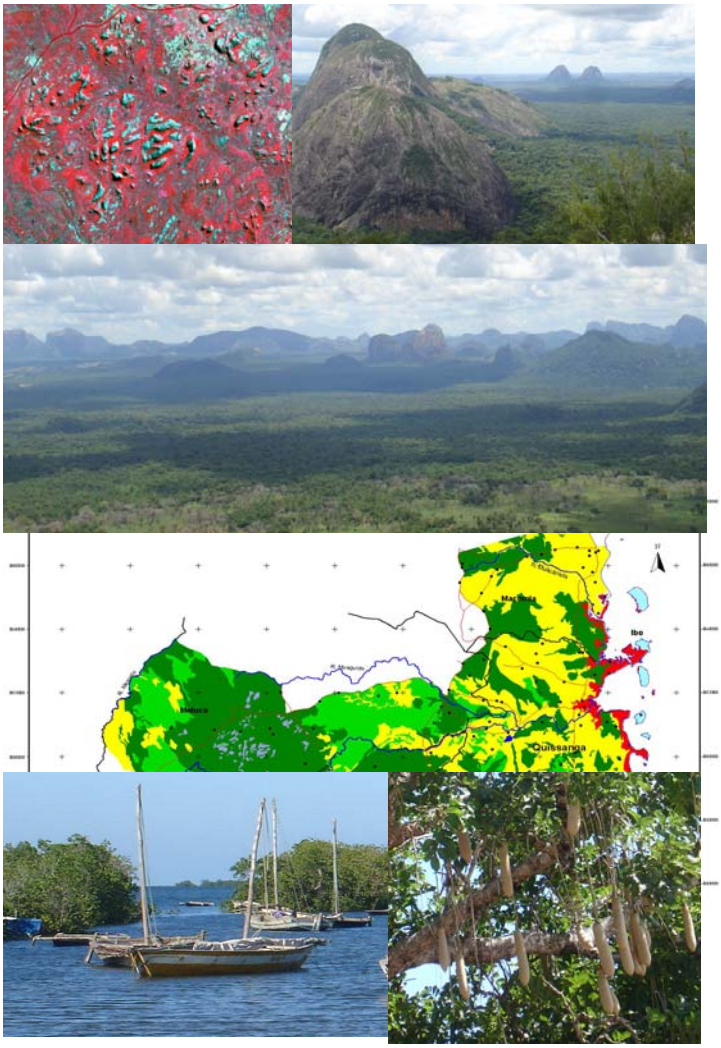
Terrestrial Vegetation Assessment of the Quirimbas National Park

(Final report submitted to the Quirimbas National Park)



Salomão Bandeira
Filomena Barbosa
Nocy Bila
Francisco Azevedo Jr.
Ernesto Nacamo
AliceMassinga Manjate
Mizeque Mafambissa
José Rafael

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Final report submitted to the Quirimbas National Park

To the project

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By:
Dr. Salomão Bandeira
Assistant Professor in botany, Dept. of Biological Sciences, Universidade Eduardo Mondlane, P.O. Box 257, Maputo, MOZAMBIQUE. Email: sband@zebra.uem.mz;

Filomena Barbosa
Senior lecturer and Head Botanical Section, Dept biological Sciences, Universidade Eduardo Mondlane, P.O. Box 257, Maputo, MOZAMBIQUE. Email: filomenabarbosa@uem.mz

Lic. Nocy Bila, Dept. of Biological Sciences, Universidade Eduardo Mondlane, P.O. Box 257, Maputo, MOZAMBIQUE. Email: kuchille80@yahoo.com.br

Lic. Francisco Azevedo Fernandes Junior, The Herbarium, Dept. of Biological Sciences, Universidade Eduardo Mondlane, P.O. Box 257, Maputo, MOZAMBIQUE azevedo@nambu.uem.mz

Ernesto Nacamo, Dept. of Biological Sciences, Universidade Eduardo Mondlane, P.O. Box 257, Maputo, MOZAMBIQUE

Lic. Alice Massingue Manjate
Lecturer, Dept. of Biological Sciences, Universidade Eduardo Mondlane, P.O. Box 257, Maputo, MOZAMBIQUE. Email: alimamassimgue@uem.mz

Lic Mizeque Mafambissa
Lecturer, Dept. of Biological Sciences, Universidade Eduardo Mondlane, P.O. Box 257, Maputo, MOZAMBIQUE. Email: mmafambissa@yahoo.com.br

M.Sc. José Rafael
Senior lecturer, Geograpgy Department, Universidade Eduardo Mondlane, P.O. Box 257, Maputo, MOZAMBIQUE. Email: jrafael@intra.co.mz

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Collaborators:

M.Sc. Ana Massinga, GIS and Maps Specialist, MICOA, Maputo

Dânia Ibraimo, student, Dept. Biol. Sci., UEM, Maputo

Neusa Pinto, student, Dept. Biol. Sci., UEM, Maputo

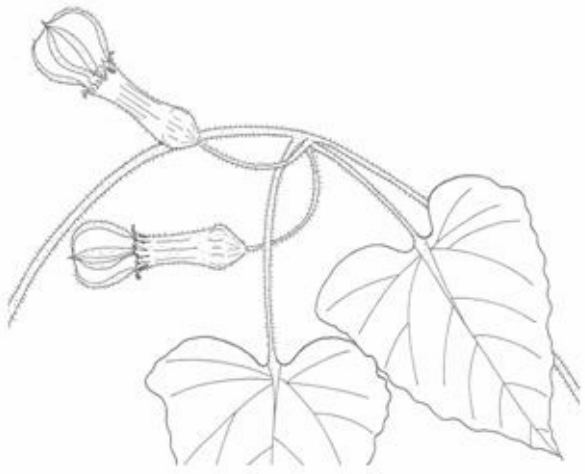
Elvino Ferrão, student, Dept. Biol. Sci., UEM, Maputo

Francisco Mapanga, Herbarium technician, Dept. Biol. Sci, UEM, Maputo

Clemente Nicolau, Student, Dept. Biol. Sci., UEM, Maputo

Célia Macamo, student Dept. Biol. Sci., UEM, Maputo

M.Sc.Gabriel Albano, Dept of Forestry, UEM, Maputo



Abstract

Terrestrial Vegetation Assessment of the Quirimbas National Park

Abstract

This is one of the first accounts on vegetation of Quirimbas National Park (QNP) and the main goal of this one-year study was to describe the plant structure parameters, identify the different plant species and communities, conduct mapping of the plant communities, describe main categories of plant utilization and conduct a preliminary analysis of abiotic factors influencing vegetation assemblages. Field expedition covered up to 50 days and the following districts visited: Ancuabe, Macomia, Meluco, Quissanga and Ibo.

Up to 580 species (around 70% of all species of QNP), grouped in 99 plant families, were identified at QNP. 35% of the entire plant diversity are made up of woody (trees and shrubs) species; a significant part being valueable species such as miombo, ebony (blackwood), chanfuta, jambiri, umbila, sandalwood. Al least 103 medicinal plant species were identified and main ailments such as malaria, diarrhea, respiratory complications as STD-AIDS covered. Main medicinal plants at QNP are *Xyloytheca tettensis, Annona senegalensis, Rourea orientalis, Ehretia amoena, Vernonia colorata, Senna petersiana, Kigelia africana, Ximena caffra, Vangueria infausta* and *Deimbolia oblongifolius*. Some plant parts (root, stem, leaf, flower and fruit) are used in the treatment of the illnesses, in varying dosages. The preparations are made through relatively simple methods such as decoction, maceration, infusion, burning or trituration. All traditional medicine practitioners (PMT) carry through ceremonies in the similar manner. Non-timber products include up to 40 species used as food, crafting including domestic tool and huts construction. Further quantification of QNP useful plants and studies on sustainable utilization are needed for appropriate management of useful plants of QNP.

Specific groups as endemic plants, rare, succulent, threatened groups were also documented. Based on the plant list generated and comparing with the existing checklist for the sorrounding areas and provinces, the following listed species of special concern were documented: *Sthrophanthus hypoleicus, Phullanthus guineense, Dombeya cinccinata,,Combretum umbricola, Quettarda speciosa, Croton megalocarpus, Diospyros consolatae, Indigofera ormocrpoides, Carpodiptera Africana, Grewia glandulosa, Euphorbia cooperi, Euphorbia confinalis, Alloe chaubaudii, Alloe maunii, Euphorbia knutii, Ceropegia* sp. (col. FMAB01). Herbarium species and photographs were taken.

Six specific plant communities were identified in the QNP Map, as a whole using extensive groundthruting and Geographic Information Systems (GIS) based techniques. These communities are miombo woodlands, mixed woodlands, miombo-vellosiaceae, acacia-grassland, mangrove forests and coastal ticket. Tographic gradient was evident from coast (East), at sea level to mountains (West), up to 800 m, with a gradual transition of coastal scrubs and mangroves, through Acacia-grassland, mixed-woodland, miombo woodland till miombo-velloziacea in the inselbergs. The communities of mixed woodlands, miombo-

velloziacea (within inselbergs) and the region of Bilibiza lake are defined as the most important area for plants due to high plant diversity, existence of plant of special concern and special habitat respectively. QNP authorities would need to give high priority to those habitats when managing both vegetation and disturbances such as fire, itinerant agriculture and potential settlement.

In terms of size distribution 1468 individuals/ha occurred for regenerating plants, 870 ind/ha for small trees or juveniles and 120 ind/ha for adult plants. Special attention was given to herbaceous species in this study and it provides main food resources for fauna. Miombo woodland and mixed-woodland were the most diverse communities with herbaceous species. Coastal thickets were the poorest. Highest biomass was observed for the rainy season and the community of Acacia-grassland had the highest biomass. Maintenance of this is needed as park authorities have to continue to mitigate the major risks for vegetation such as recurrent wild fires.

The soil of Quirimbas National Park presents a great variety of physic-chemical characteristics. The soil has the tendency to be acid, which is typical of the miombo woodland, one of the dominant communities. The exchange capacity base (cation exchange) is low in those acid soils as so do nitrogen and phosphorous concentration. Phosphorous controls the soils nutrients solubility, but insoluble phosphate becomes not available for plant uptake. Further studies are needed in order to understand plant growth limitation due to N or P availability, amount of insoluble phosphate, and thereafter evaluate further the most important assemblages and existing grazed species in different seasons of the year. Most soils present sand texture with very diversified colors; soils were relatively poor with rather lower values of organic matter. Inselbergs area had relatively richer soils due to deposition of plant organic matter on inselberg rocks.

Management plan for vegetation has to continue to pursue (i) further acquisition of field knowledge of specific plant communities such as miombo-velloziacea within inselbergs region (ii) field knowledge of special plant species such as rare, endemic or threatened groups (iii) monitoring and advising on sustainable utilization of useful plants of QNP, (iv) management of major risk factors to vegetation such as wild fires, (v) integration of knowledge of flora with that of wildlife utilization of these flora (e.g. grass utilization by herbivores). Floristic knowledge will be better incorporated into QNP daily work if parks authorities pursue a construction of expertise on flora together with a development of local herbarium devoted to QNP flora. A field guide to main plants of QNP and basic plant ecological analysis will be an important asset and that can be initiated from the findings of this study.

Acknowledgements

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- Local community leaders for support in the field or while working on socio-economis aspects of the plants namely: medicinal plants, timber plants and other uses
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List of Acronyms, Symbols and Abbreviations

DINAGECA – Direcção Nacional de Geografia a Cadastro

EPDA – Estudo de Pre-viabilidade Ambiental e Definição de Âmbito.

EIA – Estudo de Impacto Ambiental

EIS – Environmental Impact Study

INIA – Instituto Nacional de Investigação Agronómica

IUCN – União Mundial para a Conservação da Natureza

LMA – Herbário do Instituto de Investigação Agrónima de Moçambique

LMU –Herbário da Universidade Eduardo Mondlane

QNP – Quirimbas National Park

TMPs - Traditional Medicine Practioners

ToRs – terms of Reference

UEM – Universidade Eduardo Mondlane

NTFPs. – Non Forest Timber products

WTP – Willing to Pay

I. HISTORICAL BACKGROUND AND RATIONALE

This proposal envisages a comprehensive vegetation analysis of Quirimbas National Park QNP). QNP comprises extensive inland flora that encompasses many habitats and fauna. This was gazetted recently (2002) and the area is still poorly known. QNP covers 5 districts (Ancuabe, Macomia, Meluco, Pemba-Metuge, Quissanga). It covers an area of approximately 7,506 km^2 with both terrestrial and marine habitats (with 11 islands: Ibo, Matemo, Quisive, Quirimba, Quipaco, Mefundvo, Quilálea, Sencar, Quirambo, Fion and Ilha das Rolas). QNP extends up to 100 km at the coast from near Tari river estuary till Mucojo view in Macomia district. Inland, it goes up to the border of Montepuez distrit an area with the landscape dominated by inselbergs. According to INIA (1999) the region of PNQ is characterized by having a humid semi-arid tropical climate. Mean precipitation varied between 900 and 1000 mm, with a dry season well defined in the winter; precipitation relatively high on the coast. Mean temperature varying between 25ºC and 26º C but with high variation through the year. Winds also follow an annual pattern blowing northwards along the entire rainy season and with comparatively less speed. During dry season it blows to the south. Mean wind speed being 9Km/hour.

Few studies on vegetation were carried out at PNQ. The best terrestrial study is the one by WRQ Luke on Preliminary Trip Report of Southern Tanzania/Northern Mozambique Plant, conducted in 2003. This study identified a total of 504 collections collected within 502 sight records. 370 species of those are housed at the University Herbarium at LMU. Other quite comprehensive report series is the detailed marine surveys conducted by Frontier Mozambique during the period 1997-1998, all assembled in 5 reports and at least 3 journal papers (Stanwell-smith et al, 1998, Heasman et al 1998, Whittington and Myers 1997a, 1997b; Whittington et al 1997, Gell 2002; Antonio e Bandeira 2003; Bandeira & Gell 2003). Extensive vegetation account large sections of African continenent was conducted by Burgess (1998); Mozambique part drawn from observations in neighbouring countries and literature (e.g. White 1983).

Additional botanical expeditions were conducted over many years by both LMU (University Herbarium) and LMA (INIA Herbarium) herbaria. Main collections came from Ancuabe, Mecufi and Pemba and some from Palma. Collectors name include Jan de Koning, Carlos Boana, Ernesto Nacamo, S Bandeira for LMU Herbarium.

Recently, plant communities classification, for southern Mozambique, was revised and standardized in both English and Portuguese languages. This was then divided into 12 plant communities: coastal mosaics (pioneer dunes, young dune scrub, dune thickets dune woodland), coastal grassland, woody grassland, Licuati forest (sand forest) open woodland, undifferentiated woodland, mangroves, miombo woodland, mopane woodland, saline lagoons and lakes, riverine vegetation, halophytic vegetation (Bandeira in press).

Recently, in 2005, Jorge has cartographic and designed various geophysical maps viz. LandSat TM5, grid map for monitoring (1 km^2), general map with districts, rivers and islands, annual mean precipitation, tri-dimensional altimetry, elevations, soils, mean

annual temperature, and land use (vegetation coverage), proposed map for zoning. This study was requested by WWF and the vegetation types mapping had little support from field groundtruthing surveys. Geo-referenced map obtained from DINAGECA.

3 types of plant communities were identified at the coastal area (i) coastal woodland on sand that can enter up to 10 km inland (ii) coastal woodland on calcareous substract and (iii) mangrove forests. Inland, several vegetation communities were identified viz. riverine savanna, mosaico of miombo and savanna, mosaic of savanna and woodland in climax, dune vegetation, vegetation surrounding inselbergs. Cartographic maps of Jorge (2005) identified the following vegetation groups: areas of agriculture by irrigation and without irrigation, open forest of low altitude, closed forest of low altitude, herbaceous formation, herbaceous formation with trees, herbaceous formation degraded and of inundation, herbaceous formation of inundation, mangroves, open woodland, tall woodland, median woodland, shrub “moita”, soil without vegetation.

Plants are important resources especially in developing countries, where they supply communities with a variety and essential products and services (Martin 1995; van Wyk & Gericke 2000; van Wyk et. al. 2000l; Cunningham 2001) . In spite of their importance plants are endangered by several factors namely: over-collection, unsustainable cultivation and forestry practices, urbanization, land use changes, the spread of invasive alien species among others (Global Strategy for Plant Conservation). These factors can cause substantial change on the species composition and therefore on the forest resources currently used by the local community.

The total plant biodiversity for QNP is unknown although, already some key threats to biodiversity may be occurring due to destructive land use practices and over-harvesting of resources.
The goal of this proposal is to conduct a Terrestrial Vegetation Assessment of the Quirimbas National Park.

II OBJECTIVES:

Identification of the vegetation types and their range within the Quirimbas National Park.

Identification of the main abiotic and biotic factors affecting the distribution and survival of species vegetation types within the Quirimbas National Park.

Identification of all terrestrial plant species (including herbaceous and lower plants) of the Quirimbas National Park.

Identification of plant species of special interest (rare, threatened, vulnerable, endemic, invasive), evaluation of threats affecting their survival, and definition of the management strategies to eliminate these threats.

Determination of species diversity and possible species abundance rating of each vegetation community.

Assessment of the importance of the vegetation of the Quirimbas National Park concerning its biodiversity, level of endemism, occurrence of plant species listed on the Red Data list on the international, regional, and local scale.

Provision of hard copies of all literary documents and maps concerning the vegetation of the Quirimbas National Park area.

III . METHODOLOGY

III METHODOLOGY

a) Identification of the vegetation types and their range within the Quirimbas National Park

The determination of vegetation types was accomplished by a combination of both field work aiming at obtaining ecological parameters such as species abundancy, species dominance, regeneration etc. (see e.g. Dombois and Ellenberg, 1974, Bonham, 1989). Geographic information system (GIS) was applied for further definition of the boundaries and differences in assemblages of plant communities within QNP. Plant communities were defined based on standard classification from the Agronomic Research Institute of Mozambique, Flora Zambesiaca maps (Wild & Grandvaux Barbosa. 1967), flora of Africa by White (1983) and with help of a classification adopted for southern Mozambique (Bandeira et al. in press).

Two types of mapping methodological approaches undertaken:
Based on *Thematic Information Extraction* and *Change Detection* techniques by a combination of fieldwork.

a) Thematic Information Extraction

Multispectral classification is one of the methods of information extraction. The procedure assumes that imagery of a specific geographic area is collected in a multiple regions of the electromagnetic spectrum. The multispectral classification may be performed using a variety of algorithms including supervised classification approach.

In a supervised classification, the identity and location of vegetation types known a prior (before the fact) through a combination of fieldwork was established for the Quirimbas area. Analysis of topographic maps (available on DINAGECA) and personal experience were taken into account as suggested by Mausel et al. (1990).

The team composed by students attempted to locate specific sites in the remotely sensed data that represent homogeneous examples of these known vegetation types. This approach is commonly referred to as training sites because the spectral characteristics of these known areas are used to train the classification algorithms for eventual vegetation types mapping of the reminder of the image. Every pixels both within and outside these training sites is then evaluated and assigned to the class of which it has the highest likelihood of being a member (Foody et all., 1992). Multivariate statistical parameters (means, standard deviation, etc.), are calculated for each training sites and the sensor system record radiant flux from a mixture of different biophysical materials within the IFOV, for example, 10% Vegetation type “X”, 20% Vegetation type ”Y”, 70% Vegetation type “Z”.

The general steps proposed to extract land cover information that address to vegetation types in Quirimbas from digital remote sensor data are summarized in Fig 1.

State the Nature of the classification Problem
Define the region of interest - QUIRIMBAS
Identify the classes of interest based on standard classification from the Agronomic Research Institute, Flora Zambesiaca maps, flora of Africa by White and with a help of a classification adopted for southern Mozambique.
Acquire Appropriate Remote Sensing and Ground Reference Data
Spatial Reference of the Image: Projection UTM, Zone 37-Moz, Datum WGS84.
Spectral: Multispectral bands + Panchromatic
Sensor: LANDSAT 7
Temporal: (period of the analyze proposed for March and July/August)
Resolution: Multispectral 60m, and Panchromatic 15m
Image Processing of Remote Sensing Data to Extract Thematic Identification
Supervised: type Maximum likelihood
Extract thematic information by vegetation classes
Extracting data from initial trainings sites using most bands

Error Evaluation of the Land Cover classification Map
A *posteriori* knowledge of the study area

Distribute Result if the Accuracy is Acceptable
Digital product
Hard copy product

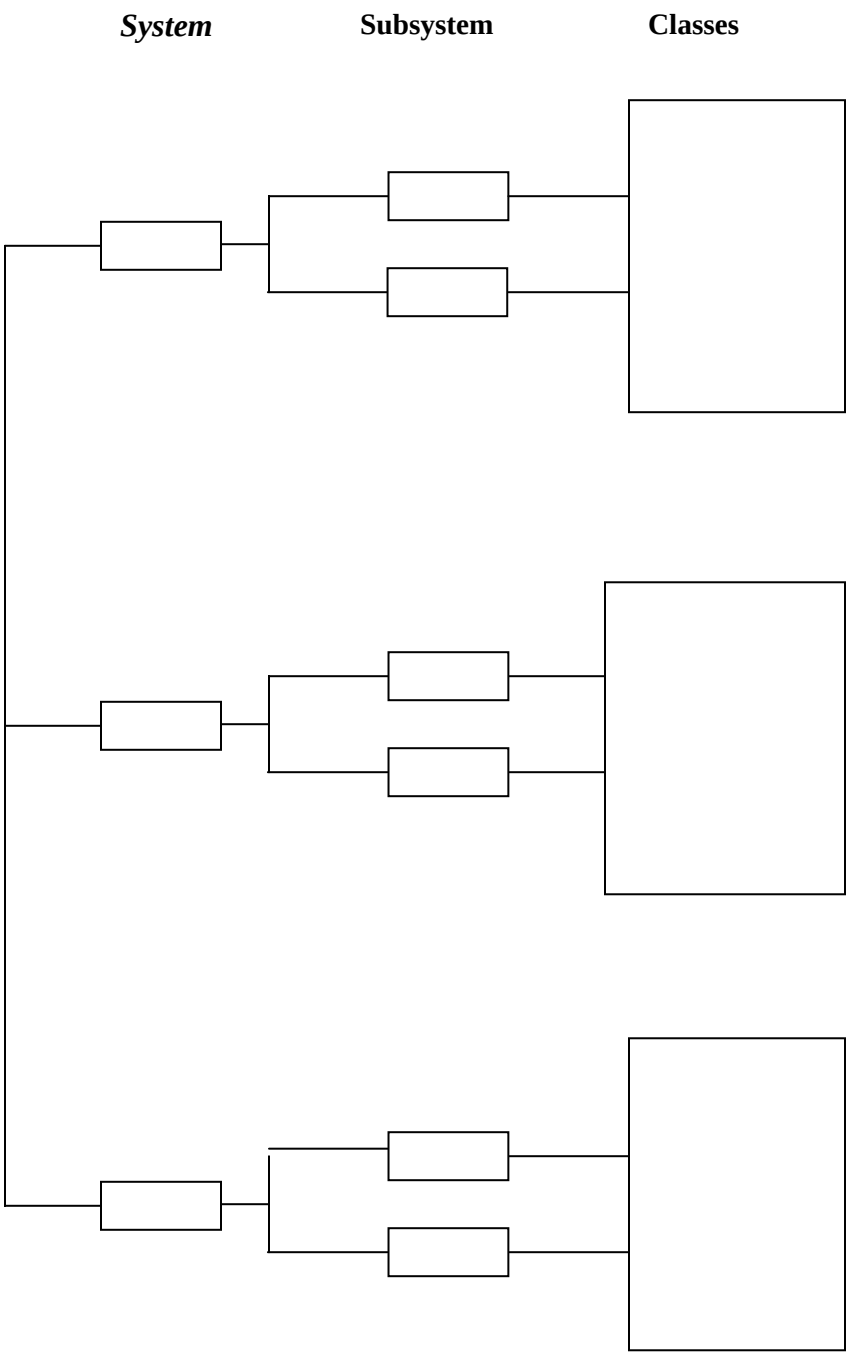
b) Land Cover Classification

All classes of interest were carefully selected and defined to successfully classify remotely sensed data into vegetation type information. This required the use of a classification scheme containing taxonomically correct definition of classes of information which are organized according to logical criteria (Gong and Howarth, 1992) like: standard classification from the Agronomic Research Institute, a classification adopted for southern Mozambique. etc.

In this process there is a fundamental difference between information classes and spectral classes (Jensen *et. al*., 1983; Campbell, 1987). Information classes are those that human being define, conversely spectral classes are those that are inherent in the remote sensor data and must be identified and then labeled by the analyst.

The type of the vegetation classification is a task to be done by the team supported both by additional literature and preliminary fieldwork.

Fig 1. Land Cover Classification Scheme



The procedures for GIS analytical work was:

GPS reading on the field (up to 200 readings were undertaken on the first field trip)
Data downloaded into a computer with GIS software (ArcView 3.2). Downloaded into shapefile obtained from DINAGENA (CENACARTA office). Shapefile is a computerized mock up of the site.
LandSat imagery used.
Overlapping of the GPS reading into the shapefile.
Supervision classification of the themes.
Main themes used is the species composition and plant community physiognomy
Other themes used are topography and soils.
Comparison with existing maps

c) Trainings Site Selection – Fieldwork phase

The fieldwork team may select training sites within the image that are representative of the vegetation classes of interest in the Quirimbas area after the classification scheme is adopted. The training data to be collected should be of value if the environment from which they were obtained is relatively homogenous. For example, if all the vegetation in grassland is composed of well-drained soils, then it is likely that grassland training data collected throughout the region would be applicable in reminder image. However, if the soils condition should change dramatically across the study area it is likely that grassland training data acquired in the well-drained soils part of the study area would not be representative of the spectral condition for grassland found on the study area.

Thus, we may have signature extension problem, meaning that it may not be possible to extend the result across to the Quirimbas area. Once signature extension factors have been considered, the fieldwork team must select representative training sites for each class and collect the spectral statistic for each pixel found within each training site.
Each site is usually composed of many pixels. The general rule is that if training data are being extracted from n bands, then $>10n$ pixel of training site is collected for each class. This is sufficient to compute the variance and covariance matrices required by some classification algorithms.

There are a number of ways to collect the training data, including:
collection of in situ information, such as tree height, percent canopy closure, diameter-at-breast-height (dbh);
on screen selection of polygonal training data;
on screen seeding of training data;

All the spatial information and their biophysical characteristics my be obtained from a planimetric map directly using a global position system (GPS).

b) Identification of the main abiotic and biotic factors affecting the distribution and survival of species vegetation types within the Quirimbas National Park

Soils analyses included the following parameters: altitude, texture (lime, clay, sand), and contents of organic material-OM, C/N rate, phosphates, soil color patterns and pH, (Brady, 1989; Kent e Cooker, 1992). In addition, based on these parameters, relevant information concerning soil characteristics were derived such as susceptibility to erosion, based on the soil texture, soil drainage and type of vegetation. These parameters allowed inferences on how soil types influence the distribution of the vegetations types within the Park, (Brady, 1989; Krebs, 1989).

Soil sample were systematically collected trough a diagonal line, in each plot (0.5m -1m, below the surface) (Lamprecht, 1990). The analysis was done by the Soil Lab of the Faculty of Agronomy and Forestry Engineering based on the *Hidrometer* method for texture, *Walkey* and *Black* method to determine C and OM contents, *Kjeldahl* method for N and pH was measured with the help of pHmeter. Additional analysis and methods applied were: 1- Ca,Mg: Complex. 2- Na, K: Fotom, 3- Textura: Pipeta/dens. 4- pF: Secagem, 5- M.O: W&B, 6- Al+H: KCl 1N/Ac.Ca 1N(pH7), 7- P: Bray/Olsen, 8- CTC: Ac(NH_4), 9- N: Kjeldahl, 10-CE: condutivimetro, 11- pH água: potenciómetro; 12- pH KCl: potenciómetro.13- $CaCO_3$: Scheibler; 14- Cor: Cartas de Mussel

c) Identification of all terrestrial plant species (including herbaceous and lower plants) of the Quirimbas National Park

This carried out using mainly:

Literature such as Flora Zambesiaca, Flora of Tropical East Africa. The procedure included built up of a standard herbarium collection of all flowering plants of the areas visited. Only plants with flowers or fruits were collected, dried and mounted in herbarium paper. Duplicates were sent to the University Herbarium in Maputo and another one available for the QNP plant collection new reference herbarium for the park. Field identification was carried out given also the involvement of Herbarium technicians and staff members of LMU herbarium. Additional literature for trees and shrubs such as Coats Palgrave 2002, Van Wyk 2000, Beetje 1983, and or herbaceous plants (e.g. Gibbs et al 1999 for grasses) used.

Vernacular names identified with the help of parataxonomists, local person who knows the name of local plants and their uses. Checklist of species occurring within QNP and neighboring areas also used. A checklist produce by De Koning (1997) was the main reference book.

The diversity of grasses carried out using mainly:

Estimation of grass biomass with the usage of the disc pasture meter. The Disc pasture meter (DPM) developed by Brandy and Tainton (1977), is used to estimate grass fuel loads in African grassland and savannas. This technique involves setting the heights of an aluminum disc dropped onto the grass, then with a conversion table this height is translated into biomass per hectare. About 5-10 quadrates, one hectare each and with aprox.300 DPM readings were carried out in each plant community (expressed in kilograms per hectare). For determination of number of quadrates, species curve area or

minimal area method was used as recommended by Dombois & Ellenberg (1974) and Kent & Coker (1994). DPM, which was developed in the Kruger National Park, has been successfully calibrated for much of the grasslands and savannas in the southern and east Africa.

d) Identification of plant species of special interest (rare, threatened, vulnerable, endemic, invasive), evaluation of threats affecting their survival, and definition of the management strategies to eliminate these threats

Southern African Plant Red Data Lists (Golding, 2002), a detailed up to date document with all known Mozambican species of special interest (Izidine & Bandeira 2002) was the main reference for identification of existing red data list (RDL) plants in QNP. Threatened habitats and more specifically the overall status of each plant communities described.

IUCN threatened categories as in Golding (2002) was followed. IUCN 1994 Red Data List categories used are: Critically endangered plants (CR), Endangered (EN), Vulnerable (VU), lower risk plants (LR), Lower risk near threatened (LR-nt), Lower risk least concern (LR-lc) and Data deficiency plants (DD). The categories Extinct (Ex) plants or Extinct in the Wild (EXW) was not used as we only looked for existing plants. Details of the explanation for each category appear in Golding (2002).

Previous important reference for threatened plants of Mozambique includes mainly '*World List of Threatened Trees'* (Oldfield et al., 1998) which listed 78 species for Mozambique; the '*1997 IUCN Red List of Threatened Plants*' (Walter & Gillett, 1998) listed 89 vascular plants (including trees) for Mozambique. In addition, several near-endemic species occurring in Mozambique were listed in Hilton-Taylor (1996) in the Red Lists for Swaziland (Lebombo Mountains) and South Africa (Maputaland).
Some 300 species are listed in the Red Data List. Of these, 122 are listed as *Critically Endangered* (CR), *Endangered* (EN) and *Vulnerable* (VU). Many species (139) have, however, been categorized as *Data Deficient* (DD). Virtually all of the *DD* species consist of one or a few herbarium collections and with very sparse and irrelevant information on the respective specimen labels. Furthermore, many species are not properly identified or have uncertain taxonomic identification. The fact that few inventories were compiled for the inland and north of Mozambique, led to a far higher representation of southerly distributed plants on the Red Data List. The new evaluations that are based on the new IUCN (1994) categories which take into account quantitative, has data resulted in the exclusion of some plant species.
With regard to plant families on the Red Data List, the Fabaceae (Leguminosae), Rubiaceae, Euphorbiaceae and Zamiaceae are well represented compared to other families. Endemism in RDL include 166 species confirmed endemic, 60 confirmed near endemic (Izidine & Bandeira 2002)

Identification and mapping of important plant areas within the PNQ

According to Anderson (2002) Important plant areas (IPAs) is definided as a natural or semi-natural site with exceptional botanical richness or under threat or a site with endemic plant species or vegetation with high botanical value.

In this context, plants are classified according to the botanical richness (high numbers of plant species showing biological diversity), habitat and conservation status (threatened or with endemic plant species), following the model proposed by the Southern African Plant Red Data Lists (Golding, 2002), with species of interest for Moçambique (Izidine & Bandeira 2002).

According to Smith (2005) there are three criteria: A, B and C, to define important plant areas. Criterium "A" (threatened species) referring to an IPA's possessing a significant population of one or more species or infra-specific taxa under a certain conservation status. Being A1, the site with globally threatened species, A2 threatened at regional level, A3 at national level and A4 at a specific location. Criterium "B" (botanical diversity), regarded as the site possessing high numbers of species or species with special interest representing the majority of the vegetation type. Criterium "C" (threatened habitat) attributed to habitats that by its specific and dynamics characteristics should be preserved. It can be further subdivided in C1 for threatened habitats at regional level and C2 at national level.

The identification and mapping of important plant areas inside the PNQ was done based on the general map of the vegetation communities (previous objective) and on the main list of PNQ species. Total species list was obtained from the general report of the Terrestrial Vegetation of the PNQ (Bandeira *et al*., in prep.). For every species in this list, a table was added containing information about the vegetation communities where the species does occur and about plant habitus (appearance) (see annex 3). Upon summarizing quantitative data of the table with species numbers per community, information was transferred ArcView GIS 3.2 software, to produce a map showing relative plant diversity. That is, important plant areas bsed on the botanical richeness.

