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THE ROLE OF TREES IN ENVIRONMENTAL CONSERVATION: A REVIEW

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Abstract:

Trees outside of forests are increasingly disappearing to make way for housing construction, road expansion, dam building, and intensive agriculture. Meanwhile, forest fires, exacerbated by climate change, have the potential to devastate forest ecosystems. Ecological restoration of forests involves reintroducing trees to their former forested lands and improving the condition of degraded forests. Restoration efforts may encompass, alongside planting native tree species, the preservation of native plants and wildlife, soil protection, and safeguarding water sources that constitute integral components of forest ecosystems. Lands cleared for agriculture and subsequently abandoned can serve as ideal areas for forest restoration. Additionally, planting native plant species in existing forests can contribute to the revival of tree cover.

Keywords: Trees, wildlife

INTRODUCTION

Forests and trees render the Earth a habitable realm, bestowing upon us clean air and pristine water. They also undertake the storage of vast quantities of carbon and temper the climate, thereby constituting a profoundly significant defense against global warming. Moreover, they serve as habitats for the majority of the astonishing biodiversity on our planet, offering us shade, leisure havens, and a sense of well-being. Additionally, they support livelihoods for millions of people across the globe.

Trees outside of forests are increasingly disappearing to make way for housing construction, road expansion, dam building, and intensive agriculture. Meanwhile, forest fires, exacerbated by climate change, have the potential to devastate forest ecosystems. Ecological restoration of forests involves reintroducing trees to their former forested lands and improving the condition of degraded forests. Restoration efforts may encompass, alongside planting native tree species, the preservation of native plants and wildlife, soil protection, and safeguarding water sources that constitute integral components of forest ecosystems. Lands cleared for agriculture and subsequently abandoned can serve as ideal areas for forest restoration. Additionally, planting native plant species in existing forests can contribute to the revival of tree cover.

However, trees play a vital role in the water cycle, support food systems, provide habitat for countless animal and bird species, and serve as building materials for humans. Unfortunately, humans often interact with trees heedlessly, cutting them down for economic gains or to make way for urban sprawl. Over the past 12,000 years, humans have uprooted nearly half of the world's trees, estimated to be around 5.8 trillion trees, due to various reasons. [13]

The environment is not just what surrounds us closely, but rather everything encompassed by the Earth. Forests are an integral part of the environment, contributing to its stability.

However, it is unfortunately slipping gradually from our grasp and is facing gradual loss, thus adding another facet to the string of human transgressions against their environment, which is committed day by day. Humans are shaping the fate of their own lives amidst the consequences of these damages that affect the entirety of life forms on Earth's surface. But what happens to this vital portion of our environment? What is its significance, given that it constitutes an expansive area of vegetative cover.

The process of tree felling in the environment results in a reduction in the number of trees, leading to a contraction of forested areas. These forests are crucial for providing the Earth with significant amounts of oxygen and removing carbon dioxide. Additionally, tree cutting results in certain animals being unable to find shelter and food, thereby posing a threat of extinction to some species due to the destruction of their natural habitats. [15]

DEFORESTATION AND CLIMATE CHANGE:

Deforestation is one of the primary contributors to climate change, taking various forms such as forest fires, tree removal for agriculture and livestock grazing, and timber harvesting. Forests cover 31% of the Earth's land area, and their

removal has multifaceted implications for the climate. Annually, approximately 75,700 square kilometers (18.7 million acres) of forests are lost. [1]

The widespread deforestation continues to threaten tropical forests and their biodiversity, as well as the services they provide to ecosystems. The primary area of concern regarding deforestation lies within tropical rainforests, as they house the majority of biodiversity. Organizations like the World Wildlife Fund focus on conserving nature and mitigating the most significant threats to life's diversity on Earth. [2]

Deforestation is the second-largest human-generated source of carbon dioxide emissions in the atmosphere. After fossil fuel combustion, deforestation and forest degradation contribute to greenhouse gas emissions in the atmosphere through the burning of forest biomass and the decomposition of remaining plant material and soil carbon. Deforestation activities were responsible for over 20% of carbon dioxide emissions, but this proportion has currently decreased to around 10%. By 2008, deforestation accounted for 12% of the total CO2, or 15% when including peatlands. These percentages have likely decreased further due to the ongoing increase in fossil fuel usage. [3]

