"The role of fire in pasture and rangeland management"

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The Role of Fire in Pasture and Rangeland Management[1]

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Burning is an important ecological tool in the maintenance and productivity of grassland and rangelands in Uganda. Properly used fire improves the quality and quantity of the forage species important for grazing animals. It is also important in the control of bush encroachment on these pastures and rangelands.

However, limited research work has been done to date in Uganda on the scientific use of fire to manage pastures. This paper highlights the areas where some research has been done and emphasises the urgent need to develop fire ecological studies for the fire-adapted biological systems.

Effects of Fire on Herbage Yield and Nutritive Value

A number of studies have assessed the influence of fires on grassland productivity (Harrington, 1974; Harrington and Ross, 1974; Edroma, 1975; Ogen-Odoi, 1985; Sabiiti, 1986; Wamara, 1987). The major conclusion put forward is that fires of different intensities and frequencies will change the botanical composition, herbage yield and nutritive value depending on the type of vegetation burned. In other words, ecological effects of fires are site specific. However, controlled burning has been found to increase grassland productivity (Sabiiti and Wein, 1988).

It is clear from the results in Table 1 that maximum grassland productivity (herbage and crude protein) was promoted by high fire intensities during late annual burning because the fire stimulates vigorous grass regrowth, grass and legume seed germination and seedling establishment. Fire exclusion clearly reduced pasture production.

In a study of natural pastures used for communal grazing, Wamara (1987) found that crude protein tended to decline with age of the pasture regrowth following a fire (Table 2). The optimum period for grazing such a pasture was between 3 and 6 months following a fire. However, these natural pastures were generally productive since mean percent CP (crude protein) never fell below the critical value of 7 percent. This may be attributed to the legume component in this pasture.

It is thus suggested that late annual fires should be encouraged in the pasture and rangelands used by livestock. Ogen-Odoi (1985) also found that fires promoted herbage production and such areas were important for wildlife grazing in Queen Elizabeth National Park, Uganda.

Effects of Fire on Bush Control

The rangelands of Uganda have been seriously encroached by bushes, especially Acacia species but few studies have been conducted to provide a scientific management approach (Harker, 1959; Harrington, 1974; Sabiiti, 1986), see Table 3.

It is clear from the data that no burning promoted maximum height growth and annual crown diameter expansion thus enhancing rapid development of a closed canopy.

Annual burning especially late in the dry season significantly retarded growth and this is attributable to the high fire intensities generated by the high fuel biomass.

In the case of Acacia and savanna grassland ecosystems it is suggested that annual high-intensity fire would promote grassland dominance and suppress bush encroachment.

Conclusions

The above studies are still limited in their scope because they are short-term studies. Long-term studies are lacking and it is important to generate data that captures the long-term dynamics of grassland ecosystems. It is nonetheless clear that controlled burning has beneficial effects on rangeland management and improvement.

Table 1. *Effect of fire regime on mean (±SE) total regrowth herbage yield (g/m, n=10) and on percentage crude protein of a natural grassland in Southwestern Uganda*

Year of burning	1986			1987			1988		
Season of burning	No burn	Early burn	Late burn	No burn	Early burn	Late burn	No burn	Early burn	Late burn
Fire intensity (kW/m)	-	2772	3276	-	2808	4590	-	2340	4536
Regrowth herbage (g/m)	60+20a*	540±18b	864±15	145±25a	675±22b	1200±14c	85+17a	983+206b	1520±10c
Crude protein	8.3±1.2a	9.0±1.4a	11.8±1.1b	7.9±1.7a	9.5±1.1a	12.6+1.2b	6.3±2.0a	9.8±1.5b	13.7±1.2c

*Means with different letter (a, b, c) within rows are significantly ($P<0.05$) different.
Source: Sabiiti and Wein, 1988.

Table 2. *Relationship between percent crude protein (%CP) and age of pasture regrowth after burning*

Age of regrowth (months)	Legumes % CP	Grasses % CP	Mean % CP
0.5	-	9.9	9.9
1	14.4	10.5	12.5
3	20.8	8.3	14.6
6	18.8	7.0	12.9
9	14.1	7.0	10.6
12	13.7	5.5	9.6
24	11.0	5.3	8.2

Source: Wamara, 1987

Table 3. *Estimates of mean (±SE) total available fuel (g/m) (n=12) and subsequent fire intensity kW/m) and mean (±SE) of Acacia sieberiana saplings (n=40) immediately preceding each annual burn*

Year	No burning	Early burning	Late burning
Total available fuel (g/m) (n=12)			
1980	438±24a*	506+24 a	57+28a
1981	481±26a	525±14a	821±45b
1982	789±40a	979±41a	1189±45b
Fire intensity (kW/m)			
1980	-	570 (1.4)	1825 (2.4)
1981	-	660 (1.5)	2170 (2.6)
1982	-	760 (1.6)	2356 (2.7)
Sapling height (cm) (n=40)			
1980	293±3a	293±3a	299±3a
1981	422±11b	236±6a	236±3a
1982	440±12c	196±6b	51±2a
Sapling crown diameter (cm) (n=40)			
1980	155±5a	158+13	144±5a
1981	236±5c	156±8b	126±4a
1982	244±4c	128±7b	87±4a

Source: Sabiiti, 1986.
Means with different letter (a, b) within rows are significantly ($P<0.05$) different. Figures in brackets after fire intensity are flame height estimates in metres.

Note

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