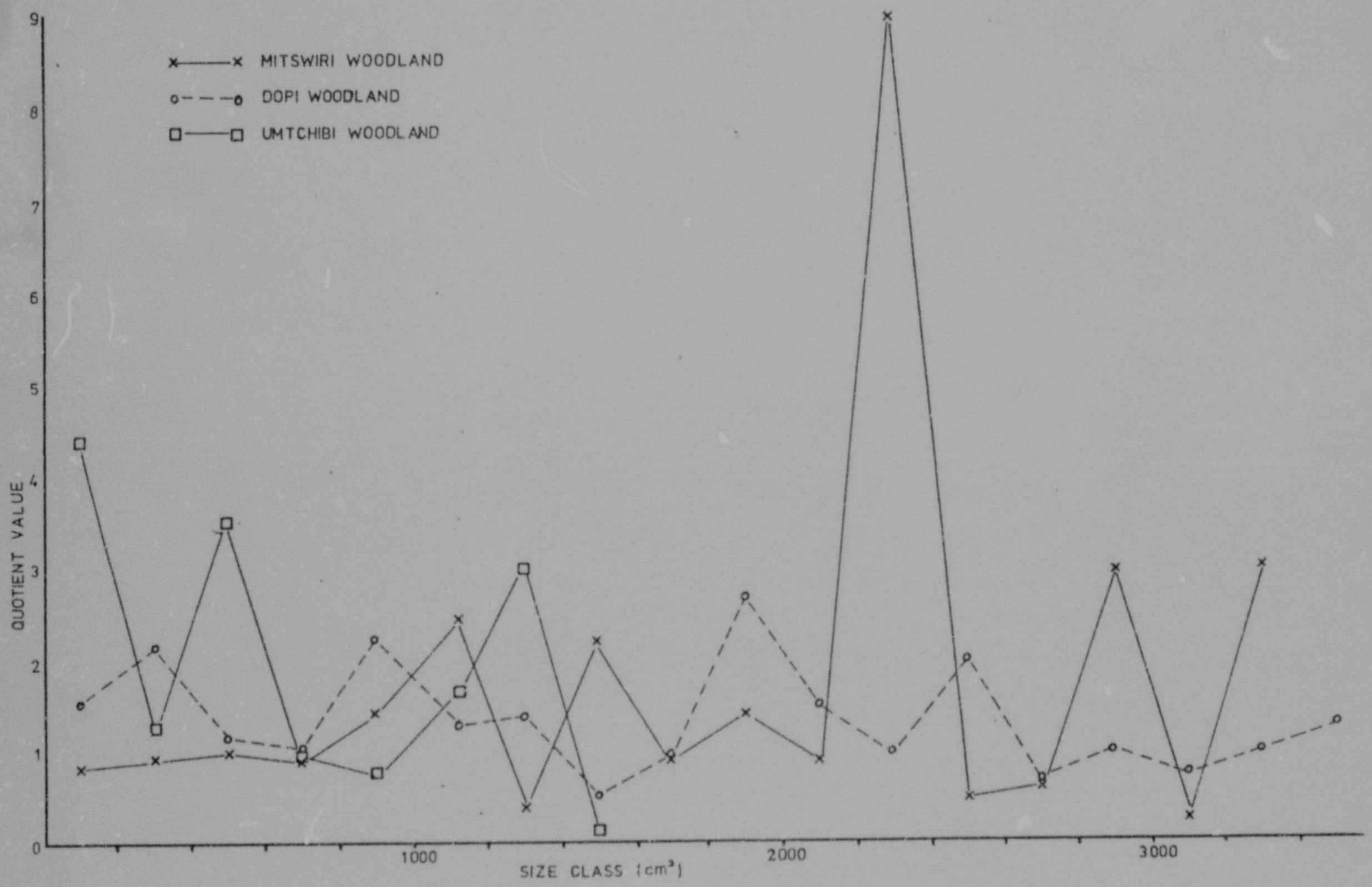


Fig. 4.6(a) Quotients for successive 2000cm^2 size classes for three woodland stands of Baikiaea plurijuga.

2 400cm^2 size class. Excluding this high value, the mean quotient is 1,3 indicating that the population is approaching a stable state. The disturbed woodland plots (Dopi and Umtchibi) show much more variation, but have no discernible trends; merely indicating past disturbance. The extreme values found in the Dopi and Umtchibi plots are a consequence of a sudden decrease in numbers per size class (see Figs. 4.5 (a) and (b)). The trees in this size range are mature and 10-12m in height. Since it occurs in both logged and unlogged plots, the reduction was not caused by timber extraction. Instead it is probably the result of root competition. As maturity is reached so the demand for water increases. There is maximum root development, with the tree extracting as much moisture as possible in order to maintain a high root: shoot ratio.

