# A conservation assessment of Lycaon pictus

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# *Lycaon pictus* – African Wild Dog

E. Do Linh San

| | |
|---|---|
| **Regional Red List status (2016)** | **Endangered D** |
| National Red List status (2004) | Endangered C2a(i)+D |
| Reasons for change | No change |
| Global Red List status (2012) | Endangered C2a(i) |
| TOPS listing (NEMBA) (2007) | Endangered |
| CITES listing | None |
| Endemic | No |

Their scientific name means "Painted Wolf" and is derived from Greek and Latin terms that refer to their tri-coloured coats. *Lycaon* comes from the Greek word *lykaios* meaning wolfish, and *pictus* comes from the Latin word *picta*, meaning painted.

## Taxonomy

*Lycaon pictus* (Temminck 1820)

ANIMALIA - CHORDATA - MAMMALIA - CARNIVORA - CANIDAE - *Lycaon* - *pictus*

**Common names:** African Wild Dog, Cape Hunting Dog, Painted Hunting Dog, Wild Dog (English), Wildehond (Afrikaans), Lethalerwa (Tswana), Ixhwili (Xhosa), nKentshane (Zulu)

**Taxonomic status:** Species

**Taxonomic notes:** Temminck originally described the African Wild Dog (hereafter Wild Dog) in 1820 from a specimen collected in coastal Mozambique, which was originally thought to be species of hyaena and was classified as *Hyena picta* (Creel & Creel 2002). Later, in 1930, it was placed in the subfamily Canidae (Creel & Creel 2002) and today, Wild Dogs belong to the family Canidae. DNA sequencing suggests that Wild Dogs are phylogenetically distinct from other wolf-like canids (such as wolves and jackals) (Creel & Creel 2002). Thus, they are considered to be a monotypic genus where they are the only remaining representatives of the genus *Lycaon* (Mills et al 1998; Creel & Creel 2002).

## Assessment Rationale

Wild Dogs have disappeared from much of their historic range within the assessment region, however, this decline has mostly been reduced during the last 20 years. The species occupies three distinct population segments in: 1) a protected population in the Kruger National Park (hereafter Kruger); 2) a free-roaming wild population residing and traversing land outside of protected areas, mostly in the northern part of Limpopo, the eastern parts of Northern Cape, northern and northwestern parts of the North West, Mpumalanga, and northern parts of KwaZulu-Natal; and 3) a protected and intensively managed metapopulation in several public and private reserves. The latter was established through a managed metapopulation strategy of active reintroduction and population management implemented by the Wild Dog Advisory Group of South Africa (hereafter WAG-SA) since 1998 (Mills et al. 1998). Although the area of land under metapopulation management has expanded (from three reserves covering 2,082 km$^2$ in March 2000 to 11 reserves covering 4,570 km$^2$ in January 2016), a range contraction has been observed in northern Kruger and the distribution range outside protected areas is poorly understood. Therefore the overall change in extent of occurrence (EOO) and area of occupancy (AOO) is unknown. The number of packs (defined as potential breeding groups containing unrelated adults of each sex) has increased from an estimated 34 in 2000 to an estimated 37 in 2016. The number of mature individuals is estimated at between 90 and 111, depending on the method used to calculate this figure (see **Population**). This represents a 9–73% increase in the number of mature individuals over the last three generations (15 years). Most of this increase has been recorded in the managed metapopulation, which increased nearly five-fold between 2000 and 2016. Although an overall population increase has been observed in the past decade, primarily due to active management, the population remains dangerously small (< 250 mature individuals) and the Endangered listing remains.

Threats facing Wild Dogs within the assessment region are severe and widespread, and while some are stable (direct persecution and disease), others may be increasing (road mortalities, habitat fragmentation and accidental persecution through snares). These threats, combined with natural fluctuations in pack number and pack size, make the species susceptible to slipping quickly into the Critically Endangered category. Continued work by WAG-SA to reintroduce packs into suitably large areas to create resilient subpopulations should be encouraged, and this species should be regularly reassessed to monitor its extinction risk.

**Regional population effects**: The species' range is continuous in parts with the rest of its African range and although dispersal can be impeded by fences and habitat fragmentation, infrequent long-distance dispersals from inside and outside the assessment region have been recorded in the past decade (Davies-Mostert et al. 2012). However, no such dispersals have yet been recorded for

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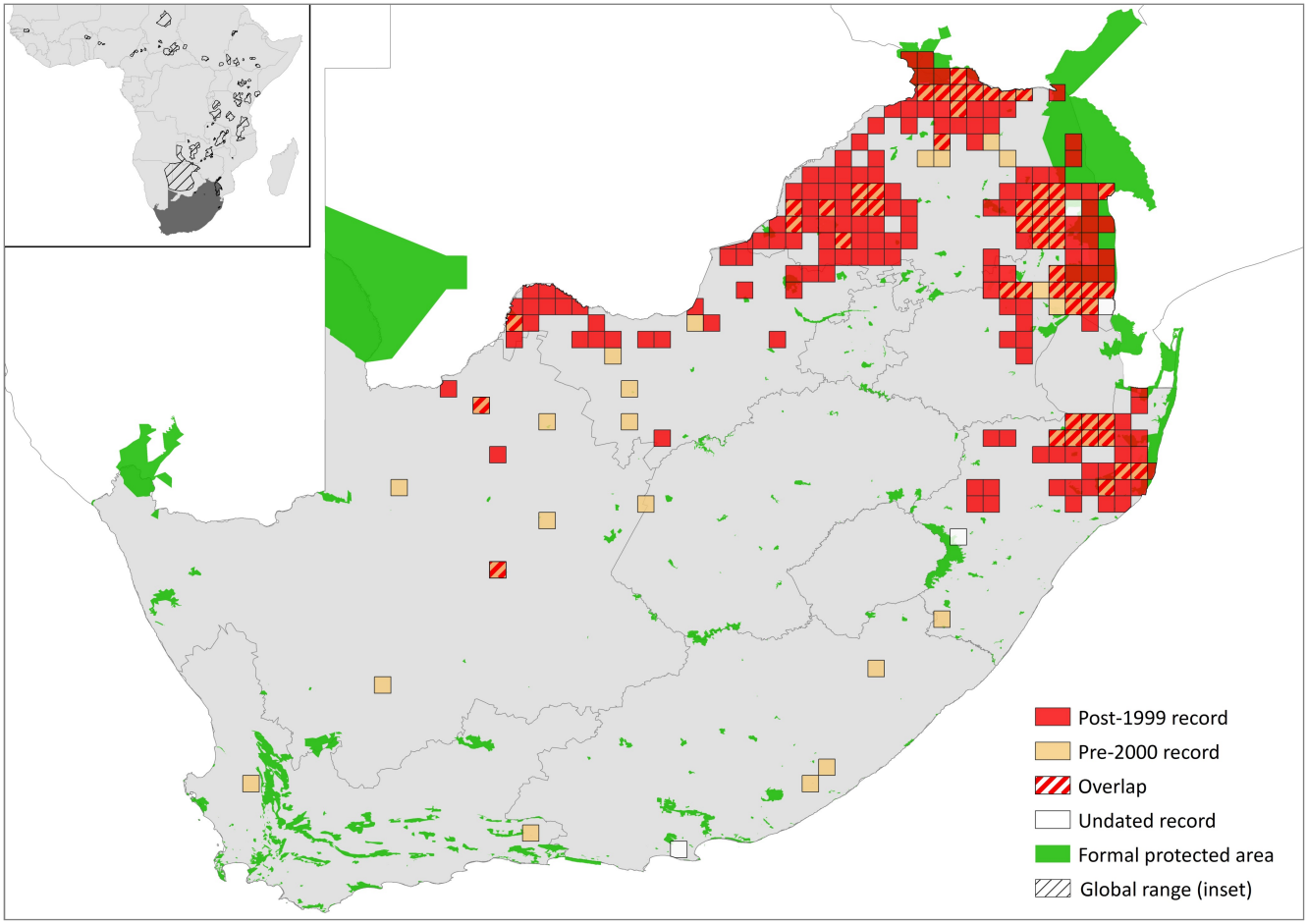



