

**Progress Report – January 2007**

**DTech: Tshwane University of Technology**

**HABITAT HETEROGENEITY AND CONSERVATION ROLES OF GLADES IN  
THE MONTANE FOREST OF MOUNT MERU GAME RESERVE**

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**1. Introduction:**

Habitat heterogeneity and the associated animal, bird and plant biodiversity holds unique management challenges, especially in the Mount Meru Game Reserve (66 km<sup>2</sup> in size) where three glade types of different sizes are found. Glades are open grassland patch in the forest. The first type is man-made glades, the second, lower natural glades and the third type, upper natural glades. The first two is located between attitude 1400-1800 m.a.s.l and the third at above 2000 m.a.s.l. These glades constitute 4.8% of the area of the reserve and vary in size from 375 to 37 694 m<sup>2</sup>.

The aim of the study was to understand the biodiversity value and the conservation role of glades in the forest. To do so, I examine the patterns and processes that drive the interaction between animal, birds and plants in the glades and surrounding forests. The second aim was to determine if the man-made and artificially maintained glades should be managed as there now, or should the forest be allowed to re-invade the glades and restore it to its natural environment. The survival of glade-associated species will only then be guaranteed.

**2. Fieldwork**

The fieldwork was conducted in the Mount Meru Game Reserve from early September 2005 to mid May, 2006. The research followed a three-way comparison between three glade types.

**2.1 Vegetation Survey**

At each of the glades, seven transects were laid out: starting at the forest edge and reaching into the forest. A fixed sample size quadrat of 10 m length x 5 m width (50 m<sup>2</sup>) was laid out with a 5 meters buffer zone between transects. Sampling from the forest edge into the glade interior a minimum of one transect and maximum of three transects were laid out depending on the glade size.

## **2.2 Birds Survey**

At each glade, three transects with the central line of the transect located 10, 40, and 70 m from the forest edge were laid out. A fixed-width transect of 10 m long x 30 m wide (300 m<sup>2</sup>) was laid out with a 20 meters buffer zone between transects. The avifauna was recorded by slowly walking (10 m per minute) and recording all species and individuals. Birds were counted from the forest floor to the canopy and their activity pattern recorded. All birds' surveys were conducted between 06h00 to 10h00 and 015h00 to 16h00 when birds are active feeding. Five visits were made to each transect and data combined. During each visit, the sequence of the survey was randomly chosen to avoid bias.

## **2.3 Vegetation and bird analysis**

For each glade type, the species richness and total abundance in each transects were calculated. Shannon diversity index ( $H'$ ) was employed to calculate the species diversity. For each site, the total abundance, species richness and diversity of bird were compared. For plants, the species richness, total abundance, crown cover, and proportion plant ground cover of the five growth forms (forbs, dwarf shrub, grass, trees and shrub) were compared. To determine which vegetation variables (independent) best predict bird diversity (dependent variables) in each habitat, correlation analysis and stepwise multiple linear regression analysis was performed.

Indicator species analysis was employed to detect and describe the value of species as habitat indicator. The method combine information on relative abundance and frequency of each species in a particular habitat to produce and indicator value that ranges from zero to 100 (100 is a perfect indication).

Multiple Response permutation procedure (MRPP) was employed to determine the plant and species composition differed between man-made, lower natural and upper natural glades. MRPP is a non-parametric procedure that evaluates the uniqueness of a group relative to all other permutation

### **3: PRELIMINARY RESULTS**

#### **3.1. Bird indicator species**

Three indicator bird species were identified in the habitat edge of man-made glades: the Collard sunbird, Black-backed puff back and Common bulbul

In the habitat edge of the upper natural glades, three indicator species were identified: the Montane White-eye, Mountain Greenbul and African dusky flycatcher. Also in the upper natural glade forest interior, four indicator bird species were identified. These are Montane White-eye, Mountain Greenbul, African Dusky flycatcher and Brown Woodland Warbler. The indicator species found in upper and lower natural glades indicate that the bird species prefers forest habitats and their survival will depend much on the conservation of the forest habitats from any human disturbance.

