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Research Paper

Effect of Extreme Drought on Reticulated Giraffe Population in Northeastern, Kenya

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ABSTRACT

Occurrence of severe drought in northeastern Kenya has emerged as a critical threat to the giraffe population in the region, exacerbating a multitude of pre-existing challenges. The primary concern stems from the drying up of acacia trees, a crucial feed source for giraffes. As these trees wither due to the prolonged drought, the giraffes are confronted with a diminishing feed supply, leading to malnutrition and an alarming decline in their overall population. One immediate consequence of the drought is the migration of giraffes to neighboring countries such as Ethiopia and Somalia in search of sustenance. Unfortunately, the situation in these regions, particularly Somalia, has been aggravated by persistent civil unrest since 1991. The ongoing conflict not only exacerbates the challenges faced by giraffes but also poses additional threats to their survival. The violence and instability in these areas hinder conservation efforts, making it more difficult to implement protective measures and conservation programs. Beyond the drought and migration, giraffes in northeastern Kenya are grappling with a host of other issues. Habitat loss, primarily driven by human activities such as deforestation and land development, further diminishes the available living space for giraffes. The encroachment of agriculture, expanding settlements, and infrastructure development contribute to the shrinking of their natural habitats.

HIGHLIGHTS

- Reticulated giraffes (*Giraffa Camelopardalis*. reticulata) are a subspecies of giraffes found in East Africa, primarily in the arid and semi-arid regions of Kenya, Somalia, and Ethiopia.
- Reticulated giraffes are easily recognized by their distinctive coat pattern, which features a network of sharp-edged, polygonal shapes outlined by a network of thin white lines.
- They inhabit savannas, open woodlands, and grasslands, where they can find an abundance of acacia trees and other vegetation.
- These animals are herbivores and primarily feed on the leaves, flowers, and fruits of acacia trees. Their long necks and prehensile tongues enable them to reach high branches.

Keywords: Reticulated giraffe, land fragmentation, overgrazing, degradation, bush-meat trade, poaching

The Horn of Africa region, characterized by its arid landscapes, harbors a remarkable array of unique wildlife, including the reticulated giraffe (*Giraffa Camelopardalis. reticulata*), hirola antelope (*Beatragus hunteri*), and African elephant (*Loxodonta africana*) (Davies and Asner, 2019). However, this biodiversity hotspot faces a dire threat due to factors such as drought, overgrazing, civil

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unrest, and the effects of climate change. The consequence of this coexistence between humans and wildlife is a growing competition for dwindling resources, leading to the perilous decline of several species primarily due to habitat loss. Research indicates that land degradation, drought, habitat destruction, diseases, illegal hunting, and armed conflicts have all taken a substantial toll on giraffe populations across Africa (Muller, 2018). In Kenya, the native reticulated giraffe, often referred to as the Somali giraffe, has suffered severely due to human population growth and land use changes. These giraffes are easily recognized by their distinctive coat pattern, which features a network of sharp-edged, polygonal shapes outlined by a network of thin white lines (Fig. 1). Unfortunately, conservation efforts for giraffes in Africa have been notably limited, resulting in the extinction of giraffe populations in several countries over recent decades, including Burkina Faso, Guinea, Malawi, Eritrea, Mauritania, Senegal, and Nigeria (Lee *et al*. 2020).

Specifically, in the Horn of Africa, giraffe populations have undergone dramatic declines in northern areas, southwestern Somalia, and parts of southern Ethiopia. Various studies have delved into the biology of giraffes, examining their ecology, genetic structure, reproductive dynamics, and population behavior, all aimed at aiding conservation efforts on the continent (Davies and Asner, 2019; Lee *et al*. 2020). While there have been efforts to restore small herds in Kenyan national parks and conservancies, the overall status of the giraffe population remains uncertain, highlighting gaps in the existing knowledge. Amidst these challenges, success stories are emerging from Africa, such as the remarkable increase in giraffe populations in South Africa by over 50%, thanks to reintroduction and conservation initiatives in their historical range. Additionally, West African giraffes, which is the tiniest subspecies, have rebounded from about 50 individuals in the 1990s to 400 today.

