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Panthera tigris, Tiger

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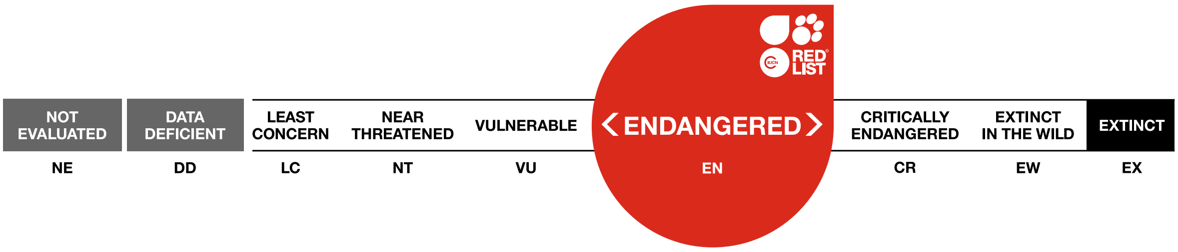

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Taxonomy

Kingdom	Phylum	Class	Order	Family
Animalia	Chordata	Mammalia	Carnivora	Felidae

Scientific Name: *Panthera tigris* (Linnaeus, 1758)

Synonym(s):

- *Felis tigris* Linnaeus, 1758

Regional Assessments:

- Mediterranean

Infra-specific Taxa Assessed:

- Panthera tigris ssp. altaica (discarded)
- Panthera tigris ssp. amoyensis (discarded)
- Panthera tigris ssp. balica (discarded)
- Panthera tigris ssp. corbetti (discarded)
- Panthera tigris ssp. jacksoni (discarded)
- Panthera tigris ssp. sondaica (discarded)
- Panthera tigris ssp. sumatrae (discarded)
- Panthera tigris ssp. tigris (discarded)
- Panthera tigris ssp. virgata (discarded)

Common Name(s):

- English: Tiger
- French: Tigre
- Spanish; Castilian: Tigre
- Achinese: Rimueng
- Bengali: Baagh
- Burmese: Kyarr gyi
- Chinese: Lǎohǔ
- Dzongkha: Taag
- German: Tiger
- Gujarati: Vāgha
- Hindi: Baagh
- Indonesian: Harimau
- Javanese: Macan
- Kannada: Huli
- Lao: seu yai
- Malayalam: kaṭuva
- Nepali: Bāgha
- Russian: Tigr
- Sundanese: Maung
- Tamil: Puli
- Thai: Seūx krong
- Vietnamese: con hổ

Taxonomic Source(s):

Luo, S.J., Kim, J.H., Johnson, W.E., Van Der Walt, J., Martenson, J., Yuhki, N., Miquelle, D.G., Uphyrkina,

O., Goodrich, J.M., Quigley, H., Tilson, R., Brady, G., Martelli, P., Subramaniam, V., Mcdougal, C., Hean, S., Huang, S.Q., Pan, W., Karanth, U.K., Sunquist, M., Smith, J.L.D. and O'Brien, S.J. 2004. Phylogeography and genetic ancestry of tigers (*Panthera tigris*). *PLoS Biology* 2: 2275-2293.

Taxonomic Notes:

The intraspecific taxonomy of the Tiger (*Panthera tigris*) has been recently debated due to inconsistent results from various methodologies (Luo *et al.* 2004, Wilting *et al.* 2015, Kitchener *et al.* 2017, Liu *et al.* 2018). Luo *et al.* (2004) identify six subspecies on the analysis of mitochondrial DNA (mtDNA) while Wilting *et al.* (2015) classified Tigers into two subspecies based on data sets of several traits [morphological (craniodental and pelage), ecological, molecular]. These inconsistencies were partly attributed to the lack of genetic samples across the Tiger range. However, Liu *et al.* (2018) used whole-genome sequencing analyses from 32 voucher specimens that resolve six statistically robust monophyletic clades. The higher resolution of data obtained from nuclear genomes highlights little admixture and gene flow between the six subspecies. Nevertheless, there is incomplete congruence between mitochondrial and nuclear DNA results for *P. t. amoyensis*, suggesting the inclusion of more samples in future analysis to confirm its relationship with *P. t. jacksoni*.

Liu *et al.* (2018) concluded that six extant subspecies exist based on genome-wide analysis:

• Amur Tiger (*P. t. altaica*): Russian Far East and northeastern China.
• Northern Indochinese Tiger (*P. t. corbetti*): Indochina north of the Malayan Peninsula.
• Malayan Tiger (*P. t. jacksoni*): Peninsular Malaysia.
• Sumatran Tiger (*P. t. sumatrae*): Sumatra.
• Bengal Tiger (*P. t. tigris*): Indian sub-continent.
• South China Tiger (*P. t. amoyensis*), although this subspecies has not been directly observed in the wild since the 1970s and is possibly extinct.

Three subspecies previously recognised based on morphology are extinct:

• Bali Tiger (*P. t. balica* Schwarz, 1912): Bal.
• Javan Tiger (*P. t. sondaica* (Temminck, 1844)): Java.
• Caspian Tiger (*P. t. virgata* (Illiger, 1815)): dry river valleys of the Takla Makan, western slopes of the Tianshan mountains, Amudarya and Syrdarya river valleys, shores of the Caspian Sea, Elburz mountains, eastern Turkey, Tigris and Euphrates River valleys.

However, given the varied interpretations of existing data, the taxonomy of this species is currently under review by the IUCN SSC Cat Specialist Group.

Assessment Information

Red List Category & Criteria: Endangered A2abcd ver 3.1

Year Published: 2022

Date Assessed: December 15, 2021

Justification:

The Tiger is listed as Endangered under criterion A2abcd. Based on the evidence of Tiger population and/or range declines across the 30-year assessment period (upper bound of GL (7-10 years)) in at least nine of the 13 countries, which had extant Tiger subpopulations at the beginning of the assessment period, we applied a conservative precautionary approach to the assessment. However, we recognize that there are several uncertainties (see below) in the available data from the past and that the classification of Endangered as opposed to Vulnerable is marginal.

There are only two population estimates available that may be used as baselines for estimating population changes over the past three generations (21–30 years): 1) in 1998, the global Tiger population was estimated at 5,000 to 7,000 Tigers (Seidensticker *et al*. 1999) and 2) in 1996, Nowell and Jackson (1996) estimated global Tiger numbers at 8,262 (based on a summation of their regional estimates). Based on the most recent national estimates (see Supplementary Information), the global Tiger population numbers between 3,726 and 5,578 individuals and is restricted to ten countries. Assuming that, on average, 70% of Tigers in a subpopulation are mature (see Supplementary Information), this provides a best estimate of 3,140 (2,608–3,905) mature individuals. Comparing the numbers of Seidensticker *et al.* (1999) to the upper and lower bounds of the current population estimate results in estimated population declines ranging from 22% to 63%. Based on these results, the Tiger qualifies for a range of possible Red List Categories from Near Threatened to Endangered applying criterion A2ab (see Supplementary Information). Comparing the estimate of Nowell and Jackson (1996) to the upper and lower bound of the current population estimate results in population declines ranging from 53% to 68%, classifying the Tiger as Endangered under criterion A2ab in all cases (see Supplementary Information). Based on these analyses, we classify Tigers as Endangered under criterion A2ab for several reasons: 1) of the nine possible outcomes from these comparisons, five result in assessing Tigers as Endangered (see Supplementary Information), 2) a precautionary approach is warranted given the severe, ongoing threats to Tigers and their extirpation from several countries since the turn of the century (see below and Supplementary Information), 3) a precautionary approach is recommended by the IUCN Guidelines and, 4) even if the lower bound of the estimated population decline would be applied, the IUCN's five-year rule would only allow moving a taxon from a Category of higher threat to a Category of lower threat if none of the Criteria of the higher Category has been met for five years, which is highly unlikely for the Tiger.

Comparing Seidensticker's e*t al.* (1999) estimate and Nowell and Jackson's (1996) estimate with the current estimated population size in 2021 results in applied generation lengths of 7.7 years and 8.3 years respectively, both of which fall within the estimated range of the estimated Generation Length of 7–10 years (see Population section). The calculations over 7 or 10 years would not change the decline significantly to change the listing of the Tiger as Endangered. Moreover, information on trends in global Tiger numbers in the 1990s are insufficient to justify linear or exponential extrapolation of the global population to explore the full range of the 7- to 10-year generation length.

Evidence indicates that Tigers have undergone a range contraction of >50% over the past three generations leading to a suspected population reduction of >50%, thereby satisfying subcriterion A2c. In 1994, Dinerstein *et al.* (1997) estimated to total 1.64 million km² in 159 Tiger Conservation Units (TCUs), roughly equivalent to discrete meta-populations, not including Russia (later estimated at 270,0000 km², making the total 1,910,000 km² (Sanderson *et al.* 2006)) and China. This exercise was revised and updated ten years later, when the occupied Tiger range was estimated at 1.1 million km² in 74 Tiger Conservation Landscapes (roughly equivalent to discrete meta-populations; Sanderson *et al.* 2006). The

TCL analysis was conducted again in 2021 (Sanderson *et al.* in prep.) when the occupied range was 978,293 km², a 54% decline since 1994 and a 7% decline since 2001. That there are currently between 654,254 and 1,030,027 km² of unoccupied Tiger habitat (includes 654,254 km² of Restoration Landscapes and 375,773 km² of Survey Landscapes (Sanderson in prep.) is testament to the severity of poaching of Tigers and their prey and recent local extinctions in Viet Nam, Cambodia and Lao PDR are directly attributed to poaching (Sanderson *et al.* 2006, O'Kelly *et al.* 2012, Johnson *et al.* 2016). Based on this, we infer a >50% population reduction over the past three generations, thereby satisfying subcriterion A2d.

Declines over the past three generations are largely due to poaching and habitat loss. Both threats continue throughout the Tiger range; hence, criterion A1 was dismissed (Walston *et al.* 2010; Sanderson *et al.* 2006 and in prep.; Robinson *et al.* 2015). Criteria A3 and A4 were also dismissed because future trends are unclear. In parts of the Tiger's range, Tigers have more recently been protected from these threats well enough to stabilize or even increase Tiger numbers (e.g., some protected areas in India, Nepal, Thailand, and NE Asia; Dhakal *et al.* 2014, Duangchantrasiri *et al*. 2016, Jhala *et al.* 2019). However, in other areas, such as most of Southeast Asia, Tiger numbers continue to decline (Walston *et al.* 2010, Raspone *et al.* 2019). These regional trends are expected to continue, with some gains in South and possibly Northeast Asia and further declines in Southeast Asia. Gains in South Asia with high Tiger densities may well offset losses in Southeast Asia, resulting in an increasing future trend in global Tiger numbers.

Seidensticker *et al.* (1999) and Nowell and Jackson (1996) did not specify whether the estimate of 5,000–7,000 and 8,262 Tigers, respectively, reflected all cohorts or only mature individuals. Still, given the low quantity and quality of data available at the time, it is likely that it included all cohorts except, perhaps, cubs, which are not normally included in population estimates. If that were the case, the estimate of mature individuals would have been lower, possibly representing <50% decline needed to qualify as Endangered. Neither of these two estimates from the 1990s were based on significant field surveys where population density was estimated or modelled from known densities, and hence caution has to be taken when estimating population trends. Nevertheless, they are the only most accurate available estimates to compare the current estimated population size to. Moreover, the decline in Tiger occupancy of >50% may not represent a >50% population decline because the decline was predominantly in Southeast Asia, where Tiger densities and subpopulations are relatively low. The low Tiger subpopulations in Southeast Asia, even at the start of the assessment period, means that their contribution to the overall range-wide decline of Tiger numbers may be relatively small. However, given intense pressures on Tiger subpopulations from poaching and habitat loss, the extirpation of Tigers from Viet Nam, Cambodia, Lao PDR since the turn of the century, and vast tracts of habitats across the species range, including regions in South Asia where the species is still sparsely distributed, or entirely absent, we believe a conservative, precautionary approach is warranted.

