CURRENT SCIENCE

Volume 122 Number 9 10 May 2022

GUEST EDITORIAL

Many facets of afforestation (tree planting) and climate change

Of all the environmental and biodiversity problems in recent times, climate change has caught the attention of people across the spectrum of society. Raising temperatures, irregular weather patterns, and natural disasters have all been obvious, tell-tale signs of climate change. From political leaders to bureaucrats, environmentalists to the media, scientists to citizens, all discuss this problem as it seems to be impacting everyone. There is even a growing interest in the consideration of religion in climate change research!

At the same time, environmental protection and biodiversity conservation are becoming increasingly popular due to social media, television and online platform series, and swelling nature-based tourism. This exposure has motivated citizen groups, corporates, and individuals to contribute their part to reducing the impacts of climate change. One tangible, straight-forward, relatively inexpensive, hands-on activity that has become so popular that even corporates are investing in their Corporate Social Responsibility (CSR) programmes is tree planting. Various studies and reports show that millions of trees have been planted under the CSR programmes. Understandably, improving green cover is seen as a direct contribution to saving nature, fighting climate change, and is seen as a first line of defense. Some of the key benefits envisaged from planting trees are that they store carbon, reduce pollution, improve biodiversity, regulate water cycles, and halt soil erosion.

But is tree planting a panacea for stabilizing our deteriorating environment? Does planting millions of trees stop climate change? Does this massive tree planting activity help improve biodiversity?

Afforestation is a double-edged sword, and it can do exactly the opposite of what it is set up to solve if the wrong species and wrong areas are selected. Forests are complex and intricately adapted to the land they grow on. They evolve due to the interplay between different species of birds, mammals, reptiles, insects, amphibians, fungi, microorganisms, water, soil, environmental conditions, and other factors. Reproducing a natural forest is very challenging, almost an impossible task as we understand little about the numerous mutualistic interactions that exist, and it is also hard to create these interactions in the sequence nature does. In India, tree planting activities as of now are largely random in nature, with little planning going into the selection of the species, area of planting, post-planting care, and scientific evaluation of such projects.

Many tree species could be native to the country, but may not be indigenous to a particular area or to a particular habitat. For instance, Indian blackwood (*Hardwickia binata*) is a hardy tree species that is well adapted to woodland savanna habitats. Because it grows well in dry areas, it should not be planted in arid grassland habitats, which have their own unique floral species. Merely selecting a species that occurs in the country or in a state does not help restore natural habitats. When such activity is undertaken, the biodiversity associated with local species fails to return to the area of afforestation. It could, in fact, impede the biodiversity that is found in the area by bringing in the wrong floral species. Many species may blink out due to conversion of their natural habitats.

A recent effort by M. D. Madhusudan and Abi Tamim Vanak mapped biologically important Open Natural Ecosystems (ONEs) (https://mdm.users.earthengine.app/view/open-natural-ecosystems). This commendable mapping exercise includes grasslands, scrubs, ravines, dunes, and woodland savanna. All such habitats have sparse or no tree growth. The study estimates that our country has approximately 320,000 km^2 of such ecosystems.

These habitats support their own distinct floral and faunal species that are uniquely adapted to local environmental conditions. Unique mammals including caracal, Bengal fox, Indian grey wolf, blackbuck, chinkara and many others, are found in these habitats. Similarly, great Indian bustard, floricans, demoiselle crane, Eurasian crane, many species of raptors, and other smaller bird species, reptiles, and arthropods all call these habitats their home. Such a diversity of wildlife species is supported by an assortment of grasses, shrubs, and bush species. In addition to wildlife, ONEs have supported livelihoods of pastoral and agropastoral communities.

Despite their biodiversity value, these habitats are disregarded and are yet to receive serious conservation attention. They have even been classified as ‘wastelands’ in several government records (https://dolr.gov.in/documents/wasteland-atlas-of-india). But the irony is that such habitats have, unfortunately, been a prime target for tree planting activities by both government and civil society initiatives. Madhusudan

and Vanak estimate that in India, nearly 51% of ONEs have been proposed for 'tree planting' activities. Planting trees in areas where they do not occur naturally will have devastating impacts on the endemic ecosystems and the indigenous wildlife they host.

India has lost some species of wildlife due to the wrong perception that ONEs are wastelands that need to be 'greened'. Protected Areas (national parks, wildlife sanctuaries, conservation reserves) that were set aside to conserve certain species have lost the very species they were intended to save due to afforestation activities. The Ranibennur Wildlife Sanctuary in Karnataka has lost its great Indian bustard. The Jayamangali Conservation Reserve seems to have lost its Indian grey wolf population due to tree planting. The grasslands that were suited for bustards and wolves were made unsuitable for these open habitat species. Research work in Jayamangali shows that wolf, a canid, a species adopted to open habitats seems to have been replaced by the leopard, a feline, which requires cover.

The great Indian bustard is a 'critically endangered' species, and its numbers are estimated to be less than 250 birds. This decimation was mostly due to the loss of its grassland habitat for various reasons, including tree planting. It is critical to note that healthy grasslands can store the same amount of carbon as forests.

Another example of such modification of natural habitats is that of planting trees in snow-covered regions or at high altitudes above the tree line. This could increase the absorption of solar radiation rather than reflect it – possibly leading to warming.

In this context, we need to take a relook at the afforestation projects carried out beyond urban limits. Per se, afforestation has noble goals, but it involves many technical details that need to be carefully considered. Overall, the devil is in the details.

We also fail to realize that tree planting often needs aftercare to ensure its survival. According to an 'analysis of a mangrove restoration project' in Sri Lanka, not a single planted tree survived at nine of the 23 project sites, and only half of the trees survived at three of the sites. Overall, only one-fifth of the trees successfully came up as healthy mangrove ecosystems. The main reasons for such a low success rate were planting in incorrect topography, inappropriate soil conditions, disturbance caused by livestock, algal accumulation and insect attacks, and lack of post-planting care. Though a few exceptions do exist, such as this mangrove restoration in Sri Lanka, there are very limited case studies that scientifically monitor and evaluate afforestation projects.

Importantly, we need to recognize that afforestation is not as simple as the easy messaging it conveys and cannot solve our climate change problem. Our environmental problems can be reduced by investing in protecting existing natural ecosystems rather than creating artificial nature. Scientific studies have shown that natural regeneration absorbs 40 times more carbon than plantations and is host to a lot more biodiversity. It provides the biggest bang for the buck. Shouldn't we be thinking of investing more in natural forest regeneration?

It is estimated that the Earth's forests absorb 16 billion metric tonnes of CO_2 annually, and human activities such as land clearing and forest fires result in an estimated 8.1 billion tonnes of CO_2 released back into the atmosphere. Deforestation and uncontrolled fires are contributing heavily to carbon emissions, and the problem is so massive that forests in Southeast Asia now emit more CO_2 than they absorb. Researchers say that by the year 2050, forests in the Amazons may become a source of carbon from currently being carbon sponges. These are true indicators that saving existing natural green cover is critical in comparison to our efforts to create green cover.

As a country, we have embarked on multiple afforestation projects with commitments of thousands of crores. This digging and planting spree needs a bit more forethought and biologically informed approaches. Suitable planning of sites and species, scientific evaluation, and importantly, not disturbing existing natural habitats should be the norm. It is high time that botanists and restoration ecologists are consulted for any kind of tree planting activity. Above all, our priority should be towards safeguarding our biodiversity hotspots – Western Ghats, the Deccan Plateau, the Eastern Himalayas, the ONEs of the arid areas and others.

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