Similarly in the habitat edge of manmade glades the indicator birds species found in there, indicates that these species prefers varied habitat types and their survival will depend much on the maintenance of different habitat types.

Test for species compositions (MRPP) between the lower natural, upper natural and manmade glades indicated that bird species found in the three types of habitats were different occupying different species space.

#### **3.2 Plant indicator species**

One hundred and sixty eight plant species were recorded in the forest and one hundreds and twenty one species in the glades of the three habitat types. The plant species composition differed significantly between habitats, i.e. the habitat occupy different region of species in space (MRPP;  $T = -6.13$ ,  $A = 0.20$ ,  $P < 0.001$ ). Tree density for the three habitats types showed that man-made glades had lower tree density compared to lower and upper natural glades. The regression analysis showed that the edge tree density for upper natural glades was significant at  $F(1, 22) = 21.5$ ,  $P < 0.01$

Seventeen plant species were identified as indicators of environmental conditions in the three habitat types. The species included six forbs, four shrubs and seven trees. One forbs was an indicator of man-made glades and five for upper natural glades. For shrubs, one species was

an indicator for lower natural glades, one for upper natural glades and one for man-made glades. While two trees were indicator for man-made glades and five for upper natural glades. In the glade, two grasses and two shrubs were indicator of environmental conditions in the upper natural glades. Similarly two grasses and two shrubs were indicator in the man-made glades, but there was none in the lower natural glades.

### **3.2 Glade size & elevation**

The comparison of glade size between the three habitats (man-made, lower natural and upper natural) using non parametric test Krusal-Wallis test showed that there was no significance difference in size between the glade types. Analysis of variance (ANOVA) between glade types upper natural, lower natural and manmade) in relation to size, attitude and neighbourhood distance, indicated that there was significant difference in altitude between the three habitat types.

### **3.3 Edge distance**

Analysis of variance (ANOVA) for edge distances for the three habitat types against plant parameters (ground cover, canopy cover, species diversity and richness), showed that ground cover increased significantly with edge distance  $P < 0.05$  for the upper and lower natural glades. Multiple regressions for the ground cover showed to be significant at  $P < 0.01$  and species richness was significant at  $P < 0.05$ .

Analysis of variance (ANOVA) for edge distances between the three types of habitats (man-made, upper and lower natural) was compared against variables total abundance, ground cover, canopy cover and species richness. Ground cover increased significantly up to 43 meters into the forest interior, then followed by a sharp decrease in ground cover due to influence of edge effect. Mann-Whitney test was further performed to detect which growth forms influence edge effects to 43 meters into the forest interior. The results indicated that shrubs total abundance was significant at  $Z = -2.10$ ,  $P < 0.04$  for the upper natural glades and significant for tree canopy cover for the lower natural glades at  $Z = -2.03$ ,  $P < 0.04$ .

### **3.4 Bird foraging and habitats**

Bird foraging and habitats (i.e. edge, mid and interior of the forest) showed that on the edge (2.5-22.5meters) 58% of the birds were of aerial foragers, 39% of the birds were ground foragers and 3% were mid foragers.

At mid-forest (32.5-42.5 meters) 59% of the birds were aerial foragers, 36% ground foragers and 5% mid foragers.

In the forest interior (52.5-62.5 meters) 82% of birds were ground foragers and 18% mid foragers. The overall results showed that birds preferred to use the edge habitat over the interior.

### 3.5 The future plans for 2007-2008:

Time	Activity
January -April 2007	Data analysis plants, birds and write up of chapter one in consultation with supervisor
May- June 2007	Travel to Tshwane University and continue with write up of chapter one, two and three. Do presentation for the initial findings.
July – September 2007	Soil data collection, an item identified to be missing in my findings after doing presentation of the initial finding of the reports. Also carryout chemical and physical analysis of glade soils at Serian Agricultural Research Institute in Arusha.
October - December 2007	Travel to Tshwane University of technology for data analysis mammals and primates under the guidance of my supervisor and write up of chapter four and Five.
December 2007- March 2008	Write up of chapter four and five and submission of first draft final report.