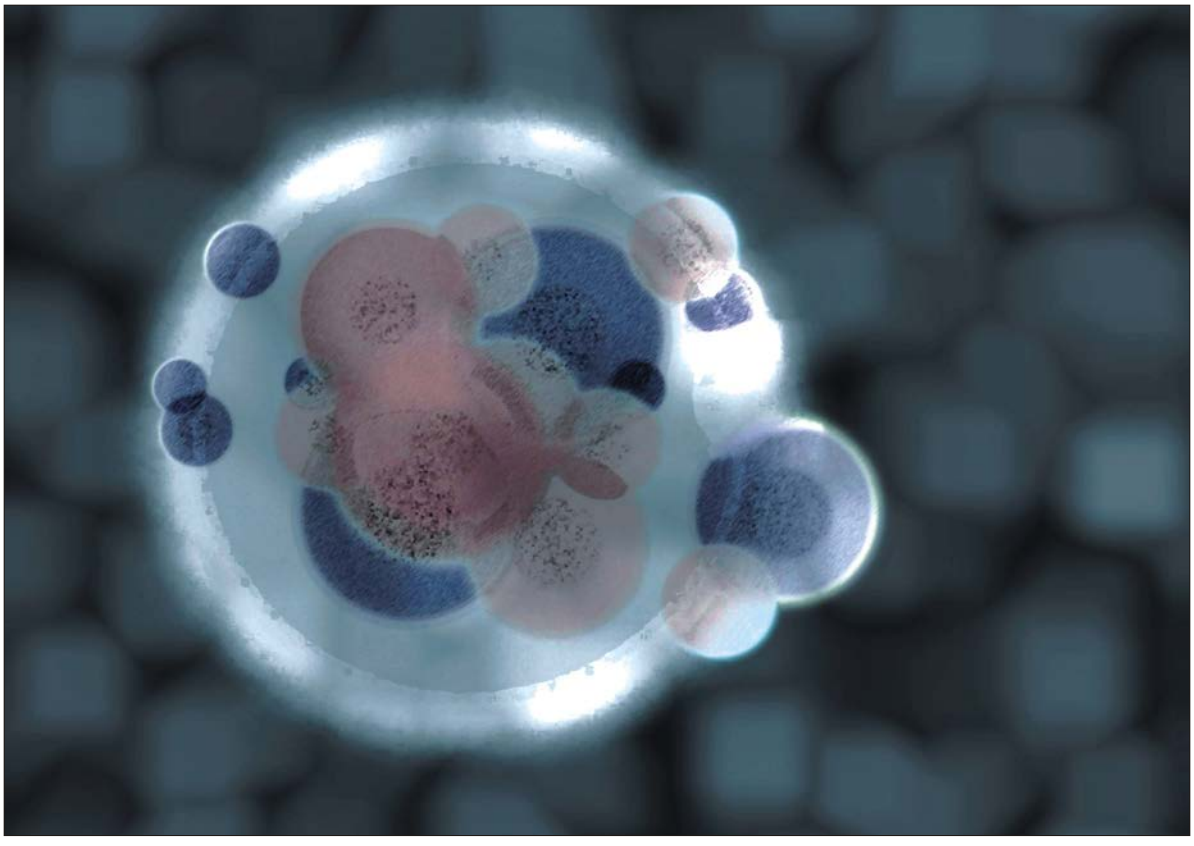

# Journal of Biological Sciences

ISSN 1727-3048

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Journal of Biological Sciences 14 (5): 355-360, 2014
ISSN 1727-3048 / DOI: 10.3923/jbs.2014.355.360


# Population Status and Habitat Association of the Ethiopian Wolf in the Simien Mountains National Park, Ethiopia

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**Abstract:** The aim of the present study is to show current population status, population trends and habitat association of the Ethiopian wolf in the Simien Mountains National Park. Data were collected from November 2010 to October 2012, seasonally. The Ethiopian wolves were counted directly during their social gatherings and border patrols in early morning and late afternoon during wet and dry seasons. Long term population census data were also taken from the Simien Mountains National Park office to analyze the Ethiopian wolf population trends. Data were analyzed using descriptive statistics; variables were compared using chi-square test and one-way ANOVA. The analysis indicated that the current population status of the Ethiopian wolf is estimated to be 98±5.99 individuals with density of 0.37 $km^{-2}$. The trend during the last 11 years census showed that its population is generally increasing from time to time with slight fluctuation. Its percentage population growth rate (r) is 9%. The Ethiopian wolf was associated with different habitat types but mostly observed in *Helichrysum-Festuca* habitat during both wet and dry seasons followed by *Festuca-Lobelia* habitat. Different conservation measures should be applied in order to increase the Ethiopian wolf population and make safe and suitable habitat by minimizing major threats.