**Figure 1. Distribution records for Wild Dog (*Lycaon pictus*) within the assessment region**

**Table 1. Countries of occurrence within southern Africa**

| Country | Presence | Origin |
|---|---|---|
| Botswana | Extant | Native |
| Lesotho | Possibly extant | Origin uncertain |
| Mozambique | Extant | Native |
| Namibia | Extant | Native |
| South Africa | Extant | Native |
| Swaziland | Possibly extant | Origin uncertain |
| Zimbabwe | Extant | Native |

the Kruger population. While northern parts of the assessment region may potentially be colonised naturally, anthropogenic mortality from direct persecution may preclude any significant rescue affect from outside the region.

# Distribution

Wild Dogs were formerly distributed throughout sub-Saharan Africa, from desert to mountain summits (Thesiger 1970), and were probably absent only from lowland rainforest and the driest desert (Schaller 1972). They have disappeared from much of their former range. The largest populations remain in southern Africa (especially northern Botswana) and the southern part of East Africa (especially Tanzania) (Creel & Creel 2002).

Within the assessment region, free-roaming Wild Dog packs reside in northern, western and eastern Limpopo, and in eastern Mpumalanga. There are free-roaming packs in the Waterberg region of Limpopo and occasionally in the north of KwaZulu-Natal. The latter typically originate as dispersers from managed metapopulation reserves. Transient Wild Dogs have been reported in the eastern parts of the Northern Cape, and in western and northern North West. Reports have also indicated that one free-roaming pack is occasionally seen in the area south of Werda in North West, on the Botswana border, and it ranges along the eastern border of the Khamab Kalahari Reserve (Power 2014). Narrative from the 2004 assessment also noted the presence of a free-roaming pack in this area, with several reports of smaller, dispersing groups (Lindsey et al. 2004). Interestingly, there have been few recent reports of these Wild Dogs, despite increased vigilance for Wild Dog sightings by WAG-SA. This may be because they are adept at avoiding human contact.

Although Wild Dogs were extirpated from most of their range within the assessment region over the past few centuries, a managed metapopulation programme coordinated by the WAG-SA since 1998 has actively expanded the area of occupancy for this species, increasing the number of metapopulation reserves from three to 11, and the area of occupancy of managed subpopulations to 4,570 km$^2$.

Although Wild Dogs are periodically recorded in the north of Kruger, it is suspected that they have not been resident there for the past three generations (Marnewick et al. 2014).

**Table 2. Wild Dog (*Lycaon pictus*) pack structures used in the estimation of number of mature individuals. Weighted mean values are calculated taking into account the numbers of pack-years of data available from each study (following Woodroffe & Sillero-Zubiri 2012).**

| Site | Number of pack-years | Adult & yearling pack size | Proportion male adults & yearlings | Proportion adults & yearlings that are alphas | | Proportion pups with sub-dominant fathers | Proportion pups with sub-dominant mothers | Sources |
|---|---|---|---|---|---|---|---|---|
| | | | | Males (PaM) | Females (PaF) | | | |
| Kruger | 16 | 9.7 | 0.54 | 0.191 | 0.224 | 0.10 | 0.08 | 1, 2 |
| Metapopulation | 75 | 8.5 | 0.56 | 0.209 | 0.270 | - | - | 3 |
| Total | 91 | - | - | - | - | - | - | - |
| Weighted mean | - | 8.7 | 0.56 | 0.206 | 0.262 | 0.10 | 0.08 | - |

**Sources**: 1 - Maddock & Mills 1994; 2 - Girman et al. 1997; 3 - Davies-Mostert, unpublished data from nine reserves between 1998 and 2006.

# Population

Although Wild Dogs are crepuscular, they are infrequently seen, and it appears that populations have always existed at low densities compared to other large African carnivores (Creel & Creel 1996). Extreme fluctuations in population size and rapid pack fusion and dissolution, mean that the number of mature individuals alone is often not a good indicator of overall population size and trends. Pack number (the number of potential breeding groups) is therefore thought to be a more robust indicator of population viability, which has increased from an estimated 34 in 2000 to 37 in 2016, chiefly through the roll-out of a managed metapopulation plan (Gusset et al. 2008; Davies-Mostert et al. 2009). Although the increase in breeding groups is small, by January 2016 there were an additional 10 non-breeding groups in managed metapopulation reserves. Given the active management to ensure that dispersers find mates and form breeding groups, the population is likely to be more robust than suggested simply by calculating the number of actively breeding animals (see explanation below).

Estimating the number of mature individuals is challenging, because Wild Dogs are near-obligate cooperative breeders; within a pack, the alpha male and female are the parents of the majority of surviving pups (Girman et al. 1997), although see Spiering et al. (2010) for exceptions. In Wild Dogs, a high proportion of individuals are indeed reproductively suppressed (Creel & Creel 2002), but these animals do not quickly become reproductive if an alpha individual dies, because in southern Africa they are locked into a seasonal reproductive cycle (only breeding once a year; Courchamp & Macdonald 2001). Death of an alpha may therefore lead to the disintegration of the pack, with no breeding until new packs are formed (although this depends on how much time is available before the next breeding season, and can sometimes be countered by direct management). In instances where there are enough unrelated adult males and females (not alphas) to assume dominance, following the death of one or both alpha animals, there is a high probability of pack persistence in the next breeding season.

Mature individuals are defined as those animals considered capable of reproduction within the current breeding season. Two methods were used to determine mature individuals, based on the census data of 37 breeding packs and 382 adults and yearlings in January 2016.

