

Human-Wildlife Interactions as a Result of Human Expansion, Tourism, and Climate Change

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## Abstract

With the increasing human expansion, the effects are being seen with changes in wildlife behaviors. With wildlife having such an important role in the world, by maintain healthy ecosystems, protecting them is very important. Behavior changes such as increased nocturnality and unsuccessful reproductive success have been seen as a result of human presence. Human expansion, tourism, and climate change all contribute to these effects, all of which are derived from human-caused circumstances. This review aims in determining the main effects of human impacts on wildlife.

## Introduction

Humans have impacted the world throughout their time on earth, however, as a result, everything around them is facing the consequences of their actions. Aspects such as human expansion, tourism, and climate change have significant impacts on wildlife specifically. With wildlife not being in the daily lives of many individuals in the world, it is hard for them to see the results of what is happening to wildlife daily. Major changes such as behavior and spatial-temporal scales are altered affecting their overall endangerment.

Wildlife is essential for healthy ecosystems to survive to then provide healthy lifestyles for humans. The importance of wildlife is often overlooked; however, wildlife provides economic, nutritional, and ecological roles in the world. Economically, wildlife conservation adds to the country's growth national product through non-consumptive and consumptive use of wildlife. Non-consumptive use of wildlife involves wildlife tourism industries and wildlife viewing while consumptive use of wildlife involves hunting or poaching. The nutritional value of wildlife is a source of food for humans in the meat industry. However, the most important role of

wildlife is its ecological role. Each wildlife species has a role within the ecosystem for all other species to survive. A simple change in one's behavior could change the whole dynamic of the ecosystem (Chardonnet, 2002).

This review intends to focus on the overall effects that humans have on wildlife around the world. Threats to wildlife as a result of human actions have detrimental effects on wildlife and without appropriate action and change, more animals will go extinct. Over 680 million vertebrate species have gone extinct as a result of humans and the number will continue to rise without intervention. In this review human expansion, tourism, and climate change are analyzed to determine the effects human disturbance has on wildlife species.

#### Human-Wildlife Interactions: Human Expansion

As the human population grows, so does the amount of land occupied by humans. The more people inhabiting the earth causes less habitat for wildlife to occupy. Humans have been modifying the landscape since the discovery of agriculture, however, during the industrial revolution, extensive modification began occurring around the world. As of 1995, approximately forty-three percent of the land on earth has been altered by humans (Hooke, 2012). Not only does the expansion of humans cause a decrease in available land for wildlife to thrive in, but the need for excess resources as a result also causes a threat to wildlife. Clearing of forested land for agriculture, lumber, and fuel has caused a clearing of over 100,000 square kilometers of forests. As a result of habitat loss, over 2,000 wildlife mammals have been affected (WWF, 2017).

Human expansion directly relates to increased human interactions with wildlife. With increasing land use, there is less area for the wildlife to inhabit, causing the wildlife to be closer to humans daily and interacting with them more. This can trigger wildlife's natural instinct of

fight or flight. The fight or flight response mechanism is a physiological reaction when there is a threat to survival. Wild animals do not see humans as more advanced, however, they do see humans as a threat, ultimately causing stress to increase as a result of their fight or flight being triggered (Wilson, 2020 and Bateman, 2017). Stress hormones such as glucocorticoid and cortisol were measured in vertebrates to determine if there was a change when humans were present. In the study, it was examined that the stress hormone levels are higher in the presence of humans. When stress levels are increased, natural behaviors such as feeding are altered in wildlife. A recent study in Beijing, China investigated the spatial stress as a result of human expansion onto wetlands. Wetlands provide an extensive amount of habitat for wildlife that is often protected under the government and removing the availability of wetlands for urban developments cause stress on both the wetland, which will eventually lead to stress and decrease in wildlife (He, 2011).