According to the Intergovernmental Panel on Climate Change, by calculating the average temperatures across continents and oceans, temperatures have increased by about 1.53 degrees Fahrenheit (0.85 degrees Celsius) between 1880 and 2012 in the Northern Hemisphere. The period between 1983 and 2012 was the warmest 30 years within the last 1400 years. [4]

CAUSES OF DEFORESTATION

Timber Industry:

One of the major contributors to deforestation is the timber industry. The widespread practice of tree cutting is largely driven by the constant demand for wood products in people's daily lives. [5]

Every year, approximately 4 million hectares (10.7 million acres) of timber are harvested. Additionally, the growing demand for low-cost wood products incentivizes timber companies to continue logging. Carbon emissions from the process of converting timber into wood products account for 15% of carbon emissions in the environment.

Deforestation is a significant concern in tropical rainforests as they are home to millions of animals in terms of biodiversity. The impact of the timber industry goes beyond deforestation; it also affects the environment due to its role in driving climate change

Urban Expansion:

Urban expansion, also known as urbanization, is the process of clearing a significant amount of land to construct more residential and urban spaces. This is a result of expanding land use for housing and urban purposes. With the continuous increase in population over the years, there is a substantial loss of land for other purposes. As the demand and necessity for life essentials increase due to a growing population, more land needs to be cleared for constructing more homes, recreational spaces, and agricultural use. Additionally, urbanization also promotes industrial growth, which further requires additional land to provide consumers with the required food products. [6]

Cattle Ranching:

Cattle ranching requires significant portions of land for grazing herds and cultivating livestock crops to meet consumption needs. The practice of cattle ranching originated in Texas between 1820 and 1865 and was primarily driven by Mexican cattle herders. After Texans displaced Mexicans, they retained their cattle. Following the Civil War, Texans began rounding up cattle and selling them to other states like California and New Orleans. According to Greenpeace, a global non-governmental environmental organization, the cattle industry is responsible for a substantial amount of methane emissions due to cattle grazers burning vast areas of rainforests to provide pasture. Rett Butler states that over 60% of deforested lands are converted into pastures for animals such as cattle and other livestock. [

Agricultural Expansion:

The primary and foremost reason for deforestation and its severe degradation is agriculture. According to Wageningen University & Research, more than 80% of deforestation is driven by agriculture, and the continuously increasing demand for wood and agricultural products serves as indirect yet crucial drivers. Forests are cleared to make way for cultivating coffee, tea, palm oil, rice, rubber, and many other highly demanded products. The rising demands for certain products and global trade agreements lead to forest conversions, ultimately resulting in soil degradation. Often, after deforestation, the upper layers of soil erode, causing increased sedimentation in rivers and ponds. Over time, agricultural lands deteriorate and become nearly unproductive, prompting producers to seek new productive lands. [8]

Biodiversity Decline:

A study conducted by the National Science Foundation in 2007 found that genetic and species diversity are interdependent. In other words, diversity among species requires diversity within species, and vice versa. If any single species is removed from the system, the entire ecosystem could collapse, leading to a community dominated by a single species. [9]

Decline in Climate Services:

Forests serve as a natural reservoir for atmospheric carbon. They absorb carbon dioxide (one of the greenhouse gases) from the atmosphere and convert it into sugars and plant materials through the process of photosynthesis. Carbon is stored within trees, plants, and forest soils. Studies indicate that intact forests actually act as carbon sinks. Large forests, such as the Amazon and central African rainforests, have a significant impact on carbon balance.

However, deforestation disrupts the carbon sequestration process and impacts local climates. Furthermore, current studies suggest that tree cutting, when viewed on a larger scale, can play a positive role in the feedback loop of climate change solutions. [10] [11]

Burning or cutting down trees leads to the opposite effects of carbon sequestration and releases greenhouse gases (including carbon dioxide) into the atmosphere. Moreover, deforestation alters the Earth's surface landscape and its reflectivity, such as reducing albedo, which results in an increased absorption of solar energy in the form of heat. Consequently, this enhances the greenhouse effect.

The Impacts on Soil and Water:

Trees are a significant carbon source. Estimates indicate that the carbon stored in Amazon rainforests surpasses the carbon emissions produced over ten years of human activity. Unfortunately, due to factors like forest fires and practices such as slash-and-burn agriculture, burning wood releases vast amounts of carbon dioxide into the atmosphere. However, the increase of carbon in the atmosphere is not the sole consequence of deforestation.