With information about plant habitus (appearance) from previous table Da tabela anterior com a informação sobre o habitus (aparência), succulent plants relative diversity map was produced and also those from arid areas, thus showing important plant areas based on the conservation (threatened or with endemic plant species).

e) Determination of species diversity and possible species abundance rating of each vegetation community.

Standard field methodologies such as quadrates, transects were used aiming at obtaining ecological parameters. Estimated parameters included: species richness, diversity parameters, diameter at breath height (DBH), height, regeneration, plant distribution. Models or projection of resources diversity, structure and abundance were also undertaken. Abundance estimative of species followed relative abundance, frequency, density, biomass, etc. Appropriate formulas and matrix for this come under the inception report.

Fulfillment of this objective allowed the determination of high and low species diversity areas, hints on rarity or species among other relevant information.

Collected samples followed transects oriented East to West and altitudinal gradient. Rectangular plots of 20 m x 20 m (0.04 ha) separating one another by 2 to 3 Km were established (Barbour et al. 1987). Inside the plot, every tree of more than 1,3m and DBH $\geq$ 10 cm was measured. Of each, the following parameters were registered: DBH, total height per tree species, length of the tree crown (Barbour *et al*., 1987; Kent and Cooker, 1992). Diameter taper, normal tape, ropes and hypsometer were used (Barbour *et al*., 1987).

Natural regeneration defined as group of individuals of a tree species at initial stages of development, including specimens from small seedlings till young plants (Hosokawa, 1986). All individuals of a certain species with (i) DBH < 5 cm and height > 10 cm, measured in plots with of 5 m x 5 m (seedlings) and (ii) all individuals with 5 < DBH < 10 (poles in the plots of 10 m x 10 m) (Hosokawa, 1986) were considered, see Fig. 2. Species identification of the regeneration woody species was also performed.

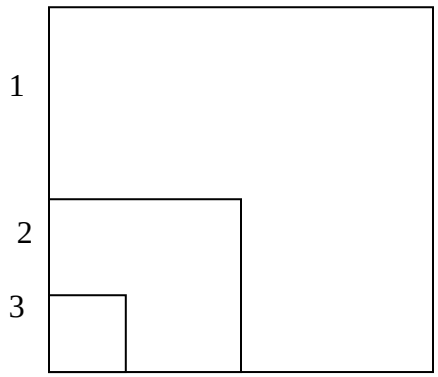


Fig 2. Sampling Diagram. (1=plot of 20 m x 20 m (adult trees with DBH > 10 cm); 2= plots of 10 m x 10 m (poles) and 3=plots of 5 m x 5 m (seedlings)

This goal and methodology was also applied in most plant communities including disturbed areas such as agricultural land and people settlements.

Methodology for the establishment of permanent plots

Areas for the establishment of Permanent plots were identified near Bilibiza Lake, at the West side of the park near Montepuez river (an inselberg area) and in the north at the inundation area of the river Muacamula. These three areas were proposed by the scientific director of the QNP (Armindo Aramane). Permanent plots to be placed later after this study comes to an end. The 3 areas being relatively dense with wildlife, will help understanding possible transformations of floral transformations or disturbances. Permanent plots provide a baseline for tree distribution, habitat

description. Monitoring changes in those permanent plots are essential to allow quantification of impacts, natural, wildlife or human disturbances.

Before choosing the plot, a survey of the area was conducted, by means of cartography, available photographs and groundtruthing. Maximum area of the plot was 25 Ha (one plot per each of the major locations defined above).

f) Proposal of priority areas of plant research necessary to the understanding and functioning of the vegetation types within the Quirimbas National Park

Once the first vegetation study was complete, a list for further research topics is provided. With some confidence, we would expect this further research to (i) be broaden to other more remote areas of the park not covered within the extent of this study; (ii) implementation of conservation strategies; (iii) ecological-economics evaluation and sustainability analysis of the already used local plants; (iv) data publication of research findings in peer-reviewed forum; (v) ecological modelling; (vi) relationship between flora and fauna (vii) areas for promotion of botanical tourism e.g. to other places with rare and nice plants such as cycads, local bamboo, tree fern, inselbergs flora, etc.

g) Identification of invasive plants, factors affecting their success, dispersal mechanisms and evaluate their threat to the vegetation types

Invasive plants were identified using mainly the already existing list of these harmfull plants. See extensive literature published for South Africa and some for East Africa.

Invasive plants are those growing in undesirable places. They do not occur naturally in determinate area, but they are introduced deliberately or unconsciously by humans. In many cases these species cause threat for biodiversity and can, in many cases constitute the second cause of habitat loss. Invasive species can be native or exotic; but emphasis was given to exotic ones. In Mozambique some of these species were introduced deliberately for commercial purposes (e.g. *Eucaliptus* sp.) for agricultural, cattle, agro-florests (e.g. *Leucaena leococephala, Azadiracta indica*, etc.) another for ornamental purpose (e.g. *Lantana camara*) or for habitat conservation or wind breaker (*Casuarina equisetifolia*). Invasive aquatic plants such as *Salvinia* sp, *Eichornia* sp can cause reduction in water availability. Relatório Preliminar Sobre Especies Invasivas (2004) is probably the main document produced in Mozambique on weed plants.

Invasive plants will be identified using existing literature (e.g Bromilow,1995, Hederson, 2001 and Henderson & Cilliers, 2002). See extensive literature published for South Africa and some for East Africa. Behaviours of these plants will be observed to allow determination of its effectiveness as an invasive in a true tropical environment.

h) Identification of non timber forest products (including medicinal plants) and their uses

Several activities were planned to assess the current use patterns and the impact of them on the existing vegetation types within the QNP:
1-Describe the traditional resource use
2- Quantify current use of the resource by the community
3- Assess the economic value of non timber products

4- Describe the current traditional management systems of the rural communities

Interviews were carried out with key people such as traditional leaders, traditional practitioners, elderly people, women, teachers and other resource users in order to describe the traditional resource use and management systems (Martin 1995; Cunningham 2001). Some of these techniques have been successfully applied for southern Mozambique (Bandeira 1994; Bandeira et al 1999). The relative importance of the forest resources in a traditional context was also assessed. An inventory of useful species was produced.

A comprehensive random sample of the households was undertaken to assess community's perceptions of the changes on the forest structures and productivity using methods described in Jackson & Ingles (1995); Martin (1995); Hoft *et. al.*(1999) Cunningham (2001). Measurements to quantify the forest-resources based currently used were done. This activity comprised the assessment of the sizes and numbers of the species collected and frequencies of collection. Free listing and pair wise techniques were used to assess the most preferred species within the Park.

Analysis of the harvesting and marketing of forest-based resources was undertaken. Value of ecosystem is roughly divided into three types (de Groot *et al*. 2002), ecological, socio-cultural and economic value. According to Martin (1995), one way of assessing the value of the forest is by comparing the rates of return or potential benefits derived from different ways of employing capital and labor. To assess the economic value four different approach were used namely i) market value, ii) indirect market value, iii) contingent valuation and iv) group valuation, (Turner 1994; Martin 1995; Godoy *et.al*. 2002; Groot *et.al*. 2002; Ntumi & Martins 2002). We looked at the contribution of the non timber assets to the households within the Park. Contingency evaluation was applied as an indirect valuation, which relies on the individual valuations of the goods; it implies the concept of (WTP). Individuals (households) were asked about their willingness to pay towards a certain asset.

Information about medicinal plants was collected using the same approach referred above namely interviews to key informant such as: Traditional Medicine Practioners, TMPs, and collectors of medicinal species to document the most commonly used plants in treatment of ailment among others: Malaria, Tuberculosis (TB), rheumatic pains and AIDS. A questionnaire was produced based on Martin (1995), Cunningham (2001), WHO (2003).

Review of existing material concerning traditional conservation practices was done and based on that development of materials involving the community in order to contribute for rational use of the NTFPs.

i) Assessment of current and future human/human related impact on the vegetation, and evaluation of these impacts

The most probable current direct human, and human related impact on the vegetation arises from agriculture, grazing logging, fire, spiritual activities, use of medicinal plants. The construction of infrastructures and roads by park management may also cause future disturbances.

These disturbances were described of each of the area visited. Category of degradation was registed. Ecological methods such as assessing amount of dead trees or debarked trees were applied. Charcoal

production in the area was estimated. Markets will be visited in order to access amounts of resources exploited.

j) Assessment of the importance of the vegetation of the Quirimbas National Park Concerning its biodiversity, level of endemism, occurrence of plant species listed on the Red Data list on the international, regional, and local scale.

Vegetation analysis, aiming to assess the overall importance of this study was performed. This analysis includes comparisons of QNP vegetation with other known vegetation studies. This is to cover aspects such as: species richness, species of special concern, habitat diversity, value of the resources (timber and non-timber), etc.

Main technique here included the usage of Criteria for selecting Important Plant Areas (IPAs) both within QNP and comparing with other areas of Mozambique. IPAs are defined as natural or semi-natural sites of exceptional botanical richness or/and supporting an outstanding assemblages of rare, threatened and/or endemic plant species and/or vegetation of botanical value (Anderson 2002). IPAs was developed in Europe in response to increasing rate of loss of plants and habitats due to development, urbanization and habitat destruction.

Such areas were identified for QNP as comparing different visited areas of the QNP as well as with existing information for other parts of Mozambique. Three criteria will be used as for IPAs. Criteria A is based on threatened species; Criteria B based on botanical diversity and Criteria C based on threatened habitats. These guidelines are detailed in Smith (2005). So far 28 IPAs sites were preliminary selected for Mozambique, with QNP being the only one preliminary selected for Cabo Delgado province based on Criteria B & C. Details of the exact location, habitat type of high botanical diversity and threatened habitat information were gathered from this study.

IV. RESULTS AND DISCUSSION

A) Identification of the vegetation types, their range within the Quirimbas National Park and Vegetation mapping

A) Identification of the vegetation types, their range within the Quirimbas National Park and vegetation mapping

GPS reading on the field and vegetation Classification

134 GPS readings (see Table 1 below) were undertaken in the field covering most of the territory of QNP. The data were downloaded into a computer with GIS software (ArcView 3.2). Downloaded into shapefile obtained from DINAGENA (CENACARTA office). LandSat imagery used (See Fig 3)

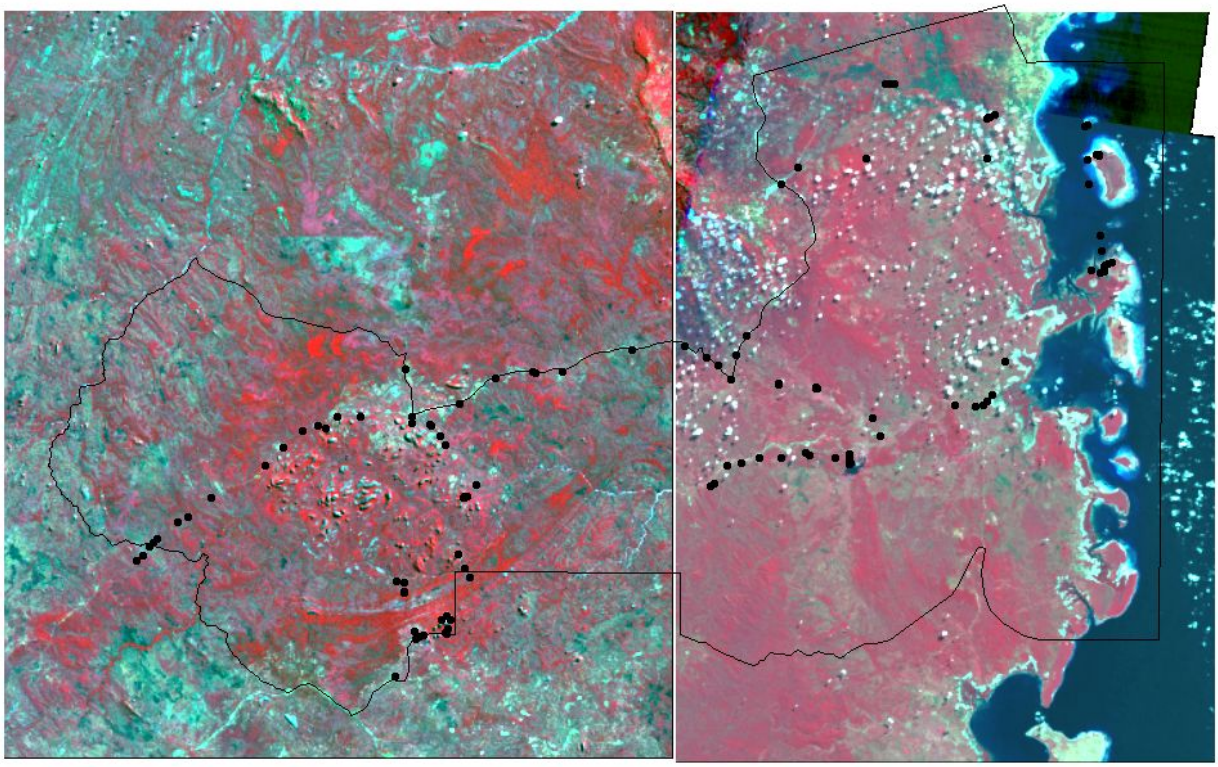


Fig 3. Reading GPS points at QNP, depicted in the shapefile.

Table1. Description of distinctive characteristics of each Plant Community at QNP

Vegetation	**Main characteristics**	**Dominant species**	**Other species**	Main places of occurrence within PNQ
Mangrove	Saline tolerance; Costal location and in the zone between-tides or the estuary of the rivers (Sacket, 1994); It possess fruits viviparous, pneumatophore roots; It is composed by shrubs or trees that can reach up to 30m (Amade, 2006)	*Soneratia alba, Avicennia marina, Rhizophora mucronata, Bruguiera cylindrica, Lumnitzera racemosa, Ceriops tagal, Xylocarpuss granatum*	Species of Chenopodeaceae family	Quirambo's Island, Sencar, Ibo, Quirimbas and in the costal zone or in the zone between-tides. (See the map, Fig. 4)

Miombo woodland	Trees of heights that vary between 7 to 15 m; Dominance of species of the Fabaceae family, subfamily Caesalpinoideae, particularly of *Brachystegia* genera, *Julbernardia* and *Isoberlinia* (White,1983)	*Brachystegia allenii, Julbernadia globiflora, Diplorhynchus Condylocarpon, Acacia gerrardii, Acácia nigrescens, Bauhinia petersiana, Afzelia quanzensis, Dalbergia melanoxylon*	*Maerua cafra, Cissus integrifolia, Cleistochlamys kirkii, Hymenocardia ulmoides, Hugonia orientalis, Millettia stuhlmannii, Stecurlia quinqueloba, Spirotachys africana, Ximenia caffra*	Around the inselbergs in the region of Ancuabe and Meluco and the north of the district of Macomia (See the map, Fig. 4)
Miombo-Velloziace	The Miombo is diverse with the dominance of *Brachystegia glaucescens* species. Normally species of Miombo are found in the base of the mount and the Velloziace at raised altitudes. The Velloziace presents adaptations to survive the extreme variations of temperature and water availability, the elevated altitudes and the inclination of mount.	*Brachystegia allenii, Julbernadia globiflora, Diplorhynchus Condylocarpon, Acácia gerrardii, Bauhinia petersiana, Afzelia quanzensis, Dalbergia melanoxylon Brachystegia glaucescens Brachystegia spiciformis Euphorbia cuperi, Euphorbia hirta, Xerophyta retinoti Aloe spp. Vellozia sp.*	*Adonsonia digitata Annona senegalensis Millettia stuhlmanii, Afzelia quanzensis, Vitex doniana, Combretum zeyheri, Sclerocarya birrea, Hibiscus sp., Sterculia quinquiloba*	In the region of the inselbergs of Ancuabe and Meluco (See the map, Fig. 4)

Mixed Woodland	Composed of different species forming a mosaic, characteristic species are: *Millettia stuhlmannii*, *M. bussei*, *Terminalia sericea*, *Pteleopsis myrtifolia*, species of miombo and agglomerated of bamboo (*Oxynanthera abyssinica*). Higher trees present heights that vary from 10 - 15 m, with highest trees presenting diameter between the 50 - 80 cm,. Found in sandy-argillaceous soils of chestnut-dark coloration with little litter.	*Millettia stuhlmannii, Millettia bussei, Terminalia sericea, Hymenocardia ulmoides Brachystegia allenii, Julbernadia globiflora Oxytenathera abyssinica Lonchocarpus bussei, Sclerocarya caffra, Sterculia quinqueloba, Albizia harveyi, Pteleopsis myrtifolia. Diplorhyncus condylocarpon, Spiritachys africana, Adansonia digitata Acácia nigrescences*	*Cleistochlamys kirkii, Kussonia arborescente, Lannea stlhumannii, Markhamia zanzibarica, Ochna arbórea, Sclerocarya birrea Acacia polyancantha, Vangueria infausta Bidens pilosa Baphia massaensis Hugonia orientalis, Combretum zeyheri, Vitex doniana, Xeroderris stuhlmanii, Boscia albitrunca, Diospyros sp. Catunaregam spinosa, Crossopterix febrifuga, Triunfetta pentadra*	In Ancuabe and Meluco region (See the map, Fig. 4)

Acacia-Grassland	It is composed by arboreous and herbaceous strata. Trees or shrubs are moderately distant. Species of *Acacia* dominate the arboreous stratum. Rich community in species for grass. The herbaceous stratum is high reaching up to 2 m. Characteristic of the alluvial zones, situated in the edge of the rivers, lakes and depressions, with altitude that varies betwenn 10 to 100m. These lands are normally subject to flooding, compact-argillaceous, and extremely impermeable	*Acacia xanthophloea, Faidherbia albida, Lonchocarpus capassa, Plyllanthus reticulatus Acacia gerrardii, Albizia amara, Albizia forbesii Lannea schweinfurthii Acácia nigrescens, Bauhinia petersiana, Afzelia quanzensis Digitaria eriantha Panicum maximum Stylochiton maximus Sesbenia sesben Corchorus trilocularis, Stemoquiton maximiza Pluchea descorides*	*Annona senegalensis, Antidesma venosum, Azanza garcheana, Cathunaregam spinosa, Cissus integrifolia, Cryptolepis obtuse, Dalbergia arbutifolia, Erythrina abyssinica, Hyphaene coriaceae Lonchocarpus capassa, Ochna arborea, Olax dissitiflora, Ozoroa obovata, Piliostigma thonningii, Senna petersiana, Sclerocarya birrea, Vernonia colorata, Xylotheca tettensis Ziziphus mucronata Pennisetum purpureum*	In Macomia, Quissanga, the region around Bilibiza lake and the edges of the rivers and inundation areas. (See the map, Fig. 4)

Costal Thicket	Shrubs of low altitude, with heights between 2 to 3 m and sub-shrubs very branchy. It occurs in coastal dunes, on limy ground, presence of many creeper and lianas sometimes impenetrable because of the density of the shrubby, sub-shrub species and also of thorny species.	*Sideroxylon inerme, Diospyros usambarensis Diospyros loureniana, Ziziphus mauritiana, Grewia sp.* *Ochna sp, Sterculia africana, Mimusops caffra, Maytenus heterophylla, Strophanthus sp., Dichrostachys cinerea, Cassita filiformes*	*Senna siamea, Senna ocidentale Phyllanhus reticulatum, Lantana camara, Walteria indica, Xylotteca tettensis, Ozoroa aobovata,* *Euclea natalensis, Commiphora sp., Strychnos spinosa, Flacourtia indica, Bridelia cantartica, Ricinus communis, Calantrophus procera. Euphorbia hirta Opuntia ficus-indica. Walteria indica, Abrus precatorius,*	In the islands Matemo, Quirimba, Mefunvo, Quissive and in the Northeast part of the Ibo island (See the map, Fig. 4)

GIS combined with groundtruthing enabled elaboration of the following map concerning plant communities in QNP as shown in Fig 4. Table 2 shows the area covered by vegetation type and its percentage in QNP.

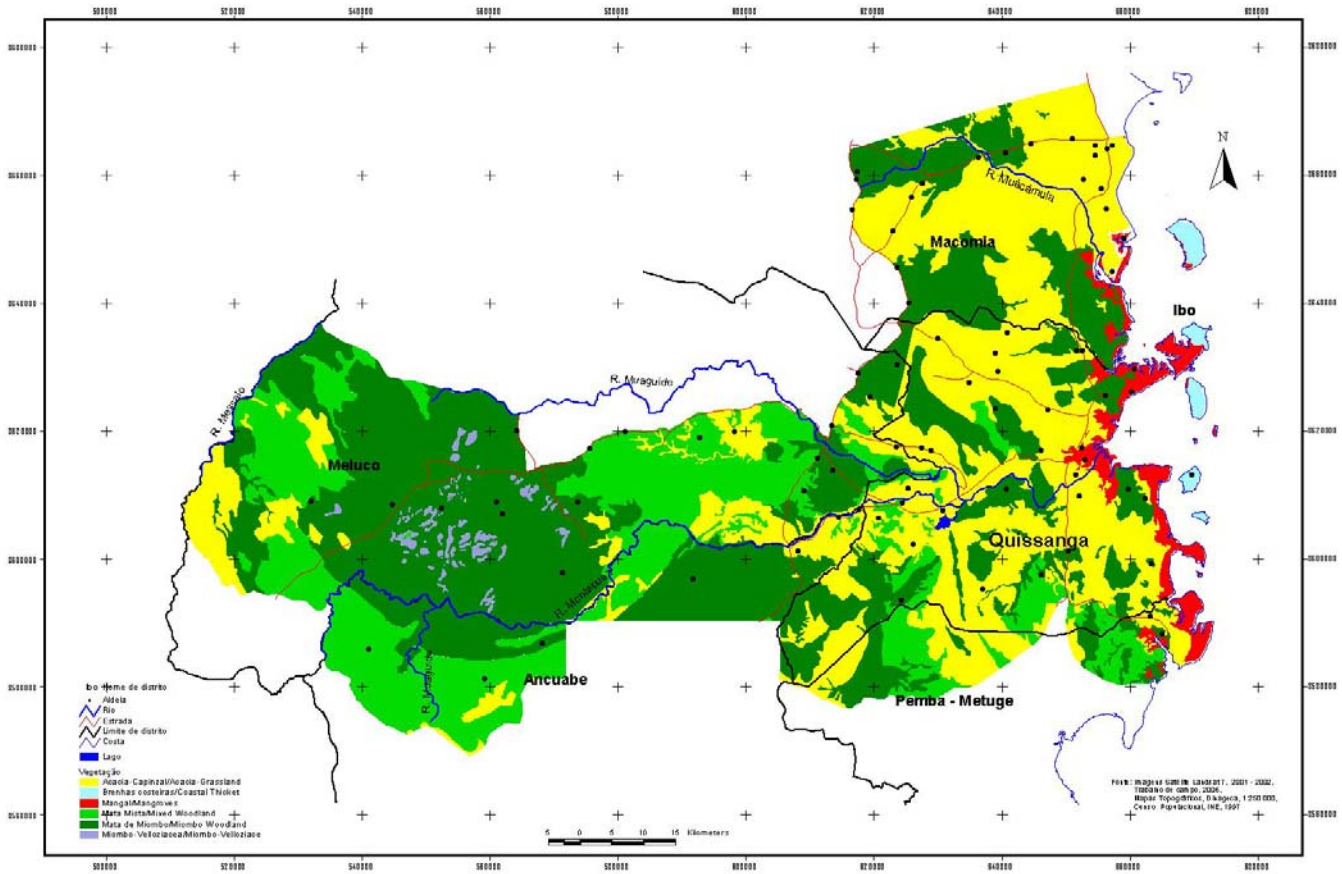


Fig 4. Map of QNP plant communities (derived from LandSat7, 2001-2002).

Table 2. Classified polygons, area and percentage of cover in QNP

Occupation form	**Polygons**	**Area in km^2**	**Percentage (%)**
Acacia-Grassland	40	2655.7	33.12
Costal Thicket	9	52.4	0.65
Lake	1	4.4	0.05
Mangrove	31	239.4	2.99
Mixed woodland	39	1709.4	21.32
Miombo woodland,	53	3275.1	40.84
Miombo-Velloziace	64	67.3	0.84
Settlements	13	14.7	0.18
Total	**250**	**8018.6**	**100.00**

The biggest vegetation cover of the QNP is composed by the Miombo Woodland community, which is about 40,84% of the total area of 8018.6 Km^2. The coastal Thicket covers the smallest area in extension, that is, 52.4 m^2, equivalent to 0,65%. This vegetation type is also present in the islands and some regions of the coast. The settlements (villages) occupy 0.18% of the area, being distributed in all districts.

Cluster analysis

The results of Cluster analysis are shown in Figure 5 below**,** with plant community in ordinate and respective values in the abscissa axis in percentage of dissimilarity, which varied from 0 (maximal similarity) to 100 (maximal dissimilarity).

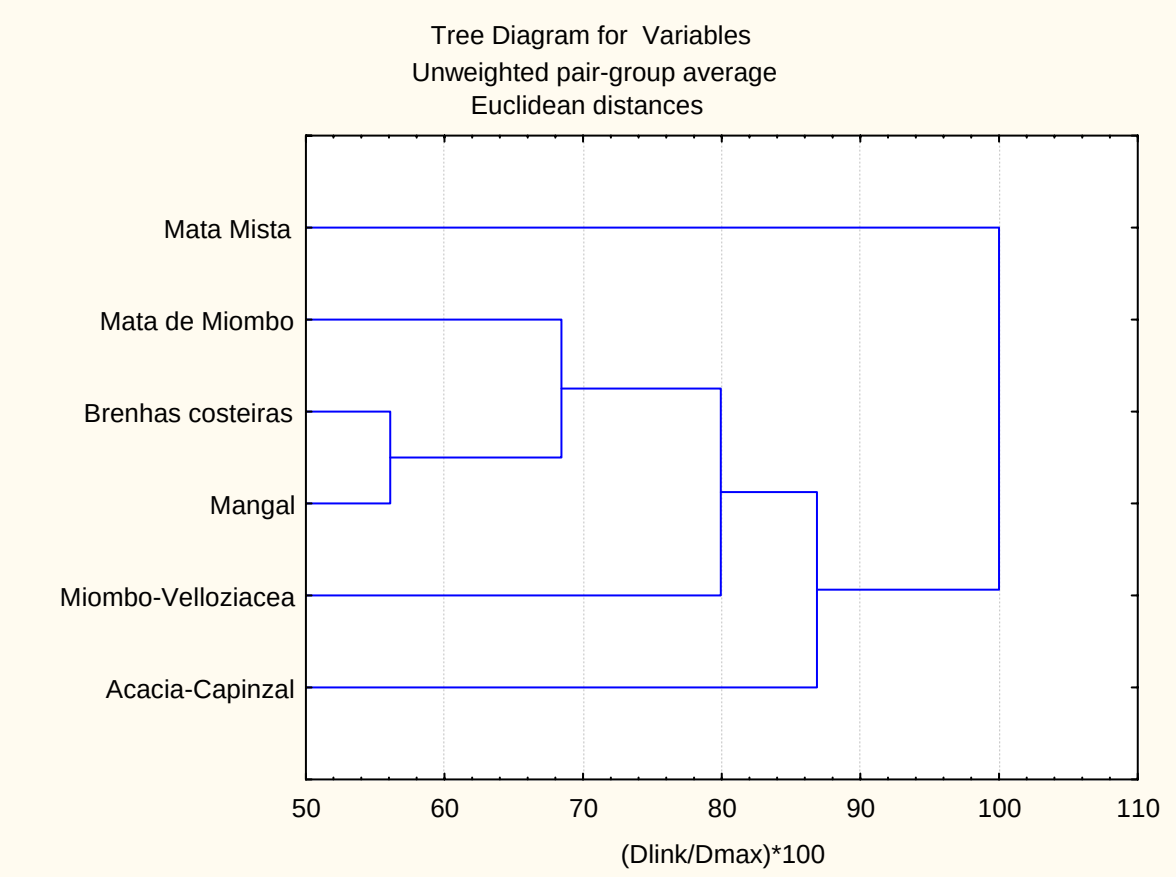


Figure2.

Fig 5. Dendrogram of Cluster analysis using Euclidian distance

Other additional maps produced in this study:

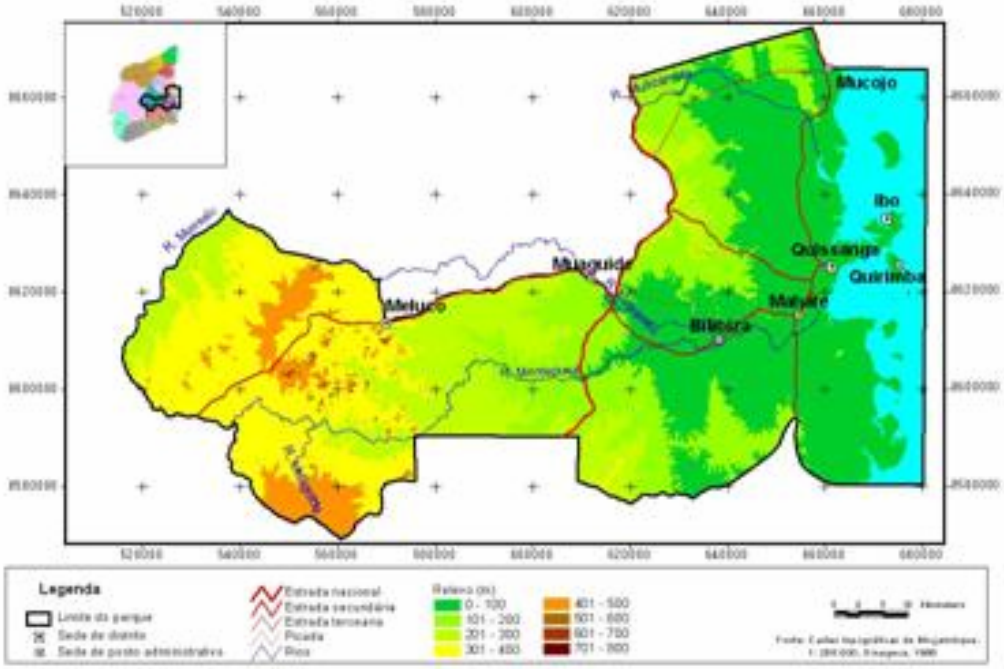


Fig 6. Elevation map

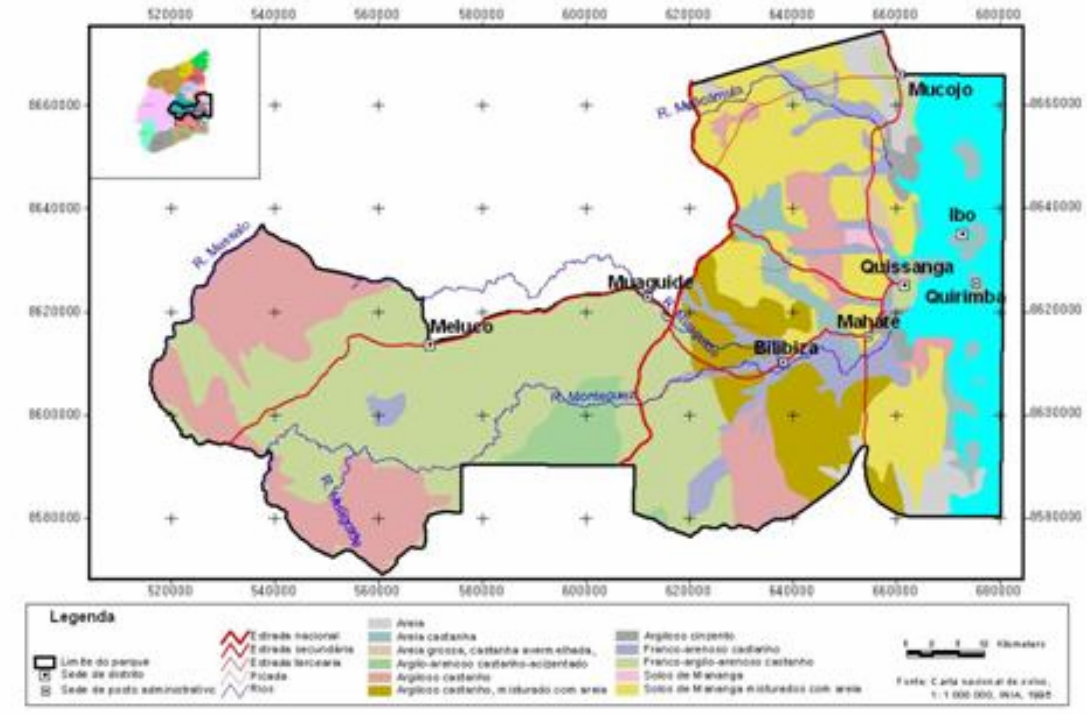


Fig 7. Soil map

B) Identification of the main abiotic and biotic factors affecting the distribution and survival of species in the vegetation types within the Quirimbas National Park

dark brawn soils of Muagamula river valey

B) Identification of the main abiotic and biotic factors affecting the distribution and survival of species in the vegetation types within the Quirimbas National Park

Soils were the main abiotic factors measured within QNP.

