A SPECIES AND CLIMATE CHANGE BRIEF FOR THE VANISHING TREASURES PROGRAMME

GETTING CLIMATE-SMART WITH THE

ROYAL BENGAL TIGER

IN BHUTAN

VANISHING TREASURES

PROTECTING ENDANGERED MOUNTAIN SPECIES

THE GOVERNMENT
OF THE GRAND DUCHY OF LUXEMBOURG

UN environment programme

GRID ARENDAL
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GETTING CLIMATE-SMART WITH THE

ROYAL BENGAL TIGER

IN BHUTAN

The goal of this information brief

This brief is one of three in a series that also includes the mountain gorilla and the snow leopard, produced under the Vanishing Treasures programme. Its goal is to highlight how climate change is – and will be – impacting the conservation of the Royal Bengal tiger in Bhutan.

The brief examines how climate change has multiple, and often interacting, impacts on the Royal Bengal tiger – be it on its physiology, on the ecosystems and prey species on which it depends, or on the behaviour of humans living in its surroundings – with important feedback loops that directly affect the conservation of this magnificent animal.

The brief also includes a series of possible options for policymakers and conservation practitioners in Bhutan. The potential solutions are based on consultations at the local and national level and will be further explored and developed in the course of the Vanishing Treasures programme. They do not, however, refer to the definitive approach being taken by the programme.

The Vanishing Treasures programme is working to:

- integrate climate-smart measures into conservation planning, including ecological connectivity measures to take into account shifting and changing habitats and other changes as a result of climate change
- pilot ecosystem-based adaptation and other measures to increase communities' resilience to climate change and to promote alternative livelihood options that reduce or diversify the dependence on natural resources, such as water, that species depend on
- pilot specific measures to reduce human-wildlife conflict.

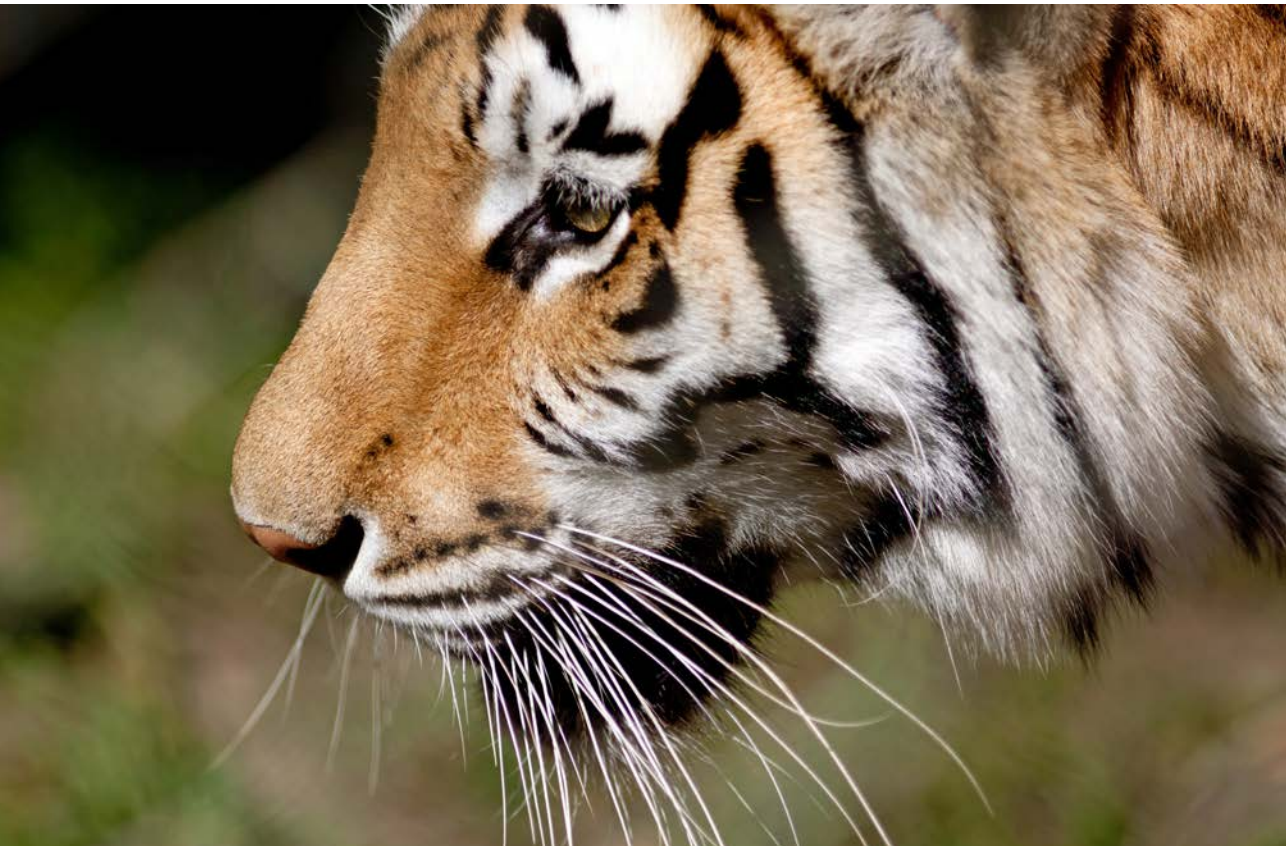
An adult Royal Bengal tiger. Credit: iStock/Amit Srivastava

> *"We're the true kings of the jungle. Our vast kingdom used to stretch over grasslands with plenty of prey to feed on, but they're decreasing. Humans have always admired and feared us. The truth is we're just trying to survive, like communities in Bhutan. We tigers need our territory to be restored, not torn into pieces, so we can hunt freely. It's the best way to reduce unnecessary encounters between tigers and humans. I shouldn't be saying this, but if you protected your livestock better, it'd be less attractive to us. Taking care of our habitats can also benefit the humans around here and increase their chances of earning a living, especially now that climate change is making things more difficult for everyone. I'm tired of being the big bad tiger. Just give me space... and peace.*
>
> – **Karma**, Royal Bengal tiger, Himalayas

