CHAPTER 5

MATERIALS AND METHODS

DATA COLLECTION ON NGAMBA ISLAND

To assure an even distribution of the sample plots over the island a stratified random sampling method was used. Data and sample collection inside the fenced-off area was conducted while the adult chimpanzees were inside their night enclosure, i.e. in the morning during the time of the infant walks (between 06:45 and 08:30) and in the evening, after the adult chimpanzees had returned to their night enclosure and before the visibility inside the forest became too low (between 18:.00 and 19:00).

Woody vegetation survey

Selecting sample plots

The circumference of the island was measured using a Global Positioning system (Garmin GPS 12XL Personal Navigator™; Garmin International, 200 East 151st Street, Olathe, Kansas 66062, U.S.A.) while kayaking around the island as close to the shore as possible. A map of the island was drawn using these GPS coordinates. Subsequently, the coordinates of the highest elevation of the island were determined. This point was then used as centre point for a cross that divided the island in four sections (called "quadrats" for the purpose of this study) of slightly different sizes (Figure 6.2) and constituting the sampling strata. Two sample plots (maximum size: 50 x 50 m) were then placed at random in each of the quadrats. Random numbers were used to determine the south/east (S/E) coordinate pair for the centre point of each sample plot. Wherever possible the centre point of a plot was positioned at the crossing of two man-made tracks. Thus, the four tracks extending from this point could be used to mark the four 25 m-long axes necessary to determine the size of the single sample squares, see 'Sampling method for woody vegetation'.

Sampling method

The woody vegetation was sampled and analysed following the "varying quadrat plot method" described by Coetzee and Gertenbach (1977). This method gives the following results per

(a) species, (b) stem growth form and (c) height class:

1. Canopy regime at different height levels;
2. Total projected canopy cover; and
3. Density.

For this study, the woody vegetation was divided into five categories according to Coetzee and Gertenbach (1977):

1. **"Tree growth form" (B)** - an individual with a single stem.
2. **"Sparse shrub growth form" (Y)** - an individual with 2 - 4 stems.
3. **"Shrub growth form" (S)** - an individual with 5 or more stems.
4. **"Standing dead" (D)** - an upright dead individual with a stem diameter > 100 mm.
5. **"Fallen dead" (L)** - a fallen dead individual with a stem diameter > 100 mm.

In the chosen sample plot area a rectangular cross with four equal arms of 25 m and extending from the determined centre point was created using marking poles placed at 5 m intervals: wooden poles were placed at five-meter intervals along the four directions. If the track system did not lend itself to be used in such a way, the necessary trails were created using a *panga*. For each of the height classes described below a total of four test squares is used to determine the size of the quadrat for that height class. One test square is put into each of the quadrants delimited by the cross. "The test square is the smallest, from the following possibilities that would include a rooted portion of a plant of the relevant height class: **5 m x 5 m**; **10 m x 10 m**; **15 m x 15 m**, **20 m x 20 m** and **25 m x 25 m**. The largest of the four [test] squares determines the quadrat size for the height class to be recorded. The quadrat is namely a square with centre at the centre of the cross and divided by the cross into four quarters, each the size of the largest test square" (Coetzee and Gertenbach 1977) (Figure 5.1). This procedure is repeated for each of the following height classes:

1. < 0.75 m	recorded as:	**0.5 m**
2. 0.75 m - < 1.50 m	recorded as:	**1.0 m**
3. 1.50 m - < 2.50 m	recorded as:	**2.0 m**
4. 2.50 m - < 3.50 m	recorded as:	**3.0 m**
5. 3.50 m - < 5.50 m	recorded as:	**4.0 - 5.0 m**
6. > 5.50 m	recorded as:	**> 6.0 m**