**Key words:** Ethiopian wolf, population status, habitat association, Simien Mountains National Park

## INTRODUCTION

Monitoring of carnivore populations is increasing in order to know their status and distribution throughout the world (Woodroffe, 2001). However, usually, most carnivores are rare, illusive or they occur at low density in their habitat so that researchers face challenges to study them (Johnson *et al*., 2001; Boitani, 2003). The difficulty to collect sufficient amounts of reliable data on carnivore distribution, numbers, population structure and habitat requirements is a limitation to the development of effective conservation (Johnson *et al*., 2001). Populations can be managed for one of the three general purposes such as control, conservation and sustained yield (Caughley, 1977).

A systematic analysis of population trends and habitats is essential to mitigate the decline of biodiversity (Kuhl *et al*., 2008). Wildlife monitoring is critical in developing plans for protected area management and the surrounding areas (Kremen *et al*., 1994). Organisms live in a constantly changing environment so that they go through changes in population size (Webb and Bartlein, 1992).

The Ethiopian wolf has become endangered due to many reasons. One reason is its specialized niche that resulted in a restricted distribution to Afro alpine grassland (Yalden, 1983; Kingdon, 1990). The other reason is habitat loss and fragmentation as a result of increased high altitude subsistence agriculture and high human population pressure (Hurni, 1986). It is also affected by direct human persecution and negative attitudes associated with livestock predation. Apparently, the presence of domestic dogs in wolf range which affect the Ethiopian wolf by direct competition and aggression, by transmitting disease and by breeding with them is another cause of decline (Sillero-Zubiri *et al*., 1996; Laurenson *et al*., 1998). Early records from Simien Mountains described as the Ethiopian wolf living and hunting in packs for domestic stock (Yalden *et al*., 1980). However, other records referred to single animal or to small groups (Morris and Malcolm, 1977). According to Sillero-Zubiri and Macdonald (1997), the number of Ethiopian wolf population estimated is not exceeded 500 individual in the country. However, recently the population has been increasing due to different conservation efforts in its range.

Species-habitat associations are a fundamental factor of its ecology and important for guiding wildlife management. Restricting or partitioning these associations is a primary mean by which sympatric

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competitor species can coexist (Schoener, 1974). Habitat partitioning may arise mainly through exploitation and competition (Case and Gilpin, 1974). The distribution of organisms relative to their habitat is of central importance to ecology (Bell *et al*., 1990). Therefore, the aims of the present study are (1) To reveal current population status of the Ethiopian wolf in the SMNP, (2) To show population trend of the Ethiopian wolf in the SMNP and (3) To identify habitat association of the Ethiopian wolf.

## MATERIALS AND METHODS

**Study area:** The Simien Mountains National Park (SMNP) is about 860 km north of Addis Ababa. It is part of the Simien Mountains (between 38000'-38012'E and 13012'-13019'N) in the Amhara National Regional State (Fig. 1). The total area of SMNP is 412 km$^2$. It occupies chains of plateau and grassy plains. The area is part of the Simien massif which includes the highest peak in Ethiopia, Ras Dejen Mountain (4,543 m asl) (Hurni and Ludi, 2000).

SMNP represents one of the most marvelous natural areas in the world. The presence of high number of endemic species, unique bio-physical features and its international significance made SMNP to become a World Heritage Site in 1978. However, in 1996 it was listed as World Heritage Site in Danger. This is due to the declining number of Walia ibex (*Capra walie*), agricultural encroachment, loss of biodiversity and impact of road construction (Falch and Keiner, 2000). The topographic feature of the SMNP is characterized by marvelous landscape composed of a broad undulating plateau. It is also known by its precipitous cliffs, deep gorges and high peaks (Hurni, 1986).