32 soil samples were collected following standard procedures in all plant communities including at Inselbergs platos. The following data were gathered: 1- Ca,Mg, 2- Na, K, 3- Texture, 4- pF, 5- M.O., 6- Al+H, 7- P, 8- CTC, 9- N, 10-CE, 11- pH in water, 12- pH KCl, 13- $CaCO_3$, 14- colour.

Information gathered:

Ph in KCl
Ph in water,
CE (electric conductivity)
Carbon,
Organic Matter
Nitrogen
Phosforous
BT (Exchangeable Bases)
Exchangable acidity
Soil Humidity
Texture
Colour

Main results are shown below.

5.1 Soils pH

Soils pH present two extremes between 4,86 to 8.23.

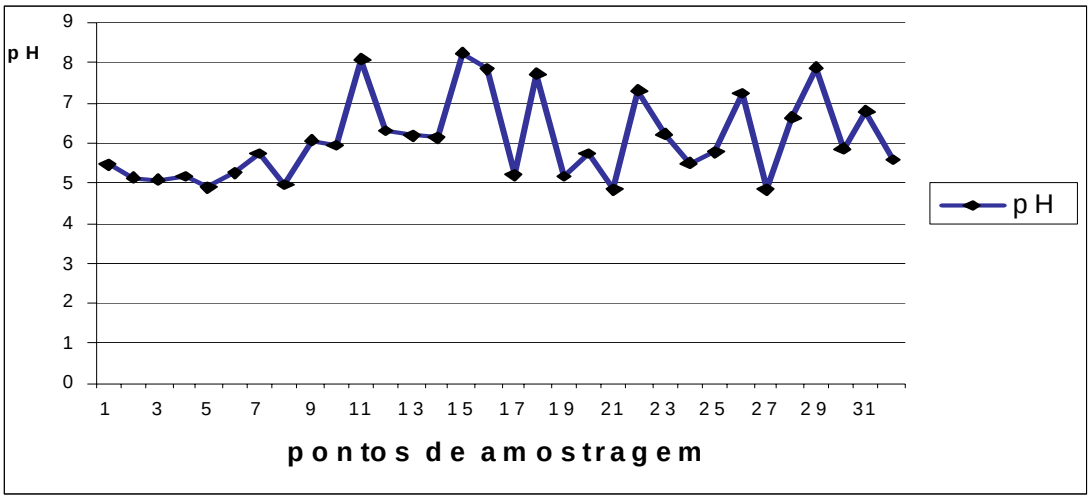


Figure 8. The soils pH in different samples.

5.2. Texture: Soils at QNP are basically sandy soils

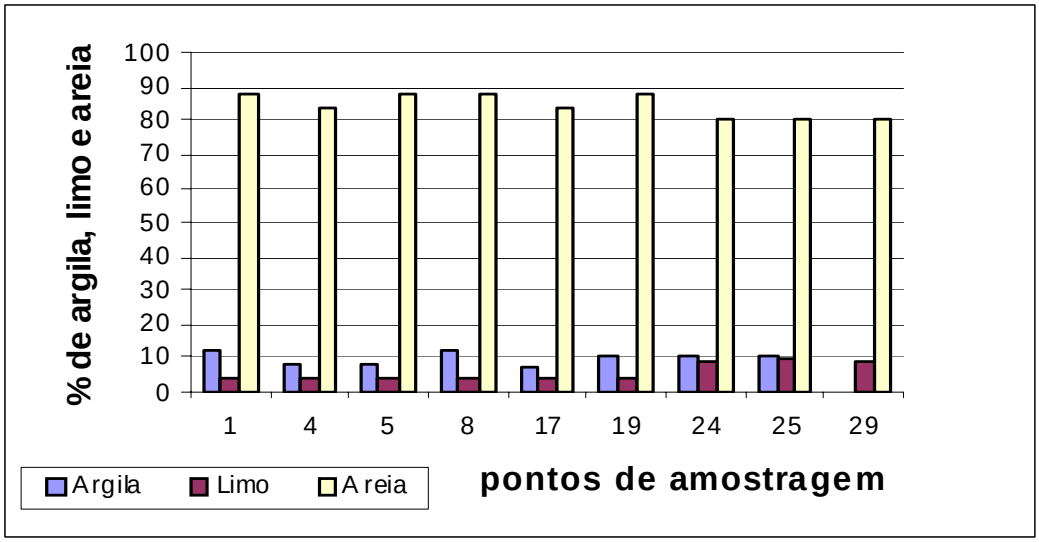


Figure 9. Relative amount of clay (=argila), limous (= limo) and sandy (=areia) soils in all samples at QNP.

5.3. Organic matter

In geral, the soils present low organic matter concentration, varying between 0.03 and 3.54 % .

Ancuabe

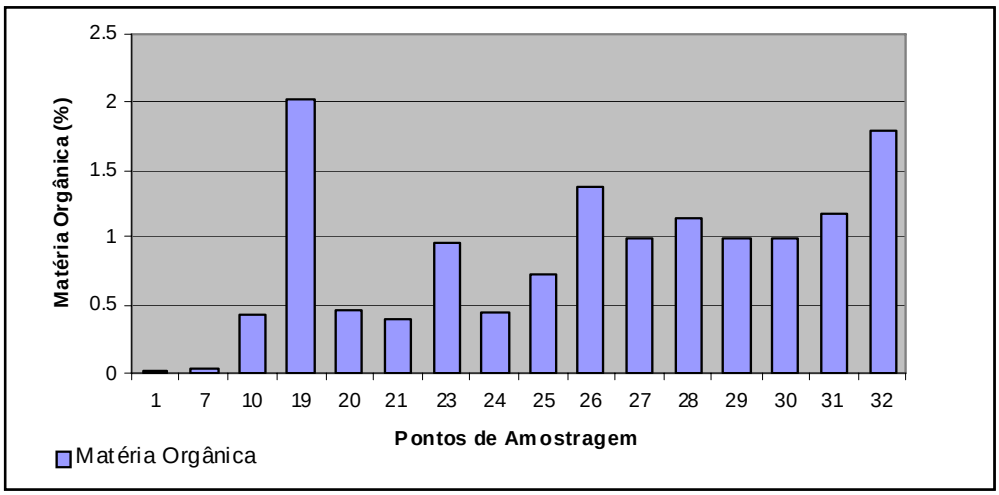


Figura 10. Organic matter in diferent samples of the Ancuabe district.

Quissanga

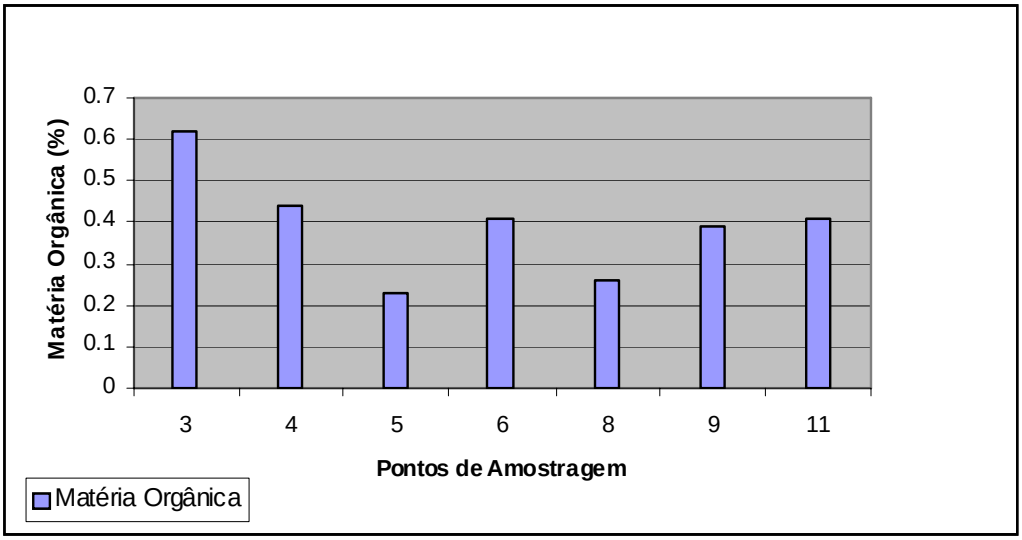


Figura 11. Organic matter in diferent samples of the Quissanga district.

Macomia

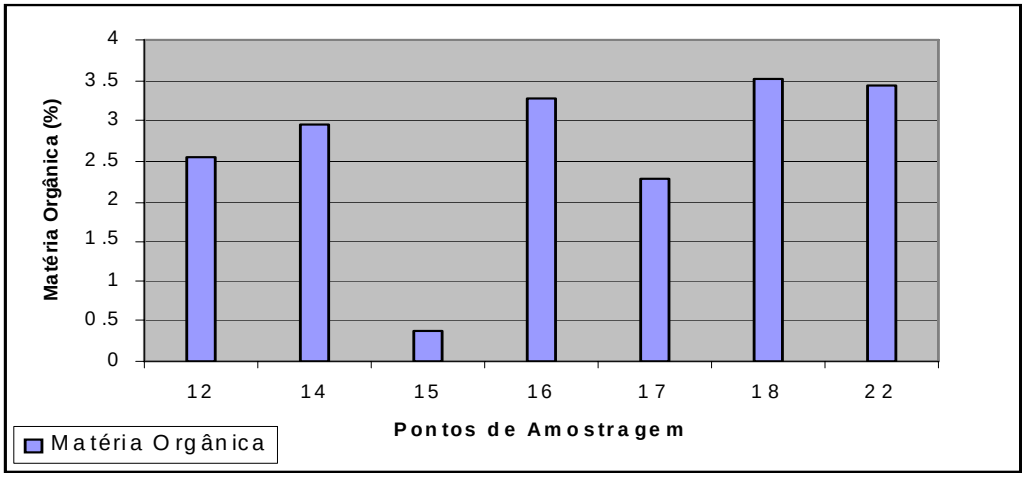


Figure 12. Organic matter in diferent samples of the Macomia district

5.4. Colour

Color is an important physical property since giving indications of other characteristics, such as the organic matter content. Normally the dark or black soil, discloses greater organic matter. Colour description for QNP samples is presented in the Table 3.

Table 3. Colour description for the sampling sites at QNP.

Sampling points	Soil condition	Soil type
1	Dry	Shady - Brown
	wet	Black - brownish
2	Dry	Red-greyist
	wet	Shady - Puce
3	Dry	Red-greyish
	wet	Puce
4	Dry	Brown-greyish
	wet	Brown-greyish
5	Dry	Brown-greyish
	wet	Brown-greyish
6	Dry	Puce
	wet	Dark- Puce
7	Dry	Shady - Brown
	wet	Brown
8	Dry	Shady - Brown
	wet	Brillant - Brown
9	Dry	Brillant - Brown
	wet	Brown
10	Dry	Shady Dark -Puce
	wet	Dark -Puce
11	Dry	Grey brownish
	wet	Black - brownish
12	Dry	Black
	wet	Shady - fawn
13	Dry	Brown
	wet	Black - brownish
14	Dry	Black - brownish
	wet	Shady Orange - yellowist
15	Dry	Dark- Brown
	wet	Black - brownish
16	Dry	Black
	wet	Black
17	Dry	Shady - fawn
	wet	Shady - fawn
18	Dry	Black - brownish
	wet	Black
19	Dry	Black - brownish
	wet	Dark- Brown
20	Dry	Dark-Puce
	wet	Shady - Brown

Table 3 (Cont.)

Sampling points	Soil condition	Soil type
21	Dry	: Dark- Brown
	wet	Black - brownish
22	Dry	Black
	wet	Puce
23	Dry	Dark-Puce
	wet	Most Dark-Puce
24	Dry	Brown-greyish
	wet	Black - brownish
25	Dry	Brown-greyish
	wet	Black - brownish
26	Dry	Black - brownish
	wet	Black - brownish
27	Dry	Brown
	wet	Castanho escuro – Dark-Brown
28	Dry	Brown-greyish
	wet	Black - brownish
29	Dry	Dark- Brown
	wet	Black - brownish
30	Dry	Dark- Brown
	wet	Black reddish
31	Dry	Most Dark-Puce
	wet	Black reddish
32	Dry	Brown
	wet	Dark- Brown

5.5. Transferable cationic capacity (TCC)

The trasnferable cationic capacity is lower in points such as 11, 12, 13, 14, 15.

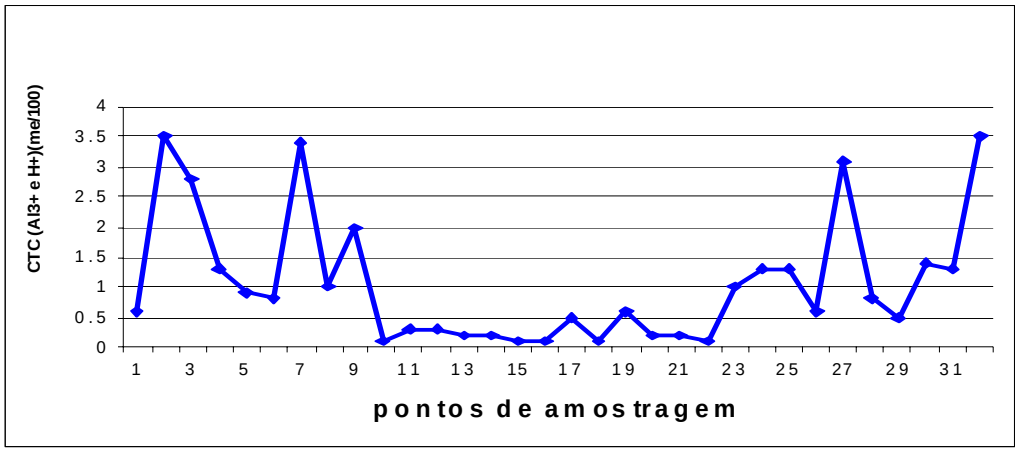


Figure 12. Exchanging cationic capacity (TCC) of different soil samples.

5.6. Exchange bases (EB)

Values of the exchange bases varied greatly, sometimes reaching the lowest values such as K+, Na+ e Mg2+.

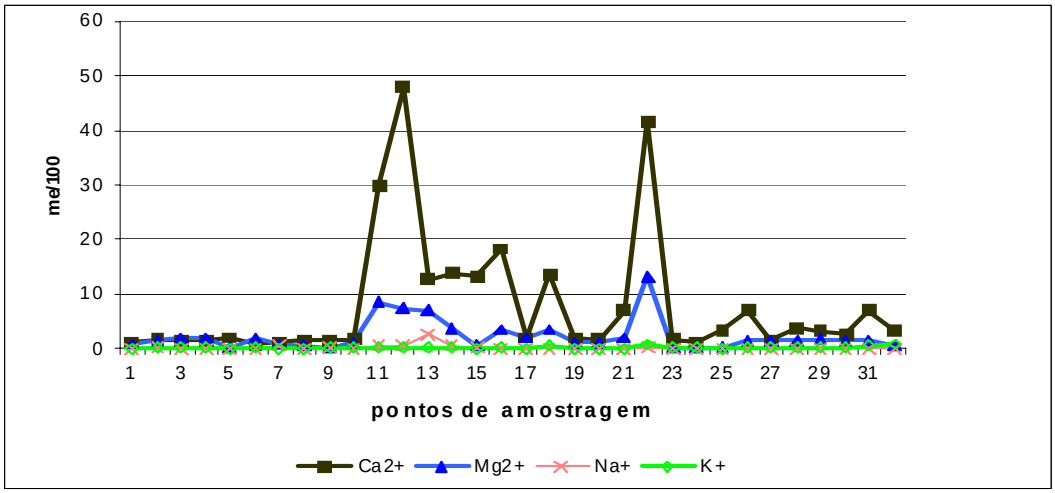


Figure 14. The exchange bases of different soil samples.

5.7. Electric conductivity (EC) of soils

The electric condutivity at different zones observed high variations as illustrated in figure 15 below.

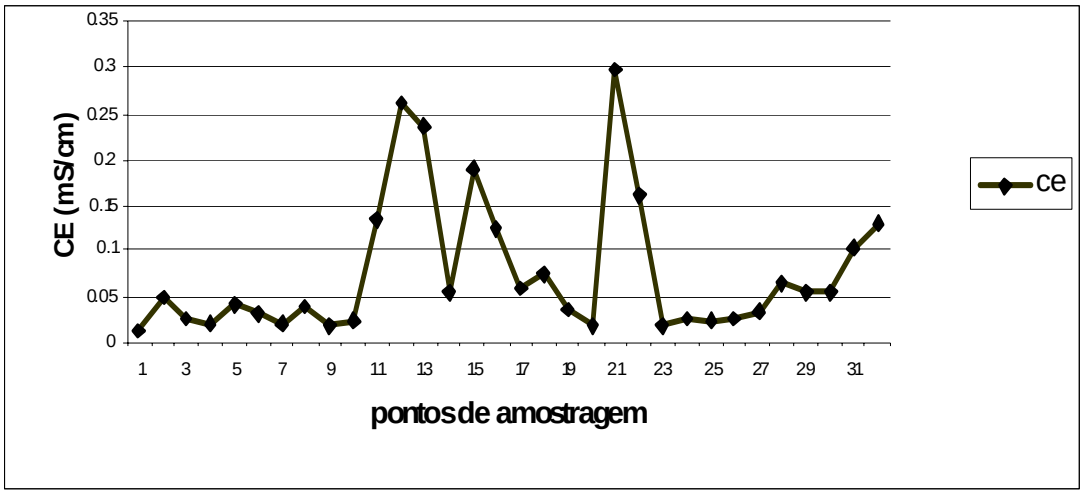


Figure 15. Electric conductivity variation in different sampling points

5.8. Nutrients

5.8.1. Nitrogen

In accordance with the results, nitrogen also showed low percentages, beginning at 0.00 at the first point, being high in Ancuabe with 0.28 at the sampling point 21.

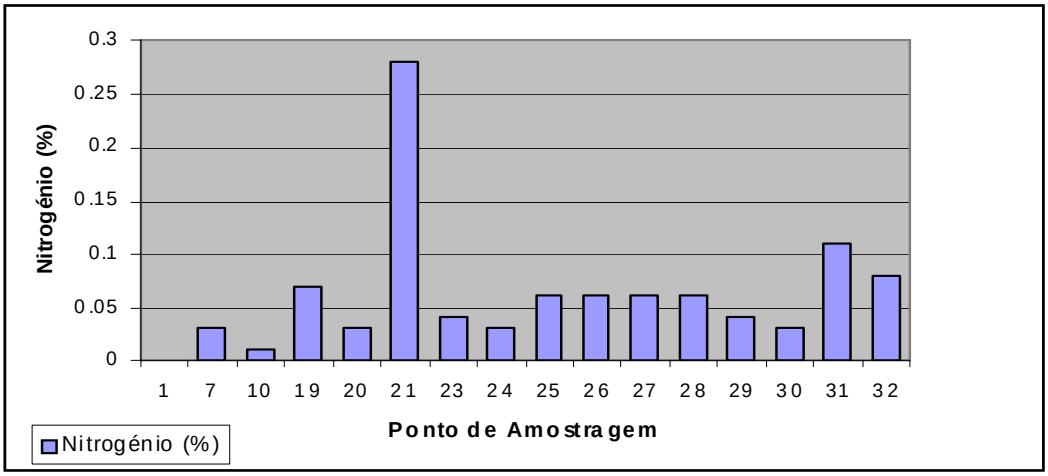


Figure 16. Nitrogen percentage variation in different samples of the Ancuabe district

In Quissanga, the Nitrogen concentration was the lowest, at sampling points 3, 4, 6, and 9 exceeded 0.02% while in sampling points 5 and 8 it reached 0.02 %, see Fig 17 below.

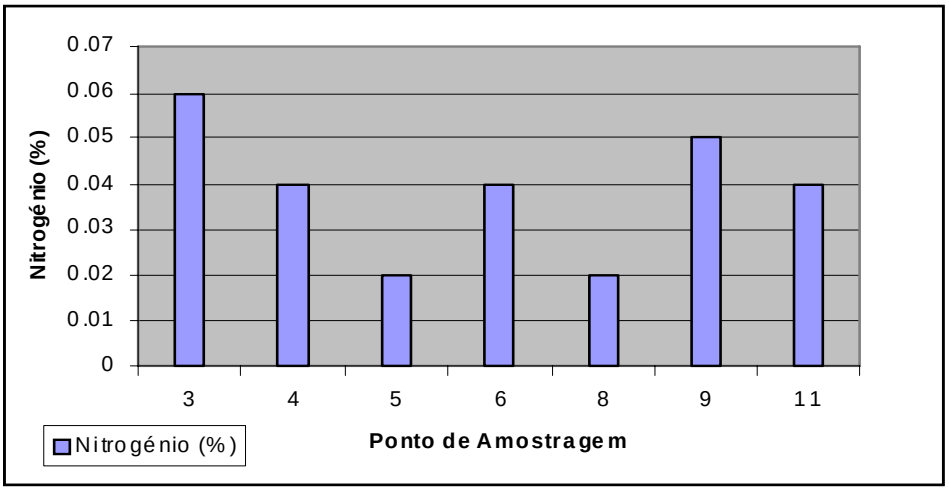


Figure 17. Nitrogen percentage variation in different samples of the Quissanga district.

At Macomia, Nitrogen percentage variation was high, although not reaching 1%.

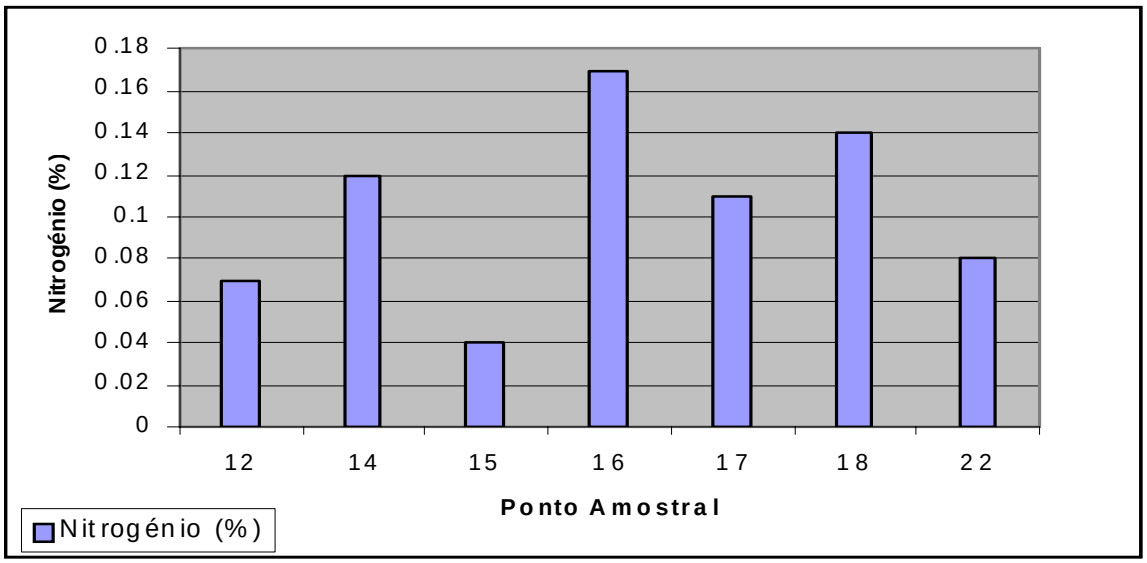


Figure 18. Nitrogen percentage variation in different samples of the Macomia district.

5.8.2. Phosphorous

In general, at the sampling points, the phosphorous concentration observed high variation, but in some zones such as points 23, 24, 25, 26, 27, 28, 29 and 30 the values were extremely low and

observed a costant line. At the sampling point 31, phosphorous concentration reached the top value, nearly 3 mE/100, see Fig 19 below.

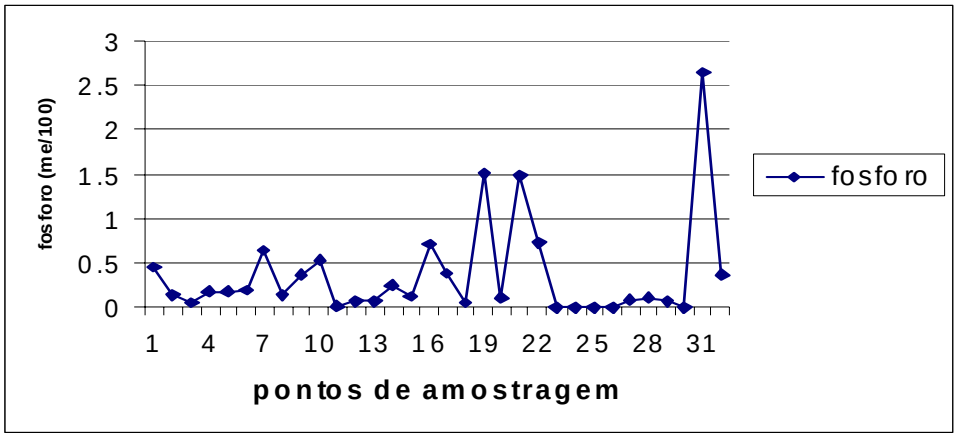


Figura 19. Phosphorous percentage variation in diference samples.

DISCUSSION :

Quirimbas National Park presents great variance in both physical and chemistry characteristics as follows:

- **PH** : In accordance with the results, the QNP soils present pH values which vary between 4,86 to 8.23. The pH average is relatively lower than 7, probably because the basic cations have been removed and they are replaced by colloidal complex or they have been dissolved by the acid associated with leaching; or it may also been influenced by some soil microorganisms which participate in the organic matter decomposition, as they release organic and inorganic acids (Correia, 1981).

- **Texture and colour**: The soils present high sand percentages, an increase related to soils formation factors, such as the topography, climate, rock mother among others. The soils present an arenaceous texture with very diversified colours such as chestnut, black, cinereous brownish, red black, greyish, brownish, shining chestnut, among others.

- **Organic matter** : High variation was observed in terms of the soils organic matter, varying between 0.03 and 3,540%, values that disclose a low organic matter concentration in the QNP in general (Botelho, 1971).

- **Exchanging cationic capacity (CCC)** : The CCC in general is relatively moderate and it is found between the intervals 0.1 to 3,5. In some points the values are vary low and it increases with variance in altitude. This increase probably due to exchange cationic efficiency at these soils, in other hand, the efficiency in the reversibility between restrained cation in the clay mineral surface with acid salt solutions probably very fast and total.

C) Identification of all terrestrial plant species (including herbaceous and lower plants) of the Quirimbas National Park

C) Identification of all terrestrial plant species (including herbaceous and lower plants) of the Quirimbas National Park

Up to 580 species were identified for the study area, of which 206 herbaceous and 201 were woody plants (see Table 4 and chapter E below).

Table 4: Main habitus of the QNP plants

Plant habitus	Species numbers
Herbaceous	206
Tree	201
Shrub	97
Climber / creeper	20
Succulent	13
Palm	3

The 580 plant species were grouped into 99 plant families. Table 5 below presents the families represented at least four species.

Table 5: Main plant families of the PNQ species.

Family Name	**Number of species**
Fabaceae	105
Poaceace	49
Euphorbiaceae	33
Asteraceae	30
Thymelaceae	18
Malvaceae	17
Combretaceae	15
Lamiaceae	14
Acanthaceae	12
Apocynaceae	12
Capparaceae	12
Anacardiaceae	11
Cyperaceae	9
Ebenaceae	9
Vitaceae	9
Convolvulaceae	8
Annonaceae	7
Bignoniaceae	7
Meliaceae	7
Moraceae	7
Rubiaceae	7
Vellozaceae	6
Aloaceae	5
Commelinaceae	5
Ochnaceae	5
Olacaceae	5
Rutaceae	5
Asclepiadaceae	4
Connaraceae	4
Loganiaceae	4

Table 6 gives an indication of the PNQ species distribution per plant community.

Table 6. Number of species per community type

Plant Community	**Number of species**	**Number of succulent species**	**Number of Endemic or near endemic species**
Mangrove	7	-	-
Costal Thicket	38	-	-
Acacia-Grassland	104	2	2
Mixed Woodland	183	6	6
Miombo Woodland	59	-	5
Miombo-Velloziace	77	10	7

D) Identification of plant species of special interest (rare, threatened, vulnerable, endemic, invasive), evaluation of threats affecting their survival, and definition of the management strategies to eliminate these threats

D) Identification of plant species of special interest (rare, threatened, vulnerable, endemic, invasive), evaluation of threats affecting their survival, and definition of the management strategies to eliminate these threats

It is presented in table 7 the groups of sensible plant species: succulents and the evaluation of threatened plants occurring at QNP.

Table 7. Succulent plant species in QNP

Succulent species	**Plant communitiy**
Adansonia digitata	Mixed woodlands , Acácia-Capinzal
Aloe maunii	Miombo-Velloziacea
Aloe chabaudii	Miombo-Velloziacea
Aloe parvibractea	Miombo-Velloziacea
Aloe sp.	Miombo-Velloziacea
Euphorbia confinalis	Miombo-Velloziacea¸Mixed Woodlands
Euphorbia cooperi	Miombo-Velloziacea, Mixed Woodlands
Euphorbia hirta	Miombo-Velloziacea, Mixed Woodlands, Acacia-Grassland
Euphorbia griseola	Miombo-Velloziacea
Euphorbia sp.	Miombo-Velloziacea, Mixed woodlands
Euphorbia tirucalli	Mixed woodlands, Miombo-Velloziacea

Table 8 . List of Mozambique threatened plants found in QNP

Plant species	**Plant community**	**E**
Afzelia quanzensis	Miombo-Velloziacea, Mata de Miombo, Mixed woodlands	LR-nt
Combretum caudatisepalum	Acacia-Grassland	VU
Lannea stulhmannii	Mixed woodlands	VU
Maytenus mossambicensis	- Mixed woodlands	VU
Millettia bussei	Acacia-Grassland, Miombo woodlands Miombo-Velloziacea,	DD
Millettia stulhmannii	Miombo-Velloziacea, Miombo woodlands Mixed woodlands	LR-lc
Pavetta catophylla	-	DD
Sterculia appendiculta	Miombo-Velloziacea, Miombo woodlands, Mixed woodlands Acacia-Grassland	VU

	Miombo-Velloziacea, Miombo woodlands,	
Sterculia quinqueloba	Mixed woodlands	VU
Strophantus hypoleicos	Miombo-Velloziacea	DD

LR- low risk species ; VU- vulnerable species; DD- data defficiency for the species

The community of Mixed Woodland presented higher number of species, showing high botanical diversity, considered therefore an Important Plant Area of the QNP, whereas the Mangrove showed to be of little diversity in terms of composition of the species as indicated in Table 6 and the map in Fig. 20. The area of the inselbergs, dominated by the Miombo-Velloziace vegetation, had higher numbers of threatened and succulent species (as shown in table 3) and for possessing greater number of species per area, showed to be an IPA's.

The region of Lake Bilibiza was considered an IPA's according to a threatened habitat

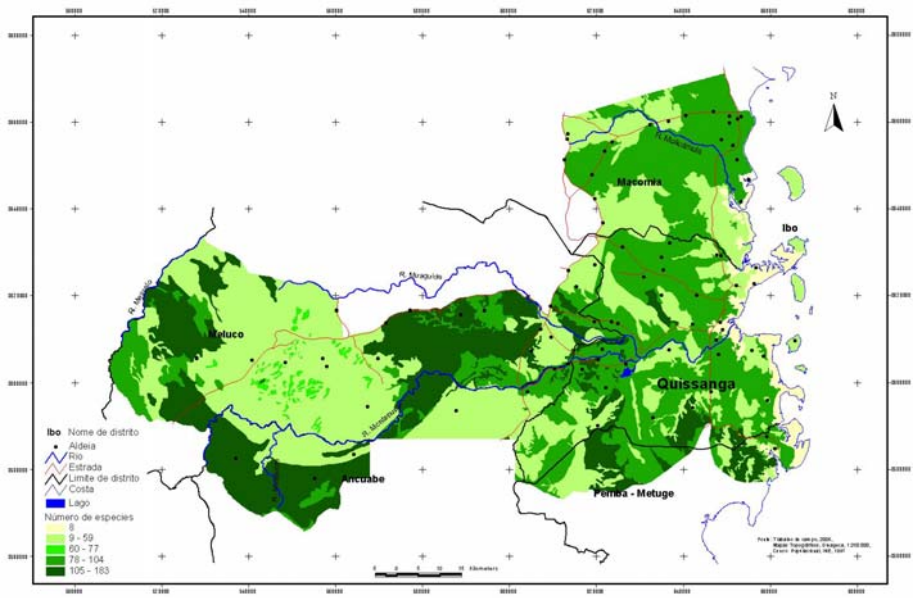


Figure 20. Map showing relative species diversity per plant community

Main threats to plants in QNP were identified and described. These include slash and burn agriculture, apparently new people settlelements within the park, wildfires. Management strategies included management of the sites where those plants occur, as well as strategies for in-situ and ex-situ conservation through the multiplication of the plants of special concern. A conservation area needs also to have a clear policy on controlling settlements also, as way to diminish conflit between man and animals.

E) Determination of species diversity and possible species abundance rating of each vegetation community.

E) Determination of species diversity and possible species abundance rating of each vegetation community.

The main parts here described include (i) Description of major plant communities (ii) fitossociological data, (iii) and vegetation profiles.

