Short Communication

ASSESSMENT OF POPULATION STRUCTURE OF MAJOR TREE SPECIES IN FIRE AFFECTED AREAS OF ACHANAKMAR-AMARKANTAK BIOSPHERE RESERVE

Bhimappa Kittur[1] and Manoj Kumar Jhariya[2*]

Department of Silviculture and Agroforestry, Kerala Agriculture University, College of Forestry, Thrissur (Kerala).
Department of Forestry, College of Agriculture, I.G.K.V., Raipur (Chhattisgarh)
**Author for correspondence: manu9589@gmail.com*

Abstract : Assessment of population structure of major tree species in fire affected areas of Achanakmar-Amarkantak Biosphere Reserve was carried out for the study by using stratified random sampling technique. The population structure was analyzed in different fire zones (i.e., High, Medium, Low and Non-fire zone) of the region. The trees and saplings were analyzed by randomly laying out five quadrats of size 20 x 20 m. A subquadrat of 5 x 5 m size was randomly laid for measuring seedlings. The study concluded that the species population in the moist deciduous forests, instead of continuous distribution of all size classes in these forests there had a discontinuation in size classes of several important major tree species in the forests vegetation due to repeated fire effect on these forests more importantly the major species population behaved differently in different fire zones.

Keywords : Fire zone, Population structure, Size classes, Species

INTRODUCTION

The forest fire is a good servant but bad master therefore, forest fires should be first prevented and then controlled (Negi, 2008). Although fire under control may be a beneficial and un-controlled fire is always harmful. Fire is therefore, innately neither destructive nor constructive, it simply causes changes, whether these changes are viewed as desirable or not dependent upon their compatibility with overall objectives. Different vegetation types have different susceptibility to fire, different fire frequencies and intensities. Interactions between the climatic regime, soil type and topography are all involved, as these features determine the vegetation type, the likelihood of fire and the probability that it will spread.

Controlled fires are beneficial in improving the site conditions, thereby ensuring the adequate regeneration of native vegetation. Fire enhances the productivity of ecosystems by releasing chemicals and nutrients locked up in the old herbage. The controlled fires enhance the microbial activity and ameliorate the physico-chemical properties of forest soil. On the other hand, the un-controlled fire is always harmful to both flora and fauna. The uncontrolled surface fires kill the young regeneration, saplings and small trees. It will arrest the progression of succession and lead to development of secondary forest communities of invasive and economically unimportant fire hardy species. The impact of fire will be detrimental to the growth of vegetation and microclimate of the area (Devagiri *et al.* 2006). Therefore the study was conducted for assessment of structural distribution of vegetation in fire prone areas of Achanakmar-Amarkantak Biosphere Reserve.

Study area

The Biosphere Reserve of Achanakmar –Amarkantak lies between 22^0 15' to 22^0 58' North latitude and 81^0 25' to 82^0 5' East longitude, having an area of 3836 sq. km, partly in Madhya Pradesh and partly falling in Chhattisgarh State. The forest area represents tropical deciduous vegetation and can be classified into Northern Tropical Moist Deciduous and Southern Dry Mixed Deciduous forests (Champion and Seth, 1968). The moist and dry Sal, Teak mixed and Bamboo brakes are predominant vegetation types found in the sanctuary. The biosphere area has a typical monsoon climate, with three distinct seasons- summer from March - June, rainy from July - October and winter from November-February. During the last few decades, these forests were subjected to severe biotic disturbances. The forest fires have became major threat in certain pockets due to repeated forest fire and illegal logging these forests. The government of India had long been started protecting these forests due to their importance in both ecologically and socio-economically.

METHODOLOGY

The population structure was analyzed for in different fire affected zones (i.e., High, Medium, Low and Non-fire zone) of the region. The trees and saplings were analyzed by randomly laying out five quadrats of size 20 x 20 m. The girth at breast height (i.e., 1.37 m above the ground) of all the trees and saplings in each quadrat was measured and recorded individually. For tree species, the individuals > 31.5 cm GBH are categorized as tree, < 31.5 cm but > 10 cm as saplings. In each of these quadrat, a subquadrat of 5 x 5 m size were randomly laid for measuring

seedlings (< 10 cm GBH). To show the regeneration pattern of tree species, the population structures were developed based on different tree girth classes in addition to seedlings and saplings. The total number of individuals belonging to these girth classes was calculated for each species on each site. In addition to seedling (A) and sapling (B) classes, three more size classes (based on G.B.H.) i.e., 31.5-70.0 cm (C); 70.1-110.0 cm (D) and > 110 (E) were arbitrarily established for each population. The total number of individuals belonging to these diameter classes was calculated following Saxena and Singh (1984).