We provide the first reasonably rigorous estimate of global Tiger numbers, based largely on capture-recapture and occupancy methodologies (see Supplementary Information). This is particularly true for South Asia range states, which make up 76% of the global population. As such, it sets a realistic baseline for future Red List evaluations. We caution the use of previous Red List estimates as a basis of comparison because of the lack of scientific rigour and poor range-wide sampling coverage. For example, the estimate of mature individuals (2,154 Tigers) from Walston *et al.* (2010) used in the 2011 and 2015 IUCN Red List Assessments of Tigers is very likely an underestimate of the number of mature individuals because it included only protected areas large enough to contain 75 adult Tigers, and hence, excluded many smaller protected areas known to contain mature, breeding Tigers. Further, many protected areas that were subsequently surveyed were not included in this analysis. Hence, this estimate was not and will not be appropriate as a baseline for comparison for future Red List Assessments.

For further information about this species, see Supplementary Material.

Previously Published Red List Assessments

2015 – Endangered (EN)
https://dx.doi.org/10.2305/IUCN.UK.2015-2.RLTS.T15955A50659951.en

2011 – Endangered (EN)

2010 – Endangered (EN)

2008 – Endangered (EN)

2002 – Endangered (EN)

1996 – Endangered (EN)

1994 – Endangered (E)

1990 – Endangered (E)

1988 – Endangered (E)

1986 – Endangered (E)

Geographic Range

Range Description:

Tigers once inhabited a wide range of countries in Asia, spanning from Turkey in the west to the eastern coast of Russia, and from the Indonesian islands of Java and Bali in the south to 55°N latitude in the far east of Russia (Sanderson *et al.* in prep.). Over the past 100 years, Tigers have disappeared from Singapore (1930s), Bali (1940s), Java and Hong Kong (1960s), central Asia (1970s), most of the mainland temperate (1980s) and tropical (1990s) China, and more recently from the Southeast Asian countries of Viet Nam, Lao PDR and Cambodia (2000s) (Sanderson *et al.* in prep.). Tigers now occupy less than 7% of their historical range, with a 7% decrease from 1,049,430 km² in 2001 to 978,293 km² in 2020. Breeding subpopulations of Tigers presently are confirmed in Bangladesh, Bhutan, China, India, Indonesia, Malaysia, Myanmar, Nepal, Russia, and Thailand. Tigers are confirmed in Myanmar, but southern and eastern Myanmar subpopulations are likely dependent on immigration from Thailand.

In 1994, the first comprehensive assessment to delineate the Tiger range was conducted (Wikramanayake *et al.* 1998). Priority areas for Tiger conservation were estimated to total 1.64 million km² in 159 Tiger Conservation Units (TCUs), roughly equivalent to discrete meta-populations, not including Russia and China (later estimated at 270,0000 km²: Sanderson *et al.* (2006)). In general, this was considered representative of current distribution, but Tigers were only found in 47% of the TCUs, and 89% were scored as experiencing medium to high levels of poaching of Tigers and prey.

This exercise was revised and updated ten years later. In delineating Tiger Conservation Landscapes (TCLs), greater emphasis was placed on actual Tiger presence and breeding (Sanderson *et al.* 2006). Tiger Conservation Landscapes were defined as areas with sufficient habitat to conserve at least five Tigers and areas where Tigers have been confirmed to exist in the past decade. Tiger range was estimated at 1.1 million km² in 76 TCLs (roughly equivalent to discrete meta-populations). This represented a 41% decline from the area described a decade earlier (in South and Southeast Asia, a drop from 1.55 million km² to 914,000 km²: Sanderson *et al.* (2006)), attributed this primarily to poaching pressure (Dinerstein *et al.* 2007). Deforestation has also caused habitat loss, particularly in Sumatra and Myanmar (Wikramanayake *et al.* 2011, Joshi *et al.* 2016). However, this apparent decline is also due to more refined information. For instance, landscapes with Tigers in India were much smaller and more fragmented than previously estimated by Sanderson *et al.* (2006). The Tiger Conservation Landscapes are currently being revised (Sanderson *et al*. in prep.: TCL V3). The current assessment identifies 71 Tiger Conservation Landscapes based on data from 2020 (Sanderson *et al.* in prep.: TCL V3). A review of TCLs highlighted that only 21% of the area is legally protected. However, only about 9% of the TCL area was protected in IUCN Categories I or II (defined as 'strictly protected areas'). Management effectiveness (based on METT scores for a sub-set of protected areas) was generally poor in the protected areas due to widespread regulatory, budgetary, and enforcement constraints, and hunting was cited as the main threat. Furthermore, some TCLs are designated concessions for resource extraction (timber, plantations, oil, minerals, etc.; Forrest *et al.* 2011).

In 2010, Walston *et al.* identified 42 Source Sites across the Tiger range. Source Sites were defined as areas with the confirmed presence of Tigers and evidence of breeding, population estimates of >25 breeding females, legal protection, and embedded in a larger habitat landscape with the potential to hold >50 breeding females. Since the publication, Tigers have been extirpated from the only Source Site in Lao PDR (Rasphone *et al.* 2019), and several others were also identified as supporting fewer Tigers than previously estimated (Harihar *et al.* 2018a). Some areas that meet Walston *et al.*'s (2010) criteria but were previously not identified as source sites have also been documented, especially in South Asia. As more information on Tiger subpopulations emerges, there is a need to reassess source sites globally, for example, while Bhutan was initially listed as a country that did not contain any source sites, breeding subpopulations within protected areas have been documented there over the past decade. Globally, over 60% of Tiger subpopulations likely occur within protected areas. About 65% of India's estimated 2,967 Tigers occur in Tiger reserves, highlighting the importance of source sites (Jhala *et al.* 2020). Even as conservation efforts continue to be prioritized in these vital source sites, there is increasing evidence of the relevance of habitats beyond protected area boundaries that also hold the potential to support breeding source subpopulations or have immense recovery potential in addition to being critical corridors to connect source subpopulations (Chanchani *et al.* 2016, Thapa and Kelly 2017, Jhala *et al.* 2020, Karanth *et al.* 2020).

While coarse-scale data on Tiger occurrence is increasingly available across most areas where the species is extant, there are still some significant data gaps on Tiger occurrence at finer spatial scales, particularly in some remote and sparsely populated regions of SE Asia and the Himalaya of India, Nepal and Bhutan. Cumulatively, these areas may span several hundred thousand kilometres of habitat – where information on occurrence, subpopulations and breeding status is sparse. It is likely that Tiger subpopulations currently only occur in low densities in these habitats, but there may be significant recovery potential or accommodate range shifts due to climate change.

The indigenous range of the Tiger has been determined by examining an extensive database of current and historical records of species occurrence (Sanderson *et al*. in prep.) and intersecting them with Dinerstein *et al*.'s (2017) ecoregional boundaries. Accordingly, the ecoregions which currently support, or once supported, breeding subpopulations have been identified as the indigenous range. As part of the revision of the Tiger Conservation Landscapes (Sanderson *et al*. in prep.), an analysis of the available habitats within the indigenous range was conducted using information from recent surveys and Tiger records. As a result of this analysis, two broad range types have been identified: (1) extant ranges, where Tiger presence has been detected as of 2020; and (2) presence uncertain, where surveys have not been conducted or are insufficient to determine whether Tigers exist. We have classified all parts of the indigenous range that do not qualify as extant or presence uncertain as extinct for this assessment.

Please see Supplementary Information for details of distribution by range state.

For further information about this species, see Supplementary Material.

Country Occurrence:

Native, Extant (resident): Bangladesh; Bhutan; China (Heilongjiang, Jilin, Tibet [or Xizang]); India (Andhra Pradesh, Arunachal Pradesh, Assam, Bihar, Chattisgarh, Goa, Jharkand, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Orissa, Rajasthan, Sikkim, Tamil Nadu, Uttar Pradesh, Uttaranchal, West Bengal); Indonesia (Sumatera); Malaysia (Peninsular Malaysia); Myanmar; Nepal; Russian Federation (Amur, Khabarovsk, Primoryi); Thailand

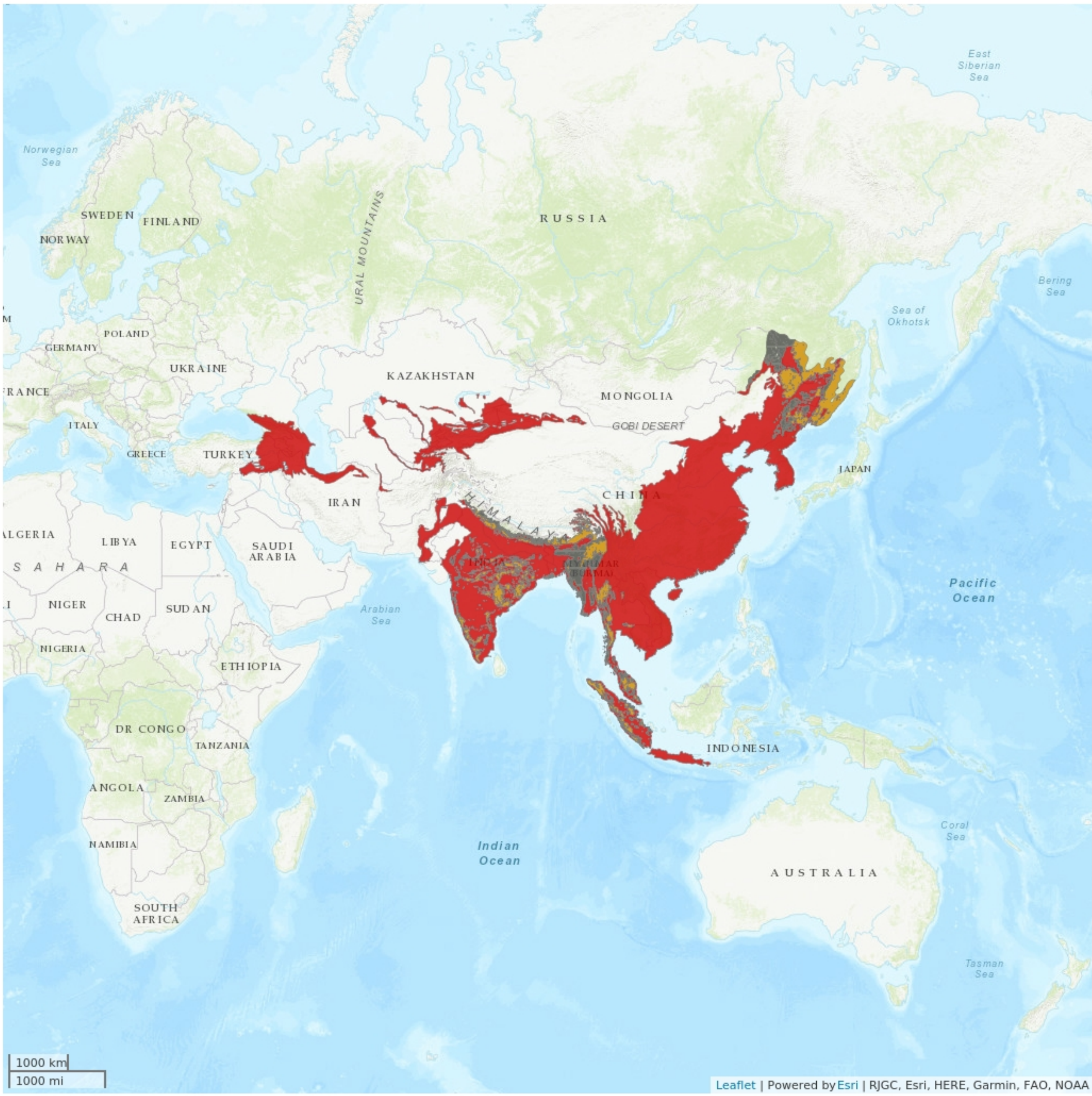
Native, Extant (passage): China (Hainan, Ningxia)

Native, Possibly Extinct: China (Shaanxi); India (Himachal Pradesh, Jammu-Kashmir, Manipur, Meghalaya, Mizoram, Nagaland, Tripura)

Native, Extinct: Afghanistan; Armenia; Azerbaijan; Cambodia; China (Anhui, Beijing, Chongqing, Fujian, Gansu, Guangdong, Guangxi, Guizhou, Hebei, Henan, Hubei, Hunan, Jiangsu, Jiangxi, Liaoning, Nei Mongol, Qinghai, Shandong, Shanghai, Shanxi, Sichuan, Tianjin, Xinjiang, Yunnan, Zhejiang); Hong Kong; India (Chandigarh, Dadra-Nagar-Haveli, Daman, Delhi, Gujarat, Haryana, Pondicherry, Punjab); Indonesia (Bali, Jawa); Iran, Islamic Republic of; Kazakhstan; Korea, Democratic People's Republic of; Kyrgyzstan; Lao People's Democratic Republic; Pakistan; Russian Federation (Chechnya, Dagestan, Ingushetiya, Kabardino-Balkariya, Karachaevo-Cherkessiya, Krasnodar, Stavropol); Singapore; Tajikistan; Turkey; Turkmenistan; Uzbekistan; Viet Nam

Extinct & Vagrant: Iraq; Mongolia; Ukraine

Distribution Map



Legend
- EXTANT (RESIDENT)
- EXTINCT
- PRESENCE UNCERTAIN

Compiled by:
IUCN SSC Cat Specialist Group 2022

The boundaries and names shown and the designations used on this map do not imply any official endorsement, acceptance or opinion by IUCN.

