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CONSERVATION STRATEGIES FOR *ANOGEISSUS LATIFOLIA* IN THE SRINAGAR VALLEY OF UTTARAKHAND, INDIA

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Abstract

The present article focuses on the various disturbance agents such as fire, grazing and browsing, over-exploitation of resources, dam constructions, road constructions etc., affecting the growth of Anogeissus latifolia in the Srinagar valley of Uttarakhand. A. latifolia is the prominent tree species of this valley and is an important source of fuel, fodder, timber and other basic uses for the local villagers. The inevitable pressure on the A. latifolia is leading to severe destruction of the species and may create the scarcity of that species in the near future. Therefore, joint efforts need to be implemented by the local villagers with government agencies for conservation and sustainable use of A. latifolia. The government may also take a initiative by allotting demarcated forests areas to the villagers as village forest, thus motivating the villagers to take special care for its protection and rehabilitation and for a sustainable output.

Keywords: *A. latifolia, disturbance, conservation, sustainable use*

Introduction

Anogeissus latifolia Wall ex Bedd., belongs to a family of combretaceae and is used for timber, fodder, gum, tannin, pulp etc. [1]. *Anogeissus latifolia* is a tree of the tropical and sub-tropical climatic regions; it grows throughout the sub-Himalayan tract up to an altitude of 1,200 m in central India and a large part of the Indian Peninsula hills at an altitude of about 1,200 m [2, 3]. It grows in association with moist Siwalik Sal forests, dry Siwalik Sal forests, southern dry mixed deciduous forests, dry peninsular Sal forests and northern dry mixed deciduous forests [4].

Its deep and spreading root system, the branches, seedling and sapling can properly withstand unfriendly conditions and can resist drought. Drought affects the tree from top downwards and the lower living parts grow again back after getting sufficient moisture. The tree has good coppicing ability and is coppiced (92-100% of total coppice shoots) in April-May. Pollarding is considered to be better than coppicing for a higher yield of leaves.

In the Srinagar valley of Uttarakhand, the southern part of *A. latifolia* is intensively exploited by the inhabitants for their daily basic needs. A few years ago *A. latifolia* was growing abundantly in this valley. It still is abundant and it has a good regeneration rate. Its

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ruthless exploitation for fuel, fodder, timber and other developmental purposes has reduced surrounding forests and forced local inhabitants to travel several kilometers away from their villages for fuel, fodder and timber.

Thus it is important to advise the villagers immediately to rehabilitate the existing forests and warn them of the possible scarcity in the near future. The severely lopped trees for fodder and fuel, affect the production of seed and therefore, the regeneration potential is very low. If seeds are produced by some trees and get favorable conditions for germination then they get trampled/grazed/browsed by roaming animals in the following years.

The few studies of *A. latifolia* which were carried out in these forests show the dominance of *A. latifolia*. Bhatt et al. [5] reported the dominance of *A. latifolia* in several areas, with a higher density in areas facing south (310 tree ha^{-1}) and an important value index (222.74). The anthropogenic disturbance was also reported to affect *A. latifolia*, by Kumar et al. [6]. Fuel wood consumption data were also collected and observed *A. latifolia* is the preferred species. More than 40-50% of forests consist of *A. latifolia*. In the tropical region Kumar et al [7] categorized the forests based on magnitude of anthropogenic disturbances (i.e., undisturbed, mildly disturbed and highly disturbed) and observed that highly disturbed forest were the ones where *A. latifolia* was intensively exploited for fodder, fuel etc. Taking into consideration the importance of *Anogeissus latifolia* forests in supplying various necessary requirements to the villagers in the subtropical region of Garhwal Himalaya and the situation of present disturbance in its forest by human activities, the present study was carried out with the object to analyse the effect of human disturbance on *Anogeissus latifolia* forest in sub-tropical region of Garhwal Himalaya

Methodology

The paper reports the information of *Anogeissus latifolia* in the Srinagar valley of Uttarakhand state, located in the sub-tropical region (30^o 29' N and 78^o 24' E) of Garhwal Himalaya. The sites experience a monosonic climate has three different marked seasons, viz., rainy, winter and summer in the year. The different disturbance factors in the forest and adjacent areas (Forest fires, over-exploitation of *A. latifolia*, grazing and browsing, loss of agro-forestry resources, air pollution, invasion of new species, developmental activities of dam) of Srinagar valley were visually observed**.** The disturbance factors are mostly human induced. *Anogissus latifolia* is only growing in good patched in the Srinagar valley and its adjacent areas, which is important source of villagers for various daily needs.

