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MIGRATORY
SPECIES**

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Agenda Item 25.1

**PROPOSAL FOR THE INCLUSION OF
THE LEOPARD (*Panthera pardus*)
ON APPENDIX II OF THE CONVENTION**

Summary:

The Governments of Ghana, I.R. Iran, Kenya and Saudi Arabia have jointly submitted the attached proposal* for the inclusion of the Leopard (*Panthera pardus*) on Appendix II of CMS.

*The geographical designations employed in this document do not imply the expression of any opinion whatsoever on the part of the CMS Secretariat (or the United Nations Environment Programme) concerning the legal status of any country, territory, or area, or concerning the delimitation of its frontiers or boundaries. The responsibility for the contents of the document rests exclusively with its author.

**PROPOSAL FOR THE INCLUSION OF THE LEOPARD (*Panthera pardus*)
ON APPENDIX II OF THE CONVENTION ON THE CONSERVATION OF
MIGRATORY SPECIES OF WILD ANIMALS**

A. PROPOSAL

Inclusion of the leopard *Panthera pardus* on CMS Appendix II

B. PROPONENT

Governments of Ghana, I. R. Iran, Kenya and Saudi Arabia

C. SUPPORTING STATEMENT

1. Taxonomy

1.1 Class:	Mammalia
1.2 Order:	Carnivora
1.3 Family:	Felidae
1.4 Species:	<i>Panthera pardus</i> (Linnaeus, 1758)
1.5 Scientific synonyms:	<i>Felis pardus</i> Linnaeus, 1758
1.6 Common name(s), in all applicable languages used by the Convention	
English:	Leopard, panther
French:	Panthère, Léopard
Spanish:	Leopardo, Pantera

Subspecies

Nine subspecies of leopards were recognized by Wozencraft (2005) (Fig. 1.):

- *Panthera pardus pardus* (Linnaeus, 1785), African leopard: Africa;
- *Panthera pardus nimr* (Hemprich and Ehrenberg, 1832), Arabian leopard: Arabia;
- *Panthera pardus saxicolor* (Pocock, 1927), Persian leopard: Turkey, Caucasus, Turkmenistan, Uzbekistan, Iran, Iraq, Afghanistan and Pakistan;
- *Panthera pardus melas* (Cuvier, 1809), Javan leopard: Java;
- *Panthera pardus fusca* (Meyer, 1794), Indian leopard: Indian subcontinent, Myanmar and China;
- *Panthera pardus kotiya* Deraniyagala, 1949, Sri Lankan leopard: Sri Lanka;
- *Panthera pardus delacouri* Pocock, 1930b, Indochinese leopard: South-East Asia and probably southern China;
- *Panthera pardus orientalis* (Schlegel, 1857), Amur leopard: Eastern Asia from Russian Far East to China.
- *Panthera pardus japonensis* (Gray, 1862), North Chinese leopard: China

Based on most recent studies *Panthera pardus ciscaucasica* and *Panthera pardus saxicolor* have been included into one subspecies *Panthera pardus tulliana*, and the subspecies *Panthera pardus japonensis* has been included into *Panthera pardus orientalis* (Kitchener et al. 2017). More studies are needed to clarify if the leopards inhabiting Africa consist of one or several subspecies and if all Asian subspecies, excluding *melas*, belong to one single subspecies (Kitchener et al. 2017).

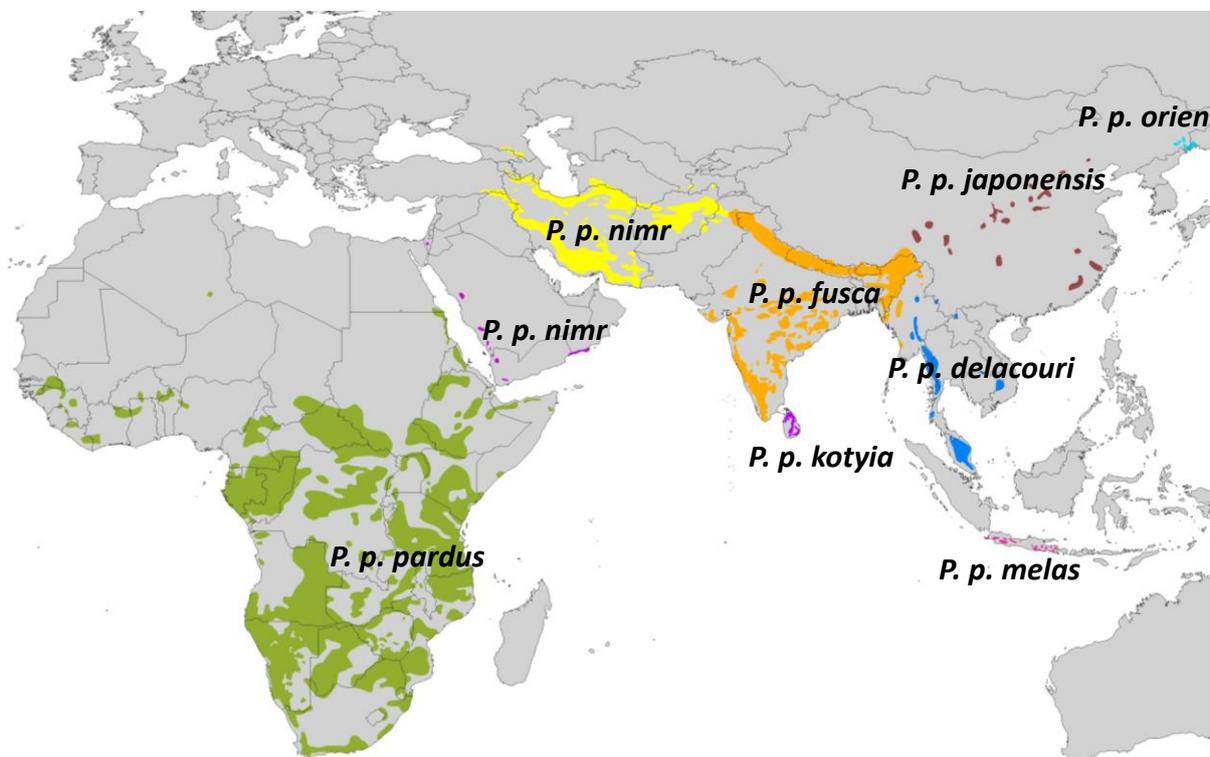


Fig. 1. Leopard distribution (including extant, possibly extant and possibly extinct range) © Jacobson et al. 2016. Leopard subspecies according to Wozencraft (2005).

2. Overview

Panthera pardus experiences globally severe declines in populations and is classified by the IUCN Red List Assessment between Vulnerable and Critically Endangered, depending on the subpopulation. With a large number of transboundary populations across its global range, *Panthera pardus* would greatly benefit from being listed on CMS Appendix II. Rather than developing a formal Agreement or Memorandum of Understanding, the Proponents propose to establish an informal initiative under which targeted conservation measures can be collectively agreed and implemented.

3 Migrations

3.1 Kinds of movement, distance, the cyclical and predictable nature of the migration

Adult, sexually mature leopards reside in generally large, but varying permanent home ranges (5.6 km² to 2750 km²; see below), within which there might be a certain seasonal “migration” according to prey availability. The home ranges of resident leopards can be transboundary in border regions. However, the migratory character of leopards in the understanding of the Conventions is a consequence of subadult dispersal, which is crucial for maintaining the genetic and demographic integrity of any solitary cat population, and is especially important for large cats such as leopards, whose populations generally spread across international boundaries (see below) and are increasingly fragmented through human activities and encroachment. Sexual dimorphism in dispersal is a mechanism to avoid inbreeding, and suppression of dispersal will eventually lead to genetic impoverishment even in populations which seem to be demographically stable. There is only anecdotal evidence of leopard dispersal, but subadult male leopards (age 2–4 years) are mandatory dispersers (hence migratory in this phase of their lives) and were reported to cover distances up to 200 km (Fattebert et al. 2013), while subadult females (age 2–3 years) tend to settle more often in the vicinity of their parental territories. Besides the importance of dispersal for the genetic fitness of a metapopulation or of an anthropogenic fragmented population, dispersal – especially of females – is the mechanism for population expansion and hence regaining lost ground across international borders, which is a conservation priority for many subspecies or regional metapopulation, e.g. the Arabian leopard (Oman, Yemen and Kingdom of Saudi Arabia), the Amur leopard (China and Russia), the Caucasus Ecoregion or the whole of West Africa (Fig.

1). Although scientific evidence for transboundary movements and long-range dispersal of leopards have so far only anecdotal character (see below), there can be no doubt that the free migration of leopards across international borders is a crucial factor for the recovery of most endangered subspecies and populations.

Leopards do move freely between countries and cross national jurisdictional boundaries. Many leopard populations inhabiting Africa and Asia and the Arabian Peninsula are transboundary (Jacobson et al. 2016; Feng et al. 2017; Askerov et al. 2015; Spalton and Hikmani 2014; cf. chapter 3.2). Leopards in West Africa, south-east and south-west Asia and the Caucasus for example are not limited to national boundaries, and transboundary sink-source populations have been observed for decades. For example, the remnant leopards in Armenia and Azerbaijan are perceived to be dependent on a larger sink population in north-western Iran (Lukarevsky et al. 2007, Breitenmoser et al. 2010a), which itself might be sustained by dispersers from Alborz Mountains south of the Caspian Sea (Zimmermann et al. 2007, Moqanaki et al. 2013, Farhadinia et al. 2015a). Also, sporadic records within Iraq's Kurdistan as well as south-eastern Turkey are assumed to be individuals originating from western Iran's Zagros Mountain population (Avgan et al. 2016). Within Lesser Caucasus, leopard individuals are known from camera trapping to move between Nakhchivan, Armenia and Azerbaijan (Avgan et al. 2012, Askerov et al. 2015). A cooperative study between China and Russia revealed that 36% of all leopards were camera trapped on both sides of the international border. According to Feng et al. (2017) this emphasizes "the need for transboundary cooperation to ensure a future for the Amur leopard". Farhadinia et al. (2017) provided radio-telemetric evidence for trans-boundary movements of leopards between Iran and Turkmenistan, where collared leopards freely move across the border.

Circadian cycles

The activity of adult, resident leopards is mainly restricted to their home range. The size of leopard home ranges is highly variable. Home range sizes are determined by resource availability (such as prey and water access), presence of other carnivores, intra-specific density and human pressures. Home range sizes from 5.6 km² (female in Kenya's Tsavo National Park) to 2,750 km² (male in the Kalahari) have been recorded. In woodland, savannah and rainforest areas mean home ranges for females are 9-27 km² and 52-136 km² for males. In arid habitats, home ranges are larger, reaching 188 to 2,750 km² (Hunter & Barrett 2011). In the Tsavo National Park, Kenya, a female leopard had a home range of 5.6 km² and in the Lolldaiga Hills ranch, home range size was 10-43 km² (Hunter & Berrett 2011, Svengren & Bjoerklund 2010).