Changes in soil properties can transform the soil itself into a carbon contributor. According to scientists at Yale University, deforestation alters the environment of soil microbial communities and leads to a loss of biodiversity in terms of microorganisms, as soil biodiversity heavily depends on soil composition. [15]

Contribution of Afforestation to Environmental Conservation:

Afforestation contributes to reducing air pollution and mitigating heat. Trees absorb pollutants and store them in their leaves and branches. Additionally, trees provide significant shade, blocking a substantial amount of sunlight. This helps to reduce the heat reaching the ground and consequently affects the temperature of the air.

Benefits of Urban Afforestation:

Urban afforestation has several benefits, including mitigating the heat absorption from sunlight and reducing the overall temperature of the city. When cities are developed with residential areas and asphalt roads, there is a significant increase in heat absorption from the sun's rays. This, in turn, raises the average temperature of the environment, as there might not be enough green spaces to reduce the direct sunlight hitting the ground. Additionally, urban afforestation provides psychological benefits to the community.

Reduction of Air Temperature:

Trees play a crucial role in energy conservation, offering substantial economic advantages. The growth of three trees around a house can decrease air conditioning needs by up to 50%, making trees a natural air conditioner. A single tree can generate a cooling effect equivalent to ten air conditioners, providing a refreshing atmosphere. Furthermore, trees reduce energy requirements during the winter by acting as windbreakers.

This reduction in energy usage helps minimize fuel consumption and simplifies pollution control, as it lowers energy consumption. Trees also contribute to lowering air temperature by shading out some of the sunlight, creating a cooler and more refreshing environment.

Especially when water evaporates from the surface of tree leaves, this greatly aids in reducing the air temperature. The tree functions as a natural air conditioner, as the amount of evaporation from a single tree is equivalent to the cooling effect of ten room-sized air conditioners, operating for twenty hours a day. As mentioned earlier, the shade provided by the tree also helps block the sun's rays during the summer and prevents them from entering the house. Trees also contribute to improving the temperature and water system of the environment, which enhances the quality of life. [14] [15]

A renewable source of energy:

In a simple manner, trees can be processed to be used as a type of biofuel, becoming a source of alternative and renewable energy. This has helped reduce the use of fossil fuels, which cause various environmental pollutants, in addition to their proximity to depletion. Trees can be used as fuel after ethanol is extracted from them. Furthermore, the residues of trees are also utilized in the production of electrical energy. [15]

Soil Enrichment:

Trees aid in reducing the temperature and moisture levels in the soil. Fallen leaves, after decomposition, provide nourishment to soil organisms, thereby supplying essential nutrients for tree growth and increasing soil fertility.

What is meant by "environmental afforestation"?

Environmental afforestation refers to the planting of trees and native shrubs in their natural habitats, such as forests, valleys, natural pastures, floodplains, meadows, coastal areas, green belts, windbreaks around cities and villages. This is done using suitable local plant species and an appropriate tree density that suits the nature of the region and the targeted location. Human intervention is usually limited in the initial stages of afforestation, allowing plants to become self-sustaining based on the climatic conditions of the specific area.

Benefits of Environmental Afforestation: Environmental, Economic, and Social

Environmental Benefits:

Preservation and enhancement of natural plant habitats, restoration of biodiversity, improvement of air quality, absorption of pollutants, climate moderation, enhancement of soil quality and prevention of erosion, halting sand encroachment, reducing dust storms, improving sustainability of surface and groundwater, and contributing to climate change adaptation by creating a natural carbon reservoir.

Economic Benefits:

Promotion of ecotourism, provision of job opportunities for local communities, supply of food, medicinal, and aromatic products.

Social Benefits:
Enhancement of quality of life, improvement of health, recreation, and psychological well-being.

Wildlife Protection:
Trees help maintain the habitat for birds and animals, preserving the biodiversity of the area. Trees are considered homes to thousands of bird species around the world. Additionally, trees create a suitable environment for the growth of various plant species. Decay in some trees caused by bacteria and fungi provides nesting places for birds and serves as a food source for microorganisms. Trees also contribute to temperature improvement and the overall ecosystem.