Population

The Tiger population estimate of between 3,726 and 5,578 individuals (not including cubs; see Assessment Rationale and Supplementary Information) is the first reasonably rigorous estimate of global Tiger numbers, based largely on capture-recapture and occupancy methodologies. Based on IUCN definitions of mature individuals (which we estimate at comprising ~70% of the camera-trapped population of Tigers; see Supplementary Information), this gives an estimated range of between 2,608 and 3,905 mature individuals, with a best estimate of 3,140.

However, there is considerable variation among countries in the methods used to calculate the estimate, the time period for which the estimate refers to, and potential double-counting of individuals in transboundary subpopulations. For example, the population estimate for Bhutan was based on surveys conducted in 2014 (DoFPS 2015), and our estimate for Indonesia was based on data collected between 2004 and 2018 and using estimated forest cover from 2017. Updated national population estimates, using similar methodologies to those in published studies (DoFPS 2015, DNPWC and DFSC 2018, Aziz *et al.* 2019, Jhala *et al.* 2020) are expected from Bangladesh, Bhutan, India, Nepal, and Russia in 2022 based on field-surveys conducted since 2021.

We believe our population estimate sets the first realistic baseline for future Red List (re-) assessments and other evaluations, but we caution the use of previous global estimates as a basis of comparison because of the lack of scientific rigour and poor range-wide sampling coverage. However, these estimates (Seidenstricker *et al.* 1999, and Nowell and Jackson 1998) are the only available estimates to compare the current population estimate to, to estimate the population trend in the past. Nevertheless, for example, the estimate of mature individuals (2,154 Tigers) from Walston *et al.* (2010) used in the 2011 and 2015 IUCN Red List Assessments of Tigers is very likely an underestimate of the number of mature individuals because many protected areas were not included in the analysis (see Rationale; Chundawat *et al.* 2011, Goodrich *et al.* 2015). Therefore, this estimate has not been used for estimating past population declines. Hence, our estimate can by no means be interpreted as an increase over previous Red List Assessments. Rather, it is a complete counting using more reliable methodologies. Furthermore, while Tiger numbers have increased in some sites, particularly in India and Nepal (e.g., Western Ghats, India, Central India, and Terai Arc Landscape across India and Nepal), they have also declined in key areas, especially in mainland SE Asia, e.g., Lao PDR has lost its Tigers since the last Assessment in 2015 and Tigers appear to be in steep decline in Malaysia (Dhakal *et al.* 2014, O'Kelly *et al.* 2012, Duangchantrasiri *et al.* 2016, Johnson *et al.* 2016, Harihar *et al.* 2020, Jhala *et al.* 2020; see also Supplementary Information).

Currently, the governments of India, Nepal, Bhutan, Bangladesh and Indonesia have implemented rigorous and regular monitoring to estimate country-wide abundance or occupancy (Indonesia). However, because methodologies change over time and are focused on estimating abundance rather than trends, it is difficult to elucidate temporal trends from the results (see Supplementary Information). Other countries have yet to implement rigorous methodologies at the country scale. However, all countries have long-term monitoring to estimate density in some protected areas and Indonesia has conducted two island-wide occupancy surveys on Sumatra that were key to estimating island-wide abundance (see Supplementary Information). Moving forward, countries must standardize their country-wide estimates in a way that focuses on accurate and precise measurement of temporal and spatial trends.

For further information about this species, see Supplementary Material.

Current Population Trend: Decreasing

Habitat and Ecology (see Appendix for additional information)

Extant Tiger subpopulations occur in the tropical, subtropical and temperate forests of South and Southeast Asia and the temperate evergreen forests of Palaearctic realms in Russia and China. Tigers are habitat generalists, and have adapted to diverse habitats inclusive of equatorial rainforests and mangroves in India and Sumatra, semi-arid habitats of western India, Himalayan deciduous and evergreen forests up to elevations of about 4,500 m and temperate forests in northeast Russia and China.

Availability of a sufficient prey base of large ungulates is the Tiger's primary habitat requirement: "wild pigs and deer of various species are the two prey types that make up the bulk of the Tiger's diet, and in general Tigers require a good population of these species to survive and reproduce" (Sunquist and Sunquist 2002). Tigers need to kill 50–60 large prey animals per year (Karanth *et al.* 2004, Hayward *et al.* 2012, Miller *et al.* 2013). However, when large prey populations are depleted they opportunistically predate on sub-optimal prey such as birds, fish, rodents, insects, amphibians, reptiles, and other mammals such as primates and porcupines. Tigers can also take ungulate prey much larger than themselves, including large bovids (Water Buffalo, Gaur, Banteng), and rarely even Asian Elephants and rhinos. However, like many large carnivores, preferred prey essential for successful reproduction are species that are approximately the same weight as Tigers themselves (Hayward *et al.* 2012).

Tigers are generally solitary, with adults maintaining exclusive territories or home ranges. Adult female home ranges seldom overlap, whereas male ranges typically overlap with 1–3 females, a typical pattern of social organisation among solitary felids. Tiger home ranges are small where prey is abundant; e.g., female home ranges in Chitwan averaged 20 km^2, while in the Russian Far East, they are much larger at about 400 km^2 (Sunquist and Sunquist 2002, Goodrich *et al.* 2010). Similarly, reported Tiger densities range from a maximum of 15–19 Tigers per 100 km^2 where prey is abundant (India's Kaziranga and Corbett National Parks) to as low as 0.13–0.45 per 100 km^2 where prey is more thinly distributed, as in Russia's Sikhote Alin Mountains (Soutyrina *et al.* 2013, Matiukhina *et al.* 2016, Jhala *et al.* 2020). In general, Tiger densities are higher in alluvial flood plains and tropical deciduous forests than tropical moist, evergreen forests of South and Southeast Asia and temperate habitats of far East Asia.

Tigers occur at their highest densities in protected areas with a long management history for the species, which attests to how habitats relatively free of anthropogenic pressure can serve as vital source sites. Yet, the relationship between human disturbance and Tigers is complex, with breeding subpopulations sometimes persisting at relatively high densities in areas subject to pressures including grazing, logging and extracting non-timber forest products (Linkie *et al.* 2008, Rayan and Mohamad. 2009, Jhala *et al.* 2020). In addition, there are breeding Tiger subpopulations that may co-occur quite extensively with people. It is, however, likely that Tiger population dynamics are more unstable in such areas and that survival across age classes is lower as a function of reduced availability of secure habitats. These aspects of how Tiger subpopulations have adapted to human-dominated landscapes merit greater attention, given that most potential Tiger habitats lie outside of protected areas and that many such sites may have significant recovery potential. A related aspect pertains to how Tiger subpopulations can adapt to use human-created habitats (such as sugarcane and oil palm plantations) that resemble or have replaced natural habitats, particularly when such areas also support wild ungulates (Warrier *et al.* 2020). Such behavioural adaptations have important implications for this species' ability to persist in the face of stressors such as habitat fragmentation, land-use change and climate impacts on habitats and will often result in increased human-Tiger conflict.

Systems: Terrestrial

Use and Trade

All Tiger subspecies have been listed in Appendix I of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) since 1975 (except for Amur Tiger, *Panthera tigris altaica*, which was added to Appendix I in 1987). Effectively this means that all international commercial trade in Tigers, their parts, products and derivatives, has long been prohibited. However, in parts of the range, Tiger trade occurs in non-government controlled areas (e.g., northern Myanmar bordering China), and implementing effective enforcement of laws and regulations is complicated (Oswell 2010). Also, there are deep-rooted cultural practices of consuming Tiger body parts in many countries where Tigers occur in South and Southeast Asia (Verheji *et al.* 2010, Stoner and Pervushina 2013, Wong and Krishnaswamy 2019).

A Tiger skin could be sold in India for USD 1,500, and in China for USD 16,000 more than ten years ago (Loveridge *et al.* 2010). All parts of Tiger can be traded for USD 10,000−70,000 (Damania *et al.* 2008). Tiger poachers, however, earned at most USD 100–200 (Loveridge *et al.* 2010). Tiger wine is sold in East and Southeast Asia at USD 80−1,000 per bottle depending on age and prestige (UNODC 2020). Tiger glue bars of 100 g are sold in Viet Nam for USD 1,000 (UNODC 2020). Tiger products were found for sale in 2005−2006 at costs of (average per gram, prices in CNY): raw Tiger bone 53.3 CNY, Tiger bone gel 3.6 CNY, Tiger bone wine 150 CNY. In wholesale markets, Tiger bone was sold for 10 CNY/g (Nowell and Xu 2007). Tiger skin chubas (traditional cloaks) were found for sale at an average price of 16,666 CNY (USD 3,370) in 2006 (Nowell and Xu 2007).

Skins, claws and canines are prestige display items for elite members of society. It had been reported anecdotally from Indonesia and Nepal that Tiger skins, in particular, were given as gifts to high-ranking police and military officers by junior officers seeking promotion. Similarly, specimens mounted using professional taxidermy were restricted to wealthy and politically powerful individuals. However, these practices are believed to have declined, and skin possession, in general, was assessed to have reduced due to the ease of detection and risks of transporting and displaying the items. Nevertheless, Tiger skins are still traded and worn in western China and Tibet (Wong 2015).

Bones, meat, and organs are believed to have healing properties for different ailments in Traditional Chinese Medicine, even whiskers, urine and scats (Stoner 2012). During the COVID-19 pandemic, Tiger products were advertised for their properties in protecting the owner against infection (Banks 2020). Belief in the healing properties of body parts blends with belief in spiritual/shamanistic healing powers in Bangladesh (Saif *et al.* 2016, 2018). Canines and claws are worn for prestige and jewellery in some places; in parts of Thailand, they are spiritual amulets protecting the wearer. A similar belief has been recorded in Bangladesh, with forest users believing a morsel of Tiger bone will protect them from attack (Saif *et al.* 2016, 2018). Elsewhere across the Tiger's range, the trade and use of body parts for occult practices, talismans and medicine have also come to light through seizures.

Within Viet Nam and China, demand for Tiger products is high. The rising affluence of consumers across the region has increased the consumption of Tiger products (Linkie *et al.* 2018, TRAFFIC 2019). In Viet Nam, research conducted in 2017 suggested consumption rates as high as 11% of the population in Hanoi and Ho Chi Minh cities (Davis *et al.* 2020), while in China, a 2007 TRAFFIC survey reported declining availability of Tiger products in Traditional Chinese Medicine (Nowell and Xu 2007).