The climate of the SMNP varies from area to area. Generally, highlands have a relatively low temperature. They are cold in early mornings of the dry season. The mean annual rainfall is 1500 mm in a single rainy season (Hurni, 1986). The temperature of SMNP shows high diurnal variability. The annual temperature ranges from -4 to 18°C (Falch and Keiner, 2000). The SMNP is part of the Afro alpine center of plant diversity with high level of endemism (Debonnet *et al*., 2006). Its rich natural vegetation of the SMNP only exists due to the steep gorges. In the SMNP, 57 tree species and herbaceous plants have been recorded (Hurni and Ludi, 2000). The SMNP harbours 22 large mammals, 13 small mammals and 180 bird species (Nievergelt *et al*., 1998).

**Population study:** To examine the current population status and population trend of the Ethiopian wolf, long

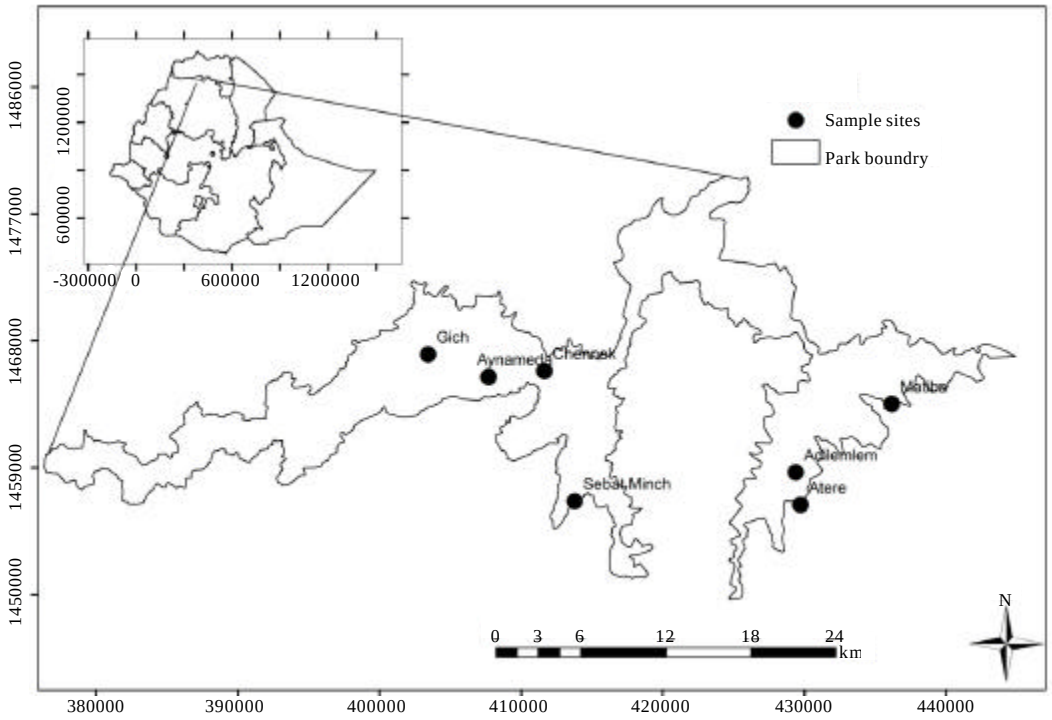


Fig. 1: Map of the Simien Mountains National Park and the study sites

term data was taken from the Park office and combined with the present data. Since it is difficult to apply line transect technique to count the Ethiopian wolf in the Simien Mountains National Park due to its rigorous topography, counting directly during their social gatherings and border patrols in early morning and late afternoon was carried out during wet and dry seasons in selected sample sites. Counts were carried out by keeping records of all wolves seen around their den (Greenwood, 1996). The Ethiopian wolves were encountered in the areas between 3600 and 4160 m asl. During data collection, information such as coordinates, altitude, habitat type, time of sighting, sighting distance, number of individuals, sex and age (adult male, adult female, sub adult male, sub adult female, pup or unidentified sex) were recorded. All these data were recorded from selected sample areas such as Sebat Minch, Chennek, Aynameda, Gich, Atere, Matiba and Adilemlem. These areas are considered to be the main Ethiopian wolf habitat. The total area of these sample sites was 62.8 $km^2$. Thus, to get the total estimates of the Ethiopian wolf population in the study area, the result was extrapolated using GIS (Geographic Information System) by calculating the total area of the Ethiopian wolf habitat in the Park, assuming that Ethiopian wolves are distributed equally in all their ranges. According to the present study, the total area of the Ethiopian wolf habitat calculated in the park was 243.4 $km^2$. The habitat was hand mapped from vantage points using topographic map of the SMNP (scale, 1:100,000). According to Malcolm and Sillero-Zubiri (1997), previous estimate of the Ethiopian wolf population in its range throughout the country was carried out on the basis of the predicted extent of Afro alpine habitats from topographic maps.