**Method 1 (following the 2004 national assessment):**

This method assumes that there are, on average, 1.5 adult males and 1.5 adult females per breeding pack. This provides an estimate of 111 mature individuals in 37 breeding packs.

**Method 2 (following the 2008 global assessment):**

This method allows the estimation of numbers of mature individuals (Nm) from the census population of adults and yearlings (Nc), based on demographic data from large unmanaged populations (Table 2). It assumes that the number of mature individuals thus comprises the sum of the number of alpha males (NaM), alpha females (NaF) and subdominant (that is, non-alpha) animals (Nsub) that breed successfully (Woodroffe & Sillero-Zubiri 2012). It assumes an adult sex ratio of 0.56:0.44 males to females (Table 2).

The number of mature individuals is therefore estimated as:

$$\begin{aligned} \text{NaM} &= \text{Nc} \times 0.56 \times \text{PaM} \\ + \text{NaF} &= \text{Nc} \times 0.44 \times \text{PaF} \\ + \text{Nsub} &= (\text{NaM} \times 0.10) + (\text{NaF} \times 0.08) \end{aligned}$$

where PaM and PaF are the proportion of adults and yearlings that are alpha males and females, respectively (from Table 2). This equation was applied to each segment of the population, providing an estimate of 90 mature individuals (Table 3).

The changes observed over the past three generations can largely be attributed to an increase in the number of reserves participating in the Wild Dog managed metapopulation, which have increased from three in 2000 (Hluhluwe-iMfolozi Park, Madikwe Game Reserve, and Pilanesberg National Park) to 11 in 2016 (Table 4). This increase occurred despite several interim setbacks when Wild Dogs have been removed from some participating reserves. Removals were as a result of perceived impacts on prey populations, and unresolvable conflicts with neighbours due to repeated breakouts (Davies-Mostert et al. 2009). Although the metapopulation network has expanded, and the number of packs and mature individuals has increased slightly, continued work is required to maintain this increase and secure areas large enough to sustain resilient and dynamic packs of Wild Dogs (such as in Kruger).

Populations of Wild Dogs are prone to marked fluctuations at a variety of temporal and geographical scales, which

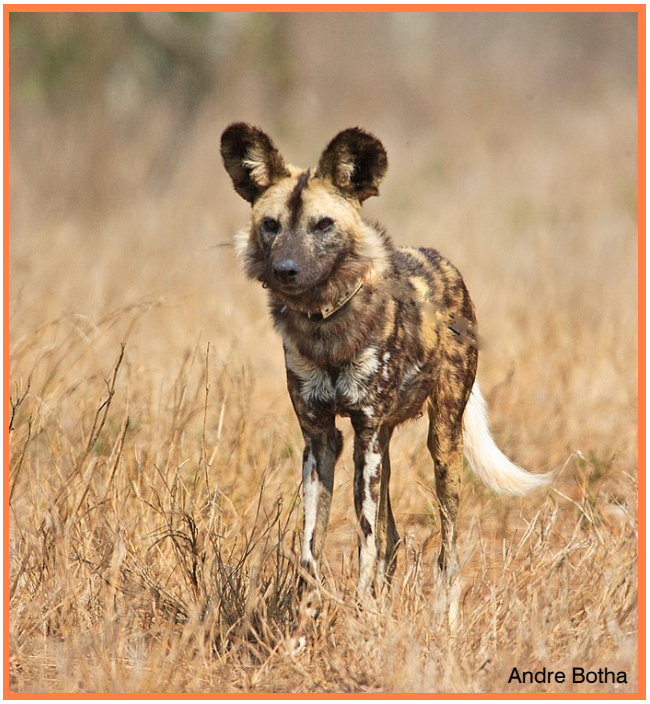
**Table 3. Data used to estimate the number of mature individuals in each segment of the Wild Dog (*Lycaon pictus*) population**

| Estimates required for calculation of number of mature individuals | Population segment | | | Total |
|---|---|---|---|---|
| | Metapopulation | Free-roaming | Kruger | |
| Census population of adults and yearlings (Nc) | 149 | 20 | 213 | 382 |
| Data source for the proportion of adults and yearlings that are alphas (NaM and NaF) – see Table 2 | Metapopulation[1] | Kruger[2,3] | Kruger[2,3] | |
| Number of alphas | 35.1 | 4.1 | 43.8 | 83.0 |
| Number of breeding subdominants | 3.2 | 0.4 | 4.0 | 7.5 |
| Total mature individuals | 38.3 | 4.5 | 47.7 | 90.0 |

[1]Davies-Mostert, unpublished data from nine reserves between 1998 and 2006; [2]Maddock & Mills 1994; 3 - Girman et al. 1997

are likely to both increase extinction risks and undermine the precision of population estimates. At the local scale, a combination of high mortality, high fecundity and dispersal by both sexes means that pack size fluctuates substantially over short periods, although fluctuation in numbers of mature individuals would be less dramatic. Because Wild Dogs are seasonal breeders across most of their remaining geographic range, fluctuations may be synchronised across packs. Managed subpopulations in metapopulation reserves are typically small (often only a single pack) and these populations are highly prone to stochastic events, further exacerbating population fluctuations.

The same demographic characteristics – high mortality, high fecundity, and long-distance dispersal – likewise lead to fluctuations at the population scale. This pattern is further exaggerated by the species' susceptibility to infectious diseases which can cause rapid localised die-offs. Massive local declines are not uncommon, and are often both rapid and unanticipated. This is exemplified by the case of Madikwe Game Reserve where, in 1997, a population of 24 animals was reduced to just three individuals following a rabies outbreak in early 1998 (Hofmeyr et al. 2000). During two, more recent incidents, 23 of the 25 Wild Dogs in Khamab Kalahari Reserve (North West) were killed due to a canine distemper virus (CDV) outbreak in 2013, and a rabies outbreak in Madikwe Game Reserve (North West) reduced the population from 30 individuals to just five in December 2015 (WAG-SA minutes).


Andre Botha

Similar die-offs have been documented in larger Wild Dog populations. For example, five of 12 study packs in Botswana (Alexander et al. 2010) and three of eight study packs in Kenya (Woodroffe 2011) have been reported as having died within short time periods during disease outbreaks. However, as most Wild Dogs in the metapopulation are regularly vaccinated against rabies and CDV (especially after these catastrophic outbreaks), they are less vulnerable to extinction from disease. Under good conditions, possibly inversely linked to rainfall (see Buettner et al. 2007), or few competing predators (Mills & Gorman 1997), Wild Dog subpopulations are able to grow relatively quickly, and rapid die-offs can be offset naturally by successful reproduction, or by active management, including artificial pack formation and reintroduction.