In both Viet Nam and China, Tiger bone is made into a 'tonic', with a preference for whole bones steeped in alcohol in China, whereas in Viet Nam, the bones are rendered into a glue, a morsel of which can then be dissolved into hot water (Stoner 2012). Research conducted in Viet Nam and China suggests that a desire to consume wild Tigers is preferred over farmed Tigers or Lions (wild or farmed), but consumers will use all options (Coals *et al.* 2020). Consumption of Tiger bone tonic is a status symbol, and Tiger wine is given as a gift (UNODC 2020). Continued demand for Tiger bone supplies led to seeking analogue species such as Lion, with much supply coming from the legal farming and euthanasia of Lions in South Africa until the trade ban (Milliken and Shaw 2012, Williams *et al.* 2017, EMS Foundation and Ban Animal Trading 2018, Ban Animal Trading and EMS Foundation 2020), Jaguar (Lemieux and Bruschi 2019) and many other species such as leopards and clouded leopards. There have been increasing reports of Tiger farming to meet rising demand and falling wild stocks in the last ten years, and anecdotal reports of wild Tigers captured live to stock breeding programs (Environmental Investigation Agency 2017, UNODC 2020). Multiple nations in the European Union have also been implicated in exporting live Tigers from private collections to countries with breeding facilities (Musing 2020). In contrast, some facilities in Europe have begun processing captive Tiger products and shipping them back to Viet Nam (TRAFFIC and WWF 2020). Tastes of elite business people and criminal bosses in the Golden Triangle have led to the consumption of Tiger meat.

Research suggests that Asian diasporas carry Tiger and other big cat consumption habits and establish new consumption centres outside Asia. A 2019 survey of shops in Vietnamese communities in South Africa found that Tiger products were widespread (Nguyen 2019).

Threats **(see Appendix for additional information)**

Hunting of Tigers and their prey has been the main driver of Tiger population declines during the assessment period (i.e., since 1991). Poaching for illegal trade in high-value Tiger products including skins, bones, meat, and tonics, is a primary threat to Tigers, which, along with prey depletion, has led to their recent disappearance from broad areas of otherwise suitable habitat and continues at unsustainable rates. Tiger occupancy has declined 53% since 1997 (Dinerstien *et al.* 1997) and 20% since 2005 (Sanderson *et al.* 2006 and in prep.), with the decline largely attributed to poaching, though habitat loss has also been considerable during that period. That there are roughly one million square kilometres of unoccupied Tiger habitat (Sanderson *et al.* 2006) is a clear indication that poaching of Tiger and prey is the greatest threat to Tigers range-wide (Chapron *et al.* 2008). Poaching was identified as the primary cause of mortality for Tigers in Russia (Goodrich *et al.* 2008, Kerley *et al.* 2002). The loss of Tigers in Lao PDR during the assessment period also appeared to be driven by targeted poaching of Tigers (Rasphone *et al.* 2019). Hunting is particularly significant in Southeast Asia, where intense snaring and poisoning have driven declines in Tigers and their prey (Lynam *et al.* 2010; Johnson *et al.* 2016; Gray *et al.* 2017a, 2018). Tigers are particularly susceptible to illegal transnational trade (Oswell 2010, Stoner and Pervushina 2013, Hossain *et al.* 2018, Wong and Krishnaswamy 2019).

Asia is a densely populated and rapidly developing region, bringing huge pressures to bear on the large areas of habitat required for viable Tiger subpopulations. The main drivers of Tiger habitat loss and fragmentation are conversion of forest land to agriculture and silviculture, commercial logging, human settlement, and linear infrastructure development are the main drivers of Tiger habitat loss and fragmentation. With their substantial dietary requirements, Tigers require a healthy large ungulate prey base, but these species are also under heavy human hunting pressure and competition from domestic livestock.

Habitat fragmentation driven by linear infrastructure development, land-use change, and urbanization can drive the extinction of Tiger subpopulations (e.g., Mondal and Nagendra 2011, Joshi *et al.* 2016). Tigers can become locally or functionally extinct in areas where habitat connectivity is severed or severely compromised (Gopal *et al.* 2010; Harihar *et al.* 2018b, 2020). Land-use change simulations coupled with connectivity analysis using Tiger genetic data from Central India has established that genetic variability (heterozygosity) will decrease in the future, greatly elevating extinction risks for small and isolated subpopulations (Thatte *et al.* 2018). Such effects may be mitigated to an extent by regulating development and land-use change around reserves, and human activity in areas already developed (e.g., along roads). Other recent research also outlines how fragmentation and isolation can lead to inbreeding depression and atypical phenotypic variation in Tiger subpopulations (Khan *et al.* 2021, Sagar *et al.* 2021). While evidence for fragmentation impacts of habitat fragmentation on Tiger and wild prey populations and movements is growing, Tiger conservation landscapes continue to be transformed by linear infrastructure and other threats at unprecedented rates across Tiger range states (Carter *et al.* 2020, Jayadevan *et al.* 2020, Palmeirin and Gibson 2021).

Tiger attacks on livestock and people can lead to intolerance of Tigers by neighbouring communities and present an ongoing challenge to managers to build local support for Tiger conservation and lead to high rates of retaliatory killing of Tigers (Goodrich 2010, Miquelle *et al.* 2005). In some areas, there have been many human deaths − for example, at least 40 people were killed by Tigers in the Sundarbans mangrove forest of Bangladesh and India in 2000−2010 (Barlow *et al.* 2013), and 320 people were killed in India from 2014 to 2020 (Manoj 2021). The retaliatory killing of Tigers in response to attacks on people and livestock is common and often assumed to be a significant cause of population decline, but this has never been systematically recorded.

Infectious disease in Tigers has been little studied and is poorly understood, but several Tiger deaths have been attributed to canine distemper virus infection, including a significant loss of Tigers from Sikhote-Alin Zapovednik in Russia (Quigley *et al.* 2010, Goodrich *et al.* 2012, Seimon *et al.* 2013, Gilbert *et al.* 2014). Disease can also impact Tiger prey, e.g. African Swine Fever is a significant concern in Russia and Indonesia and will likely spread throughout the Tiger range (Luskin *et al.* 2021).

Conservation Actions (see Appendix for additional information)

At a Tiger Summit held in St Petersburg, Russia in November 2010, the 13 Tiger Range Countries adopted a Global Tiger Recovery Program (GTRP 2010). The goal was to effectively double the number of wild Tigers by 2022 through actions to:

i) effectively preserve, manage, enhance and protect Tiger habitats;
ii) eradicate poaching, smuggling and illegal trade of Tigers, their parts and derivatives;
iii) cooperate in transboundary landscape management and in combating illegal trade;
iv) engage with indigenous and local communities;

v) increase the effectiveness of Tiger and habitat management; and
vi) restore Tigers to their former range.

All of these actions are being implemented by governments and NGOs to varying degrees in each range state. Details by country can be found in the Supplementary Information.

The Tiger Summit was attended by Heads of State, including Russia, China, Lao PDR, Nepal and Bangladesh, and represented significant government commitment to Tiger conservation. This Summit is expected to be repeated in 2022 to assess progress towards the goal at the end of the 12-year deadline for doubling global Tiger numbers, and plan for the next 12 years.

The future of Tigers depends upon the Asian governments creating effective Tiger landscapes by conserving large areas of suitable habitat and by maintaining habitat connectivity. Within these landscapes, the most urgent need is to first secure the Source Sites (*sensu* Walston *et al.* 2010) - protected areas with the potential to contain viable Tiger subpopulations - where most of the global Tiger population is now clustered. However, many Source Sites are currently too threatened to deliver their potential as the demographic sources for species recovery (Walston *et al.* 2010). Key to success will be eliminating poaching and illegal trade in Tigers and their prey and habitat loss and degradation within and outside of protected areas, while ensuring connectivity within Tiger Conservation Landscapes. Further, with only 21% of Tiger habitat protected, expanding protected area systems, enlarging the conservation portfolio to include areas beyond protected areas, restoring connectivity between protected habitat remnants, as well as improving the management effectiveness of existing protected areas (Hossain *et al.* 2018, Stolton *et al.* 2019) will be critical to recovery. In many areas, these will require empowering and enabling communities living within and around Tiger habitats to contribute to conservation actively.

Better collaboration among Tiger conservation organizations, including NGOs and government, is also needed, including developing an agreed-upon and shared vision and strategy for Tiger conservation and sustainable financing thereof.

The absence of Tigers across much of the species' historical range, largely due to poaching of both Tigers and prey, presents opportunities for future range expansion and targeted Tiger reintroductions and translocations. Tigers have been successfully reintroduced into a number of protected areas in India and Russia (Sankar *et al.* 2010, Sarkar *et al.* 2016, Kolipaka *et al.* 2017, Rozhnov *et al.* 2021) and there are ongoing plans for reintroduction into former range countries including Kazakhstan and Cambodia (Chestin *et al.* 2017, Gray *et al.* 2017b).

For further information about this species, see Supplementary Material.

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Bibliography

Aziz, M.A., Kabir, M.J., Shamsuddoha, M., Ahsan, M.M., Sharma, S., Chakma, S., Jahisd, M., Chowdhury, M.M.R. and Rahman, S.M. 2019. Second phase Status of Tigers in Bangladesh Sundarban 2018. Department of Zoology, Jahangirnagar University; WildTeam, Forest Department, Bangladesh.

Balmford, A., Green, J.M.H., Anderson, M., Beresford, J., Huang, C., Naidoo, R., Walpole, M. and Manica, A. 2015. Walk on the wild side: estimating the global magnitude of visits to protected areas. *PLoS Biology* 13(2): e1002074.

Banks, D. 2020. "Glue" made from the bones of endangered tigers is being sold to promote health during the pandemic. Available at: https://eia-international.org/blog/glue-made-from-the-bones-of-endangered-tigers-is-being-sold-to-promote-health-during-the-pandemic/.

Barlow, A.C.D., Ahmad, I. and Smith, J.L.D. 2013. Profiling tigers (*Panthera tigris*) to formulate management responses to human-killing in the Bangladesh Sundarbans. *Wildlife Biology in Practice* 9: 30-39.

Bhagabati, N. K., Ricketts, T., Sulistyawan, T. B. S., Conte, M., Ennaanay, D., Hadian, O., McKenzie, E., Olwero, N., Rosenthal, A., Tallis, H. and Wolny, S. 2014. Ecosystem services reinforce Sumatran tiger conservation in land use plans. *Biological Conservation* 169: 147-156.

Carter, N. H. and Allendorf, T. D. 2016. Gendered perceptions of tigers in chitwan national park, Nepal. *Biological Conservation* 202: 69-77.

Carter, N., Killion, A., Easter, T., Brandt, J. and Ford, A., 2020. Road development in Asia: Assessing the range-wide risks to tigers. *Science Advances* 6(18): p.eaaz9619.

Chanchani, P., Noon, B.R., Bailey, L.L. and Warrier, R.A. 2016. Conserving tigers in working landscapes. *Conservation Biology* 30: 649-660.

Chapron, G., Miquelle, D.G., Lambert, A., Goodrich, J.M., Legendre, S. and Colbert, J. 2008. The impact on tigers of poaching versus prey depletion. *Journal of Applied Ecology* 45(6): 1667-1674.

Chestin, I.E., Paltsyn, M.Y., Pereladova, O.B., Iegorova, L.V. and Gibbs, J.P. 2017. Tiger re-establishment potential to former Caspian tiger (*Panthera tigris virgata*) range in Central Asia. *Biological Conservation* 205: 42-51.

Chundawat, R.S., Habib, B., Karanth, U., Kawanishi, K., Ahmad Khan, J., Lynam, T., Miquelle, D., Nyhus, P., Sunarto, S., Tilson, R. and Wang, S. 2011. *Panthera tigris*. *The IUCN Red List of Threatened Species* 2011: e.T15955A5332619.

Chundawat, R.S., Raju, V.U. and Rajora, H. 2018. The value of Wildlife Tourism around Ranthambhore Tiger Reserve in Rajasthan for Wildlife Conservation and Local Communities. Available at: https://www.toftigers.org/wp-content/uploads/2019/05/Value-of-Wildlife-Tourism-to-Ranthambhore-Sept-2018.pdf.

