

QUANTIFICATION OF FUEL LOADS IN FIRE AFFECTED AREAS OF TROPICAL MOIST DECIDUOUS FORESTS OF ACHANAKMAR-AMARKANTAK BIOSPHERE RESERVE

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Abstract : Fuel load assessment in fire affected areas of Tropical Moist Deciduous Forests was carried out in Achanakmar-Amarkantak Biosphere Reserve. Historical ground based fire data of last 10 years was used for delineation and identification of fire affected areas. The fuel load was analyzed in different fire zones (i.e., High, Medium, Low and Non-fire) of the pre-fire and post- fire season in the area. The components of fuel load are assessed by laying a quadrat size of 1m x 1m. The biomass of duffs litter and wood litter were summed to derive total fuel load. The net change in fuel load was assessed by subtracting the fuel load existing in pre-fire and post-fire seasons in each fire zone. The total fuel load in different fire zones during pre-fire seasons followed the order: non-fire > medium fire > high fire > low fire zones, whereas during post-fire season it was in the follow the order: non-fire > low fire > medium fire > high fire zones. The results indicated that the duffs litter and wood litter in both high fire and medium fire zones in the post-fire season was decreased. While in low fire and non-fire zones the fuel load was increased due to protection from fire. There is urgent need for management strategies to these forests.

Keywords : Biomass, Duffs litter, Fuel load, Wood litter

INTRODUCTION

Fire has been a part of the co-evolution of seasonally dry-forests and grasslands across the globe (Keeley and Bond, 1999). Forest fires cause enormous loss to the forest ecosystem, diversity of flora and fauna, and economic wealth. In India, out of 67.5 million ha of forests, about 55% of the forest cover is being annually subjected to fires (Gubbi, 2003). In accordance with positive attributes that fire enhances the productivity of ecosystems by releasing chemicals and nutrients locked up in the old herbage, but the uncontrolled fire destructs the micro-flora and micro-fauna in the top soil and litter layers in forests could have impacts on the organic decomposition and soil fertility (Kodandapani, 2001). Indian forests are burnt every summer, as it is believed to encourage the

growth of succulent fresh grasses after the first rains. The forests are also burnt for collecting non-timber forest products, hunting and various other reasons. Very few studies that are available from Indian forests report that fires mostly affect ground vegetation.

Study site

The Achanakmar-Amarkantak Biosphere Reserve lies between $22^{\circ} 15'$ to $22^{\circ} 58'$ North latitude and $81^{\circ} 25'$ to $82^{\circ} 05'$ East longitude (Figure 1), having an area of 3836 sq. km, partly in Madhya Pradesh and partly falling in Chhattisgarh State. The state-wise distribution of the area shows that 1224.98 sq. km area comes under Madhya Pradesh and remaining 2610.53 sq. km. area in Chhattisgarh.

