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The Ecology of Forest Fires

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ABSTRACT

Forest fires, while often perceived as destructive forces, play a complex role in the ecology of forest ecosystems. This paper explores the dual nature of wildfires, emphasising their capacity to disrupt biodiversity and impact the environment while also facilitating ecological succession and promoting biological diversity. It examines the effects of forest fires on carbon dioxide emissions and air quality, particularly in regions like California, where human activities have intensified fire occurrences. Additionally, the paper highlights the adaptive responses of flora and fauna to fire, showcasing examples such as the serotiny of Monterey pines and the dependency of wild lupine for the endangered Karner blue butterfly. A case study on forest fires in Latin America underscores the implications of agricultural practices and deforestation on wildfire frequency and intensity. This literature review emphasises the necessity of understanding the ecological benefits of fires while addressing the challenges posed by climate change and deforestation, advocating for a balanced approach to forest management that preserves the integrity of forest ecosystems.

Keywords: Forest Fires, Biodiversity, Latin America, Wildlife, Deforestation

WHAT ARE FOREST FIRES? AN INTRODUCTION

Forest fires or wildfires are large, destructive fires that spread over a forest or area of woodland. They pose a threat not only to the forest wealth, but also to the fauna and flora, seriously disturbing the biodiversity and the environment of a region. However, they also help in the onset of an ecological succession and allow species to flourish.



The Amazonian Forest Fires

IMPACT ON THE ECOSYSTEM

Forest fires release carbon dioxide, a prominent greenhouse gas into the atmosphere. The effect of the gas on the landscape is usually long-lasting as it pollutes the area and worsens air quality. These effects on the environment are influenced by forest conditions before the fire and management action taken after the fire. For instance, since the 1980s, the size and intensity of wildfires in California have notably increased due to increased manmade projects and activities. According to the California Department of fishing and wildlife, 15 of the 20 largest wildfires in California history have occurred since 2000, and ten of the most costly and destructive fires to life and property in the state have occurred since 2015 as the intensity of projects and manmade activities has drastically augmented.

CHANGES FELT IN THE FOREST BIODIVERSITY DUE TO FIRES

Due to increasing fire size, frequency, and susceptibility to beetle outbreaks and drought driven mortality, forest biodiversity and composition is changing rapidly. Changes in vegetation structure alter important aspects of fire regimes, and these changes impact the management of biodiversity, groundwater management, forestry, recreation, as well as human safety.

THE UPSIDE OF FOREST FIRES

Even though forest fires can be deemed destructive, they do have an upside. Fire acts as a catalyst for promoting biological diversity and healthy ecosystems, removing low-growing underbrush, cleaning the forest floor of debris, opening it up to sunlight, and nourishing the soil. Moreover, several plants also require fire to move along their life cycles. Seeds from many pine tree species such as *monterey pine*, and *bishop pine* are enclosed in cones that are covered in pitch (a protective covering which can be natural or manufactured, derived from petroleum, coal tar, or plants), which must be melted by fire for them to be released. It requires intense heat for the seed cones to explode and crack their hard kernels, so that water can leak in and begin the growth process of the seeds.



Monterey pines after serotiny due to forest fires

Certain types of lilies also require fire for seed germination as the fire acts like a catalyst for melting away the pitch. Forest fires are also helpful for animals. For example, the sole food source for the endangered *Karner blue butterfly* caterpillar is a plant called *wild lupine* which is primarily found on dry soils. Wild lupine requires fire to maintain an ecosystem balance in which it can thrive as an adult plant. As a result of forest fires, the burned plots produce more biomass, allocate more of this biomass to leaves and stems, and thus transfer significantly higher nitrogen content to the plants than seen in unburned plots. Thus, burning lupine sites increases leaf production and seed set while also improving seedling mortality.



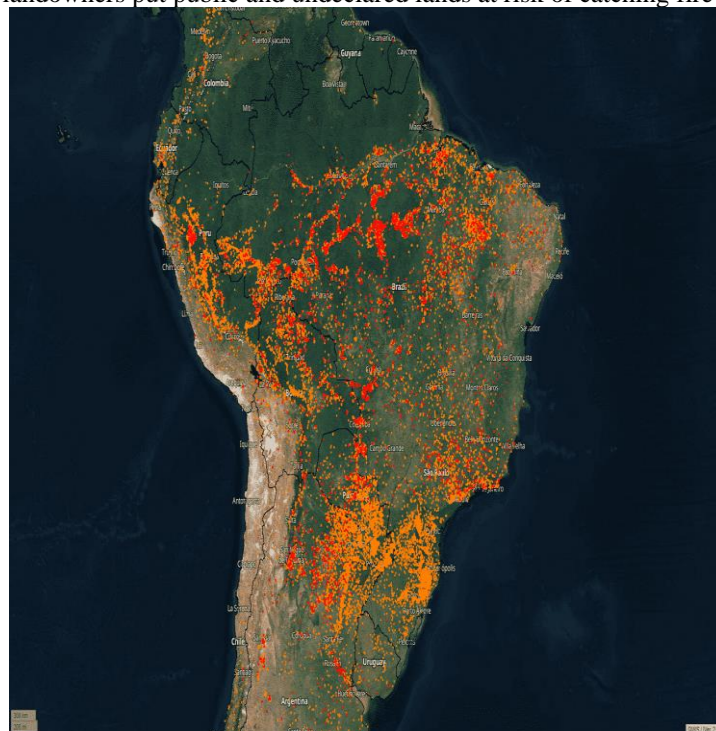
Wild lupine after a forest fire

FOREST FIRES IN LATIN AMERICA

A Case Study

Trees play a vital role in influencing the Earth's climate as even one tree takes in about 48 pounds of carbon dioxide each per year. Their presence is essential to maintaining wildlife and their ecosystems. However, the tree population has continuously decreased due to the large amount of deforestation around the world due in large part to agriculture and forest fires.

Deforestation due to agriculture has been commonplace for thousands of years. It is a common practice by private landowners, in South America, used to make a clearing for agricultural and cattle production. One of the most common methods farmers use to clear land is through controlled burns. This practice results in loss of native vegetation and species in areas like Brazil, Peru, Ecuador, and Colombia. In doing so, private landowners put public and undeclared lands at risk of catching fire as well.



Forest fires occurring in South America

In Argentina, half of the country is enduring the worst fires in decades, causing sore eyes and breathing difficulties in a number of smoke-invaded cities, while destroying wildlife – from endangered monkeys to jaguars, as well as birds and reptiles. Parts of its heavily deforested northern *Gran Chaco* are burning, as are the country's eastern Paraná Delta wetlands, where fires skip from one cattle-grazing island to the next, forming gigantic walls of flame



Gran Chaco forest in Argentina after recent fires

Increased fire activity in South America is one of the most concerning of all the recent events, given the potential impacts on local ecosystems and the global climate from the loss of large carbon stores under future socio-environmental change.

CONCLUSION

Conclusively, forest fires are crucial for the integrity of forest ecosystems. Fires help in the growth of many species of plants and are helpful for many animals. However, with the advent of climate change this picture has completely changed. Rising temperatures have escalated fires all around the world. Additionally, the tree population has continuously decreased due to the large amount of deforestation, encroachment and agriculture. Deforestation due to agriculture has been commonplace for thousands of years. It is a common practice by private landowners, in South America, used to make a clearing for agricultural and cattle production. One of the most common methods farmers use to clear land is through controlled burns. This practice results in loss of native vegetation and species in areas like Brazil, Peru, Ecuador, and Colombia. In doing so, private landowners put public and undeclared lands at risk of catching fire as well.

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