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Study on impact of biotic interference on vegetation of narhar conservation forest area

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Abstract
Study was conducted to assess biotic interferences and their relationship with ecological degradation in the Narhar Conservation forest area. Various interferences like incidence of fire, lopping, grazing and fodder collection, litter removal, soil erosion, tree felling, invasion of exotic species, fuelwood consumption in households are the major factors for vegetation depletion in a forest. Increased population and developmental activities are putting huge pressure on the forest resources and has led to ecological degradation in the area. So, in this context the present study was carried out to understand the impact of biotic interference on Narhar Conservation forest ecosystem, Chirawa. Hopefully the present study on this forest ecosystem will provide a baseline for scientific understanding of the rich biodiversity to enable undertaking effective initiatives for the conservation and management of this forest reserve.

Keywords: Biotic interferences, vegetation depletion, population, grazing, forest resources

Introduction

One of the elements that determines the kind or state of vegetation in any given place is biotic interference. Because of the population boom and the conversion of agricultural land to residential areas, the intensity of biotic disturbance in the woods is growing daily, posing a threat to their encroachment and degradation (Singh *et al.*,2019) [11]. Because they offer a variety of ecological services, including the preservation of plant and animal habitat, the avoidance of soil erosion, and species protection, forests are vital. The diversity of tree species determines the overall biodiversity of forests because trees serve as habitats and a source of supplies for nearly all other forest species. The richness of tree species in forest ecosystems varies widely across locations, mostly as a result of changes in biogeography, habitat, and disturbance. The primary environmental elements that control the temporal and spatial patterns of an ecosystem's vegetation are human interference, social resources, herbivore grazing, and climate variability. Nonetheless, the makeup of vegetation is always changing due to variations in temperature, moisture, sunlight, and nutrient availability. In ecology, a wide range of occurrences are referred to by the word disturbance. Among many other things, disturbances can be caused by fires, storms, illnesses, volcanic eruptions, earthquakes, pollutant spills, clearing land, and dredging (Dornelas *et al.*, 2010) [2] for an overview of sources and characteristics of disturbance. The various factors responsible are urban sprawl, encroachment on forest land, loss of forest cover for non-forest uses, illicit felling, lopping for fuel wood and fodder, removal of forest floor litter and forest fires (Sharma et al., 2008) [8]. Excessive lopping of trees and shrubs can cause slow death of tree species due to fungal infection, infecting fruit and seed production and ultimately hampering the process of regeneration. Frequent lopping of trees meant to provide fodder to livestock results in reduced growth of tree girth and production of leafy biomass (Bhat et al., 2002) [1]. There are many different kinds of disturbances involved, ranging from isolated tree falls to massive ecological disasters. In this framework, disturbance is significant because it triggers secondary succession and occasionally keeps societies from reaching their tipping point. The intermediate disturbance theory was developed as a result of the increasing recognition of the roles that predation and grazing play in postponing competitive exclusion.

The earth's abundant and diverse natural resources are vital to humankind's survival and well-being. Due to human ecological assemblages and ecosystem interferences, forest resources are currently under extreme stress. Uncontrolled degradation and conservation to other land uses, influenced by growing human needs, agricultural expansion, and environmentally damaging mismanagement, such as unsustainable commercial logging, overgrazing, uncontrolled browsing, etc., pose a threat to the forests. The main causes of forest degradation are different anthropogenic forces. Anthropogenic disturbance levels have been a significant factor in the decline of biodiversity in recent decades, both locally and globally. Human activity in the forest ecosystems has had a direct and indirect impact on the vegetation. The composition of the forest vegetation has changed recently and even now, largely due to biotic reasons. The building of roads, the harvesting of timber, pressure from tourism, the gathering of medicinal herbs, the gathering of fodder, grazing and browsing activities, habitat destruction, overexploitation, pollution, and the introduction of new species are some of the biotic factors that disrupt the numerical diversity in the forest ecosystem. The state of the forest ecosystem is concerning as a result of these biotic interferences, which also have an impact on the general environmental conditions of the corresponding places. In the recent past, increasing biotic pressures on forest ecosystem has altered their structure and function. Current forest ecosystem of Narhar Conservation Forest region (Chirawa) is increasingly impacted by variety of biotic interference such as deforestation, habitat loss, habitat fragmentation, fires, over exploitation of resources etc. While being utilize the various services as well as foods from forest ecosystems, the fragile ecosystem becomes prime targets of various biotic interferences (Hassan *et al.*, 2020) [3]. Anthropogenic influence on the landscape modifies landscape, ecosystems, communities and population structure, the physical

environment and availability of resources (White and Pickett, 1985) [15]. It is the man-made threats, such as clearance of prime forests for agriculture, mining, urbanization, industrialization, grazing, over-exploitation of components of floristic diversity and introduction of alien species which have severely threatened many of the wild species. Due to extensive anthropogenic activities such overgrazing, habitat fragmentation, and illicit harvesting, the threatened, uncommon, and endemic status of the plant species was proven by their survival in their native habitats. Over exploitation of economically important plants, smuggling of plants and encroachment by nearby local communities, pollution due to sewage and dumping of solid waste, alien species invasion, deforestation and unplanned developmental activities at study areas (Jeph and Khan, 2019) [4]. Correlating extinction of species to biodiversity loss ignores other subtle events that endanger the long-term ecosystem health (Rafferty, 2022) [7].