Home ranges of females and males generally overlap with each other but male home ranges are generally exclusive or only overlap to a very limited extent (Sanei et al. 2015). Considering that many remnant populations are transboundary, some individual leopards may have to cross frequently national boundaries during their circadian cycles to access resources such as waterholes or prey. Daily travel distances of leopards vary with habitat and prey density. In Kenya, the average daily travel distance of a male was 10.9 km (Hamilton 1981). In Kgalagadi Transfrontier Park, South Africa, the mean daily distance was 14.3 km for males, and 13.4 km for females, while the maximum daily distance was 33 km (Bothma & le Riche 1984). The distance travelled in one day depends on hunting success. The killing of prey limited further movements and daily travel distances increased as the period since the previous kill became longer (Bothma & le Riche 1984).

Life cycles

Subadult leopards start to disperse at an age of 13–14 months for both sexes. A positive density-dependence for the age of dispersal was observed in Phinda Private GR, South Africa. Males dispersed on average over a distance of 11 ± 2.5 km, and females over 2.7 ± 0.4 km. In fact, all 13 observed females remained philopatric whereas twelve of 22 males dispersed. Males remained in their natal home range when the situation allowed it (Fattebert et al. 2015), likely dependent on the turn-over of the population. But generally, dispersal of males is remarkable. A subadult male leopard, first radio-collared in Phinda game reserve, traversed

three countries covering a minimum distance of 352.8 km between his natal range and the site of his death. His movements reveal potential linkages between leopard populations in southern Mozambique, Swaziland, northern KwaZulu-Natal and the Greater Kruger Ecosystem, which might represent a functioning leopard metapopulation currently regarded as separate conservation units (Daly et al. 2005, Fattebert et al. 2013). In Kgalagadi Transfrontier Park between Botswana and South Africa, home ranges of observed leopards were transboundary and a dispersing male leopard travelled 112.6 km before the contact with him was lost (Bothma et al 1997).

Annual cycles

As other solitary cats, adult leopards live in life-long, relatively stable home ranges. The land tenure system of the population is not adapted to seasonal movements or seasonally changing availability of prey, but individual home-ranges in climate zones with seasonal fluctuations (winter-summer, wet-dry) are large enough to compensate for seasonal fluctuations of resource availability. This explains the huge variety of leopard home range size (see above). There is no reference to annual changes in home-range use, although it can be assumed that leopards may seasonally adapt e.g. to snow cover or lack of water and consequently reduced prey availability.

3.2 Proportion of the population migrating, and why that is a significant proportion

If dispersal is considered a migratory stage of leopards, half of the population (all males) are “migratory” in a given phase of their lives. Even the dispersal of the more philopatric females has an important transboundary component, considering that e.g. in Africa, 54.2% of all leopard populations identified stretch across international borders (Jacobson et al. 2016). The Critically Endangered leopard in the Caucasus Ecoregion is a transboundary population stretching over six countries, and international connectivity is crucial for its recovery (Farhadinia et al. 2015b). The likewise Critically Endangered Amur leopard is a population shared between three countries, Russia, China, and North Korea.

The following countries share transboundary leopard populations that cyclically and predictably cross their national jurisdictional boundaries:

Africa (population identification and names according to Jacobson et al. 2016):

- Guinea/Guinea-Bissau/Mali/Senegal: Nikolo;
- Liberia/Sierra Leone: North Liberia;
- Ivory Coast/Liberia: Tai forest;
- Burkina Faso/Ivory Coast/Ghana: Comoe and Mole;
- Ghana/Burkina Faso: northern Ghana and southern Burkina Faso; Kabore-Tambi;
- Benin/Burkina Faso/Niger: W-Arly-Pendjari;
- Benin/Nigeria: Kainji and Trois Rivieres;
- Cameroon/Nigeria/Chad: Benoue ecosystem;
- Cameroon, Equatorial Guinea: Camp Ma’an;
- Angola/CAR/Cameroon/DRC/Congo/Gabon/Equatorial Guinea: West Congo Basin;
- CAR/DRC/Sudan/South Sudan/Chad: Eastern Central African Republic;
- Egypt/Sudan: Red Sea coast;
- Ethiopia/Sudan: northern Ethiopia;
- Djibouti/Eritrea/Ethiopia: Mousa Ali Mountains;
- Ethiopia, Kenya, South Sudan: southern Ethiopia;
- Ethiopia/Somalia: Gaan Libaax and eastern Ethiopia;
- Kenya/South Sudan/Uganda: northern and eastern Uganda;
- DRC/Uganda: greater Virunga;
- Rwanda/Tanzania/Uganda: Akagera, Rumanyika and Lake Mburo;
- Burundi/Rwanda: Nyungwe;
- Kenya/Mozambique/Somalia/Tanzania: central Kenya and Tanzania;
- Angola/Botswana/DRC/Mozambique/Malawi/Namibia/South Africa/Zambia/Zimbabwe: central Southern Africa & coastal Namib;
- Mozambique/Zimbabwe: Marromeu and central Mozambique;
- Botswana/Zimbabwe: Matopos and south western Zimbabwe;

- Botswana/Mozambique/South Africa/Swaziland/Zimbabwe: Kruger and eastern Southern Africa;
- Lesotho/South Africa: Drakensberg Mountains.

Asia:

- Saudi Arabia/Yemen (Jacobson et al. 2016)
- Oman/Yemen: Jabal Samhan and coastal Oman (Spalton & Al Hikmani 2014)
- Talysh Mountains (Southern Azerbaijan) and Alborz Mountains (NW Iran) (Askerov et al. 2015)
- Nakhichevan/Azerbaijan/southern Armenia (Askerov et al. 2015, Jacobson et al. 2016)
- Eastern Georgia/northwest Azerbaijan, the Iori-Ajinour Plateau (Askerov et al. 2015, Jacobson et al. 2016)
- Georgia/Daghestan/Russia, Eastern Greater Caucasus (Askerov et al. 2015, Jacobson et al. 2016)
- Iraq/Turkey/Iran small transboundary population may persist in Zagros Mountains (Raza et al. 2012a, Jacobson et al. 2016, Avgan et al. 2016)
- Russian Far East/China, Sino-Russian population, Primorsky Krai and eastern China (Feng et al. 2017)
- China/Lao Peoples Democratic Republic: Xishuangbanna (Jacobson et al. 2016)
- Myanmar/Thailand: Northern Tenasserim Forest Complex (Rostro-García et al. 2016)
- Cambodia/Thailand: Northern Plains landscape (Jacobson et al. 2016)
- Malaysia/Thailand: Belum-Temengor (Jacobson et al. 2016)
- Bhutan/China/India/Myanmar/Nepal/Pakistan: Himalaya range (Jacobson et al. 2016)
- Bangladesh/India/Myanmar: Chittagong and Chin hills (Jacobson et al. 2016)
- Possibly border between Bangladesh, southeast corner of Chittagong Hills, and Myanmar (Jacobson et al. 2016).

Efforts for transboundary conservation or recovery of leopard populations include conservation strategies for the Arabian leopard (Breitenmoser et al. 2010), for the leopard in the Caucasus (Breitenmoser et al. 2007) and a recent collaboration agreement for transboundary cooperation between China and Russia for the Amur leopard (Feng et al. 2017, Jacobson et al. 2016). The Chinese government recently announced to create a National Park for Amur leopards and Amur tigers, which will cover about 15,000 km² and be adjacent to the Land of the Leopard National Park in Russia, covering 2,620 km², thus creating a large transboundary protected landscape (Feng et al. 2017). More such international cooperation agreements for leopard conservation are needed.

4. Biological data (other than migration)

4.1 Distribution (current and historical)

Leopards are distributed across 79 African and Asian countries. The species ranges from sub-Saharan Africa to the Arabian Peninsula, through southwest Asia and the Caucasus up to the Himalayan foothills, India, China and the Russian Far East and occurs on the islands of Java and Sri Lanka (Stein et al. 2016, Fig. 2). The leopard still occurs in Afghanistan, Angola, Armenia, Azerbaijan, Bangladesh, Benin, Bhutan, Botswana, Burkina Faso, Burundi, Cambodia, Cameroon, Central African Republic, Chad, China, Congo, The Democratic Republic of the Congo, Côte d'Ivoire, Djibouti, Egypt, Equatorial Guinea, Eritrea, Ethiopia, Gabon, Ghana, Guinea, Guinea-Bissau, India, Indonesia (Jawa), Islamic Republic of Iran, Iraq, Kenya, Liberia, Malawi, Malaysia, Mali, Mozambique, Myanmar, Namibia, Nepal, Niger, Nigeria, Oman, Pakistan, Russian Federation, Rwanda, Saudi Arabia, Senegal, Sierra Leone, Somalia, South Africa, Sri Lanka, Sudan, Swaziland, United Republic of Tanzania, Thailand, Turkey, Turkmenistan, Uganda, Yemen, Zambia and Zimbabwe (Stein et al. 2016).

Leopard populations have been highly reduced and isolated across its range. The species has been extirpated from large portions and only occupies 25-37% of its historical range (Jacobson et al. 2016, Stein et al. 2016). Range loss of subspecies varies between 48 and 98% (Table 1).

Subspecies	Extant range km ²	Percentage of historical range loss
<i>P. p. orientalis</i>	8,100	97-98
<i>P. p. nimr</i>	17,400	98
<i>P. p. melas</i>	20,600	84
<i>P. p. kotiya</i>	24,400	63
<i>P. p. japonensis</i>	68,000	96-98
<i>P. p. delacouri</i>	90,400	93-96
<i>P. p. saxicolor</i>	602,000	72-84
<i>P. p. fusca</i>	1,066,600	70-72
<i>P. p. pardus</i>	6,613,000	48-67

Region	Extant range km ²	Percentage of historic range lost
North Africa	5,800	99
West Africa	196,000	86-95
East Africa	1,457,200	47-61
Central Africa	2,081,900	45-66
Southern Africa	2,872,200	28-52

Leopards have lost 48–67% of their historical range in Africa (Table 2), 83–87% in Asia, and 70% on the Arabian Peninsula (Durant et al. 2014, Ray et al. 2005, Jacobson et al. 2016). Leopards are now extinct in North Africa, and have disappeared from most of the West African coastal belt. In Africa, the leopard is classified as “possibly extinct” in Gambia and Lesotho and as “regionally extinct” in Mauritania, Morocco, Togo and Tunisia. Historically, the leopard was found throughout Kenya (Jacobson et al. 2016), but since the last IUCN Red List Assessment in 2008, the distribution of leopards has been reduced (Stein et al. 2016). Today, leopards in Kenya are mainly found in transboundary areas, in the transboundary patch covering *Kenya, Tanzania and North Mozambique* and in narrow strips belonging to the transboundary patches of *northern and eastern Uganda* in the west, and *Boma-Gambella & southern Ethiopia* in the north (Jacobson et al. 2016). Leopards are considered possibly extinct in the arid regions of the north and east of the country, and in unprotected lands west of Tana river, while they are confirmed to be extinct in eastern Lake Victoria, western Lake Turkana, the western Chalbi desert, central Kenya and the Tana delta (Jacobson et al. 2016). Historically, leopards occurred across Ghana but already by the 1950s they were vanishing from the country mainly due to habitat loss, exploitation, persecution and prey reduction (Jacobson et al. 2016). Today, the species is found along the boundary with Côte d’Ivoire, in the Bia Conservation Area, in the Mole National Park and possibly in Kakum National Park (Jacobson et al. 2016, Stein et al. 2016). Leopard abundance however decreased from 1968 to 2008 in Mole NP (Burton et al. 2011). Leopards declined from 1975 to 1994 by 98% and 96% in Mole National Park and Kalakpa Reserve respectively (Brashares & Sam 2005).

