
Notes and records

Protecting terrestrial mammal communities: potential role of pine plantations

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Introduction

Conservation efforts traditionally have concentrated on protecting wildlife through establishment of national parks in pristine or semi-pristine habitats. However, as tropical forests and the wildlife they support are increasingly threatened by forest conversion and degradation (Brown & Lugo, 1990; FAO, 1999), pressures increase to consider conservation strategies outside, as well as within, national parks.

In this study, we examine attracting terrestrial mammals to abandoned plantations as a conservation strategy. These plantations could augment existing strategies by serving as park buffer zones or facilitating reforestation in degraded habitats (Chapman & Chapman, 1996; Fimbel & Fimbel, 1996; Zanne & Chapman, in press). In Kibale National Park, Uganda (766 km²), we compared terrestrial mammal abundance between a plantation (Nykatotojo; 86.2 ha) and natural forest site within Kibale, and between Nykatotojo and a plantation (Oruha; 262 ha) outside Kibale.

Materials and methods

The forest site is relatively undisturbed moist-evergreen forest (Skorupa, 1988). The plantation was established in Kibale between 1963 and 1977 in areas dominated by elephant grass (*Pennisetum purpureum*) using softwoods (primarily pines; Kaumi, 1989). After 1970, plantations

were not maintained, and indigenous understorey grew (Zanne & Chapman, in press). Pines were also planted on grassland outside Kibale surrounded by agriculture at Oruha from 1952 to 1967.

From June 1994 to May 1995, large terrestrial mammal abundance in Nykatotojo pines was compared to their abundance in forest. A 1-km transect was established in each area; transects were 0.5 km apart and parallel. Twenty tracking stations (2 m × 2 m) 50 m apart were established along transects by removing litter and exposing soil. In July 1994, both transects were walked in a single day for 20 consecutive days; transect order was alternated. Subsequently, to increase temporal scale, transects were sampled once a month for 11 months. The 20 consecutive days were averaged for a July sample. We analysed number of stations with tracks per sampling time.

From June to July 1996, large terrestrial mammal abundance was determined with increasing distance into the plantation surrounded by forest (Nykatotojo) and into the isolated plantation (Oruha), and total abundance was compared between sites. Twenty tracking stations in Oruha and 40 tracking stations (1 m × 1 m) in Nykatotojo were randomly established as in part one, with twice as many transects in Nykatotojo than Oruha because Nykatotojo was twice as wide as Oruha. Each plantation was monitored for 10 consecutive days. We analysed number of stations with tracks per sampling time. Because sample sizes were small for each species, species were summed into two categories, wild and domestic, and categories were compared between plantations.

Results

In the 1994–1995 study, duiker (*Cephalophus harveyi* and *C. monitcola*), bushbuck (*Tragelaphus scriptus*), bushpig (*Potamochoerus porcus*), and civet/genet (*Viverra civetta*, *Nandinia binotata*, *Genetta* sp.) prints were common and analysed further. Tracks of elephants (*Loxodonta africana*, $n = 2$, pines), sitatunga (*Tragelaphus spekei*, $n = 2$, forest), chimpanzees (*Pan troglodytes*, $n = 5$, forest; $n = 1$, pine), and l'hoesti monkeys (*Cercopithecus l'hoesti*, $n = 8$, forest)

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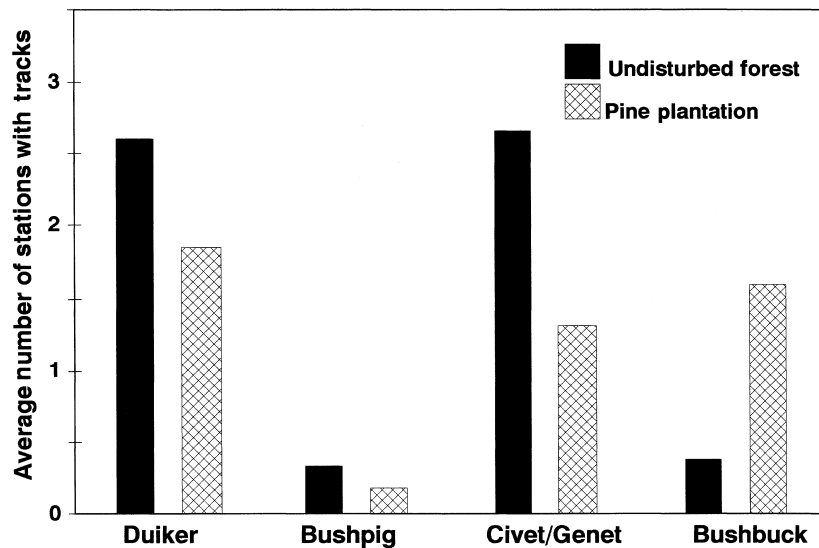