**Habitat association:** Whenever there were the Ethiopian wolf sightings, their habitat types were also recorded to see their habitat association. Furthermore, the foecal dropping sites of the Ethiopian wolf were also recorded. In each habitat type, the vegetation structure was investigated and characterized. Then, GPS positions were also recorded. Integration of information helps to accurately reflect species habitat associations (Saveraid *et al*., 2001).

**Data analysis:** Using an eleven years time serious population census data obtained from Park office and present study, population growth rate and percentage growth were calculated. The equation is as follows:

$$\text{Population growth rate } (r) = \frac{\ln (N(t_2)) - \ln (N(t_1))}{t_2 - t_1}$$

$$\text{Percentage growth} = r \times 100\%$$

Where:
N = No. of individuals
t = Time
ln = Natural logarism

## RESULTS

**Population status:** The current population status of the Ethiopian wolf in the Simien Mountains National Park is estimated about 98±5.99 individuals based on the total area of the Ethiopian wolf habitat in the Park. The average numbers of individuals counted during the wet and dry seasons were 2.04±0.35 and 1.37±0.13, respectively. The maximum pack sizes of the Ethiopian wolf observed were 5 and 3 during the dry and the wet seasons, respectively. However, the minimum pack size was 1 during both seasons. The density of the Ethiopian wolf in the Simien Mountains National Park is 0.37 $km^{-2}$. Animal groups observed during the study periods were adult males, adult females, sub adult males, sub adult females and pups. Some individuals were unidentified sex.

Eleven years of monitoring data set of the Ethiopian wolf has provided valuable information to understand more about their population trends in the Simien Mountains National Park. The population trend of the Ethiopian wolf has been increasing from time to time with some fluctuations. The population was 41 in 2002 and 98 in 2012. There was significant variation ($t = 7.7$, $df = 10$, $p<0.001$) in trend of population change with slight fluctuation during 2007 but with continuous growth until 2011 and slight decrease in 2012. However, the change was somewhat stagnant between the year 2002 and 2004 (Fig. 2). The Ethiopian wolf population growth rate (r) in the Simien Mountains National Park was 0.09 and the percentage growth was 9%.

**Habitat association:** The habitat association of the Ethiopian wolf varied significantly during the dry ($\chi^2 = 39.6$, $df = 3$, $p<0.001$) and the wet ($\chi^2 = 43.5$, $df = 5$,

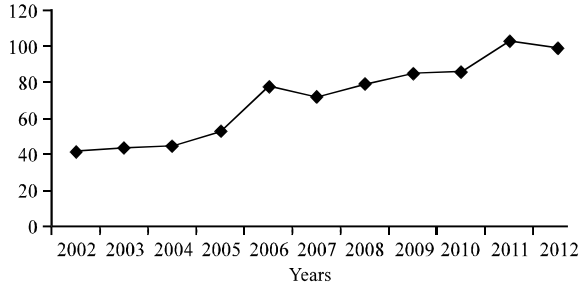


Fig. 2: Ethiopian wolf population trends in the Simien Mountains National Park during the last 11 years (Source: SMNP office and present census data)