Coals, P., Moorhouse, T.P., D'Cruze, N.C., Macdonald, D.W. and Loveridge, A.J. 2020. Preferences for lion and tiger bone wines amongst the urban public in China and Vietnam. *Journal of Nature Conservation* 57(48): 125874.

Damania, R., Seidensticker, J., Whitten, A., Sethi, G., Mackinnon, K., Kiss, A. and Kushlin, A. 2008. A future for wild tigers. Available at: http://www.environmentportal.in/files/24.pdf.

Davis, E.O., Willemsen, M., Dang, V., O'Connor, D. and Glikman, J.A. 2020. An updated analysis of the consumption of tiger products in urban Vietnam. *Global Ecology and Conservation* 22: e00960.

Dhakal, M., Karki (Thapa), M., Jnawali, S.R., Subedi, N., Pradhan, N.M.B., Malla, S., Lamichhane, B.R., Pokheral, P.C., Thapa, G.J., Oglethorpe, J., Subba, S.A., Bajracharya, P.R. and Yadav, H. 2014. Status of Tigers and Prey in Nepal.

Dinerstein, E., Loucks, C., Wikramanayake, E., Ginsburg, J., Sanderson, E., Seidensticker, J., Forrest, J., Bryja, G., Heydlauff, A., Klenzendorf, S., Leimgruber, P., Mills, J., O'Brien, T. G., Shrestha, M., Simons, R. and Songer, M. 2007. The fate of wild tigers. *Bioscience* 57(6): 508-514.

Dinerstein, E., Olson, D., Joshi, A., Vynne, C., Burgess, N.D., Wikramanayake, E., Hahn, N., Palminteri, S., Hedao, P., Noss, R. and Hansen, M. 2017. An ecoregion-based approach to protecting half the terrestrial realm. *BioScience* 67(6): 534-545.

Dinerstein, E., Wikramanayake, E. D., Robinson, J., Karanth, U., Rabinowitz, A., Olson, D., Mathew, T., Hedao, P., Connor, P., Hemley, G. and Bolze, D. 1997. A Framework for Identifying High Priority Areas and Actions for the Conservation of Tigers in the Wild. A Framework for Identifying High Priority Areas and Actions for the Conservation of Tigers in the Wild.

DNPWX and DFSC. 2018. Status of Tigers and Prey in Nepal. Department of National Parks and Wildlife Conservation & Department of Forests and Soil Conservation. Ministry of Forests and Environment, Kathmandu, Nepal.

DoFPS. 2015. Counting the Tigers in Bhutan: Report on the National Tiger Survey of Bhutan 2014 - 2015.

Duangchantrasiri, S., Umponjan, M., Simcharoen, S., Pattanavibool, A., Chaiwattana, S., Maneerat, S., Kumar, N.S., Jathanna, D., Srivathsa, A. and Karanth, K.U. 2016. Dynamics of a low-density tiger population in Southeast Asia in the context of improved law enforcement. *Conservation Biology* 30(3): 639-648.

EMS Foundation & Ban Animal Trading. 2018. The Extinction Business: South Africa's "Lion" Bone Trade. Available at: http://emsfoundation.org.za/wp-content/uploads/THE-EXTINCTION-BUSINESS-South-Africas-lion-bone-trade.pdf.

EMS Foundation & Ban Animal Trading. 2020. Breaking Point: Uncovering South Africa's Shameful Live Wildlife Trade with China. Available at: https://emsfoundation.org.za/wp-content/uploads/BreakingPoint__FINAL_15052020_web.pdf.

Environmental Investigation Agency. 2017. Cultivating Demand: The Growing Threat Of Tiger Farms. Available at: https://eia-international.org/wp-content/uploads/Cultivating-Demand-The-Growing-Threat-of-Tiger-Farms.pdf.

Forrest, J.L., Bomhard, B., Budiman, A., Coad, L., Cox, N., Dinerstein, E., Hammer, D., Huang, C., Huy, K., Kraft, R., Lysenko, I. and Magrath, W. 2011. Single-species conservation in a multiple-use landscape: current protection of the tiger range. *Animal Conservation* 14(3): 283-294.

Gilbert, M., Miquelle, D.G., Goodrich, J.M., Reeve, R., Cleaveland, S., Matthews, L. and Joly, D.O. 2014. Estimating the potential impact of canine distemper virus on the Amur tiger population (*Panthera tigris altaica*) in Russia. *PLoS ONE* 9: e110811.

Goodrich, J., Htun, S., Jhala, Y., Karanth, U., Kawanishi, K., Lynam, T., Miquelle, D., Pattanavibool, A., Tempa, T. and Wibisono, H. 2015. *Panthera tigris*. *IUCN Red List of Threatened Species* 2015: e.T15955A50659951.DOI: 10.2305/IUCN.UK.2015-2.RLTS.T15955A50659951.en.

Goodrich, J.M. 2010. Human-Tiger Conflict: a Review and Call for Comprehensive Plans. *Integrative Zoology* 5: 297-308.

Goodrich, J.M., Kerley, L.L., Smirnov, E.N., Miquelle, D.G., McDonald, L., Quigley, H.B., Hornocker, M.G.

and McDonald, T. 2008. Survival rates and causes of mortality of Amur Tigers on and near the Sikhote-Alin Biosphere Zapovednik. *Journal of Zoology* 276: 323-329.

Goodrich J.M., Miquelle, D.G., Smirnov, E.N., Kerley, L.L., Quigley, H.B. and Hornocker, M.G. 2010. Spatial structure of Amur (Siberian) tigers (*Panthera tigris altaica*) on Sikhote-Alin Biosphere Zapovednik, Russia. *Journal of Mammalogy* 97: 737-748.

Goodrich, J., Quigley, K.S., Lewis, J.C.M., Astafiev, A.A., Slabi, E.V., Miquelle, D., Smirnov, E.N., Kerley, L.L., Armstrong, D.L., Quigley, H.B., Hornocker, M.G. 2012. Sero-survey of free ranging Amur Tigers in the Russian far east. *Journal of Wildlife Diseases* 48: 186-189.

Gopal, R., Qureshi, Q., Bhardwaj, M., Singh, R. J. and Jhala, Y. V. 2010. Evaluating the status of the endangered tiger *Panthera tigris* and its prey in Panna Tiger Reserve, Madhya Pradesh, India. *Oryx* 44(3): 383-389.

Gray, T.N.E., Crouthers, R., Ramesh, K., Vattakaven, J., Borah, J., Pasha, M.K.S., Lim, T., Phan, C., Singh, R., Long, B. and Chapman, S. 2017. A framework for assessing readiness for tiger *Panthera tigris* reintroduction: a case study from eastern Cambodia. *Biodiversity and Conservation* 26(10): 2383–2399.

Gray, T. N., Hughes, A. C., Laurance, W. F., Long, B., Lynam, A. J., O'Kelly, H., Ripple, W. J., Seng, T., Scotson, L. and Wilkinson, N. M. 2018. The wildlife snaring crisis: an insidious and pervasive threat to biodiversity in Southeast Asia. *Biodiversity and conservation* 27(4): 1031-1037.

Gray, T.N., Lynam, A.J., Seng, T., Laurance, W.F., Long, B., Scotson, L. and Ripple, W.J. 2017. Wildlife-snaring crisis in Asian forests. *Science* 355: 255-256.

GTRP. 2010. Global Tiger Recovery Program, 2010-2022. Thirteen Tiger Range Countries and Partners of the Global Tiger Initiative. World Bank, Washington DC.

Harihar, A., Chanchani, P., Borah, J., Crouthers, R.J., Darman, Y., Gray, T. N. E., Mohamad, S., Rawson, B.M., Rayan, M.D. and Roberts, J L. 2018. Recovery planning towards doubling wild tiger *Panthera tigris* numbers: Detailing 18 recovery sites from across the range. *PloS ONE* 13(11): e0207114.

Harihar, A., Ghosh-Harihar, M. and MacMillan, D.C. 2018. Losing time for the tiger *Panthera tigris*: Delayed action puts a globally threatened species at risk of local extinction. *Oryx* 52(1): 78-88.

Harihar, A., Pandav, B., Ghosh-Harihar, M. and Goodrich, J. 2020. Demographic and ecological correlates of a recovering tiger (*Panthera tigris*) population: Lessons learnt from 13-years of monitoring. *Biological Conservation* 252(2): 108848.

Hayward, M.W., Jedrzejewski, W. and Jedrzewska, B. 2012. Prey preferences of the tiger *Panthera tigris*. *Journal of Zoology* 286: 221-231.

Hockings, M., Dudley, N., Elliott, W., Ferreira, M., Mackinnon, K., Pasha, M., Phillips, A., Stolton, S., Woodley, S. and Appleton, M. 2020. COVID-19 and protected and conserved areas. *Parks* 26: 7-24.

Hossain, A.N.M., Lynam, A.J., Ngoprasert, D., Barlow, A., Barlow, C.G. and Savini, T. 2018. Identifying landscape factors affecting tiger decline in the Bangladesh Sundarbans. *Global Ecology and Conservation* 13: 382.

IUCN. 2022. The IUCN Red List of Threatened Species. Version 2022-1. Available at: www.iucnredlist.org. (Accessed: 21 July 2022).

Jayadevan, A., Nayak, R., Karanth, K.K., Krishnaswamy, J., DeFries, R., Karanth, K.U. and Vaidyanathan, S. 2020. Navigating paved paradise: Evaluating landscape permeability to movement for large mammals in two conservation priority landscapes in India. *Biological Conservation* 247: 108613.

Jhala, Y.V., Qureshi, Q. and Nayak, A.K. 2020. Status of tigers, copredators and prey in India, 2018. National Tiger Conservation Authority, Government of India, New Delhi, and Wildlife Institute of India, Dehradun.

Johnson, A., Goodrich, J., Hansel, T., Rasphone, A., Saypanya, S., Vongkhamheng, C., Venevongphet, and Strindberg, S. 2016. To protect or neglect? Design, monitoring, and evaluation of a law enforcement strategy to recover small populations of wild tigers and their prey. *Biological Conservation* 202: 99-109.

Joshi, A.R., Dinerstein, E., Wikramanayake, E., Anderson, M.L., Olson, D., Jones, B.S., Seidensticker, J., Lumpkin, S., Hansen, M.C., Sizer, N.C., Davis, C.L., Palminteri, S. and Hahn, N.R. 2016. Tracking changes and preventing loss in critical tiger habitat. *Science Advances* 2(4): e1501675.

Karanth, K.K., Jain, S. and Mariyam, D. 2017. Emerging trends in wildlife and tiger tourism in India. In: J.S. Chen and N.K. Prebensen (eds), *Nature Tourism*, pp. 171-183. Routledge, New York.

Karanth, K.U., Kumar, N.S. and Karanth, K.K. 2020. Tigers against the odds: Applying macro-ecology to species recovery in India. *Biological Conservation* 252: 108846.

Karanth, K.U., Kumar, N.S., Nichols, J.D., Link, W.A. and Hines, J.E. 2004. Tigers and their prey: Predicting carnivore densities from prey abundance. *Proceedings of the National Academy of Sciences of the United States of America* 101: 4854-4858.

Kerley, L.L., Goodrich, J.M., Miquelle, D.G., Smirnov, E.N., Nikolaev, I.G., Quigley, H.B. and Hornocker, M.G. 2002. Effects of roads and human disturbance on Amur tigers. *Conservation Biology* 16: 1-12.

Kerley, L.L., Goodrich, J.M., Miquelle, D.G., Smirnov, E.N., Nikolaev, I.G., Quigley, H.B. and Hornocker, M.G. 2003. Reproductive parameters of wild female Amur (Siberian) tigers (*Panthera tigris altaica*). *Journal of Mammalogy* 84: 288-298.

Khan, A., Patel, K., Shukla, H., Viswanathan, A., van der Valk, T., Borthakur, U., Nigam, P., Zachariah, A., Jhala, Y. V., Kardos, M., Ramakrishnan, U. 2021. Genomic evidence for inbreeding depression and purging of deleterious genetic variation in Indian tigers . *Proceedings of the National Academy of Sciences (USA)* 118(49): e2023018118. DOI: 10.1073/pnas.2023018118.