RESULT AND DISCUSSION

The interpretation of population structure of tree species was based on the assumption that size class corresponds with age of individuals. Though the size distribution often differs from the age class distribution, the former in case analyses properly can also be useful for interpretation of patterns of population changes.

In the high fire zone the seedling size class (A) and sapling size class (B) were represented by *Diospyros melanoxylon, Dalbergia sissoo, Shorea robusta* and *Tectona grandis*. The nil or negligible presence of intermediate species (*Tectona grandis*, *Dalbergia sissoo, Shorea robusta* and *Diospyros melanoxylon*). The *Ougeinia oojeinensis* and *Anogeissus latifolia* were only represented intermediate size (B) or (C) classes. The younger and older trees are higher in *Tectona grandis* and *Dalbergia sissoo* this represented that once the intermediate trees are higher but consequently disappeared due catastrophic effects like logging and forest fires Knight (1975) referred to the species showing such population structure as infrequent reproducer.

Medially fire affected zone showed *Anogeissus latifolia* and *Emblica officinalis* were represented only by saplings size class (B) and small trees size class (C). *Lannea coromandelica* and *Semicarpus anacardium* showed higher proportion of older tree, while *Anogeissus latifolia* and *Shorea robusta* represented all diameter classes. The young seedlings and older trees are nil or negligible (*Emblica officinalis, Anogeissus latifolia*, *Tectona grandis* and *Lannea coromandelica*) in the medially fire affected zone, according to Saxena and Singh (1984), Bargali *et al.* (1987) the population is on the way to extinction if such a trend continues. The proportion of saplings class (B) and small trees class (C) to older tree size class (D and E) increased gradually (*Shorea robusta*) while in *Lannea coromandelica* class (C) to class (E) the proportion was decreased.

The low fire zone represented that mostly seedlings layer of all the species are dominated, exemplified by *Lagerstroemia parviflora*, *Shorea robusta*, *Cassia fistula* and *Diospyros melanoxylon*. The entire or negligible presence of all the older trees are represented by all the species, except *Terminalia tomentosa*, while the *Ougeinia oojeinensis, Buchanania lanzan* and *Semicarpus anacardium* represented the more saplings (B) and younger trees (C) in the lowly fire affected zones.

The non-fire zone represented that dominant seedling class (A) except by *Terminalia tomentosa*. The size classes (C), (D) and (E) represented negligible presence or entire absence of older trees, exemplified by *Saccopetalum tomentosum, Schleichera oleosa, Diospyros melanoxylon, Emblica robusta* and *Lagerstroemia parviflora*. The sapling size represented by class (B) to older size class (E) was increased proportionally (e.g. *Shorea robusta* and *Terminalia tomentosa*). Kafle (2004) also reported that very young trees were quite abundant in the unburnt areas as compared to the burnt areas.

The hump in the middle size classes may indicate comparatively fast growth or less mortality in individuals once they successfully crosses the sapling layer and attained the first tree size class (C) as exemplified by *Tectona grandis, Terminalia tomentosa* and *Ougeinia oojeinensis* in high fire zone and *Ougeinia oojeinensis* in medium fire zone, *Semicarpus anacardium* and *Ougeinia oojeinensis* in low fire zone and in non-fire zone recorded by *Shorea robusta*. According to West *et al.* (1981) such type patterns indicate the heavy exploitation of older individuals and greater mortality among young individuals by repeated forest fires.

On the basis of the population structures of different tree species in different stands following six general patterns are recognizable.

(1) Generally greater population of individuals of *Shorea robusta* in seedling size class (A) as compared to sapling size class (B) and slightly higher percentage of individuals in third and fourth size classes and sometimes decline or increase the higher size class (E). This situation might have resulted from rapid conversion of seedlings into saplings and that of saplings into trees in the past but the rate has been showed down at present. This species can be referred as a fair reproducer.

(2) The concentration of individuals in intermediate size classes with generally absence or negligible representation of individuals both towards higher and lower size classes (e.g., *Semicarpus anacardium*, *Terminalia tomentosa*). According to Saxena and Singh (1984), Bargali *et al.* (1987) the population is on the way to extinction if such a trend continues. Knight (1975) referred to the species showing such population structure as infrequent reproducer.