Description of major plant communities

At the Quirimbas National Park, six vegetation types were identified, namely:

- Miombo –Velozeace
- Mixed woodlands
- Miombo woodlands
- Acacia – Grasslands
- Coastal thickets
- Mangroves

Each plant community has distinctive characteristics, not capturable at the maps level. A detailed description of different groups and sub-groups observed per plant community was done in order to get better acquainted with plant communities from the Quirimbas National Park map. (see Table 9 and text below)

Table 9. Plant communities and dominat species

Plant communities	**Main characteristics**	**Dominant species**	**Other important associations**	**Main places of occurrency at PNQ**
Mangrove	Tolerance to salt; Localization along coastal zones or river mouths (Sacket, 1994); Possess viviparous fruits, pneumatophore roots; Composed of shrubs or trees up to 30m high (Amade, 2006)	*Soneratia alba, Avicennia marina, Rhizophora mucronata, Bruguiera cylindrica, Lumnitzera racemosa, Ceriops tagal, Xylocarpuss granatum*	Species of the family Chenopodeaceae	Quirambo Islands, Sencar, Ibo, Quirimbas and coastal intertidal.

Miombo woodlands	Tree height varying from 7 to 15 m; Dominance of species of the family Fabaceae, subfamily Caesalpinoideae, particularly genera *Brachystegia, Julbernardia* and *Isoberlinia* (White, 1983)	*Brachystegia allenii, Julbernadia globiflora, Diplorhynchus Condylocarpon, Acácia gerrardii, Acácia nigrescens, Bauhinia petersiana, Afzelia quanzensis, Dalbergia melanoxylon*	Bamboo woodlands *Terminalia mollis* woodlands	Around the mounts – islands in the Ancuabe and Meluco as well as north of the Macomia district
Miombo-Velloziacea	Miombo is more diverse with dominance of *Brachystegia glaucescens*. Species of Miombo found at the foot of the highs and mountains and Velloziaceae at higher altitudes. Velloziaceae show adaptations to survive extreme temperature and water availability variations, high altitudes, and slope landscape	*Brachystegia allenii, Julbernadia globiflora, Diplorhynchus Condylocarpon, Acácia gerrardii, Bauhinia petersiana, Afzelia quanzensis, Dalbergia melanoxylon Brachystegia glaucescens Brachystegia spiciformis Euphorbia cuperi, Euphorbia hirta, Xerophyta retinoti Aloe spp. Vellozia sp*.	*Brachystegia glaucescens* *Velloziaceaae* represented in its majority by *Vellozia* spp. and *Xerophyta* spp.	At the inselbergs of the Ancuabe and Meluco region

Mixed woodlands	Composed of different species forming mosaics, characteristic species are: *Millettia stuhlmannii, M. bussei, Terminalia sericea, Pteleopsis myrtifolia* Miombo species and native bamboo (*Oxynanthera abyssinica)*. Highest trees reach 10 – 15 m. The highest showing diameters between 50 – 80 cm, found in sandy-clay type of soils	*Millettia stuhlmannii, Millettia bussei, Terminalia sericea, Hymenocardia ulmoides Brachystegia allenii, Julbernadia globiflora Oxytenathera abyssinica Lonchocarpus bussei, Sclerocarya caffra, Sterculia quinqueloba, Albizia harveyi, Pteleopsis myrtifolia. Diplorhyncus condylocarpon, Spiritachys africana, Adansonia digitata Acácia nigrescences*	Bamboo woodlands *Terminalia*-woodlands Miombo woodlands *Millettia* woodlands	In the Ancuabe and Meluco region
Acacia-Grasslands	Composed by tree and herbaceous strata Trees or shrubs moderately disperse. Acacia species dominate tree/shrub stratum. Community rich in pasture species. Herbaceous tratum is high, reaching 2 m. Characteristic of aluvionar zones, located in river margins, lakes and valleys, in altitudes varying from 10 to 100 m These are generally flooded lands, clay type, and with little drainage.	*Acacia xanthophloea, Faidherbia albida, Lonchocarpus capassa, Plyllanthus reticulatus Acacia gerrardii, Albizia amara, Albizia forbesii Lannea schweinfurthii Acácia nigrescens, Bauhinia petersiana, Afzelia quanzensis Digitaria eriantha Panicum maximum Stylochiton maximus Sesbenia sesben Corchorus trilocularis, Stemoquiton maximiza Pluchea descorides*	*Faidherbia albida* woodlands and grassland *Albizia* woodlands Grasslands	In Macomia, Quissanga in the regions around Bilibiza lake and river margins In areas of old plantations, altitudes varying between 10 and 100m

Coastal thickets	Low altitude shrub, dense vegetation. Occurs in coastal dunes, in calcareous soils, with the presence of many climbers and lianas. Sometimes not accessible due to high density of tree and sub-shrubby species. Also with thorny species.	*Sideroxylon inerme, Diospyros usambarensis Diospyros loureniana, Ziziphus mauritiana, Grewia sp. Ochna sp, Sterculia africana, Mimusops caffra, Maytenus heterophylla, Strophanthus sp., Dichrostachys cinerea, Cassita filiformes*	*Grewia* spp. *Mimisops caffra* *Xylotheca tettensis*	At the Matemo islands, Quirimba, Mefunvo, Quissive and northeastern of Ibo island

1. Miombo-Veloziacea Community

This community type is composed by specific miombo and the Velosiacea species, those groups explore different niches of the inselbergs. The Vellosiaceae corresponde to the dominant group in the inselbergs, and it is composed by *Vellosia* spp. *Xerophyta* spp., *Merothamnus flabelifolius, Ficus* spp.

It is surrounded by mountains, called "Island Mounts or Inselbergs". Altitudes varying between 300 – 800 m. The organic matter deposited on the rocks form the carboniferous soil system on the Mountain base.

This vegetation type is found in the rocky stratum on the mountain (rock scarps), they exist in small quantities of organic matter coming from the rising elevation. The vegetation is characterized as open woodlands on the mountain foot, with high trees, the heigh varying between 8 – 12 m, diameter between 10 - 80 cm. The main wood species which characterize this vegetation type are *Brachystegia* spp. (*B. glaucescens, B. torrei;* or *B. glaucescens, B. bussei, B. allenii, B. microphylla* or also *B. allenii* and *B. utilis*). Frequent scort species are *Millettia stuhlmannii, Annona senegalensis, Afzelia quanzensis, Vitex doniana, Combretum zeyheri, Sclerocarya birrea, Hibiscus sp., Sterculia quinqueloba. Brachystegia spiciformis* and *Brachystegia boehmii*, are not

found in the high altitudes of the inselbergs (White, 1983). Surrounding Inselbergs on the base, between 250 and 300 m, the vegetation is characterized by being open, with small portions of thicket, predominantly with *Brachystegia* spp. (*B. torrei* and *B glaucescens*) as dominants, tree heights of 5 – 8. *Millettia stuhlmannii, Terminalia stenostachya, Sterculia appendiculata* had the biggest diameters between 100 – 250 cm and 30 m tall. The *Terminalia* sp. on the rocks indicate surface water. Additonal woody species are *Hymenocadia ulmoides, Albizia gummifera, Boscia albitrunca, Ficus abutilifolia, Ficus glumosa, Vitex doniana, Vitex payos, Commiphora neglecta, Combretum apiculatum, Lannea* sp., *Dracaena* sp., *Tabernaemontana ventricosa, Burkea africana, Dalbergia melanoxylon, Julbernardia globiflora, Pteleopsis myrtifolia, Pterocarpus angolensis, Terminalia sericea, Diplorhychus condylocarpon, Combretum apiculatum, Azanza garckeana, Brackenridgea zanguebarica, Dracaena sp., Flacourtia indica, Markhamia obtusifolia, Holarrhena pubescens, Sclerocarya birrea, Xylotheca tettensis, Anona senegalensis, Commiphora Africana. H*erbaceous species in the rainy season are rich and very dense, with 80% cover per $1m^2$: *Bidens pilosa, Digitaria* sp., *Phyllanthus amarus, Ceratophyllum* sp., *Striga gesnerioides, Tephrosia nictiflora, Tephrosia purpurea, Tephrosia villosa, Fimbristylis hispidula, Merremia tridentata, Merremia pinnata, Tricholaena momachne, Heteropogon contortus, Heteropogon melanocarpus, Hyperthelia hirta, Cenchrus ciliaris, Eragrostis ciliaris, Corchorus trilocularis, Sansevieria sp., Agerantum conyzoides, Indigofera sp., Gloriosa superba. Catunaregam spinosa, Cyphostemma* sp., *Justicia* sp., *Merremia tridentata, Siphonoschilus aethiopicus, Solanum panduriforme, Tephrosia sp., Croix lacrim.*

When the altitude increases, different vegetation patches can be found separated 100 m apart in open areas. They are composed by two strata, the tree top very close from

one another. Soils are shallow, not exceeding 50 cm depth, therefore, the rock is near to the surface, with the organic matter deposition on the cracks that allows plant occurrence and development. Typical plant species of this vegetation type are *Bombax rhodognaphalon, Hymenocardia ulmoides, Ochna arborea, Euphorbia cooperi, Ficus glumosa* and the species association of *Albizia adianthifolia, Boscia albitrunca, Commiphora africana, Dracaena sp, Erythrina abyssinica, Ficus* sp., *Lannea* sp, *Terminalia sericea, Vitex payos, Vitex* sp, *Acacia nigrescens, Azanza garckeana, Combretum apiculatum, Clerodendrum* sp., *Diospyros galpinii, Ficus abutilifolia, Sclerocarya birrea, Sterculia appendiculata*, *Strychnos* sp, *Xerophyta retinervis, Xerophyta* sp., *Xeroderris stuhlmannii, Dombeya* sp. *Dracaena* sp, *Cleistochlamys kirkii, Boscia albitrunca, Vepris ondulata, Zanha golungencis*. The herbaceous species are *Hibiscus micranthus, Phyllanthus reticulatus, Senna singueanna, Digitaria* sp., *Boscia albitrunca, Aneilema dregeanum, Cissus integrifolia, Aspargus racemosus, Bidens pilosa, Fimbristylis hispidula.*

On the mountain tops, patches of plant species with xerophitic habitus are disperse and grouped. This vegetation alternate the dense mountain vegetation, those xerophitic patches are ordered in parallel bar lines (horizontal) on the rock. Species association of *Euphorbia* spp. (*E. ingens, E. cooperi, E. griseola, E. hirta Euphorbia sp. E. tirucalli*); *Strophanthus hypoleicus, Strophanthus kombe Mundulea sericea, Croton pseudopulchellus, Hymenocardia ulmoides, Eulophia petersii, Commiphora* spp. (*Commiphora africana. Commiphora* sp.) *Lannea* sp., *Lannea discolor, Dombeya burgessiae, Dombeya* sp., *Afzelia quanzensis, Vangueria randii. Vepris* sp. *Pellaea (Cheilanthes) viridis, Fimbristylis* sp., *Aspargus* sp., *Tephrosia* sp., *Dioscorea* sp., *Myrothamnus flabellifolius, Hibiscus meyeri, Ficus glumosa.* Species with succulent structure such as *Aloe* spp. (Liliaceae), *Vellozia* sp. *Xerophyta* spp (Velloaciaceae) and grass (*Themeda triandra*) and Juncacea were observed by White (1983).


Xerophyta retinoti dominant at upper inselbergs and mountain acacia (*Brachystegia glaucescens*)

2 Mixed Woodlands

This vegetation is described as "Mosaic of Miombo", due to typical species agglomerations, with different composition. It is normally called miombo when the dominant species are characterized by genera *Brackystegia* spp. (*B. torrei; B. glaucescens* – "Nsini"); *Millettia stuhlmannii, Hymenocardia ulmoides*. *Brachystegia* woodlands present 2 or 3 strata, with the tallest having a tree percentage cover around 70%. The highest trees are 10 - 15 m tall, leafy and very sparsed from one another, the highest trees with diameters between 50 - 80 cm, in patches moderately dense of bamboo, *Oxytenanthera abyssinica.*

The first stratum includes herbaceous species between 10 cm - 2 m tall, namely *Panicum maximum, Indigofera ormocarpoides* (1 – 5 m tall); *Triumffetta pentandra, Justicia betonica, Justicia* sp., *Merremia pinnata, Hibiscus micranthus, Euphorbia* sp., *Euphorbia hirta, Cucumis* sp., *Heteropogon* sp. (reaching up to 2 m tall), *Bidens pilosa, Crinum delagoensis, Cissus integrifolia, Eragrostis ciliaris, Phyllanthus amarus, Baphia* sp., *Tacca leontopetaloide, Cassia abbreviata, Ubecium* sp., *Byssoncarpus orientalis, Rottboellia cochinchinensis, Senna absus, Dioscorea dumetorum, Blumea* sp. Inside the woodlands there are abundant shrubby species, typically on moist zones or near to surface water or sheet of water, *Alchornea* sp. and *Acalypha ornate*, which belongs to low woodland stratum, with height varying between 10 cm – 5 m tall from soil surface. Other shrubby species are *Randia* sp., *Steganotaenia araliacea, Vangueria* sp., *Bauhinia petersiana, Phyllanthus reticulatus, Grewia* sp., *Euphorbia cooperi, Deinbollia oblongifolia*. The wood species are *Monodora junodii, Dracaena sp., Ochna arborea, Cleistochlamys kirkii, Markhamia obtusifolia, Xylotheca tettensis, Afzelia quanzensis, Cordyla africana. Combretum spp.* (*C. apiculatum, C. erithrophylum, C.* sp., *C. collinum*) *Stereospermum kunthianum, Ptelopsis myrtifolia, Holarrhena pubescens, Markhamia zanzibarica, Margaritaria discoidea, Lannea sp., Hugonia orientalis, Uvaria caffra, Balanites maughamii, Albizia amara.*

In the mixed formations, subgroups were found, defined as :

***Terminalia spp., Millettia spp*. and Bamboo (*Oxynanthera abyssinica*).** Main species of concern in the *Terminalia sericea* and bamboo patches are *Terminalia* spp. (*T. sericea, T. stenostachya*), *Millettia* spp. (*M. bussei, M. stuhlmannii*), *Hymenocardia ulmoides, Lonchocarpus bussei, Sclerocarya birrea, Sterculia quinqueloba, Albizia harveyi, Pteleopsis myrtifolia. Diplorhynchus condylocarpon, Spirostachys africana, Adansonia digitata.* Other species, immediately below these are *Baphia* sp., *Acacia nigrescens, Holarrhena pubescens, Hugonia orientalis, Combretum apiculatum, Combretum zeyheri, Vitex doniana, Xeroderris stuhlmannii, Boscia* spp. (*B. filipes, B. albitrunca*), *Diospyros* sp., *Cleistochlamys kirkii, Cussonia arborea, Lannea* spp. (*L. schimperi, L. schweinfurthii, L. stuhlmanni*), *Markhamia zanzibarica, Ochna arborea, Stereospermum kunthianum.* The herbaceous species are *Catunaregam spinosa, Crossopterix febrifuga, Triumffetta pentandra*. In some areas where the soil is sandy and clay, black-brown with low litter, trees about 4 to 8,5 m tall were found, with groups of dryer type savanna tree species such as *Albizia harveyi, Albizia amara, Acacia nigrescens, Acacia polyancantha, Vangueria* sp., *Vangueria infausta, Strychnos* sp.

Riverine forests: these forests are marginal, with edaffic riverine formations, wet edges of permanent water courses, composed by high trees, the majority presenting green foliage all year round, in general with dense shrubby stratum and almost reduced herbaceous stratum (Gomes and Sousa, 1967). Some of the commonest tall species are *Khaya nyasica, Albizia gummifera, Albizia versicolor, Adansonia digitata, Bombax rhodognaphalon, Acacia* sp., *Dracaena sp., Trycalysia* sp., *Pteleopsis myrtifolia, Sterculia appendiculata, Cordyla africana.* It is dominated by moist sub-shrub humus, shady and dense *Acaliphas* sp. reaching 2,5 - 3 m tall. Lower species are *Afzelia*

quanzensis, Margaritaria discoidea, Cleistochlamys kirkii, Commiphora neglecta, Commiphora sp., *Monodora* sp. *Hugonia orientalis, Vitex payos, Phragmites australis, Bauhinia petersiana, Schrebera* sp. Herbaceous species are *Achyranthes aspera, Panicum maximum, Rottboellia cochinchinensis, Eragrostis ciliaris, Corchorus trilocularis, Commelina* sp., *Cucumis rehmannii, Pluchea dioscorides, Sorghum bicolor, Ludwigia, Digitaria* sp., *Catunaregam spinosa, Mimosa pigra.*

3. Miombo Woodland

Some subgroups occur here:

Millettia, Terminalia, Pteleopsis: In the woodland parts of the miombo mosaic, epyphytic fern climbs miombo species. Main species are semi - deciduous, from the wet zone (Eg. along the Nkulo River), belonging to Mountain Complex "Monte Erati and Monte Nhomi (Nholi)". One dense type vegetation occurs, with two strata, the arboreal composed by leafy dispersed trees, 10 - 20 m tall and herbaceous stratum composed by grasses up to 2 m tall, normally occurring in the valleys. These areas are cut disturbed, most of trees present DBH > 40 cm, and are scattered, and abundant trees species with DBH< 30 cm, low wood species regeneration.

Near the Inselbergs relief, in altitudes between 300 – 350 m, abundant species regeneration of *Alchornea* sp., 50 cm to 1,5 m tall. *Ipomoea* sp., *Penisetum* sp., and species of Cyperaceae, indicate presence of marshy zones. Main species include *Millettia* spp. (*M. stuhlmannii, M. bussei*), *Pteleopsis myrtifolia, Terminalia* spp. (*T. stenostachya, T. mollis*). *Julbernardia globiflora, Combretum spp. (C. apiculatum, C collinum), Vitex doniana, Ficus sycomorus, Dalbergia melanoxylon, Deinbollia xanthocarpa, Pterocarpus angolensis. Lonchocarpus capassa.* arboreal species at foot hills are *Cussonia arborea, Cordyla africana, Sterculia appendiculata, Tamarindus indica, Cola* sp., *Tabernaemontana ventricosa, Cleistochlamys kirkii, Recinodendrom rauteneii, Commiphora* sp., *Vitex doniana, Albizia* spp. (*A. gummifera, A. adianthifolia, A. amara*), *Grewia* sp., *Erythrophleum africanum, Antidesma venosum,*

Erhetia amoena, Trema orientalis, Trichilia emetica, Deinbollia xanthocarpa, Dombeya kirkii, Markhamia zanzibarica, Commiphora edulis, Cladostemon kirkii, Erythrophleum lasiathum, Xeroderris stuhlmannii, Trema orientalis, Piliostigma thonningii, Xylotheca tettensis, Grewia flavescens. Shrubs include *Bauhinia petersiana, Baphia* sp., *Hibiscus sp., Hibiscus micranthus, Tacca leontopetaloide, Alysicarpus* sp. *Celtis* sp., *Euphorbia tirucalli. Vernonia colorata, Combretum microphylla, Holarrhena pubescens, Antidesma venosum, Solanum panduriforme, Byssoncarpus orientalis, Bauhinia petersiana.* The herbaceous stratum is dominated by *Heteropogon contortus, Heteropogon melanocarpus, Cissus absus, Hibiscus micranthus, Abutilon grantii, Digitaria eriantha, Crotolaria labomoides, Tacca leontopetaloide,* Cissus *integrifolia, Cissus integrifolia, Cenchrus ciliaris ciliaris, Leonotis* sp., *Leonotis nepetifolia, Corchorus olitorius, Agerantum conyzoides, Commelina benghalensis, Achyranthes africana, Achyranthes* aspera, *Drypetes natalensis, Triumffetta pilosa, Vigna unguiculata, Hibiscus surattensis, Siphonochilus* sp. occurring in ferratic red soils.

***Pteleopsis, Pterocarpus, Millettia* spp and *Sterculia* spp** – The dominant species are *Pteleopsis myrtifolia, Pterocarpus angolensis, Millettia* spp. (*M. stuhlmann*ii, M. Bussei) *Sterculia appendiculata.* Other species include *Adansonia digitata, Commiphora neglecta, Dalbergia melanoxylon, Terminalia sp., Xeroderris stuhlmann*ii, *Holarrhena pubescens, Hugonia orientalis, Xylotheca tettensis, Cussonia arborea, Dombeya kirkii, Hymenocardia ulmoides, Trichilia emetica, Drypetes natalensis, Commiphora neglecta, Deinbollia xanthocarpa, Lonchocarpus* spp. *(L.capassa, L. bussei), Dovyalis longispina, Zanha golugensis, Trichilia zanzibarica, Cleistochlamys kirkii, Monodora kirkii, Vitex doniana, Albizia gummifera.*

At the edges of the stream valleys, main species occurring include *Triumffetta pentandra, Triumffetta pilosa, Agerantum conyzoides, Epoema* sp., *Sesbania sesban, Ludwigia* sp., *Corchorus aestuans, Corchorus olitorius, Cyperus kirkii, Cyperus distans* and the herbaceus species *Cyphostemma, Cissus* sp., *Urochloa mosambicensis, Cissus integrifolia, Achyranthes aspera, Hetetopogom contortus.*

***Brachystegia* spp, *Julbernardia* and *Pteleopsis* :** The composing wood species are *Brachystegia allenii, Brachystegia* sp., *Julbernardia globiflora, Diplorhynchus condylocarpon*. Other species are *Acacia gerrardii, Acacia nigrescens, Afzelia quanzensis, Bauhinia petersiana, Boscia* sp., *Maerua caffra, Brackerindgea zanguebarica, Cissus integrifolia, Combretum* spp. (*C. apiculatum, C. hereroense, Combretum* sp.), *Commiphora africana, Cleistochlamys kirkii, Dalbergia melanoxylon, Dalbergia sp., Hymenocardia ulmoides, Hugonia orientalis, Lannea* sp., *Maerua caffra, Millettia stuhlmannii, Ochna* sp., *Sterculia quinqueloba, Spirostachys africana, Strychnos* sp., *Tragia* sp, *Ximenia* spp. (*X. americana, X.caffra*).

4. Acacia – Grassland

This formation type occurs in alluvial soil areas where tree or shrub roots are kept submerse. The trees or shrubs are moderately scattered. This community is a typical community from lowland or valleys.

In the Muagamula Plateau, beginning of the mesoplanaltic zone, the dominant arboreal species are 12 m tall. The inferior stratum (shrubs and herbaceous) are covered by grasses that reach 1,5 m tall, also rich in climbers with poor development due to light scarcity. Soils are derived from the granitic-gneissic complex, shalow and stony. Main species are *Dalbergia melanoxylon, Cleistochlamys kirkii, Millettia* spp. *(M. busseie M. stuhlmannii), Diplorhynchus condylocarpon, Pteleopsis myrtifolia*, and as associated species *Acacia nigrescens, Acacia* sp., *Commiphora* sp., *Combtretum* spp., *Dalbergia arbutifolia, Lonchocarpus* spp. *(L. bussei, L. capassa), Sclerocarya birrea, Spirostachys africana, Stercurlia quinqueloba, Dombeya sp., Spirostachys africana, Tamarindus indica, Afzelia quanzensis, Xylotheca tettensis.* The grass layer is predominantly composed by *Tephrosia* sp., *Panicum maximum, Digitaria eriantha* and *Eragrostis heteromera*, *Pluchea dioscorides, Abutilon sp.*

Muagamula Valley, area of Napala-Mucojo: This vegegetation type is characteristically from alluvial zones throughout the rivers, diverse lake edges or lagoons and depressions. These lands are normally subject to floods, soils are clay and

compact, extremely impermeable. Some of them are of concern due to agriculture activity (rice plantation); where it is notorious the transition of Miombo vegetation type to *Acacia* spp. bush, with altitudes varying between 10 - 100 m.

This vegetation type is characterized by edaffic formations, deciduous, semideciduos, spiny and sub-humid. Trees are between 6 - 8 m tall. Main species are *Acacia* spp. (*A. gerrardii A. siberiana, A. nigrescens A. xanthophloea), Faidherbia albida, Lannea* sp.*, Lonchocarpus capassa, Phyllanthus* sp.*,* and the commonest species include *Acacia gerrardii, Albizia* spp. *(A. amara, A. forbesii, Albizia* sp.), *Boscia* sp.*, Commiphora* sp.*, Deinbollia* sp.*, Diospyros squarrosa, Diplorhychus condylocarpon, Ehretia amoena, Euclea* sp.*, Grewia* sp.*, Grewia monticola, Markhamia* sp*, Markhamia zanzibarica, Phyllanthus reticulatus, Spirostachys africana, Strychnos* sp.*, Vernonia colorata, Combretum, Annona senegalensis, Azanza garckeana, Catunaregam spinosa, Hymenocardia ulmoides, Lannea sp., Lannea schweinfurthii, Ochna arborea, Olax dissitiflora, Ozoroa obovata, Pteleopsis myrtifolia, Piliostigma thonningii, Sclerocarya birrea, Stereospermum kunthianum, Strychnos* sp.*, Vernonia colorata, Vitex sp., Xylotheca tettensis, Mangifera indica, Ziziphus mucronata*. Predominant wood species which correspond to the low stratum are *Acalypha* sp.*, Euclea* sp. *e Strychno* sp.*,* the shrubby species *Ancylobotrys petersiana, Antidesma venosum, Cissus integrifolia, Hyphaene coriacea, Hoslundia* sp*, Phyllanthus* sp.*, Prostideos* sp.*, Rhus* sp.*, Rourea* sp.*, Senna petersiana, Tricalysia* sp. The herbaceous stratum is dominated by *Panicum* sp.*, Pyllanthus reticulatus, Stylochaeton natalensis, Aspargus* sp. At very wet soils the herbaceous stratum is 2 m tall with great *Sesbania sesban* regeneration and species association such as *Corchorus trilocularis, Cyperus* sp.*, Pluchea dioscorides*. The soil is black, extremely clay.

Moving from Montepuez River edges towards the Bilibiza Lake, 10 m in altitude. A vegetation type charaterized by mosaic communities is found and includes:

Deciduos dry lowland savanna – woodland (*Adansonia, Sterculia, Millettia* and *Bernaniodendron*) : Open savanna woodlands 10 – 12 m high of *Millettia stuhlmannii, Brenaniodendron carvalhoi, Afzelia quanzensis*. Other woody apecies include

Adansonia digitata, Sterculia appendiculata, Acacia spp. (*A. nigrescens, A. nilotica, A. xanthophloea*), *Faidherbia albida, Dichrostachys cinerea, Dalbergia melanoxylon, Sclerocarya caffra, Albizia gummifera, Piliostigma thonningii, Lonchocarpus* sp., *Ficus sp.,, Sclerocarya birrea, Zanthoxylon sp, Boscia albitrunca, Kigelia africana, Dombeya* sp., *Commiphora* sp., *Phyllanthus reticulatus* and some abundant xerophitic plants such as *Euphorbia* spp. (*E. confinalis, E.ingens, E. tiricalii*) and the succulent species *Aloe* sp. *Agave sisalana.* Grass layer of *Setaria sp, Themeda sp.* in sandy, clay soils, dark-grey. The human disturbance, transformed some of these areas in secondary thickets and woodlands, containing *Sclerocarya birrea, Vitex doniana,* Markhamia spp. (*M. zanzibarica, M. obtusifolia), Mangifera indica, Fernandoa magnifica, Trema orientalis, Erytrina sp., Anacardium occidentale* association with *Setaria* sp., *Urochloa mosambicenssis, Sorghum* sp., *Panicum* sp., *Cynodon dactylon*.

Tree Shrub Savanna with *Hyphaene coriacea* : In and around the Montepuez River, and other swampy places, in poorly drained areas near Bilibiza Lake, ground characterized by grey loose sands is found, with *Borassus aethiopum, Cyperus* spp. *Phragmites communis, Nyphaene campensis, Dissotis augustifolia,* Palmae community including *Hyphaene coriacea* in great regeneration, patches of *Phoenix reclinata,* in assotiation with *Indigofera* sp., *Senecio* sp. and *Eragrostis ciliaris*.

Fig. 21 *Acacia* woodland, Muagamula valley

5. Coastal thicket

This vegetation type occurs north of Mozambique, parts of this vegetation type is impenetrable due to shrubby species. The majority of wood species were present in bigger shrubby form, 2 – 3 m tall, and the shrubby are very ramified, not higher than 1 m tall. The shrubby trees present very small diameters (BDH < 10 cm). *Adansonia digitata, Casuarina equisetifolia, Cocus nucifera* and *Terminalia catapa* are species which normally can be found near to human setlements. The soils are brown, pale, in some parts presenting sandy and coraline rocks. The sandy soil is found only inside the island; the coast line being dominated by coralimestone.

Dry semi deciduous lowland sub littoral Coastal thicket (*Sideroxylon* and *Diospyros*) Main species include *Sideroxylon inerme, Diospyros usambarensis (= D. loureniana*), *Ziziphus mauritiana, Grewia* sp., *Ochna* sp, *Sterculia africana, Mimusops caffra, Maytenus heterophylla, Strophanthus* sp., *Dichrostachys cinerea*, *Cassytha filiformes* cover majority of bush species. Lower species of this vegetation type are *Senna* spp. (*Senna* sp. *Senna siamea, Senna occidentale*), *Phyllanthus reticulatus, Azedarach indica, Delonix regia, Lantana camara, Walteria indica, Xylotheca tettensis, Pavetta* sp., *Sclerocarya birrea, Ozoroa obovata, Euclea natalensis, Commiphora* sp., *Strychnos spinosa, Flacourtia indica, Ficus* sp., *Bridelia cathartica, Annona squamosa, Ricinus communis, Calantrophus procera.* Near the thicket *Euphorbia* spp. (*E. hirta, E. tirucalli*), *Opuntia ficus-indica*. The herbaceous species *Walteria indica, Leonotis leoptelifolia, Tridax procumbes, Tragia* sp, *Abrus precatorius, Argemone mexicana, Melania forbesii* were found.

Dry semi deciduous lowland sublittoral Coastal thicket (*Cordia monoico, Sideroxylon* and *Erythroxylum*) – Rolas and Matemo Islands. This vegetation type occurs in the Arquipélago das Quirimbas (Rolas Island), 7 m of altitude. The soil is sandy, coraline, and presents two differents characteristics: the vegetation is composed by shrub and shrubby plants, which vary between 50 cm to 3 m tall. The vegetation is

open and dominated by species such as *Cordia monoica, Maerua angolensis, Sideroxylon inerme, Erythroxylum lasianthu, Pappea* sp., *Clorodedrum glabrum, Rhynchosia minima, Cordia monoica.* These species are associated with *Grewia* sp., *Balanites maughamii, Capparis tomentosa, Olax dissitiflora*. The herbaceous stratum is not superior than 40 cm tall, and it has layer grass *Panicum maximum, Dactyloctenium aegyptium, Sansevieria acinthoides* (forming colonies in low stratum), *Tephrosia* sp., *Ehretia* sp., *Azistachya gazetica, Vigna* sp. In the northwest direction, close woodland with trees and shrubs 5-7 m tall found. The species are *Sideroxylon inerme, Erythroxylum lasiathum, Cordia monoica*. The herbaceous species are *Abutilon* sp., *Tragia* sp., *Aspargus* sp., *Achyranthes aspera Panicum maximum, Cymbopogon* sp., *Heteropogon* sp., *Hyperthelia* sp., *Hyperthelia dissoluta, Boerhavia erecta, Sansevieria* sp., *Acalipha* sp., *Cissus quadrangularis, Melhania forbesii, Phyllanthus discoides, Cenchrus sp., Sonchus oleraceus, Tridax procumbens, Corchorus trilocularis, Bridelia cathartica, Crotolaria* sp., *Azistackya gazetica, Indigofera* sp., *Senna occidentale, Senna sp., Tribulus terrestris, Euphorbia hirta, Canavalia rosea, Agave sisalana, Vigna* sp., *Cassytha filiformis., Hyphaene coriacea.*

6. Mangrove

Mangrove is typical vegetation of the narrow littoral belts of mud and saline sands, between low altitude (0 – 150 m altitude)**,** subject to tidal influences. Generally abundant in the gulf and estuaries of the larger river where there are recently formed fluvio-marine alluvial soils subject to tidal innudantion with low altitude tides of 0 to 150m. It is characterized by possessing species with saline tolerance; they possess pneumatophore roots and viviparous fruits. In NQP five principal mangrove types occur: *Avicennia marinha, Ceriops tagal, Bruguiera gymnorrhyza, Xylocarpus grantum, Sonneratia alba*. The mangrove species association include *Pemphis acidula, Sizuvium portulacastrum, Salicornia sp.* Epiphytic species include *Oncolalix bulosi.* The mangrove community is composed by shrubs or trees that can reach up to 30m.

Phytossociological Parameters (= forest parameters) / fitossociological data,

QNP Floristical Comparison

The tree and shrub density in QNP reached 120 individuals per hectare, grouped into 36 botanic families, with Fabacea, Combretaceae and Anacardiaceae being more represented.