The COVID-19 pandemic around the globe opened the eyes of investigating the effects of human activity on wildlife. With countries imposing lockdown restrictions there were fewer people outside to interact with wildlife. The lockdowns across the globe allowed researchers to see how a sudden decrease in human activity can cause a resulting change in animal behavior. In the decrease in humans, sightings of unexpected wildlife in urban areas, aquatic animals swimming in uncommon water, or commonly nocturnal animals coming out in broad daylight. While wildlife that has had no common interactions with humans saw changes in behavior, so did animals that have adapted to human presence such as rats or gulls. They have become reliant on food scraps from humans. After lockdowns became lifted slightly, humans began to venture out into local parks in which the wildlife had accustomed to less human presence that more

wildlife was seen by humans (Rutz, 2020). By using citizen scientists, researchers were able to determine the new and evolving sightings of wildlife in urban developments.

A probable cause of wildlife venturing out into urban settings is noise pollution. Urban noise such as traffic and human noise. Noise as a result of human activities has grown with the growth of human populations. While sensitivity to noise varies among different species, the overall effects show similarities. Noise can either be perceived as a threat or alter their ability to comprehend natural sounds in the wild (Shannon, 2016). On the individual level of effects of noise on wildlife, it has been studied that as a result of excess noise, bird songs are unable to be interpreted by other birds causing a lack of communication which can ultimately result in reduced reproduction in the bird species as songs are mainly used for mate recognition. Wildlife also avoids noisy areas which can result in endangerment or possible extinction of species from having no available optimal habitat. This can also be applied to other species that communicate through sounds such as frogs, monkeys, and marine animals such as dolphins. In one study it was examined with increased noise levels, there was a reduction in reproductive and pairing success which poses a threat to the overall population level (Blickley, 2010).

General human presence, as a result of human expansion, also impacts the spatial-temporal scales of wildlife. The spatial-temporal scales involve the movement and physical changes as a result of changing climatic conditions. Through recent studies, it has become known that in response to human disturbances, wildlife becomes more nocturnal. In Gaynor's research, mammal nocturnality increased by 83% to avoid human interaction. Seeing humans as a threat, becoming more nocturnal while humans are diurnal, prevents potential threats such as hunting, hiking, or transportation roads. As seen in Figure 1, as a direct result of human presence, whether that be hiking, daily actions, or hunting, various species of animals

have increased their nocturnality and other behaviors (Gaynor, 2018). In urban areas around the

world, artificial light is highly used. As a result, migration is disrupted in birds. Annual migration occurs every year as a result of seasonal variation and changes in resources. However, the natural and instinctive action to move south is disrupted by artificial light. Birds are attracted to bright lights and as a result, birds collide with infrastructure causing injuries or possible death of the bird. Urban areas also have high populations of humans feeding birds throughout the year, however, without adequate education, humans continue feeding birds during their migration times. This can cause the birds to never leave the location or migrate too late in the year that it is too late which also results in possible death

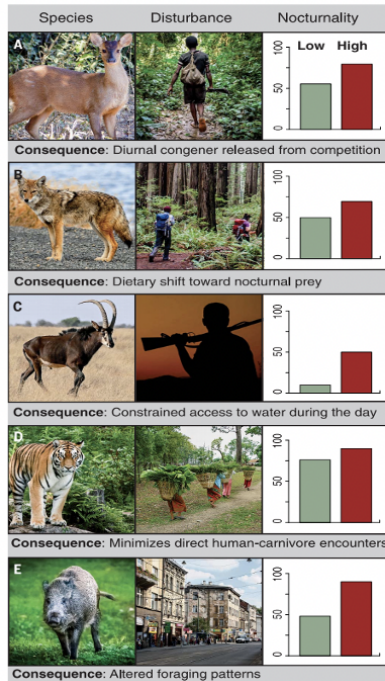


Figure 1. Case studies demonstrate the diverse consequences of human-induced increases in nocturnality. (A) Red brocket deer (*Mazama americana*) and subsistence hunting, Atlantic Forest, Argentina (50). (B) Coyote (*Canis latrans*) and hiking, Santa Cruz Mountains, CA (51, 52). (C) Sable antelope (*Hippotragus niger*) and sport hunting, Hwange National Park, Zimbabwe (53). (D) Tiger (*Panthera tigris*) and forest product collection and farming, Chitwan National Park, Nepal (26). (E) Wild boar (*Sus scrofa*) and urban development, Cracow and Bialowieza Forest, Poland (54). Green bars represent nocturnality (the percentage of total activity that occurs in the night) in areas of low human disturbance (Xl), and red bars represent nocturnality in areas of high human disturbance (Xh). (Gaynor, 2018)