Fig 1 The mean number of tracking stations on which tracks occurred. Stations were monitored for 20 consecutive days

were rare and are not considered further. Sample size (n) represents total stations with tracks across all sampling times.

Tracking stations monitored for 20 days revealed no differences for duiker or bushpig between pines and forest (duiker $t = 1.42$, $P = 0.164$; bushpig $t = 1.29$, $P = 0.204$; Fig. 1). In contrast, bushbuck were less frequent in forest than pines ($t = 3.30$, $P = 0.002$), and civet/genet were more common in forest than pines ($t = 2.29$, $P = 0.028$; Fig. 1).

In the 1-year study, no differences were found between pines and forest for any species (duiker $t = 1.21$, $P = 0.240$; bushpig $t = 0.25$, $P = 0.81$; civet/genet $t = 0.15$, $P = 0.882$; bushbuck $t = 1.74$, $P = 0.098$). Differential use of pines by bushbuck in the intensive sampling period may reflect seasonal food availability.

In the second study, which determined large terrestrial mammal abundance with increasing distance in Nykatojo, red-duiker ($n = 17$), chimpanzee ($n = 31$), and civet ($n = 15$) prints were common while genet and mongoose only occurred once. Chimpanzee tracks were noted only on 2 days. In Oruha, wild mammal prints were rare (civet, $n = 3$; red-duiker, $n = 4$; genet, $n = 1$), while humans and domesticated mammal prints were common in Oruha (dog, $n = 5$; goat, $n = 5$; human, $n = 3$; rabbit, $n = 1$), but absent in Nykatojo.

Nykatojo had greater abundance of total wild terrestrial mammals than Oruha when chimpanzees were

included ($t = -2.84$, $P = 0.013$), but not when chimpanzees were excluded from analyses ($t = -1.19$, $P = 0.250$). However, relative abundance of any given species was less in Oruha than Nykatojo except for genets. When plots were considered in 60-m intervals from plantation edge to interior, no difference in mammal abundance with increasing distance into plantations was found for either Nykatojo for wild ($\chi^2 = 1.91$, $P = 0.75$) or Oruha for domestic ($\chi^2 = 0.76$, $P = 0.420$) mammals; however, a greater abundance of wild mammals occurred in Oruha's interior than edge ($\chi^2 = 4.08$, $P = 0.045$). Thus, wild mammals were moving throughout Nykatojo and domestic mammals were moving throughout Oruha, but wild mammals were more common in Oruha's interior than periphery.

Discussion

Results suggest abandoned pine plantations both surrounded by and isolated from natural forest attract wild terrestrial mammals. Abundance of each species, however, tended to be lower in isolated plantations than plantations surrounded by forest, and wild mammals were more abundant in the isolated plantation's interior than its edge. These results may be due to elevated domesticated mammal and human numbers in and near the isolated plantation and separation of this plantation from natural forest. However, terrestrial mammals in both

plantations are probably more abundant and diverse than in degraded grasslands that plantations replaced. These results suggest several management options requiring further study. For example, plantations planted as buffers may attract more terrestrial mammals than current agricultural and fallow land and serve as wildlife refuges in fragmented landscapes. In addition, plantations may represent a mechanism to restore indigenous forests (Zanne & Chapman, in press).

While terrestrial mammals used plantations, understanding how these mammals use plantations requires further study. These results suggest, in addition to protecting undisturbed habitats in national parks, we should consider values conferred by alternative habitats.

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