CONGO NETWORK

Workshop Kisangani

12-14 May 2011

CSB-UNIKIS

DIVERSITY OF THE FLORA PTERIDOPHYTES THE LONG OF THE GRADIENT ALTITUDINAL WITHIN THE KAHUZI BIEGA NATIONAL PARK IN THE FOREST ECOSYSTEM OF MIDDLE AND HIGH ALTITUDE (RD CONGO)

By

MANGAMBU Mokoso Jean de Dieu, Prof. Dr. Elmar ROBBRECHT, Prof. Dr. Van DIGGELEN and Prof. Dr. Honorine NTAHOBAVUKA

belspo

AVEC LE SUPPORT DE LA COOPÉRATION BELGE AU DÉVELOPPEMENT .be

PLAN OF THE PRESENTATION

- Introduction
  - Background and zonation in the KBNP
  - Map of the KBNB and problem statement
- Methodology and Data analysis
- Results
  - Diversity of the Pteridophytes in the KBNP
  - Pteridophytes diversity Curve pattern
  - Pteridophytes diversity Similarities in the three drills according to the altitudinal gradient
  - Influence of tree density on the diversity of Pteridophytes
  - Influence of the environmental variables on the distribution and diversity of Pteridophytes
- Conclusions

INTRODUCTION

- **Backg round**

- **1937**: Creation of Kahuzi-Biega Wildlife Reserve (75.000 ha) (main goal: ***Gorilla beringei graueri*** protection);
- **1970:** Becomes Kahuzi-Biega NP (60 000 ha) (mainly mountain forests);
- **1975**: Park extension to the equatorial forest (600.000 ha)
- **1980:** Recognized as UNESCO World Heritage

- **Zonation in the KBNP**

- Its vegetation spaces out between 678 - 3326 m altitude
- Ombrophile forest of plain (678-1250 m altitude)
- Subhighland Forests or medium forests (1250-1700m altitude)
- Highland Forests (1700-2600 m altitude)
- Forest Afro-subalpine (2600-3326m altitude).