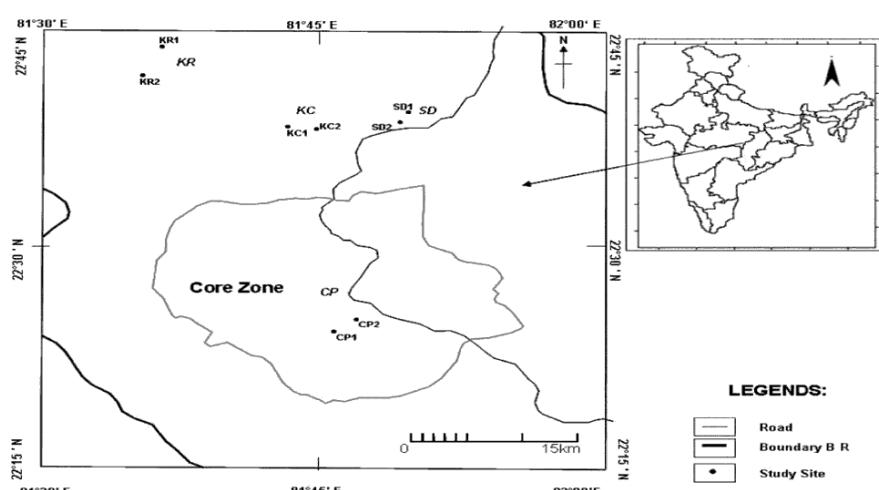


Fig. 1: Location map of the study area

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. Generally, May and June are the hottest months, whereas December and January are the coolest months of the year. The average annual rainfall of the area is about 1624.3 mm. The forest area of the Achanakmar-Amarkantak biosphere reserve represents tropical deciduous vegetation and can be classified into Northern Tropical Moist Deciduous and Southern Dry Mixed Deciduous forests (Champion and Seth, 1968). The former type predominates in the Biosphere Reserve area.

METHODOLOGY

Historical ground based fire data for last 10 years was used for delineation and identification of fire affected areas. Based on the frequency and spatial extent of forest fire damage, the fire affected areas were divided into four fire regime *viz.*, high, medium, low and non-fire zones. Under each fire zone the fuel loads assessment was done during pre-fire (January-February) and post-fire (May-June) seasons in order to assess both qualitative and quantitative changes in forest floor biomass.

The total fuel load in each fire zone was estimated following Kodandapani *et al.* (2008). The fuel load is assessed by a quadrat of 1m x 1m was laid out to measure the Duffs (dead grass, leaf litter, organic matter, etc.) and wood litter. The biomass of duffs litter and wood litter were summed to derive total fuel load. The net change in fuel load was assessed by subtracting the fuel load existing in pre-fire and post-fire seasons in each fire zone.

RESULTS AND DISCUSSION

Results on the components of fuel load *viz.* Duffs litter (duffs litter includes leaf, grass, flowers, bark and twig litters) and wood litter on forest floor during pre-fire and post-fire seasons are presented in table 1 and figure 2.

Pre-fire season

The major contributing components of fuel load include the duffs litter and wood litter existed on the

forest floor. The duffs litter ranged from 1.77 Mg/ha to 2.62 Mg/ha and wood litter from 0.43 Mg/ha to 0.76 Mg/ha. Both wood litter and duffs litter were highest under non-fire zone, whereas it was lower under high and low fire zones.

Total fuel load on the forest floor varied from 2.2 Mg/ha to 3.38 Mg/ha. It was highest under non-fire zone and lowest in low fire zone. The total fuel load in different fire zones during pre-fire seasons followed the order: Non-fire > Medium fire > High fire > Low fire zones.

Post-fire season

During the post-fire seasons, the duff litter varied from 0.26 Mg/ha to 3.25 Mg/ha. It was highest under non-fire zone and lowest under high fire zone. The medium and high fire zones comparatively had lower amount of duffs litter just after the post-fire season. The fuel load of 0.392 Mg/ha and 0.37 Mg/ha was lost due to burning. Whereas the 0.11 Mg/ha and 0.83 Mg/ha of total load were accumulated in low fire and non-fire zones, respectively. Wood litter varied from 0.96 Mg/ha and 1.88 Mg/ha. It was higher under medium fire and high fire zones, whereas lower under low and medium fire zones. Total litter varied from 1.8 Mg/ha to 4.21 Mg/ha. The total litter during post-fire seasons was in the following order: Non-fire > Low fire > medium fire > High fire zones

The net change in fuel load was positive under high and medium fire zones and negative under low and non-fire zones. The present results indicated that fuel load ranged from 2.2 to 4.2 Mg/ha in pre and post-fire seasons, which is comparable with fuel load observed in dry mixed deciduous forests of Thailand between 4000 – 5000 kg /ha (FFCD, 2009). Increase in litterfall and with it increasing fine woody fuels, would seem to be a biological phenomenon in stands in early stages of stand development, where crown development, branch shedding and canopy closure occur at a relatively rapid rate compared to latter stages of stand development (Oliver and Larson, 1996). The trend in leaf litter (serving as fuel) accumulation is similar to that in the monsoonal forests of the Western Ghats, Australia and East Africa (Murali *et al.*, 1993; Troup, 1921).