Guibourtia coleosperma. Both the disturbed woodland plots (Dopi and Umtchibi) (Fig. 4.6 (b)) have highly variable quotient values, confirming the past disturbance shown by the *B. plurijuga* populations. The numbers in the Sinanga stand are too low and irregular to calculate the quotients.

Terminalia sericea (Fig. 4.6 (d)). In all stands except for Shakwanki, *T. sericea* is in a highly unbalanced state, with very high quotient values in the first two size classes. Shakwanki is perhaps the best example in the five plots of an undisturbed population of *T. sericea*. Dopi and Umtchibi represent secondary succession woodland phases, and Sinanga a highly disturbed scrub.

Erythrophleum africanum (Fig. 4.6 (c)). This species shows the least variation in quotients in the one woodland plot (Dopi) where it is fully represented in a wide range of classes, and the below ground population is fairly stable. The

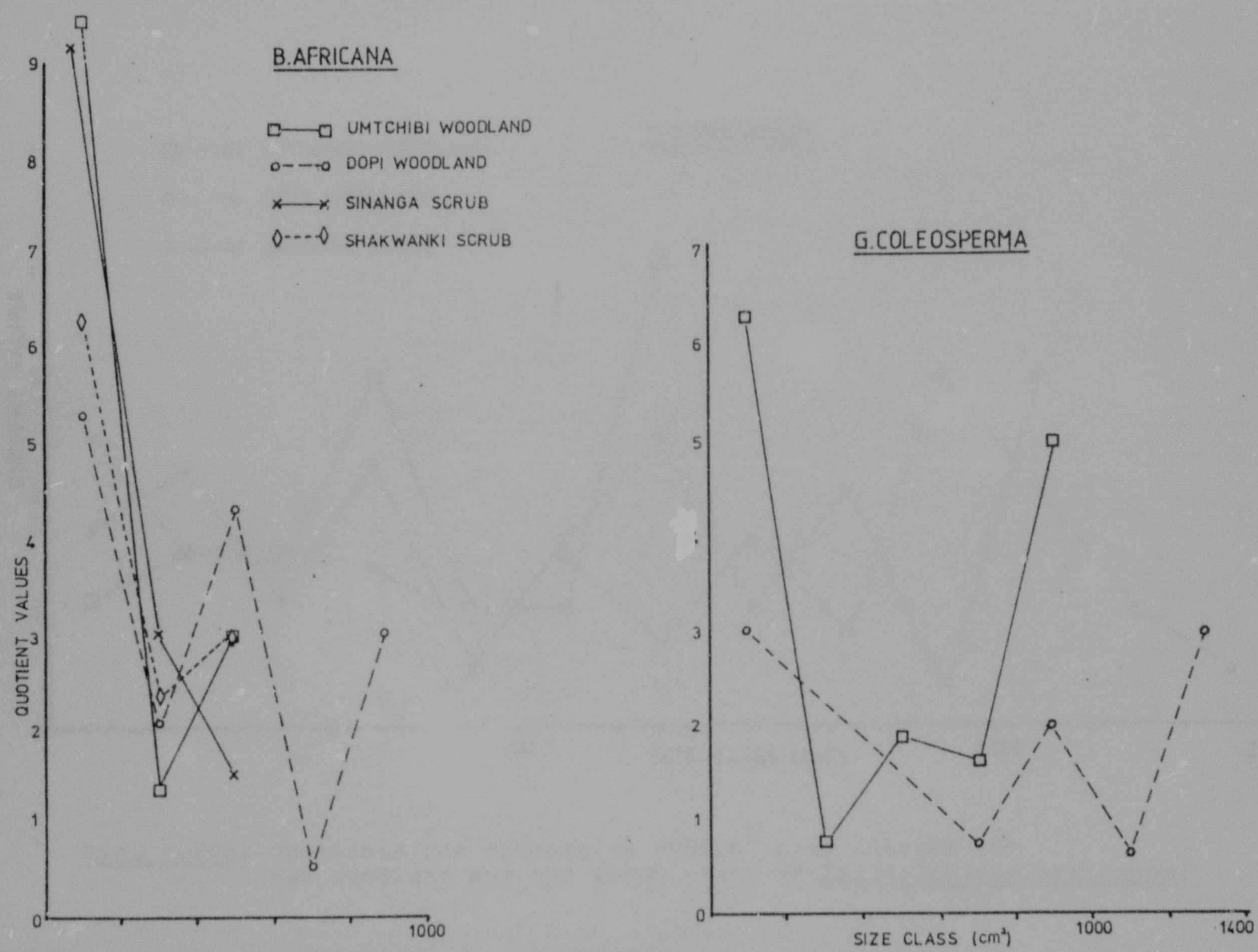


Fig. 4.6(b) Quotients for successive 2000cm^2 size classes for one woodland and one scrub stand of *Guibourtia coleosperma*, and two woodland and two scrub stands of *Burkea africana*.