Although the majority of reticulated giraffes inhabit eastern Kenyan counties like Garissa, Lamu, Mandera, and Wajir, current conservation efforts have largely concentrated on populations in northern Kenyan counties, including Laikipia, Samburu, and Marsabit, mainly due to accessibility (Berkes, 2004). However, construction of the Lamu Port-South Sudan-Ethiopia Transport (LAPSSET), Eastern Africa's extensive infrastructure project, through the giraffe's native range in Garissa, Lamu, and Wajir Counties poses a significant threat to their habitat quality and population. Hence, the giraffe's status in such part of Africa remains uncertain, with anecdotal reports of its presence and habitat use in the Juba region. To address the gaps in data and knowledge, organizations like the Northern Rangelands Trust in Kenya and the Hirola Conservation Program have been collecting data on reticulated giraffe numbers, particularly in Laikipia, Isiolo, and Garissa Counties. Still, this data is insufficient for developing a comprehensive conservation plan given the extensive range of the reticulated giraffe. Therefore, a well-coordinated effort involving local communities, scientists, non-profit conservation agencies, and government entities is needed to conduct area-wide research and conservation efforts for the long-term survival of giraffes.

Fig. 1: Reticulated giraffes with a distinctive network of white sharp-edged, polygonal shapes.
Credit: Hirola Conservation Program

Nevertheless, despite the proven success of community-based giraffe conservation, in various regions, it has received limited attention. Investigating the extent of giraffe population decline in areas managed by local communities is a promising avenue. Given the numerous threats these giraffes face, initiating a robust conservation program is essential, focusing on raising awareness, implementing strategies to mitigate human-giraffe conflicts, and building capacity for in-country giraffe conservation actions. Such coordinated efforts can

pave the way for the recognition, protection, and support of all giraffe populations along the Kenya-Somalia border, ensuring their continued existence.

Poaching poses a significant threat to giraffe populations as well. The demand for giraffe parts, including their skin, bones, and tails, fuels illegal hunting activities. Giraffes are also targeted in the bush meat trade, adding another layer of danger to their existence. The combination of these factors puts immense pressure on the giraffe population, hence pushing them closer to the brink of extinction.

HUMAN-WILDLIFE CONFLICT: A GROWING CHALLENGE

The term "human-wildlife conflict" (HWC) refers to the frequently harmful interactions that occur when wild animals come into contact with humans. These interactions have an impact on people's resources, wildlife, and ecosystems (Soulsbury *et al*. 2015). Such conflicts, driven by competition for natural resources, have escalated in many countries due to factors like population growth, infrastructure development, and changes in land use. HWC poses a significant global threat to sustainable development, food security, and wildlife conservation, affecting both urban and rural environments. Its effects encompass crop loss, reduced agricultural productivity, competition for grazing land and water sources, livestock predation, human injuries and fatalities, infrastructure damage, and heightened risks of disease transmission between wildlife and livestock.

The conflict between humans and wildlife has far-reaching implications for human safety, well-being, ecosystem health, and biodiversity. These impacts can be direct or indirect, ranging from animals directly harming humans through attacks to accidents involving animals, zoonotic disease transmission, and economic losses such as damage to crops, livestock, and property. Indirect consequences include opportunity costs for farmers and rangers, mental health impacts, disruptions to livelihoods, and food insecurity (Karanth *et al*. 2017). The severity and frequency of human-wildlife interactions can vary widely, from minor incidents involving common garden pests to severe encounters with apex predators like tigers, lions, and sharks. Conflict frequency also varies within and between regions, with some areas experiencing minimal harm while others face occasional surges in predator attacks or uneven protection measures.

Farmers-Giraffe Conflict

The establishment of farms along the river in Garissa has had detrimental effects on the natural water corridors for wildlife, particularly impacting negatively on giraffes. The farmers in the region have fenced their farms and employed guards, effectively blocking the traditional routes that giraffes used to access water sources. This obstruction has created a conflict between the farmers and giraffes, leading to various consequences for both parties (Stoldt *et al*. 2020). Such fencing of farms and the denial of access to water have forced giraffes to find alternative routes, often traversing through farmlands. In their quest for water, giraffes have resorted to feeding on crops such as mangoes along the way, causing economic losses for the farmers. This has created a cycle of conflict between the two groups.