Kitchener, A.C., Breitenmoser-Würsten, C., Eizirik, E., Gentry, A., Werdelin, L., Wilting, A., Yamaguchi, N., Abramov, A.V., Christiansen, P., Driscoll, C., Duckworth, J.W., Johnson, W., Luo, S.-J., Meijaard, E., O'Donoghue, P., Sanderson, J., Seymour, K., Bruford, M., Groves, C., Hoffman, M., Nowell, K., Timmons, Z. and Tobe, S. 2017. A revised taxonomy of the Felidae. The final report of the Cat Classification Task Force of the IUCN/SSC Cat Specialist Group. *Cat News Special Issue* 11.

Kolipaka, S.S., Tamis, W.L.M., van 't Zelfde, M., Persoon, G.A. and de Iongh, H.H. 2017. New insights into the factors influencing movements and spatial distribution of reintroduced Bengal tigers (*Panthera tigris tigris*) in the human-dominated buffer zone of Panna Tiger Reserve, India. *Mammalia* 83(3): 207-217.

Lemieux, A.M. and Bruschi, N. 2019. The production of jaguar paste in Suriname: a product-based crime script. *Crime Science* 8: 4-8.

Lindsey, P., Allan, J., Brehony, P., Dickman, A., Robson, A., Begg, C., Bhammar, H., Blanken, L., Breuer, T. and Fitzgerald, K. 2020. Conserving Africa's wildlife and wildlands through the COVID-19 crisis and beyond. *Nature Ecology & Evolution* 4: 1300-1310.

Linkie, M., Haidir, I.A., Nugroho, A. and Dinata, Y. 2008. Conserving tigers *Panthera tigris* in selectively logged Sumatran forests. *Biology Conservation* 141: 2410-2415.

Linkie, M., Martyr, D., Harihar, A., Mardiah, S., Hodgetts, T., Risdianto, D., Subchaan, M. and Macdonald, D. 2018. Asia's economic growth and its impact on Indonesia's tigers. *Biological Conservation* 219: 105-

109.

Liu, Y.C., Sun, X., Driscoll, C., Miquelle, D.G., Xu, X., Martelli, P., Uphyrkina, O., Smith, J.L.D., O'Brien, S.J. and Luo, S.J. 2018. Genome-wide evolutionary analysis of natural history and adaptation in the world's tigers. *Current Biology* 28(23): 3840-3849.

Liu, Y.C., Sun, X., Driscoll, C., Miquelle, D.W., Xu, X., Martelli, P., Uphyrkina, O., Smith, J.L.D., O'Brien, S.J. and Luo, S.J. 2018. Genome-wide evolutionary analysis of natural history and adaptation in the world's tigers. *Current Biology* 28(23): 3840-3849.

Loveridge, A.J., Wang, S.W., Frank, L.G. and Seidensticker, J. 2010. People and wild felids: Conservation of cast and management of conflict. In: D.W. Macdonald and A.J. Loveridge (eds), *Biology and Conservation of Wild Felids*, pp. 161-195. Oxford University Press, Oxford.

Luo, S.J., Kim, J.H., Johnson, W.E., Van Der Walt, J., Martenson, J., Yuhki, N., Miquelle, D.G., Uphyrkina, O., Goodrich, J.M., Quigley, H., Tilson, R., Brady, G., Martelli, P., Subramaniam, V., Mcdougal, C., Hean, S., Huang, S.Q., Pan, W., Karanth, U.K., Sunquist, M., Smith, J.L.D. and O'Brien, S.J. 2004. Phylogeography and genetic ancestry of tigers (*Panthera tigris*). *PLoS Biology* 2: 2275-2293.

Luskin, M.S., Meijaard, E., Surya, S., Walzer, C. and Linkie, M. 2021. African Swine Fever threatens Southeast Asia's 11 endemic wild pig species. *Conservation Letter* 14(3): 12784.

Lynam, A.J. 2010. Securing a future for wild Indochinese tigers: Transforming tiger vacuums into tiger source sites. *Integrative Zoology* 5: 324-334.

Manoj, E.M. 2021. 40 killed in tiger attacks in the country last year. The Hindu 13 Sept 2021. Available at: https://www.thehindu.com/news/national/kerala/40-killed-in-tiger-attacks-in-the-country-last-year/article36442241.ece.

Matiukhina, D.S., Vitkalova, A.V., Rybin, A.N., Aramilev, V.V., Shevtsova, E.I. and Miquelle, D.G. 2016. Camera-trap monitoring of Amur Tiger (*Panthera tigris altaica*) in southwest Primorsky Krai, 2013-2016: preliminary results. *Nature Conservation Research: Zapovednaâ Nauka* 1(3): 36-48.

Miller, C.S., Hebblewhite, M., Petrunenko, Y.K.Seryodkin, I.V., Decesare, N.J., Goodrich, J.M. and Miquelle, D.G. 2013. Estimating Amur tiger (*Panthera tigris altaica*) kill rates and potential consumption rates using global positioning system collars. *Journal of Mammalogy* 94: 845-855.

Milliken, B.T. and Shaw, J. 2012. The South Africa – Viet Nam Rhino Horn Trade Nexus: A Deadly combination of institutional lapses, corrupt wildlife industry professionals and Asian crime syndicates. TRAFFIC.

Miquelle, D. G., Nikolaev, I. J. Goodrich, G., Litvinov, B., Smirnov, E. N. and Suvorov, E. 2005. Searching for the Co-Existence Recipe: A Case Study Of Conflicts Between People And Tigers In The Russian Far East. In: R. Woodruffe and S. Thirgood (eds), *People and wildlife: conflict or co-existence?*, pp. 305-322. Cambridge University Press, Cambridge.

Mondal, P. and Nagendra, H. 2011. Trends of forest dynamics in tiger landscapes across Asia. *Environmental Management* 48(4): 781.

Musing, L. 2020. EU's "unlikely" role in global tiger trade revealed in new WWF. Available at: https://www.traffic.org/publications/reports/eus-unlikely-role-in-global-tiger-trade/.

Nguyen, T. 2019. The impact of Traditional Asian Medicine on African wildlife: the role of East Asian immigrants. University of Kent.

Nowell, K. and Jackson, P. 1996. *Wild Cats. Status Survey and Conservation Action Plan*. IUCN/SSC Cat Specialist Group, Gland, Switzerland and Cambridge, UK.

Nowell, K. and Xu, Ling. 2007. Taming the tiger trade: China's markets for wild and captive tiger products since the 1993 domestic trade ban. TRAFFIC East Asia, Hong Kong, China.

O'Kelly, H.J., Evans, T.D., Stokes, E.J., Clements, T.J., Dara, A., Gately, M., Menghor, N., Pollard, E.H.B., Soriyun, M. and Walston, J. 2012. Identifying Conservation Successes, Failures and Future Opportunities; Assessing Recovery Potential of Wild Ungulates and Tigers in Eastern Cambodia. *PLoS ONE 7(10): e40482. doi:10.1371/journal.pone.0040482*.

Oswell, A. 2010. The Big Cat Trade in Myanmar and Thailand. TRAFFIC Southeast Asia, Bangkok.

Palmeirim, A.F. and Gibson, L. 2021. Impacts of hydropower on the habitat of jaguars and tigers. *Community Biology* 4: 1358.

Pasha, M.K.S., Dudley, N., Stolton, S., Baltzer, M., Long, B., Roy, S., Belecky, M., Gopal, R. and Yadav, S.P. 2018. Setting and implementing standards for management of wild tigers. *Land* 7(3): 93.

Quigley, K.S., Evermann, J.F., Leathers, C.W., Armstrong, D.L., Goodrich, J.M., Duncan, N.M. and Miquelle, D.G. 2010. Morbillivirus infection confirmed in a wild Siberian tiger in the Russian Far East. *Journal of Wildlife Diseases* 42: 1252–1256.

Rasphone, A., Kéry, M., Kamler, J.F. and Macdonald, D.W. 2019. Documenting the demise of tiger and leopard, and the status of other carnivores and prey, in Lao PDR's most prized protected area: Nam Et-Phou Louey. *Global Ecology and Conservation* 20: 1-15.

Rastogi, A., Hickey, G., Anand, A. and And, R.B.-F.P. 2015. Wildlife-tourism, local communities and tiger conservation: A village-level study in Corbett Tiger Reserve, India. *Forest Policy and Economics* 61: 11-19.

Rayan, D.M. and Mohamad, S. W. 2009. The importance of selectively logged forests for tiger conservation: a population density estimate of tigers *Panthera tigris* in Peninsular Malaysia. *Oryx* 43: 1-4.

Reddy, C.S. and Yosef, R. 2016. Living on the edge: Attitudes of rural communities toward Bengal tigers (*Panthera tigris*) in Central India. *Anthrozoös* 29: 311-322.

Robinson, H.S., Goodrich, J.M., Miquelle, D.G., Miller, C.S. and Seryodkin, I.V. 2015. Mortality of Amur tigers: The more things change, the more they stay the same. *Integrative Zoology* 10(4): 344-353.

Rozhnov, V.V., Naidenko, S.V., Hernandez-Blanco, J.A., Chistopolova, M.D., Sorokin, P.A., Yachmennikova, A., Blidchenko, E. Yu., Kalinin, A. Yu. and Kastrikin, V.A. 2021. Restoration of the Amur Tiger (*Panthera tigris altaica*) population in the northwest of Its distribution area. *Biology Bulletin of the Russian Academy of Sciences* 48: 1401–1423.

Sagar, V., Kaelin, C.B., Natesh, M., Reddy, P.A., Mohapatra, R.K., Chhattani, H., Thatte, P., Vaidyanathan, S., Biswas, S., Bhatt, S. and Paul, S., 2021. High frequency of an otherwise rare phenotype in a small and isolated tiger population. *Proceedings of the National Academy of Sciences* 118(39).

Saif, S., Russell, A.M., Nodie, S.I., Inskip, C., Lahann, P., Barlow, A., Barlow, C.G., Islam, A. and MacMillan, D.C. 2016. Local usage of tiger parts and Its role in tiger killing in the Bangladesh Sundarbans. *Human Dimensions of Wildlife* 21: 95–110.

Saif, S., Tuihedur Rahman, H.M. and MacMillan, D.C. 2018. Who is killing the tiger *Panthera tigris* and why? *Oryx* 52(1): 46-54.

Sanderson, E., Forrest, J., Loucks, C., Ginsberg, J., Dinerstein, E., Seidensticker, J., Leimgruber, P., Songer, M., Heydlauff, A., O'Brien, T., Bryja, G., Klenzendorf, S and Wikramanayake, E. 2006. Setting Priorities for the Conservation and Recovery of Wild Tigers: 2005-2015. The Technical Assessment. WCS, WWF, Smithsonian, and NFWF-STF, New York and Washington, DC, USA.

Sanderson, E.W. et al. in prep. Tiger Conservation Landscapes 3.0.

Sankar, K., Qureshi, Q., Nigam, P., Malik, P. K., Sinha, P. R., Mehrotra, R. N., Gopal, R., Bhattacharjee, S., Mondal, K. and Gupta, S. 2010. Monitoring of reintroduced tigers in Sariska Tiger Reserve, Western India: preliminary findings on home range, prey selection and food habits. *Tropical Conservation Science* 3(3): 301-318.

Sarkar, M.S., Ramesh, K., Johnson, J.A., Sen, S., Nigam, P., Gupta, S.K., Murthy, R.S. and Saha, G.K. 2016. Movement and home range characteristics of reintroduced tiger (*Panthera tigris*) population in Panna Tiger Reserve, central India. *European Journal of Wildlife Research* 62(5): 537-547.

Seidensticker J., Christie S. and Jackson, P. 1999. Preface. In: J. Seidensticker, S. Christie and P. Jackson (eds), *Riding the tiger: tiger conservation in human-dominated landscapes*, Cambridge University Press, Cambridge, UK.

Seimon, T.A., Miquelle, D.G. and Chang, T.Y. 2013. Canine Distemper Virus: an emerging disease in wild endangered Amur Tigers (*Panthera tigris altaica*). *Molecular Biology* 4: 00410-13.