Introduction

The Royal Bengal tiger once ranged widely across Asia, but nowadays its habitat and population size has been drastically reduced. The International Union for the Conservation of Nature (IUCN) has listed this species as endangered, and it is estimated that there has been as much as a 50 per cent decline in global tiger populations over the last three decades, with around 5,000–7,000 tigers in 1998 compared with 3,500 in 2014 (Goodrich et al. 2015). Bhutan lies within the Greater Manas conversation landscape, and is one of eight countries where a breeding population can be found in the wild (World Wide Fund for Nature [WWF] 2012). The Bhutanese tiger population is estimated to be around 90 individuals (Tempa et al. 2019). Based on camera trap recordings, most of these identified tigers are distributed across the north-western, central, and south-central parts of the country (see Figure 1), which are mainly conifer forests, alpine meadows, warm and cool broad-leaved forests and sub-tropical forests, which allow for a wide-ranging biodiversity (Ministry of Agriculture 2009; Sangay, Rajaratnam, and Vernes 2014). Tiger habitats in Bhutan range from 150 metres above sea level (a.s.l) in the southern region to 4,000 metres a.s.l in the northern region (Nature Conservation Division 2018; Tempa et al. 2019). Adult tigers maintain exclusive territories and are generally solitary animals.

The range of tigers' habitats depends on the availability of sufficient prey. Although tigers can eat almost anything they catch, the availability of their preferred prey (spotted deer, wild pig, other ungulates such as the sambar deer) is key to successful reproduction (Sunquist and Sunquist 2002). Livestock (horses and cows) also contribute



Royal Bengal tiger. Credit: iStock/demeri

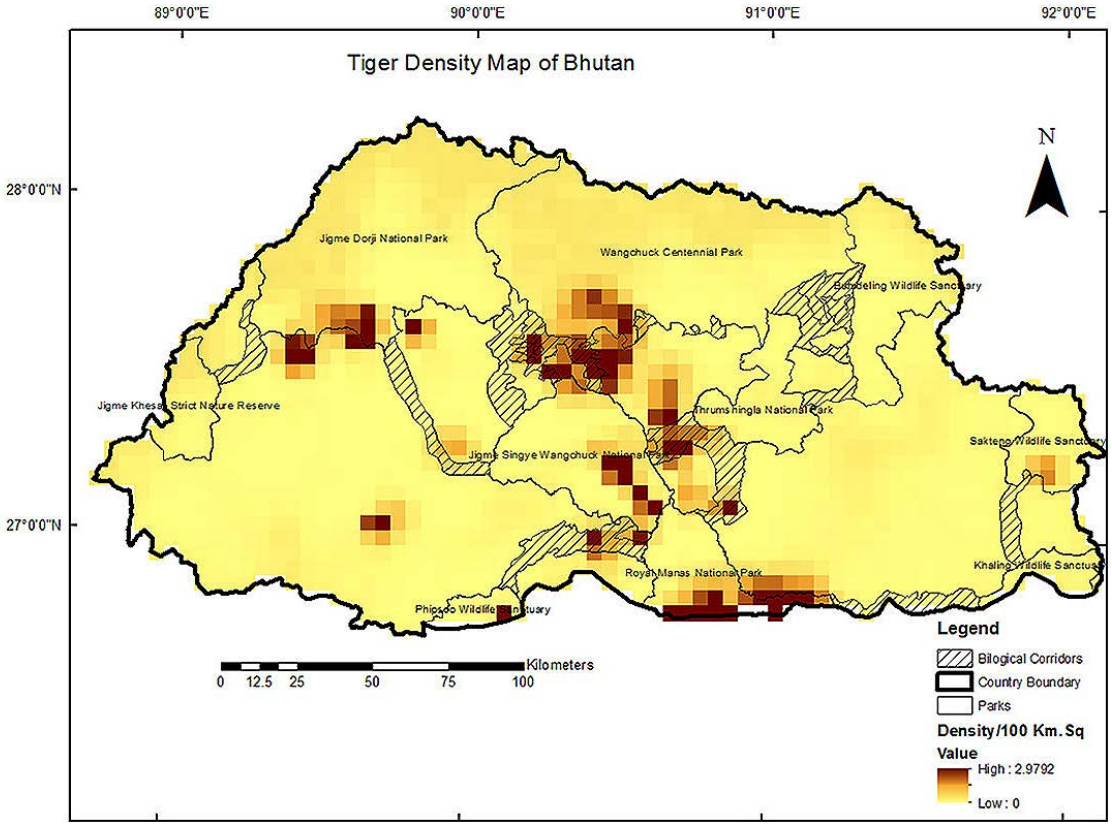


Figure 1: Map of tiger density in Bhutan using the Bayesian spatial capture-recapture model, D + σsex, 2014–2015. Source: Reproduced from Tempa et al. (2019), with permission from Elsevier.

Mountains are global biodiversity hotspots

Mountains are hugely important for biodiversity: about half of the world's biodiversity hotspots are located in highland or mountain regions (Myers et al. 2000). There are many reasons for this high biodiversity, including the varied physical terrain across steep altitudinal gradients that has encouraged a high number of endemic species, the historically low human population densities and the convergence of several ecosystem boundaries in one place. The Hindu Kush Himalaya region is currently considered a biodiversity hotspot by Conservation International, due to its rich combination of endemic species of plants, mammals, birds, reptiles, amphibians and freshwater fish (Wester et al. 2019).