In response to the intrusion of giraffes and the damage caused to their crops, farmers have retaliated by attacking the giraffes with spears. Such confrontations have resulted in injuries and even death for the giraffes, exacerbating the already strained relationship between humans and wildlife in the region. The conflict, particularly affecting reticulated giraffes, has persisted for many decades with limited attention and resolution. Lack of intervention and sustainable solutions has allowed the situation to escalate, posing a threat not only to the giraffe population but also to the delicate balance of the local ecosystem.

Consequences of human-wildlife conflict

The conflict between farmers and giraffes can have various consequences, affecting both the agricultural communities and the giraffe populations. Some of the consequences of this conflict include the following:

- Feeding on crops by giraffes: This leads to significant economic losses to farmers. Consequently, this can affect the livelihoods of agricultural communities, especially in areas where subsistence farming is prevalent (Gulati *et al.* 2021).
- Retaliatory killing: Farmers may resort to retaliatory killing of giraffes as a response

to crop damage or perceived threats to their livelihoods. This can have severe consequences for giraffe populations, contributing to their decline.

- Habitat fragmentation: As agricultural activities expand, they often lead to habitat fragmentation, isolating giraffe populations and limiting their ability to access essential resources. This can contribute to a decline in genetic diversity and overall population health. Human activities, particularly habitat fragmentation and extensive land use changes, have played a significant role in the dire situation faced by giraffes in northeastern Kenya. One major contributor to the challenges is the fragmentation of giraffe habitats. As human populations expand, settlements, agriculture, and infrastructure projects have increasingly encroached upon the once-vast territories where giraffes roamed freely. Such fragmentation disrupts the natural connectivity of habitats, restricting the movement of giraffe populations and hence limiting their access to essential resources.
- Loss of biodiversity: Giraffes play a role in maintaining ecosystem balance and their exclusion or decline due to conflict can disrupt the natural biodiversity of an area. This can have cascading effects on other species and ecosystem dynamics. The clearance of acacia trees, a vital component of the giraffe's diet, for various purposes has added to the predicament. Acacia trees not only serve as a primary food source for giraffes but also provide shade and act as crucial elements in the ecosystem. Unfortunately, these trees are often cleared to make way for human settlements or to create space for fencing livestock. The depletion of acacia trees deprives giraffes of their nutritional needs, exacerbating the impact of the severe drought already affecting the region.
- Community discontent: Persistent conflicts between farmers and giraffes can create tensions within communities. This may lead to discontent and negatively impact social cohesion as residents grapple with economic losses and safety concerns.
- Impact on tourism: In regions where giraffes are a tourist attraction, conflicts with farmers can affect local tourism. Negative encounters with wildlife may deter visitors, impacting the tourism industry and associated economic benefits for the community.

Competition for resources

In times of drought, scarcity of water and food resources triggers intense competition for the limited available sustenance among various animal species, including giraffes. Such heightened competition can have significant repercussions for giraffes, potentially leading to increased stress levels and conflicts, especially with other herbivores sharing similar dietary preferences (Maja, & Ayano; 2021). One notable source of competition often observed during drought involves the browsing habits of giraffes and camels. Both species are adapted to feed on vegetation at similar heights, particularly the leaves of trees and shrubs. This similarity in browsing preferences can result in direct competition for the same limited food sources. Female giraffes, with their characteristic long necks, and camels, known for their ability to reach high branches, may find themselves vying for access to the remaining greenery.

Livestock grazing, while essential for the livelihoods of local communities, can also intensify the competition for resources between domestic animals and giraffes. Overgrazing by livestock can lead to the degradation of vegetation, making it even more challenging for giraffes to find sufficient food (Teixeira *et al*. 2020). Resource depletion and the shared reliance on specific vegetation by giraffes and camels can lead to the depletion of these resources in the local ecosystem. As both species consume leaves from similar heights, the pressure on acacia trees and other preferred plants intensifies, potentially affecting the regeneration and sustainability of these key plant species.