Singh, R., Majumder, A., Sankar, K., Qureshi, Q., Goyal, S.P. and Nigam, P. 2013. Interbirth interval and litter size of free-ranging Bengal tiger (*Panthera tigris tigris*) in dry tropical deciduous forests of India. *European Journal of Wildlife Research* 59(5): 629-636.

Smith, J. L. D. and Mcdougal C. 1991. The contribution of variance in lifetime reproduction to effective population size in tigers. *Conservation Biology* 5: 484-490.

Soutyrina, S.V., Riley, M.D., Goodrich, J.M., Seryodkin, I.B. and Miquelle, D.G. 2012. *A Population Estimate of Amur Tigers Using Camera Traps*. Dalnauka, Vladivostok, Russia [in Russian and English].

Stolton, S., Dudley, N., Belokurov, A., Deguignet, M., Burgess, N., Hockings, M., Leverington, F., MacKinnon, K. and Young, L. 2019. Lessons learned from 18 years of implementing the Management Effectiveness Tracking Tool (METT): A perspective from the METT developers and implementers. *PARKS*: 79-92.

Stoner, S.S. 2012. Reduced to skin and bones: an updated analysis of tiger seizures from 12 Tiger Range Countries. Kuala Lumpur.

Stoner, S.S. and Pervushina, N. 2013. Reduced to Skin and Bones Revisited: An Updated Analysis of Tiger Seizures from 12 Tiger Range Countries (2000–2012). TRAFFIC, Kuala Lumpur, Malaysia.

Sunquist, M. and Sunquist, F. 2002. *Wild Cats of the World*. University of Chicago Press.

Thapa, K. and Kelly, M.J. 2017. Density and carrying capacity in the forgotten tigerland: Tigers in the understudied Nepalese Churia. *Integrative Zoology* 12: 211-227.

Thatte, P., Joshi, A., Vaidyanathan, S., Landguth, E. and Ramakrishnan, U. 2018. Maintaining tiger connectivity and minimizing extinction into the next century: Insights from landscape genetics and spatially-explicit simulations. *Biological Conservation* 218: 181-191.

Thinley, P., Rajaratnam, R., Lassoie, J.P., Morreale, S.J., Curtis, P.D., Vernes, K., Leki, L., Phuntsho, S., Dorji, T. and Dorji, P. 2018. The ecological benefit of tigers (*Panthera tigris*) to farmers in reducing crop and livestock losses in the eastern Himalayas: Implications for conservation of large apex predators. *Biological Conservation* 219: 119-125.

TRAFFIC. 2019. Tiger product consumers demand: reduction messaging guide for consumers in Viet Nam. Available at: https://www.traffic.org/publications/reports/tiger-product-consumers-in-viet-nam/.

TRAFFIC and WWF. 2020. Falling Through the System: The Role of the European Union captive tiger population in the trade in tigers. Cambridge, UK.

UNODC. 2020. World Wildlife Crime Report 2020: Trafficking in protected species. Available at: https://www.unodc.org/documents/data-and-analysis/wildlife/2020/World_Wildlife_Report_2020_9July.pdf.

Verheij, P.M., Foley, K.E. and Engel, K. 2010. *Reduced to skin and bones: An analysis of Tiger seizures from 11 Tiger range countries (2000-2010)*. TRAFFIC International.

Verma, M., Negandhi, D., Khanna, C., Edgaonkar, A., David, A., Kadekodi, G., Costanza, R., Gopal, R., Bonal, B.S. and Yadav, S.P. 2017. Making the hidden visible: Economic valuation of tiger reserves in India. *Ecosystem Services* 26: 236–244.

Walston, J., Robinson, J.G., Bennett, E.L., Breitenmoser, U., da Fonseca G.A.B., Goodrich, J., Gumal, M., Hunter, L., Johnson, A., Karanth, K.U., Leader-Williams, N., MacKinnon, K., Miquelle, D., Pattanavibool, A., Poole, C., Rabinowitz, A., Smith, J.L.D., Stokes, E.J., Stuart, S.N., Vongkhamheng, C. and Wibisono, H. 2010. Bringing the Tiger Back from the Brink—The Six Percent Solution. *PLoS Biology* 8(9): e1000485.

Warrier, R., Noon, B.R. and Bailey, L. 2020. Agricultural lands offer seasonal habitats to tigers in a human-dominated and fragmented landscape in India. *Ecosphere* 11(7): p.e03080.

Wikramanayake, E.D., Dinerstein, E., Robinson, J.G., Karanth, U., Rabinowitz, A., Olson, D., Mathew, T., Hedao, P., Conner, M. and Hemley, G. 1998. An ecology-based method for defining priorities for large mammal conservation: The tiger as case study. *Conservation Biology* 12: 865–878.

Wikramanayake, E., Dinerstein, E., Seidensticker, J., Lumpkin, S., Pandav, B., Shrestha, M., Mishra, H., Ballou, J., Johnsingh, A. J. T., Chestin, I., Sunarto, S., Thinley, P., Thapa, K., Jiang, G., Elagupillay, S., Kafley, H., Pradhan, N. M. B., Jigme, K., Teak, S., Cutter, P.G., Aziz, Md.A. andThan, U. 2011. A landscape-based conservation strategy to double the wild tiger population. *Conservation Letters* 4(3): 219-227.

Williams, V.L., Loveridge, A.J., Newton, D.J. and Macdonald, D.W. 2017. A roaring trade? The legal trade in *Panthera leo* bones from Africa to East-Southeast Asia. *PLoS ONE* 12: 1-22.

Wilting, A., Courtiol, A., Christiansen, P., Niedballa, J., Scharf, A. K., Orlando, L., Balkenhol, N., Hofer, H., Kramer-Schadt, S., Fickel, J. and Kitchener, A.C. 2015. Planning tiger recovery: Understanding intraspecific variation for effective conservation. *Science Advances* 1(5): e1400175. DOI: 10.1126/sciadv.1400175.

Wong, R. and Krishnasamy, K. 2019. Skin and bones: Unresolved. Available at: https://www.traffic.org/publications/reports/skin-and-bones-unresolved/.

Wong, R.W.Y. 2015. The organization of the illegal tiger parts trade in China. *British Journal of Criminology*: 1-19.

WWF International. 2017. Beyond the stripes: Save tigers, save so much more. Available at: https://www.worldwildlife.org/publications/beyond-the-stripes-save-tigers-save-so-much-more.

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External Resources

For Supplementary Material, and for Images and External Links to Additional Information, please see the Red List website.

Appendix

Habitats

(http://www.iucnredlist.org/technical-documents/classification-schemes)

Habitat	Season	Suitability	Major Importance?
1. Forest -> 1.1. Forest - Boreal	Resident	Suitable	Yes
1. Forest -> 1.4. Forest - Temperate	Resident	Suitable	Yes
1. Forest -> 1.5. Forest - Subtropical/Tropical Dry	Resident	Suitable	Yes
1. Forest -> 1.6. Forest - Subtropical/Tropical Moist Lowland	Resident	Suitable	Yes
1. Forest -> 1.7. Forest - Subtropical/Tropical Mangrove Vegetation Above High Tide Level	Resident	Suitable	Yes
1. Forest -> 1.8. Forest - Subtropical/Tropical Swamp	Resident	Suitable	Yes
1. Forest -> 1.9. Forest - Subtropical/Tropical Moist Montane	Resident	Suitable	Yes
2. Savanna -> 2.2. Savanna - Moist	Resident	Suitable	Yes
3. Shrubland -> 3.3. Shrubland - Boreal	Resident	Marginal	-
3. Shrubland -> 3.4. Shrubland - Temperate	Resident	Marginal	-
3. Shrubland -> 3.5. Shrubland - Subtropical/Tropical Dry	Resident	Suitable	Yes
3. Shrubland -> 3.6. Shrubland - Subtropical/Tropical Moist	Resident	Suitable	Yes
4. Grassland -> 4.4. Grassland - Temperate	Resident	Marginal	-
4. Grassland -> 4.5. Grassland - Subtropical/Tropical Dry	Resident	Suitable	Yes
4. Grassland -> 4.6. Grassland - Subtropical/Tropical Seasonally Wet/Flooded	Resident	Suitable	Yes
4. Grassland -> 4.7. Grassland - Subtropical/Tropical High Altitude	Resident	Marginal	-
5. Wetlands (inland) -> 5.4. Wetlands (inland) - Bogs, Marshes, Swamps, Fens, Peatlands	Resident	Suitable	Yes
13. Marine Coastal/Supratidal -> 13.4. Marine Coastal/Supratidal - Coastal Brackish/Saline Lagoons/Marine Lakes	Resident	Suitable	Yes
14. Artificial/Terrestrial -> 14.3. Artificial/Terrestrial - Plantations	Resident	Marginal	-
14. Artificial/Terrestrial -> 14.4. Artificial/Terrestrial - Rural Gardens	Passage	Marginal	-
14. Artificial/Terrestrial -> 14.6. Artificial/Terrestrial - Subtropical/Tropical Heavily Degraded Former Forest	Resident	Suitable	Yes

Use and Trade

(http://www.iucnredlist.org/technical-documents/classification-schemes)

End Use	Local	National	International
3. Medicine - human & veterinary	No	Yes	Yes
10. Wearing apparel, accessories	Yes	Yes	Yes
12. Handicrafts, jewellery, etc.	No	Yes	Yes
13. Pets/display animals, horticulture	No	Yes	Yes
15. Sport hunting/specimen collecting	No	Yes	No
16. Establishing ex-situ production *	No	Yes	Yes

Threats

(http://www.iucnredlist.org/technical-documents/classification-schemes)

Threat	Timing	Scope	Severity	Impact Score
2. Agriculture & aquaculture -> 2.1. Annual & perennial non-timber crops -> 2.1.1. Shifting agriculture	Ongoing	Minority (50%)	Causing/could cause fluctuations	Low impact: 5
	Stresses:	1. Ecosystem stresses -> 1.1. Ecosystem conversion 1. Ecosystem stresses -> 1.2. Ecosystem degradation 1. Ecosystem stresses -> 1.3. Indirect ecosystem effects 2. Species Stresses -> 2.2. Species disturbance 2. Species Stresses -> 2.3. Indirect species effects		
2. Agriculture & aquaculture -> 2.1. Annual & perennial non-timber crops -> 2.1.2. Small-holder farming	Ongoing	Minority (50%)	Slow, significant declines	Low impact: 5
	Stresses:	1. Ecosystem stresses -> 1.1. Ecosystem conversion 1. Ecosystem stresses -> 1.2. Ecosystem degradation 1. Ecosystem stresses -> 1.3. Indirect ecosystem effects 2. Species Stresses -> 2.1. Species mortality 2. Species Stresses -> 2.2. Species disturbance 2. Species Stresses -> 2.3. Indirect species effects		
2. Agriculture & aquaculture -> 2.1. Annual & perennial non-timber crops -> 2.1.3. Agro-industry farming	Past, unlikely to return	Minority (50%)	Very rapid declines	Past impact
	Stresses:	1. Ecosystem stresses -> 1.1. Ecosystem conversion 1. Ecosystem stresses -> 1.2. Ecosystem degradation 1. Ecosystem stresses -> 1.3. Indirect ecosystem effects 2. Species Stresses -> 2.1. Species mortality 2. Species Stresses -> 2.2. Species disturbance 2. Species Stresses -> 2.3. Indirect species effects		
2. Agriculture & aquaculture -> 2.2. Wood & pulp plantations -> 2.2.1. Small-holder plantations	Ongoing	Minority (50%)	Slow, significant declines	Low impact: 5
	Stresses:	1. Ecosystem stresses -> 1.1. Ecosystem conversion 1. Ecosystem stresses -> 1.2. Ecosystem degradation		
2. Agriculture & aquaculture -> 2.2. Wood & pulp plantations -> 2.2.2. Agro-industry plantations	Past, unlikely to return	Minority (50%)	Rapid declines	Past impact
	Stresses:	1. Ecosystem stresses -> 1.1. Ecosystem conversion 1. Ecosystem stresses -> 1.2. Ecosystem degradation		

