

Chapter 3

Endangering Processes

The previous chapter has shown that in the recent past Ethiopian wolves have declined throughout their range. The main threats facing Ethiopian wolves are essentially those encountered by most wildlife today: habitat loss and fragmentation and human interference. The recent decline in the numbers of wolves in Bale seems to be due to a combination of factors that result, directly or indirectly, from the above causes and include: road kills, shooting, disease epizootics, hybridization with domestic dogs and possibly loss of genetic variability. Most of these threats are exacerbated by the Ethiopian wolf's specialization to life in the afroalpine ecosystem of Ethiopia (Gottelli and Sillero-Zubiri 1992, Sillero-Zubiri and Gottelli 1994, 1995a. See also Kingdon 1990, Yalden and Largen 1992).

The relevance of each of these endangering factors and their interaction need to be seen in the context of how rarity and population fragmentation affects a species' survival.

Rarity and Endangerment

Why is the Ethiopian wolf endangered? To understand this we must address the questions of why some species are rare, why populations and species become extinct, and what makes a population vulnerable.

Species may be rare in two senses: they may occur in very restrictive ranges or may not be common even in suitable habitat. There are several reasons why species confined to real or ecological islands show high rates of extinction. Their restricted distribution may limit population size, and allow adverse factors to operate on the entire population. Island species are less likely to receive immigration or be recolonized from neighbouring populations. They may also have evolved adaptations that render them vulnerable to predation or competition from humans, introduced species or their pathogens. Most of the 491 species reported extinct in the last 400 years (WCMC 1992) had restricted distributions, 96% were endemic to single countries and 75% were restricted to islands (Magin *et al.* 1994).

Most rare canids occur at low density, their total population divided into many populations. Examples of rare, low density canids are grey wolves (*Canis lupus* –

0.01–0.001 per km²), African wild dogs (*Lycaon pictus* – one pack per 500/2,000 km²), Asian dhole (*Cuon alpinus*) and bush dogs (*Speothos venaticus* – ca. one per 20 km²). They share other natural history features: all are communal hunters, live in packs, are cooperative breeders, but as a rule only the dominant male and female breed once a year, producing large litters (an important implication of this is that in good years populations can recover quickly). As a consequence, large areas and many populations are required to conserve them.

In contrast, Ethiopian wolves have a narrow ecological niche, living at high density as a strict rodent predator in a few populations scattered in the Ethiopian highlands. The extinction chances of mammal species living on mountain tops are negatively affected by two traits: large body size and habitat specialization (Brown 1971), both characteristics apply to the Ethiopian wolf. A medium-sized canid, its distribution is limited to isolated pockets of afroalpine habitat.

In closed populations (*i.e.* without immigration) such that of the Ethiopian wolf, the reproductive monopoly of only a small number of individuals, sustained over several generations, will lead to the depletion of genetic variation. Genetic variation is a pre-requisite for evolutionary adaptation to a changing environment. Fluctuating populations reach certain minima, known as population bottlenecks, which also have significance in determining the rate at which variability is lost, and occasionally result in biased sex ratios that may affect overall population reproductive success.

Extinction is a natural process, and all species become extinct sooner or latter, simply as a result of variation in population numbers. Adaptive, environmental and stochastic factors operate over populations making them more or less susceptible to extinction. Small populations are more susceptible to local extinction. Large populations may be decimated by catastrophes such as epidemics, cyclones or droughts, and then recover, but small populations are likely to be extirpated by the same catastrophes. Even less dramatic effects, such as a decline in the food resource affecting overall condition, survival and reproductive success over a few years may reduce a small population to a handful of animals, at which point stochastic effects (such as biased sex ratio or heavy

mortality) may lead to local extinction.

Furthermore, in a small population the frequency of mating between close relatives may increase, which can increase random genetic drift and inbreeding depression. Reduced heterozygosity may expose recessive alleles which can reduce fecundity and increase mortality (Templeton 1986), driving a declining population to extinction. The fragmentation of a population and its reduction in size, may also increase the risk of genetic introgression. This may be of particular importance with closely related, sympatric carnivores with small population sizes that are the result of ecological and anthropogenic factors (Brownlow 1996). Members of small populations may become less able to find an appropriate mate, and mate instead with a closely-related species (Hubbard *et al.* 1992, Jenks and Wayne 1992).