(McLaren, 2018). Artificial light also alters the behavior of sea turtle hatchlings. Sea turtles lay their eggs in the sand on beaches, when time for hatching, the hatchlings are directed to the ocean by the moonlight. However, when artificial light is exposed nearby, the sea turtles are no longer directed by the moon, they move toward the artificial light source ultimately causing a greater risk for predation (Thums, 2016).

Wildlife is exposed to pesticides by directly ingesting pesticide-treated crops or consuming another animal in which they have been exposed to pesticides. While pesticides are successful in controlling unwanted pests, they also have detrimental effects on nontargeted

species. In one study, the effects of insecticides were shown when chicks fed on exposed insects. This resulted in a decrease in chick survival (Berny, 2007). This showed parallels in other recent studies in aquatic animals as well. Pesticides are applied by spraying the targeted area, however, when precipitation occurs it gets run-off into streams, lakes, and oceans causing the same or similar effects on aquatic species. While the initial exposure of pesticides on the animals does not cause immediate death, they do have sublethal effects such as changes in behavior or impaired reproductive success over time (Helfrich, 2009).

The development of agriculture has affected more wildlife species both directly and indirectly. To ensure a greater outcome of the crop, farmers use pesticides to ward off or kill potential predators. Pesticides have been shown to affect wildlife from mammals to plants and fungi, however, each is affected differently. Pesticide is a general term used to describe many substances used to control pests such as insecticides, herbicides, rodenticides, or repellants of any kind. Mammals have been shown to have altered behavior, reproductive failure, and increased mortality. Bird species have been researched to find that they have altered feeding behaviors and eggshell thinning, which ultimately result in reproductive failure. Reptiles and amphibians were shown to have reproductive failure and higher parasite loads. Insects show altered behavior which results in altered pollination. Plants and fungi show impaired metabolism and photosynthesis as a result of pesticide use. The effects on the wildlife at the population level also affect communities and therefore affecting the overall ecosystem. When insects are unable to pollinate, plant species diversity declines, which results in the overall ecosystem functioning inefficiently because the nutrient cycles are altered. When there are mass deaths in mammals, birds, and reptiles results in nutrient and energy cycles to be affected. Species depend on one another and when there are mass deaths in one species, other species are guaranteed to be

affected as well. As shown in the figure below, the exposure of pesticides to various species of wildlife can affect the overall dynamic of the ecosystem (Kohler, 2013).