		1. Ecosystem stresses -> 1.3. Indirect ecosystem effects 2. Species Stresses -> 2.1. Species mortality 2. Species Stresses -> 2.2. Species disturbance 2. Species Stresses -> 2.3. Indirect species effects		
2. Agriculture & aquaculture -> 2.3. Livestock farming & ranching -> 2.3.2. Small-holder grazing, ranching or farming	Ongoing	Minority (50%)	Slow, significant declines	Low impact: 5
	Stresses:	1. Ecosystem stresses -> 1.1. Ecosystem conversion 1. Ecosystem stresses -> 1.2. Ecosystem degradation 1. Ecosystem stresses -> 1.3. Indirect ecosystem effects 2. Species Stresses -> 2.1. Species mortality 2. Species Stresses -> 2.2. Species disturbance 2. Species Stresses -> 2.3. Indirect species effects		
3. Energy production & mining -> 3.1. Oil & gas drilling	Past, likely to return	Majority (50-90%)	Very rapid declines	Past impact
	Stresses:	1. Ecosystem stresses -> 1.1. Ecosystem conversion 1. Ecosystem stresses -> 1.2. Ecosystem degradation 1. Ecosystem stresses -> 1.3. Indirect ecosystem effects 2. Species Stresses -> 2.1. Species mortality 2. Species Stresses -> 2.2. Species disturbance 2. Species Stresses -> 2.3. Indirect species effects		
3. Energy production & mining -> 3.2. Mining & quarrying	Ongoing	Unknown	Causing/could cause fluctuations	Unknown
	Stresses:	1. Ecosystem stresses -> 1.1. Ecosystem conversion 1. Ecosystem stresses -> 1.2. Ecosystem degradation 1. Ecosystem stresses -> 1.3. Indirect ecosystem effects 2. Species Stresses -> 2.1. Species mortality 2. Species Stresses -> 2.2. Species disturbance 2. Species Stresses -> 2.3. Indirect species effects		
4. Transportation & service corridors -> 4.1. Roads & railroads	Ongoing	Minority (50%)	Slow, significant declines	Low impact: 5
	Stresses:	1. Ecosystem stresses -> 1.1. Ecosystem conversion 1. Ecosystem stresses -> 1.2. Ecosystem degradation 1. Ecosystem stresses -> 1.3. Indirect ecosystem effects 2. Species Stresses -> 2.1. Species mortality 2. Species Stresses -> 2.2. Species disturbance 2. Species Stresses -> 2.3. Indirect species effects		
5. Biological resource use -> 5.1. Hunting & trapping terrestrial animals -> 5.1.1. Intentional use (species is the target)	Ongoing	Whole (>90%)	Very rapid declines	High impact: 9
	Stresses:	2. Species Stresses -> 2.1. Species mortality 2. Species Stresses -> 2.2. Species disturbance 2. Species Stresses -> 2.3. Indirect species effects		
5. Biological resource use -> 5.1. Hunting & trapping terrestrial animals -> 5.1.2. Unintentional effects (species is not the target)	Ongoing	Minority (50%)	Slow, significant declines	Low impact: 5
	Stresses:	2. Species Stresses -> 2.1. Species mortality 2. Species Stresses -> 2.2. Species disturbance 2. Species Stresses -> 2.3. Indirect species effects		
5. Biological resource use -> 5.1. Hunting & trapping terrestrial animals -> 5.1.3. Persecution/control	Ongoing	Minority (50%)	Rapid declines	Medium impact: 6
	Stresses:	2. Species Stresses -> 2.1. Species mortality 2. Species Stresses -> 2.2. Species disturbance		

		2. Species Stresses -> 2.3. Indirect species effects		
5. Biological resource use -> 5.3. Logging & wood harvesting -> 5.3.3. Unintentional effects: (subsistence/small scale) [harvest]	Ongoing	Minority (50%)	Causing/could cause fluctuations	Low impact: 5
	Stresses:	1. Ecosystem stresses -> 1.1. Ecosystem conversion 1. Ecosystem stresses -> 1.2. Ecosystem degradation 1. Ecosystem stresses -> 1.3. Indirect ecosystem effects 2. Species Stresses -> 2.1. Species mortality 2. Species Stresses -> 2.2. Species disturbance 2. Species Stresses -> 2.3. Indirect species effects		
5. Biological resource use -> 5.3. Logging & wood harvesting -> 5.3.4. Unintentional effects: (large scale) [harvest]	Ongoing	Minority (50%)	Slow, significant declines	Low impact: 5
	Stresses:	1. Ecosystem stresses -> 1.1. Ecosystem conversion 1. Ecosystem stresses -> 1.2. Ecosystem degradation 1. Ecosystem stresses -> 1.3. Indirect ecosystem effects 2. Species Stresses -> 2.1. Species mortality 2. Species Stresses -> 2.2. Species disturbance 2. Species Stresses -> 2.3. Indirect species effects		
6. Human intrusions & disturbance -> 6.2. War, civil unrest & military exercises	Ongoing	Minority (50%)	Rapid declines	Medium impact: 6
	Stresses:	2. Species Stresses -> 2.1. Species mortality 2. Species Stresses -> 2.2. Species disturbance 2. Species Stresses -> 2.3. Indirect species effects		
7. Natural system modifications -> 7.1. Fire & fire suppression -> 7.1.1. Increase in fire frequency/intensity	Ongoing	Minority (50%)	Unknown	Unknown
	Stresses:	1. Ecosystem stresses -> 1.1. Ecosystem conversion 1. Ecosystem stresses -> 1.2. Ecosystem degradation 1. Ecosystem stresses -> 1.3. Indirect ecosystem effects 2. Species Stresses -> 2.1. Species mortality 2. Species Stresses -> 2.2. Species disturbance 2. Species Stresses -> 2.3. Indirect species effects		
7. Natural system modifications -> 7.2. Dams & water management/use -> 7.2.1. Abstraction of surface water (domestic use)	Ongoing	Unknown	Causing/could cause fluctuations	Unknown
	Stresses:	1. Ecosystem stresses -> 1.1. Ecosystem conversion 1. Ecosystem stresses -> 1.2. Ecosystem degradation 1. Ecosystem stresses -> 1.3. Indirect ecosystem effects 2. Species Stresses -> 2.1. Species mortality 2. Species Stresses -> 2.2. Species disturbance 2. Species Stresses -> 2.3. Indirect species effects		
9. Pollution -> 9.2. Industrial & military effluents -> 9.2.1. Oil spills	Ongoing	Minority (50%)	Unknown	Unknown
	Stresses:	1. Ecosystem stresses -> 1.1. Ecosystem conversion 1. Ecosystem stresses -> 1.3. Indirect ecosystem effects 2. Species Stresses -> 2.1. Species mortality 2. Species Stresses -> 2.2. Species disturbance		
11. Climate change & severe weather -> 11.4. Storms & flooding	Ongoing	Minority (50%)	Unknown	Unknown
	Stresses:	1. Ecosystem stresses -> 1.2. Ecosystem degradation 1. Ecosystem stresses -> 1.3. Indirect ecosystem effects 2. Species Stresses -> 2.1. Species mortality		

Conservation Actions in Place
(http://www.iucnredlist.org/technical-documents/classification-schemes)

Conservation Action in Place
In-place research and monitoring
Action Recovery Plan: Yes
Systematic monitoring scheme: Yes
In-place land/water protection
Conservation sites identified: Yes, over entire range
Area based regional management plan: Yes
Occurs in at least one protected area: Yes
Invasive species control or prevention: Yes
In-place species management
Harvest management plan: No
Successfully reintroduced or introduced benignly: Yes
Subject to ex-situ conservation: Yes
In-place education
Included in international legislation: Yes
Subject to any international management / trade controls: Yes

Conservation Actions Needed
(http://www.iucnredlist.org/technical-documents/classification-schemes)

Conservation Action Needed
1. Land/water protection -> 1.1. Site/area protection
1. Land/water protection -> 1.2. Resource & habitat protection
2. Land/water management -> 2.1. Site/area management
2. Land/water management -> 2.2. Invasive/problematic species control
2. Land/water management -> 2.3. Habitat & natural process restoration
3. Species management -> 3.1. Species management -> 3.1.1. Harvest management
3. Species management -> 3.1. Species management -> 3.1.2. Trade management
3. Species management -> 3.2. Species recovery
3. Species management -> 3.3. Species re-introduction -> 3.3.1. Reintroduction
3. Species management -> 3.4. Ex-situ conservation -> 3.4.1. Captive breeding/artificial propagation

Conservation Action Needed
3. Species management -> 3.4. Ex-situ conservation -> 3.4.2. Genome resource bank
4. Education & awareness -> 4.1. Formal education
4. Education & awareness -> 4.2. Training
4. Education & awareness -> 4.3. Awareness & communications
5. Law & policy -> 5.1. Legislation -> 5.1.1. International level
5. Law & policy -> 5.1. Legislation -> 5.1.2. National level
5. Law & policy -> 5.1. Legislation -> 5.1.3. Sub-national level
5. Law & policy -> 5.2. Policies and regulations
5. Law & policy -> 5.3. Private sector standards & codes
5. Law & policy -> 5.4. Compliance and enforcement -> 5.4.1. International level
5. Law & policy -> 5.4. Compliance and enforcement -> 5.4.2. National level
5. Law & policy -> 5.4. Compliance and enforcement -> 5.4.3. Sub-national level
6. Livelihood, economic & other incentives -> 6.1. Linked enterprises & livelihood alternatives
6. Livelihood, economic & other incentives -> 6.2. Substitution
6. Livelihood, economic & other incentives -> 6.3. Market forces
6. Livelihood, economic & other incentives -> 6.4. Conservation payments
6. Livelihood, economic & other incentives -> 6.5. Non-monetary values

Research Needed

(http://www.iucnredlist.org/technical-documents/classification-schemes)

Research Needed
1. Research -> 1.1. Taxonomy
1. Research -> 1.2. Population size, distribution & trends
1. Research -> 1.3. Life history & ecology
1. Research -> 1.4. Harvest, use & livelihoods
1. Research -> 1.5. Threats
1. Research -> 1.6. Actions
2. Conservation Planning -> 2.1. Species Action/Recovery Plan
2. Conservation Planning -> 2.2. Area-based Management Plan
2. Conservation Planning -> 2.3. Harvest & Trade Management Plan
3. Monitoring -> 3.1. Population trends

Research Needed
3. Monitoring -> 3.2. Harvest level trends
3. Monitoring -> 3.3. Trade trends
3. Monitoring -> 3.4. Habitat trends

Additional Data Fields

Distribution
Estimated area of occupancy (AOO) (km^2): 978293
Continuing decline in area of occupancy (AOO): Yes
Extreme fluctuations in area of occupancy (AOO): No
Estimated extent of occurrence (EOO) (km^2): 6407413
Continuing decline in extent of occurrence (EOO): Yes
Extreme fluctuations in extent of occurrence (EOO): No
Continuing decline in number of locations: Yes
Extreme fluctuations in the number of locations: No
Lower elevation limit (m): 0
Upper elevation limit (m): 4,500
Population
Number of mature individuals: 2,608-3905,3140
Continuing decline of mature individuals: Unknown
Extreme fluctuations: No
Population severely fragmented: No
Continuing decline in subpopulations: Yes
Extreme fluctuations in subpopulations: No
All individuals in one subpopulation: No
Habitats and Ecology
Continuing decline in area, extent and/or quality of habitat: Yes
Generation Length (years): 7-10
Movement patterns: Not a Migrant

The IUCN Red List Partnership

The IUCN Red List of Threatened Species™ is produced and managed by the IUCN Global Species Programme, the IUCN Species Survival Commission (SSC) and The IUCN Red List Partnership.

The IUCN Red List Partners are: ABQ BioPark; Arizona State University; BirdLife International; Botanic Gardens Conservation International; Conservation International; Missouri Botanical Garden; NatureServe; Re:wild; Royal Botanic Gardens, Kew; Sapienza University of Rome; Texas A&M University; and Zoological Society of London.