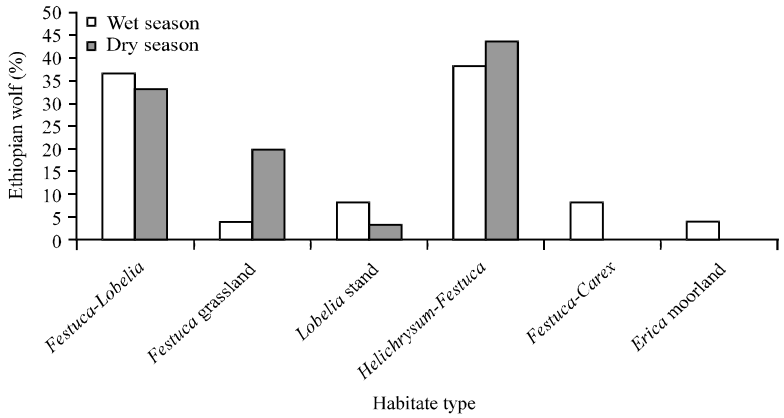


Fig. 3: Percentage occurrence of the Ethiopian wolf in different habitat types during wet and dry seasons

Table 1: Percentage occurrence of the Ethiopian wolf in different habitat types based on their faecal dropping points

| Habitat type | Percentage |
|---|---|
| *Festuca-Lobelia* | 27.6 |
| *Festuca* grassland | 20.8 |
| *Lobelia* stand | 1.9 |
| *Festuca-Helichrysum* | 34.7 |
| *Festuca-Carex* | 5.7 |
| *Erica* moorland | 0.9 |
| *Festuca-Kniphofia* | 5.7 |
| *Helichrysum* meadow | 1.8 |
| *Lobelia-Carex* | 0.9 |
| Total | 100.0 |

$p<0.001$) seasons based on the proportional sightings in each habitat type. The Ethiopian wolf mostly observed in *Helichrysum-Festuca* habitat during the dry (43.4%) and the wet (38.3%) seasons. *Festuca-Lobelia* habitat was another habitat where the Ethiopian wolf spent their time during the dry (33.3%) and the wet (36.7%) seasons. There were no records of the Ethiopian wolf in *Festuca-Carex* and *Erica* moorland habitats during the dry season. On the other hand, 8.3 and 4.2% of the Ethiopian wolf spent their time in *Festuca-Carex* and *Erica* moorland habitats, respectively (Fig. 3).

Using faecal dropping points, habitat association of the Ethiopian wolf was also analyzed. Here the Ethiopian wolf was detected in nine different habitat types. The result also confirmed that *Festuca-Helichrysum* (34.7%) was the main habitat to the Ethiopian wolf and *Festuca-Lobelia* (27.6%) was the second important habitat followed by *Festuca* grassland (20.8%) in the study area. In contrast to this, habitat types such as *Erica* moorland (0.9%) and *Lobelia-Carex* (0.9%) were the least frequently visited area by the Ethiopian wolf (Table 1).

## DISCUSSION

The need for monitoring carnivore populations is increasingly acknowledged in response to growing concern about the status and distribution of terrestrial carnivores throughout the world (Woodroffe, 2001). Estimating animal abundance and understanding their population dynamics is essential for studying population ecology and devising appropriate conservation practice and management (Ginsberg and Macdonald, 1990; Wilson and Delahay, 2001). According to the present study, the current population status of the Ethiopian wolf is estimated to be 98±5.99 individuals in the SMNP. The density of the Ethiopian wolf is 0.37 $km^{-2}$ in the Park. However, previous study by Marino *et al.* (1999) indicated that the density of the Ethiopian wolf in the SMNP used to be 0.18 $km^{-2}$. This indicated that within such long time interval the population has been increased due to improved conservation practices by the Park. On the other hand, the density of the Ethiopian wolf in Guassa area of Menz was 0.19 $km^{-2}$ (Tefera, 2001).

The percentage growth rate (r) of the Ethiopian wolf in the SMNP was 9%. Eleven years of population census data indicated that the Ethiopian wolf has been increasing from time to time with slight fluctuation in the SMNP. This might have caused due to effective conservation practices by the park office and other nongovernmental organizations since some years ago. This includes awareness creation by educating local people about the Ethiopian wolf and other wildlife, allowing people to get benefits from tourists through hiring their pack animals, guarding and others. Some tourists provide books, cloths and medicines to schools, health centers and people in the park.