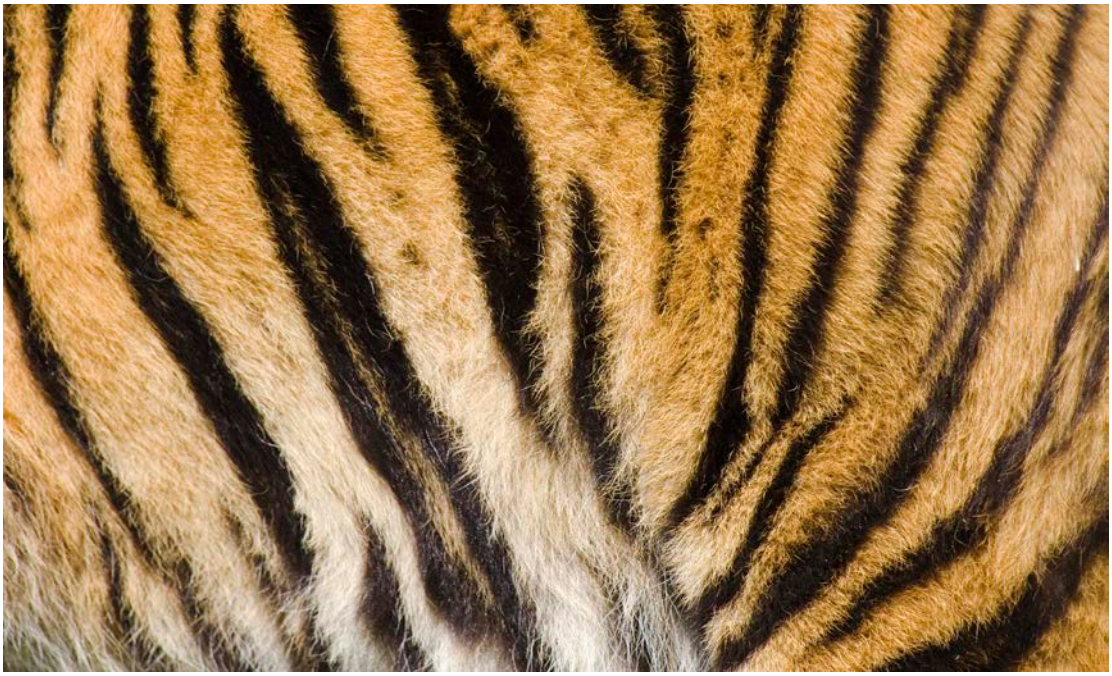
Many of the same societal forces driving biodiversity loss in lowland areas affect mountains: increasing human populations, the expansion and intensification of agriculture, the exploitation of natural resources, infrastructure development and unsustainable tourism practices have transformed many mountain regions around the world, leading to the fragmentation of natural habitats and replacement by human-dominated landscapes (Peters et al. 2019). Conservation in the twenty-first century needs to fully consider and plan for all the impacts of climate change. Climate change is an important driver of change in ecosystems, in the behaviour of individual species and their prey, and perhaps just as crucially, in human behaviour, which has important feedback loops for ecosystems and individual species.

A camera trap with flash and motion sensor. Credit: BTC/DoFPS

A Royal Bengal Tiger captured on camera. Credit: BTC/DoFPS

to their diet in the mid-temperate regions of Bhutan (Nature Conservation Division 2018). A yearly minimum kill for a tiger consists of 50–60 large prey animals (Karanth et al. 2004).

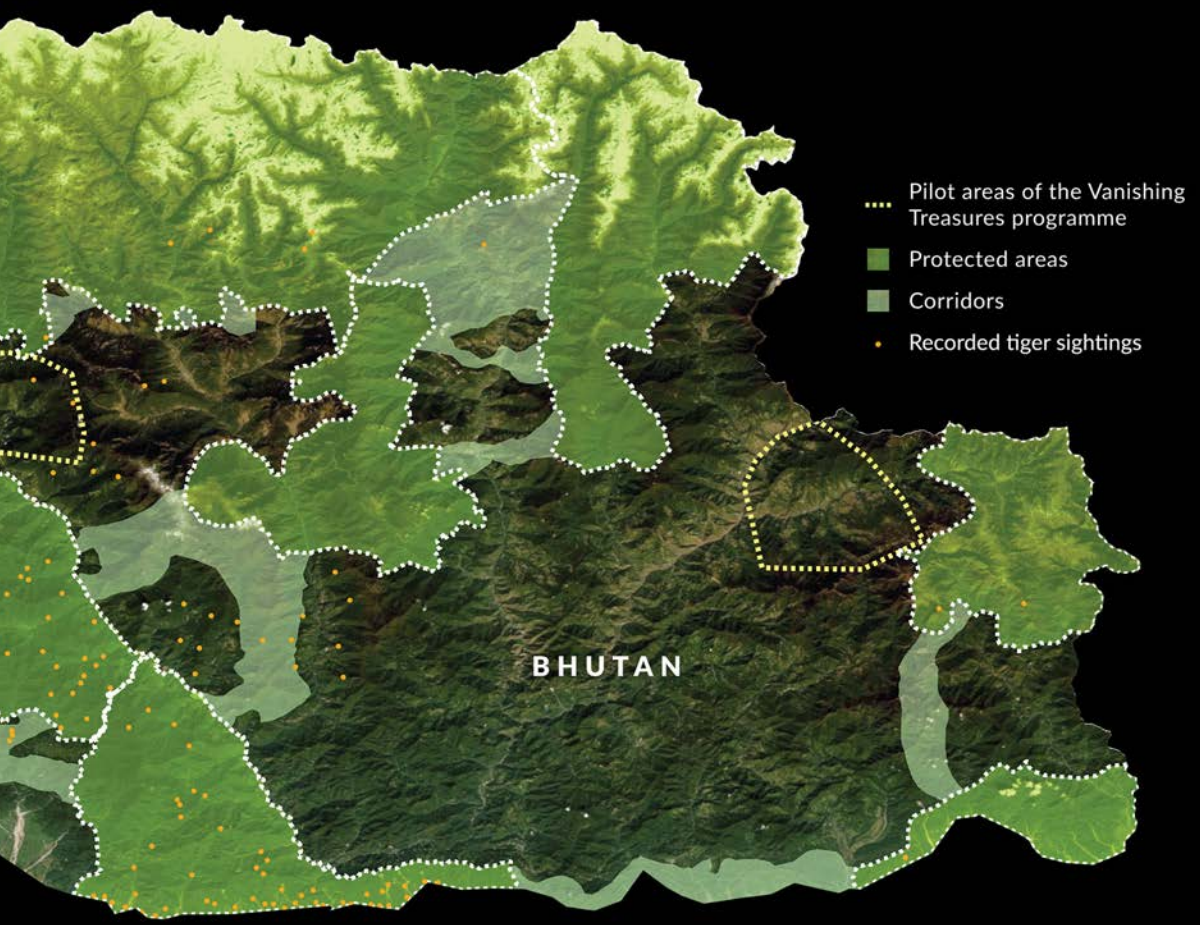
Bhutan has an extensive network of protected areas and corridors connecting its various national parks. A 2016 survey concluded that the network is ecologically representative and a well-connected system, though its effectiveness is limited by inadequate financial and technical resources, as well as gaps in monitoring and research data (Wildlife Conservation Division 2016). The 2014–2015 National Tiger Survey (Dorji et al. 2015) also found that many tigers reside outside of conservation areas where they sometimes come into conflict with farmers, indicating that the tiger conservation regime needs to incorporate tiger habitats outside national parks.