(3) A greater population of individuals in lower size classes compared to larger classes as exemplified by *Cassia fistula, Tectona grandis, Emblica robusta, Schleichera oleosa, Diospyros melanoxylon* and *Lagerstroemia parviflora*. The structure represents frequent reproduction according to Knight (1975).

(4) A lesser population of individuals in lower size classes compared to larger size classes as exemplified by *Shorea robusta, Semicarpus anacardium, Terminalia tomentosa, and Ougeinia oojeinensis*. These species have produced abundant population in the past with better conversion rate from one size class to another but at present though the seedlings are not comings up frequently, though the species might have produced the seeds but, the environment is not supporting their proper establishment.

(5) *Lagerstroemia parviflora, Diospyros melanoxylon, Cassia fistula* was represented by mainly two size classes i.e. seedling and sapling. These species are facing much pressure and unable to grow towards the higher size classes. If this situation will exhibit for longer time these species may be washed out.

(6) *Buchanania lanzan, Tectona grandis* and *Anogeissus latifolia* were represented by single size class (B) these may be referred as either an accidental or the nomads, in future if these species will found the suitable environmental conditions and they will survive or otherwise washed out if the condition not favor with the progress of time.

CONCLUSION

The study concluded that the species population in the moist deciduous forests, instead of continuous distribution of all size classes in these forests there had a discontinuation in size classes of several important major tree species in the forests vegetation due to repeated fire effect on these forests more importantly the major species population behaved differently in different fire zones. The species like *Terminalia tomentosa, Ougeinia oojeinensis* and *Anogeissus latifolia* population was more in high fire zone. Distribution of *Diospyros melanoxylon* and *Shorea robusta* of size class (A) population was more in medium and low fire zone. But the size class (C), (D) and (E) population *Lagerstroemia parviflora, Cassia fistula, Buchanania lanzan* and *Diospyros melanoxylon* are negligible of or nil. The *Lagerstroemia parviflora, Diospyros melanoxylon and Shorea robusta* of lower size class (A) and (B) had more population as compared to *Terminalia tomentosa, Ougeinia oojeinensis* and *Buchanania lanzan* in low fire zone. In case of non-fire zone the population of intermediate size class (B) and (D) exemplified by *Schleichera oleosa, Terminalia tomentosa, Diospyros melanoxylon* and *Emblica officinalis* are absent or negligible. If this type of size class discontinuation persists in these forests, there will be problem for sustainable harvesting and management in these moist deciduous forests and moreover there might be even species extinction if a repeated forest fire continues over several years. Therefore there is urgent need for new policy formation and adaptation of scientific forest protection measures against catastrophic hazards like forests fires.

REFERENCES

Bargali. S.S., Tewari, J.C., Rawat, Y.S. and Singh, S.P. (1987). Woody vegetation in high elevation blue-pine mixed oak forest of Kumaun Himalaya, India. In Y.P.S. Pangty and S.C. Joshi (eds.) Western Himalaya: Environment, Problems and Development. *Gyanodaya Parakashan*, Nainital. pp 121-155.

Champion, H.G. and Seth, S.K. (1968). *A Revised Survey of the Forest Types of India*. Government of India Publication New Delhi.

Devagiri, G.M., Ullasa, K., Deepak, M.S., Ramakrishna, H., Murthy, M.M., Devakumar, A.S. and Kumar, Naveen (2006). Effect of forest fire on natural regeneration of plant species in Rajiv Gandhi National Park, Karnataka. *Annals of Forestry*, **14**(2): 177-183.

Knight, D.H. (1975). A phytosociological analysis of species-rich-tropical forest on Barro Colorado Island; Panama. *Ecological Monograph*, **45**: 259-284.

Kafle, S.K. (2004). Effects of Forest Fire Protection on Plant Diversity in a Tropical Deciduous Dipterocarp-Oak Forest, Thailand. Proceedings of the second international symposium on fire economics, planning and policy: A Global View, pp. 465-472.

Negi, S.S. (2008). Forest fire meeting report. *Current Science*, **94**(12): 1558-1559.

Saxena, A.K. and Singh, J.S. 1984. Tree population structure of central Himalayan forest associations and implications concerning their future composition. *Vegetatio*, **54**: 61-69.

West, D.C., Shugart Jr., H.H. and Ranney, J.W. (1981). Population structure of forest cover in a large area. *Forest Science*, 27: 701-710.