The Wild Dog's capacity for very long-range dispersal means that subpopulations sometimes reappear unexpectedly and grow rapidly. Within the assessment region, though, this capacity to seed new subpopulations and grow rapidly is severely compromised by habitat fragmentation, geographic isolation and persecution, which will limit any population recovery. Although Wild Dog populations can exhibit substantial temporal changes, fluctuations in the assessment region have largely been contained by active metapopulation management. Nevertheless, the potential for rapid population fluctuations, combined with severe habitat fragmentation, contribute to their vulnerability to extinction within the region.

**Current population trend:** Stable to slightly increasing.

**Continuing decline in mature individuals:** No

**Number of mature individuals in population:** 90–111

**Number of mature individuals in largest subpopulation:** 48

**Number of subpopulations:** 14

**Severely fragmented:** Yes

# Habitats and Ecology

Wild Dogs can survive in most habitat types as long as the habitat is large enough, contains sufficient suitable prey and is free from direct threats such as accidental and deliberate persecution.

**Table 4. Subpopulation estimates for Wild Dogs (*Lycaon pictus*) within the assessment region (January 2016)**

| Segment/Reserve | Province | No. packs | No. groups | Adults & yearlings | Pups | Total |
|---|---|---|---|---|---|---|
| **Metapopulation** | **National** | **18** | **10** | **149** | **90** | **239** |
| Hluhluwe-iMfolozi Park | KwaZulu-Natal | 6 | 2 | 56 | 36 | 92 |
| Tembe Elephant Park | KwaZulu-Natal | 2 | 1 | 11 | 3 | 14 |
| Mkhuze Game Reserve (iSimangaliso Wetland Park) | KwaZulu-Natal | 10 | 6 | 78 | 51 | 129 |
| Zimanga Private Reserve | KwaZulu-Natal | 1 | 0 | 4 | 4 | 8 |
| Somkhanda Game Reserve | KwaZulu-Natal | 1 | 0 | 3 | 5 | 8 |
| Zululand Rhino Reserve | KwaZulu-Natal | 1 | 0 | 5 | 0 | 5 |
| Tswalu Kalahari Reserve | Northern Cape | 1 | 0 | 10 | 9 | 19 |
| Khamab Kalahari Reserve | North West | 2 | 2 | 13 | 4 | 17 |
| Madikwe Game Reserve | North West | 1 | 1 | 8 | 9 | 17 |
| Pilanesberg National Park | North West | 1 | 1 | 11 | 4 | 15 |
| Blue Canyon Conservancy | Limpopo | 1 | 0 | 6 | 8 | 14 |
| Holding bomas (off site) | | 0 | 1 | 4 | 0 | 4 |
| **Free-roaming** | **National** | **2** | **2** | **20** | **4** | **24** |
| KwaZulu-Natal | | 0 | 2 | 10 | 4 | 14 |
| Limpopo | | 2 | 0 | 10 | 0 | 10 |
| **Kruger National Park** | **Limpopo** | **17** | **6** | **213** | **43** | **256** |
| Southern region | Limpopo | 7 | 2 | 80 | 1 | 81 |
| Central region | Limpopo | 5 | 2 | 83 | 13 | 96 |
| Northern region | Limpopo | 3 | 2 | 28 | 18 | 46 |
| Western boundary | Limpopo | 2 | 0 | 22 | 11 | 33 |
| **Reserve total** | | **34** | **12** | **341** | **125** | **466** |
| **Reserve + boma total** | | **35** | **16** | **362** | **133** | **495** |
| **Reserve + boma + free-roaming total** | | **37** | **18** | **382** | **137** | **519** |

[1]WAG-SA minutes; [2]EWT unpubl. data

Wild Dogs are coursing predators that mostly hunt medium-sized ungulates ranging from 15–200 kg, which are usually the most abundant prey species available (Hayward et al. 2006). Weighing between 25 and 30 kg, Wild Dogs cross the 21.5 kg threshold considered for obligate carnivory; meaning that they lack the physiological ability to digest plant matter (Creel & Creel 2002). For their size, and due to their high metabolic demands, Wild Dogs consume more meat per day (about 3 kg) than any other carnivore relative to their size (Creel & Creel 2002). In most areas within the assessment region Common Impala (*Aepyceros melampus*) is the principal prey species, and the remainder of the diet is likely to include Greater Kudu (*Tragelaphus strepticeros*), Common Duiker (*Sylvicapra grimmia*) and/or Nyala (*Tragelaphus angasi*). Common Warthogs (*Phacochoerus africanus*) are also taken in some populations. They will give chase of larger species, such as Common Eland (*Tragelaphus oryx*) and African Buffalo (*Syncerus caffer*), but rarely kill such prey. In smaller fenced systems (< 550 km$^2$), Wild Dogs have adapted to use fence lines in their hunting, allowing them to capture such larger prey (Rhodes & Rhodes 2004; Bissett 2008; Davies-Mostert et al. 2013). Wild Dogs also take very small prey such as hares, lizards and even eggs, but these make an insignificant contribution to their diet.

With the exception of desert and tropical forests, Wild Dogs historically inhabited most of sub-Saharan Africa (Fuller et al. 1992). They are the first large carnivore to disappear down the rainfall gradient at about 350 mm (Mills 2015). Previously believed to be a primarily open plains species, based on early studies, for example, those done in the Serengeti National Park, Tanzania (Frame et al. 1979), Wild Dogs are now known to occupy a wide range of habitats including short-grass plains, savannahs and uplands forest. Recent studies in fact show that Wild Dogs reach their highest densities in thicker bush, for example in Selous Game Reserve (Tanzania), Mana Pools National Park (Zimbabwe) and northern Botswana (Creel & Creel 2002). Within the assessment region, they occur in the Lowveld, open grasslands and have also been known to occur in thicket-type vegetation specifically found in the Eastern Cape (Skead 2007). In recent years, their distribution has been limited primarily due to human activities and availability of prey, rather than habitat preferences.

**Ecosystem and cultural services:** As coursing predators, Wild Dogs exert higher selection for animals in poorer condition than ambush predators, and tend to select weaker animals from prey populations (Pole 2000). They therefore help to regulate ecosystems from the top down by reducing the proportion of weaker prey animals, creating landscapes of fear for prey species and helping

**Table 5. Use and trade summary for the Wild Dog (*Lycaon pictus*)**

| Category | Applicable? | Rationale | Proportion of total harvest | Trend |
|---|---|---|---|---|
| Subsistence use | No | Subsistence/ad hoc medicinal use. | Limited | Stable/increasing |
| Commercial use | Yes | Ecotourism | None | Stable |
| Harvest from wild population | No | - | - | - |
| Harvest from ranched population | No | - | - | - |
| Harvest from captive population | No | - | - | - |

to regulate prey numbers. It should be noted, however, that human-mediated changes in habitat structure (such as those resulting from habitat fragmentation, roads and particularly fencing) can lead to both quantitative and qualitative shifts in prey selection patterns by Wild Dogs, potentially undermining the positive ecosystem benefits of their predation (Davies-Mostert et al. 2013).