By studying the pattern of the stripes on a tiger, it is possible to distinguish it from other tigers. Credit: iStock/ProjectB

Figure 3: Map of protected aeras, corridor networks and recorded tiger sightings in Bhutan
Note: The Vanishing Treasures programme works in two core areas: in the centre of the country (Trongsa district) and the far east of the country (Trashigang district).

A tiger during winter in Bhutan. Credit: BTC/DoFPS



A tiger captured on camera. Credit: BTC/DoFPS

Effects of climate change on the Royal Bengal tiger

Climate change in Bhutan: key trends

The Royal Bengal tiger has important ecological significance as an apex predator, with its presence indicating a healthy ecosystem (Nature Conservation Division 2018). However, there are several concerns regarding tigers' habitats in Bhutan, some of which are either directly or indirectly linked to observed and predicted climate change. Mountains are one type of region experiencing noticeable impacts, among which include the phenomenon of elevation-dependent warming, with mountain regions warming faster than lowlands (Wang, Fan and Wang 2016).

Bhutan's mountainous terrain and rapid variation in agro-ecological zones are increasing its vulnerability to climate change, climate variability and related impacts (United Nations Development Programme [UNDP] 2016). The National Action Plan on Biodiversity Persistence and Climate Change of Bhutan (National Biodiversity Centre 2011) has listed a number of observed climate change impacts and threats to biodiversity, including the disruption of ecosystems and ecosystem services, loss of species, increased establishment of invasive species, increased risk of forest fires, loss of agro-biodiversity, increased incidence of pests and diseases, and loss of livelihood, traditional knowledge and practices (biocultural loss).

> *"The biggest threat for tiger conservation in Bhutan is human-tiger conflicts and climate change. Through the Vanishing Treasures programme, our department is working towards addressing these threats. We are committed to secure the future of this iconic species.*
>
> – **Lobzang Dorji**, Director of Department of Forests and Park Services under the Ministry of Agriculture and Forests of the Royal Government of Bhutan

There are three main climatic and environmental factors that drive these changes as described in Table 1.

Direct impacts of the climate on the Royal Bengal tiger

Physiological impacts

Climate change may directly affect Royal Bengal tigers' physiology, with temperature and water stress affecting their development, survival and reproductive success, for example. A possible effect of physiological stress could include their migration into upland areas where temperatures are cooler, but resources are fewer (Nature Conservation Division 2018). Several studies show that tigers are somewhat resilient, as they feed on various prey species and can adapt to various climate conditions and ecosystems (Sunquist and Sunquist 2002; Dhendup 2019; Tempa 2017). However, no studies or information on the impact of climate change on tigers' physiology are available, highlighting the need to produce such data.

The ecosystem: indirect impacts of climate change on the Royal Bengal tiger

Shift in plant phenology

Phenology is the study of the life cycle of flora and fauna and how these are influenced by seasonal climate changes and habitat changes. Altitudinal temperature differences determine an ecosystem's suitability for different species (Dorji et al. 2016) and increasing temperatures will, and already do, affect phenology and the composition and distribution of species in Bhutan (Corlett and Lefrankie 1998; Xu et al. 2009; Wang et al. 2019). While some species may become rarer or even disappear, others will increase in distribution and occurrence (Williams et al. 2007). Invasive plant species have already colonized some highland pastures, adversely affecting the growth of grass for fodder (Thiney et al. 2019).

Table 1: Climatic and environmental drivers in Bhutan

	Observed changes	Predicted changes
Warming	It is estimated that warming at higher altitudes has accelerated up to 75 per cent faster than the global average over the last 20 years (Pepin et al. 2015), thus leaving Bhutan vulnerable due to its geography.	An annual mean temperature increase of 1.3–4.5°C by the end of the twenty-first century is predicted in Bhutan according to phase 6 of the Coupled Model Intercomparison Project (CMIP6), the most recent climate global model (Almazroui et al. 2020) Overall temperature across the mountainous Hindu Kush Himalaya will increase by about 1–2°C (in places by up to 4–5°C) by 2050 (Shrestha, Bawa and Gautam 2015).
Precipitation	An increase in extreme weather events, more erratic rainfall patterns and increased intensity of rainfall has led to flash floods in some parts of the country and caused drought in other parts (Chhogyel and Kumar 2018)	Projections vary, but according to latest projections from the CMIP6 model, Bhutan's annual precipitation is projected to increase by 1.6–18.9 per cent (Almazroui et al. 2020). In a high emission scenario, monsoon precipitation is projected to increase by 16.5 per cent (Ibid).
Glaciers	Glacier extent decreased by 23 per cent between 1980 and 2010 (Bajracharya et al. 2014)	If present-day climate values continue, glacier extent is expected to decrease by 10 per cent, with glacial retreat continuing at around 25 per cent with a 1°C regional temperature increase (Rupper et al. 2012). This will lead to a 30 per cent and 65 per cent loss of annual meltwater flux, respectively (Ibid). Warming of 2.5°C is estimated to reduce glacier extent by 50 per cent.