In the Middle East leopards are classified as “possibly extinct” in Israel and to be extinct on the Sinai Peninsula, Egypt, Jordan, Lebanon, Syrian Arab Republic and in the United Arab Emirates. The Arabian leopard only persists in around 2% of its historical range (Spalton & Al Hikmani 2014, Jacobson et al. 2016, Stein et al. 2016). Recent surveys found that leopards have still a wide distribution in Iran, mostly in the region of the two mountain chains consisting of Alborz running northwest to northeast and Zagros from northwest to the south (Sanei et al. 2016, Jacobson et al. 2016). The most viable leopard populations exist in Golestan National Park and Tandoureh National Park in the north-eastern part of Iran near the border with Turkmenistan (Hamidi et al. 2014, Farhadinia et al. 2017, Ghoddousi et al. 2017). Surveys in the Iranian Caucasus suggest that viable leopard populations are in the Western Alborz range, with small and increasingly isolated populations scattered across Talysh Mountains and bordering areas between Iran, Azerbaijan and Armenia (Moqanaki et al. 2013). A few recently confirmed records from Iraq and Turkey are restricted to the mountainous areas of Kurdistan in Zagros (Avgan et al. 2016), where leopard is scarce. There are numerous camera-trap records dated 2013-2014 confirming the presence of a small population in the Zangezur Ridge

shared by Armenia and Azerbaijan, also in Talysh Mountains adjacent to the Iranian border (Askerov et al. 2015). There is recent leopard evidence from Nakhchivan Autonomous Republic, Azerbaijan, only a few km from the Iranian border (Avgan et al. 2012). Recently, a leopard was video-trapped in North Ossetia of the Greater Caucasus, Georgia (Yarovenko & Zazanashvili, 2016). There are no confirmed recent records in Dagestan as the last confirmed photograph was taken in 2009 (Yarovenko & Zazanashvili 2016).

In Asia, mainly in South-east and East Asia, the leopard distribution has become very fragmented and the species has disappeared from most protected areas. In Asia the leopard is “regionally extinct” in Hong Kong, Korea, Kuwait, Singapore and Uzbekistan and is “possibly extinct” in Tajikistan, Laos PDR and Vietnam. Leopards possibly only persist in small isolated populations in some protected areas in Myanmar, Thailand, Cambodia, Malaysia and China (Li et al. 2010). In China, the leopard persists only in 0.4% of its former range (Rostro-García et al. 2016). Leopard range is suspected to have been reduced by over 30% globally in the last three leopard generations (22.3 years; Stein et al. 2016). Generation length for the leopard was calculated at 7.42 years based on the method of Pacifici et al. 2013 and data on wild leopards in Balme et al. 2013).

According to the latest IUCN assessment, the extant leopard range is 8,515,935 km² (Stein et al. 2016)

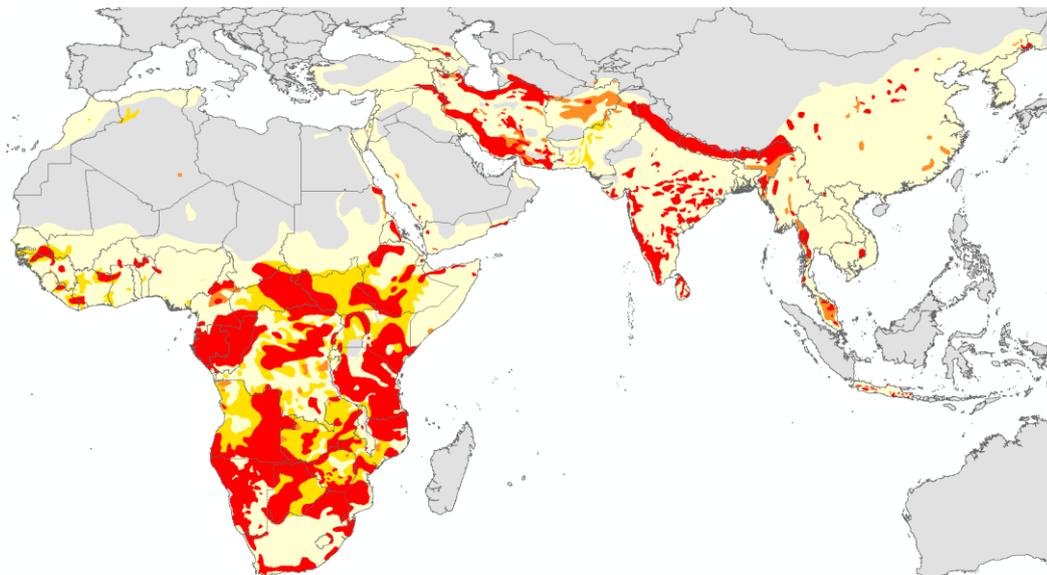


Fig. 2. Leopard distribution. Red = extant, orange = possibly extant, dark yellow = possibly extinct, yellow = extinct. From Jacobson et al. 2016.

4.2 Population (estimates and trends)

Highly adaptable and widely distributed, the common leopard can persist in areas where other large carnivores have been extirpated. (Jacobson *et al.* 2016). A recent robust population estimate of mature leopards range-wide does not exist, but the current range-wide population trend is assessed as decreasing (Stein et al. 2016). For some subspecies population estimates exist (Table 3) and for some populations the density has been estimated since 2000 (Table 4).

Across Africa few reliable data on leopard population trends over the last three generations exist (Stein et al. 2016). The most recent continent wide population estimation for Africa dates back to a model from 1988 developed by Martin & de Meulenaer (1988). They estimated 714,000 leopards across the whole of Africa, but this estimate was highly questioned, it was believed to be too simplistic and refuted by several researchers to be a high overestimate (Jackson 1989, Norton 1990, Nowell & Jackson 1996, Henschel 2008, Balme et al. 2010b). The leopard population across Kenya was last estimated at 10,000-12,000 animals by Hamilton (1981).

Table 3. Population estimates for leopard subspecies (Stein et al. 2016).

Subspecies/region	Population estimate	References
W-Asia and Caucasus	<800–1,000	Stein et al. 2016
Persian leopard	871–1290	Khorozyan 2008
Iran	550–850	Kiabi et al. 2002
Arabian leopard	45–200	Mallon et al. 2008
Oman	17 (Jabal Samhan)	Spalton et al. 2006
	44–58 (Dhofar)	Spalton & Al Hikmani 2014
Saudi Arabia	<100	Boug et al. 2009
Javan leopard	350–525 (<250 MI)	Ario et al. 2008
Sri Lankan leopard	700–950	Kittle & Watson 2015
Amur leopard	<60	Stein et al. 2016
	87	Feng et al. 2017
Russia	26	Hebblewhite et al. 2011
	26	Sugimoto et al. 2014
China	42	Wang et al. 2015
African leopard	No recent estimates	
Namibia	5,469–10,610	Hanssen & Stander 2004
	<14,000	Stein et al. 2012
South Africa	2,185–6,780 in 10 core areas	Daly et al. 2005
Uganda	≤150–200	UWA 2012
Indochinese leopard	973–2503 (409–1051 MI)	Rostro-García et al. 2016
Cambodia	44–13	Rostro-García et al. 2016
China	8–22	Rostro-García et al. 2016
Malaysia	282–847	Rostro-García et al. 2016
Myanmar	223–670	Rostro-García et al. 2016
Thailand	416–832	Rostro-García et al. 2016
North China leopard	174–348	Laguardia et al. 2017
South-eastern China	<20 (SE China)	Laguardia et al. 2017
Indian leopard		
India	12,000–14,000	Bhattacharyal 2015
Nepal	<1000 in Nepal	Jnawali et al. 2011

Populations in the Iranian Caucasus are very small, supposedly few (<10) reproducing leopards exist in this region (Moqanaki et al. 2013). Yet, moving towards Alborz range, specifically in eastern parts of Alborz close to the Iran-Turkmenistan border, leopard populations are viable and supposedly the largest in this region (e.g. 23–42 individuals in Golestan National Park: Hamidi et al. 2014).

Table 4. Leopard population density estimates for data collected after 2000 (Jacobson et al. 2016).			
Subspecies	Extant range	Density estimate (leopards/100 km ²)	Regions
<i>P.p. delacacouri</i>			
Cambodia	14,801	3.6 (Gray & Prum 2012)	Mondolkiri Protected Forest
Malaysia	65,638	4.0 (Sanei et al. 2011); 3 (Hedges et al. 2015)	Ayer Hitman Forest Reserve; Kenyir wildlife corridor
Thailand	35,689	4.78 (Raza et al. 2012b)	Kaeng Krachen NP
<i>P.p. fusca</i>			
Bhutan	30,472	1.04 (Wang & Macdonald 2009)	Jigme Singye Wangchuck NP
India	825,450	3.4 (Borah et al. 2014); 1.68 (Goswami & Ganesh 2014); 23.5 (Chauhan et al. 2005); 14.99 (Harihar et al. 2009); 4.8 (Athreya et al. 2013); 40 (Athreya et al. 2004); 4.2–6.2 (Edgaonkar 2008); 14.9 (Kalle et al. 2011); 1.1–2.99 (Selvan et al. 2014)	Manas NP; Manas core area; Sariska tiger reserve; Chilla reange of Rajaji NP; Maharastra; Sanjay Gandhi NP; Satpura tiger reserve; Mudumalai tiger reserve; Pakke tiger reserve
Nepal	107,908	5.61 (Thapa et al. 2014); 5.0 (Wegge et al. 2009)	Parsa wildlife reserve and Bardia Naitonal Park
<i>P.p. orientalis</i>			
China	3,119	0.62 (Qi et al. 2015)	Laoye Mountains of Jilin province
<i>P.p. saxicolor</i>			
Iran	337,992	1.87 (Ghoddousi et al. 2010); 2.6 (Hamidi et al. 2014)	Bamu NP; Golestan NP
<i>P.p. pardus</i>			
Botswana	366,640	7.5 (Shashe Limpopo group 2010); 0.1 (Boast & Houser 2012); 0.48 (Kent 2011)	Northern Tuli Game Reserve; Ghanzi commercial farmlands; Ghanzi region
Cameroon	132,555	1.28 (Croes et al. 2011); 1.46 (Croes et al. 2011)	Bénoué Complex (Bénoué NP, Boubandjida NP and Faro NP) and Hunting Zones (28 sport zones adjacent to parks)
Gabon	252,151	2.7–12.1 (Henschel 2008)	Lope and Ivindo NPs
Ghana	14,700	2-2.9 (Brashares & Sam 2005)	Mole National Park
Kenya	259,227	8.4–12 (O'Brien & Kinnaird 2011)	Mpala ranch
Namibia	568,590	3.6 farmland and 1.0 park (Stein et al. 2011); 1.18 and 2.4 (Funston et al. 2014)	Waterberg plateau farmland and Waterberg Plateau Park; Bwabwata NP
Senegal	29,492	2.0–4.0 (Kane et al. 2015)	Niokolo Koba NP
South Africa	401,336	10.7 (Chase Grey et al. 2013); 0.25–2.3 (Martins 2010); 2.49–11.11 (Balme et al. 2010a); 7.17–11.21 (Balme et al. 2009); 2.5–7.0 (Chapman & Balme 2010); 12.7 (Maputla et al. 2013); 18.8 (Owen et al. 2010)	Soutpansberg mountains, Cederberg mountains, various, Phinda Private Game Reserve, Zululand Rhino Reserve, northern Kwazulu-Natal, Karongwe private game reserve
Tanzania	668,760	7.9 (Msuha 2009)	Small part of Tarangire NP
Zambia	233,265	3.36 (NP only); 4.79 (Ray 2011)	Luambe NP and GMA-Chanjuzi
Zimbabwe	121,406	7.64 (Williams 2011); 5.12 (Grant 2012); 8.3 (Groom & Brand 2011); 6.0 (du Preez et al. 2014)	Save Valley, Mangwe district, Gonarezhou NP