Table 10. The family abundance in the QNP

Family	%
Fabaceae	32.05
Combretaceae	8.12
Anacardiaceae	7.26
Euphorbiaceae	4.27
Sterculiaceae	4.27
	100

Value Importance Index (IVI) per districts studied at the QNP

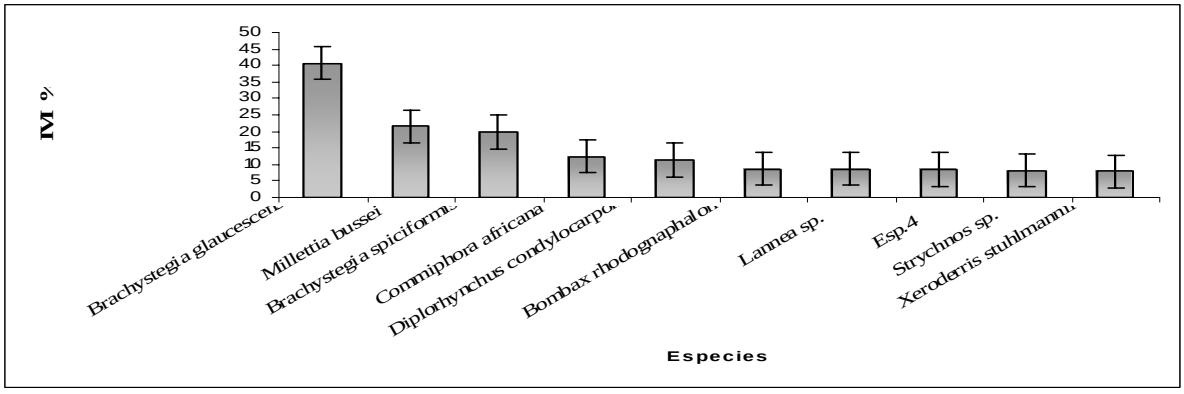


Fig. 22a.IVI from the 10 more abundant species in the Ancuabe district

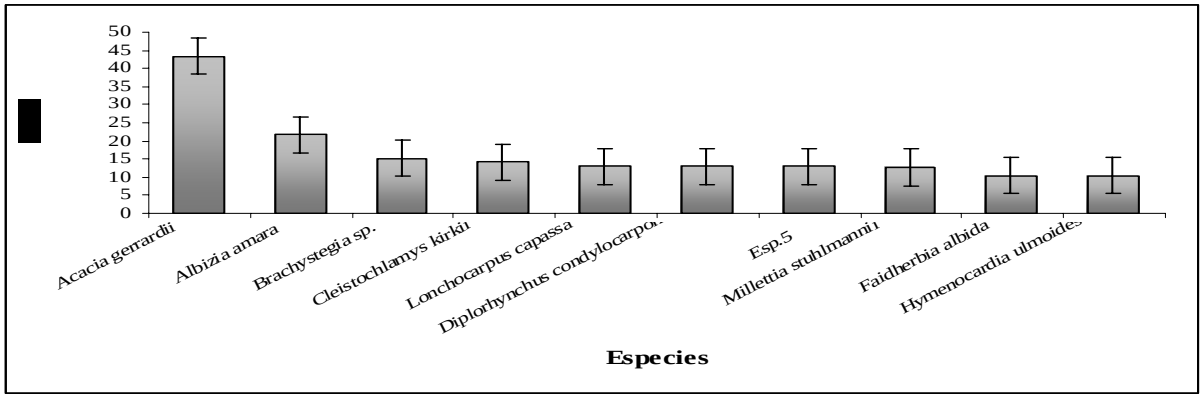


Fig. 22b. IVI from the 10 more abundant species in the Macomia district

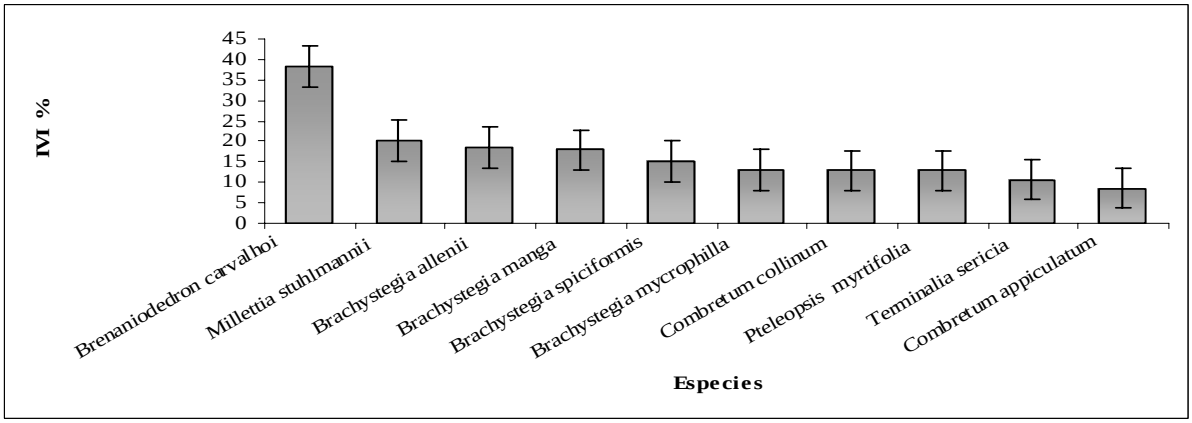


Fig. 22c. IVI from the 10 more abundant species in the Quissanga district

Forest vertical structure (Height)

In general, at QNP, it is possible to separate the forest in three strata: lower stratum, middle stratum and superior stratum. Based in this characteristic, it is possible to characterize the forest structure in:

Table 11. Height within QNP districts. Hmax (Dom): maxim dominant height ; X_1 : maximum height from lower stratum, X_2 e X_3 : Height gap from middle stratum and X_4 : Minimum height from superior stratum.

PNQ areas	Stratum			
	Hmax (Dom)	**Lower**	**Middle**	**Superior**
		$X_1 < h$	$X_2 < h < X_3$	$X_4 \geq h$
Ancuabe	16 m	5 m	5 m < h < 11 m	11 m
Ancube – Meluco	11 m	4 m	4 m < h < 7 m	7 m
Macomia	12 m	4 m	4 m < h < 8 m	8 m
Quissanga	14 m	5 m	5 m < h < 9 m	9 m

Around 8.36 % of all individuals belong to lower stratum, 42,68 % to the middle stratum and 48,95 % of total individuals belonging to superior stratum.

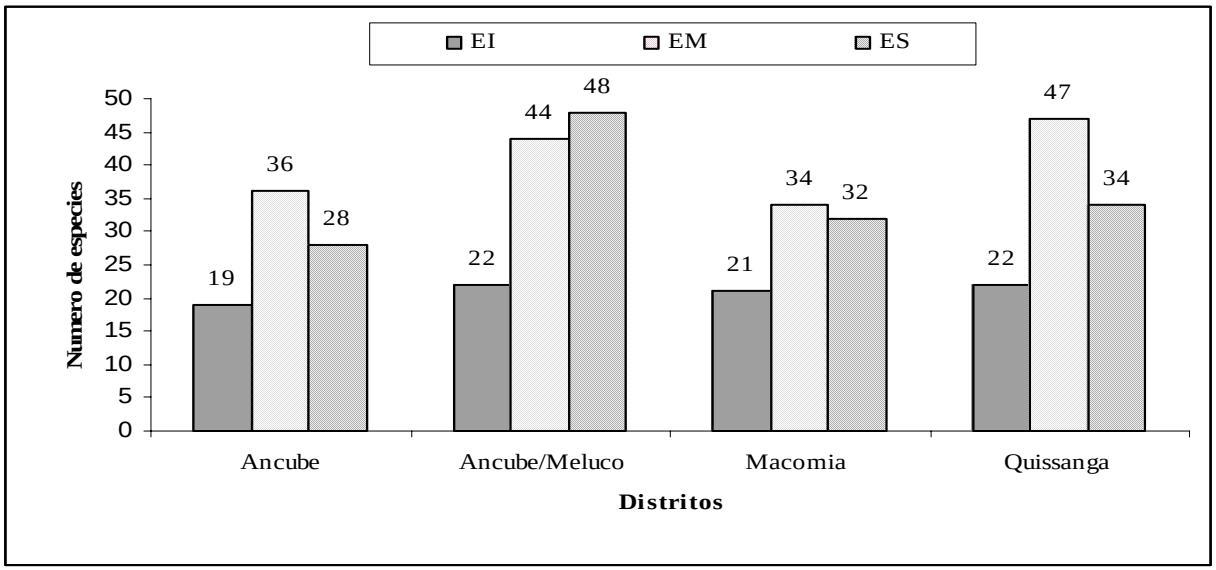
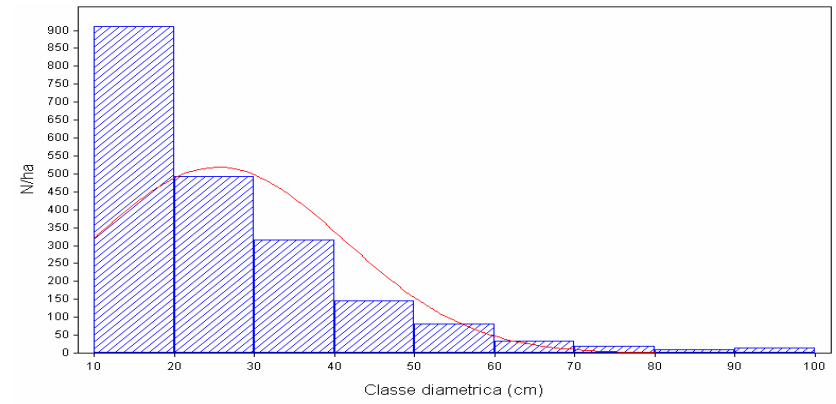
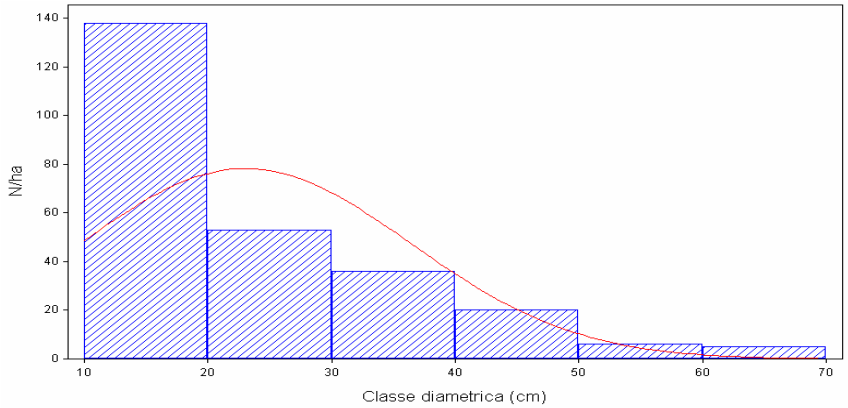


Figure 23. Tree species per stratum per ha in every QNP district

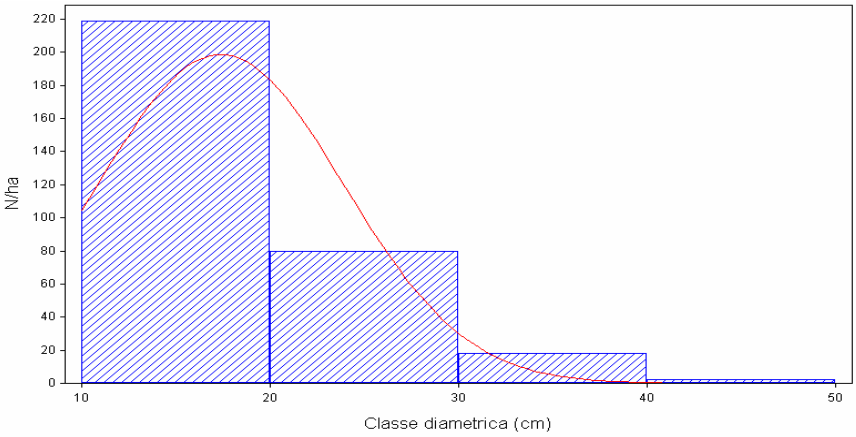
Forest Horizontal Structure



(a)

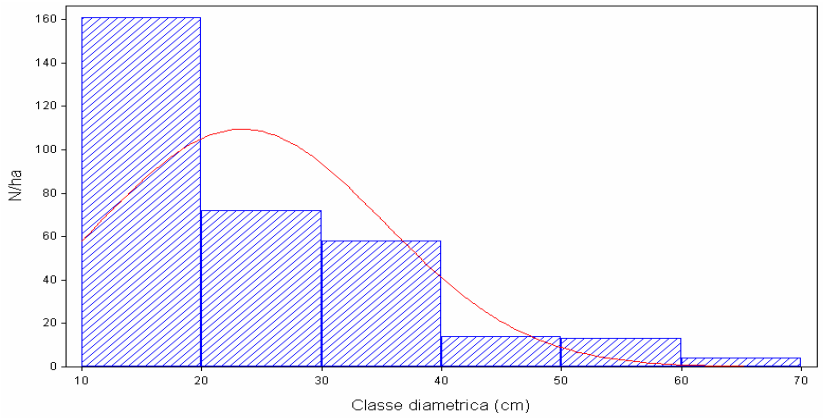


(b)

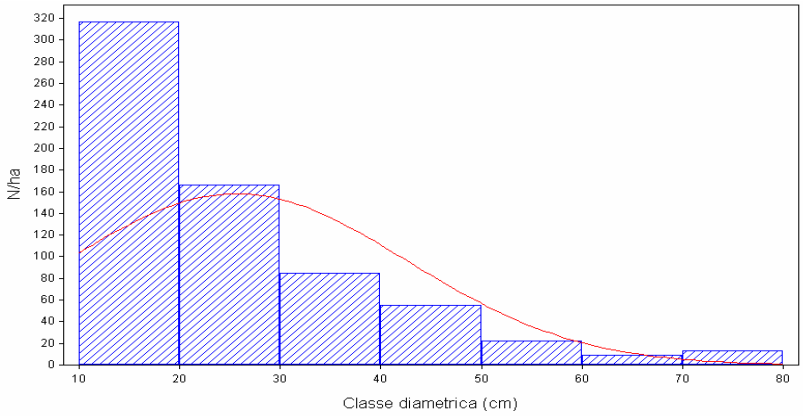


(c)

Figure 24. Individuals diametric distribution: (a) Total area, (b) Ancuabe area, (c) Ancuabe/Meluco area.



(d)



(e)

Fig. 25. Individuals diametric distribution: (d) Macomia area, (e) Quissanga area.

QNP presents a diametric curve distribution resembling the "j-inverted", where 84.8 % of total individuals are concentrated in the first 3 class diameter (DBH $\leq$ 40 cm), the remaining classe diameters reflect about 16.2 % of the individuals. In the QNP there were individuals which diameters exceed 1m, but the present study analized indivíduals with DBH (diameter at breast height) reaching 1m of width, which are more representatives.

Ancuabe had a similar diametric curve distribution with "j-inverted" shape showing that species with high occurrence frequency were in classes betwen 10 and 20 cm. More than 80 % of total forest individuals did not present DBH superior to 40 cm. This fact is observed in Ancube with 87.5 % individuals, Ancuabe /Meluco 82.1 %, Macomia with 90.1 % and the last in Quissanga with 84.6 %.

Natural Regenenaration

Plant species in QNP were represented by only few naturally regenerating species (5 cm < DBH < 10 cm), 34.7 % of total species found in regeneration, demonstrating some of the areas are experiencing major disturbances. The low species representativeness per family in the natural regeneration, may indicate high mortality rate. It is therefore recommended that QNP to be mananged by cooppice rotation as a silvicultural system. Wildfires are aslo to be controlled. Table 12 presents statistics of natural regeneration as associated with other parameters

Table 12. Density (N/ha), species richness (S) and natural regeneration per plant Family (F) at QNP.

	Regeneration							
	Poles (5 < DBH < 10 cm)				Seedlings			
Area	N/ha	S	% S	F	N/ha	S	S %	F
Ancuabe 1	88	18	12.5	7	266	19	13.2	7
Ancuabe 2	351	35	24.3	17	384	29	20.1	11
Macomia	198	19	13.2	9	487	25	17.4	13
Quissanga	233	22	15.3	18	677	37	25.7	17
Total	870	-	65.3	-	1468	-	76.4	-

RICHNESS DIVERSITY INDEX

The Shannon Wiener, Equitability and Simpson Index are presented in Table 13 below. The Ancuabe and Meluco districts present the highest index values while the Quissanga district presented the lowest index values.

Table 13. (H') Shannon Wiener Index, (J') Equitability Index and (D) Simpson Index per QNP districts.

	H'	J'	D
Ancuabe	3.39	0.59	0.96
Anc. / Mel.	3.57	0.47	0.99
Macomia	3.14	0.58	0.84
Quissanga	3.08	0.50	0.78

Ancuabe and Meluco districts had the highest diversity values probably due to more diversity plants and regular species distribution than the Quissanga district. Ancuabe and Meluco showed landscape condition (Inselbergs Complex) that constrains Human setlements.

Description of the profile of the vegetation and zonation in the topographical gradient

Profile of zonation in the topographical gradient of the QNP from the East to the West

In Fig. 25, the profile of zonation in the topographical gradient is given. From the East (in the coast) to the West (high zone in the interior) there was a variation from Costal Thicket and Mangrove, passing by communities of Acacia-Grassland, Mixed Woodland, Miombo Woodland and Miombo-Velloziace in the inselbergs in the region of Meluco-Ancuabe. The Costal Thicket community occupies the Islands and the coastal zone. The Mangrove occupies the majority of the Islands and in almost all coastline, intercalating at times with Costal Thicket. The community of Acacia-Grassland occupies the regions of low altitude that vary from 10 to 100 m, in the river banks and in the old plantation zones. The Miombo-Velloziace is the typical community in the inselbergs. In this community, the most dominant Miombo species is *Brachystegia glaucescens* and Velloziacae species dominating places of high altitude, with *Xerophyta* spp. a dominant species. Mixed Woodland is a community in transition occupying areas with altitude that varies from 100 to 400m, being composed of a mixture of the species of Miombo, bamboo (*Oxytenanthera abyssinica*), *Terminalia, Pteleopysis* and species of *Millettia* forming a mosaic.

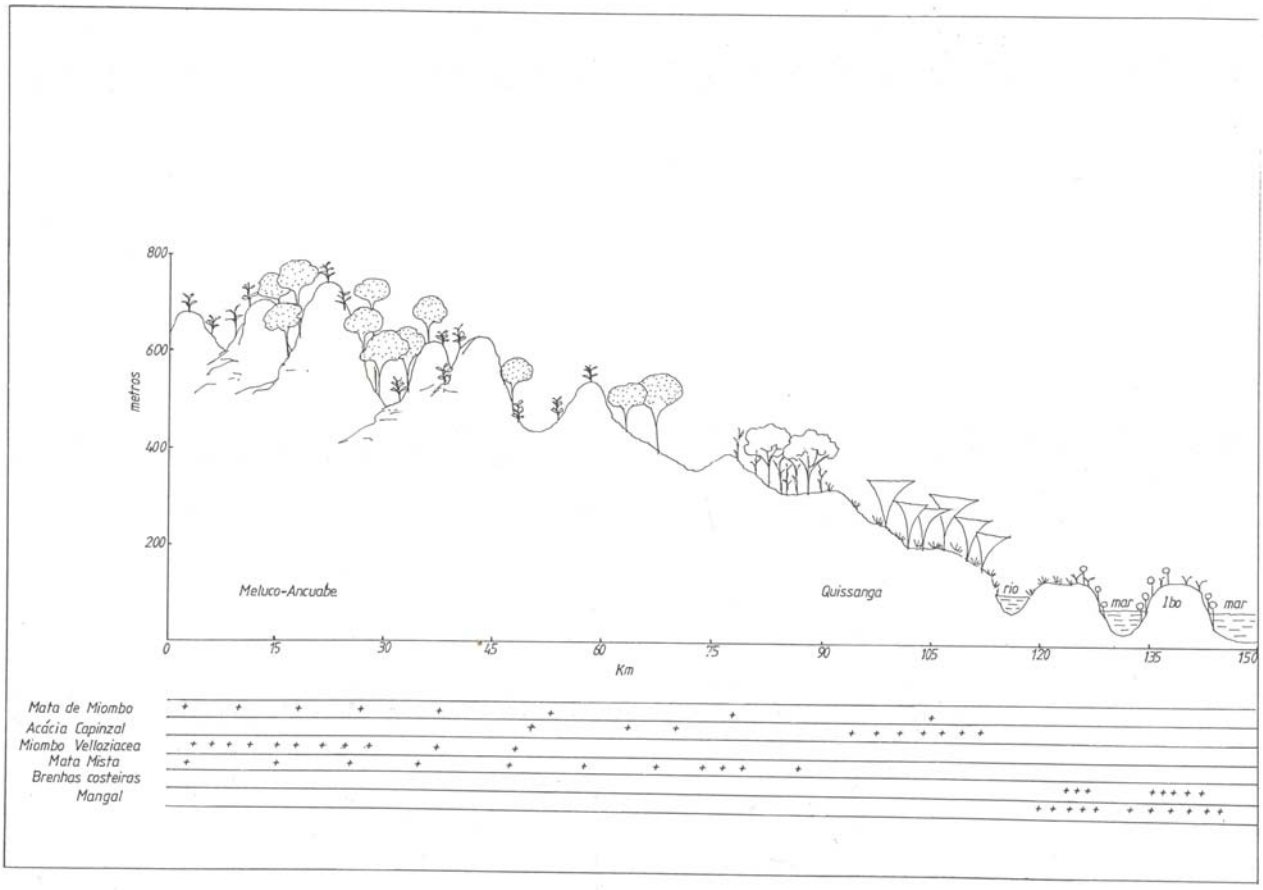


Figure 26. Profile and the topographical gradient of the QNP from East to the West

Profile of the vegetation of the Mantje mount (inselberg)

The Mantje mount is located in the district of Ancuabe, in the village of Ngura. At the Mantje mount foot where the relief is plain, *Adansonia digitata, African Cordyla, adiantifolia Albizia, Sterculia spp., Milletia sthulmanii* are the dominant species. In the shade of these trees, groups of shrubs grow as well as grasses, mostly *Panicum maximum.* Other plant species are also found in the base of the mount such as *Annona senegalensis*, *Vitex doniana* and *Xerophyta retinoti*. When the altitude increases, in the granitic stone area, species of *Brachystegia, Euphorbia cooperi, Mascarenhiasa variagata* shrub and many *Ficus* are common. Many species of *Aloe* (Liliaceae) are also found, being the most common *Aloe chabaudi*. In the high altitudes *Aloe sp.* and in the top *Euphorbia cooperi* are common. The distribution of the species is related with the variation in altitude.

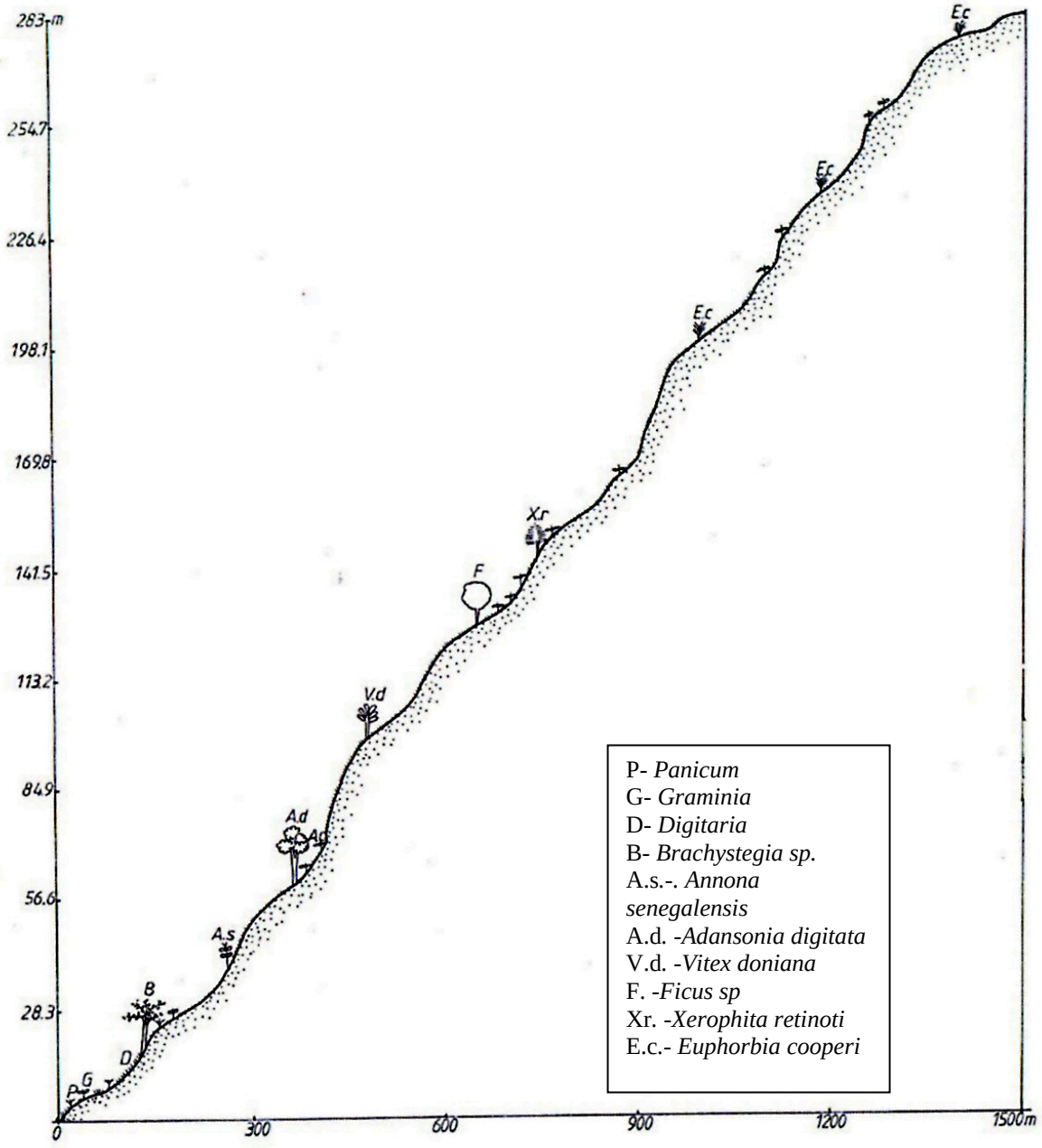


Figure 27. Zonation profile in the Mantje mount

Table 14. Relation between altitude and distribution of the species in the Mantje mount-island (Ancuabe)

Altitude in (m) / **Dominant spec.**	**350**	**375**	**400**	**425**	**450**	**475**	**500**	**525**	**550**	**575**	**600**	**630**
Adansonia digitata	X	X	X									
Albizia adiantifolia	X	X	X									
Aloe chabandi	X	X	X	X			X			X		
Annona senegalensis,	X		X									
Brachystegia glauscescens						X		X				
Grassland	X											
Cordyla africana	X											
Euphorbia cooperi										X	X	X
Euphorbia cooperi									X	X	X	
Ficus sp				X	X							
Mascarenhiasa variagata						X						
Sterculia spp	X			X								
Vitex doniana					X	X						
Xerophita retinoti						X	X	X	X	X	X	X

Profile of the vegetation of the Siamara mount (inselberg)

The Siamara mount is situated in the district of Meluco, next to the Nametil village, at altitude about 780 m. The profile of the vegetation in its topographical gradient varies in this way: the species of miombo are distributed in the base of the mount being the main species: *Brackystegia eleni*, *B. bussei* and other species such as *Cordyla africana* while the species of the Velloziacea family are situated in elevated altitudes, dominated by the species *Xenophyta* and *Aloe* (Figure 6).

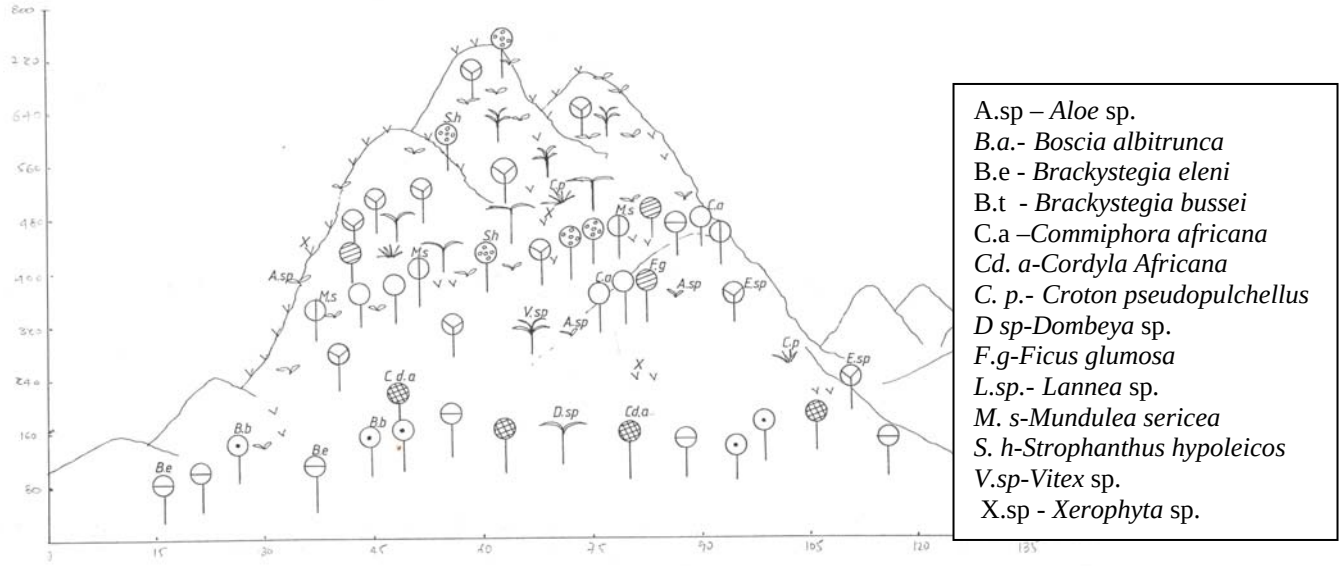
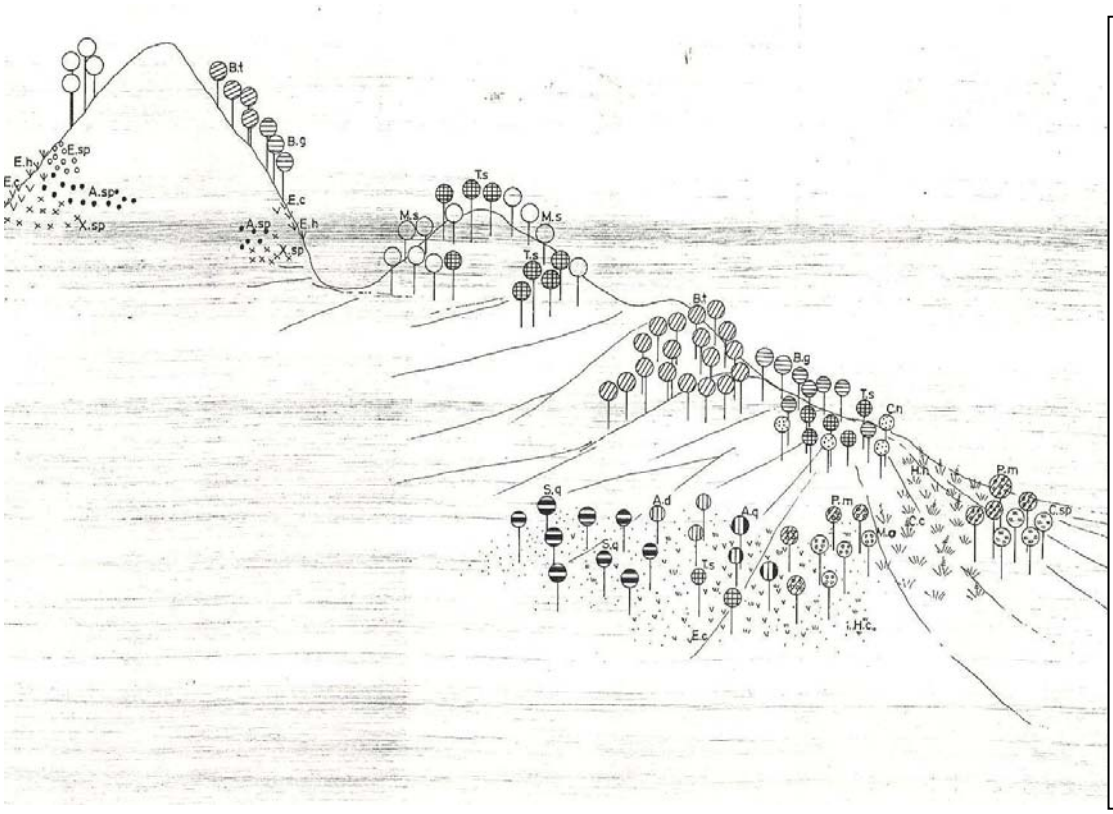


Figure 28. Profile of the Siamara mount, in the district of Meluco



A.d - *Adansonia digitata*
A.q – *Afzelia quanzensis*
A.sp – *Aloe* sp
B.g - *Brackystegia glauscences*
B.t - *Brackystegia torrei*
C.c – *Cierus ciliares*
C.n – *Commiphora neiglecta*
C.sp – *Combretum sp*
E.c – *Euphorbia cooperi*
E.h - *Euphorbia hirta*
E.sp - *Euphorbia sp.*
H.c - *Heteropogon contortus*
H.h - *Hyperthelia hirta*

Figure 29. Profile of Zonation in the Ancuabe's Inselbergs, in the community of Miombo-Velloziacae