Forest cover increased nationally from 72 per cent in 1995 to 81 per cent in 2010 (National Soil and Services Centre and Policy [NSSCP] 2011). At the district level, Bumthang (277 km^2), Wangdue Phodrang (148 km^2) and Trashigang (110 km2) have seen the greatest change in non-forest land becoming forested (Gilani et al. 2014). Trongsa, one of the two Vanishing Treasures programme areas, also experienced an increase in forest cover of around 70 km^2 (Ibid). Although increased forest cover has the clear positive effect of storing higher amounts of CO_2 in Bhutan,

A tiger captured on camera. Credit: BTC/DoFPS

impacts on conservation efforts may include its reduction of heterogeneity (despite contributing to conservation of endangered species), which negatively affects local biodiversity (Belsky and Siebert 2016).

Forest areas are expected to move higher up mountains and expand further north, along with the species that inhabit them, which includes tigers' prey. As a response to these changes, tigers may move from Bhutan's southern and central areas to riverine habitats spread across the whole country (National Environment Commission 2011). Changes in temperature, precipitation and glacier melt fluctuations are expected to lead to changes in surface water levels and groundwater recharge, and may also affect hydrological cycles and subsurface reservoirs (Beldring and Voksø 2011; Mahanta et al. 2018). Drought linked to changes in precipitation patterns may induce changes in Bhutan's forest cover. This, along with biomass production changes, for example, may impact the Royal Bengal tiger's natural habitat, while also resulting in a two-fold increase in wildlife hazard risks for the blue pine ecosystem in central and western Bhutan (Wangdi et al. 2017; Vilà-Vilardell et al. 2020).

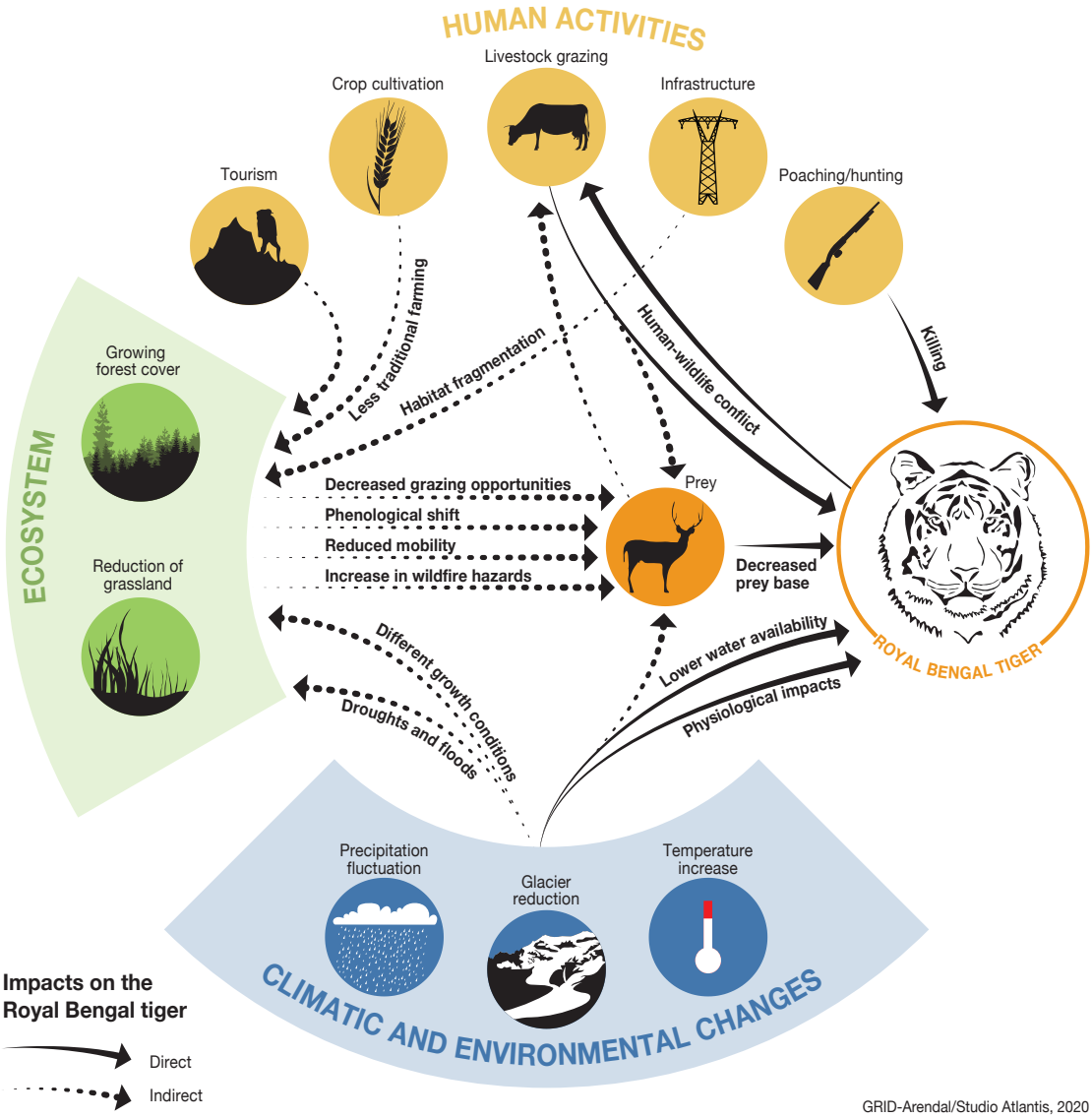


Figure 2: The impacts of climate change and human activities on the Royal Bengal tiger in Bhutan.

Human responses to climate change and land-use change

Landscapes that represent important tiger habitats are also important for the livelihoods of local communities. It is estimated that around 5,325 households reside within national parks and 1,662 households within 500 metres of national parks, while around 3,425 households reside inside biological corridors and 2,748 households within 500 metres from biological corridors (Nature Conservation Division 2018). Many of these communities are highly dependent on forests for fodder, fuel, timber and non-wood forest products (Wangchuk et al. 2019).