The distribution of species is determined by evolutionary processes, historical factors and physical tolerance of the species (Campbell, 2004). Species distribution reflects dispersal ability, habitat selection and species interaction (Thomson *et al.*, 1996). Habitat selection links an animal to environmental processes at a variety of spatial scales (Holling, 1992). Usually, habitat

quality is mainly used to evaluate habitat suitability. However, spatial pattern among sites is also important in determining the suitability of habitat for a species (Riitters *et al*., 1997). According to the present study, *Helichrysum-Festuca* habitat was the most preferred habitat during both dry (43.4%) and wet (38.3%) seasons followed by *Festuca-Lobelia* habitat during the dry (33.3%) and wet (36.7%) seasons. Similar result was obtained from analysis of habitat type using faecal dropping points. *Helichrysum-Festuca* habitat accounted for 34.7% where as *Festuca-Lobelia* habitat accounted for 27.6%. This is probably because such *Helichrysum-Festuca* might have not disturbed by livestock so that there were plenty rodents and provided them enough cover and food. Similarly, the distribution of the Ethiopian wolf was correlated with the abundance of rodents in the Bale Mountains National Park (Sillero-Zubiri and Gottelli, 1995) and Guassa Area of Menz (Tefera, 2001). The least frequently visited area by the Ethiopian wolf in the SMNP was *Erica* moorland (4.2%). Similar result has been observed in Guassa area of Menz, where *Erica* moorland was the least preferred habitat type by the Ethiopian wolf (Tefera, 2001). Generally, the Ethiopian wolf population status will increase better than the present figure if appropriate conservation practices including community based conservation is implemented. Furthermore, the available habitat for the Ethiopian wolf in the study area should be conducive for its survival by avoiding threats affecting its population.

## ACKNOWLEDGMENTS

We would like to thank Addis Ababa University for providing fund to conduct this study. We are also grateful to Ethiopian Wildlife Conservation Authority for providing permit to conduct the study in the Simien Mountains National Park.

## REFERENCES

Bell, S.S., E.D. McCoy and H.R. Muschinsky, 1990. Habitat Structure: The Physical Arrangement of Objects in Space. Chapman and Hall, London, UK.

Boitani, L., 2003. Wolf Conservation and Recovery. In: Wolves: Behaviour, Ecology and Conservation, Mech, L.D. and L. Boitani (Eds.). The University of Chicago Press, Chicago, USA., pp: 317-340.

Campbell, L., 2004. Distribution and habitat associations of mammalian carnivores in the central and southern Sierra Nevada. Ph.D. Thesis, University of California, USA.

Case, T.J. and M.E. Gilpin, 1974. Interference competition and niche theory. Proc. Natl. Acad. Sci. USA., 71: 3073-3077.

Caughley, G., 1977. Analysis of Vertebrate Populations. John Wiley and Sons, New York, USA.

Debonnet, G., L. Melamari and B. Bomhard, 2006. Reactive monitoring mission to simien mountains national park, Ethiopia. WHC/IUCN Mission Report, UNESCO, Paris and IUCN, Switzerland.

Falch, F. and M. Keiner, 2000. Simien mountains national park management plan. Final Draft, Amhara National Regional State, Bahir Dar, Ethiopia.

Ginsberg, J.R. and D.W. Macdonald, 1990. Foxes, Wolves, Jackals and Dogs: An action plan for the conservation of canids. IUCN/SSC Canid Specialist Group and Wolf Specialist Group, Gland and Cambridge, Switzerland and UK.

Greenwood, J., 1996. Basic Techniques. In: Ecological Census Techniques, Sutherland, W. (Ed.). Cambridge University Press, Cambridge, USA., pp: 11-109.

Holling, C.S., 1992. Cross-scale morphology, geometry and dynamics of ecosystems. Ecol. Monogr., 62: 447-502.

Hurni, S.J., 1986. Management Plan: Simien Mountains National Park and Surrounding Rural Area. UNESCO World Heritage Committee, Switzerland.

Hurni, H. and E. Ludi, 2000. Reconciling Conservation with Sustainable Development. University of Berne, Switzerland.

Johnson, W.E., E. Eizirik, M. Roelke-Parker and E.J. O'Brien, 2001. Applications of Genetic Concepts and Molecular Methods to Carnivore Conservation. In: Carnivore C onservation, Gittleman, J.L., S.M. Funk, D. Macdonald and R.K. Wayne (Eds.). Cambridge University Press, Cambridge, UK., pp: 335-358.

Kingdon, J., 1990. Island Africa. Collins, London, UK.

Kremen, C., A.M. Merenlender and D.D. Murphy, 1994. Ecological monitoring: A vital need for integrated conservation and development programs in the tropics. Conservat. Biol., 8: 388-397.