4.3 Habitat (short description and trends)

The leopard is highly adaptable and inhabits a wide range of different ecosystems, with extreme variation in conditions and habitat types (Hunter & Barrett 2011, Stein & Hayssen 2013). It occurs in the boreal forests of Russia with winter temperatures dropping below -30 C° and in deserts where summer temperatures can reach up to 70 C° (Hunter & Barrett 2011). Leopards are found in tropical rainforests, grassland plains, dry scrub, savannah, temperate deciduous and pine forests, alpine areas, in semi-desert and desert areas up to high mountain slopes. Leopards can also occur close to major towns, e.g. Mumbai, India, and Johannesburg, South Africa (Odden et al. 2014, Kuhn 2014, Jacobson et al. 2016, Henschel et al. 2008, Mallon & Budd 2011). In Iran, the leopard occurs apart from the hyper arid habitats in the central deserts of the country (Kiabi et al. 2002), in diverse habitats over much of Iran (Sanei et al. 2016; Jacobson et al. 2016), from semi-arid plateaus in Central Iran to highland meadows, alpine steppes, and deciduous mixed forests in north-western and northern Iran. Although, the species appears to have a wide geographical distribution in Iran, it has generally a low abundance mainly restricted to well-protected reserves with viable populations of wild ungulates (Ghoddousi et al. 2010, Farhadinia et al. 2014).

In the Arabian Peninsula, it mainly inhabits the mountainous regions along the coast (Mallon & Budd 2011). On the Indian subcontinent, the species occurs in habitats such as forests, rocky outcrops and anthropogenic landscapes. In South-west and central Asia, leopards are nowadays mainly restricted to remote mountain areas and rugged foothill regions (Henschel et al. 2008). In sub-Saharan Africa the leopard has been recorded up to 5,600 m on Mt. Kilimanjaro (Tanzania) and up to 5,200 m in the Himalaya (Hunter & Barrett 2011, Nowell & Jackson 1996).

4.4 Biological characteristics

The leopard has a large and muscular body, wide head and short legs with strong paws. The fur is soft and short, light buff in colour which becomes lighter under the belly and covered with spots, or rosettes. External Features: HB 110- 180 cm, T 60- 100 cm, SH 45- 78 cm and W 35- 90 Kg. Leopard size varies in correlation with climate and prey abundance. Male Persian leopards from north Iran and leopards from woodland habitats of eastern and southern Africa can weigh up to 90 kg and are significantly heavier than males of the neighbouring subspecies, the Arabian leopard, which only weigh up to 35 kg (Hunter & Barrett 2011, Sanei et al. 2015, Spalton & Hikmani 2014). Such size difference indicates dependence on prey size, e.g. large ungulates such as wild sheep or red deer for the Persian leopard, and rock hyrax for the Arabian leopard. Female leopards in the coastal Cape Mountains (South Africa) have an average weight of 21 kg and male leopards in Zimbabwe can weigh up to 60 kg (Stein & Hayssen 2013). On average, male leopards in South Africa and Namibia measured a total length of 210-218 cm while females measured 185-198 cm (Stein & Hayssen 2013).

The species is mainly active from dusk to dawn. However, their activity pattern can vary depending on prey availability, competing predator presence, temperature and human disturbance (Spalton & Al Hikmani 2014). Leopard populations in undisturbed rainforest in Gabon for example were largely diurnal (Henschel 2008). Adults are solitary with the territories of each male overlapping those of several females. Territories are strongly defended and marked on the boundaries by scrapes on the ground, scratches on the trees and faeces and urine (Stein & Hayssen 2013). The size of leopard home ranges is highly variable. Home range size ranges from 5.6 km² (female, Tsavo National Park, Kenya) to 2,750 km² (male, Kalahari). A collared adult male in Bafq Protected Area, Yazd Province, Iran, used 626 km² over 10 months (H. Jowkar & L. Hunter, unpubl. data). Home range size of six adult leopards (5 males and 1 female) tracked with GPS-satellite collars in Tandoureh National Park, Iran, ranged from 62.9 to 1,098.3 km² (100% MCP; Farhadinia et al. 2017). Leopards are visual hunters and excellent climbers (Sunquist & Sunquist 2002, Hunter & Barrett 2011).

The diet of leopards is influenced by many factors such as prey density and composition, other predators, environmental factors and anthropogenic pressure (e.g. overhunting for bushmeat; Balme et al. 2007, Henschel et al. 2011). Leopards can kill prey up to 2 or 3 times larger than

themselves but they have a preference for medium sized ungulates with a weight of 15-80 kg (Henschel et al. 2005, Henschel 2008, Hunter & Barrett 2011). Although small prey is mostly taken opportunistically, primates, hares, rodents, birds and small carnivores form an important part of the diet where large ungulates are less frequent (Nowell & Jackson 1996). In sub-Saharan Africa, 92 prey species were recorded. Leopards prey opportunistically mainly on mammalian prey ranging from large ungulates such as elands to small species such as rock hyraxes. However, they mainly prey on medium sized to large ungulates such as impala or springbok (Balme et al. 2007, Henschel et al. 2008, Hunter & Barrett 2011, Stein & Hayssen 2013). In Asia, the main prey are muntjac, chital deer, mountain goats, roe and sika deer, hog deer, tufted deer, wild pig, hog badger and langur (Johnson et al. 1993, Khorozyan & Malkhasyan 2003, Mukherjee & Mishra 2001, Odden et al. 2010). The Arabian leopard preys predominantly on rodents such as abundant rock hyrax but also takes Arabian gazelles, Nubian ibex, cape hares, birds, Indian Crested porcupines, Ethiopian hedgehogs, lizards and insects (Al Jumaily et al. 2006, Judas et al. 2006, Spalton & Al Hikmani 2014). The bulk of diet for the Iranian leopards are consisting of wild medium-sized to large ungulates, with the major prey species being wild goat *Capra aegagrus* and wild sheep *Ovis* spp., in addition to wild boar *Sus scrofa*, different deer species, and less commonly gazelles *Gazella* spp., small mammals, birds, reptiles and even insects (Farhadinia et al. 2014, Sharbafi et al. 2015, Ghoddousi et al. 2016). Occasionally, leopard predating on domestic animals and sheepherding dogs have been reported as well (Ghoddousi et al. 2016, Babgir et al. 2017). In intensively human used landscapes in India, livestock and dogs form the base of the leopard's diet (Athreya et al. 2016).

In South Africa, leopards reproduce throughout the year but in some areas of southern Africa, birthing peaks may coincide with the birth season of the leopard's main prey species. In Asia, reproduction is more seasonal except for the tropics (Stein & Hayssen 2013). In Iran, the species usually mates in February. Oestrus lasts about 7-14 days, the oestrus cycle for around 46 days and the gestation period for 90-106 days (Hunter & Barrett 2011, Sunquist & Sunquist 2002). Age at first reproduction is 30-36 months for females and 42-48 months for males. A 16-year old female was recorded giving birth in the Sabi Sand Game Reserve (South Africa) (Balme et al. 2012, Hunter & Barrett 2011). The inter-birth interval is 16-25 months (Stein & Hayssen 2013). 1 to 4 cubs are born though rarely are more than 2 cubs raised successfully. Cubs remain with their mother until they are 12 to 18 months old (Sunquist & Sunquist 2002) and remain together for several months afterwards. Longevity is 14 to 19 years in the wild and up to 23 years in captivity.

Leopard density reported varied widely from 0.1 leopard per 100 km² (Ghanzi farmland, Botswana) to 22 per 100 km² (Lopé National Park, Gabon). This large density variation can be attributed to the habitat type, prey density, presence of sympatric carnivores and persecution by humans.

The adaptability and response of leopards to human presence is highly variable and changes from region to region. Human and co-predator activity and presence can have varying influences on the species' spatio-temporal activity and behaviour (Carter et al. 2015). In some countries such as in Gabon, leopards appear to actively avoid areas with human presence, while in some areas of India leopards co-exist with humans in densely populated areas (Henschel et al. 2011, Carter et al. 2015).

4.5 Role of the taxon in its ecosystem

Leopards are large carnivores and as such have an important regulatory role in its ecosystems: "Large carnivores have substantial effects on the structure and function of diverse ecosystems" (Ripple et al. 2014). Where leopards and lions coexist, they control mesopredator populations (Ripple et al. 2014). Leopards are part of the species with "mesopredator cascades" from large carnivores to mesopredators to prey of mesopredators (Ripple et al. 2014). In areas where leopards and lions were extirpated, olive baboons increased and small ungulates and primates decreased (Ripple et al. 2014). Moreover, "large carnivores help reduce disease prevalence in ungulate prey populations" (Ripple et al. 2014) and "by reducing the numerical abundance of a competitively dominant prey species, carnivores erect and enforce ecological boundaries

that allow weaker competitors to persist” (Miller et al. 2001). Thus, carnivores are able to reduce competition among herbivore species (Miller et al. 2001).

In Africa, leopards prey on species such as nyala, springbok, reedbuck, duiker, impala, kudu, wildebeest, oryx, kob, oribi, bushbuck, waterbuck, steenbok, blesbok, Thompson’s gazelle, dikdik, aardvark, porcupine, warthog, bushpig, genets, klipspringer, rock hyrax and tree hyrax, primates, bad-eared fox and wildcats (Smithers 1971, Bertram 1982, Mizutani 1999, Hayward et al. 2006, Ott et al. 2007, Balme et al. 2010a, Hunter & Barrett 2011, Jones 2013, Stein & Hayssen 2013) and in Asia on muntjac, chital deer, mountain goats, roe and sika deer, hog deer, tufted deer, wild pig, hog badger and langur (Johnson et al. 1993, Khorozyan & Malkhasyan 2003, Mukherjee & Mishra 2001, Odden et al. 2010). Leopards “potentially limit herbivores through predation and mesopredators through intraguild competition, structuring ecosystems” (Ripple et al. 2014).