Disturbance causes of *A. latifolia*

The personal observed disturbances in the *A. latifolia* forest and adjacent of Srinagar valley, are main of following types:

a. Forest fires

In the last few years, fire was noticed one of the major cause with a severe impact on forest growth and regeneration and some times whole trees were damaged due to the devastating effects of fire. The repeated controlled fires, especially in Pine and other forests

floors, may help regeneration by removing unwanted materials, but the intensity of uncontrolled fires damage whole trees and their regeneration in the forest, as shown in *A. latifolia* forests (Fig.1a and 1b). The effect of fire on *Anogeissus latifolia* were also recorded by categorized forest in burned and unburned (paper under preparation) where the preliminary analysed data has showed that the density, basal cover of burned area of forest has reduced regenerating of *Anogeissus latifolia* and others species.

b. Over-exploitation of A. latifolia

The locals people are not aware of the percent of trees should be affected by lopping and other needs, for its suitability of growth in coming year without affecting its physiological needs. Thus, villagers remove whole crowns of the trees, for fodder, fuel wood and other purposes which in the following year never flush again and will stop further growth of the tree. When trees in the forest are beyond the reach of the villagers they remove saplings and pole for fuel and fodder, which causes permanent damage to the plant. A study carried out by Sen et al [8] in Dadra and Nagar Haveli of India reveals the nature of changes effected on the character and composition of the forests as a result of increasing human interference. They suggested in that region, the growing stock of *Anogeissus latifolia* with other important timber species has decreased due to their relentless exploitation. Thakur and Khare [9] carried a study Patharia hills, Sagar, India to compare the changing status of the forest vegetation of Patharia hills. Topography, soil properties and extent of human disturbance (like cutting, quarrying, and grazing) are attributed as the major factors influencing the vegetation. Phytosociological attributes showed that at present *Acacia leucophloea*, *Diospyros melanoxylon* and *Butea monosperma* are the dominant species while, earlier it was dominated by *Anogeissus latifolia* and *Diospyros melanoxylon*

1a 1b

Fig. 1. The effect of fire on forest vegetation

c. Grazing and Browsing

Grazing and browsing of animals also plays an important role in reducing further growth of *A. latifolia*. Grazing animals remove newly grown saplings, affecting the regeneration process. The browsing animals mainly affect the growth of seedling/sapling by browsing over them and in time the plants stop growing.

d. Loss of agro-forestry resources

Many development activities of dam constructions (Fig.2) have changed the land pattern, especially the dam channel excavations dumping (Fig.3, Fig.4) which overburden (Fig.5) with materials cause most of the agro forestry trees form the area to die. The remaining trees cannot be used as fodder by villagers, due to the dust covering their leaves. Another disturbing aspect is that the grazing land gets converted to dumping sites and agro forestry land is also threatened. Therefore, the threat to the *A. latifolia* forest increases day by day.

Fig. 2. Vegetation loss in dam construction

Fig. 3. Dam canal excavation changing existing land pattern

Fig. 4. Dumping of canal excavation material

Fig. 5. Loss of agro-forestry resource by dam overburden material

e. Air Pollution

The air pollution, mainly dust, (Fig.6) caused by running vehicles and wind also affected the surrounding forest vegetation and human habitation areas and slowly the growth of adjacent forest decreased, due to changes in the physiological activities of plants. Air pollution generally played a key role in changing the distribution of plant species and the ecology of susceptible plant communities in polluted regions. Air pollution also affect the biodiversity of the region. Few studies of air pollution have been carried out for trees [10, 11, 12] and herbaceous flowering plants [13, 14].