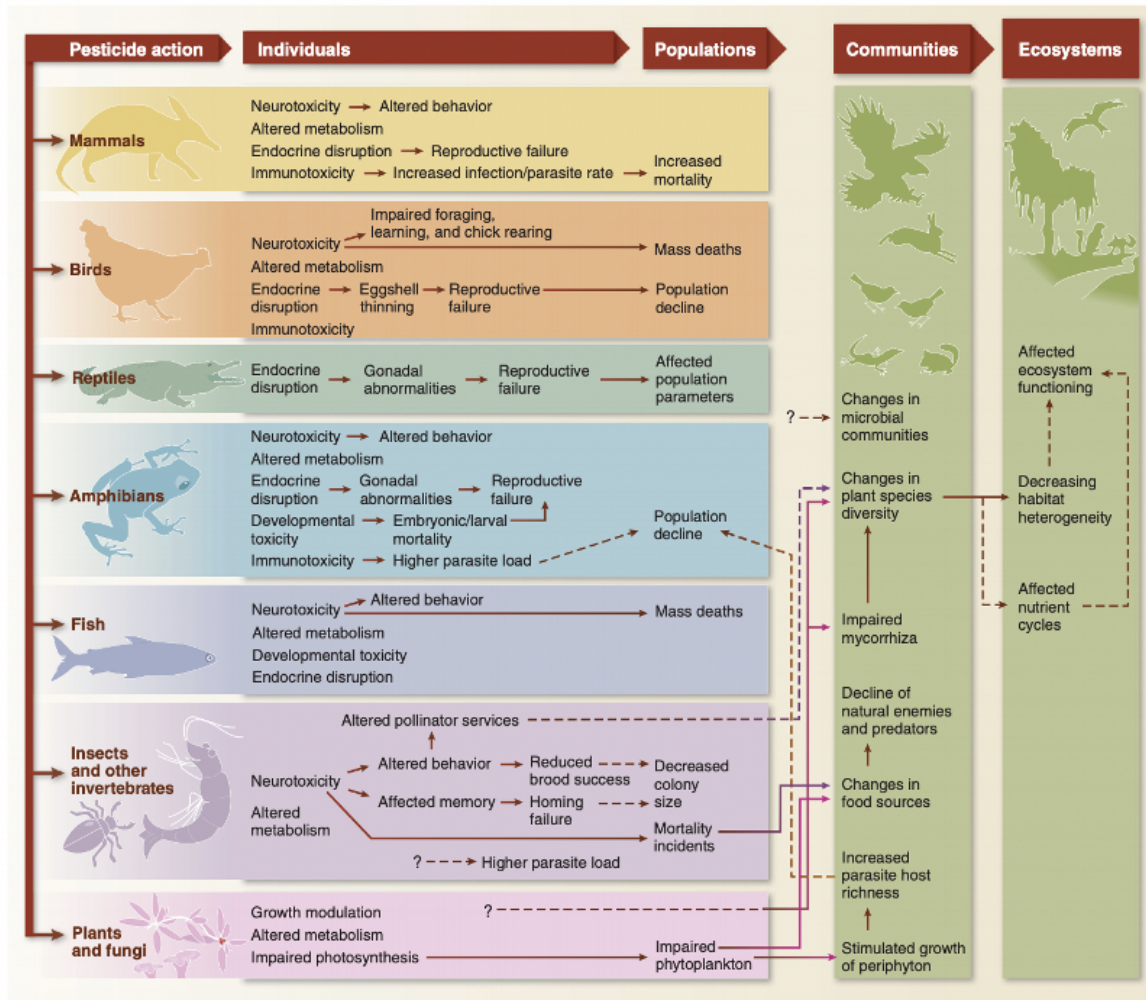


Fig. 2. Documented pesticide effects on wildlife at different levels of biological organization and known (solid arrows) or evidence-supported, anticipated (dashed arrows) interrelations among them. (Kohler, 2013)

### Human-Wildlife Interactions: Tourism

Wildlife tourism is a growing industry around the world involving encounters with non-human animals either in their natural habitats or in captivity such as taking photographs, viewing the animals, or feeding them. Over the past 25 years, tourism has increased by 400



million, in which 40% involve wildlife. While the tourism industry is important for the economy, employment, and cultural expansion, the negative effects it has on the wildlife contradict the benefits. Wildlife in high tourist locations shows more stress, less diversity, and increased mortality.

While wildlife tourism is important for the economy, there is growing evidence that suggests there are more negative effects regarding wildlife wellbeing causing a need for action. Providing towards conservation efforts of wildlife when participating in wildlife tourism activities seems beneficial because it is going towards the protection of wildlife, however, throughout the time the more human interaction the wildlife encounter can be detrimental to their overall health. Wildlife tourism has been shown in multiple studies to show an increase in stress in multiple species. An increase in stress can cause a decreased ability of survival, reproduction, and welfare. In a study performed by Szott, elephants ranging in age presented with high human tourist presence showed glucocorticoid concentrations were higher than under low human tourist presence. Fecal glucocorticoid levels increased by 112% during peak tourism times of the year. Increased stress hormone concentrations over time cause a decrease of reproductive hormones as well as a decreased immune system. It has also been seen that stress causes muscle loss and reduction of growth. All of these factors cause the species to become more susceptible to disease, predation, and starvation (Szott, 2020).

A common tourist activity when involving wildlife is feeding wild animals to become closer to them and have a more intimate encounter with the species. This causes multiple problems involving the overall behavior of the wildlife. Animal species will become dependent on the food resources being supplied by humans. Also, aggression between species in

competition for food poses a threat to the safety of both humans and surrounding wildlife (Orams, 2002).