Where leopards do not co-occur with lions and tigers they are the apex predator and therefore also play an important role as umbrella and flagship species.

5. Conservation status and threats

5.1 IUCN Red List Assessment (if available)

Globally:

- Vulnerable A2cd ver 3.1 (Stein et al. 2016)

Regionally:

- West Asia and Caucasus: Endangered (IUCN 2008)
- Mediterranean: Critically Endangered (Jdeidi et al. 2010)

Subspecies (as far as assessed): Table 5

“Leopards are widely distributed across Africa and Asia, but populations have become reduced and isolated, and they are now extirpated from large portions of their historic range” (Stein et al. 2016). In the 2016 IUCN Red List assessment, the leopard was up-listed from Near Threatened to Vulnerable (Stein et al. 2015). According to Stein et al. (2016), leopards are difficult to assess as a single species as they have a wide geographic range, elusive nature and habitat tolerance. Their status in most areas of Africa and Asia is poorly known (Stein et al. 2016). However, evidence suggests “that leopard populations have been dramatically reduced due to continued persecution with increased human populations, habitat fragmentation, increased illegal wildlife trade, excessive harvesting for ceremonial use of skins, prey base declines and poorly managed trophy hunting” (Stein et al. 2016). Across the majority of its range in West and Central Asia as well as in North, East and West Africa, leopards have declined substantially and suffered regional extirpation due to poaching, habitat loss and fragmentation, and prey loss (Jacobson et al. 2016, Stein et al. 2016), leopards have almost completely disappeared from the Greater Caucasus (Askerov et al. 2015, Yarovenko & Zazanashvili 2016), where they were recorded in the previous assessment. In the Southern Lesser Caucasus (Azerbaijan, Armenia and bordering areas in north-western Iran), leopards have persisted at very low level due to improved law enforcement and recent intensive conservation efforts (Breitenmoser et al. 2010a).

Stein et al (2016) proposed a range reduction of 61% for the leopard across its range from the previous IUCN Red List Assessment in 2008. However, the severity of this reduction might be inaccurate due to lack of reliable information and insufficient sampling in the previous effort, thus the reduction has likely happened over a longer time scale (Stein et al. 2016). Jacobson et al. (2016) argue that over 84% of leopard habitat has been lost across West Asia and the Caucasus. Even in its stronghold, southern Africa, there are no evidences that leopard populations remained stable and a range loss of 21% was estimated (Stein et al. 2016). A worldwide range reduction of over 30% in the last three generations (22.3 years) is suspected (Stein et al. 2016). Though the knowledge of leopard distribution and population status is better today, extensive knowledge gaps still exist at both national and regional scales because of

lack of reliable data on leopard population dynamics and trends from large portions of their range (Stein et al. 2016).

Recent assessments suspect that at least half of the reduction in the leopard population translates to real and relatively recent range loss (Jacobson et al. 2016, Stein et al. 2016). “Leopard population density across the species’ range is known to track the biomass of principle leopard prey species, medium-size and large wild herbivores. Prey species are increasingly under threat from an unsustainable legal or illegal harvesting, leading to collapses in prey populations across large parts of the species’ range” (Stein et al. 2016).

Table 5. IUCN Red List leopard subspecies assessments and population trends. EN = Endangered, CR = Critically Endangered. Assessments in square brackets [...] were proposed in scientific publications, but have not yet been formally assessed in the IUCN Red List.

Subspecies	Red List status	Population trend
Persian leopard <i>P. p. saxicolor</i> (Khorozyan 2008)	EN C2a(i)	Decreasing
Arabian leopard <i>P. p. nimr</i> (Mallon et al. 2008)	CR C2a(i)	Decreasing
Javan leopard <i>P. p. melas</i> (Ario et al. 2008)	CR C2a(i)	Decreasing
Sri Lankan leopard <i>P. p. kotiya</i> (Kittle & Watson 2008)	EN C2a(i)	Decreasing
Amur leopard <i>P. p. orientalis</i> (Jackson & Nowell 2008)	CR C2a(ii), D	Increasing
African leopard <i>P. p. pardus</i> (Stein et al. 2016)	[VU]	Decreasing
Indochinese leopard <i>P. p. delacouri</i> (Rostro-Garcia et al. 2016)	[EN A2b,c,d; A3b,c,d; C1]	Decreasing
North China leopard <i>P. p. japonensis</i> (Laguardia et al. 2017)	[CR A2bc, C2a(i)]	Decreasing
Indian leopard <i>P. p. fusca</i>	Not assessed	

Based on this information, the recent IUCN assessment of threatened species up-listed the leopard from Near Threatened to Vulnerable under criterion A2cd, mainly due to loss of habitat and prey, and exploitation (Stein et al. 2016). According to Stein et al. (2016), “these causes of the suspected reduction are not well understood, have not ceased, and are likely to continue, and future decline is anticipated unless conservation efforts are taken”. The formal assessment of the leopard subspecies in the IUCN Red List is not completed yet, but all subspecies assessed were classified as Endangered or Critically Endangered due to low population numbers and population fragmentation (Stein et al. 2016; Table 5).

5.2 Equivalent information relevant to conservation status assessment

Several scientific reviews have adopted IUCN rules for the assessment of additional subspecies (Table 5) or populations. The leopard populations in the different regions of Africa were all proposed to meet the criteria for a threatened category (North Africa: CR, West Africa: EN, Central Africa VU, East Africa: VU and southern Africa: VU; Stein et al. 2016; Table 6).

Table 6. Status information on leopards per region in Africa.

Region	Status information
North Africa	Leopard is proposed as Critically Endangered. Remaining populations previously thought to persist in Morocco and Algeria have probably vanished. The population in Egypt is considered to be very small (Stein et al. 2016).
West Africa	Leopard is proposed as Endangered (Stein et al. 2016). Resident leopard populations unlikely persist outside protected areas. Main problem is lack of prey (mainly due to bushmeat hunting) and the poisoning of carcasses (P. Henschel, pers. comm.).

Central Africa	The leopard is proposed to be Vulnerable (Stein et al. 2016). Close to human areas, large species are virtually lost due to heavy hunting pressure (P. Henschel, pers. comm.). Little survey work has been carried out and there is little information on the leopard.
East Africa	The leopard is thought to be Vulnerable (Stein et al. 2016). Information on leopards is rare.
Southern Africa	Leopard is proposed as Vulnerable. Leopard populations within Angola, Zambia, Mozambique, Zimbabwe and South Africa appear to be decreasing from previous estimates with leopards disappearing from areas of increased human development and areas of intensive conflict with humans (G. Balme, pers. comm., Stein et al. 2016). Bushmeat trade has highly reduced leopard prey (and leopards directly) in Mozambique and Zambia (Fusari & Carpaneto 2006, Lindsey et al. 2013). There is no information available on the leopard status in Angola (P. Henschel, pers. comm.).

5.3 Threats to the population (factors, intensity)

In spite of changing land-use, prey availability and direct mortality from humans, leopards have been able to persist where other large predators have not (Jacobson et al. 2016). As a result of the leopards' ability to live in human-dominated landscapes and feed on a variety of prey, it was believed for a long time that their conservation is of little concern. However, recent surveys have shown that leopard populations were significantly reduced throughout West and Central Africa, south-west and south-east Asia and China (Jacobson et al. 2016). The primary threats to Leopards are human-caused: habitat fragmentation (through deforestation, mining, and/or infrastructure development), reduced prey base (overhunting and competition with growing livestock herds), and conflict with livestock and game farming. Additional threats are poorly managed trophy hunting, persecution due to human conflicts, illegal killing for the wildlife trade, and incidental snaring (Boast 2014, Constant 2014, Daly et al. 2005, Hunter & Barrett 2011, Nowell & Jackson 1996, Ray et al. 2005, Stein et al. 2016, Strampelli 2015).

Habitat

As human populations expand, natural habitats are converted to urban or agricultural landscapes or to ranch land for livestock breeding, causing directly habitat and prey base loss for leopards (Stein et al. 2016), but also increasing conflicts with herders. Although leopards are adaptable, they have limited levels of ecological resilience to habitat alteration and fragmentation and they need sufficient contiguous habitats with low human impact to reproduce successfully (Balme et al. 2010a). In sub-Saharan Africa (where leopard populations were less reduced than in other parts of the species' global range), the human population increased by 126% between 1970 and 2000 (UN 2013). Agricultural landscapes increased by 57% and the natural vegetation decreased by 21% from 1975 to 2000 (Brink & Eva 2009). The human population in this region is projected to increase more than twice between 2010 and 2050 (UN 2013) and the area of cultivated land by approximately 21% between 2005 and 2050 (Alexandratos & Bruinsma 2012). In forested Africa, deforestation has been identified as a significant threat to leopard populations (Ikemeh 2007).

In Asia, habitat loss and fragmentation is a major threat to leopards throughout their range (Stein et al. 2016, Jacobson et al. 2016). On the Arabian Peninsula habitat loss through overgrazing by livestock is, besides direct persecution, the main reason for the leopard's decrease (Judas et al. 2006, Spalton et al. 2006). Habitat conversion to palm oil and rubber plantations are major contributing factors to the recent high loss of leopard range across South-east Asia, where deforestation rates are still increasing (Rostro-García et al. 2016, Sanei & Zakaria 2009, Stein et al. 2016, Sodhi et al. 2010):

“Because <10% of South-east Asian forests are under some form of protection, and prices of luxury wood, palm oil, and rubber are expected to increase, habitat loss in the region is expected to continue and thus likely to have negative impacts on the leopard populations” (Stein et al.2016).