INTRODUCTION

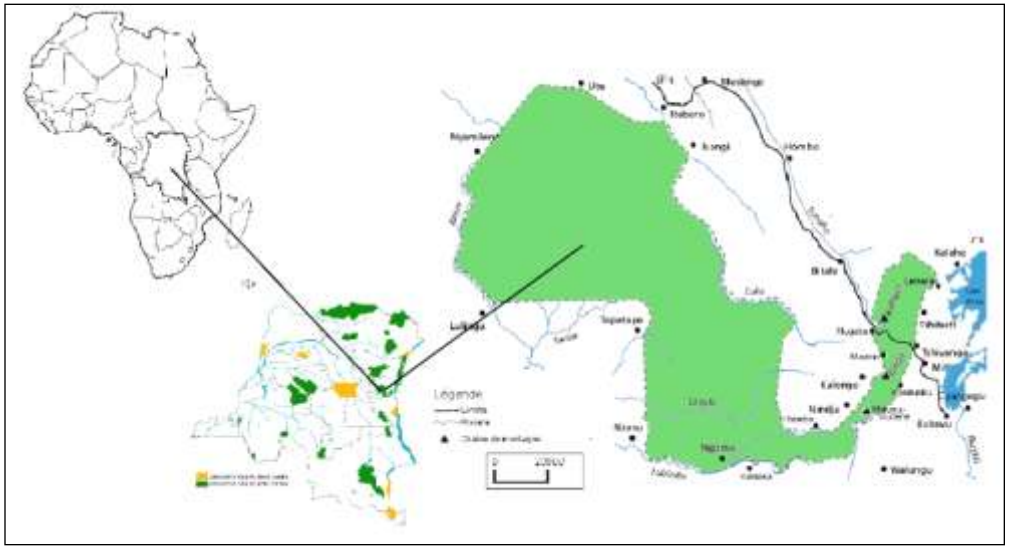
MAP OF THE KBNP

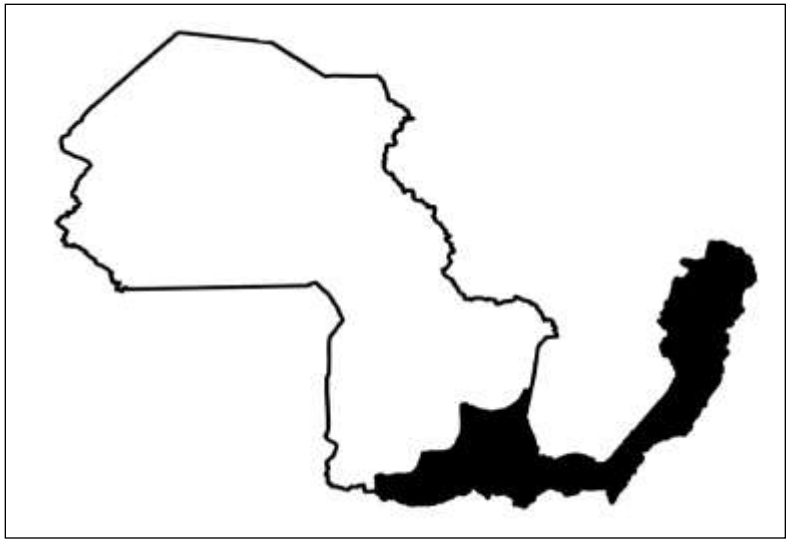
- **Situated at**

- 1 36'-2 37 ' latitude South and
- 27 33'-28 46 ' longitude East

- **Covered surface**

- 2/5 (240.000 ha) of the KBNP





PROBLEM STATEMENT

- The phytodiversity of the KBNP is currently not well known
- Research started in the colonial period (1930)

- **Hypothesis:**
  The altitude influences the diversity of the Pteridophytes flora in the KBNP in the forest ecosystem medium and high altitude.

- **Objectives:**

- to evaluate the Pteridophytes richness and to show the similarity between the 3 floors.
- to highlight the characteristic species for each floor and
- to show the role of the altitudinal variation and the influence of the environmental parameters on the diversity of the Pteridophytes

METHODOLOGY

- **12 transects: between 1279 and 3202 m of altitude**

- **transects**: 2 per side (E and W);
- **2** : the 1st square at the beginning and 2d at the end
- Inventory: Pteridophytes and Cormophytes in DBH ≥ 10 cm