The Wild Dog is a flagship species for the African continent. It symbolises the need for unbroken and wild landscapes. Wild Dogs have the potential to raise significant income through specialist wildlife-viewing initiatives (Lindsey et al. 2005), as has been illustrated through the ecotourism initiatives at both the De Beers Venetia Limpopo Nature Reserve (H. T. Davies-Mostert pers. obs. 2006), and the fact that Madikwe Game Reserve has been marketed as a Wild Dog “haven”, where several private lodges have even made use of the Wild Dog in their branding.

# Use and Trade

Across most of its geographical range, there is minimal human use of this species. There is evidence of localised traditional use in Zimbabwe (Davies & du Toit 2004) and South Africa (KwaZulu-Natal Wild Dog Advisory Group [KZNWAG] minutes), but this is unlikely to threaten the species’ persistence. There are also some reports of trade in captive and wild-caught animals from southern Africa, although this is not believed to be significant. Wild Dogs are persecuted as a damage-causing animal (shot, poisoned or captured and removed from the wild) over their entire range within the assessment region. Only two to five packs and dispersing groups persist outside protected areas (Table 4).

Trade is local (traditional medicine), international (zoos and traditional medicine) and commercial. Medicinal uses for Wild Dogs do still exist in some South African traditional cultures (Page et al. 2015). Uses include curing illnesses such as headaches, and smoking the fur is believed to allow one to sleep (Page et al. 2015).

The extent of facilities holding and breeding captive Wild Dogs in South Africa is currently unknown. While an African Regional Studbook is run under the auspices of the Pan-African Association for Zoos and Aquaria (PAAZA), the number of private facilities that do not participate in the studbook is unclear, and could be more than 20. Fewer than ten facilities submit data to the studbook, with only two facilities known to be actively breeding Wild Dogs. These facilities once played an important role in the formation of the metapopulation by providing animals for reintroduction purposes. Indeed, a significant proportion (24%) of founder stock for the managed metapopulation was sourced from captive centres in South Africa and Botswana between 1998 and 2009 (Davies-Mostert & Gusset 2013). However, without a current significant need for release from ex situ institutions, surplus Wild Dogs are often sold to private facilities both locally and internationally. Some ex situ facilities continue to play a small part in the conservation of the Wild Dogs through participation in research projects, as temporary holding facilities for the managed metapopulation and through education and awareness. However, significant improvements must be implemented before captive facilities can be regarded as making a valuable overall contribution to the conservation of this species, such as: 1) a fully functioning self-sustainable breeding programme with clear goals, and which only requires the addition of new founders based on sound population management principles; 2) research programmes that have clear benefits to the in situ population; and 3) a well-developed education programme to be implemented across all ex situ facilities.

Wildlife ranching has generally increased the prey base for Wild Dogs, but they are still heavily persecuted by

**Table 6. Possible net effects of wildlife ranching on the Wild Dog (*Lycaon pictus*) and subsequent management recommendations**

| | |
|---|---|
| Net effect | Positive |
| Data quality | Estimated |
| Rationale | Anecdotal observations support the notion that game farms and ranches can be suitable habitat for Wild Dogs and increase the prey base for this species. However, ranchers often persecute this species, especially as a result of conflict for high-value game species. In reality, game ranches (whether focussed on high value game species or general plains game) are not suitable for Wild Dogs, as every single antelope species has a monetary value to the farmer while Wild Dogs are perceived to be worthless predators and the small size of the ranches are likely to be of inadequate size for Wild Dogs. Only the much larger game ranches and private reserves should be seen to be areas where Wild Dogs will be tolerated. This tolerance level also decreases dramatically during denning season when Wild Dogs do not move over large distances while there are pups. |
| Management recommendation | Reduce persecution of this species through holistic management techniques and economic ventures that offset the costs of their predation, such as Wild Dog-based ecotourism (Lindsey et al. 2005). |

**Table 7. Wild Dog (*Lycaon pictus*) mortalities in the three sub-populations in South Africa; limited data are available for Kruger National Park and for the free-roaming population (EWT unpubl. data)**

| | Free-roaming population | Managed metapopulation | Kruger population |
|---|---|---|---|
| Number of mortalities | 282 | 142 | 19 |
| Period | 1998–2014 | 1998–2014 | 2011–2014 |
| Natural causes | 2.1% | 44.6% | 52.6% |
| Anthropogenic mortalities | 45.6% | 15.7% | 42.0% |
| Other/unknown | 2.1% | 39.6 % | 5.2% |
| Capture and removal by farmers or conservation authorities | 50.0% | 0.0% | 0.0% |

landowners and can be unfeasibly expensive to sustain on small private nature reserves.

# Threats

The causes of Wild Dog decline are reasonably well understood and include sensitivity to habitat fragmentation as a consequence of wide-ranging behaviour, direct persecution as a result of conflict with livestock and game farmers, accidental killing through poachers' snares and road accidents, and infectious disease, especially in small populations (Hofmeyr et al. 2000). All of these causes are associated with human encroachment on Wild Dog habitat and, as such, have not ceased and are unlikely to be reversible across most of the species' historical range. Snares and diseases in the buffer zone on the periphery of protected areas may also serve as an ecological trap for this species where they cannot perceive the threats as traded off against potentially fitness-enhancing resources (van der Meer et al. 2014).

Threats to the following different groups of Wild Dogs within the assessment region are as follows:

**Free-roaming packs outside protected areas:**

Our understanding of rates and causes of mortality in this segment of the population is severely limited by the fact that none of these packs are closely monitored, resulting in a bias towards anthropogenic causes of mortality (see Woodroffe et al. 2007). However, instances of the following threats have been occasionally documented:

- Direct persecution by farmers and communities: minimum estimate in the Waterberg region is 15 Wild Dogs / year (Thorn et al. 2013).
- Road mortalities (sometimes this is a form of direct persecution; Davies-Mostert, pers. comm.): minimum estimate is 1–2 Wild Dog(s) / year. Twelve mortalities have been recorded in the free-roaming population since 1999.
- Accidental persecution through poachers' snares: not possible to estimate the extent of this threat as free-roaming animals are not closely monitored and very few individuals have been recorded carrying snares.
- Potential disease transmission from domestic dogs: although this has the potential to decimate entire packs, no known occurrences have been documented.
- Based on the limited data available, during 1998–2014, 282 Wild Dog mortalities were recorded outside of protected areas, of which the most frequent causes were: capture and removal by farmers or conservation authorities (50%), direct persecution (39.3%) and vehicle collisions (6.3%; EWT unpubl. data). Natural mortality (2.1%) and unknown causes (2.1%) of mortality were rarely recorded.
- Habitat fragmentation has reduced the ability of Wild Dogs to survive in suitable areas: the increasing use of impenetrable fencing for wildlife ranching and game breeding activities is likely to negatively impact the small number of free-roaming packs in South Africa (Taylor et al. 2015).