Prey

Prey depletion is a major threat almost across the whole leopard range (Al Jumaily et al. 2006, Henschel 2008, Judas et al. 2006, Pitman 2012, Stein et al. 2016). In Africa, leopard prey is hunted intensively for bushmeat trade (Jorge 2012, Stein et al. 2016). Data on herbivore populations in 78 protected areas in western, eastern and southern Africa monitored from 1970 to 2005 revealed an average 59% decline in population abundance across these three regions. While large mammal populations increased by 24% in southern Africa, they declined by 52% in East Africa and by 85% in West Africa (Craigie et al. 2010). According to Stein et al. (2016) “considering the leopards dependence on wild prey species within its African range, concomitant leopard declines in the same order of magnitude (>50%) in West and East Africa can be inferred for the same time”. In several places of West and Central Africa the “empty forest syndrome” (intact forest habitat but no prey species due to overhunting) is observed (Henschel 2008, Hunter & Barrett 2011). Leopards are already absent from the rainforest in Cameroon where bushmeat extraction is high (Toni & Lodé 2013). Bushmeat hunting is also in Ghana a major issue (IUCN PACO 2009). In the African rainforests, leopards exhibit a strong functional and numerical response to human hunters competition for prey; leopard populations are smaller or absent close to settlements where hunting pressure is high (P. Henschel, pers. comm., Henschel 2008, Henschel et al. 2011, Willcox 2002). Even in savanna Africa, large herbivores are under threat from unsustainable bushmeat trade, leading to a collapse of prey as for example in Zambia, where populations of wild animals have been reduced in 70% of game management areas (Lindsey et al. 2013). Over-hunting and habitat loss led to a decline or the extirpation of leopard prey species in Asian countries such as in Saudi Arabia, Yemen, Pakistan or the Caucasus Ecoregion (Judas et al. 2006, Al Jumaily et al. 2006; Williams et al. 2006). In Ayubia NP, Pakistan, the leopard survives mainly on livestock, due to lack of prey species, which enhances human-leopard conflicts (Shehzad et al. 2015). The depletion of the prey base is one factor responsible for the significant decline of the leopard across South-east Asia (Rostro-Garíá et al. 2016a).

Conflict

Human-leopard conflicts due to predation on livestock and game, or attacks on humans are recurrent across much of the leopard’s range, leading to retaliation killing in many areas. Factors contributing to human-leopard conflicts include again habitat deterioration, prey depletion, increasing human population, and poor livestock husbandry practices (Qamar et al. 2010, Kala & Kothari 2013). In Africa, retaliation killing due to livestock predation is a major threat for leopards in East and southern Africa and to a lesser extent in West and Central Africa. Leopards are frequently killed in retaliation by poisoning their prey, captured in snares, shot or speared (Chase-Grey et al. 2007, Croes et al. 2008, Boast 2014, Jorge 2012, Olupot et al. 2009, Purchase et al. 2007, Swanepoel et al. 2014b). Across southern Africa, the killing of carnivores to protect livestock is legal (Boast 2014). Carnivores can be killed by local farmers and permits are even distributed retroactively (Stein et al. 2016). In Kenya, a major threat is the poisoning of leopards by local herders near Amboseli and human-leopard conflict near Hell’s Gate, Ruma and in Nairobi National Park (Jacobson et al. 2016, Kuloba 2012). Leopards are killed in retaliation for livestock predation or because they are perceived as direct competitors for game across the Arabian Peninsula and in Asian countries (Judas et al. 2006, Spalton et al. 2006, Shehzad et al. 2015, Qamar et al. 2010). Where livestock pastures and traditional pastoralism occur, leopards may kill such prey, causing conflicts with herders, as reported from Iran (Ghoddousi et al. 2016, Babrgir et al. 2017). These communities may be intolerant to leopard and kill them for real or perceived threats to their lives or livelihoods (Sanei et al. 2016, Babrgir et al. 2017). For example, Babrgir et al. (2017) showed that in a conflict hotspot in the Iranian Caucasus, 80% of respondents considered the leopard as pest, with nearly half of them supporting licensed hunting or culling of the species.

Trophy hunting

Where trophy hunting is permitted (East, Central and southern Africa), leopards are an important game species. Trophy hunting has the potential to be a conservation tool, but only when hunting practises are sustainable, scientifically based, well managed and only if economic benefits from trophy hunting are high enough to balance out the costs of livestock

predation for communities living alongside carnivores (Balme et al. 2010b, Chase-Grey 2011, Leader-Williams & Hutton 2005). Leopards are overharvested in many parts of their range and revenue generated from trophy hunting often does not contribute towards meaningful leopard conservation or enhance tolerance towards the species (G. Balme, pers. comm., Jorge et al. 2013, Palazy et al. 2011). If poorly managed and unsustainable, trophy hunting negatively affects leopards, disrupts their social organisation and spatial dynamics, contributes to infanticide and threatens local populations (Balme et al. 2010b, Pitman 2012, Jacobson et al. 2016, Stein et al. 2016). Trophy hunting was suggested to be most sustainable if no leopard under 4 years old and only males are hunted (NCP 2014). In the Luangwa Valley, Zambia, trophy hunting was shown to posing a high pressure on the species (Ray 2011) and in the Mangwe area, Zimbabwe, the trophy hunting quota was assessed as unsustainable (Grant 2012). Little scientific data is available to officials to determine hunting quotas and not all authorities have or use accurate leopard estimates to set and manage hunting quotas (Balme et al. 2010b, Strampelli 2015). No country so far has both, detailed information of leopard populations and of the impact of hunting on the populations and a proper regulatory framework (Balme et al. 2010b, Jacobson et al. 2016). South Africa recently introduced a year-long hunting ban on leopards for 2016 – and extended it for 2017 (DEA 2017) – due to the lack of population data and understanding of the impact of hunting, but also because significant leopard decline was observed in some important areas, e.g. in the Soutpansberg Mountains, where density declined by 66% from 2008 to 2016 (Williams et al. 2017). Nevertheless, quota demands across Africa are increasing. Since 2002, they have been raised in Namibia, South Africa, Tanzania and Mozambique, while Uganda introduced trophy hunting (Balme et al. 2010b).

Illegal killing

Illegal snaring, mainly used for bushmeat hunting, is rampant in some parts of Africa, particularly in West and Central Africa (P. Henschel, pers. comm.). In such snares set for other target species also leopards get caught (P. Henschel, pers. comm., Yasuoka 2014, Hargreaves 2010). Leopards are however intentionally poached for wildlife trade as their skins are still popular and their bones are partly used as substitutes for tiger parts in Chinese medicine (Hunter & Barrett 2011, Raza et al. 2012b, Di Silvestre & Bauer 2013, Gandiwa 2011, Olupot et al. 2009). Around and in Mole NP, Ghana, illegal hunting was recorded and a leopard skin was sold in a tourist market next to the national park (Burton et al. 2011). Mainly in southern Africa, leopards are excessively harvested for their skins which are used in ceremonies and for cultural purposes (Constant 2014, Stein et al. 2016). Around 4,500–7,000 leopards are harvested each year to meet the demand for skins by followers of the Nazareth Baptist (Shembe) Church alone (G. Balme, unpubl. data). In Asia, leopards are heavily hunted for skins and body parts used in traditional medicine and for luxury home décor, taxidermy and bribery purposes, especially in China (Hunter & Barrett 2011, EIA 2011a, b). Since 2002, at least 4,189 leopards (representing around 10% of the real traded amount; EIA 2013) have been traded. In 2013, leopard seizures in Asia have for the first time outnumbered those of tigers (Nowell & Pervushina 2014). Trading routes for leopard skins are from India via Nepal to China, or via Myanmar or Laos PDR (EIA 2015). Most leopard skins sold in China are claimed to originate from India and some from Africa (EIA 2011a,b). During 2014, 115 leopard skins were seized in India, and since 2001, 1,696 leopards have been reported killed for the illegal trade (EIA 2015). In one operation in Khaga, Uttar Pradesh, 18,000 leopard claws were seized, and a regional survey in India indicated that 4 leopards were poached per week for the illegal wildlife trade during a study of 10 years (Stein et al. 2016). In 2003, 581 leopard skins were seized on the China-Nepal border (Nijman & Shepherd 2015). Targeted poaching may be the main reason for the recent strong declines of the leopards in South-east Asia. In Cambodia and Lao PDR, leopards have been extirpated from several regions, which appear to still have extensive forests and sufficient prey abundance (Rostro-García et al. 2016).

5.4 Threats connected especially with migrations

Remote areas hosting remnant wildlife populations and international borders often concur, and hence many important leopard areas are found along the borders between countries (Fig. 1). Such areas are however often also conflict zones or targeted specifically by organised

poachers. In the southern Lesser Caucasus, in an area of conflicts and lack of law enforcement, leg-amputated leopards were observed, but it remained unclear if the injuries were the result of land mines or gin traps (WWF Caucasus Programme Office & IUCN/SSC Cat Specialist Group 2016). The impact of snaring on leopard populations has not yet been quantified, but it was shown that snaring has a potential impact on habitat suitability and connectivity for dispersing leopards (Fattebert et al. 2013). Data from the Russian Far East suggests that habitat fragmentation is limiting the movement of leopards in some areas (Miquelle et al. 2015). Fragmentation can also be the result of border fortification. Linnell et al. (2016) have warned that the increasing tendency to construct border fences negatively impacts wildlife movements. While most of these fences are not built to restrict a leopard, they certainly increase the risk of injuries or mortalities and hinder the movement of the leopard's prey. But even where fences are erected to protect wildlife including leopards – e.g. in southern Africa – they substantially increase the fragmentation of the populations and hinder the exchange of individuals through migration. To maintain the (genetic) integrity of such populations, new approaches (“managed metapopulations”) will be needed, requiring in many situations international cooperation.

5.5 National and international utilization

Non-consumptive use of leopards is e.g. game viewing. Legal consumptive use takes place for example through trophy hunting and permitted killing of damage-causing leopards, illegal through targeted and non-targeted poaching. The leopard is included in the provisional list of animal species used in traditional medicine compiled by the CITES (Convention on International Trade in Endangered Species of Wild Fauna and Flora) Animal Committee; parts known to be used for medicinal purposes are its skin, flesh, bone, fat and heart (CITES 2002). International trade in leopard parts and products is considerable; leopard is a key species for the trophy hunting industry (Braczkowski et al. 2015). In 2012, 271–281 leopards (excluding 1,233 scientific specimens) were imported by the EU, representing an increase of 11% compared to 2011.

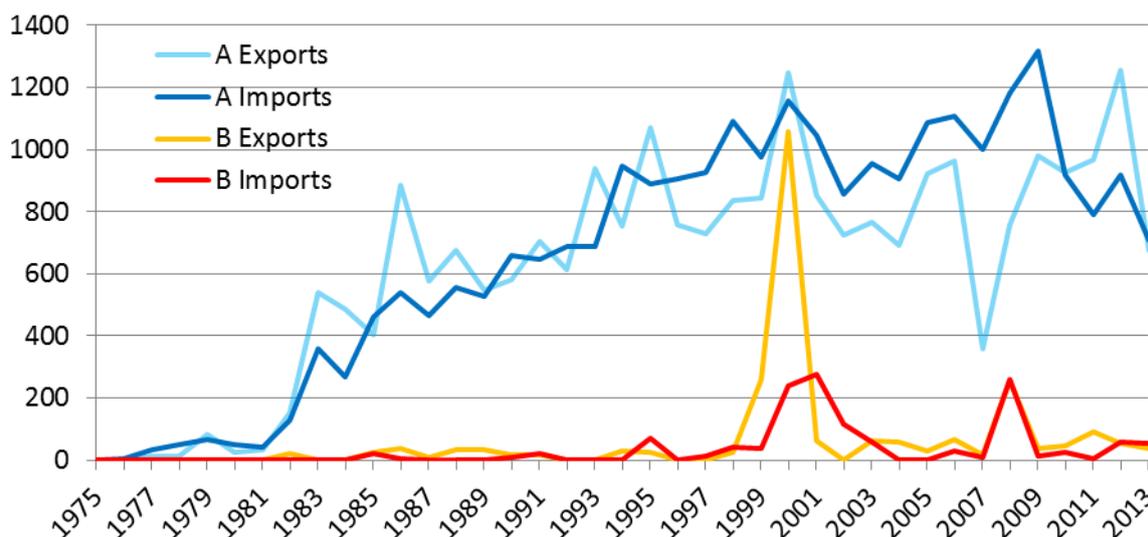


Fig. 3. Reported leopard trade from 1975–2013 for the countries with the highest CITES quotas (Botswana, Mozambique, Namibia, South Africa, Tanzania, Zambia and Zimbabwe). Category A includes bodies, live animals, skins, skulls and trophies. Category B includes bones, claws and teeth. Light blue: exports for Category A from the countries listed above as reported by those countries. Dark blue: imports for Category A from the countries listed above as reported by all member parties to CITES. Orange: exports for Category B from the countries listed above as reported by those countries. Red: imports for Category B from the countries listed above as reported by all member parties to CITES (CITES 2015b). Data source see Appendix 1, Table A2.