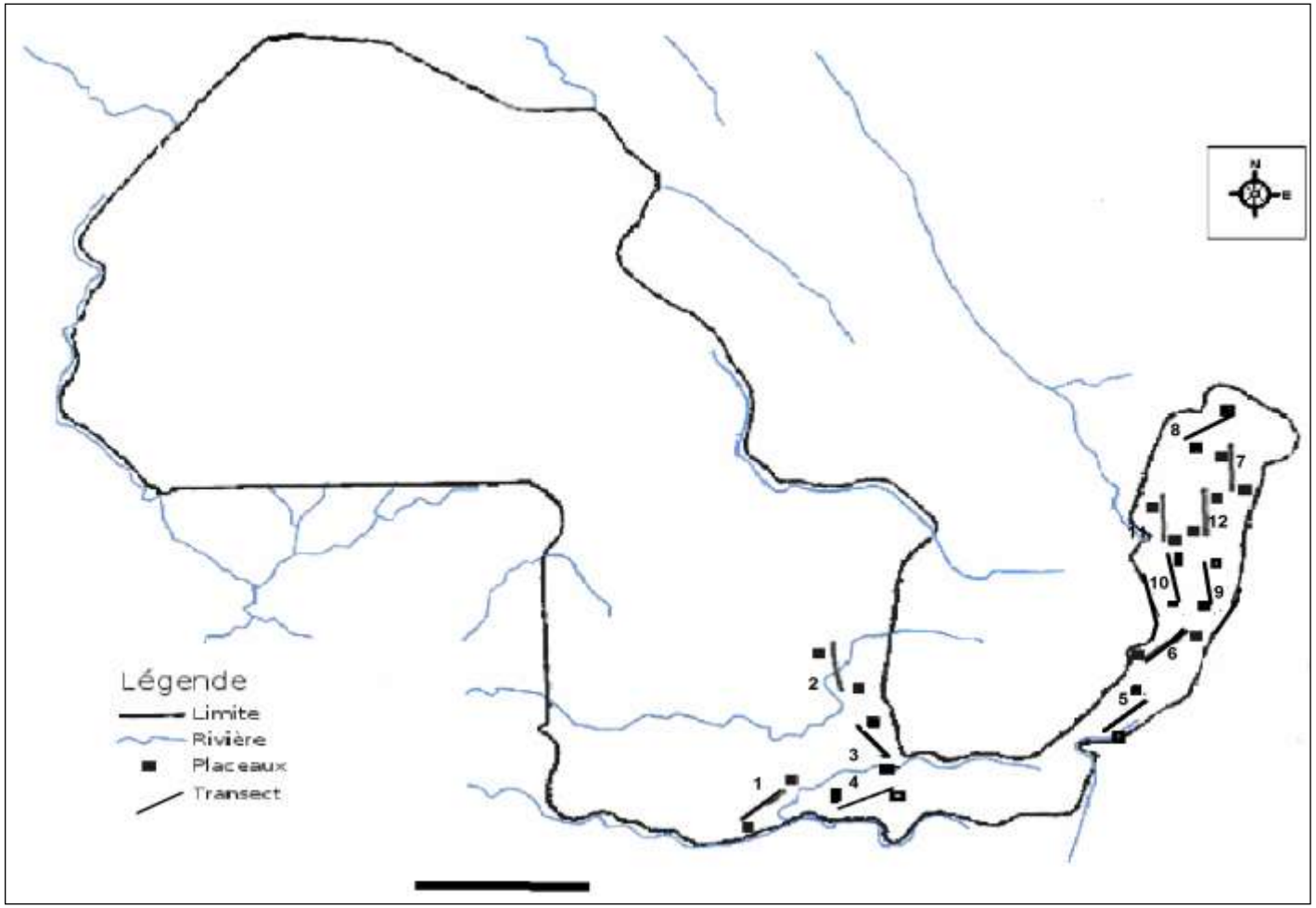
- **24 Squares**

- **Square**: subdivided into 16 quadrants of 25 x 25 m²
- **Inventory**: Pteridophytes and Cormophytes in DBH ≥ 10 cm

- **Criteria for the squares**

- Evolution stage (succession of vegetation) and climax
- Clearings (invasion by some species or nature)
- Vegetation degradation
- Homogeneity or heterogeneity of vegetation

LOCALIZATION MAP OF THE TRANSECTS AND SQUARES ALONG THE ALTITUDINAL GRADIENT



DATA ANALYSIS

- **Indication of biodiversity**

- Shannon-Weaver Indication : ISH = - ∑ (Ni/N) log2 (Ni/N),
- Equitability: EQ = ISH/log2 (N)
- Simpson biodiversity Indicatior : D' = ∑(Ni/N) 2
- Similarity and«'Clustering' » Indicators: K = (2C/A+B) x 100

- **Software**

- Canonical Correspondence Analysis (CCA),
- Statistica, Multi Variate Statistica Package (MVSP),
- The twinspan program « TWINSPAN, HILL, 1994. »

RESULTS

- **Diversity of the Pteridophytes in the KBNP**

- 154 species of the Pteridophytes, 66 genera and 34 families on three floor distributions between 1250 and 3326 m of altitude .
- The Asplenium kind is represented best (with 26 species, either 39,39%), Pteris with 11 species (either 16,66/)
- 194 Cormophytes with a DBH≥ 10 cm.
- **sub highland forest** (the lower extremity): 69 to 77 species/ha.
- **mountain forest** (the intermediate extremity): 93 to 107 species /ha.
- **Afro-subalpine forest** (to the superior extremity): 10 to 42 species/ha.