Soil Erosion Control:
Trees play a vital role in reducing soil erosion and expanding agricultural areas. The deep-reaching roots of trees help stabilize the soil, preventing it from being exposed to erosion. This is particularly beneficial in preventing soil loss on slopes. Some notable trees that contribute to soil erosion control include:

- willow trees,
- Moroccan red cedar
- fir trees
- large-leaved holly trees
- pine trees
- cascara trees

As for improving access to water supplies for underground organisms through their roots, and preventing water leakage into the ground. [20]
They also contribute to getting rid of toxic gases in the atmosphere, like sulphur dioxide, and renewing carbon dioxide into oxygen, as a single tree can renew air for four people over 24 hours.
Trees are thus an integral part of the ecosystem, contributing to maintaining environmental balance, mitigating air and water pollution, preserving soil from erosion, and enhancing its fertility. Moreover, they play a role in maintaining climate moderation, cooling streets and cities, and combating greenhouse gas emissions. [17]

The Importance of Green Spaces for Health
Green spaces and trees are not only essential for maintaining environmental balance but also play a crucial role in health, contributing to:

- Reducing the risk of cardiovascular diseases.
- Improving brain function, focus, and cognition.
- Lowering the prevalence of type 2 diabetes.
- Enhancing the health of pregnant women and their unborn babies.
- Contributing to a reduction in mortality rates, as highlighted in a study conducted by doctors Richard Mitchell and Frank Popham in 2008. The study examined nearly 40 million patients and established a connection between patients' income levels, their proximity to natural environments, and their life expectancies. The findings revealed that individuals living near nature, particularly in rural areas, had life expectancies equivalent to those with higher incomes

Water Pollution Prevention
Tree leaves play a role in reducing water pollution by preventing rainwater from directly reaching contaminated surfaces, such as pavements that carry harmful pollutants to seas and rivers.
Tree leaves absorb a significant amount of rainwater and gradually release it back into the environment through processes like evaporation and transpiration. Additionally, tree roots transport rainwater to be stored along with groundwater beneath the soil surface. [17]
Trees help reduce the flow of rainwater and improve its quality.
This method is a way of conserving water in general, achieved by reducing surface runoff during and after storms through the following:

- Tree leaves prevent direct rainwater impact on the ground.
- Tree roots absorb water infiltrated into the soil, reducing the amount of runoff.
- In terms of improving water quality, the following steps are taken:
- Lowering soil erosion to prevent sediment from reaching waterways.
- Trees trap pollutants resulting from decomposed organic matter present on their roots when water infiltrates the deeper layers of the soil

CONCLUSION:
Trees exist under the sun and in the shade, some thrive on land while others in water. Plants adapted to hot climates, while others to temperate or cold regions. Our eyes have wandered through the beauty and splendor of nature, experiencing the myriad colors and forms of creatures, few of which resemble each other. This leaves us with feelings of joy and curiosity, yearning to explore more of this vast world.
Preserving and enhancing natural plant families, restoring biodiversity, improving air quality, absorbing pollutants, moderating weather, enhancing soil quality, preventing erosion, halting sand encroachment, reducing dust storms, and sustaining surface and groundwater – all contribute to adapting to climate change and building a natural carbon reservoir.

Trees also filter the air by trapping fine particles like dust, dirt, or smoke in their leaves and bark. However, trees aren't just beneficial for the environment; they have positive effects on us as humans too. Research shows that living near and having access to green spaces can improve physical and mental health by lowering high blood pressure and stress, for instance.

For all these reasons, modern urban planning must take trees seriously. This is why the Food and Agriculture Organization, in collaboration with the Arbor Day Foundation, launched the Tree Cities of the World program. It's a collaborative effort aiming to encourage cities and towns worldwide to invest in urban forests and trees.

And trees are a crucial means to alleviate the impact of climate change and enhance air quality, making cities healthier places to live. They are equally essential for warm climates. In fact, strategically distributing trees in cities can help cool the air by as much as two to eight degrees Celsius, making humid urban areas more bearable. Large trees are also excellent at absorbing pollutants. [21]

Curbing unnecessary tree cutting can be achieved through:

1. Awareness and education campaigns.
2. Environmental forestry practices.
3. Tree planting initiatives.
4. Economizing paper usage or recycling.
5. Purchasing only sustainable wood products.
6. Avoiding excessive use of firewood. [18] [19]

By implementing these measures, we can protect our trees and, in turn, preserve the health and vitality of our environment

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