Thus the biggest threat for the long-term survival of Ethiopian wolves, and other rare species, is the small size of their remaining populations (Chapters 2 and 6).

Threats to Ethiopian wolves

Habitat Loss and Fragmentation

The specialized Ethiopian wolf's niche as the prime afroalpine rodent predator has resulted in the species' restricted distribution. Afroalpine habitats were geographically widespread during the Pleistocene (Yalden 1983, Kingdon 1990). However, during the last 15,000 years these habitats became increasingly rare and fragmented due to a gradual warming of the African continent that pushed upwards the lower boundaries of the afroalpine grasslands. This process has reduced the habitat available to the Ethiopian wolf by at least one order of magnitude (Gottelli and Sillero-Zubiri 1992, Chapter 2).

Habitat loss and fragmentation are further worsened by increasing high-altitude subsistence agriculture and grazing. The highlands of Ethiopia are among the most densely populated agricultural areas within Africa today: rural densities of 47 people/km² are typical (Mesfin Wolde-Mariam 1972). The problems of habitat destruction, soil degradation and high population pressure are persistent and, although concentrated in the north of the country, are spreading south rapidly. Remnants of afroalpine ecosystems increasingly resemble islands hemmed in by degraded or lowland areas that act as ecological boundaries (Hurni 1986). The risk of local extinctions of many endemic species is increased by this process of insularization (Kingdon 1990), and the resulting susceptibility to human

persecution, hybridization, inbreeding, disease and natural catastrophes.

Loss of habitat can affect the survival of Ethiopian wolves in two ways:

- i) by decreasing the total area of habitat available and therefore placing an upper limit on the global population, and
- ii) through habitat fragmentation.

Much of the Ethiopian wolf's decline during the last few decades is the result of habitat destruction, particularly in northern Ethiopia. Heather and grasslands have been cleared and ploughed to grow cereal crops and provide grazing. The immediate consequences are diminished rodent prey populations and increased conflict with human interests. At least two wolf populations in Gojjam and Shoa have been extirpated due to habitat degradation, and the ranges of other wolf populations have been reduced.

Habitat fragmentation is a complex phenomenon which, at its extreme, causes isolation and therefore increasing vulnerability to demographic stochasticity and the consequent damaging loss of genetic variability (Chapter 5). The fragmentation of the wolf's range is worrying: only two of the five areas the species now inhabits hold more than 100 animals. Even when habitat fragmentation does not result in total isolation, its influence on range geometry (*i.e.* decreasing area and increased fragmentation result in areas with



Habitat degradation in Menz.

relatively larger perimeters) eventually result in increasing contact with humans, roads, livestock and domestic dogs.

In summary habitat loss and fragmentation result in:

- population isolation, increasing the rate at which genetic variability is lost,
- smaller populations, increasing rates of demographic and other stochasticity,
- juxtaposition with human interests, increasing contact with people, livestock and domestic dogs.
- All these factors result in increased risks of local extinction.

Human Factors

In addition to the habitat degradation and loss caused by people, there are other derived threats, such as:

- increased exposure of livestock to wild carnivores, conceivably resulting in stock losses and escalation of human-wildlife conflict,
- increased contact of domestic dogs and wolves, resulting in potential for hybridization and disease transmission,
- increased road kills.

Most canid species have been implicated in predation on livestock. Twenty-one of 34 species of canid have been reported to kill domestic animals (Ginsberg and Macdonald 1990), although for only a few species could this predation be considered economically significant. Although Ethiopian wolves are very rare, they occur locally in fairly high densities and may conflict with people whose livestock share their foraging grounds. This is especially obvious in northern Ethiopia, where the human population is one of the highest in Africa. Predation on livestock may be an indication of the destruction of the Ethiopian wolves' natural habitat, forcing them to turn to prey upon small stock in areas where agricultural practices and overgrazing have diminished the availability of rodent prey. This possibility however, remains to be substantiated.