Wildlife tourism also disturbs animals in their natural habitats and also can disrupt the life cycle of the animals. Tourism is a year-round industry and without the intervention of destinations or specific activities, humans will continue to visit during all times of the year. During reproductive cycles of wildlife, disruptions will cause the inability to reproduce and ultimately cause a decline in the population of the species as it is one of the most vulnerable times for the species. Also, intended human disturbance when wildlife has young offspring is fight or flight. The animal can be separated from the mother or community and be at risk for predation. Habitats of the wildlife are also disturbed as a result of tourism. Even if the animal is in their natural habitat, daily wear and tear of the ecosystem by humans walking or driving causes degradation of essential aspects of their habitat including food source. The creation of additional roads to access the habitats of wildlife for tourism activities causes a traffic threat to the animals as road killings to kill millions of animals per year (Oviir, 2012).

### Human-Wildlife Interactions: Climate Change and Pollution

While climate change has not been proven to be caused by humans, the actions performed by them have shown to increase the rate of climate change on earth. Climate change occurs when the planet warms as a result of greenhouse gases trapped in the atmosphere preventing heat from being radiated back into space. Gases such as carbon dioxide, methane, nitrous oxide, and water vapor are common greenhouse gasses that prevent heat from escaping the atmosphere. Humans contribute to increased greenhouse gases by burning fossil fuels which include oil and coal. As a result of climate change, sudden droughts, temperatures, and flooding

occur in which threatens the surrounding communities as well as wildlife around the world (NASA, 2021). While the aspect of climate change is not a direct human-wildlife interaction, the significance of the effects on wildlife is notable to mention because humans have contributed to climate change.

The behavior of animals can be represented by the climatic changes within their environment. How well they can maintain homeostasis determines their ability to survive in a rapid change in the environment. Environments are constantly changing, and wildlife has been able to adapt to the slow, gradual changes throughout time, however, with accelerated rates of climate change as a result of increase human productions, animals are having to adapt more quickly and efficiently to favor the accurate traits to withstand the new conditions. In a study performed in 2019, they measured how well animals can adapt to sudden climatic changes and natural disasters. It has been shown in various studies of how different species have adapted to additional heat forces. For example, kangaroos pant and lick to expel heat while bird species soak themselves in water to survive extreme temperatures. Some species of wildlife move locations concerning the temperatures. In times of drought, animals will move to areas of greener vegetation or marine species change their movement within the body of water to avoid water level decreases. Another example is tortoises. They will change their metabolic rate in response to the lack of certain resources and move shorter distances. While behavioral actions such as the ones described previously are beneficial to the species currently, they will not be able to last long term and the species will risk extinction (Bucholz, 2019). Geographic ranges have been studied as temperatures increase throughout the world. For example, butterflies' geographic range has shifted north as temperatures in the south increase and their thermal maximum is reached. Wildlife is continuing to be born earlier as a result of warm temperatures being earlier in the year

which can cause additional competition with other wildlife that are active at the same time. Bird migration arrivals are earlier and depart later because spring and summer temperatures come earlier and leave later (Root, 2002).

Pollution also contributes to the threat to wildlife species. Physical debris and chemical pollutants impact all wildlife in which interacts with it, directly and indirectly. A chemical pollutant such as lead poses a severe threat to wildlife. Lead gets into ecosystems as a result of the bringing of oil and coal into factories. It has been estimated that approximately 15 million animals die annually as a result of lead exposure. Wildlife can be exposed to lead through ingesting it directly or consuming another animal that has been exposed by lead (Sabate, 2019). Plastics in the ocean are a major contributor to marine animal deaths or injuries. Specifically, sea turtles ingesting plastic particles that have been thrown away and have ended up in the ocean. Sea turtles mistake plastic for jellyfish, which they consume daily, however, ingest plastic instead. The growing amount of plastic pollution, as well as fishery pollution, poses a tremendous threat to marine species and their populations (Wilcox, 2017).

