

Threats to the Amazon's Biodiversity: Impacts of Deforestation and Climate Change on Evolution and Behavior of Animals

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ABSTRACT

The Amazon Rainforest is one of the most biodiverse biomes on Earth. Yet, deforestation for agriculture and logging have become increasingly common. Global temperatures have also been registering a rapid increase. Both these factors have influenced the behavior and evolutionary path of the Amazon fauna. Having a high dispersal ability has proven to be crucial if human activity continues to impact the environment. Yet, many species will be unable to disperse at the same rate as climate change. Deforestation has not only influenced dispersal ability rates, but it has also impacted the weather of the region. Precipitation reduction has resulted in the decrease of animal population, and consequently the genetic variety that allows for a more likely evolution success. The general neglect shown by governments responsible for the research and preservation of the Amazon basin has further emphasized the continuous destruction of the environment.

Keywords: deforestation, climate change, evolution.

INTRODUCTION

The Amazon Rainforest in South America is considered one of the most biodiverse biomes in the world, with one in ten known species being found there. The rainforest covers around 6.7 million square kilometers, distributed throughout eight countries: Brazil, Bolivia, Peru, Ecuador, Colombia, Venezuela, Guyana, and Suriname, in addition to French Guiana (WWF, 2022). Its importance to Earth's climate is unquestionable, with 120 to 350 tons of carbon dioxide (CO₂) being stored per hectare in the Amazon basin (Imazon, 2013). Although it is known for its rich biodiversity and benefits to global climate, governments and other institutions from the region do not view the conservation of this biome as a priority. In the past 50 years, 17% of the forest has been destroyed (WWF, 2022). From January to September 2022, 9,000 square kilometers have been deforested. This has been the highest deforestation level registered in the past 15 years (Imazon, 2022). The main causes are logging, and agriculture and its consequences include forest fragmentation (Elias, 2014; Hagen et al., 2012). The rapid increase of the Amazon's deforestation has resulted in it releasing more CO₂ than it is able to absorb in 2021 (de Alencar, 2021). In addition to contributing to climate change, these human activities have been causing irreversible damage to the fauna of Amazonia. Still, little research has been done to understand the impacts that climate change and deforestation have had on the behavior and evolution of Amazon species (Buchholz et al., 2019). This paper focuses on analyzing the consequences of human activity on the biodiversity of the Amazon basin. More specifically, the effects of global warming and deforestation on the fauna of the Brazilian Amazon Rainforest and if the animals will be able to survive anthropogenic climate change.

Climate Change

The consequences of global warming will have lasting effects in the Amazon rainforest, as they set the path for the future of its biodiversity (Siepielski et al., 2017). Climate changes in the biome are likely to cause the extinction of species from the forest, many of which are endemic to the Amazon basin. This "climate-driven selection" (Siepielski et al., 2017) is the result of rising temperatures which have been affecting the vegetation of the area, causing a series of changes in the biome such as decrease of food sources and habitat loss (International Fund for Animal Welfare, 2022). If species do not have a high dispersal ability, nor are they able to acclimate to the environment's new conditions (both of which are highly probable), then their population will decrease (Sales et al., 2020). To keep up with climate changes, the species would have to be able to migrate at a faster pace than these changes, also due to deforestation, which does not allow animals to move through large areas of forest. The land is occupied for agricultural purposes, for instance, thus making climate-driven migration much more challenging and unnatural (Sales et al., 2020). If the species is unable to move to separate locations due to deforestation, they will

have to remain in the same forest space and suffer from habitat loss as well. Species distribution in the rainforest will therefore be reduced (Sales et al., 2020).

A dispersal simulation published in 2020 of primates found in the Amazon basin, shows that the biotic velocity for multiple species used in this simulation is much higher than their maximum dispersal ability, in some cases being almost ten times as fast (Sales et al., 2020). This demonstrates species inability to quickly adapt to the fast-changing environment caused by human activities, a problem that is affecting animals at a global scale and will result in fast decline in populations of the Amazonian fauna (Sales et al., 2020). The simulation also showed that 67 (82%) of the 82 species used in the conducted scenarios are expected to be subjected to temperatures that surpass the maximum temperature of the current ecosystem they live in. The rise in heatwave regularity and extent is predicted to cause the highest effect on animal behavior (Buchholz et al., 2019). With large-scale deforestation and degradation, as well as global warming, the likelihood for recovery of biodiversity will be minimal and the fauna of the Amazon Forest will slowly become extinct.

Effect of Deforestation on Precipitation

The destruction of habitat, water sources, food sources, and several other impacts of forest fragmentation and degradation has increased to the point where the Amazon's biodiversity is at critical risk. Deforestation is the main influencing factor for the reduction of precipitation in the Amazon basin (Feeley et al., 2020). As a result, species from the area will have a reduction in population, as many of them are water demanding (Buchholz et al., 2019). Consequently, the chances for their adaptation to new climates and changing environments may further decrease due to the lower genetic variety (Bemmels & Anderson, 2019). This is also a consequence of poaching and deforestation for agricultural purposes which continue to reduce the population of most Amazonian species directly and indirectly, including the already endangered ones. Although some studies show that characteristics that evolved for different purposes other than climate change survival may prove to be effective to reduce the impact of global warming on species from other biomes, it is unlikely to be enough to save most of the Amazon's fauna (Buchholz et al., 2019). It has been observed in research conducted for different climate conditions that climate oscillation has altered natural selection and globally determined the evolution of species (Siepielski et al., 2017).

CONCLUSION

This research shows how climate change and deforestation of the Amazon Rainforest has affected animal behavior of the basin, and how it will change the evolutionary path of its fauna, consequently its biodiversity. Although some information is available, there has been little behavioral research on the effects of climate change and the consequences to the biodiversity of the Amazon basin. Lack of funding from the governments responsible for the preservation and research of the Amazon Rainforest, especially Brazil, further emphasize the neglect and ignorance shown by these countries in relation to the preservation of our world (Sales et al., 2020). The tipping point of this biome will occur when global temperatures rise 4 degrees Celsius above pre-industrial revolution temperatures or when deforestation of 40% of the Amazon rainforest is reached (Nobre et al., 2016). Yet, humans continue to interfere with nature and cause damage that may determine the future of thousands of species. Drastic measures must be taken by governments to continue to attempt the reduction of greenhouse gas emissions. Amazonian countries must reduce deforestation to preserve the biodiversity found in the Amazon Rainforest.

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