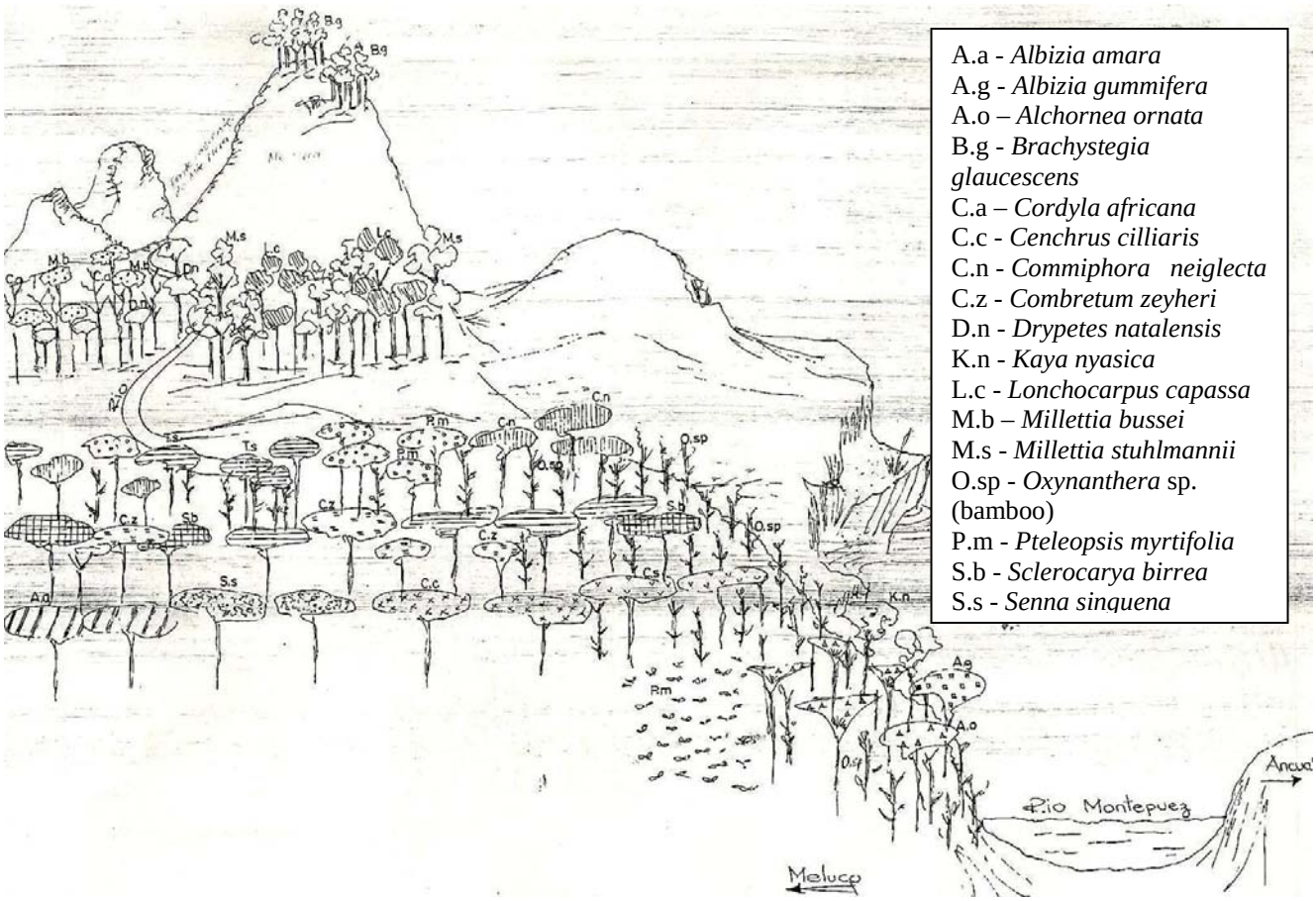


Fig. 30 Profile of zonation in the inselberg in the region of Meluco in the community of Miombo-Velloziace

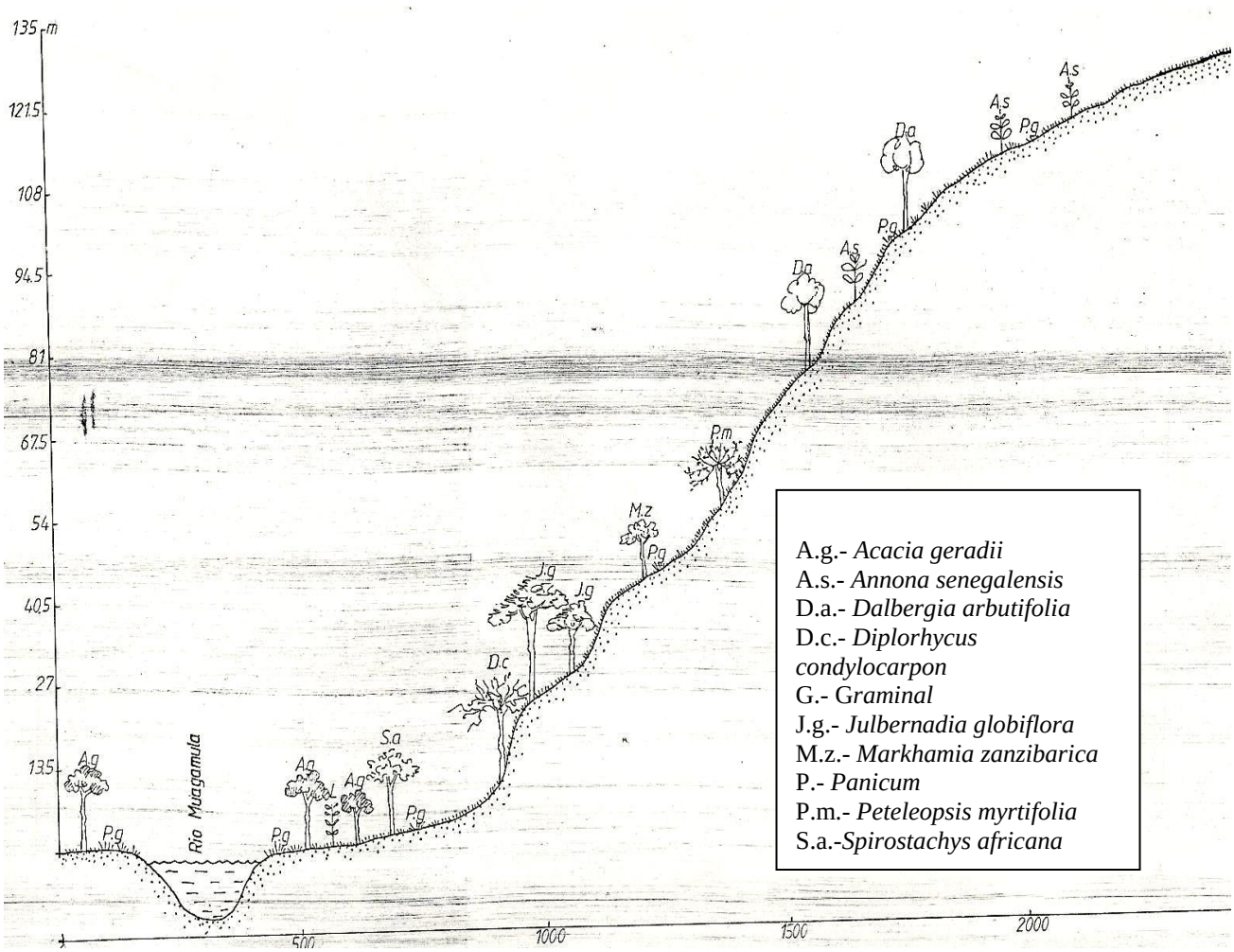


Figure 31. Profile of the vegetation in the Muagamula valley in Mucojo, Macomia district.

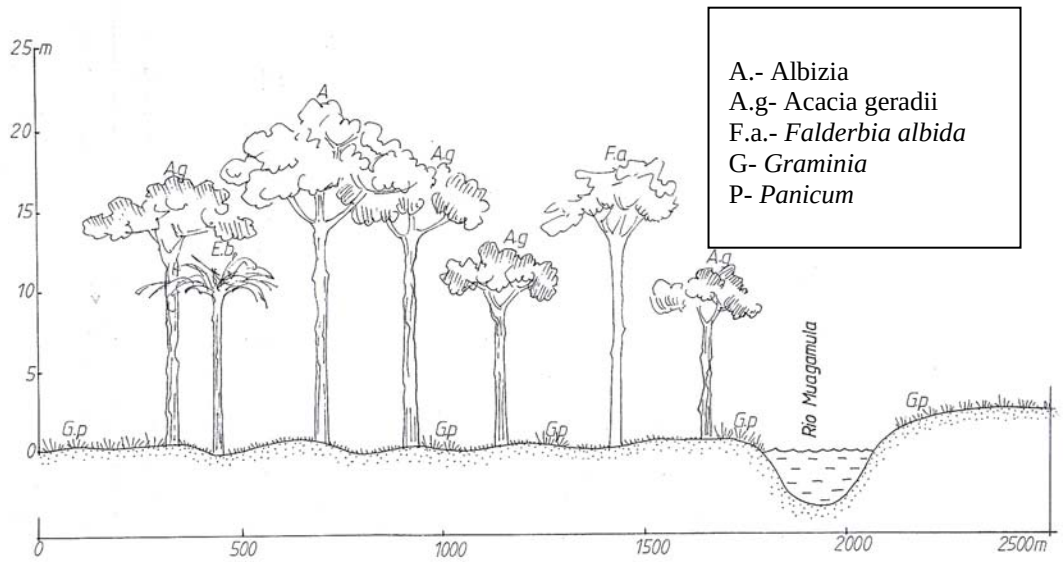


Figure 32. Profile in the community of Acacia-Grassland, on the Muagamula river in the village of Napala, Macomia district.

F) Proposal of priority areas of plant research necessary to the understanding and functioning of the vegetation types within the Quirimbas National Park

F) Proposal of priority areas of plant research necessary to the understanding and functioning of the vegetation types within the Quirimbas National Park

A. Meluco inselbergs is probably the most important plant ecosystem within QNP. During the field trip, we managed to visit the southern side of Meluco chain of inselbergs (Ancuabe district) and northern side (Meluco Distrct). A trip to the centre of this unique landscape was not possible due to heavy rains and localized floods and lack of road infrastructure. We believe this place (here described as Meluco Inselberg chain of archipelagos) being unique with a concentration of about 150 mountains in a small area being a possible area of speciation of plant species. Up to 580 species of plants, mainly succulents, were identified here. Succulents were here regarded as species of special concern. Some of them in need of more detailed identification. Meluco also had the highest species diversity. The habitat is unique in the park and Cabo Delgado province. Given the above, Meluco inselbergs should be regarded as a possible sanctuary for species, being the area for major protection and more detailed research.

Fig 33. Sattelite map of Meluco chain of inselbergs, showing more than 150 most granitic inselbergs.

Further aspects to be looked at include:

-Implementation of conservation strategies for Meluco chain of inselbergs;
-Studies to understand the relationship between flora and fauna
-Areas for promotion of botanical tourism e.g. places with rare and unique plants such as local bamboo, tree fern, inselbergs flora, etc.
B. A detalied mapping for QNP or part of it (e.g. Meluco Inslebergs) using mapping technique with more detailed resolution such as QuickBird or Spot or combined with aerophotos could be desired.

Analysis of images of time scale (between set of years); aiming at understanding both antropogenic and natural transformations.

C. Detailed research on grasses. This to tackle several aspects ranging from detailed grass palatability; importance to fauna; biomass and diversity studies.

D. Studies to evaluate potential of sustainable exploitation of natural bamboos (*Oxythenanthera abissinica*).

E. Field guide for the main plants of QNP. This could, as a start, cover trees and shrubs; also could cover wild flowers.

E. Study on relationship of vegetation profiles and plant communities. To relate this with elevation, rainfall and faunal components.

F. Study on ebony or black wood (*Dalbergia melanoxylon*) and other important timbers. This is the best paid timber in Mozambique and unfortunately one of the most burned in Cabo Delgado. Studies could cover uses, regeneration, conservation etc.

G) Identification of invasive plants, factors affecting their success, dispersal mechanisms and evaluate their threat to the vegetation types

G) Identification of invasive plants, factors affecting their success, dispersal mechanisms and evaluate their threat to the vegetation types

Based on quadrats sampling, observed species listed as invasive are *Cantharanthus roseus* invasive to several habitats and *Pennisetum purpureum* common invasive in riverine areas. Other species found and identified as invasive occurring within the areas visited are *Parkinsonnia aculeata*, common in Bilibiza (Quissanga distrit) and *Opuntia* sp., *Eleusine cocarana*, *Senna occidentalis*, *Indigofera* sp, *Sonalum paduriforme*, *Cynodon dactylon*.

H) Identification of timber and non timber forest products (including medicinal plants) and their uses

H) Identification of timber and non timber forest products (including medicinal plants).

1. **Study locations**

The following districts were visited in QNP:

- Quissanga district – Bilibiza, 19 Outubro Village;
- Ancuabe district – Ngura Village;
- Macomia district - Villages of Ningaia, Rueia at first trip and the Islands Rolas, Matemo, Ibo;
- Meluco - Meluco headquarters, Nkoripo and Mitepu Village at the second trip.

For the non timber resources identification, participatory diagnostic interviews (Theis and Grady, 1991; Campbell *et al*., 1994; Whitside, 1994, Martin, 1995) were used. The questionaire used is annexed to this report.

Small representative groups represented by famale and male persons (young, adults and elderly) who developed different activities such as: agriculture, crafts, practitioners of traditional medicine, fishers were formed in order to collect information.

When not possible to organize full group interviews, some volunteers and persons intercepted by chance provided informal interviews only to give an idea about the normal life, activities and the traditional costums.


Figura 34. People participating in the interview

2. Socio – cultural Characterization

The political structure of Quirimbas National Park follows a local government and community/traditional system. The maximum authority is the administrative chief, followed by the president of the locality, secretary of the quarter, head of the block and in some cases, this person is responsible for the ten houses. Community/Traditional autority is also a strong component of rural governance at QNP.

The majority of QNP communities profess the Muslim religion.


Figure 35. The traditional tree ceremony to introduce the team before working inside the forest.

The main tribes who inhabit the QNP are Macondes, Macua and the Mwanie. At the Rolas Island which is the youngest of The Querimbas archipelago, 5 families live there,

all time. The majority, however, have occasional residence. It is frequent that the fisher men travel to the Rolas only to practice fishery. During the hot season, the number of people increase, reaching 70 persons.

The family unit is normally numerous, and the polygamy is frequent where one family chief has in average two wives and 6 - 8 children each. Similar standard in terms of aggregate composition occurs in the communities located in the centre and interior of the QNP.

In these communities, work division occurs obeying gender and age; men and woman practices fishery using nets or artisan instruments (to catch fish, octopuses or bivalves). Hunting is only practised by men. They are also involved in house construction, that is, make the skeleton of the house using woods, bamboo and rocky stones. Women normally make the hut walls using mud, covering it with dried grass. Regarding farming, men are responsible for opening the forest (cutting and burning the trees), while women are in charge for the cleanning, till and crop planting, domestic works, search for firewood, water collecting, food confection etc. Children mainly help parents in the farm until the culture maturation. Grass for house roof is colected by women and, it must be harvested in June until December where it becomes fragile and inappropriate. Grass is changed in average every 3 years.

3. Economic activities

Main activities are agriculture, fish, carpentry, pottery and production of charcoal. The income generating activities are agriculture and fishery. Although agriculture is the most sustainable activity in all communities, fishery plays major role to peoples who live in the littoral, where 70 % of the population get the income from this activity. However, factors such as the conflict elephants/man presented in all the localities and so, those people had problems to transport and drain crop products to bigger markets.

3.a) Agriculture

Subsistence agriculture is practised by QNP communities. Crops are grown in small and fertile areas, not exceeding 3 ha per farm. In Matemo and Ibo, however, the areas are considerably larger.

Agricultural production totally depends on rains. Harvesting takes place from January to July. When the harvest is good in terms of its purpose, part is conserved for the next crop season and the remaining is for sell and consumption. After harvest, conservation poses great challenges for the populations since in the majority of the cases due to precarious conditions of storage, stored stuff suffer attacks by pests and fungi among others.

From February, all family members, including children, go to defend farm against animal attacks. These facts endanger children performance at school after missing parts of the academic year. Diet of these communities depends on many native species (plants and animals) exploration to complement nutrition requirements (see exemple below).

***Cleome gynandra*, native species with edible leaves**

3.b) Fisheries

Coastal fishing

Fishery activity is the most practiced income generating activity. Boat fishing only carried out by men. Fisherman is an artisan, and uses hook, nets, traps and gamboas.

Gamboa (canoe) is made of timber from mangal tree species. Helm is made of bamboo. Fishers use nets or lines to fish. They usually use big nets, that consumes around 5 line packs, each costing 1600,00 Mtn, materials regarded as very expensive.

There is a cooperative association grouping 14 fishermen from Matemo Island. Seldom they sell fresh fish of all sort, which is usually sold dry. The process starts with cleaning, salting it later before drying outdoors in great amounts during more or less 3 weeks.

Fig. 36. The fishermen and the fish of all sort during the drying process.

Fisheries in Rivers and Lakes

It is only practised by men. Main rivers are Rio Montepuez, Rio Messalo and Rio Menapu. The activity is conducted 2 - 3 times per week, and temporary, limited to the months of March to May, before the rivers dry.

3.c) **Catlle breeding**

Domestic animal raising e.g. birds, goats and cattle is common. Cattle raising has relatively less expression at QNP. Consequently, communities throughout the coast as well as from the interior do not regularly consume domestic animals. Usually, the person in charge for the livestock is the family head, who decides the moment and the purpose of the animals. The prices practised vary from 30,00 MT for hen, 300,00 - 500,00 MTn a sheep, 60,00 MTn for a duck.

3. d) Hunting

The hunting is an activity practised by men. This is a complementary to agriculture activity, fact related to the existence of a small number of individuals. The animals that often hunt are for sell.

3e) Edible grass for fauna at QNP

An additional study in the QNP included species used by wild animals (herbivorous); having been classified in accordance with literature in palatable and less palatable species (see table 14).

Table 14. Plant species palatability (for herbivores) at QNP.

Plant community	Palatable species	Less Palatable species
Miombo Woodland	*Digitaria eriantha* *Panicum maximum* *Urochloa mosambicensis* *Diheteropogon amplectens*	*Endigofera ormorpoides* *Vigna unguiculata*
Acacia – Grassland	*Eriochoa meyeriana* *Digitaria eriantha* *Panicum maximum* *Pennisetum purpureum* *Urochloa mosambicenses* *Sorghum bicolor*	*Paspalum scrobiculatum* *Vigna unguiculata*
Mixed Woodlands	*Diheteropogon ampelectens* *Panicum maximum* *Pennisetum purpureum* *Panicum coloratum*	*Vigna unguiculata*
Miombo-Veloziacea Community	*Panicum maximum* *Digitaria eriantha*	*Vigna unguiculata* *Senna absus* *Vernonia* sp.

4. Timber products

Up to 22 timber species were identified at QNP:

Table 15. Timber species of QNP

Species	Family	Habitus	Use of timber
Julbernardia globiflora	Fabaceae	Tree	x
Pseudolachnostylis maprouneifolia	Euphorbiaceae	Tree	x
Afzelia quazensis	Fabaceae	Tree	x
Bombax rhodognaphalon	Bombacaceae	Tree	x
Brachystegia allenii	Fabaceae	Tree	x
Brachystegia boehmii	Fabaceae	Tree	x
Brachystegia glaucescens	Fabaceae	Tree	x
Brachystegia sp.	Fabaceae	Tree	x
Brachystegia spiciformis	Fabaceae	Tree	x
Burkea africana	Fabaceae	Tree	x
Dalbergia melanoxylon	Fabaceae	Tree	x
Lannea stlhumannii	Annacardiaceae	Tree	x
Lonchocarpus capassa	Fabaceae	Tree	x
Milletia sthulmani	Fabaceae	Tree	x
Pteleopsis myrtifolia	Combretaceae	Tree	x
Pterocarpus angolensis	Fabaceae	Tree	x
Sclerocarya birrea	Anacardiaceae	Tree	x
Spirostachys africana	Fabaceae	Tree	x
Stecurlia quinqueloba	Sterculiaceae	Tree	x
Terminalia stenostachya	Combretaceae	Tree	x
Terminalia sericea	Combretaceae	Tree	x
Xeroderris stuhlmannii	Fabaceae	Tree	x

Table 16 . Species used for house constrution and furniture

Species	Local name	Uses
Berkmemia zyeri	Pau rosa	Furniture and art craft
Dalbergia melanoxylon	Pau preto	Building material
Terminalia stenostachya	Nompa	Building material, poles for bridges, and trailers
Diospiros mespiliformis		Building material
N/identified	M'pari	Building material , furniture
N/identified	Intatavala	Building material
Pterocarpus angolensis	Jambila	Furniture
Afzelia quanzensis	Chanfuta	Furniture

Millettia stulmanii	Jambila	Furniture
Oxytenanthera abyssinica	Bamboo, Ipapa	Building material, furniture and domestic tools
Sterculia sp.	N'tonha/Mutonha	Rope from the bark
Cocos nucifera	coco	Rope from the fruit fibre
Cordyla africana	N'roto	For traditional gun
	N'tili	For plates and spoons
N/identified cf Hyphaene coriacea	Mecuta/ N'lala/macuti	Art craft for making mats, hats, baskets and ropes
Ziziphus spp.	M'sawe	Poles
Annona senegalensis	N'repe	Poles
N/identified	Malaci	Art craft for making mats, hats, baskets and ropes

5. Non timber forest exploration

The communities explore non timber forest products for self-consumption; through collecting wild fruits, medicinal plants, mushrooms, honey, tubers etc. When the rivers and farmlands do not offer many alternative options, people appeal to the forest and search for fruits and tubers that serve as feeding supplement at times of food scarcity;

They also collect multiple use forest plants such as *Lagenaria* sp. (Icahê), which seeds from green fruits are used as seasoning and when mature and dry it is used as sponge (Poyopé).

The Ulapa is used as cough remedy, extracted from dry leaves; seeds are edible. *Sclerocarya birrea* (Mongo) kernels are very important for food confection, fruits are used for traditional drink preparation, vinegar. Baobab is the most important tree for the variety of products offered. Leaves and fruits are edible, when the trunk is old, edible mushrooms can be extracted for consumption, fruit makes a drink. *Zinziphus mauritianus* is another species of great importance in this region, where the fruit makes traditional drink and can also be consumed fresh or dry. Other consumed products include the

bamboo (*Oxynantera abyssinica*) shoot, honey extracted from the forest trees or holes where bees or ants find their shelter.

Medicinal Plants: At least 132 medicinal plants were identified, of these, 105 plant species belong to 49 families. According to the interviewees all of them use the species *Flacourtia indica, Xylotheca tettensis* and *Rourea orientalis* as medicinal plants, 67% of the interviewees use the species *Kigelia africana, Azanza garckeana, Senna petersiana* and *Abrus precatorius* while 33% used *Adansonia digitata, Terminalia stenostachia, Lannea schimperi, Albizia adianthifolia, Corchorus tridens* and *Abutilon englerianum* as medicinal plants. Interviews to the Traditional Medicinal practitioners (TMP) listed 52 diseases, out of which 9 species covered diarrhea, respiratory complications, STD-AIDS , malaria, eye diseases, ear complications, obstipation and hernia, considered as the most frequent. The majority of Tratitional Medicinal Practitioners (TMP) use plants which occurs in QNP for treatments.

Honey is commonly used for treating fire diseases and respiratory problems. According to the interviewees, medicinal plants are aboundant at the QNP.

The following table 16 contains a list of different products, information gathered during the interviews.

Edible plants.

Close to 30 species of edible plants were identified for QNP.

Table 16. List of edible fruits plant species

Species	Local name	Uses and other information
	yhuru	Edible fruit
	Nanranta	Fruits
	Ithupi	Fruits
Adansonia digitata	Ulapa	Leaves from young plants
Adansonia digitata	*Ulapa*	Edible fruit, seeds and leaves used as condiment
Amaranthus sp.	Inhewe	
Annona senegalensis	Nrepe	Fruits
Cleome sp.	Not given	Edible leaves
Cordyla africana	Maroto/roto	Fruits
Cucumis sp.	Insire/pepino	Fruit
Dioscorea sp	Itia	Tuber edible
Flacourtia sp.	Itema	Edible fruit
Hyphaene coriacea	Nicomo	Fruits
Lagenaria sp.	Icahê	Spice
Landolphia sp.	rava	Fruits, sometimes sold in castal areas
Moringa oleífera	Lenkero	Edible leaves
N/identied	*Ueilê*	Native bean
N/identified	Mwiti	Collected near rivers
Ricinodendron rautenenii	Mpaka	Nut powder
Sclerrocarya birrea	ncoco/Mongo/icoco	Edible kernel
Sterculia appendiculata	Ntile	Spice
Strychnos sp.	Nalunkane/lunkama	Fruits
Tamarindus indica	Wepa	Fruits
Vangueria infausta	Munpululu/Nampilulu	Fruits
Vitex doniana	Iuro/Phuvu/Ihuru	Fruits
Ziziphus mucronata	Unazi,Maçanica	Fruits

Main species have been listed in local name due to the difficulties with tree identification since the study was conducted during non fruiting periods. Other edible species listed, include a fungus group, the mushrooms. Some collected mushrooms are used as diet supplements for the population; 6 species were identified in local names, assigned as “wioulo”, “iyutho”, “utepôu”, “nessa” and “n'lapa” the last one so called for growing in branches and trunks in decomposition phase of the Imbondeiro tree. It was reported that a

number of poisoning cases occurring in the area are caused by mushrooms consumption, therefore, better knowledge of mushrooms could lead to reduction of poison species.

Common mushrooms in QNP (Species not identified and not edible).

Other uses

Figure 37. Basket made of bamboo to transport goods from the farmland.

African bamboo, *Oxytenanthera abissinica* – Vegetal material mostly used at QNP

Malaci, *Xerophyta* sp.

Merremia tridentada, used to absorve weight when women carry loads on the head.

Table 17. Summary of other uses (including unidentified species)

Uses	Local name	Portuguese name	Scientific name
Workmanship and Beatuy products		Sisal	*Agave sisalana*
	Mussiro	Mussiro	*Olax dissiflora*
	Xicodê/Chicodo		*Ehretia* sp.
Tuber	Thêthê		
	Wêpa		
	Minama		
	Yêle-watakwane		
Edible leaves	Fukulo		
	Thêthê		
	Ulapa		
	Insire	Pepino	*Cucumis* sp.
Firewood	Nkokoro		*Brackystegia bissei*
	Npacala*		*Julbernardia globlifora*
	Roncochi		*Diplorhychus condylocarpon*
	Nkwame		
	Ntalala*		Dicrostachys cinérea
	Mpare		*Bauhinia petersiana*
	Kukwi*		
	Nhassurutu*		
	Nikiniki*		*Pseudolachynostylis maproneifolia*
	Nihatse		
	Wepa		*Tamarindus indica*
	Natica*		
	Nacoto*		
	Kurupa*		
	Uipu*		*Combretum collinum*
	Miko*		*Dalbergia melanoxylon*
	Kussandje		*Terminalia sericea*
	Nalwé*		
	Ntatavala		*Millettia stuhlmannii*
	Manga	Mangueira	*Mangifera indica*
	Isente		
	Sanganlucuto		
	Nsanúnpa		
	Mpapo		

	Nowé		
	Riba-riba		*Grewia* sp.
	Nandedereka		
Rope		Palmeiras	
	Nakoto		
	Mpove (liana)		*Cocclus* sp.
	Mtonha		*Sterculia aquinqueloba*
	Ntupo		*Sterculia africana*
	Nakoto		*Brachystegia alennii*
	Ulapa	Imbondeiro	*Adansonia digitata*
Pestle	Lote		*Xerroderris stuhlmannii*
	Moko		*Afzelia quazensis*
	Miko		*Dalbergia melanoxylon*
	Nhacatê		
House Roof	Malasse		
	Naveve 1		*Rotoboellia* sp.
	Naveve 2		*Penisetum* sp.
	Niwahawassu		
	Ntikina		
	Namuala (montanha)		
	Nhanthoveru		
	Ntsêle		*Hyperthelia dissoluta*
	Nhancthassa (pântano)		*Hyperthelia hirta*
	Nhapa		
	Niwaruwaru		
	Nipipo		
	Itupu		
Fishery material	(Gamboa) Kandala		
	Kandala ntunolo		
	(Lema) - Bambu		
	Ndungwedi (canoa)		*Sideroxylon inerme*
	(Cordas) Mulala		
Construction material (Houses, stakes)			*Grewia* sp
	Ndungwedi		*Sideroxylon inerme*
			Erytroxylon sp.
			Papeia sp.
			Commiphora sp.
Fishes	Ndjama	Peixe pedra	
	Rimba	Taínha	
	Sala		

	Safi		
	Marekerera		
	Xerewe		
Other shellfish	Anguissa	Lulas	
	Mweza	Polvo	
Domestic animals	Uku	Galinha	
	Bunzi	Cabrito	
	Mabata	Pato	
	Ango	Galinha do mato	
	kondo	Ovelha	
Traditional drinks	Kabenga		*Zea mays* (corn lawns)
	Nipa		*Saccharum officinarum*
	Uteka		Marupi, honey and *Sorghum* sp.

*Best Firewood ; Long duration and good fuel, dry is very profitable.

I) Assessment of current and future human/human related impact on the vegetation, and evaluation of these impacts

I) Assessment of current and future human/human related impact on the vegetation, and evaluation of these impacts

A list of infesting and alien plants were compiled from various sites visited (see above). A map of areas with agricultural activity is presented below. Quite an extensive settlement does exist within QNP. It is not shown in the map settlements reduction in the western side of the QNP due to a positive community work carried out by park officials.

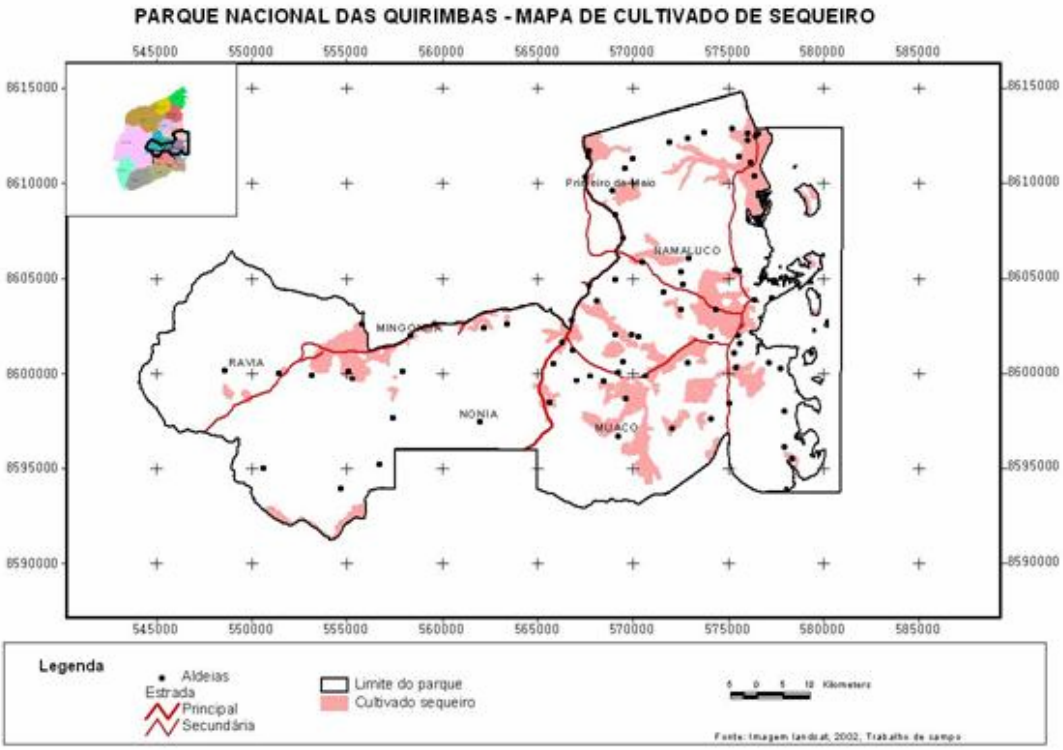


Fig. 38. Map indicating agricultural activities impact.

J) Assessment of the importance of the vegetation of the QNP Concerning its biodiversity, level of endemism, occurrence of plant species listed on the Red Data list on the international, regional, and local scale.

J) Assessment of the importance of the vegetation of the Quirimbas National Park Concerning its biodiversity, level of endemism, occurrence of plant species listed on the Red Data list on the international, regional, and local scale.