Table 1: Duffs and Wood litter quantification (Mg/ha) in different fire zones during pre and post-fire seasons in Achanakmar- Amarkantak Biosphere Reserve

| Pre Fire Season | | | | Post Fire Season | | | |
|-----------------|--------------|-------------|--------------|------------------|-------------|--------------|------------|
| Fire Regimes | Duffs litter | Wood litter | Total litter | Duffs litter | Wood litter | Total litter | Net change |
| High Fire | 1.82 | 0.46 | 2.28 | 0.218 | 1.67 | 1.888 | 0.392 |
| Medium Fire | 1.77 | 0.74 | 2.51 | 0.26 | 1.88 | 2.14 | 0.37 |
| Low Fire | 1.77 | 0.43 | 2.2 | 0.76 | 1.55 | 2.31 | -0.11 |
| Non-Fire | 2.62 | 0.76 | 3.38 | 3.25 | 0.96 | 4.21 | -0.83 |

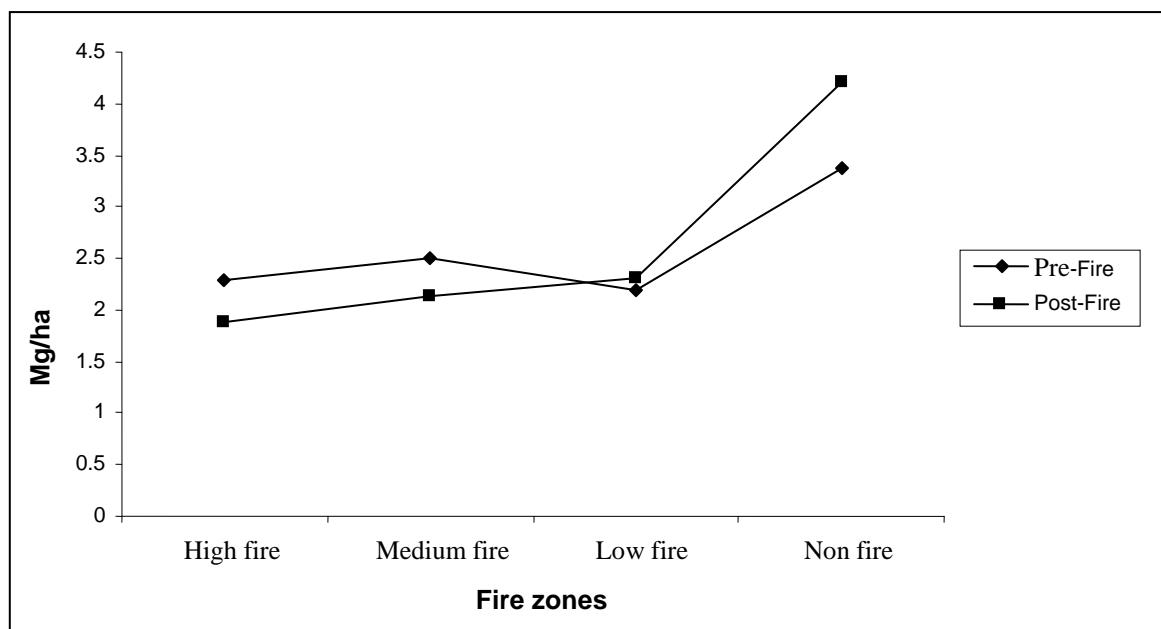


Fig. 2: Duffs litter and Wood litter quantification (Mg/ha) in different fire zones during pre and post-fire seasons in Achanakmar- Amarkantak Biosphere Reserve

CONCLUSION

The duffs litter and wood litter in both high fire and medium fire zones in the post-fire season was decreased. While in low fire and non-fire zones the fuel load was increased due to protection from fire. However, due to the repeated effect of fires on these forests are slowly decreasing the stability of the fragile moist deciduous ecosystem. The forest fires alter the structure, diversity and results the community of lesser important secondary species. The management of fire and vegetation in the forests of the central India has a long history. Prescribed burning can be applied to reduce the high intensity of wild fires. Prescribed burning especially under moist conditions could be pursued to reduce the fuel loads and create a spatial mosaic of fuel load distribution.

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