Aggression and competition for limited resources induce stress among giraffes, as well as between giraffes and other competing species like camels. Elevated stress levels can compromise the overall health and well-being of giraffes, making them more susceptible to diseases and other environmental stressors. Additionally, heightened competition may escalate into aggressive encounters, further threatening the stability of the ecosystem.

Perceptions by pastoralists, in areas where pastoralists coexist with wildlife, there may be a perception that giraffes contribute to the depletion of scarce resources such as water and acacia trees. This can lead to conflicts between local communities and giraffe populations. Pastoralists, dependent on these resources for their livestock, might view giraffes as competitors for essential elements, potentially fueling negative attitudes toward giraffe conservation.

IMPACT OF DROUGHT ON GIRAFFE REPRODUCTION

Drought exerts a profound influence on the reproductive success of giraffes. Shortage of essential resources, namely food and water, can result in diminished fertility and lower survival rates for giraffe calves. Moreover, the heightened stress induced by environmental changes can adversely affect the females' capacity to conceive and rear their offspring successfully. Consequently, the cumulative impact of these factors poses a significant threat to giraffe populations, potentially leading to a decline in their overall numbers. Efforts to mitigate the effects of drought on giraffes are crucial for sustaining their populations and ensuring long-term ecological balance.

Giraffe migration

Giraffes, by nature, are highly mobile creatures, and their survival is intricately tied to their ability to find suitable food and water sources. In times of drought, when these resources become scarce in their usual habitats, giraffes display a remarkable capacity to cover extensive distances in search of more favorable conditions. This behavior often manifests as long migrations, where herds traverse various landscapes to locate areas with better access to essential resources (Ledee *et al.* 2020). Nonetheless, such increased movement during droughts comes with its own set of challenges. The physical toll of covering large distances, often in harsh environmental conditions, can be taxing on giraffes. The extended journeys require significant energy expenditure and can lead to exhaustion, particularly among the young, elderly, or already weakened individuals.

Moreover, the nomadic behavior of giraffes during drought exposes them to heightened risks, particularly from predators. The extended time spent in unfamiliar territories makes them more vulnerable to predation, as they may not be as adept at navigating potential threats in new environments (Altizer *et al.* 2021). In some instances, giraffes may embark on migrations that take them across national borders, for example, from Kenya to Ethiopia and Somalia. While this movement is driven by the imperative to find sustenance, it introduces additional challenges. Unfortunately, civil unrest is a common occurrence in some of these areas, making the situation even more precarious for the giraffes. The presence of human conflict poses threats not only from a direct safety standpoint but also in terms of potential disruptions to their movement patterns and access to essential resources.

While the migratory behavior of giraffes during drought underscores their adaptability, it also underscores the complex challenges they face. Balancing the need for survival with the inherent risks associated with increased mobility, especially in regions prone to conflict, adds a layer of complexity to the conservation efforts aimed at protecting these iconic animals during periods of environmental stress (Brown & Bolger, 2020).

Road Kill

According to Schell *et al*. 2020, the phenomenon of urbanization and the implementation of the Lamu Port-South Sudan-Ethiopia Transport (LAPSSET) corridor have led to a substantial expansion of road networks in the northeastern region. While this development has undoubtedly enhanced connectivity and facilitated transportation, it has also introduced significant challenges for the local giraffe population.

Rangelands in the northeastern region serve as crucial territories for giraffes, offering diverse nutrients and serving as migration routes for various purposes, including mating and foraging. However, the increased road network has resulted in a rise in accidents involving giraffes (Fig. 2). The primary cause of these incidents is the collision between over-speeding vehicles and migrating giraffes. Such escalating issues further exacerbate the existing challenges faced by giraffes, particularly in terms of nutritional stress. Giraffes, which already contend with the complexities of finding adequate nutrients in their natural habitat, now

(a) **(b)**

Fig. 2: Giraffe waiting for traffic to clear before crossing **(a)**, on the other hand, black-backed jackal knocked down by over-speeding vehicle **(b)**

face the additional threat of navigating through an expanded and potentially hazardous road network.