Countries with the highest amount of exports to the EU were Tanzania and Zimbabwe (UNEP-WCMC 2015). Leopards have been among the most commonly imported hunting trophies into the United States and were imported from Botswana, Mozambique, Namibia, South Africa, Tanzania, Zambia and Zimbabwe (U.S. Fish & Wildlife Service 2012). In 2012, hunting quotas for 2,163 leopards were allocated to African countries (Botswana 130, Central African Republic 40, Democratic Republic of Congo 5, Ethiopia 10, Kenya 80, Malawi 50, Mozambique 120,

Namibia 250, South Africa 150, Tanzania 500, Uganda 28, Zambia 300, Zimbabwe 500; CITES 2015a). Leopard trade increased from 1975 to 2013 (Fig. 3).

Until 1976, leopard skins could be legitimately traded in Kenya, including leopard skins harvested legally from problem animal control (Degeorges & Reilly 2008). Since 1977 Kenya has a hunting ban in place. In 1983, the 4th Conference of the Parties to CITES granted Kenya an export quota of 80 leopard skins (Wilson 2006). Nonetheless, Kenya's hunting ban remained in place (CITES 1994), but the export of body parts and skins resulting from problem animal control was allowed (Braczkowski et al. 2015).

Leopards poached in Africa are appearing in the so-called Golden Triangle Special Economic Zone, in Bokeo Province Lao PDR, from where they are sold mainly to China (EIA 2015). In a review of trade in tigers and other CITES Appendix I species, including leopard, Nowell & Pervushina (2014) found that seizures of leopards were similar to those of tigers in many Asian range States, and outside Asia in terms of derivate seizures. Based on its research, EIA has identified seven border towns in China, Nepal and India as hotspots of illegal trade in Asian big cats (EIA in litt. 2014). Traders occasionally claimed that leopard skins were sourced from Africa (EIA 2011a, b). Assuming these claims are true, the trade poses not only a serious threat to leopards in Asia but also to the ones in Africa (EIA 2011a). Leopards in Africa "might be increasingly targeted as a substitute source" (EIA 2011a).

6. Protection status and species management

6.1 National protection status

Africa

The leopard is specifically listed as Endangered in Kenya (Republic of Kenya 2013) and as "threatened" in the Democratic Republic of Congo (Eba'a Atyi & Bayol 2009). Hunting is prohibited or restricted to "problem" animals in Angola, Algeria, Benin, Burkina Faso, Congo, Côte d'Ivoire, Democratic Republic of Congo, Djibouti, Equatorial Guinea, Gabon, Ghana, Guinea Bissau, Liberia, Mali, Mauritania, Morocco, Niger, Nigeria, Rwanda, Senegal, Sierra Leone, Somalia, South Sudan, Togo and Uganda. There is no legal protection in Gambia.

Trophy hunting is permitted in Central African Republic, Democratic Republic of Congo, Ethiopia, Malawi, Mozambique, Namibia, Uganda (only if it is a problem animal), Tanzania, Zambia and Zimbabwe. Leopard trophy hunting was examined in Namibia in 2010, regional studies of the hunting quota system were conducted in South Africa, Mozambique and Botswana (Stein et al. 2016). Leopard trophy hunting was or is banned in Kenya (since 1977), Namibia (in 2010), Botswana (since 2014), South Africa (since 2016), Tanzania (1973-1978) and Zambia (2013-2015) (Stein et al. 2016).

Legal protection of the species alone is however not sufficient, if the ecological conditions are inadequate. Long-term survival of the leopard in the Congo Basin e.g. will highly depend on regulations of excessive and unsustainable bushmeat harvesting practices (Henschel et al. 2011).

Asia and Arabian Peninsula

Leopards are legally protected in Jordan and Yemen but enforcement is weak or lacking (Al Jumaily et al. 2006, Qarqaz & Abu Baker 2006). In Oman, the leopard is protected and activities such as hunting and capturing are prohibited (Spalton et al. 2006). In the United Arab Emirates, there is no federal legislation officially protecting the Arabian leopard within the country (Edmonds et al. 2006).

Hunting is prohibited or restricted to "problem" animals in Armenia, Georgia, Iran, Israel, Pakistan, Russia, Saudi Arabia, Turkmenistan and Uzbekistan. Hunting of leopards was prohibited in Azerbaijan in 1967 (Breitenmoser et al. 2014). In Afghanistan, the leopard is protected (hunting and trading prohibited). There is no legal protection in Lebanon, Tunisia and Turkey. No information is available for Iraq, Libya, Kuwait, Syria and Tajikistan.

The leopard is protected in all six countries of the Caucasus ecoregion (Armenia, Azerbaijan, Georgia, Iran, Russia, and Turkey; Bürki et al. 2017). The leopard is classified as a strictly protected species by the Iranian wildlife and hunting law. The fine for illegal hunting of leopards in Iran is currently IRR 800,000,000 (equal to c. USD 21,500).

Panthera pardus is listed in Schedule I of the Indian Wildlife (Protection) Act, 1972 (absolute protection), and offences under this schedule are prescribed the highest penalties. In China, the leopard is a National Class I protected species, which can only be caught, hunted or traded with a special license obtained from the department of wildlife administration under the State Council (Lu Jun et al. 2010). In Malaysia and China, leopards require increased protection from illegal trade and there is an urgent need for more information on the subspecies in these countries (Stein et al. 2016).

6.2 International protection status

Recent Assessment by IUCN (Stein et al. 2016) lists the Leopard globally as a Vulnerable species. The leopard has been on Appendix I of CITES since 1975. “Trade of leopard skins and products is restricted to 2,560 individuals in 11 countries in sub-Saharan Africa” (Stein et al. 2016). In 1992, Botswana, Malawi, Namibia, Zambia and Zimbabwe proposed to transfer the sub-Saharan leopard population from CITES Appendix I to Appendix II (CITES 1992). In the Bern Convention (Convention on the Conservation of European Wildlife and Natural Habitats), *Panthera pardus* is listed as a strictly protected species under Appendix II. The leopard *Panthera pardus* is protected under the U.S. Endangered Species Act (ESA), 16 United States Code, Section 1538.

6.3 Management measures

Specific conservation and management plans with Governments’ involvement for *Panthera pardus* are far more advanced in its Asiatic range than in Africa. This is probably a consequence of the clearly more critical status of the leopard in Asia, but depends also on the ecological status of the species: Wherever the leopard is the apex predator of the ecosystem (or tiger or lions have been extinct), the leopard has the role of a flagship species and gets more attention. An exception is the Russian Far East and North East China, where the Amur leopard and the Siberian tiger are both in the focus of specific conservation programmes.

Asia and Arabian Peninsula

In the Caucasus, a regional conservation initiative has been launched in 2004, focusing on enhancing the knowledge of leopard status and distribution across the Caucasus Ecoregion, improving the legal status of leopard, its prey and critical habitat in the region (Breitenmoser et al. 2010a). Yet, conservation efforts need to be focused towards leopard populations outside the current network of protected areas as well, as the majority of available leopard habitats presently receive no legal protection (Jacobson et al. 2016). The leopard occurs in several Iranian protected areas, but the majority of these populations are small, supposedly less than 10 mature individuals. Even inside protected areas leopards face an increasing level of human-caused mortalities and habitat loss.

Range-wide, international or regional conservation strategies exist for two Asian subspecies, the Arabian leopard *P. p. nimr*. *Strategy for the conservation for the Leopard in the Arabian Peninsula* (Breitenmoser et al. 2010b), *Regional Red List Status of carnivores in the Arabian Peninsula 2011* (Mallon & Budd 2011), and *The Arabian leopard Panthera pardus nimr conservation breeding programme 2011* (Budd & Leus 2011), as well as for the Caucasus: *Strategy for the conservation of the leopard in the Caucasus Ecoregion 2007* (Breitenmoser et al. 2007; to be revised in 2017).

Specific reintroduction plans are available for the Amur leopard *P. p. orientalis*: *A program for reintroduction of the Far Eastern Leopard into Southern Sikhote-Alin, Primorskii Krai, Russian Far East* (Spitzen et al. 2012), and for the Caucasian Biosphere Reserve east of Sochi: *Program for reintroduction of Central Asian Leopard in the Caucasus Region* (Roshnov & Lukarevsky 2007).

At the national level, the following countries have developed National Leopard Conservation Action Plans:

- Russia: *Strategy for the conservation of the Central Asian leopard in the Russian Federation 2008* (Lukarevsky 2008), *Action Plan for conservation of the Central Asian leopard in Russian Federation 2008* (Anonymous 2008a), *Recovery plan for conservation of the Far Eastern leopard 1996* (Miquelle et al. 1996), *Strategy for the conservation of the Far Eastern leopard in Russia 1999* (Pikunov et al. 1999), *Strategy and action plan for conservation and restoration of the Far Eastern leopard* (Darman & Williams 2003); *Strategy for the Far Eastern leopard 2014* (MoENR 2014), *Far Eastern leopard and Siberian tiger conservation measures 2001* (Han 2001);
- Armenia: *National action plan for leopard conservation in Armenia 2008* (Anonymous 2008b);
- Azerbaijan: *National Action Plan for conservation of the leopard in the Azerbaijan Republic 2009* (MoENR 2009);
- Georgia: *National Action Plan for the conservation of the leopard in Georgia (2010-2014)* (Zazanashvili et al. 2010);
- Turkmenistan: *Biological environment and road map for saving the leopard in Turkmenistan 2003* (Raschapow & Akmyradow 2003);
- India: *Guidelines for human-leopard conflict management 2011* (MoEF India 2011)

Africa

Recent status assessment information, strategic planning documents and National Action Plans are very scarce for African leopard populations, as in the past the species was not considered to be of conservation concern. The leopard will certainly profit from the conservation initiatives for lions, cheetahs and African wild dogs as they address threats that are also relevant for leopards, but more targeted efforts are needed to improve its conservation status, which has strongly deteriorated across large parts of its range also in Africa (Stein et al. 2016, Jacobson et al. 2016). There are a few national documents addressing leopard conservation such as the Tanzanian Lion and Leopard Conservation Action Plan (Tawiri 2009) or the Conservation plan for the Cape mountain leopard population 1986 (Norton 1986).