Unlike the northern highlands, the Bale Mountains have never been heavily populated. In 1984, permanent settlement in BMNP was estimated by an aerial survey to be 2,500 people, approximately one person per km² (Hillman 1986), of which about one third live in wolf habitat. More recently the 1992 census indicated at least 7,000 living within the BMNP boundaries. These people are Oromo pastoralists, depending for their livelihood on cattle and smaller stock which they graze in the mountain grasslands and heathlands. In areas

below 3,500 m raising livestock is combined with the cultivation of barley. Within BMNP, the Oromo have hitherto coexisted peacefully with wolves and other wildlife, although this is quickly changing (see below).

Overgrazing

Extensive overgrazing by cattle may have a significantly unfavourable impact on rodent populations. For example, in Uganda's Queen Elizabeth National Park, highest populations of rodents occurred where large mammals were least numerous, whereas areas heavily grazed had fewer rodents (Delany 1972). However in areas of BMNP moderate grazing may not have a negative influence on rodent populations. In west BMNP the Web Valley meadows seem to be maintained by grazing and carried similar biomass of rodent species to ungrazed areas. Similarly, heath stands kept open by grazing and/or fire may sustain higher rodent densities. Furthermore, vegetation height may have an influence on wolf foraging success, with higher wolf densities occurring in areas of short grass (Sillero-Zubiri *et al.* 1995b).

Regular livestock censuses in the Web Valley indicated a combined average of 22 head of cattle, horses and donkeys per km², with a maximum of 46 heads per km². Sheep and goats forage on the steep valley sides and ridges. Livestock numbers are highest during the late wet season when the herds are kept away from the extensive wheat crops in the lowlands and lowest in the dry season, as the herds are then taken to feed on the fields which have been left fallow. Traditionally, people from all around BMNP regularly take their cattle to the high altitude mineral springs, but the recent prolonged stays of livestock by the springs suggests that their use is becoming the excuse for grazing at high altitudes (Hillman 1986, Kemp-McCarthy 1990). A perception of wild carnivores as



Increasing domestic cattle pose two problems for the remaining Ethiopian wolves: reduction of rodent prey through overgrazing, and increasing contact with the local people's dogs.

predators of livestock may develop with these protracted grazing periods inside wildlife areas.

Persecution by Humans

Local people's attitudes towards Ethiopian wolves vary from indifferent to negative, always in direct relation to their need for farming and grazing land. While wolves in Arsi, Bale and May are tolerated, they are persecuted in the other northern populations. Conflict is likely where there are shepherds, and in some areas Ethiopian wolves have been accused of taking small domestic stock and are persecuted.

Persecution has been notable in Simien (Brown 1964a) where in the past even park staff perceived wolves as vermin (Nicol 1971). Brown (1964a) suggested that wolves may be more nocturnal in locations where they are persecuted. The flight distance of wolves in Simien, however, is not significantly greater than elsewhere, suggesting perhaps that persecution is not the actual cause of the wolves' decline (B. Nievergelt pers. comm., J. Malcolm pers. obs.). A small number of interviews in Menz and Gosh Meda, north Shoa, suggested that wolves are tolerated, although they are perceived as killers of small stock (Sillero-Zubiri 1995).

Until recently the Oromo people were remarkably tolerant of wolves in the Bale Mountains. Four years of close observations on wolf-human interactions showed that wolves and pastoralists interacted very little and coexisted peacefully. The pastoralists did not regard the wolf as a threat to their stock and even occasionally left their sheep unattended during the day. Sixty percent of 40 heads of family interviewed in areas of high wolf density claimed to have lost at least one lamb from their flock to wolves within the last three years, but dismissed such losses when compared to damage by spotted hyaenas (*Crocuta crocuta*) (Gottelli and Sillero-Zubiri 1990). Only two cases of predation on sheep were observed in Bale in more than 3,900 hours of observations, including 946 hours of foraging observations (Sillero-Zubiri and Gottelli 1995a).

Children looking after sheep and goats in BMNP keep any inquisitive wolves away from their herds by shouting and throwing stones, but this was an unusual occurrence. With the exception of rare attacks by children, people were indifferent to wolves. Similarly, wolves did not avoid human habitation and were oblivious to people walking or riding across their range. Wolves drifted cautiously away only if people came within 100 metres or showed interest in them. Wolves seemed to be more aware of approaching tourists than of the Oromo residents (Gottelli and Sillero-Zubiri 1990).

An additional source of wolf persecution in the past came from sport hunters seeking trophies in afroalpine habitat. Sport hunters reputedly shot and killed wolves in West Bale and Arsi on two separate occasions in the 1980s (Gottelli and Sillero-Zubiri 1990). Sport hunting is currently banned in Ethiopia.