The multifaceted impact of these collisions extends beyond the immediate physical harm to individual giraffes. It disrupts their natural migration patterns, hindering their ability to access essential nutrients and complicating their already challenging quest for suitable mating grounds. In essence, the burgeoning road network not only poses a direct threat to the physical well-being of giraffes but also disrupts their ecological behaviors and contributes to the broader challenge of nutritional stress.

Habitat loss and degradation

In northeastern Kenya, giraffes are facing a significant threat to their habitat due to extensive land encroachment by farmers. Expansion of agricultural activities has led to the clearance of once-thriving bushy woodlands, which served as vital ecosystems for giraffes and other wildlife. Such habitat loss not only diminishes the available space for giraffes but also disrupts the intricate balance of the ecosystem they inhabit (Tang *et al.* 2020; Nungula *et al.* 2023)

Encroachment of farmlands is an ongoing issue, with farmers continuing to expand their cultivation areas (Maitra *et al.* 2023; Sahoo *et al.* 2023). As agricultural activities intensify, the pressure on the remaining natural habitats increases, exacerbating the challenges faced by giraffe populations. Conversion of these woodlands into farmlands not only affects the giraffes directly but also contributes to the fragmentation of their habitats, making it more difficult for them to find suitable feeding grounds, water sources, and safe areas for reproduction.

Another contributing factor to the diminishing giraffe habitat in northeastern Kenya is the rise in human population and settlements. The towns in the region are experiencing overpopulation, leading to increased demand for resources and land. As a result, people are migrating to rural areas, including those that were once inhabited by giraffes. The expansion of human settlements further intensifies the competition for space between giraffes and humans, often resulting in the displacement of these majestic creatures (Gonçalves-Souza *et al.* 2020). Settlement expansion contributes to habitat loss, reducing the available space for giraffes to roam and find food. Additionally, the fencing of land for livestock further fragments the landscape, creating barriers that impede the natural movement patterns of giraffes. This habitat disruption upsets the delicate balance of the ecosystem and increases the vulnerability of giraffes to external threats.

Impact of Land Fragmentation on Wildlife and Livestock

Mounting evidence underscores a pressing concern, the global decline of wildlife populations and their

habitats, with Africa bearing a significant brunt of this crisis. These losses manifest in various forms, spanning scale, geography, and root causes. Recent years have witnessed sharp reductions in wildlife numbers across African regions such as South, West, Central, and East Africa (Sutton *et al*. 2016). The drivers behind these declines are multifaceted and complex, encompassing rapid human population growth, alterations in land use, habitat fragmentation, infrastructure expansion, trophy hunting, bushmeat trade, climate change, disease outbreaks, the proliferation of firearms, lax law enforcement, governance challenges, resource competition with livestock, and glaring socioeconomic disparities.

Notably, rapid human population growth stands out as a prominent catalyst for the dwindling wildlife populations in Africa. This surge contributes to the expansion of agriculture, human settlements, and the development of infrastructure. Climate change further compounds the degradation of wildlife and livestock habitats due to the unpredictable alterations in these environments stemming from extensive land use changes. This places substantial pressure on pastoralism, ranching, and wildlife conservation in African rangelands and protected areas (Allan *et al*. 2017). These rangelands are essential for livestock, primarily raised for meat and milk production, and the preservation of wildlife. Surprisingly, over 70% of protected wildlife reserves and parks are situated within these rangelands.

Furthermore, a considerable portion, approximately 65-70%, of national terrestrial animal populations inhabit human-modified rangelands outside of protected areas. For instance, in Kenya, only 10-12% of land is officially allocated for biodiversity protection, and wildlife areas constitute a mere 8% of this land. The rest is divided into forests, water catchment areas, and private sanctuaries. Kenya's tourism sector, with its focus on wildlife observation and photography, plays a pivotal role in the country's economy, contributing approximately 14% to its GDP and employing more than 10% of the workforce.

CLIMATE CHANGE AND INVASIVE SPECIES

Climate change has become synonymous with environmental destabilization, which in turn amplifies the proliferation of invasive species. These invasive species, often foreign to a particular ecosystem, wreak havoc on native flora and fauna (Chepkoech *et al*. 2018). This destructive relationship between climate change and invasive species has been noted as a significant driver of ecological shifts (Makokha, 2018).