Fig. 6. Air pollution in dam, affecting human lives and forests

Mostly the susceptible individuals are affected by pollution. The studies reported that broadleaved trees such as *Quercus robur*, *Quercus alba*, *Acer saccarina*, *Populus tremulens* and many others are sensitive to acute damage by ozone and other air pollutants [15, 16] and coniferous trees *Larix europeaus*, *Picea abies*, and others species are also sensitive to acute damage by ozone and other air pollutants [15].

f. Invasion of new species

The changes in the area caused by developmental activities affect regularly the growth of native forests, the vegetation near human habitation areas and areas of agriculture/agro forestry. We assumed that one solution to clear the disturbance in the area was the introduction of new, invasive species such as *Parthenium*, *Eupatorium*, *Lantana*, *Euphorbia* and many others. Nevertheless, that invasion of new species may affect the growth of existing species in the future. Such invasive species cover may create demographic instability among the tree species and reduce tree diversity and can even change the structure of the forest in the near future. As seedlings of most of the tree species of tropical dry deciduous forest are adapted to grow in relatively open conditions, because of the poor canopy cover and deciduous nature. The presence of *Lantana* shrub as dense understorey perturbs the seedling recruitment of native tree species in the forest and this lead to differential depletion of native trees [17]

g. Other factors

High electric power lines are also major disturbing factors for the *A. latifolia* forests and for other species. Vegetation around the power-line poles dies and sparks from the electric lines may ignite fires and cause severe damages to the forest. Electric power lines also affect biodiversity on land. The use of herbicides to control plant growth under power lines probably reduces native plant diversity in favour of weed species, which are often exotic. Baker [18] reported that power lines corridors can serve as refuges for rare species. Tree trimming may provide a haven for native 'sun-loving plants'. Shrub communities may flourish under power lines and provide habitat for nesting and migratory birds.

The study reveled that due to the dominance of *A. latifolia* and to its multipurpose value, villagers are exploiting this species at a much faster rate then expected. But among the causes affecting that species, the most severe cause is disturbance due to dam activities (Fig.7) shrinking species population regularly. The construction of a hydro electric project (Fig.8) in

The Srinagar Valley of Uttarakhand, India has affected a large forest area of *A. latifolia* and other vegetation. The dust particles from the project works also affect new and existing growth and in the near future a large portion of forest area will be submerged under water. This devastating phenomenon will cause severe scarcity of *A. latifolia* and other species in the coming years. Many villages in this valley exist at short distance from each other and they depend on the forest for their daily needs. In many other parts of this region it was noted that the forest are managed by the villagers. They have a higher density of trees compare to the non-managed forests. It is because of the proper care provided in the area managed by the villagers. Thus, considering the factors of disturbance in *A. latifolia*, the following conservation strategies could be helpful to minimize the loss of *A. latifolia* and of other valuable species in the future.

Fig. 7. Forest disturbance in dam road construction

Fig. 8. Forest damage in dam development activity

Conservation strategies

- Awareness programmes about its importance for the villagers need to be implemented.
- The village committee/panchayat committees should implement some common rules in collaboration with the forest departments, for the protection and amelioration of *A. latifolia* forests.
- The forest can be spread by plantation of *A. latifolia* and other valuable indigenous species, especially in degraded/wasteland areas.
- Special attention should be payed for the protection of existing trees, especially of seed bearing ones, for further regeneration.
- The forest resources should be used in a sustainable manner, for the sake of villagers and of the national economy.
- A major initiative should be taken by the government by allotting demarcated forests areas to the villagers as village forest, thus motivating the villagers to take special care for its protection and rehabilitation and for a sustainable output.
- The dam authorities should pay special attention to the compensatory afforestation programme for the benefit of local villagers and should restore the lost forest areas to compensate local affected people for their loss.

Conclusions

We conclude that the disturbance factors, as observed in the Srinagar Valley of Uttarakhand, are constantly reducing the forest cover of *A. latifolia* and if the necessary conservation strategies are not implemented immediately, they will wipe out the entire species from this valley and may affect the security provided to villagers by *A. latifolia* in the near future.

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