Bhutan's mountainous topography exacerbates the vulnerability of land-use practices to climate change, due to their high sensitivity to temperature and precipitation changes and proneness to natural hazards (Dorji et al. 2016; Chhogyel and Kumar 2018). For example, water is currently one of the main causes of soil degradation in Bhutan through soil erosion (0.04 million hectares) (Srinvasarao et al. 2019). Changes in precipitation patterns and rainfall intensity already impact water resources and crop yields throughout the country, with such changes likely to further decrease yields and increase the risk of crop failure (Mahanta et al. 2018).

Climate change will, and already is, forcing many farmers to change their livelihoods and agricultural practices, leading to the adoption of adaptation measures that are likely to exacerbate pressure on tiger habitats. Modernization in the agriculture sector and agricultural policies have also led to a change in practices that interact

The fortress in Nubi Geywog, Trongsa District, one of the pilot areas for Vanishing Treasures. Credit: BTC/DoFPS

with the environment in a different manner to traditional methods. There are still large gaps and limits in systematic research on the impacts of land-cover change on ecosystems, biodiversity and the services they provide for mountain communities in Bhutan, representing a barrier to informed planning for sustainable development and management (Chaudhary et al. 2017).

Regional populations and economic growth have put pressure on forests and led to local declines in cover due to the extensive consumption of timber (Wangchuk et al. 2019). For example, the Phobjikha Valley in central Bhutan has seen a 2 per cent loss in forest cover and 7 per cent decrease in marsh cover over 32 years, caused by local pressure on resources that has led to a reduction in ecosystem services and has in turn negatively impacted local biodiversity (Chaudaray et al. 2017). Increased usage of pesticides in this area has also contaminated water bodies, thus posing a threat to local wildlife (Ibid.).

Direct impacts on the Royal Bengal tiger

Human-wildlife conflict

Human-wildlife conflict is common in areas where livestock and agriculture are important to rural livelihoods, where there is an overlap between wild animals' habitats and human activities, and where there is competition for the same resources. Bhutan is already experiencing high levels of human-wildlife conflicts, with a report from the Ministry of Agriculture and Forests noting that wildlife's predation of livestock was a contributing factor in rural peoples' migration to urban areas (Siddiqui et al. 2019). In addition to wild carnivores' predation of livestock, other reasons for human-wildlife conflicts include retribution by farmers and the killing of prey animals (wild pigs, sambar deer, barking deer), which are considered pests and are known to damage crops (Nature Conservation Division 2018).

A farmer receives monetary compensation for cattle lost to tigers. Credit: BTC/DoFPS

> *Tigers are increasingly attacking our livestock. I have lost 15 of my livestock in the last five years. I think herding of livestock and monetary compensation would help mitigate our loss.*
>
> – **Karma Jurmey** (local farmer, Village Dangdung, Trongsa District)

> *I feel climate has changed over the years. The temperature has become much warmer compared to the last 10 years. The drinking water source in our locality has almost dried up now.*
>
> – **Sangay Wangmo** (local community member, Village Phoshing, Trashigang District)

It is estimated that levels of conflict between tigers and humans have increased in recent years, with the increase in income and living standards that allow farmers to keep more livestock a contributing factor (Sangay and Vernes 2008).

Poaching

In general, the risk of poaching has not been deemed high in Bhutan due to the Buddhist belief of causing no harm to living creatures and the strict punitive measures for people involved with tiger poaching. However, in the period between 2013 and 2017, 17 cases of illegal trade in or poaching of tigers were recorded and prosecuted, which is almost 20 per cent of the total tiger population in Bhutan (Nature Conservation Division 2018). Poaching is often linked to poverty and can therefore increase if more people are pushed into poverty (Duffy and St. John 2013). The vulnerability of Bhutanese communities to both social and ecological stress is consequently interlinked with the safety of tigers (Nature Conservation Division 2018).

Indirect impacts on the Royal Bengal tiger

Infrastructure development

Habitat fragmentation due to infrastructure development is also a serious threat to tigers, as they require large, connected areas for their survival, with limited movements of individuals potentially causing disruptions to the species' gene flow (Mills 2012). In addition to being an ecosystem barrier, transportation infrastructure that overlaps with tiger habitats could have other impacts, such as an increased accessibility of poachers to tigers and increased road-related casualties (Quintero et al. 2010). Newer available statistics report that Bhutan lost 113,761.5 hectares of State Reserve Forest cover between 2013 and 2017 to infrastructure development, with 83 per cent of this loss occurring in 2017 for roads and power transmission lines (Ministry of Agriculture and Forests 2017). Although individual infrastructure projects might not have severe impacts on tigers, cumulative effects of infrastructure development pose a threat to the country's small tiger population.

Hydropower is an important energy provider and economic sector, with Bhutan earning more than 60 per cent of its national gross domestic product from hydropower sales to India alone (Shah and Giordano 2013). Hydropower also plays an important role in the country's climate adaptation and mitigation strategy, which outlines the country's aim of offsetting up to 2.4 million tons of CO2 equivalent per year by 2025 through exports of clean energy (National Environment Commission 2015). As outlined in the Tiger Action Plan for Bhutan (2018–2023), important tiger habitats currently overlap with water bodies that maintain and regulate flows to hydropower dams (Nature Conservation Division 2018). Future

Cameras can capture night scenes. Credit: BTC/DoFPS

construction of hydropower infrastructure and other forms of infrastructure needs to incorporate concerns regarding tiger habitats in their project plans to ensure that tigers are protected.

Livestock grazing, farming practices and changes in forest composition

Agricultural practices have changed in Bhutan in recent years, moving from subsistence-based practices towards agricultural practices that favour increased mechanization and improved technology, thus allowing for the export of agricultural products (apples, oranges, cardamom, potatoes) to Bangladesh and India (Dorji et al. 2015). Historically, various land-use practices have impacted the composition and structure of flora and fauna throughout the country. For example, particular long-fallow, pastoralist, integral swidden systems based on traditional knowledge were wide-spread in rural Bhutan, as was migratory livestock grazing (Belsky and Siebert 2016), both of which impacted local environments through intermediate disturbances. Since the 1960s, however, policies have restricted various traditional practices, which in some places caused grasslands to become overgrown by trees and shrubs (Siebert and Belsky 2014). This situation has been reported in Nubi Gewog, Trongsa district, which has lost grazing grounds and pasture lands.