The repercussions of this association are substantial. As climate conditions become more volatile, invasive species find it easier to extend their reach beyond their native habitats (Fagundes *et al*. 2019). Notably, the United States Department of Agriculture (USDA) has identified climate change and invasive species as two of the primary culprits behind global biodiversity loss. Fortunately, communities can employ various strategies like prevention, early detection, climate forecasting, and genetic control to mitigate their impact.

The domino effect of climate change is keenly felt by the plants and animals in affected areas. Increased CO_2 levels, altered water pH, and species extinctions are just a few of the consequences (Şen *et al*. 2011). These changes lead to physiological stress for native species. Moreover, temperature variations, either warmer or colder than usual, open pathways for non-native organisms to enter new territories and compete with native species. Non-native plants, in particular, demonstrate remarkable adaptability, often displacing native flora within introduced ecosystems.

The International Union for Conservation of Nature (IUCN) defines invasive species as organisms introduced outside their natural range, negatively affecting biodiversity, ecosystems, and human well-being (Demertzis and Iliadis, 2017). Climate change, interestingly, can redefine the concept of invasiveness. Species once considered invasive may become less influential in evolving ecosystems, while previously non-invasive species may acquire invasive traits. Native species may also undergo range shifts and relocation to new areas (Pyke *et al*. 2008).

For centuries, alien species invasion has been a leading driver of biodiversity loss and species extinctions (Demertzis and Iliadis, 2017). Invasive alien species further erode the resilience of natural ecosystems, agricultural regions, and urban areas to climate change. Conversely, climate change weakens

habitat resistance to invasive species. Both biological invasions and climatic changes profoundly impact global diversity, but their complex interactions are often examined in isolation.

Importance of water in ASAL areas of Kenya

In Kenya's arid and semi-arid lands (ASALs), scarcity of water is a critical issue that perpetuates a persistent crisis (Alhammad *et al*. 2022; Otieno *et al*. 2023). This scarcity is exacerbated by inadequate government support and fierce competition among water users, which can escalate into armed conflicts. The ASAL regions are predominantly inhabited by nomadic pastoralist communities who rely on seasonal migrations in search of grazing pastures for their livestock. Unfortunately, this nomadic lifestyle often leads to clashes within these communities as they compete for limited grazing and water resources. Regrettably, these conflicts frequently escalate into violence, posing a serious threat to Kenya's peace and security (Muratoglu *et al*. 2022).

The significance of water in the region cannot be overstated, especially considering that most of the livestock kept by these communities, except for camels, rely heavily on water. Moreover, water is crucial for their daily subsistence needs, including cooking, drinking, and the construction of their temporary and semi-permanent dwellings. Despite the evident and urgent need for water among these communities, efforts to address the water shortage have been insufficient over the years. Many interventions have been short-term in nature, narrowly focused on individual issues rather than the broader, interconnected challenges faced by these communities (Williams, 1999). Consequently, the benefits of these interventions tend to be short-lived and overshadowed by the persisting problems.

Interestingly, Kenya receives an annual rainfall that, in theory, should be sufficient to support the livelihoods of its inhabitants (Ochieng *et al*. 2023). However, the discrepancy arises because a significant portion of this water goes unused where it gets lost through surface runoff, flooding, and evaporation (Şen *et al*. 2011; Nyawade *et al*. 2021). To address this complex challenge, a fresh approach is urgently needed to unlock the untapped potential of water sources and to manage them strategically and sustainably. This approach should aim to maximize the utilization of available water resources, ensuring they benefit the communities over the long term.

Encroachment of water corridors

Ecosystem loss and destruction, a process by which a natural ecosystem can no longer support its native species, results in the displacement or demise of the organisms residing in a habitat (Kavwele, 2017). This process is a primary driver of biodiversity decline, making it a critical focal point in ecological research, especially concerning the preservation of endangered species.