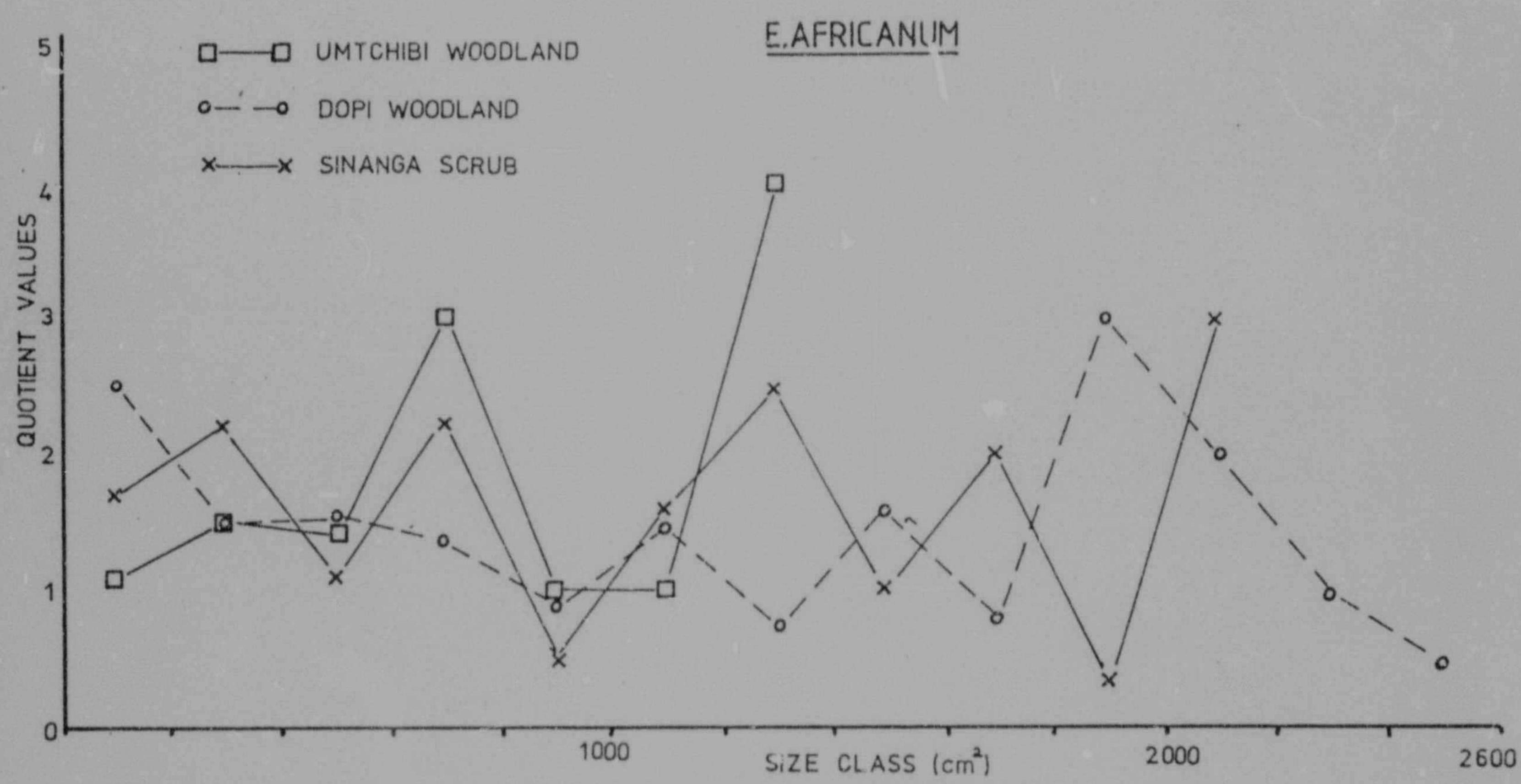


Fig. 4.6(c) Quotients for successive $2000cm^2$ size classes for two woodland and one scrub stand of *Erythrophleum africanum*.