The effects of grazing on local biodiversity are site specific. While it has been argued that increased forest cover supports biodiversity, traditional farming practices have also been crucial in maintaining biodiversity in many places as well. Forest grazing does not only influence understory biomass and tree species composition (Darabant et al. 2007; Buffum et al. 2009) but, together with disturbances, also species richness and diversity (Wangchuk et al. 2014). Changes to forest composition and a reduction of grassland can reduce the suitable environments for ungulates such as spotted deer and sambar deer, which are some of tigers' main prey. Although currently not a very high threat, it has been reported that prey availability for tigers is decreasing in Bhutan (Nature Conservation Division 2018).

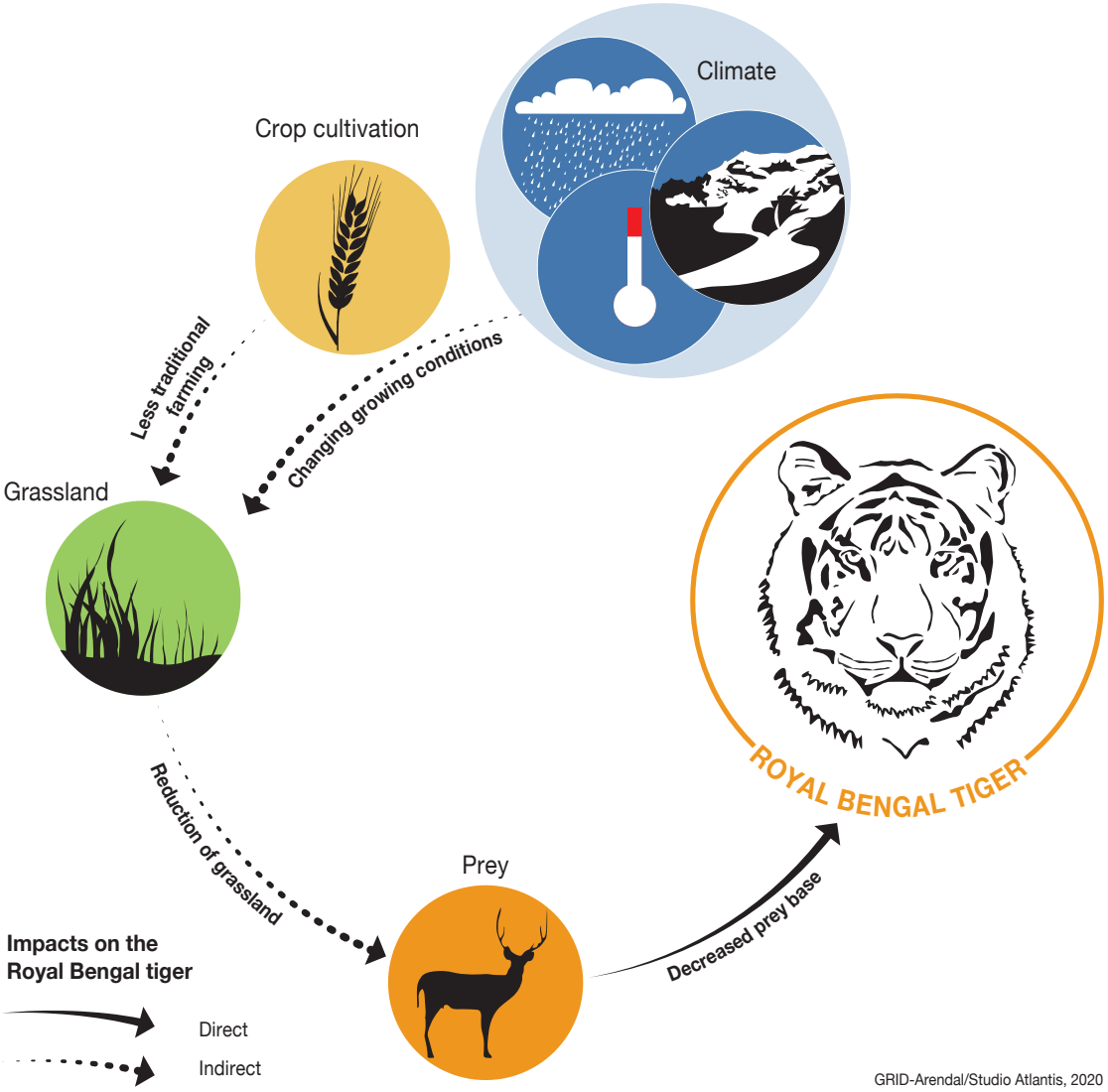
Tourism

Bhutan's economy is becoming increasingly dependent on the tourism sector, which is highly controlled by the government (Mahanta et al. 2018). Tourism was opened up in Bhutan to attain foreign currency, contributing $88.6 million in foreign exchange earnings in 2019 (Nepal and Karst 2016; Tourism Council of Bhutan 2019). As a measure to control the COVID-19 outbreak, Bhutan closed its borders to tourists; it is still

Adult tigers are generally solitary animals. Credit: BTC/DoFPS

uncertain when the country will re-open (as per September 2020).

Ecotourism is developing in Bhutan, and the government has recognized community-based ecotourism as a central tool in linking environmental conservation with economic development (Karst and Gyeltshen 2016). This form of ecotourism is set up to finance conservation and create alternative income opportunities for local populations through an economic sharing mechanism (WWF 2012). Although ecotourism projects are often presented as a win-win solution, it is important to ensure that they are economically beneficial to local communities, are in accordance with local social and cultural values, and have positive environmental impacts (Gurung and Scholtz 2010; Karst and Gyeltshen 2016; Montes and Kafley 2019). Research on ecotourism found little to no evidence that it contributes to deforestation or reduces forest loss in Bhutan (Brandt et al. 2019). More knowledge is needed in this area to determine whether the sector will have implications for biodiversity, especially tiger habitats.