Overall, when one species is affected, the entire ecosystem is also affected. Modifications of the natural energy flow of an ecosystem of the food web can alter the wellbeing of each species. Threats to already endangered or threatened species face even more threats to their future existence on earth as a result of human actions resulting in climate change.

## Conclusion

Human expansion has more impact and causes a bigger threat than the other two aspects of tourism and climate change, however, human expansion can be attributed to tourism and

climate change. Overall, humans have caused behavioral effects on daily wildlife actions which results in changes in the overall dynamic of the ecosystems.

This information can be used in future applications and studies to expand the knowledge of humans to change their actions to better improve the well-being of wildlife populations. The prevention of behavioral and spatial-temporal changes will reduce the number of wildlife extinctions by allowing the animals to thrive without human disturbances or environmental changes. Not only will these changes in human behavior benefit the behavior of wildlife, but the environment will improve as a result and a more considerate human population.

### Literature Cited

- Blickley 1, J.L. and Patricelli 2, G.L., 2010. Impacts of anthropogenic noise on wildlife: research priorities for the development of standards and mitigation. *Journal of International Wildlife Law & Policy*, 13(4), pp.274-292.
- Buchholz, R., Banusiewicz, J.D., Burgess, S., Crocker-Buta, S., Eveland, L. and Fuller, L., 2019. Behavioural research priorities for the study of animal response to climate change. *Animal behaviour*, 150, pp.127-137.
- Chardonnet, P., Clers, B.D., Fischer, J., Gerhold, R., Jori, F. and Lamarque, F., 2002. The value of wildlife. *Revue scientifique et technique-Office international des épizooties*, 21(1), pp.15-52.
- Gaynor, K; Hojnowski, C; Carter, N; Brashares, J. 2018. The Influence of Human Disturbance on Wildlife Nocturnality. *Science*. 360. 1232-1235.
- Hooke, R.L., Martín Duque, J.F. and Pedraza Gilsanz, J.D., 2012. Land transformation by humans: a review. *GSA today*, 22(12), pp.4-10.
- Köhler, H.R. and Triebkorn, R., 2013. Wildlife ecotoxicology of pesticides: can we track effects to the population level and beyond?. *Science*, 341(6147), pp.759-765.
- McLaren, J.D., Buler, J.J., Schreckengost, T., Smolinsky, J.A., Boone, M., Emiel van Loon, E., Dawson, D.K. and Walters, E.L., 2018. Artificial light at night confounds broad-scale habitat use by migrating birds. *Ecology Letters*, 21(3), pp.356-364.
- Orams, M.B., 2002. Feeding wildlife as a tourism attraction: a review of issues and impacts. *Tourism management*, 23(3), pp.281-293.
- Oviir, M, Utah, L, Liphafa, L. 2012. Impact of tourism on wildlife conservation.

- Root, T.L. and Schneider, S.H., 2002. Climate change: overview and implications for wildlife. *Wildlife responses to climate change: North American case studies*, 10(2002), pp.765-766.
- Rutz, C., Loretto, M.C., Bates, A.E., Davidson, S.C., Duarte, C.M., Jetz, W., Johnson, M., Kato, A., Kays, R., Mueller, T. and Primack, R.B., 2020. COVID-19 lockdown allows researchers to quantify the effects of human activity on wildlife. *Nature Ecology & Evolution*, 4(9), pp.1156-1159.
- Cartró-Sabaté, M., Mayor, P., Orta-Martínez, M. and Rosell-Melé, A., 2019. Anthropogenic lead in Amazonian wildlife. *Nature Sustainability*, 2(8), pp.702-709.
- Szott, I.D., Pretorius, Y., Ganswindt, A. and Koyama, N.F., 2020. Physiological stress response of African elephants to wildlife tourism in Madikwe Game Reserve, South Africa. *Wildlife Research*, 47(1), pp.34-43.
- Wilson, M; Ridlon, A, Gaynor, K; Gaines, S; et.al. 2020. Ecological Impacts of Human-Induced Animal Behavior Change. *Ecology Letters*. 23(10). 1522-1536.
- WWF. 2017. What impacts do human activities have on habitats and wildlife. *World Wildlife Fund*.