In Ghana, in the Mole NP large carnivore surveys have been completed in 2010 (P. Henschel, pers. comm.). In Kenya, several local research projects including leopards took place in recent years: leopard population densities, movement patterns and diet was studied in the Nairobi National Park (Yamane 2009, Kenya Wildlife Service 2012), livestock predation and its mitigation were studied along the north-eastern border of the Maasai Mara National Reserve (Kolowsky & Holekamp 2006), in Isiolo County (Kenya Wildlife Service 2012) and in the Laikipia district (Ogada et al. 2003), human-carnivore conflicts were addressed in Western Conservation Area (Kenya Wildlife Service 2012) and in the Tsavo-Amboseli ecosystem (Oskello et al 2014a,b), leopard density and home range size was estimated in Sangare Ranch Conservancy (Svengren 2008, Svengren & Bjoerklund 2010), large carnivore spoor surveys were completed in 2013 in the Tsavo East and West NP (and attitudes towards predators in central Kenya were looked at (Romañach et al. 2007).

6.4 Habitat conservation

Around 17% of the leopard's global extant range is protected (Jacobson et al. 2016). Extant leopard range overlap with protected areas is very variable between subspecies. Only 9% of extant range of *P. p. nimr* is protected whereas 50% of the range of *P. p. kotiya* is protected (Table 7). The relative figures presented in Table 7 are however not really meaningful for countries where the extant range is only a small fraction of the original distribution range of the species (Tables 1 and 2). E.g. less than 10% of south-east Asian forest (originally mostly inhabited by leopards) is protected (Sodhi et al. 2010). Over 7% of the Iranian land receives legal protection by the Iranian Department of Environment. The area supports many small and isolated leopard populations and their natural prey base. However, leopards are not limited to these areas in Iran, and many potential leopard habitats currently do not receive any formal

protection (e.g. Farhadinia et al. 2015a, Sanei et al. 2016). Even inside the protected areas the conservation measures vary, and law enforcement to minimize the unsustainable human development and establish critical habitats conservation is questionable. Significant leopard habitats are protected in some African countries, however. For instance, about 18% of Botswana's land area consists of national parks and game reserves where only non-consumptive tourism is allowed. A further 22% of land in the country is designated as wildlife management areas where hunting is possible (Barnett & Patterson 2005) (but presently under a moratorium).

Table 7. Percentage of protected extant range of leopard subspecies in range countries which contain extant leopard range (according to the old taxonomy; Jacobson et al. 2016).

Country	Extant Range [km ²]	Protected Area [km ²]	% PA (IUCN Cat. I–IV) of Extant Range
<i>P. p. delacouri</i>	90,400	40680	45
Cambodia	13,400	8,128	60.7
China	4,400	2,764	62.8
Laos	100	7	6.8
Malaysia	18,200	5790	31.8
Myanmar	22,900	214	0.9
Thailand	30,000	22,725	75.8
Vietnam	1,300	866	66.6
<i>P. p. fusca</i>	1,066,600	117,326	11
Bangladesh	5,300	644	12.1
Bhutan	37,300	14,580	39.1
China	34,200	22,031	64.4
India	821,000	69,344	8.4
Myanmar	24,000	4,727	19.7
Nepal	123,700	10,674	8.6
Pakistan	21,000	47	0.2
<i>P. p. orientalis (=japonensis)</i>	68,000	12,240	18
China	68,000	11,977	17.6
China (north-east)	3,100	-	-
Russia	5,100	1,800	35.3
<i>P. p. kotiya</i>	24,400	12,200	50
Sri Lanka	24,400	12,185	49.9
<i>P. p. melas</i>	20,600	3502	17
Indonesia	20,600	3,388	16.4
<i>P. p. nimr</i>	17,400	1566	9
Oman	6,900	1,510	21.9
Saudi Arabia	4,800	77.9	1.6
Yemen	5,600	-	-
<i>P. p. pardus</i>	6,613,000	112,4210	17
Angola	678,600	60,723	8.9
Benin	16,300	5,047	31
Botswana	367,200	107,761	29.3
Burkina Faso	19,000	8,550	45
Ivory Coast	39,200	16,277	41.5
Cameroon	132,700	29,122	21.9
Central African Republic	369,200	70,871	19.2
Chad	68,700	27,021	39.3
Congo	310,000	36,366	11.7
Dem. Rep. Congo	657,600	102,879	15.6
Djibouti	1,600	-	-
Egypt	5,800	-	-
Equatorial Guinea	12,800	2,812	22
Eritrea	22,600	1,743	7.7
Ethiopia	346,900	35,444	10.2

Country	Extant Range [km ²]	Protected Area [km ²]	% PA (IUCN Cat. I–IV) of Extant Range
Gabon	250,000	33,218	13.3
Ghana	14,700	4,115	28
Guinea	28,700	891	3.1
Guinea-Bissau	7,000	0	0
Kenya	312,900	39,401,	12.6
Lesotho	100	1	1.1
Liberia	23,000	984	4.3
Malawi	11,100	7,733	69.7
Mali	6,000	-	-
Mozambique	457,000	66,738	14.6
Namibia	568,900	106,866	18.8
Niger	500	497	99.5
Nigeria	11,500	7,860	68.4
Rwanda	2,200	911	41.4
Senegal	29,400	7,415	25.2
Sierra Leone	500	315	63
Somalia	33,700	-	-
South Africa	401,300	33,894	8.4
South Sudan	249,800	49,848	18.8
Sudan	31,000	7,969	25.7
Swaziland	10,100	454	4.5
Tanzania	672,100	160,595	23.9
Togo	56,800	4,166	7.3
Uganda	65,100	17,742	27.3
Zambia	218,000	52,638	24.1
Zimbabwe	160,000	26,796	16.7
<i>P. p. tuliana</i> (=saxicolor)	602,000	108,360	18
Afghanistan	5,700	825	14.5
Armenia	3,300	769	23.3
Azerbaijan	5,600	2,074	37
Georgia	1,000	425	42.5
Iran	525,700	99,642	19
Iraq	23,000	1,149	5
Pakistan	2,900	-	-
Russia	6,800	1,536	22.6
Turkey	9,000	-	-
Turkmenistan	19,100	2,141	11.2

6.5 Population monitoring

Robust monitoring of leopard populations is so far mostly local and refined to scientific conservation projects. Most of the density estimates presented in Table 4 were the results of such projects, which however seem only partly to have informed the population estimations presented in Table 3. The local leopard population status has e.g. been studied in several Iranian protected areas, including Bamou National Park in Fars Province (Ghoddousi et al. 2010), Sarigol National Park in North Khorasan Province (Farhadinia et al. 2014), Golestan National Park in Golestan Province (Hamidi et al. 2014) and Tandoureh National Park in Razavi Khorasan Province (Farhadinia et al. 2017). However, none of these efforts have been effective to form a long-term population monitoring program yet. Efforts for a consistent transboundary monitoring of leopard populations were made in the Caucasus Ecoregion (Caucasus Leopard Working Group 2011) and for the Amur leopard between Russia and China (Feng et al. 2017).

7. Effects of the proposed amendment

7.1 Anticipated benefits of the amendment

Panthera pardus needs considerably more awareness and concerted conservation efforts. It is – compared to other large cats – a species not only neglected by many range countries, but also by international conservation organisations. The fact that leopards more than other *Panthera* species can persist in human-dominated lands and even close or within cities has camouflaged the recent strong range loss and increasing fragmentation of the distribution range. To maintain the integrity of small and no longer viable subpopulations or local nuclei, the connection between neighbouring populations needs to be maintained or restored, which requires adequate migration corridors for dispersing animals. To facilitate landscape-level, large-scale transboundary conservation is the core function of the Convention, and leopard conservation will hence profit from the species' listing under Appendix II. Concrete expected benefits are:

- Increased global awareness for the conservation status of *Panthera pardus* and international support for leopard conservation programmes;
- Motivation for leopard range states to evaluate the local/regional conservation status of shared leopard populations and consistent transboundary assessments;
- International conservation strategies at the level of subspecies or regional metapopulations to secure the consistent conservation and management for shared populations;
- International monitoring and review of conservation status developments and conservation measures through the analysis and review of Parties' National Reports by the Conference of Parties at each meeting.
- Agreements (e.g. MoUs) between range states sharing populations for the cooperative implementation of conservation measures and action plans.

7.2 Potential risks of the amendment

None.

7.3 Intention of the proponent concerning development of an Agreement or Concerted Action

Implementation of targeted and fast conservation measures is of ultimate importance to the Proponents. The Proponents therefore do not wish to develop an Agreement or Memorandum of Understanding, which would require further negotiations among the Range States, would potentially take a long time to be developed and incur considerable overhead costs. Instead, the Proponents suggest to establish an informal initiative to develop, collectively, concerted actions for highly endangered leopard subspecies or regional transboundary populations, such as transboundary action plans, which will help each Range State to address the individual challenges faced by them. Implementation of the collectively developed measures will be reviewed on a regular basis through the Conference of Parties of CMS.

8. Range States

Native: Afghanistan; Angola (Angola); Armenia (Armenia); Azerbaijan; Bangladesh; Benin; Bhutan; Botswana; Burkina Faso; Burundi; Cambodia; Cameroon; Central African Republic; Chad; China; Congo; Congo, The Democratic Republic of the; Côte d'Ivoire; Djibouti; Egypt; Equatorial Guinea; Eritrea; Ethiopia; Gabon; Ghana; Guinea; Guinea-Bissau; India; Indonesia (Jawa); Iran, Islamic Republic of; Iraq; Kenya; Liberia; Malawi; Malaysia; Mali; Mozambique; Myanmar; Namibia; Nepal; Niger; Nigeria; Oman; Pakistan; Russian Federation; Rwanda; Saudi Arabia; Senegal; Sierra Leone; Somalia; South Africa; South Sudan; Sri Lanka; Sudan; Swaziland; Tanzania, United Republic of; Thailand; Turkey; Turkmenistan; Uganda; Yemen; Zambia; Zimbabwe.

Possibly extinct: Gambia; Israel; Korea, Democratic People's Republic of; Lao, People's Democratic Republic; Lesotho; Tajikistan; Viet Nam.

Regionally extinct: Hong Kong; Jordan; Korea, Republic of; Kuwait; Lebanon; Mauritania; Morocco; Singapore; Syrian Arab Republic; Togo; Tunisia; United Arab Emirates; Uzbekistan.

9. Consultations

The I.R. Iran on behalf of all co-proponents circulated this listing proposal on 14 May 2017 to all CMS Range State Parties of *Panthera pardus*, inviting comments until 20 May 2017. No comments were received on the proposal by the set deadline.

10. Additional remarks

None

11. References

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