PTERIDOPHYTES at the KBNP HIGHLAND

Huperzia dacrydioides

Lycopodium carolinum

Huperzia saururus

Coniogramme africana

Equisetum ramossisimum

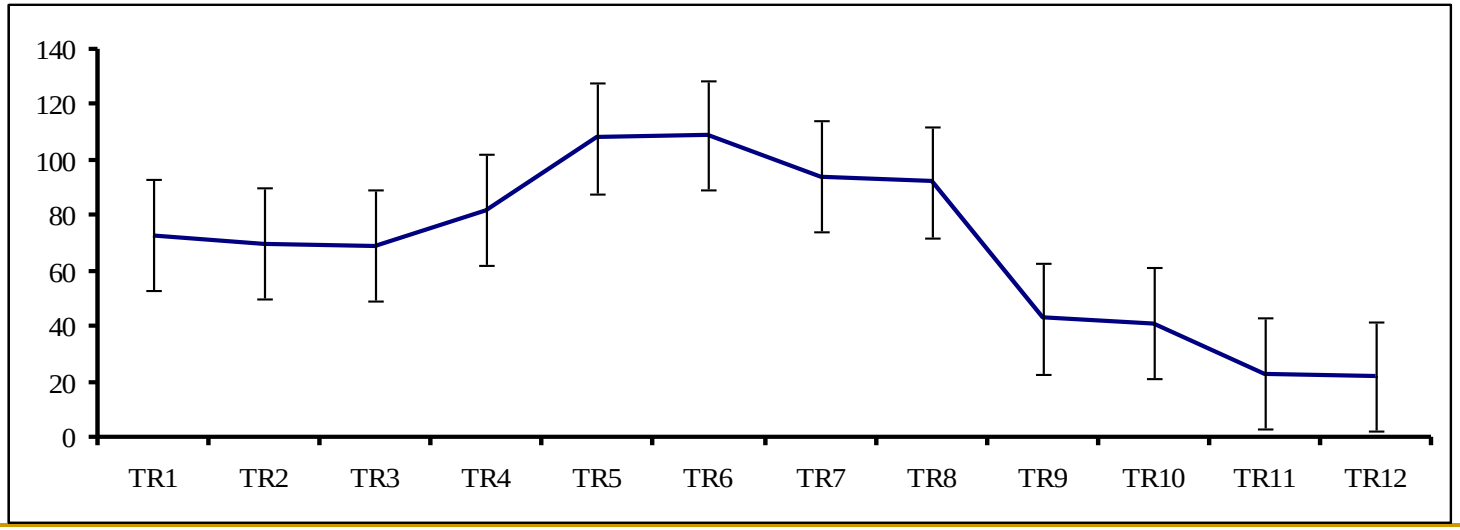
Elaphoglossum kivuense

Blechnum tabulare

Pleopeltis lanceolata

PTERIDOPHYTE DIVERSITY CURVE PATTERN

- **Sub mountain forest** :107 species (either 69,48%). 18 species (either 11,68%) are characteristic. Major species are terrestrial, hemi-epiphytes and hygrophytes.
- **Mountain forest** : 126 species (either 81,81%), 19 (either 12,33%) are characteristic. The major species are epiphytes.
- **Afro-subalpine forest**: 54 species (either 35,06%) and 1 characteristic specie. Major species are epilithes.



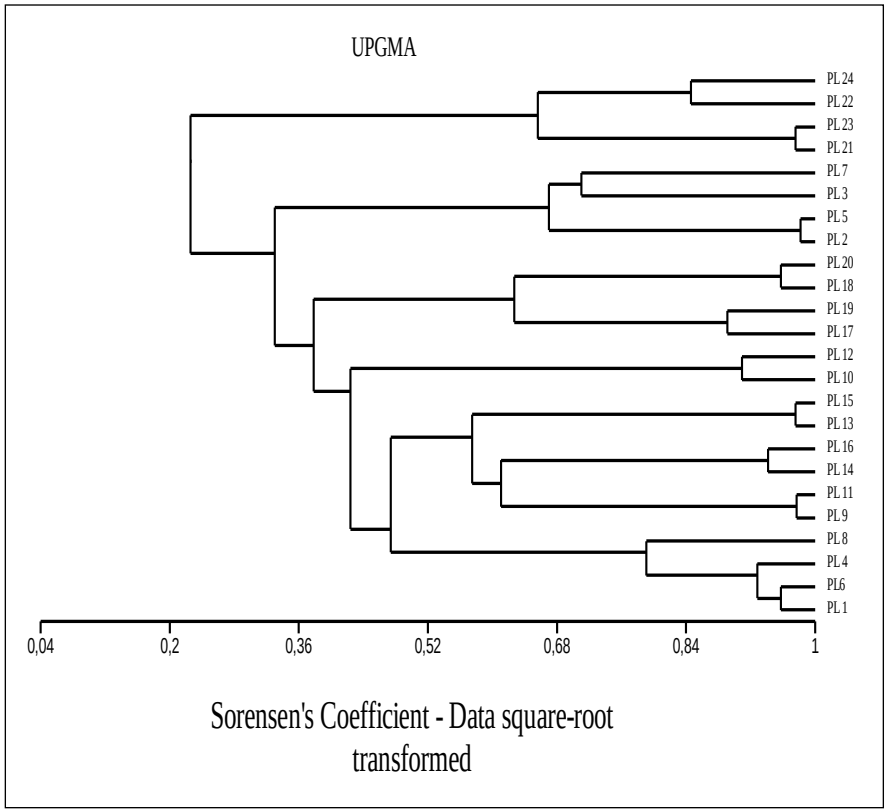
PTERIDOPHYTE DIVERSITY SIMILARITIES IN THE THREE DRILLS ACCORDING TO THE ALTITUDINAL GRADIENT