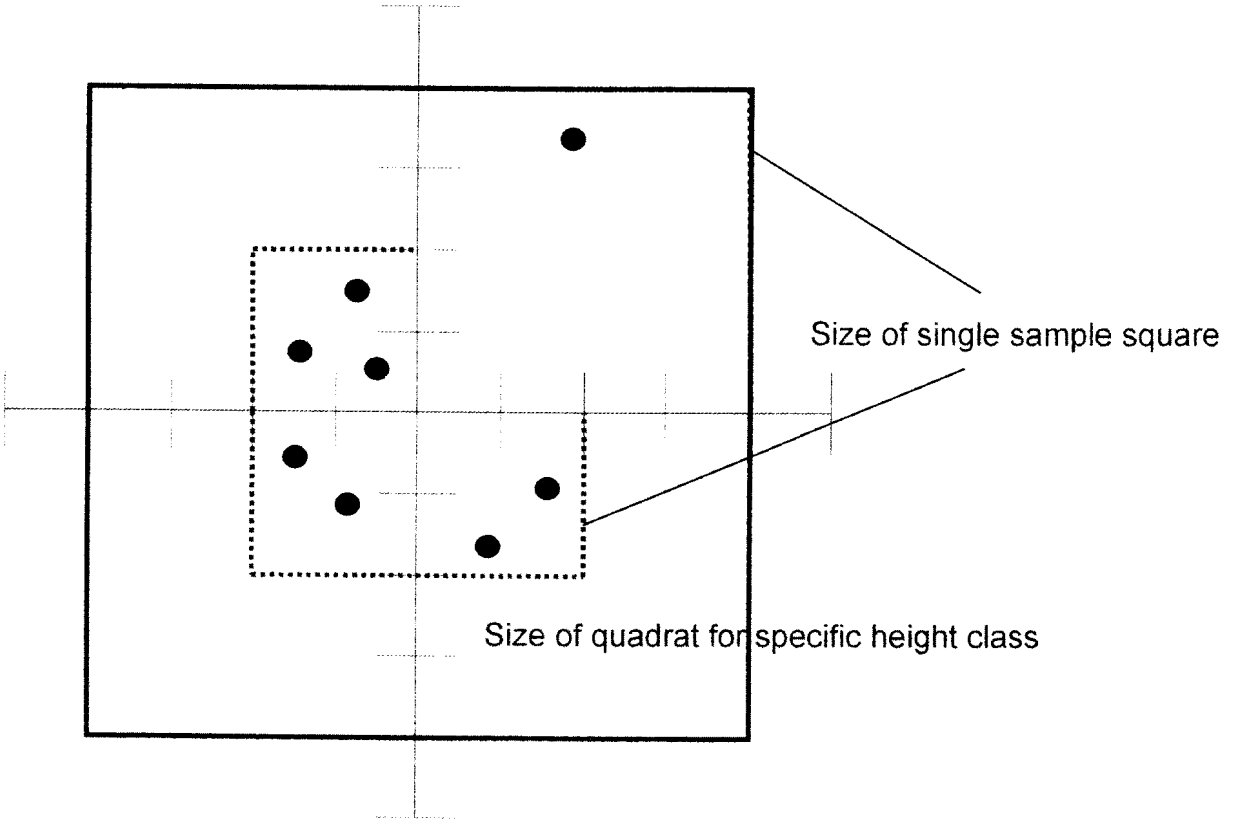

Figure 5.1: Determining quadrat size following the method to analyse woody vegetation structure according to Coetzee and Gertenbach (1977).

Analysis of data

The data thus collected were analysed using the computer programme "Struktuuranalise" available at the Department of Botany at the University of Pretoria. This programme also calculates the Braun-Blanquet cover-abundance value for each species occurring in a plot (Werger 1974):

1.	**+**	=	less than 1% cover
2.	**1**	=	1- 5% cover
3.	**2a**	=	6- 12% cover
4.	**2b**	=	13 - 25% cover
5.	**3**	=	26 - 50% cover
6.	**4**	=	51 - 75% cover
7.	**5**	=	76 - 100% cover

The Braun-Blanquet method estimates the vegetation cover of a given area visually, giving a value for the cover-abundance of every single species present. Since vegetation can be stratified

or consist of multiple layers, total cover-abundance values of more than 100% may result (Kent & Coker 1996). "**Cover** is defined as the area of ground within a quadrat which is occupied by the above-ground parts of each species when viewed from above" (Kent & Coker 1996).

Using the Braun-Blanquet values of each species combined with the distribution of species among plant communities the species can then be categorised as either *differential species*, *indifferent species* or *companion species* (Kent & Coker 1996). The *constancy* of a species, i.e. the number of sample plots in which it occurs, determines foremost in which of the before-mentioned categories it will be placed. *Differential species* show medium to low constancy and tend to occur together in a number of sample plots. They can therefore be used to characterise these as a group or plant community (Kent & Coker 1996). *Indifferent species* do not show a definite affinity for any particular plant community (Kent & Coker 1996). *Companion species* only occur in certain sample plots and can be used to place the most similar sample plots of a specified plant community next to each other (Table 6.3) (Kent & Coker 1996).

