Effect of Fire on Vegetation Cover in Acacia seyal Forests at Blue Nile State,Sudan

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ABSTRACT: This study was carried out in Acacia seyal forests, in Elnour forest, east of Eldamazeen in the Blue Nile State, Sudan where seasonal fires occur to examine the effect of fire on vegetation cover richness and density. In savannahs, the main short term impact of fires is to prevent the replacement of herbaceous strata by woody biomass and to enhance the production of some graminaceous species and fires may also induce long-term changes in vegetation cover through their impact on soil nutrients. The most common causes of forest fires in Sudan were honey collectors, cleaning of agricultural lands, conflicts between farmers and nomads and smokers. Grass fire with three intensities (light, moderate and severe) was applied for three consecutive seasons. The results showed that the fire had no effect on vegetation cover richness and density, but both of them affected through time they were decreased significantly in the third season. The study showed some species as fire resistance; they were not affected with fire with its three intensities through three seasons, while they were species were disappearing after two seasons. One of these species was one of the dominant species (Cymbobogon nrvatus).there were species that appear in the site after fire.

KEY WORDS: Acacia seyal, richness, density, fire.

1-INTRODUCTION:

In Sudan the occurrence of large- scale fires about 67% of the total area every year and this is due to natural vegetation, which characterized by open savannah grass land(Goldammer, 1991). The most common causes of forest fires in Sudan were honey collectors, cleaning of agricultural lands, conflicts between farmers and nomads and smokers (Alhassan and Elgamri, 2002). All fires are human – made and there no evidence of natural fire ignition (Alhassan and Elgamri, 2002). In savannahs, the main short term impact of fires is to prevent the replacement of herbaceous strata by woody biomass and to enhance the production of some graminaceous species (Menaut, 1993). Fires may also induce long-term changes in vegetation cover through their impact on soil nutrients (Crutzen & Andreae, 1990). In the higher-elevation coniferous forests, species diversity was a function of fire severity and time since fire. High-intensity fires create gaps that decrease canopy coverage and increase light levels and nutrients for an ephemeral successional flora. Few species have persistent seed banks, so the time since fire is an important determinant of colonization success. There was a highly significant interaction between fire severity and time since fire for understory cover, species richness, and alien richness and cover. Understory was sparse in the first year after fire, particularly in low-severity burns, and increased substantially several years after fire, particularly on high-severity burns. Both fire severity and time since fire affected alien species richness and dominance(Keeley et al, 2003).So this study was aimed to study the effect of fire on vegetation cover richness and density.

II-MATERIALS & METHODS:

This study was carried out in Elnour forest, east of Eldamazeen in the Blue Nile State. (11o 50/ North and 34o 29/ East) during 2001-2002-2003. Clearance of all kinds of trees was done in an area of 100 m x 80 m (area of study). The number and species of trees cleared were 56 A.seyal, 27 A.senegal, 5 Zizphus.spina –Christi, 11 Balanites aegyptiaca. The experimental area was divided into four blocks; each block was further divided into four plots with an area of 7 m X 12.5 m each. Fire lines 3 m wide within the plots and 10 m wide around the whole area were established. Plots in each block received one of the following treatments:

Control: grass cover kept intact. (Grass was 120 cm tall), Light fire: fire with low intensity, this was done by cutting 75% of the grass tallness and burning the rest, Moderate fire: fire with moderate intensity, this was done by cutting 50% of the grass tallness and burning the rest, Severe fire: fire with high intensity, this was done by burning all the grass (100%).

The first burning was in November 2001, second in November 2002 and the third in November 2003.

After the three consecutive rainy seasons, the new generations was counted in an area of 1X1 m using square sampling unit (quadrat) in each plot in all blocks. The regeneration of trees and grass were counted. The numbers of species in the plots were counted to determine vegetation cover diversity (Alpha richness). Number of individual's plants was counted to determine vegetation cover density.

III-RESULTS AND DISCUSSION:

The richness of the site is an important factor that measures the changes occurring in vegetation cover through time or with treatments. Fire of three intensities (light, moderate and severe) was found to have no effect on vegetation cover richness (table 1) although there studies showed that species richness is higher soon after fire and succession proceeds by successive elimination of species (Bond and Van Wilgen, 1996), in some ecosystems the species richness (a) increase up to 15 years and then decrease (Saı¨d, 2001). However richness decreased with seasons; it was steady in the first and second seasons but decreased in the third season (table 2). (Bleby et al 2009) reported an increase in species richness over few years followed by a steady decline although there were differences in the rate and progress of regeneration between communities, while Blank, 1994 disagreed with them and believed that fire usually causes an initial decreases in the number of species present, followed by a gradual return to pre-fire richness levels.
Table 1 showed that vegetation cover density was not affected by fire; it was no significantly different from untreated area (control).But it was decreased with seasons, it was steady in first and second seasons ad declined in the third season(table, 2). This it seems to have a relationship with soil seed bank accumulation, which deceased in both herbaceous and woody species, this finding was reported from study carried out in this forest and showed a decline in soil seed bank through seasons (Hassan, 2004). This decrease in density may allow *A. seyal* seedlings to reestablish and dominate the site. This kind of succession which occurred in Acacia forests was documented by Mustafa, 1997. The grasses dominated for first years after tree clearance and then Acacia trees dominated the scene.

Some species were recorded as fire resistance; they were not affected with fire with its three intensities through three seasons, while they were species were disappearing after two seasons.

One of these species was one of the dominant species (*Cymbobogon nrvatus*).there were species that appear in the site after fire (table 3)

1. **Table (1) Effect of fire vegetation covers (Alpha richness and density) overall seasons**

Treatments	Alpha richness(mean No of plants/ m2)	Density (mean No of plants/ m2)
Control	3.67 a	19.75 a
Light fire	3.17 a	20.08 a
Moderate fire	3.42 a	20.5 a
Severe fire	3.33 a	20.91 a
p≥	0.8	0.9
SE±	0.4	3.1
CV	39	58

2. **Table (2) Effect of seasons on vegetation covers (Alpha richness and density) overall treatments**

Seasons	Alpha richness(mean No of plants/ m2)	Density (mean No of plants/ m2)
2001	3.56 a	26.06 a
2002	3.88 a	23.56 a
2003	2.75 b	11.31 b
p≥	0.04	0.0006
SE±	0.3	2.6
CV	39	58

3. **Table 3 effect of fire on species availability**

Fire resistant species	Species that disappear after 2 season	Species that disappear after 3 season	Species that appear after fire
Brachiaria obtusiflora	Cymbobogon nervatus	Abutilons sp	Aristida hordeace
Acacia seyal	Casia ouidentalis		Rottboelia exaltata
Merremia emarginata	Tephrosia uniflo		Sterculia setigera

cyperus rotundus			Sehima ischaemoides
Ischaemum afrum			Alysicarpus vaginalis

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