Kuhl, H., F. Maisels, M. Ancrenaz and E.A. Williamson, 2008. Best practice guidelines for surveys and monitoring of great ape populations. IUCN, Gland, Switzerland.

Laurenson, K., C. Sillero-Zubiri, H. Thompson, F. Shiferaw, S. Thirgood and J. Malcolm, 1998. Disease as a threat to endangered species: Ethiopian wolves, domestic dogs and canine pathogens. Anim. Conserv., 1: 273-280.

Malcolm, J.R. and C. Sillero-Zubiri, 1997. The Ethiopian Wolf: Distribution and Population Status. In: The Ethiopian Wolf Status Survey and Conservation Action Plan, Sillero-Zubiri, C. and D.W. Macdonald (Eds.). IUCN/SSC Canid Specialist Group, Gland, Switzerland, pp: 12-25.

Marino, J., M.K. Laurenson and C. Sillero-Zubiri, 1999. Distribution of the Ethiopian wolf (*Canis simensis*): Population status and habitat analysis. Ethiopian Wolf Conservation Programme, Report to the National Geographic Society, WildCRU, Oxford, UK.

Morris, P.A. and J.R. Malcolm, 1977. The simien fox in the bale mountains. Oryx, 14: 151-160.

Nievergelt, B., T. Good and R. Guttinger, 1998. A survey of the flora and fauna of the Simien Mountains National Park, Ethiopia. Ethiopian Wildlife and Natural History Society, Addis Ababa, Ethiopia.

Riitters, K.H., R.V. O'Neill and K.B. Jones, 1997. Assessing habitat suitability at multiple scales: A landscape-level approach. Biol. Conserv., 81: 191-202.

Saveraid, E.H., D.M. Debinski, K. Kindscher and M.E. Jakubauskas, 2001. A comparison of satellite data and landscape variables in predicting bird species occurrences in the Greater Yellowstone Ecosystem, USA. Landscape Ecol., 16: 71-83.

Schoener, T.W., 1974. Resource partitioning in ecological communities. Science, 185: 27-39.

Sillero-Zubiri, C. and D. Gottelli, 1995. Diet and feeding behavior of Ethiopian wolf (*Canis simensis*). J. Mammal., 76: 531-541.

Sillero-Zubiri, C., D. Gottelli and D.W. Macdonald, 1996. Male philopatry, extra-pack copulations and inbreeding avoidance in Ethiopian wolves (*Canis simensis*). Behav. Ecol. Sociobiol., 38: 331-340.

Sillero-Zubiri, C. and D.W. Macdonald, 1997. The Ethiopian Wolf: Status Survey and Conservation Action Plan. IUCN, The World Conservation Union, Cambridge, Pages: 123.

Tefera, Z., 2001. Common property resource management of an afro-alpine habitat: Supporting a population of a critically endangered Ethiopian wolf (*Canis simensis*). Ph.D. Thesis, Durrel Institute of Conservation and Ecology, University of Kent, UK.

Thomson, J.D., G. Weiblen, B.A. Thomson, S. Alfaro and P. Legendre, 1996. Untangling multiple factors in spatial distributions: Lilies, gophers and rocks. Ecology, 77: 1698-1715.

Webb, T. and P.J. Bartlein, 1992. Global changes during the last 3 million years: Climatic controls and biotic responses. Ann. Rev. Ecol. Syst., 23: 141-173.

Wilson, J.G. and J.R. Delahay, 2001. A review of methods to estimate the abundance of terrestrial carnivores using field signs and observation. Wildl. Res., 28: 151-164.

Woodroffe, R., 2001. Strategies for Carnivore Conservation: Lessons from Temporary Extinctions. In: Carnivore Conservation, Gittleman, L., S.M. Funk, D.W. Macdonald and R.K. Wayne (Eds.). Cambridge University Press, Cambridge, UK., pp: 61-92.

Yalden, D.W., M. Largen and D. Kock, 1980. Catalogue of the mammals of Ethiopia. Carnivora. Mon. Zool. Ital. N.S. Suppl., 13: 169-272.

Yalden, D.W., 1983. The extent of high ground in Ethiopia as compared to the rest of Africa. SINET Ethiop. J. Sci., 6: 35-39.