Table 18. Plant species endemic and near-endemic at PNQ

Species	**Family**	**Status**	**Location found**	**Other known distribution areas**
Strophanthus hypoleucus	Asclepiadaceae		Mt Mantje	CD, Nampula, Niassa, Zambézia
Milletia bussei	Fabaceae	Endemic	Mantje, Muagamula	
Phyllantus guineense	Euphorbiaceae	Near-endemic	?	
Dombeya cinccinata	Sterculiaceae	Near-endemic	Mantje	
Combretum umbricola	Combretaceae	Endemic	?	Ancuabe
Quettarda speciosa	Rubiaceae	Endemic		Ancuabe
Croton megalocarpus	Euphorbiaceae	Near-endemic		Ancuabe
Diospyros consolatae	Ebenaceae	Near-endemic		Ancuabe
Indigofera ormocarpoides	Fabaceae	Near-endemic		Ancuabe
Carpodiptera africana	Tiliaceae	Near-endemic		Ancuabe
Grewia glandulosa	Tiliaceae	Near-Endemic		Ancuabe

***Milletia bussei*, possible endemic plant**

Table 19. First list of rare and threatened plants occurring in the PNQ and surrounding regions

Species	Family	Location found	Other known distribution
Ceropegia sp. (collection FMAB01)	Asclepiadaceae	Napala dense woodland	
Euphorbia cooperi	Euphorbiaceae	Mt. Mantje	
Euphorbia confinalis	Euphorbiaceae	Mucojo	
Strophanthus hypoleucos	Asclepiadaceae	Mt Mantje	
Sterculia quinqueloba	Sterculiaceae	Mt Mantje	
Sterculia apendiculata	Sterculiaceae	Ancuabe, Meluco	Nampula, Tete, Zambézia (?)
Mistacidium sp.	Orchidaceae	Near Montepuez R.	

***Mistacidium* sp. rare orchid collected near Montepuez**

Euphorbia confinalis

***Euphorbia cooperi* , Mt Mantje**

***Strophanthus hypoleucos*, mt Mantje**

***Ceropegia* sp., a rare plant found at Napala dense woodland with no fire history. This species has been chosen as a symbol flower for the QNP botanical expedition**

Other groups include the list of succulent plants occurring in the PNQ and surrounding regions

Table 20. list of succulents occurring at QNP.

Succulent species	**Plant communities**
Adansonia digitata	Mixed woodlands, Acacia – Grassland
Aloe maunii	Miombo-Veloziacea Community
Aloe chabaudii	Miombo-Veloziacea
Aloe parvibractea	Miombo-Veloziacea
Aloe sp.	Miombo-Veloziacea
Euphorbia confinalis	Miombo-Veloziacea and Mixed Woodlands
Euphorbia cooperi	Miombo-Veloziacea and Mixed Woodlands
Euphorbia hirta	Miombo-Veloziacea and Mixed Woodlands, Acacia – Grassland
Euphorbia griseola	Miombo-Veloziacea
Euphorbia sp.	Miombo-Veloziacea and Mixed Woodlands
Euphorbia tirucalli	Miombo-Veloziacea and Mixed Woodlands

K) Application of the information generated for management purposes / solving problems on the ground

k. Application of the information generated for management purposes/solving problems on the ground

Training activities undertaken during the field trips.

- production of a first set of plant specimens as part of the future local herbarium for the QNP is underway

- staff training in plant collection, preservation for herbaria.

- Training in plant identification specially trees and grass identification

- Training in using disk pasture meter for grass assessment (a powerful tool for grass management with insight to fire and herbivore control)

- The Scientific Coordinator of QNP (Mr Armindo Aramane) is co-supervisor of one University undergraduate student. Mr Aramane is expert at the interface between plants and animals, making him an ideal co-supervisor for studies such as those on grass vegetation, association with fire.

- Training in socio-ecological interviewing undertaken in the last field trip (training undertaken mainly in the Meluco district).

M) Conclusions and Recommendations

Various activies were undertaken at QNP. Substantial data were gathered for

- species diversity (near 600 species) comprising at least 70% of the entire plant diversity of QNP. Major goups were timber and herbaceous species.
- Community description. 6 communites were identified: Acacia – Grassland; coastal thicket, mangroves, mixed woodland, miombo woodland, miombo-velloziacea.
- Vegetation map completed.
- Detailed soil analyses undertaken; various parameters determined.
- Initial discussion on Meluco chain of inselbergs, believed to be the cradle of plant diversity at QNP.
- Extensive studies of medicinal plants covering nine main ailments such as malaria, diarreias, respiratory complications and STD were undertaken. 105 medicinal plants were identified.
- non-timber products include up to 40 species used as food, crafting, domestic tolls, hut construction.
- specific groups such as endemics, rare plants, succulents, threatned groups were also evaluated.
- Aspects for management of the vegetation of QNP and for further research were also documented.

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O) Annexes

ANNEX 1.

List of thesis, research documents produced in connection with the project, raw data (this part is provided separatelly)

(i) Licenciatura Thesis of Mr. Francisco Azevedo Junior
Title: Mapeamento da vegetação do Parque Nacional das Quirimbas com base na Teledatação

(ii) Licenciatura thesis of Ms. Dânia B. S. Ibraimo
Title: Diversidade e Estrutura da Vegetação Lenhosa no Parque nacional das Quirimbas

(iii) Licenciatura thesis of Mr. Elvino José de Sousa Ferrão
Title: Plantas Medicinais do Parque Nacional das Quirimbas, Ênfase para as Usadas no Tratamento de Malaria, Diarreias e Infecçoes de Transmissao Sexual

(iv) Licenciatura thesis of Mr. Clemente Delfim Manuel Nicolau,
Title: Caracterização dos Tipos de Solo do Parque Nacional das Quirimbas

(v) Licenciatura thesis of Ms. Neusa venturas Pinto
Title: Diversidade das Plantas Herbáceas do Parque Nacional das Quirimbas

ANNEX 2.
Details and timetable of the field trip to QNP

Participants and their main role

Student 1 (Miss Neusa Pinto, licenciatura student)- herbaceous plant assessment, biomass and diversity, difference between community and seasons

Student 2 (Mr. Elvino Ferrão, licenciatura student) - Plant utilization with emphasis to medicinal plants, its uses and conservation

Student 3 (Miss Dânia Ibraimo, Licenciatura student) –Tree ecology.

Student 4 (Mr Azevedo Francisco, Licenciatura student) – GIS mapping and vegetation profiles.

Mr – Osvaldo Filipe, recently graduated with licenciatura – vegetation ecology with emphasis to woody plants.

Miss Nocy Bila, recently graduated with Licenciatura –woody plants ecology and soil analysis, co-supervisor of Dânia Ibraimo. Ms Bila is potentially a masters student to undertake research on woody plants ecology

Mr Mizeque Mafambissa, lecturer Biology Dept – GIS specialist, soils analysis. Supervisor of Azevedo Francisco.

Mr Ernesto Nacamo, University Herbarium staff – technicians in plant systematics with extensive plant diversity knowledge of Cabo Delgado and QNP.

Mr Francisco Mapanga, University Herbarium staff – technicians in plant systematics with extensive plant diversity knowledge of Cabo Delgado and QNP.

Ms Filomena Barbosa, Senior lecturer of botany – extensive knowledge on plant utilization. Supervisor of Etelvino Ferrão, Dânia Ibraimo.

Dr Salomão Bandeira, assistant professor in botany – principal investigator and coordinator of vegetation studies at QNP. Supervisor of most of the students.

Timeplan of the first field trip

Day	Morning
15 March	Arrival in Pemba
16 March	Trip to Ancuabe (Ngura)
17 March	Meluco
18 March	Meluco
19 March	Trip to Muagamula
20 March	Muagamula valley
21 March	Muagamula river banks and Napala
22 March	Macomia Miombo and bamboo woodland near Bilibiza
23 March	Bilibiza inundation grassland and vegetation assessment at IBO
24 March	Return to Maputo of 6 people
25 March	Napuda
26 March	Napuda and Quissanga region
27March	Napuda
28March	Napuda – Pemba
29March	Pemba – Maputo (for the remaining 4 people)

Timeplan of the second field trip

Date	Activity
19 May 2006	Arrival in Pemba
22 Maio – 2 June 2006	Studies in Ancuabe - Meluco
3 June 2006	Return to Pemba city
5 June 2006	Arrival in Maputo

Timeplan of the third field trip

Date	Activity
8 October 2006	Arrival in Pemba
8 – 11 October 2006	Departure to Ibo – Staying in Ibo and accommodation at TDM rooms
12 – 17 October 2006	Visit to Bilibiza and Meluco
17 October 2006	Return to Pemba and staying at Hotel Nautilus
18 October 2006	Return to Maputo

ANNEX 3

Main list of all plant species from QNP (provided separately)

UNIVERSIDADE EDUARDO MONDLANE
Departamento de Ciências Biológicas

Check List of Plants - Quirimbas National Park


Salomão Bandeira*
Ernesto Nacamo
Filomena Barbosa
Nocy Bila
Neusa Pinto
* sband@zebra.uem.mz

Plant Check List of the Quirimbas National Park
By: Salomão Bandeira, Ernesto Nacamo, Filomena Barbosa, Nocy Bila, Neusa Pinto
Univerisdade Eduardo Mondlane, Maputo, Mozambique

Species	**Local names**	**Family**	**Habitus**	**Community**	**Voucher specimen (LMUHerbarium, UEM)**
Abrus precatorius		Fabaceae	Climber herb	Coastal ticket	Ban2558
Abrus sp.		Fabaceae	Climber herb	Coatal thicket	-
Abutilon englerianum	Namadjulu-Namarrutchulu	Malvaceae	Shrub	Mixed woodland	-
Abutilon grantii		Malvaceae	Herb	Mixed woodland, Miombo woodland	NB100
Abutilon sp.		Malvaceae	herb	Mixed woodland, Acacia grassland, Coastal thicket	-
Acacia siberiana		Fabaceae	Tree	Acacia grassland	-
Acacia xanthophloea		Fabaceae	Tree	Acacia grassland	-
Acacia gerrardii		Fabaceae	Tree	Acacia grassland, Mixed woodland, Miombo woodland	-
Acacia grandicornuta		Fabceae	Tree	_	-
Acacia nigrescens		Fabaceae	Tree	Miombo-xerophyte, Miombo woodland, Acacia grassland, Mixed woodland	-
Acacia nilotica		Fabaceae	Tree	Acacia grassland	-
Acacia polyacantha		Fabaceae	Tree	Mixed woodland	-

Acacia sieberana		Fabaceae	Tree	_	-
Acacia sp.		Fabaceae	Tree	Miombo woodland	-
Acacia sp.		Fabaceae	Climber herb	Coastal thicket	-
Acacia sp.		Fabaceae	Tree	Acacia woodland	FMAB 82
Acacia tortilis		Fabaceae	Tree	_	-
Acalypha ornata		Euphorbiaceae	Shrub	Miombo-xerophyte, Mixed woodland	NB 132
Acalypha sp.		Euphorbiaceae	shrub	Coastal thicket	-
Acalypha sp.		Euphorbiaceae	Shrub	Acacia grassland	Ban 2528
Acalypha sp.		Euphorbiaceae	Shrub	Acacia grassland	Ban2617, NB43
Acanthospermum hispidum		Asteraceae	herb	Acacia grassland	-
Achyranthes africana		Acanthaceae	herb	Mixed woodland, Miombo woodland	-
Achyranthes aspera		Acanthaceae	Herb	Mixed woodland, Coastal thicket, Miombo woodland	-
Achyranthes sp.		Acanthaceae	Herb	thicket	-
Adansonia digitata		Bombacaceae	Tree	Acacia grassland, Mixed woodland, Coastal thicket, Miombo woodland	-
Afzelia quanzensis		Fabaceae	Tree	Miombo-xerophyte, Miombo woodland, Mixed woodland, Acacia grassland	-
Agave sisalana		Agavaceae	subshrub	Acacia grassland, Coastal thicket	-
Agerantum conyzoides		Asteraceae	Herb	Miombo-xerophyte, Mixed woodland, Miombo woodland	NB11, NB96, NB110

Albizia adianthifolia	N´tanga	Fabaceae	Tree	Miombo-xerophyte, Mixed woodland, Miombo woodland	-
Albizia amara		Fabaceae	Tree	Acacia grassland, Miombo woodland, Mixed woodland	NB68
Albizia brevifolia		Fabaceae	Tree	_	-
Albizia forbesii		Fabaceae	Tree	Acacia grassland	NB137
Albizia gummifera		Fabaceae	Tree	Acacia grassland, Miombo-xerophyte, Mixed woodland, Miombo woodland	-
Albizia harveyi		Fabaceae	Tree	Mixed woodland	-
Albizia sp.		Fabaceae	Tree	Acacia grassland, Mixed woodland	-
Albizia versicolor		Fabaceae	Tree	Acacia grassland, Mixed woodland	-
Alchornea sp.	*N´Kute-kuthe-Nakutekuke*	Euphorbiaceae	succulent	Mixed woodland	-
Alloteropsis cimicina		Poaceae	grass	?	Ban 2545
Aloe cf mauni		Aloaceae	succulent	Miombo-Velloziaceae	-
Aloe chabaudii	Ilai	Aloaceae	succulent	Miombo-Velloziaceae	-
Aloe parvibracteata		Aloaceae	succulent	Mixed woodland	-
Aloe sp		Aloaceae	succulent	Miombo-xerophyte	-
Alysicarpus sp.		Aloaceae	Shrub	Mixed woodland, Miombo woodland	-
Amaranthus sp.		Amaranthaceae	Herb	mixed woodland	NB 127
Ampelocissus obtusa		Vitaceae	herb	_	-

Anacardium occidentale		Anacardiaceae	Shrub	Miombo woodland, Acacia grassland	-
Ancylobotrys petersiana	Kurua/m'pira/rawa	Apocynaceae	Perennial climber	Acacia grassland	-
Aneilema aequino		Commelinaceae	Herb		NB 204
Aneilema dregeanum		Commelinaceae	Herb	Miombo-xerophyte	NB 99, NB 121
Aneilema pedunculosum		Commelinaceae	Herb	mixed woodland	Ban 2524
Annona senegalensis	M'pire/n'repe/m'tope/ Mwheve/ Muiepe	Annonaceae	Tree	Miombo-xerophyte, Acacia grassland, Mixed woodland, Miombo woodland	Ban 2606
Annona spp.		Annonaceae	Tree	coastal thicket	-
Annona squamosa		Annonaceae	Tree	Coastal thicket	-
Annonaceae		Annonaceae	Climber herb	Acacia grassland?	FMAB 49
Antidesma venosum		Euphorbiaceae	Tree	Acacia grassland, Mixed woodland, Miombo woodland, Miombo-xerophyte	Ban 2572
Argemone mexicana		Papaveraceae	Herb	Coastal thicket	FMAB 90
Aristida cf transvaalensis		Poaceae	Grass		Ban 2551
Aristida sp.		Poaceae	grass	Miombo woodland	-
Artabotrys brachypetalus		Aristolochiaceae	Herb	_	Ban 2624
Asistachya gazetica		Acanthaceae	herb	Coastal thicket	-
Asparagus africanus		Asparagaceae	Perennial climber herb	_	NB 149
Aspargus racemosus		Asparagaceae	Perennial climber herb	Miombo-xerophyte	-

Aspargus sp	Nhaua-nhaua	Asparagaceae	Herb	Acacia grassland, Coastal thicket, Miombo-xerophyte	-
Aspilia mossambicensis		Asteraceae	Perennial herb	_	Ban 2546
Asteraceae		Asteraceae	Climber herb	_	FMAB 37
Azadiracta indica		Meliaceae	Tree	Coastal thicket	-
Azanza garckeana		Malvaceae	Tree	Miombo-xerophyte, Acacia grassland, Mixed woodland	NB 206
Balanites maughamii		Balanitaceae	Shrub	Coastal thicket, Mixed woodland	-
Balanites sp.		Balanitaceae	shrub	Mixed woodland	-
Baphia gazensis		Fabaceae	Tree		NB 55
Baphia massaensis		Fabaaceae	Tree		NB 192
Baphia sp.		Fabaceae	Tree	Mixed woodland, Miombo woodland	NB 34
Barleria cf. obtusa		Acanthaceae	subshrub	_	FMAB 101
Barleria delagoensis	cadela	Acanthaceae	Herb	Mixed woodland	NB 80, NB 86
Bauhinia petersiana	Impair/m'pari/kukui	Fabaceae	Tree	Miombo woodland, Mixed woodland	-
Bauhinia sp.		Fabaceae	Tree	Acacia grassland	-
Bauhinia tomentosa	micorra/mucorra	Fabaceae	Tree	Coastal thicket	NB 142
Berchemia zeyheri		Rhamnaceae	Tree	Acacia- grassland	-
Berlinia auriculata		Fabaceae	Tree	_	FMAB 83
Berlinia sp.		Fabaceae	tree	_	FMAB 97
Bidens pilosa		Asteraceae	Herb	Miombo-xerophyte, Mixed woodland	NB 67

Blumea sp.		Asteraceae	Herb	Mixed woodland	-
Boerhavia erecta	Nêphara-Neparra/ Nakorrokowondo/ Naparra-naparra/ Neparra-neparra	Nyctaginaceae	Tree	Coastal thicket	-
Boerhavia scabra		Nyctaginaceae	Herb		NB 59
Bombax rhodognaphalon	Muma	Bombacaceae	Tree	Miombo-xerophyte, Acacia grassland, Mixed woodland	-
Bombax sp.		Bombacaceae	Tree	_	-
Boscia albitrunca		Capparaceae	Tree	Mixed woodland, Miombo-xerophyte, Acacia grassland	NB 2
Boscia filipes		Capparaceae	Tree	Mixed woodland	-
Boscia sp.		Capparacaeae	Tree	Acacia grassland, Acacia grassland, Mixed woodland, Miombo woodland	-
Boscia transvaalensis		Capparaceae	Tree	Mixed woodland	-
Brachiaria serrata		Poaceae	Grass	Acacia-grassland	Ban 2528
Brachiaria sp.		Poaceae	grass	Acacia -Grassland	FMAB 91
Brachystegia allenii	Pakala/ Tupiri	Fabaceae	Tree	Mixed woodland, Miombo woodland, Miombo-xerophyte	-
Brachystegia boehmii	Kelehenia/ Tacata/ Ntupuri/ Lotaco	Fabaceae	Tree	Acacia grassland, Miombo-xerophyte	-
Brachystegia bussei		Fabaceae	Tree	Miombo-xerophyte	-

Brachystegia glaucescens		Fabaceae	Tree	Miombo-xerophyte, Mixed woodland	Ban 2576, NB 1
Brachystegia sp.		Fabaceae	Tree	Mixed woodland	NB 114
Brachystegia spiciformis	Namurrazimue/pakala/ Miroto/ M'pama/ Mutupuro	Fabaceae	Tree	Miombo woodland, Miombo-xerophyte	-
Brachystegia torrei		Fabaceae	Tree	Miombo-xerophyte, Mixed woodland	-
Brackenridgea zanguebarica	Muauarra	Ochnaceae	Tree	Mixed woodland, Miombo woodland	-
Brackystegia manga	Vate	Fabaceae	Tree	Mixed woodland, Miombo woodland	-
Brackystegia microphylla		Fabaceae	Tree	Miombo woodland, Miombo-xerophyte	-
Brenaniodendron carvalhoi		Fabaceae	Tree	Acacia grassland	-
Bridelia cathartica		Euphorbiaceae	Tree	Coastal thicket	NB 118, NB 169
Bruguiera gymnorhiza		Rhizophoraceae	Tree	Mangroove	FMAB 33
Bulbostylis burchelii		Cyperaceae	Perennial herb cyperoid	Acacia-Capinzal	-
Burkea africana	Unkarara/N'kara ra/Mukararo	Fabaceae	Tree	Miombo woodland, Mixed woodland, Miombo-xerophyte	-
Byrsocarpus boivinianus		Cannaraceae	Herb	_	-
Byssocarpus orientalis		Connaraceae	Tree	Mixed woodland	-

c.f. Acalypha sp.	Sôloco	Euphorbiaceae	Shrub	mixed woodland	-
c.f. Toddaliopsis	Nkovani	Rutaceae	Shrub	Acacia-grassland	-
c.f.Acalypha spp.	Upele	Euphorbiaceae	Shrub	Miombo-Xerophyte	-
Calantrophus procera		Asclepiadaceae	shrub	Coastal thicket	FMAB 41
Canavalia rosea		Fabaceae	Herb	Coastal thicket	-
Canavalia sp.		Fabaceae	Herb	_	Ban 2608
Canavalia virosa		Fabaceae	Herb	_	NB 150
Capparaceae		Capparaceae	subshrub	_	FMAB 84
Capparaceae		Capparaceae	herb	_	FMAB 87
Capparis tomentosa		Capparaceae	Shrub	Coastal thicket	-
Capsicum frutescens		Solanaceae	Herb	_	NB 134
Carphalea sp.		Rubiaceae	Shrub	Acacia-grassland	FMAB 50
Cassia abreviata	Môlua/ Molea/ Moloa	Fabaceae	Shrub	Mixed woodland	-
Cassytha filiformes		Lauraceae	Herb	Coastal thicket	-
Casuarina esquisetifolia		Casuarinaceae	Tree	Coastal thicket	-
Catharanthus roseus		Apocynaceae	Shrub		-
Catunaregam sp.		Rubiaceae	Shrub	_	FMAB 60
Catunaregam spinosa	Etucotuco/ Pâpa/ Pahapa/ Popa	Rubiaceae	Shrub	Acacia grassland, Mixed woodland, Miombo-xerophyte	-

Celosia trigyna	Enyewe (tipo de)	Amaranthaceae	Herb	mixed-woodland	NB 23
Celtis sp.		Celtidiaceae	Shrub	Mixed woodland, Miombo woodland	-
Cenchrus cilliaris		Poaceae	Herb	Miombo-xerophyte, Mixed woodland, Miombo woodland	NB 50
Cenchrus sp.		Poaceae	Herb	Coastal thicket	-
Cerathoteca sesamoides		Pedaliaceae	Herb		NB 45
Ceratophyllum sp		Ceratophyllaceae	Herb	Miombo-xerophyte	-
Ceriops tagal		Rhizophoraceae	Tree	Mangroove	NB 34
Cf Rutaceae		Rutaceae	Shrub	_	Ban 2525
Cf Sonchus		Asteraceae	herb	_	Ban 2531
cf. Ipomoea sp.		Convolvulaceae	herb	_	FMAB 92
cf. Sycomone sp.		Asclepiadaceae	Herb	Coastal thicket	FMAB 44
cf. Synadenium		Euphorbiaceae	Herb	Mixed woodland	-
Chamaecrista absus		Fabaceae	herb	Acacia grassland	Ban 2552, NB 85, NB 153
Chamaecrista mimosoides	Namatikila	Fabaceae	herb	Acacia grassland	-
Chamaesyce mimosoidea		Euphorbiaceae	herb	Acacia grassland	-
Chrysopogon serrulatus		Poaceae	Herb	Acacia-grassland	NB 97, NB 122
Cissus absus		Vitaceae	Herb	Mixed woodland, Miombo woodland	-
Cissus integrifolia	Naharupa/ Ntjárupa	Vitaceae	Climber	Acacia grassland, Mixed woodland, Miombo-xerophyte, Miombo woodland	Ban 2609

Cissus quadrangularis		Vitaceae	Herb	Coastal thicket	-
Cissus sp.		Vitaceae	Climber	Mixed woodland, Miombo woodland	NB 154
Citrus limon	Ndimu	Rutaceae	Exotic shrub		-
Cladostemon kirkii		Capparaceae	Tree	Acacia grassland, Mixed woodland, Miombo woodland	-
Cleistochlamys kirkii		Annonaceae	Tree	Miombo-xerophyte, Mixed woodland, Acacia grassland, Miombo woodland	-
Clerodendrum glabrum		Lamiacae	Shrub	Coastal thicket	-
Clorodendrum sp.		Lamiacae	Tree	Miombo-xerophyte	-
Cocus nucifera		Palmae	Tree	Coastal thicket	-
Coix sp.		Poaceae	Herb	_	NB 143
Cola sp.		Clusiaceae	Tree	Mixed woodland, Miombo woodland	-
Combretum apiculatum	Ehupu/M'parre/ Iupo/ M'tacele/ M'tecele	Combretaceae	Tree	Miombo-xerophyte, Mixed woodland, Miombo woodland	NB 190, NB 201
Combretum hereroense	N'naru/ Nrupanari	Combretaceae	Tree	Mixed woodland, Miombo woodland	-
Combretum caudatisepalum		Combretaceae	Tree	Acacia grassland	-
Combretum collinum	Iúpu / Iúpo/ N´kupatura	Combretaceae	Tree	Mixed woodland, Miombo woodland	NB 199
Combretum erithrophylum		Combretaceae	Tree	Mixed woodland	-
Combretum microphylla		Combretaceae	Tree	Mixed woodland, Miombo woodland	FMAB 88, FMAB 63

Combretum molle		Combretaceae	Tree	miombo woodland	NB 36
Combretum sp.	Tricatura	Combretaceae	Tree	Acacia grassland, Mixed woodland, Miombo woodland	Ban 2541
Combretum zeyheri	Náwa/ Jupo	Combretaceae	Tree	Miombo-xerophyte, Mixed woodland	-
Commelina benghalensis	Nicorroane	Commelinaceae	Herb	Mixed woodland, Miombo woodland	NB 116
Commelina sp.		Commelinaceae	Herb	Acacia grassland, Mixed woodland	-
Commiphira caffra		Burseraceae	Tree	Miombo woodland	-
Commiphora africana	N'ripue	Burseraceae	Tree	Miombo-xerophyte, Mixed woodland, Miombo woodland, Coastal thicket	-
Commiphora neglecta		Burseraceae	Tree	Miombo-xerophyte, Mixed woodland, Miombo woodland	-
Commiphora cf. africana	Namapuipi	Burseraceae	Tree	Acacia grassland	-
Commiphora sp.		Burseracae	Tree	Miombo woodland, Acacia grassland, Mixed woodland	-
Commiphora edulis		Burseraceae	Tree	Mixed woodland, Miombo woodland	-
Commiphora sp.		Burseraceae	tree	Coastal thicket	-
Commiphora sp.		Burseraceae	Tree	Miombo-xerophyte	-
Corchorus aestuans		Tiliaceae	Herb	Mixed woodland, Miombo woodland	NB 25
Corchorus olitorius		Tiliaceae	Herb	Mixed woodland, Miombo woodland	NB 182
Corchorus sp.		Tiliaceae	Herb	Acacia -grassland	NB 155

Corchorus tridens	Namirêtcha-Namirete	Tiliaceae	Dwarf shrub	Acacia grassland	-
Corchorus trilocularis		Tiliaceae	Dwarf shrub	Acacia grassland, Miombo-xerophyte, Coastal ticket, Mixed woodland	FMAB 56
Cordyla africana	M'roto	Fabaceae	Tree	Miombo woodland, Acacia grassland, Mixed woodland, Miombo-xerophyte	-
Crinum delagoensis		Amaryllidaceae	Herb	Mixed woodland	Ban 2567
Crinum sp.		Amaryllidaceae	Herb	Acacia grassland	-
Crinum stuhlmannii		Amaryllidaceae	Herb	Acacia Grassland	-
Croix lacrima			Herb	Mixed woodland, Miombo-xerophyte	-
Crossopteryx febrifuga	Nakusandjere	Rubiaceae	Tree	Mixed woodland	NB 166
Crotolaria goetzei		Fabacea	Herb	_	NB 81, NB 91
Crotolaria labomoides		FAbaceae	Herb	Mixed woodland, Miombo woodland	NB 172
Crotolaria sp.		Fabaceae	Dwarf shrub	_	-
Crotolaria sp.		Fabaceae	Herb	Acacia grassland, Coastal thicket	NB 10
Crotolaria vasculosa		Fabaceae	Herb	_	NB 102
Croton pseudopulchellus		Euphorbiaceae	Tree	Miombo-xerophyte	NB 31
Cryptolepis obtusa		Periplocaceae	climber	Acacia grassland	-
Cucumis rehmannii		Cucurbitaceae	Herb	Mixed woodland	NB 52
Cucumis sp.		Cucurbitaceae	Herb	Mixed woodland, Costal thicket	-

Culcasia facifolia		Cucubitaceae	Herb	_	-
Cussonia arborea	Copo-copo/ Yeratephole	Araliaceae	Tree	Mixed woodland, Miombo woodland	-
Cymbopogon sp.		Poaceae	Herb	Coastal thicket	-
Cynodon dactylon		Poaceae	Herb	Acacia grassland	-
Cyperus distans		Cyperaceae	Perennial herb cyperoid	Mixed woodland, Miombo woodland	Ban 2536, NB 95
Cyperus esculentus		Cyperaceae	Perennial herb cyperoid	Acacia grassland	-
Cyperus kirkii		Cyperaceae	Perennial herb cyperoid	Mixed woodland, Miombo woodland	-
Cyperus mapanioides		Cyperaceae	Herb	miombo woodland	NB 76
Cyperus sp.	Ntipwa/tekele	Cyperaceae	Perennial herb cyperoid	Acacia grassland	Ban 2532
Cyphostemma buchananii		Vitaceae	Herb	miombo-Xerophya	NB 47
Cyphostemma crotalarioides		Vtaceae	Herb	miombo-Xeophyta	NB 168
Cyphostemma gigantophyllum		Vitacae	Herb	Miombo-Xerophyta	NB 175
Cyphostemma sp.		Vitaceae	Climber herb	Miombo-xerophyte, Mixed woodland, Miombo woodland	-
Cyrtochis arcuata		Orchidaceae	Herb	_	NB 207
Cyrtochis sp.		Orchidaceae	Epiphytic	_	FMAB 73

Dactyloctenium aegyptium	namussoro/ Ipadendia/ Ipátandia	Poaceae	Grass	Acacia grassland, Coastal thicket	-
Dactyloctenium giganteum	naparapari/ Ipatângia	Poaceae	grass	Mixed woodland	-
Dactylotenium australe		Poaceae	grass	Mixed woodland	Ban 2550
Dalbergia arbutifolia	Maroro/nahakua	Fabaceae	Shrub	Acacia grassland, Miombo woodland	Ban 2568
Dalbergia melanoxylon	Mepevi/micó	Fabaceae	Tree	Miombo woodland, Mixed woodland, Acacia grassland, Miombo-xerophyte	-
Dalbergia sp.		Fabaceae	Tree	Acacia grassland, Miombo woodland, Mixed woodland	-
Deinbollia oblongifolia	Muaka /n'miti	Sapindaceae	Shrub	Acacia grassland, Mixed woodland	-
Deinbollia sp.		Sapindaceae	Tree	Acacia grassland, Miombo woodland	-
Deinbollia xanthocarpa		Sapindaceae	small tree	Mixed woodland, Miombo woodland	-
Delonix regia		Fabaceae	Tree	Coastal thicket	-
Desmodium salicifolium		Dennstaedtiaceae	subshrub	_	NB 131
Dialium sp		Dennstaedtiaceae	Tree	_	-
Dicerocaryum sp.		Pedaliaceae	Perenial herb prostrate	Miombo woodland	
Dichrostachys cinerea		Fabaceae	Shrub	Coastal ticket, Acacia grassland	-
Dicoma sp.		Asteraceae	Asteraceae	Miombo woodland	FMAB 79
Dicoma sp.		Asteracae	Herb	Miombo woodland	NB 173
Dietes iridioides		Iridaceae	Herb	_	-

Digitaria eriantha	etupo	Poaceae	Grass	Acacia grassland, Mixed woodland, Miombo woodland	Ban 2530, Ban 2605
Digitaria sp.	retiwa	Poaceae	Grass	Miombo-xerophyte, Mixed woodland	NB 18, NB 27, NB 35, NB 128
Dioscorea dumetorum	pomula	Dioscoreaceae	creeper	Mixed woodland	NB 63
Dioscorea sp.		Dioscoreaceae		Miombo-xerophyte	-
Diospyros cf. squarrosa		Ebenaceae	Shrub	Acacia grassland, Mixed woodland	-
Diospyros cf. loureiriana		Ebenaceae	Tree	_	FMAB 61
Diospyros galpinii		Ebenaceae	Herb	Miombo-xerophyte	Ban 2573, NB 190
Diospyros rotindifolia		Ebenaceae	Shrub	Mangroove	FMAB 36
Diospyros sp.	Sindja	Ebenaceae	Tree	Miombo woodland, Mixed woodland	-
Diospyros usambarensis		Ebenaceae	Tree	Coastal thicket	-
Diplorhynchus condylocarpon	Kokodji/ Rocotchi	Apocynaceae	Tree	Miombo woodland, Acacia grassland, Mixed woodland, Miombo-xerophyte	-
Dombeya acutangula		Sterculiaceae	Tree	Miombo woodland	Ban 2539
Dombeya burgessiae		Sterculiaceae	Shrub	Miombo-xerophyte	-
Dombeya kirkii		Sterculiaceae	Tree	Mixed woodland, Miombo woodland	NB 120
Dombeya shupangae	Catapuri	Sterculiaceae	Tree	miombo woodland	-

Dombeya sp.		Sterculiaceae	Tree	Miombo-xerophyte, Miombo woodland, Mixed woodland, Acacia grassland, Coastal ticket	-
Doviyalis longispina		Dipterocarpaceae	Tree	Mixed woodland, Miombo woodland	-
Dracaena sp.		Dracaenaceae	Tree	Miombo-xerophyte, Mixed woodland	-
Drypetes natalensis		Euphorbiaceae	Herb	Mixed woodland, Miombo woodland	-
Echynocloa haploclada		Ebenaceae	Herb		Ban2580
Ehretia sp.		Boraginaceae	Herb	Coastal thicket	-
Ehretia amoena	N'ruta/ N'runta	Boraginaceae	Tree/ Shrub	Acacia grassland, Mixed woodland, Miombo woodland	FMAB 78
Ekbergia sp.		Meliaceae	Tree		Ban 2569
Eleusine indica	Etupu/sinyombe	Poaceae	Grass	Acacia grassland	-
Eragrostis ciliaris		Poaceae	Herb	Miombo-xerophyte, Mixed woodland, Acacia grassland	NB 12, NB 69, Ban 2610
Eragrostis heteromera		Poaceae	Grass	Miombo woodland	Ban 2577
Eragrostis sp.		Poaceae	Grass	Miombo woodland	-
Eriosema sp.		Fabaceae	subshrub		FMAB 75
Erythrina abyssinica	Maliconacoma	Fabaceae	Tree	Miombo-xerophyte, Acacia grassland, Coastal ticket	-
Erythrina sp.		Fabaceae	Tree	Acacia grassland	-
Erythrophleum africanum	Mucarara/ Mukarare	Fabaceae	Tree	Mixed woodland, Miombo woodland	-
Erythrophleum aspera		Fabaceae	Tree	_	-