GRID-Arendal/Studio Atlantis, 2020

Figure 4: The reduction of grassland and its impact on tigers

The risk of zoonotic diseases to the Royal Bengal tiger

The Tiger Action Plan (2018–2023) listed zoonotic diseases as a new potential threat to the Royal Bengal tiger and called for long-term wildlife monitoring as a response (Nature Conservation Division 2018). Although zoonotic diseases are mostly spread between domestic animals and humans, wild animals can also be at risk of infection through direct or indirect contact with humans and domestic animals.

Research has found that tigers are susceptible to multiple zoonotic pathogens, some of which can also infect humans (Iatta et al. 2020). In the Bronx Zoo in New York, five tigers tested positive for COVID-19. Although the cats recovered, this shows that tigers can be contaminated by this coronavirus (Wildlife Conservation Society 2020). In India and Russia, some tigers have been found to have canine distemper, an infectious virus that is causing death among dogs worldwide (Nature Conservation Division 2018). Although the canine distemper virus has not been found in any tigers in Bhutan, the virus exists among pets and stray dogs in the country, meaning there is a risk of infection (Dorji et al. 2020). In Bhutan, a dead tiger was also found with tapeworm cysts in the brain, with the infection possibly passed from domestic animals (Nature Conservation Division 2018).

Prey infected with zoonotic diseases could also pose direct and indirect threats to tigers, as this comprises their source of food. For example, in Bhutan there are sporadic occurrences of anthrax cases among livestock, with anthrax also found in wild animals of other countries (Thapa et al. 2014).

> *"With COVID-19, nature has sent us a stronger message. To protect ourselves and Earth's precious wildlife for the long term, we must tackle habitat and biodiversity loss. These briefs show the path to the future we all want – one where people's well-being and livelihoods go hand-in-hand with thriving habitats and species.*
>
> – **Bruno Pozzi**, United Nations Environment Programme, Europe Director

Figure 5: Camera traps record and monitor tiger movements within Bhutan. Note: These images were captured in the pilot area of Trongsa. Source: Dorji et al. (2015)

Potential solutions

Support communities' mitigation and adaptation strategies for climate change

To mitigate human-wildlife conflict, it is beneficial to create synergies between an ecosystem-based adaptation approach and a community-based approach. The former focuses on rebuilding and protecting ecosystems to provide essential ecosystem services (Munang et al. 2013), while the latter ensures that the response addresses local vulnerabilities to climate change and builds on local structures.

Both approaches should be gender-sensitive and take into consideration the contributions and participation of women, including in decision-making roles. These interventions would require consultation with local communities through climate risk workshops, for example, to jointly develop key adaptation interventions at the local level. One possible intervention could be the introduction of low-voltage electrical fencing, which would safeguard livestock and thus reduce tension between farmers and tigers. Another community-based intervention could be the setting up of biogas digesters as a new way of creating energy locally, thereby reducing pressure on local resources such as timber.

Target and fund scientific research to better understand the climate change-induced risks for tigers and the ecosystems in Bhutan

Scientific research on the impacts of climate change and their possible consequences should be targeted and tailored to understand and assess the likely impacts on the most important ecosystems in Bhutan for the tiger (including grassland habitats) and its prey species. This requires both baseline data on species distributions, as well as modelling efforts, in order to understand habitat suitability for tigers under various climate scenarios and identify and select possible mitigation and adaptation strategies. In addition, research should identify possible scenarios for human behaviour in response to climate change and how this may impact the habitat of the tiger.

Credit: iStock/abirmallick

Finally, research should be interdisciplinary, involving a diverse and gender-inclusive pool of climate modellers, conservationists, wildlife professionals, social scientists and adaptation practitioners, while also being grounded in local realities, utilizing the best available local- and traditional ecological knowledge to gather a holistic and integrated overview of possible impact chains by climate change risks, including how they will impact human-wildlife conflict.

Support the diversification of livelihoods within sensitive tiger corridors and habitats to reduce human-wildlife conflict

Efforts should be made to diversify livelihoods beyond agriculture and forest use in specific areas where human-wildlife conflict is high, especially within important migratory corridors and outside of protected areas. The creation of alternative livelihood opportunities, with a particular focus on youth, would encourage local development and participation in sustainable ecosystem-based adaptation solutions. For example, nature guide training and the development of eco-nature trails could stimulate the ecotourism sector and ensure local economic benefits for both women and men. The collection of sex-disaggregated data further documents and supports gender mainstreaming efforts in sustainable wildlife management.

In places where human-wildlife conflict is high and few diversification measures away from agriculture are possible, efforts should be made to fund, test and upscale gender-responsive, effective human-wildlife mitigation measures, including compensation schemes, and infrastructure options to protect livestock assets and human safety. Innovative finance schemes which consider the gender-differentiated roles and circumstances that women and men face should also be explored to fund such programmes.

Adapt the policy and legal framework in Bhutan to ensure an even more climate-smart development framework

Future fragmentation of tiger habitats should be prevented, with existing habitats restored and improved both for tigers and their prey upon which they depend. This can be achieved through preventing grassland and forest succession and enhancing landscape connectivity. National and local adaptation measures, such as the further development of hydropower and other infrastructure, should be developed with a thorough and prior understanding of current and potential impacts on the tiger, its habitat and prey species. Comprehensive wildlife or environmental impact assessments should be conducted before any more developments are carried out.

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This brief is one of three in a series that also includes the mountain gorilla and the snow leopard, produced under the Vanishing Treasures programme. Its goal is to highlight how climate change is – and will be – impacting the conservation of the Royal Bengal tiger in Bhutan. The brief examines how climate change has multiple, and often interacting, impacts on the Royal Bengal tiger – be it on its physiology, on the ecosystems and prey species on which it depends, or on the behaviour of humans living in its surroundings – with important feedback loops that directly affect the conservation of this magnificent animal.