**Free-roaming packs inside Kruger National Park:**

- Road mortalities: likely to be 1–2 Wild Dog(s) / year (EWT unpubl. data).
- Accidental persecution through poachers' snares: several Wild Dogs are observed carrying snares each year, and where possible these snares are removed. In the last five years, 17 Wild Dogs have been recorded carrying snares, and only seven of these have been removed.
- The potential for disease transmission from domestic dogs: for example an entire pack of Wild Dogs (N = 16) contracted rabies in the Guernsey area on the Western boundary of Kruger mid-2015, with all individuals dying (EWT unpubl. data).

**Managed metapopulation:**

- Economic sustainability: Wild Dogs are expensive to sustain in small protected areas due to high prey consumption (abetted by their use of fences to hunt; Davies-Mostert et al. 2013). Ecotourism benefits must outweigh the costs at sites where economic benefits are the driver for reintroduction (Lindsey et al. 2005).
- Human–wildlife conflict following escapes: this results in direct mortality through persecution and reduces social capital between communities and reserve managers, therefore reducing the desirability of holding subpopulations. Twelve recorded mortalities over 16 years (EWT unpubl. data).
- Accidental persecution through poachers' snares (both inside and outside metapopulation sites: this is particularly severe in Mkhuze Game Reserve. Estimated 2–3 Wild Dogs / year (EWT unpubl. data), although in some instances multiple simultaneous mortalities have occurred when a pack becomes entangled in a single snare line.
- Potential inbreeding as a result of inadequate population management: although genetic evidence suggests that management has performed well to

**Table 8. Threats to the Wild Dog (*Lycaon pictus*) ranked in order of severity with corresponding evidence (based on IUCN threat categories, with regional context)**

| Rank | Threat description | Evidence in the scientific literature | Data quality | Scale of study | Current trend |
|---|---|---|---|---|---|
| 1 | *1.1 Housing & Urban Areas* and *2.1 Annual & Perennial Non-Timber Crops* and *2.3 Livestock Farming & Ranching*: the growing human footprint leading to habitat loss and fragmentation. Current stresses *1.1 Ecosystem Conversion* and *1.2 Ecosystem Degradation.* | Driver et al. 2012 | Indirect (land cover change from remote sensing) | National | Increasing |
| 2 | *5.1.3 Persecution/Control*: direct persecution by livestock and game farmers, and communities. Current stress *2.1 Species Mortality.* | Davies-Mostert et al. 2015 | Empirical | National | Increasing |
| | | WAG-SA minutes | Anecdotal | National | - |
| | | Woodroffe et al. 2007 | Empirical | National | - |
| 3 | *5.1 Hunting & Collecting Terrestrial Animals*: incidental snaring for other large mammals (primarily ungulates) for subsistence and commercial bushmeat. | Davies-Mostert et al. 2015 | Empirical | National | Increasing |
| | | WAG-SA minutes | Anecdotal | National | - |
| 4 | *8.2 Problematic Native Species/Diseases*: diseases (specifically canine distemper and rabies) can cause massive localised die-offs. | Hofmeyr et al. 2000 | Empirical | Local | Stable |
| | | WAG-SA minutes | Empirical | Local | Increasing (in short term) |
| 5 | *4.1 Roads & Railroads*: vehicle collisions. | Davies-Mostert et al. 2015 | Empirical | National | Increasing |
| 6 | *8.2 Problematic Native Species/Diseases*: inter-specific competition in small reserves where artificially high densities of competing predators (Lions and Spotted Hyaenas *Crocuta crocuta*) are maintained for tourism purposes. | EWT unpubl. data | Empirical | Local | Stable |

date by ensuring that translocated groups are unrelated to receiving populations (Edwards 2009), continued effort is required to avoid inbreeding in small subpopulations.

- Anthropogenic threats may be exacerbated by constraints from interspecific competition, particularly where high Lion (*Panthera leo*) densities are maintained to support tourism activities. When such competition keeps Wild Dog densities and population sizes lower than necessary to support viable packs, this renders populations unviable. However there is little evidence for such effects within the current managed metapopulation.
- Within the metapopulation, most recorded mortalities (44.6%; N = 142) between 1998 and 2014 were due to natural causes, including disease (51.8%), predation by other carnivores (26.8%), death by conspecifics (13.4%) and death from injury (8.5%) (EWT unpubl. data). Anthropogenic mortality made up 15.7% (N = 50) of recorded mortalities and included snaring (76.5%), persecution (23.5%) and vehicle collisions (4.4%). Other mortalities (N = 126) made up 39.6% of mortalities, and included veterinary complications and unknown causes.
- Volatility of subpopulation participation due to management/owner perceptions: Continued participation in the managed metapopulation is heavily dependent on the attitude of managers. For example, when reserve management perceives that Wild Dog populations are too high this can result in pressure to remove packs.
- Disease: while diseases are not a primary cause of mortality amongst metapopulation reserves as Wild Dogs are often vaccinated before release, occasional outbreaks have been known to occur. For example: 23 of the 25 Wild Dogs in Khamab Kalahari Reserve were killed due to a CDV outbreak in 2013 and a rabies outbreak in January 2015 killed most of the Madikwe Game Reserve Wild Dogs.
- Road mortalities: although Wild Dogs are generally kept to the confines of metapopulation reserves and strict speed limits are enforced within them, road mortalities do occur. Since 2003, 13 Wild Dogs have been killed through vehicle collisions; 12 of those occurring in KwaZulu-Natal—especially on the corridor road in Hluhluwe-iMfolozi Park.

Human-induced Wild Dog mortality has two significant and long-term conservation implications in the assessment region. First, it reduces the likelihood that Wild Dogs may coexist outside protected areas unless land-use plans and other conservation management actions are implemented. Second, although "predator-proof" fencing around small reserves to protect intensively managed subpopulations has proved reasonably effective at keeping dogs confined to these reserves, such fencing is not 100% effective (Gusset et al. 2008; Davies-Mostert et al. 2009). Conflict with neighbouring communities is therefore not prevented, and alternative proactive strategies such as keeping neighbours informed about breakouts, developing clear breakout strategies and the use of insurance and/or compensation to reduce costs of conflict are necessary. In addition, the military-style electric fencing has undesirable impacts on other wildlife species, in particular Temminck's Ground Pangolin (*Smutsia temminckii*) and tortoises that are regularly electrocuted (Beck 2010).

Even in large, well-protected reserves, or in stable subpopulations remaining largely independent of protected areas (as in northern Botswana), small subpopulations are vulnerable to local extinction. “Catastrophic” events such as outbreaks of epidemic disease may severely reduce numbers (Hofmeyr et al. 2000) when larger subpopulations have a greater probability of recovery. Problems of small population sizes will be exacerbated through edge effects if subpopulations occur in small reserves or habitat patches. Thus, small subpopulations might be expected to suffer disproportionately high mortality as a result of their contact with humans and human activity, and it is desirable to encourage the establishment of populations in large areas.