Warfare

Ethiopia has suffered the ravages of war between government forces and guerrilla movements for several decades, and only recently has the fighting stopped. War affects wildlife conservation directly through destruction of the environment and shooting of wildlife, and indirectly due to the repercussions on national policy and people. The impact of war is manifested in policy changes, blocking conservation activities, deterring outside funding for projects, and diverting funds from social to military activity. For instance, in the late 1980s up to half of the Ethiopian budget was allocated to defence, reducing the funds available for other activities including education and wildlife conservation. As a consequence of the war most afroalpine ranges in northern Ethiopia were out of bounds for wildlife conservation and surveys. Simien Mountains National Park was closed for at least six years and Park staff became targets of guerrilla activity. In addition to indiscriminate killing of wildlife, the effects of war may linger: land mines may restrict access to conservation areas and kill people and wildlife, and displaced people may be forced to exploit the environment. Much of SMNP was opened for settlement when it was outside EWCO control.

Even areas outside the direct influence of war may suffer increased availability of weapons. Wildlife conservation and park management in BMNP deteriorated quickly following the end of the war and change of government in May 1991. Following the overthrow of Mengistu's government, peaceful coexistence between people and wildlife turned into persecution. Automatic weapons sold by run-away soldiers became widely available, and Ethiopian wolves and other wildlife became shooting targets. The killing seemed to be part of the 'retribution' being carried out by local people against all elements of government, probably fuelled by grudges against the Park administration (Sillero-Zubiri and Gottelli 1993). At least six known adult wolves were shot in late 1991. The shooting of a breeding female led to the death of her 3-week old litter. In another instance, two pups perished after their den was plugged with the corpse of a shot wolf. The slaughter subsided after lengthy discussions with the local elders, but the threat is likely to persist until some sort of gun control is imposed.



Trucks cross the Sanetti Plateau on an all-weather road.

Road Kills

With an ever-expanding human population, increased development and habitat loss, Ethiopian wolves and other afroalpine wildlife are increasingly exposed to death on new roads. As the habitat available to wildlife declines, and contact with man increases, the shooting of wolves from cars or killed by cars may also increase. There is concern that increasing use of roads over the next few years as a consequence of economic growth and increased transport will exacerbate this trend.

The Ethiopian wolves in BMNP are particularly vulnerable to traffic kills because they regularly cross busy roads in Gaysay near Dinsho, and on the Sanetti Plateau, where an all-weather road runs across 40 kilometres of prime wolf habitat. Between 1988–1991 an average of 26 vehicles (mostly trucks) used the road every day (Gottelli and Sillero-Zubiri 1990). The wolves are unafraid of vehicles and ignore them even at close proximity. They may den and rear pups within one hundred metres of the road.

At least two animals were killed on the Sanetti road between 1984–1986 (Hillman 1986). Another four car kills were reported between 1988–1991. Two other animals have been shot from the road and another two were left permanently lame from collisions with vehicles. Some accidents may have been caused by fast driving or heavy mist, but we suspect that some drivers deliberately drive at wolves. A local superstitious belief associates wild canids crossing somebody's path with bad luck (Hillman 1986) and leads some drivers to shoot or run over wolves and other wild canids.

The existence of the road across Sanetti Plateau, and the fearless wolves beside it, are great assets for the development of tourism in BMNP. However, immediate measures should be taken to educate drivers and the local administration to avoid unnecessary wolf deaths.

Road kills may also be a mortality factor elsewhere. A juvenile wolf was killed in 1988 in a road traffic accident between Tarmaber and Mehal Meda in Menz,

north Shoa (M. Melloni, pers. comm.). Similar accidents could occur on other roads across wolf habitat such as the Debre Birhan – Ankober road in Gosh Meda, north Shoa, the Bekoji – Gobesa and Ticho roads in Arsi.

Domestic Dogs

Even when people tolerate wolves human presence may have secondary effects on the survival of the species through the presence of domestic dogs. Wild canids may be affected by domestic dogs in three different ways:

- i) by direct competition and aggression;
- ii) by dogs acting as vectors of disease;
- iii) by introgression and outbreeding depression.