Slope and Aspect

Using the GPS, altitude measurements were taken from the centre point of each plot and the 25 m endpoints of the four trails. Since these measurements, especially taken underneath a dense vegetation cover, show quite a high variation, a large number of measurements was taken at each point and on different days. Arithmetic mean and standard deviation of the height in meters of each of the points were then calculated. Using these data and the 50 m distance from one endpoint of the sampling cross to the directly opposite one, the slope of each aspect present in the plot area was then calculated. Six 'slope categories' were distinguished and the calculated slopes were then placed in one of the following categories:

Slope categories:	0.0 - 4.5°	=	**no slope**
	4.6 - 9.9°	=	**slight slope**
	10.0 - 27.0°	=	**moderate slope**
	27.1 - 45.0°	=	**marked slope**
	45.1 - 67.5°	=	**steep slope**
	67.6 - 100.0°	=	**very steep slope**

Herbaceous vegetation survey

Selecting sample plots

The size of the grassland area in the north-eastern corner of the island was determined using a GPS. Three transects were then placed in this area: Two transects (T1+2) ran in an east-west direction parallel to the fence and the visitors' platform and a third one (T3) ran perpendicular to those in a north-south direction.

Sampling method

A square wooden frame was constructed to give a **1 x 1 m** sampling area. Every five meters along the transects the frame was placed on the ground. The vegetation cover inside the frame was estimated using the Braun-Blanquet method as described by Kent and Coker (1996). The following six categories were used to determine the cover of each species in the sample quadrat:

1.	**+**	=	less than 1% cover
2.	**1**	=	1 - 5% cover
3.	**2**	=	6 - 25% cover
4.	**3**	=	26 - 50% cover
5.	**4**	=	51 - 75% cover
6.	**5**	=	76 - 100% cover

Analysis of data

The data thus collected were analysed using TWINSPAN (Two Way Indicator Species Analysis) for a classification of the samples by a divisive method (Hill, 1979a) and DECORANA (Detrended Correspondence Analysis) for an ordination of the data (Hill 1973 + 1979b).

Soil samples

Sampling method

Soil samples were collected at the centre point of each sampling plot for the woody vegetation survey to a depth of between 50 – 100 mm. For the herbaceous vegetation three samples were collected for each transect, at the same depth and at either end and in the centre of the transect.

The samples were stored in plastic bags for analysis at the Department of Botany and the Department of Soil Science at the University of Pretoria.

pH determination

20 g of each soil sample were mixed with 50 ml of distilled water, stirred thoroughly and left standing. After 30 minutes this suspension was thoroughly stirred again and left to settle for another 30 minutes. After stirring and leaving the suspension to settle for another 10 minutes the pH was measured using a Crison pH-meter (Crison Instruments S.A. made by Ingold, Dr. W. Ingold AG, Industrie Nord, 8902 Urdorf, SWITZERLAND) (Van der Waals pers. comm.[1]).

Daily temperature, relative humidity and precipitation

Daily temperature and relative humidity were measured in the shade three times a day (at 08:00, 14:00 and 18:00) using a battery driven, digital and combined thermo- and hygrometer (the name and address of the supplier could not be established). Rainfall was measured several times daily if necessary, using a commercially obtainable 'pluvimeter'.

Photographic records

Photographs of the island vegetation were taken from the air, the water, standing on the visitors' platform and on the ground inside the forest.

DATA COLLECTION ON NSADZI ISLAND

Control plots were sampled on neighbouring Nsadzi Island (Figure 6.68) to allow for a long term comparison of changes of the island vegetation on Ngamba Island and to evaluate their possible causes. An area of secondary rainforest was identified on the eastern side of the island. The circumference of this area was measured with the GPS by walking around the forested patch. Using random numbers to select the S/E coordinates for the centre point of each plot, the positions of two plots were determined in the control area. This area will not be part of the area allocated for the new chimpanzee sanctuary on Nsadzi Island.

The woody vegetation was sampled and analysed using the methods employed on Ngamba Island. Soil samples were taken at the centre point of each plot and also analysed by the

[1] Van der Waals, J. (2001) Department of Soil Science, University of Pretoria, Pretoria, R.S.A.

Departments of Botany and of Soil Science at the University of Pretoria following the above cited method. The data and samples were collected during daylight hours on several consecutive days.

IDENTIFICATION OF COLLECTED VEGETATION SAMPLES

Samples collected of the woody and herbaceous vegetation were identified by Mrs. Olivia Wanyamaganyi and Mrs. Mary Namaganda at the Herbarium of the Department of Botany, Makerere University, Kampala, Uganda.