Due to the negative attitude of farmers towards this species, there is limited hope for further free-roaming pack establishment. For example, farmers and community members in the Opathe (KwaYanguye) area of KwaZulu-Natal tolerated the presence of a pack of Wild Dogs for a few months during 2014, however such tolerance is unusual and active engagement with landowners and users is only likely to successfully reduce conflict in particular sites.

**Current habitat trend:** Stable. Most of the Wild Dog subpopulations in the region occur in well-protected savannah ecosystems, which are not projected to decline (Driver et al. 2012). The expansion of wildlife ranching over the past few decades has provided a wider prey base for Wild Dogs within the free-roaming subpopulation range, however the propensity for conflict between Wild Dogs and wildlife ranchers is likely to prevent Wild Dogs from becoming resident over much of the wildlife ranching estate. Both the extent of occurrence and area of occupancy have increased for the managed metapopulation, but given that Wild Dogs require large areas to persist, the rate of establishment of new subpopulations is likely to decline and eventually stabilise over time. Wild Dogs are excellent dispersers and are able to recolonise suitable unoccupied habitat (Davies-Mostert et al. 2012), provided that there is suitable connecting habitat for them to do so (Whittington-Jones et al. 2011). Increased snaring throughout their range erodes the quality of habitat for Wild Dogs, even inside large well-protected conservation areas, and suggests a potential future decline in suitable habitat should this threat not be adequately curtailed.

# Conservation

Regional conservation strategies have been developed for Wild Dogs throughout their range (IUCN SSC 2008, 2009, 2012), and these have catalysed the development of national action plans in many range states. Key conservation strategies for the species include improving coexistence between people and Wild Dogs, encouraging land-use planning to maintain and expand subpopulations, building capacity for Wild Dog conservation within range states, outreach to improve public perceptions of Wild Dogs at all levels of society, and ensuring a policy framework compatible with Wild Dog conservation.

Within the assessment region, continued investment in the managed metapopulation strategy of WAG-SA, has successfully increased Wild Dog numbers and distribution. Consider that the decline in Wild Dogs in Kruger (from 450 to 250) has not affected the overall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numbers in South Africa, due to the managed metapopulation approach. The ecotourism potential of Wild Dogs needs to be exploited, to enhance the sustainability of new tourism ventures that will make Wild Dogs more desirable and ultimately result in increased habitat availability. The role of conservancies and larger conservation areas in Wild Dog conservation needs to be researched, promoted and implemented.

Specifically, the following interventions should be continued or tested:

1. Promote the formation of conservancies and transfrontier parks large enough to sustain resilient subpopulations of Wild Dogs. Dropping fences may well provide positive economic benefits for landowners by reducing prey costs (allowing Wild Dogs to roam across the landscape), reducing poaching (less wires for snares) and increasing ecotourism value (Lindsey et al. 2009). Potentially reintroducing Wild Dogs to the northern section of Kruger to create a larger and more resilient subpopulation within the Great Limpopo Transfrontier Park could provide a useful test case for this intervention.
2. Ensure that Wild Dog conservation is adequately considered in land-use planning, and especially protected area expansion strategies, in order to drive landscape-level connectivity among subpopulations.
3. Continued coordinated metapopulation management by WAG-SA to ensure demographic viability and genetic diversity of subpopulations within the assessment region. An important caveat is that reintroductions take place only onto properties that meet the minimum ecological and other requirements to support Wild Dogs, and are properly coordinated through WAG-SA.
4. Research to understand how to manage the boom and bust in Wild Dog numbers at a reserve level within managed subpopulations.
5. Reduce persecution of free-roaming packs through appropriate conflict mitigation measures, including but not limited to placement of livestock guarding dogs, compensation/revenue generation schemes and education campaigns. The continued existence of the free-roaming packs in the Waterberg region shows that packs can persist even in fenced landscapes where they are heavily persecuted.
6. Vaccinating metapopulation packs to guard against disease transmission from feral dogs and other

**Table 9. Conservation interventions for the Wild Dog (*Lycaon pictus*) ranked in order of effectiveness with corresponding evidence (based on IUCN action categories, with regional context)**

| Rank | Intervention description | Evidence in the scientific literature | Data quality | Scale of evidence | Demonstrated impact | Current conservation projects |
|---|---|---|---|---|---|---|
| 1 | *1.1 Site/Area Protection*: create conservancies and transfrontier parks. | - | Anecdotal | - | - | - |
| 2 | *2.3 Habitat & Natural Process Restoration*: promote landscape-level connectivity through appropriate land-use planning. | Whittington-Jones et al. 2011 | Empirical | Local | Suitable habitat exists in KZN for linkages between subpopulations. | Wild Dog Advisory Group (National, KZN) |
| 3 | *3.3.1 Reintroduction*: reintroductions and translocations coordinated by WAG-SA. | Davies-Mostert et al. 2009 | Empirical | National | Managed metapopulation size grew to 264 individuals in 8 years. | Wild Dog Advisory Group (National, KZN) |
| 4 | *4.3 Awareness & Communications* and *6.3 Market Forces*: marketing and awareness to increase ecotourism value of Wild Dogs. | Lindsey et al. 2005 | Indirect | - | - | Wild Dog Advisory Group (National, KZN) |
| 5 | *6.1 Linked Enterprises & Livelihood Alternatives*: implement effective conflict mitigation strategies such as livestock guarding dogs. | Leijenaar et al. 2015 | Indirect | Local | Decrease in livestock depredation. | Carnivore Conservation Program (EWT) |
| | | Rust et al. 2013 | Indirect | Local | Decrease in livestock depredation. | Cheetah Outreach |
| 6 | *2.1 Site/Area Management*: erect predator-proof fencing to protect valuable game. | - | Anecdotal | - | - | - |
| 7 | *3.2 Species Recovery* and *2.2 Invasive/ Problematic Species Control*: vaccination against rabies/canine distemper. | Hofmeyr et al. 2004 | Empirical | Local | All vaccinated adults (N = 5) survived a rabies outbreak. | Wild Dog Advisory Group (National, KZN) |

canids. Vaccination of domestic dogs in communities surrounding reserves with Wild Dogs will protect Wild Dogs, be good for community relations and also provide an opportunity to raise awareness among community members.