Cases of negative impact of domestic dogs on wild carnivores abound, but a typical one is that of grey wolves and dogs in Italy (Boitani 1983).

Domestic dogs, kept by shepherds to guard livestock from predators, are present throughout BMNP. Very few dogs are fed or looked after, rather they are effectively independent, living on offal and carrion. Dogs pose a threat to wildlife in the northern areas of BMNP, where they reputedly kill antelopes. Dogs are also known to have killed sheep and are a threat to the human population as vectors of rabies, a common disease in Bale Region (Chapter 4).

Every settlement in the Web Valley, has several dogs with an estimated 0.7 dogs per km² in the survey area, at an average of 11 dogs per settlement (Gottelli and Sillero-Zubiri 1990). The presence of large numbers of domestic dogs in prime wolf habitat has been considered the most immediate threat faced by the species in BMNP (Gottelli and Sillero-Zubiri 1992, Gottelli *et al.* 1994).



Domestic dogs accompany the Oromos people living in the Bale Mountains.

In BMNP, dogs roam across wide areas of wolf range and forage on rodents, potentially competing with the wolves for the same food resource. Additionally, all ungulate carcasses that may become available to carnivores, including those of livestock, are quickly monopolized by dogs. Thus a potential source of food is denied to the wolves. Dogs travel regularly with their owners in and out of the Bale Mountains and are then in contact with many other dogs which are attracted to garbage and carrion in villages. These dogs may provide the vehicle for pathogens to reach their wild relatives (Mebatsion *et al.* 1992b, Sillero-Zubiri *et al.* 1996a, Chapter 4).

Wolves normally avoid direct contact with dogs. In all 34 agonistic dog-wolf interactions observed in BMNP dogs always chased away wolves, which were faster than dogs and escaped easily (Sillero-Zubiri 1994). No information is available on wolf-dog interactions in other Ethiopian wolf populations. However, contact between both species is greater at the lower limits of the species' altitudinal range, and thus is likely to increase with increases in human density and habitat fragmentation. Ethiopian wolf packs located at the periphery of a restricted population would therefore have more contact with domestic dogs. A comparable phenomena was observed in Simien where wolves were seen together with sympatric golden jackals (*Canis aureus*) at least four times (Nicol 1971, Nievergelt 1981). Non-resident female wolves dispersing away from centres of high wolf density will face increasing chances of meeting domestic dogs or jackals instead of another wolf.

Hybridization

The Ethiopian wolf is closely related to the grey wolf and coyote and can hybridize with domestic dogs (Gottelli *et al.* 1994, Chapter 5). Following hybridization, a population may be affected by a reduction in fitness (in either fertility or viability) known as outbreeding depression (Templeton 1986). Concern was raised of the possibility that the wolves in BMNP may hybridize with sympatric domestic dogs (Sillero-Zubiri and Gottelli 1991). Some animals in the Web Valley population had an unusual appearance, characterized by shorter muzzles, heavier-built bodies and differences in



An Ethiopian wolf-dog hybrid.

coat patterns. A study of interspecific hybridization and genetic variability indicated that hybridization of wolves and their domestic relatives had indeed occurred (Gottelli *et al.* 1994, Chapter 5).

Disease

As a species becomes more endangered, their last remaining individuals are likely to be concentrated in a few relict populations. Any of these populations could be eradicated by the sudden outbreak of disease. Rabies poses a serious risk for populations of rare carnivores and is possibly the most dangerous disease that may affect the Ethiopian wolf. For instance, rabies was confirmed as the cause for one, and possibly two, epizootics in BMNP, which killed whole wolf packs in 1990 and 1991 and accounted for most of the recorded population decline (Sillero-Zubiri *et al.* 1996a, Chapter 4).

Recent cases of rabies in rare and endangered canids (*i.e.* Ethiopian wolf, Blanford's fox *Vulpes cana*, African wild dog), all surviving in small, fragmented populations, have given a new dimension to concerns about the control of rabies (Macdonald 1993). Epidemiologists must now consider wild carnivores not only as rabies reservoirs but also as casualties of the disease, and efforts should focus not only on control but also on the protection of endangered species.

Due to the importance of the threats posed by hybridization and disease to the survival of Ethiopian wolves these topics are dealt separately in the following two sections (Chapters 4 and 5).