The planet Earth is endowed by nature with a multitude of biotic communities and forests, one of the major natural resources. Forests hold a special place in society as they play a vital role in the development of society by offering a wide range of goods services and playing a variety of ecological roles. One essential element of ecosystems that reflects the influence of the entire environment is the vegetation. Different vegetation types arise in different places as a result of plants growing together in a particular ecosystem and their relationships with each other and the local environment.

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The primary environmental elements that control the temporal and spatial patterns of an ecosystem's vegetation are human interference, social resources, herbivore grazing, and climate variability. Nonetheless, the makeup of vegetation is always changing due to variations in temperature, moisture, sunlight, and nutrient availability. Human activity in the forest ecosystems has had a direct and indirect impact on the vegetation. The complexation of the forest vegetation has changed recently and even now, largely due to biotic reasons. The building of roads, the harvesting of timber, pressure from tourism, the gathering of medicinal herbs, the gathering of fodder, grazing and browsing activities, habitat destruction, overexploitation, pollution, and the introduction of new species are some of the biotic factors that disrupt the numerical diversity in the forest ecosystem.

The forest ecosystem is in a dangerous state as a result of these biotic interferences, which also have an impact on the general environmental conditions in the affected areas. The structure and function of the forest ecosystem in the Kashmir valley have changed recently due to an increase in biotic stress. A range of biotic interference including deforestation, habitat loss, fragmentation of habitat, fires, over-exploitation of resources, etc., are having an increasing negative impact on the valley's current forest ecosystem. As a result of humans using the forest ecosystem's many functions and food sources, the delicate ecology is frequently harmed by biotic meddling. Kashmir the ecosystems of the Himalayan forests are incredibly complex and delicate due to their diverse topography. As a result, a number of issues are faced that have a significant impact on the preservation and management of natural resources such soil, water, forests, and land. Researchers have paid little attention to vegetation dynamics because of its remoteness, difficulty in access, danger, and lack of local infrastructure.

The forest ecosystems are seriously threatened by the unsustainable anthropogenic activities that have occurred recently the diversity and structure of these plant communities can be influenced by various abiotic and biotic factors, and some species and/or families may not be as able to inhabit particular habitats as others (Rahman *et al*., 2018) [8]. Certain species and/or families rarely have the same ability to occupy specific habitats as others, where varied abiotic and biotic effects can alter the diversity and organization of these plant communities (Haq *et al*., 2021b; Nafeesa *et al.*, 2021). [5, 6]

Material and Methods

Extensive site visits on regular bases were done to observe various biotic interference like incidence of fire, lopping, grazing, litter removal, soil erosion, tree felling, invasive sps invading.

A total of 100 households were studied to collect information regarding fuelwood consumption with help of personal interview and a structured questionnaire. In addition to primary data, the secondary data was collected from forest guards.

Result and Discussion

In the present study, following reasons of destruction of vegetation in the study area were found-

1. **Overgrazing:** The amount of vegetation is decreasing daily as a result of increased grazing pressure on habitat. Plant life is physically harmed by trampling, the ecosystem is deprived of nutrients or receives them in the form of dung and urine, and the sward experiences defoliation as a result of interference from overgrazing by herds of domesticated animals in protected areas. Uninterrupted and indiscriminate grazing frequently causes dangerous and unpalatable plant species to invade the impacted areas. Later on, as these species get established, the grazing area's productivity declines. One of the causes of the area's forest degradation is the rising demand for fodder due to the growing number of local livestock and the seasonal migration of Nomads. It speeds up soil erosion and causes a loss of vegetation. Maximum harms to the forest's regeneration process is caused by heavy grazing and lopping. There is a lot of pressure on the region in the form of grazing and collecting fodder.

2. **Population Growth:** The natural resources are under extreme strain as a result the population's fast expansion. The primary factor contributing to the loss of forest resources is deforestation. The notable regions that are unlawfully used for the exploitation of timber.

3. **Overexploitation of Resources:** One of the biggest threats to the forest is thought to be the gathering of

medicinal plants (Jadi-booti), which in this case comprises edible and aromatic plants as well as therapeutic herbs. While some of the herbs can also be found in woodlands, the majority are restricted to high-altitude meadows. June/July to August/September is the busiest collection season. Various medicinal plant species are reportedly collected from the forest.

4. **Habitat Loss and Fragmentation:** The principal factor contributing to the decline in biodiversity is the destruction and fragmentation of natural ecosystems brought about by the conversion of these regions into agricultural land, urban areas, and infrastructural development. As humans take over previously wild lands, we reduce the available space for native species to live, feed and reproduce, and also disrupt the connections between different ecosystems.

5. **Climate Change:** Because of the changing ecosystems brought about by global warming and the ensuing changes in climatic patterns, it is becoming more difficult for species to carry out their natural tasks to adapt in new environments. Certain plants find it more difficult to develop or survive when temperatures or rainfall patterns change, for example, and this has an impact on the species that depend on those plants.