Erythroxylum lasianthum	N'kola	Fabaceae	Tree	Mixed woodland, Costal thicket, Miombo woodland	-
Erythroxylum sp.	Saúpa	Fabaceae	Shrub	_	FMAB 53
Euclea natalensis		Ebenaceae	Shrub	Coastal thicket	-
Euclea sp.		Ebenaceae	Tree	Acacia grassland	-
Eulophia petersii		Orchidaceae	Herb	Miombo-xerophyte	-
Euphorbia confinalis		Euphorbiaceae	succulent	Coastal thicket	-
Euphorbia cooperi		Euphorbiaceae	succulent	Miombo-xerophyte, Mixed woodland, Coastal thicket	-
Euphorbia griseola		Euphorbiaceae	succulent	Miombo-xerophyte	-
Euphorbia hirta		Euphorbiaceae	succulent	Miombo-xerophyte, Acacia grassland, Mixed woodland, Coastal thicket	-
Euphorbia hypercifolia		Euphorbiaceae	succulent	Coastal thicket	-
Euphorbia ingens		Euphorbiaceae	succulent	Acacia grassland, Miombo-xerophyte	-
Euphorbia sp.		Euphorbiaceae	succulent	Miombo-xerophyte, Mixed woodland	-
Euphorbia tirucalli		Euphorbiaceae	succulent	Mixed woodland, Coastal thicket, Miombo woodland, Miombo-xerophyte	-
Eureiandra sp.		Cucurbitaceae	Herb	_	NB 130
Fabaceae	Pothe	Fabaceae	_	_	FMAB 68
Faidherbia albida	Icuti	Fabaceae	Tree	Acacia grassland	-
Fernandoa magnifica		Bignoniaceae	Shrub	mixed woodland	FMAB 96

Ficus abutilifolia		Moraceae	Tree	Miombo-xerophyte	-
Ficus exasperata		Moraceae	Shrub or Tree	_	NB 178a
Ficus glumosa	narale/ Nanresene/ Nragawa	Moraceae	Tree	Miombo-xerophyte	Ban 2544
Ficus sp.		Moraceae	Tree	Miombo-xerophyte	-
Ficus sp.		Moraceae	Tree	Acacia grassland	FMAB 95
Ficus sycomorus	Katjare	Moraceae	Tree	Acacia grassland, Miombo woodland Mixed woodland	-
Fimbristylis hispidula		Cyperaceae	Herb	Miombo-xerophyte	NB 32
Fimbristylis sp.	Narôrô	Cyperaceae	herb	Miombo-xerophyte	Ban 2543
Flacourtia indica	Muziro	Flacourtiaceae	Shrub or small tree	Mixed woodland, Coastal thicket	-
Flagellaria guineensis	Namathalani-Namitale	Flagelarieceae	herb	mixed woodland	NB 178b
Flaveria bidentis		Asteraceae	herb	_	NB 9
Gloriosa superba		Liliaceae	Herb	Miombo-xerophyte	NB 37
Gnaphalium luteo-album		Asteraceae	Herb	_	NB 92
Grewia flavescens	Kukuchulo	Tiliaceae	Tree	Acacia grassland, Mixed woodland, Coastal thicket	-
Grewia forbesii	Buhudo (emaconde)	Tiliaceae	Tree	coastal thicket	NB 109, NB 133
Grewia monticola	Nulula	Tiliaceae	Tree	Acacia grassland	Ban 2627
Grewia sp.	Nakanga	Tiliaceae	Tree	Acacia grassland, Mixed woodland, Miombo woodland	-
Grewia sp.		Tiliaceae	shrub	Coastal thicket	-

Grewia sp.	Nowé	Tiliaceae	shrub	mixed woodland	FMAB 51
Grewia sp.		Tiliaceae	Shrub	_	FMAB 67
Halarena pubescens		Apocynaceae	Shrub	Mixed woodland	-
Heteropogon contortus	iti'khina	Poaceae	Herb	Miombo-xerophyte, Mixed woodland, Miombo woodland	NB 14
Heteropogon melanocarpus		Poaceae	Herb	Miombo-xerophyte, Mixed woodland, Miombo woodland	NB 15
Heteropogon sp.		Poaceae	Herb	Mixed woodland, Coastal thicket	-
Hibiscus altissimus		Malvaceae	Herb	miombo woodland	NB 202
Hibiscus dongolensis		Malvaceae	Herb	miombo woodland	NB 51
Hibiscus mastersianus		Malvaceae	Herb	miombo woodland	NB 89, NB 159
Hibiscus meyeri		Malvaceae	Herb	Miombo-xerophyte	-
Hibiscus micranthus	Namtodge	Malvaceae	Herb	Miombo-xerophyte, Mixed woodland, Miombo woodland	NB 87
Hibiscus palmatus		Malvaceae	Herb	_	Ban 2542
Hibiscus physaloides		Malvaceae	Herb	_	NB 62, NB 83
Hibiscus schinzii		Malvaceae	Herb	mixed woodland	NB 16
Hibiscus sp.		Malvaceae	Herb	Miombo-xerophyte, Miombo woodland	NB 177
Hibiscus surattensis	M'tama/ Mthama	Malvaceae	Herb	Mixed woodland, Miombo woodland	NB 77, NB 125
Holarrhena pubescens	Namele	Apocynaceae	Tree	Mixed woodland, Miombo woodland, Miombo-xerophyte	-

Hoslundia sp.		Lamiaceae	Perennial herb	Acacia grassland	-
Hoslundia sp.		Verbenaceae	shrub	Coastal thicket	FMAB 43
Hugonia orientalis	Macusanae/m'tul utulu	Linaceae	Shrub	Mixed woodland, Miombo woodland	Ban 2564, NB 145
Hugonia sp		Linaceae	Shrub	Mixed woodland	-
Hugonia sp.		Linaceae	Shrub	Miombo woodland	-
Hymenaea verrucosa	N'cumbi	Fabaceae	Tree	Mixed woodland, Miombo woodland	-
Hymenocardia ulmoides	Masipalale/nkulu bina	Euphorbiaceae	Tree	Miombo-xerophyte, Acacia grassland, Mixed woodland, Miombo woodland	NB 54
Hymenodictyon floribundum	N'tumpho	Rubiaceae	Tree	_	-
Hyperthelia dissoluta		Poaceae	Herb	Coastal thicket	-
Hyperthelia hirta		Poaceae	Herb	Miombo-xerophyte	NB 29
Hyperthelia sp.		Poaceae	Herb	Coastal thicket	-
Hyphaene coriacea		Arecaceae	Palm	Acacia grassland, Coastal ticket	-
Hyphaene sp.		Arecaceae	Palm	Acacia-grassland	Ban 2603
Imperata cylindrica	Taka-taka	Poaceae	Grass	Acacia grassland	-
Indigofera hirsuta		Fabaceae	Herb	mixed woodland	NB 28
Indigofera sp.		Fabaceae	Herb	Coastal thicket	-
Indigofera sp.	N'kukummwala	Fabaceae	Perennial herb	Miombo-xerophyte	Ban 2526
Indigofera sp.		Fabaceae	Herb	Acacia grassland	NB 24

Indogofera ormocarpoides		Fabaceae	Herb	Mixed woodland	NB 73, Ban 2611
Ipomoea cairica		Convolvulaceae	Herb	Acacia grassland	-
Ipomoea pes-capre		Convolvulaceae	Herb	coastal Thicket	-
Ipomoea pes-tigridis		Convolvulaceae	Herb	_	NB 57
Ipomoea sp.		Convulvulaceae ae	Trailing herb	Mixed woodland, Miombo woodland	-
Ipomoea sp.		Convolvulaceae	Climber	miombo woodland	FMAB 85
Ipomoea sp. (com latex)		Convolvulaceae	herb	Acacia grassland	-
Jasminum fluminense		Oleaceae	Herb	Acacia grassland	-
Julbernardia globiflora	M'pakala, othaku	Fabaceae	Tree	Miombo-xerophyte, Miombo woodland, Acacia grassland, Mixed woodland	-
Justicia betonica		Acanthaceae	Herb	Mixed woodland	NB 60
Justicia flava		Acanthaceae	Herb	miombo woodland	NB 78, NB 90, NB 152
Justicia sp.	Rupiane	Acanthaceae	Herb	Mixed woodland, Miombo-xerophyte	NB 165
Kahantia virgata		Rubiaceae	Herb		NB 7
Khaya nyasica		Meliaceae	Tree	acacia grassland, Mixed woodland	-
Kigelia africana	Murrucurruco	Bignoniaceae	Tree	Acacia grassland	-
Kraussia floribunda		Rubiaceae	Shrub	_	FMAB 64
Lamiaceae		Lamiaceae	Shrub	_	FMAB 74
Lamiaceae		Lamiaceae	Herb	_	FMAB 76

Landolphia sp.	Mopé/m'pine	Apocynaceae	Climbing herb	_	-
Lannea stuhlmannii		anacardiaceae	Tree	Mixed woodland	-
Lannea discolor		anacardiaceae	Tree	Miombo-xerophyte	-
Lannea schimperi	Canhupo/ Kanhuko	anacardiaceae	Tree	Mixed woodland	-
Lannea schweinfurthii	M'pandja	anacardiaceae	Tree	Mixed woodland, Acacia grassland	-
Lannea sp.		Anacardiaceae	Tree	Miombo-xerophyte, Acacia grassland, Mixed woodland, Miombo woodland	-
Lantana camara		Verbenaceae	Shrub	Coastal thicket	-
Lathyrus sp.		Mamiaceae	Herb	_	NB 48
Launaea cornuta	Newadi/luminyoto	Asteraceae	Herb	_	-
Leonotis cf. leoptelifolia		Lamiaceae	shrub	Coastal thicket	-
Leonotis nepetifolia		Lamiaceae	Herb	Mixed woodland, Miombo woodland	NB 75
Leonotis sp.		Lamiaceae	Herb	Mixed woodland, Miombo woodland	-
Lonchocarpus bussei	Napiche	Fabaceae	Tree	Acacia grassland, Miombo woodland, Mixed woodland	FMAB 98
Lonchocarpus capassa	Mawae	Fabaceae	Tree	Acacia grassland, Mixed woodland, Miombo woodland	-
Lonchocarpus sp.		Fabaceae	Tree	Acacia grassland	-
Ludwigia sp.		Loranthaceae	Herb	Mixed woodland, Miombo woodland	-
Luffa cylindrica		Cucurbitaceae	Herb	Acacia-grassland	NB 180

Maclura africana		Moraceae	Shrub	Coastal thicket	-
Maerua angolensis		Capparaceae	Shrub	Coastal thicket	-
Maerua caffra	Dapelamathu/kulupalameto	Capparaceae	Shrub	Mixed woodland, Miombo woodland	-
Maerua pinnata		Capparaceae	Shrub	miombo woodland	NB 3
Maerua sp.		Capparaceae	Shrub	_	-
Mangifera indica		Anacardiaceae	Tree	Acacia grassland	-
Margaritaria discoidea		Marratiaceae	Tree	Miombo woodland, Mixed woodland	-
Markhamia obtusifolia	Mauthu/nauthu/tatavala	Bignoniaceae	Tree	Acacia grassland, Mixed woodland, Miombo woodland, Miombo-xerophyte	FMAB 100
Markhamia sp.	Papahá	Bignoniaceae	Tree	Acacia grassland	-
Markhamia zanzibarica	Tatavala	Bignoneaceae	Tree	Mixed woodland, Acacia grassland, Miombo woodland	Ban 2554
Maytenus heterophylla		Celastraceae	Shrub	Coastal thicket	-
Maytenus mossambicensis	N´kokwata	Celastraceae	Shrub	_	-
Megastachya mucronata		Poaceae	Grass	miombo woodland	NB 89, NB 97
Melhania forbesii		Sterculiaceae	Dwarf shrub	Coastal thicket	-
Melinis repens	Kamaele/zacoti	Poaceace	Grass	Acacia grassland	-
Memecylon sp.		Melastomataceae	Tree	_	-
Merremia pinnatta		Convolvulaceae	Climber annual herb	Miombo-xerophyte, Mixed woodland	-

Merremia tridentata		Convolvulaceae	Herb	Miombo-xerophyte, Mixed woodland	NB 26, NB 88
Millettia bussei	Sjamoronto, Natica, Nassuruto	Fabaceae	Tree	Mixed woodland, Acacia grassland, Miombo woodland	NB 203
Millettia sp.		Fabaceae	Tree		-
Millettia stuhlmannii	Nampirri/jambire	Fabaceae	Tree	Miombo-xerophyte, Miombo woodland, Mixed woodland, Acacia grassland	-
Mimosa pigra	Namanhoco/ Namanhalo	Fabaceae	Shrub	Mixed woodland	NB 184
Mimusops caffra		Sapotaceae	Shrub	Coastal thicket	-
Momordica balsamina		Cucubitaceae	Perennial herb climber	mixed woodland	-
Momordica charantia		Cucurbitaceae	Herb	mixed woodland	NB 129, NB 208
Monodora grandidieri	Kuripiassa	Annonaceae	Tree	_	-
Monodora junodii	Kuripiassa	Moniaceae	Tree	Mixed woodland	-
Monodora kirkii		Anonnaceae	Tree	Mixed woodland, Miombo woodland	-
Monodora sp.		Annonaceae	Tree	Acacia woodland, Mixed woodland	-
Moringa sp.		Moringaceae	Exotic tree	Coatal Thicket (IBO)	-
Mucuna pruriens	Oyele	Fabaceae	herb climber	Acacia grassland	-
Mundulea sericea	Hadge/Ihadge	Fabaceae	Shrub	Miombo-xerophyte	NB 205
Myrothamnus flabellifolius		Myrothamnaceae	Shrub	Miombo-xerophyte	-
Ochna arborea		Ochnaceae	Tree	Miombo-xerophyte, Mixed woodland, Acacia grassland, Miombo woodland	-

Ochna sp.		Ochnaceae	Tree	Acacia grassland, Mixed woodland, Miombo woodland	-
Ochna sp.		Ochnaceae	shrub	Coastal thicket	-
Ochna sp.		Ochnaceae	Shrub	_	FMAB 62
Ocimum gratissimum		Lamiaceae	Herb	_	NB 65
Olax dissitiflora		Olacaceae	Tree	Acacia grassland, Miombo-xerophyte, Coastal ticket	-
Oldenlandia corymbosa	Merrupani	Rubiaceae	Perennial Herb	_	-
Oplismenus sp.		Opiliaceae	Herb	_	NB 13
Opuntia ficus-indica		Cactaceae	Succulent	Coastal thicket	-
Oxytenanthera abyssinica		Poaceae	Herb	Mixed woodland	NB 197
Ozoroa obovata	Muconhera	Anacardiaceae	Tree	Acacia grassland, Coastal thicket	-
Panicum calvum		Poaceae	Grass	miombo woodland	Ban 2533
Panicum cf.natalense		Poaceae	Grass	_Miombo Woodland	-
Panicum maximum	Maparre	Poaceae	Grass	Acacia grassland, Miombo woodland, Mixed woodland, Coastal thicket	-
Panicum sp.		Poaceae	Herb	Acacia grassland	NB 121
Pappea sp.		Sapindaceae		Coastal thicket	-
Pavetta catophylla		Rubiaceae	Tree	Coastal thicket	Ban 2622
Pavetta sp.		Rubiaceae	Shrub	Coastal thicket	-
Pavetta sp.		Rubiaceae	Shrub	Coastal thicket	FMAB 48
Pellaea viridis		Adiantaceae	Rhizome	Miombo-xerophyte	-

Pemphis acidula		Lythraceae	Shrub	Coastal thicket	FMAB 55a
Pennisetum atrichum		Poaceae	Herb	Miombo woodland	NB 38
Pennisetum purpureum	Chuchuru	Poaceae	Grass	Miombo woodland	Ban 2571
Perotis leptopus		Poaceae	Grass	Mixed woodland	-
Phaulopis sp.		Acanthaceae	Herb	Mixed woodland	NB 8
Phoenix reclinata		Asteraceae	Tree	Acacia grassland, Coastal thicket	-
Phragmites australis		Poaceae	Grass	Mixed woodland	-
Phragmites communs		Poaceae	Herb	Mixed Woodland	NB 187
Phyllanthus amarus		Euphorbiaceae	Shrub	Miombo-xerophyte, Mixed woodland	NB 17
Phyllanthus discoides		Euphorbiaceae	Herb	Coastal thicket	-
Phyllanthus guineense		Euphorbiaceae	Shrub	Mixed woodland	-
Phyllanthus reticulatus		Euphorbiaceae	Shrub	Miombo-xerophyte, Mixed woodland, Acacia grassland, Coastal thicket	-
Phyllanthus sp.		Euphorbiaceae	Shrub	Acacia grassland	-
Phyllanthus sp.		Euphorbiaceae	shrub	Mixed woodland	FMAB 45
Physostigma sp.		Periplocaceae	Herb	Mixed woodland	NB 123
Piliostigma thonningii	Citimbe/ Itimbe	Fabaceae	Tree	Acacia grassland, Mixed woodland, Miombo woodland	-
Plectranthus alboniolanceus		Lamiaceae	Herb	Mixed woodland	NB 539, NB 98

Pluchea dioscorides	M'furia	Asteraceae	Shrub	Acacia grassland, Miombo woodland, Mixed woodland	NB 183
Pluchea sp.		Asteraceae	shrub	Mixed woodland	-
Podocarpus sp.		Podocarpaceae	Tree	Acacia grassland	-
Pogonarthria sp.		Podocarpaceae	Herb	Mixed woodland	-
Prosthecidiscus sp.		Asclepiadaceae	Shrub	Mixed woodland	-
Prostideos sp.		Asclepiadaceae	Tree	Acacia grassland	-
Pseuderanthemum subviscosum		Acanthaceae	Herb	Mixed woodland	NB 108
Pseudolachnostylis maprouneifolia	N'tolo/m'tolo	Euphorbiaceae	Tree	Miombo woodland, Acacia grassland	FMAB 69
Psophocarpus scandens	Navula-Navuli	Fabaceae	Perennial Herb		-
Psychotria sp.		Rubiaceae	Tree	Miombo woodland	NB 160
Pteleopsis myrtifolia	Mulewa/muleba/ m'leia	Combretaceae	Tree	Miombo woodland, Acacia grassland, Acacia grassland, Mixed woodland, Miombo-xerophyte	Ban 2557
Pterocarpus angolensis	Mbila/umbila	Fabaceae	Tree	Miombo woodland, Acacia grassland, Mixed woodland, Miombo-xerophyte	-
Pterocarpus sp.		Fabaceae	Tree	Miombo woodland	-
Pycnostachys urticifolis		Lamiaceae	Herb	Mixed woodland	NB 5
Pycreus cf atrobulbus		Cyperaceae	Herb	Coastal thicket	Ban 2570

Pyrenacantha kaurabassana	Kalomba	Icacinaceae	Perennial climber shrub		-
Randia sp.		Rubiaceae	Shrub	Mixed woodland	NB 61, NB 194
Recinodendrom rauteneii		Euphorbiaceae	Tree	Mixed woodland, Miombo woodland	-
Rhizophora mucronata		Rhizophoraceae	Tree	Mangroove	FMAB 35
Rhus sp.		Anacardiaceae	Tree	Acacia grassland, Coastal ticket	-
Rhynchosia minima		Fabaceae	Climber	Coastal thicket	-
Rhynchosia sp.		Fabaceae	Prostrate herb	Miombo woodland	-
Rhynchosia sp.		Fabaceae	herb	Miombo woodland	FMAB 57
Ricinus communis		Euphorbiaceae	Herb	Coastal thicket	-
Rothmannia manganjae		Rubiaceae	shrub	Mixed woodland	NB 106
Rottboellia cochinchinensis	Nyapa	Poaceae	Herb	Mixed woodland	NB 82
Rourea orientalis	Hunha/muitho/purunha/purundjia	Connaraceae	Shrub	Acacia grassland	-
Rourea boiviniana		Connaraceae	Shrub	Mixed woodland	Ban 2548
Rourea sp.	M'purrunha/ M'purrundjia	Connaraceae	Shrub	Acacia grassland	-
Ruspolia decurrens		Acanthaceae	Herb	Mixed woodland	NB 64a
Saba florida		Apocynaceae	Climber	Mixed woodland	NB 112, NB 141
Sansevieria acinthoides		Liliaceae	Herb	Coastal ticket, Miombo-xerophyte	-

Sansevieria sp.		Liliaceae	Shrub	Mixed woodland, Coastal thicket	-
Schrebera sp.		Olacaceae	Herb	Mixed woodland	-
Schrebera trichoclada	Maiopa/Maiope	Olacaceae	Herb	Miombo woodland	-
Sclerocarya birrea	mepepo	Anacardiaceae	Tree	Miombo- xerophyta, Acacia grassland, Miombo woodland, Mixed woodland, Coastal ticket	-
Sclerocarya caffra		Anacardiaceae	Tree	Mixed woodland, Acacia grassland	-
Senecio sp.	N'wawe	Asteraceae	Herb		Ban 2556
Senecio sp.		Asteraceae	Shrub	Coastal thicket	FMAB 59
Senecio sp.		Asteraceae	Herb	Mixed woodland	NB 6, NB 117
Senna absus		Fabaceae	Herb	Mixed woodland	NB 174
Senna occidentale		Fabaceae	Subshrub	Coastal thicket	-
Senna petersiana	pembenembe	Fabaceae	Shrub	Acacia grassland, Mixed woodland, Miombo woodland	-
Senna siamea		Fabaceae	Tree	Coastal thicket	-
Senna singuena	Nabelambe/ Nabelembe/Renberembe/ Rhepe-rhepe	Fabceae	Tree	Mixed woodland, Miombo-xerophyte	NB 200
Senna sp.		Fabaceae	Tree	Coastal thicket	-
Senna sp.		Fabaceae	shrub	Coastel thicket	FMAB 42
Sesbania sesban		Fabaceae	Shrub	Mixed woodland, Miombo woodland	NB 151
Setaria sp.		Poaceae	Grass	Acacia grassland	-
Sida alba	Vakaliwasakava/ alike	Malvaceae	Herb	Acacia grassland	-

Sida dregei		Selaginellaceae		Mixed woodland, Miombo woodland	NB 144
Sideroxylon inerme		Sapotaceae	Tree	Miombo woodland, Coastal thicket	-
Siphonochilus aethiopicus		Simaroubaceae	Herb	Mixed woodland, Miombo-xerophyte	-
Siphonochilus sp.		Simaroubaceae	Herb	Mixed woodland, Miombo woodland	-
Siphonochilus sp.		Zingiberaceae	Herb	Mixed woodland	-
Solanum anguivi		Solanaceae	Herb	Mixed woodland	NB 139
Solanum panduriforme	Itulu/lula/Tulo	Solanaceae	Dwarf shrub	Acacia grassland, Mixed woodland, Miombo woodland, Miombo-xerophyte	-
Solenostemon autranii		Lamiaceae	Herb	Mixed woodland	NB 113
Sonchus oleraceus		Compositae	Herb	Coastal thicket	-
Sonneratia alba	N´thindir	Sonneratiacae	Shrub/mangrove		-
Sophora inhambanensis		Fabaceae	Shrub	Coastal thicket	FMAB 39
Sorghum arundinaceum	Nahele	Poaceae	Herb	Mixed woodland	NB 186
Sorghum bicolor	Ipwale	Poaceae	Grass	Mixed woodland	Ban 2578
Sorghum sp.		Poaceae	Grass	Acacia grassland	-
Spirostachys africana	N'kumi	Euphorbiaceae	Tree	Miombo woodland, Mixed woodland, Acacia grassland	-
Steganotaenia araliacea		Apiaceae	Shrub	Mixed woodland, Miombo-xerophyte	-

Stenochlaena auliaceae		Blechnaceae		Acacia grassland	-
Sterculia africana		Sterculiaceae	Tree	Coastal thicket	FMAB 46
Sterculia appendiculata	Metil/tile	Sterculiaceae	Tree	Miombo-xerophyte, Miombo woodland, Mixed woodland, acacia grassland	-
Sterculia quinqueloba	Nefomba/tile	Sterculiaceae	Tree	Miombo-xerophyte, Miombo woodland, Mixed woodland, Acacia grassland	-
Sterculia sp.		Sterculiaceae	Tree	Acacia grassland	-
Stereospermum kunthianum	Muterere	Bignoniaceae	Tree	Mixed woodland, Acacia grassland, Miombo woodland	-
Stereospermum sp.		Bignoniaceae	Shrub	Coastal thicket	FMAB 65
Stilochyton maximum		Araceace	herb	Acacia grassland	-
Striga gesnerioides		Scrophulariaceae	Herb	Miombo-xerophyte	Ban 2566, NB 22, NB 40
Strophanthus hypoleicos	M'rincote	Apocynaceae	Shrub	Miombo-xerophyte	-
Strophanthus sp.		Apocynaceae	Shrub	Miombo-xerophyte	-
Strophanthus sp.		Apocynaceae	shrub	Coastal thicket, Miombo-xerophyte	-
Strophantus kombe		Apocynaceae	Shrub	Miombo-xerophyte	Ban 2540, NB 101
Strychnos c.f. madagascariensis		Loganiaceae	Tree	Mixed woodland	-
Strychnos sp.	Nkulukhu	Loganiaceae	Tree	Miombo-xerophyte, Miombo woodland, Mixed woodland, Acacia grassland	-

Strychnos spinosa		Loganiaceae	Shrub	Coastal thicket	-
Strycnos henningsii		Loganiaceae	Tree	Mixed woodland	Ban 2607
Syderoxylon sp.	Nhuiuguidzi	Sapotaceae	Tree	Coastal thicket	FMAB 54
Synaptolepsis sp.		Thymelaceae	Perennial shrub	Mixed woodland	-
Syzygiumm partalaeastrum		Myrtaceae	Herb	Mangroove	FMAB 38
Tabernaemontana elegans	Monalé/ Moreré/Racaraca	Apocynaceae	Tree	Mixed woodland, Miombo woodland, Miombo-xerophyte	-
Tabernaemontana ventricosa		Apocynaceae	Tree	Miombo woodland	-
Tacca leontopetaloide		Taccaceae	Herb	Acacia grassland, Mixed woodland, Miombo woodland	-
Tamarindus indica	Vepa	Fabaceae	Tree	Miombo woodland, Mixed woodland, Acacia grassland, Coastal thicket	-
Tephrosia nictiflora		Fabaceae	Herb	Miombo-xerophyte	NB 49
Tephrosia purpurea		Fabaceae	Herb	Miombo-xerophyte	NB103
Tephrosia sp.		Fabaceae	Shrub	Miombo woodland, Mixed woodland, Acacia grassland, Coastal ticket, Miombo-xerophyte	-
Tephrosia villosa		Fabaceae	Shrub	Miombo-xerophyte	Ban 2579
Terminalia stenostachya	Mucurruco	Combretaceae	Tree	Mixed woodland, Miombo-xerophyte, Miombo woodland	-

Terminalia catapa		Combretaceae	Tree	Coastal thicket	-
Terminalia mollis		Combretaceae	Shrub	Mixed woodland, Miombo woodland	-
Terminalia sericea	Casseche/mipitua	Combretaceae	Tree	Miombo-xerophyte, Mixed woodland	-
Terminalia sp.		Combretaceae	tree	Miombo woodland, Miombo-xerophyte	-
Themeda sp.		Poaceae	Herb	Acacia grassland	-
Themeda triandra		Poaceae	Herb	Miombo-xerophyte	NB 93, NB 167
Thespesia sp.		Malvaceae	Shrub	Mixed woodland	FMAB 86
Thespesia sp.		Malvaceae	Shrub	Mixed woodland	FMAB 99
Tiliaceae		Tiliaceae		Mixed woodland	FMAB 81
Tragia sp.		Euphorbiaceae	Herb	Mixed woodland, Coastal thicket, Miombo woodland	-
Trema orientalis	Camile	Ulmanaceae	Tree	Mixed woodland, Miombo woodland	-
Tribulus terrestris		Zygophyllaceae	Herb	Coastal thicket	-
Tricalysia delagoensis		Rubiaceae	Shrub	Mixed woodland	NB 126
Tricalysia sp.		Rubiaceae	Tree	Acacia grassland, Mixed woodland	-
Trichilia emetica	Pilivili/Pilivili	Meliaceae	Tree	Mixed woodland, Miombo woodland	-
Trichilia zanzibarica		Meliaceae	Tree	Mixed woodland, Miombo woodland	-
Trichilia zeylanicum		Meliaceae	Tree		-
Tricholaena momachne		Poaceae	Herb	Miombo-xerophyte	NB 20, NB 39

Tridax procumbens	Namantale/Namatchahi/ Ndrupavili/Namwakoe/ Namwakoni	Asteraceae	Annual herb	Coastal thicket	-
Triumffetta annua		Tiliaceae	Herb	Mixed woodland	NB 44, NB 157
Triumffetta pentandra	Parapara	Tiliaceae	Annual herb	Mixed woodland, Miombo woodland	NB54a
Triumffetta pilosa		Tiliaceae	Perennial shrub	Mixed woodland, Miombo woodland	NB 111
Triumffetta rhoimboidea		Tiliaceae	Herb	Mixed woodland	NB 70, NB 72
Triumffetta sp.		Tiliaceae	Herb	Mixed woodland	NB 146
Urochloa mosambicensis	Nauphakara	Poaceae	Grass	Acacia grassland, Mixed woodland, Miombo woodland	-
Uvaria caffra		Annonaceae	Tree	Mixed woodland	-
Vangueria infausta	Ntjululu/ N'tululu	Annonaceae	Tree	Mixed woodland, Miombo woodland	-
Vangueria randii		Rubiaceae	Shrub	Miombo-xerophyte	-
Vangueria sp.		Rubiaceae	Tree	Mixed woodland	Ban 2555
Vellozia sp.		Velloziaceae		Miombo-xerophyte	-
Vepris ondulata		Rutaceae		Miombo-xerophyte	-
Vernonia adoensis		Asteraceae	Herb	Mixed woodland	NB 66
Vernonia calyculata		Asteraceae	Shrub	Mixed woodland	NB 74
Vernonia cinerea	Ndrumpwane	Asteraceae	Herb	Mixed woodland	NB 58

Vernonia colorata	Navetha	Asteraceae	Shrub	Acacia grassland, Mixed woodland, Coastal thicket, Miombo woodland	NB 193
Vernonia glabra	Navalo	Asteraceae	Herb	Mixed woodland	NB 135
Vernonia philipsomiana		Asteraceae	Shrub	Mixed woodland	NB 181
Vernonia poskeana		Asteraceae	Shrub	Miombo-xerophyte	NB 58
Vernonia sp.		Asteraceae	Shrub	Acacia grassland	NB 79
Vigna sp.		Fabaceae	Herb	Coastal thicket	-
Vigna unguiculata	Nakuti-nakuti	Fabaceae	Annual herb	Acacia grassland, Mixed woodland	-
Vitex doniana		Lamiaceae	Tree	Miombo-xerophyte, Miombo woodland, Acacia grassland, Mixed woodland	-
Vitex payos		Lamiaceae	Tree	Miombo-xerophyte	Ban 2547
Vitex sp.		Lamiaceae	Tree	Miombo-xerophyte, Miombo woodland, Acacia grassland, Mixed woodland	-
Waltheria indica		Sterculiaceae	Herb	Coastal thicket	NB 115
Xeroderris stuhlmannii		Fabaceae	Tree	Miombo-xerophyte, Mixed woodland, Miombo woodland	-
Xerophyta cf retinervis		Velloziaceae	Perennial herb	Miombo-xerophyte	Ban 2534
Xerophyta retinervis		Vellozaceae	Herb	Miombo-xerophyte	NB30
Xerophyta sp		Velloziaceae	Perennial herb	Miombo-xerophyte, Mixed woodland	-
Ximenia americana		Olacaceae	Shrub	Mixed woodland, Miombo woodland	-

Ximenia caffra		Olacaceae	Shrub	Mixed woodland, Miombo woodland	-
Xylotheca tettensis	Akaukau/ Kavokavo	Flacourteaceae	Tree	Acacia grassland, Miombo woodland, Mixed woodland, Coastal thicket, Miombo-xerophyte	Ban2562
Zanha golungensis		Sapindaceae	Tree	Mixed woodland, Miombo woodland, Miombo-xerophyte	-
Zanthoxylum holtzianum	Chafuri/namavele	Rutaceae	Shrub	Acacia grassland	-
Zanthoxylum sp.		Rutaceae		Acacia grassland	-
Ziziphus mauritiania		Rhamnaceae	Tree	Coastal thicket	-
Ziziphus mucronata	Kunassi/masano/ nawinica	Rhamnaceae	Shrub	Acacia grassland	-

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