Human activities significantly contribute to habitat degradation, including deforestation, urbanization, and industrial expansion (Alkharabsheh *et al*. 2021). Agriculture, the cornerstone of many developing economies, often expands near water sources, severely impacting wildlife corridors and causing widespread habitat loss. Such actions are currently recognized as the leading global cause of species extinction (Bulte and Horan, 2003). Moreover, indirect environmental factors, like the introduction of invasive species, ecosystem nutrient depletion due to overgrazing, climate change, and noise pollution, also play a detrimental role.

Habitat loss frequently begins with habitat fragmentation, which diminishes the carrying capacity (CC) of native flora and fauna. Among the numerous threats to biodiversity and species survival, habitat loss stands out as the most severe. Critically endangered species are especially vulnerable to habitat loss, given their unique existence in specific regions, making their chances of survival precarious. Many endemic species possess highly specialized habitat requirements, which, when unmet, restrict their population range and heighten the risk of extinction. Consequently, habitat destruction not only jeopardizes specific organisms but also contracts the geographic range of numerous populations.

Mitigation measures of human-wildlife conflict

Human-wildlife conflict emerges when the needs and activities of humans intersect with those of wildlife, frequently resulting in adverse outcomes for both parties. Mitigating such conflicts is imperative for the conservation of biodiversity and

the well-being of communities. The following are common measures employed to address human-wildlife conflicts. Implementing proper land-use planning to minimize overlap between human activities and wildlife habitats. Some of the actions recommended include the following:

- Restoring degraded habitats to provide ample resources for wildlife, thereby reducing their necessity to venture into human-occupied areas.
- Erecting physical barriers, such as fences or walls, to deter wildlife from human settlements and agricultural areas. Implementing wildlife-friendly fencing designs that minimize the risk of injury to animals.
- Creating corridors that connect fragmented habitats, allowing wildlife to move freely without encroaching on human settlements (Branco *et al*. 2019).
- Developing and implementing systems that offer early warnings to communities regarding the presence of wildlife, to enable them to take preventive measures.
- Encouraging proper livestock management practices to minimize conflicts between predators and domestic animals.
- Providing secure enclosures or nighttime housing for livestock to protect them from wildlife predation.
- Introducing deterrents such as scarecrows, noise devices, or lights to discourage wildlife from agricultural fields.
- Promoting the use of crop protection measures like fencing or netting to safeguard crops from wildlife damage.
- Involving local communities in conservation efforts and providing incentives for wildlife protection.
- Educating communities about the importance of coexisting with wildlife and the ecological benefits they provide.
- Implementing compensation programs to reimburse communities for losses incurred due to wildlife damage.
- Introducing wildlife insurance schemes to alleviate economic burdens on individuals affected by wildlife conflicts.
- Researching to understand the behavior and movement patterns of wildlife, informing more effective mitigation strategies.
- Implementing monitoring programs to track wildlife populations and assess the impact of mitigation measures.
- Establishing and enforcing laws and regulations that safeguard both wildlife and human interests.
- Implementing penalties for illegal activities contributing to human-wildlife conflicts, such as poaching or habitat destruction.

A combination of these measures, adapted to the specific context of each situation, is often necessary for successful human-wildlife conflict mitigation. Collaborative efforts involving local communities, conservation organizations, and government authorities are essential for long-term success.

CONCLUSION

Giraffes, the world's tallest land animals, are facing numerous challenges that threaten their survival. One significant threat is habitat loss, driven by human activities such as agriculture, logging, and infrastructure development. As their natural habitats shrink, giraffes face increased competition for resources and fragmentation of their populations. Drought also poses a serious threat to giraffes, especially in regions where climate change is leading to more frequent and intense droughts. This results in a scarcity of water and food, impacting the health and reproductive success of giraffe populations.

Poaching is another critical issue, driven by the demand for giraffe body parts, including their skin, bones, and tails. Giraffe populations are also affected by the bush meat trade, where they are hunted for their meat. Land degradation further compounds these challenges, as overgrazing and soil erosion reduce the availability of nutritious vegetation. Human-wildlife conflict is on the rise as giraffes encroach on agricultural lands, leading to retaliatory killings and further habitat loss. Given their economic importance, the study fully recommends that it is imperative to focus protection of these key animals.

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