6. **Invasive Species:** Non-native species introduced to new locations have the ability to outcompete native species for resources, prey on them, or spread diseases because ecosystems have evolved to ensure a relative stability of species populations. The populations of the prey that invading species feed on can be reduced when they are at higher positions in the food chain. On the other hand, native species that prey on invasive species may experience a population boom when they occupy the middle or lower reaches of the food chain. This could have an impact on the ecosystem as a whole. In several regions of the world, native species are also under threat from exotic species (Singh *et al*., 2019) [11]. The invasive species in the study area are *Prosopis juliflora, Conyza boneriensis, Lantana camara, Parthenium hysterophorus, Croton sparciflorus which have* great impact on native vegetation. According to the Convention on Biological Diversity (CBD), the second worst threat to the existence of biodiversity is the biological invasion of exotic species (WCMC, 1992) [14].

7. **Pollution:** Air, soil and water pollution can harm species by degrading their habitats, physically harming them, or increasing their vulnerability to diseases or predation. Some pollutants, such as pesticides and heavy metals, can be passed up the food chain, therefore contaminating many levels of the ecosystem.

8. **Diseases:** The spread of infectious diseases, often facilitated by human activities, can devastate wildlife populations. Organisms have developed natural defense against disease-inducing microbes native to their region. However, when human activity contaminates ecosystems with non-native microbes, indigenous species are not equipped to combat them.

9. **Tree Felling and Timber Extraction:** Various species are in demand for various purposes and are under threat as these are being illegally cut and sold to get easy money by the local and influential people. The demand for timber and its illegal extraction by the timber mafia worsened the situation in the area. The impact was more visible on tree species**.** The rural populations in most of the developing countries depend mostly on forest to meet most of their needs. In order to satisfy their need, they engage in tree felling to get timber, fuel wood or to make money by selling them illegally. Due to heavy pressure of demand, the regeneration of tree species is affected (Singh *et al.*, 2019) [11].

10. **Litter Removal:** Litter removal from the forest floors may affect the process of succession and establishment of plant species. Litter removal also affects the germination of seedlings and decreases the species diversity**.** They reported higher population of livestock as cause of deforestation and loss of plant species because regeneration is hampered due to grazing beyond the carrying capacity of the forests (Taddesse *et al*, 2002 and ` *et al*., 2008) [9] and Litter removal from the forest floors may affect the process of succession and establishment of plant species.

11. **Soil Erosion:** Due to above mentioned biotic interference, the intensity and frequency of soil erosion and landslides are quite high in the area especially during monsoon.

12. **Developmental Activities:** Mass scale soil cutting, bulldozing, digging and deforestation is making soil prone to soil-erosion. It is also destabilizing the slopes and causing enhancement in landslides and land subsidence in the area. Developmental activities like road- widening, construction of new houses, shops and roads are also having a negative impact on plant diversity (Singh *et al*., 2019) [11].

13. **Fuel wood Consumption in Households of The Study Area:** Fuelwood use and over-exploitation is one of the major causes of depletion of forests. Fuel wood is still the main domestic fuel in the rural households in most of the developing countries (Singh *et al.*, 2019) [11]. Fuel wood is mainly used for cooking and heating purposes. People of the area are economically weak to buy modern fuel for the domestic consumption. The majority of the population depends largely on trees and shrubs to meet their energy requirement for cooking and other purposes. There is huge pressure on vegetation in this respect. Some poor people generate some money by collecting and selling fuel wood to households, sweetshops, dhabas, etc.

Conclusion

The observations from the present investigation conclude that the forest ecosystem of the Narhar forest area is victim of varied biotic stresses. Biotic interference had significantly degraded the vegetation cover in the forest area. Biotic interference is a significant factor influencing vegetation in various ecosystems. Understanding the specific impacts of different types of interference is crucial for developing effective management strategies to protect and sustain plant communities and the overall health of the environment.

The numerical density, diversity and richness of various plant species have decreased due to rigorous biotic interventions. The cumulative biotic interferences have made the entire ecology of Narhar forest vulnerable to various threats. The cumulative effect of the biotic interferences was significantly seen in the reduction of vegetation cover. Their study revealed that the prominent factor for the exploitation of the vegetation cover of the study area at herbaceous level is simply the overgrazing. The increasing disturbances not only disturb the plant species diversity, richness and evenness significantly but various plant species have been got completely eliminated from grazing area by different kinds of interferences like overgrazing, deforestation, forest fire, tourist impacts etc Therefore, the current study is a reminder to conserve the pivotal resources bestowed upon us by Mother Nature in the form of plants. Considering the current state of affairs, if the biodiversity extinction continues to occur at this alarming rate, the day is not far off when all forms of life will cease to exist on earth. In this context, setting up of conservation reserves like Narhar conservation forest region by State and Central governments is a crucial step towards amelioration of the pathetic situation. However, apart from the government agencies, common people participation is needed to make this endeavour successful towards achieving a harmonious homeostatic society for all forms of living beings.

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