- **36 species** = 3 floors of the KBNP
- **sub mountain and highland forest:**

- clearings : recovery is weak, diversity is weak
- primary forests: it varies.
- 2 floors have 49 common species, between 1500-2000 m altitude.

- **Afro-subalpine forest:**

- diversity is weak,
- major species are the superior forest mountain



INFLUENCE OF TREE DENSITY ON THE DIVERSITY OF PTERIDOPHYTES

- **Sub Mountain forest** : the trees have rough peels, very long stocks and ramifications at the summit. Density of the trees is increasing much.
- **Mountain forest** : the structure of the hosting plant plays a determining role. The exposed trees host better than the shy ones, light and had big surface on the woody organs.
- **Afro-subalpine forest**: poor species, open covers. Rocky soil.

Type de forêt	Moyenne de DBH_{130} cm	Hauteur des arbres	Densité des arbres par 1ha
Submontagnarde	86,65 64,58	40,45 16,25	121,41 67,25
Montagnarde	80,25 63,37	25,12 12,12	59,04 17,16
Afro-subalpine	40,71 10,55	9,11 7,11	11,11 7,82

LIFE PATTERNS and ADAPTATION of the PTERIDOPHYTES

Pyrrosia schimperiana

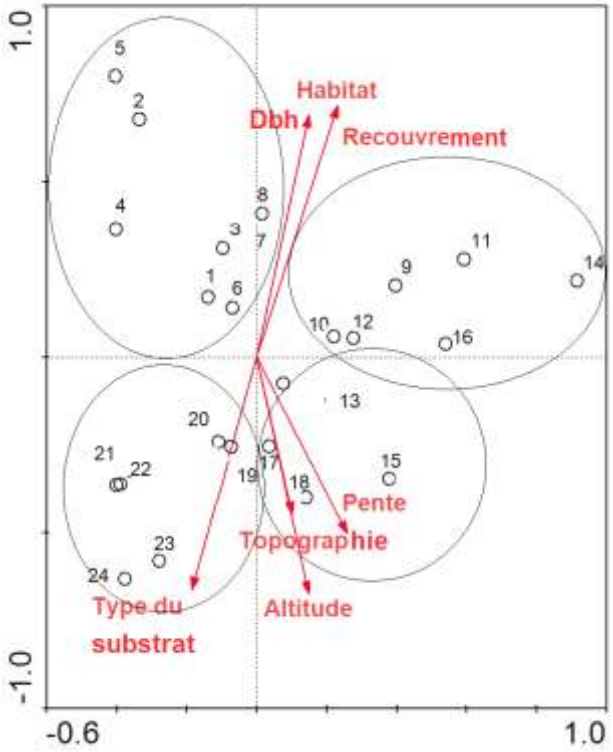
Pleopeltis preussii

Marsilea minuta

Actiniopteris dimorpha

INFLUENCE of the ENVIRONMENTAL VARIABLES on the DISTRIBUTION and DIVERSITY of PTERIDOPHYTES

Valeur propre	0.270	0.157	0.113	0.076	1.000
Correction espèces – environnement	0.757	0.859	0.284	0.683	
Pourcentage cumulé des variances					
des espèces	27.0	42.6	54.0	61.6	
De la relation espèces-environnement	38.4	67.1	69.4	78.2	
Sommes des valeurs propres					1.000
Sommes des valeurs propres canoniques					0.403



- **5 environmental variables**:

• recovery of covers, type of habitat and the DBH of the trees: the sub mountain and mountain floors

•Substratum: Afro-subalpine floor

•Slope, topography: mountain floor

CONCLUSIONS

Results of the study:

- support for managers and scientists
- installation of permanent transects (4 years) with the KBNP
- partnership: UOB-ICCN (NBGB)
- paper and chapter of thesis
- Flora of the Pteridophytes of Central Africa

I thank you