7. Raising the public profile of Wild Dogs. Di Minin et al. (2013) illustrate that tourists have nuanced viewing preferences, with first-time tourists more interested in the Big Five and more experienced tourists interested in a wider range of species (including Wild Dogs). Promotional and marketing work should be done to increase tourist willingness to pay for Wild Dog sightings, which would then make private reserves more willing to reintroduce Wild Dog packs to their properties. One mechanism could be to begin referring to Wild Dogs as Painted Dogs. Preliminary research suggests that tourists are more intrigued by, and incentivised to pay, to see Painted Dogs rather than Wild Dogs (Davies 1998).
8. Communities should be made responsible for the conservation and management of Wild Dog packs with input and advice from WAG-SA. If people are given ownership under practical conditions attitudes towards these packs might change due to pressure from within the communities who have to live with these dogs.

**Recommendations for land managers and practitioners:**

- Continued work in local communities to mitigate prey loss and raise concern for the Wild Dog.
- Reintroduced (small) populations must continue to be managed and monitored closely by WAG-SA, and new reintroduction sites identified and incorporated into the managed metapopulation.
- Wild Dog habitat requirements should be incorporated into conservation and land-use planning exercises.
- The non-consumptive economic value of Wild Dogs should be promoted through expanding ecotourism ventures.
- Vaccination of managed populations, in particular against rabies and CDV.
- Indiscriminate captive breeding of Wild Dogs should be discouraged as this does not make a contribution to their conservation, and can negatively impact metapopulation management. Ex situ programmes need to focus on genetically known individuals that can be linked to the metapopulation management plan for reintroduction to the wild and for education, research and export to registered international facilities registered with the World Associations of Zoos and Aquariums (WAZA). Captive breeding needs to be coordinated, and genetic lineages documented (in a studbook).
- Facilitating a process that will result in northern Kruger becoming resident range for Wild Dogs again and keeping track of the population status.

**Research priorities:**

- Understanding the reasons behind the shrinkage of Wild Dog distribution range in the north of Kruger

could provide management insights for increasing the subpopulation overall within the Great Limpopo Transfrontier Park.

- Development of cost-effective methods for surveying Wild Dogs across large geographical scales.
- Development of locally-appropriate and effective means to reduce conflict between Wild Dogs and farmers.
- Establishing which techniques will be most effective and sustainable for protecting Wild Dogs from disease.
- Determining the landscape features which facilitate (or prevent), Wild Dog movement over long distances and hence promote (or block) landscape connectivity. This question has been researched to some degree in KwaZulu-Natal.
- Investigating the effectiveness of awareness and education campaigns in reducing persecution outside of protected areas.
- Establishing which population management interventions are most effective at maintaining Wild Dogs at acceptable numbers at reintroduction sites.
- Investigating the feasibility of Wild Dog-based ecotourism outside of protected areas.

Some current Wild Dog research and conservation projects include:

- Conflict mitigation between farmers and predators including Wild Dog: Cheetah Outreach Trust, www.cheetah.co.za
- Kruger Wild Dog Photographic Census: Carnivore Conservation Programme, Endangered Wildlife Trust, www.ewt.org.za
- Kruger Wild Dog Project: Carnivore Conservation Programme, Endangered Wildlife Trust, www.ewt.org.za
- PAAZA Regional studbook for the Wild Dog: Pan-African Association of Zoos and Aquaria, www.zoosafrica.com
- PhD study: "Ecology of an inverse density dependent canid: a case study of the Wild Dog (*Lycaon pictus*) metapopulation in KwaZulu-Natal, South Africa": Centre for Wildlife Management, University of Pretoria, David Marneweck, www.up.ac.za/centre-for-wildlife-management
- Various student projects including those on genetics and prey use.
- Waterberg Wild Dog Project: Carnivore Conservation Programme, Endangered Wildlife Trust, www.ewt.org.za
- Wild Dog monitoring projects on various reserves: Wildlife ACT, www.wildlifeact.com

**Encouraged citizen actions:**

- Report all Wild Dog sightings to MammalMAP or the EWT; especially those of the free-roaming packs in northern Limpopo, North West and northern parts of KwaZulu-Natal.
- Participate in photographic censuses conducted in Kruger and the Waterberg region.
- Landowners should drop fences to form conservancies, or ensure that fence configuration allows for the free passage of Wild Dog packs.
- Tourists should actively visit reserves with reintroduced packs belonging to the managed metapopulation.
- Motorists should drive slowly and carefully through areas known to contain Wild Dog packs.
- Attention should be put on increasing tolerance levels and creating and acknowledging predator friendly areas where Wild Dogs can move freely with minimal persecution.
- Landowners should be encouraged to become custodians of the free-roaming packs.
- Tourism and conservation publications should actively promote Wild Dog conservation success stories and encourage fact-based tolerance.
- Dissemination of accurate information on Wild Dog behaviour, threats and positive conservation stories available to field guide training establishments.
- Purchase of commercially available products which contribute percentages to financially support Wild Dog conservation initiatives.
- Increased tolerance from landowners in areas occurring within the area of occupancy of Wild Dogs.

## Data Sources and Quality

**Table 10. Information and interpretation qualifiers for the Wild Dog (*Lycaon pictus*) assessment**

| | |
|---|---|
| Data sources | Field study (unpublished), indirect information (literature, expert knowledge) |
| Data quality (max) | Estimated |
| Data quality (min) | Suspected |
| Uncertainty resolution | Maximum/minimum values |
| Risk tolerance | Precautionary |

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## Assessors and Reviewers

**Harriet T. Davies-Mostert[1,2,†], Samantha Page-Nicholson[1], David G. Marneweck[1,2], Kelly Marnewick[1,2,†], Deon Cilliers[3], Brendan Whittington-Jones[1], Hanno Killian[4], Michael G.L. Mills[5,†], Dan Parker[6], R. John Power[7], Tracy Rehse[8], Matthew F. Child[1]**

*[1]Endangered Wildlife Trust, [2]University of Pretoria, [3]Cheetah Outreach, [4]Khamab Kalahari Reserve, [5]Private Wildlife Researcher, [6]Rhodes University, [7]North West Provincial Government, [8]Pan-African Association of Zoos and Aquaria*

*[†]IUCN SSC Canid Specialist Group*

## Contributors

**Greg Canning[1], Steve Dell[2], Dave Druce[3], Gus van Dyk[4], Carlien Esterhuizen[2], Rosemary Groom[5], Markus Gusset[6], Chris Kelly[7], Kath Potgieter[8], Dean Peinke[9], Michael J. Somers[8], Gerrie Camacho[10]**

*[1]Limpopo Lipadi, [2]North West Parks and Tourism Board, [3]Ezemvelo KZN Wildlife, [4]Tswalu Kalahari Reserve, [5]African Wildlife Conservation Fund, [6]World Association of Zoos and Aquariums, [7]WildlifeACT, [8]University of Pretoria, [9]Eastern Cape Parks and Tourism Agency, [10]Mpumalanga Tourism and Parks Agency*

## Species Champion

**Guy Ellis[1]**

*[1]X-Posé Holdings (Pty) Ltd*

Details of the methods used to make this assessment can be found in *Mammal Red List 2016: Introduction and Methodology.*