The effect of topographic factors on the productivity of mountain grasslands in northwestern Benin

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Introduction The Atacora mountains range in northern Benin (660 m altitude) is a special ecosystem in the sudanian zone because of the overriding importance of topographic factors and shallow soils. The vegetation over this mountain range consists of shrub and tree savannas, woodlands and fallows. More and more cattle herds graze on this range. But the functioning of this ecosystem is still unknown like many others in the tropical zone (Sene & Zingari, 2001). This study aims to determine the impact of topography and mountain side exposure on the productivity of the Atacora mountains grasslands in the Atacora mountains.

Materials and methods Five grassland types respectively dominated by *Loudetia flavida* Stapf, *Andropogon schirensis* Hochst, *Andropogon tectorum* Schumach & Thonn, *Andropogon gayanus* Kunth and *Hyparrhenia involucrata* Stapf, were identified for the study. Three protected plots of 10 m × 10 m were set up on the mountain range per grassland type, per topographic level (hilltop, middle side, lower steep and valley) and per type of mountain side exposure (east or west). Seven sub-plots of 1 m^2 were sampled randomly inside each protected plot. Maximum standing biomass was cut from these sub-plots and weighed at the end of the rainy season in order to assess herbaceous dry matter production. The average productivity of grasslands was determined for each topographic level and for each type of exposure based on the biomass production of the five plant communities. Data were analysed through analysis of variance with significance assessed at the 0.05 level.

Results and discussion The results showed that topography did not influence productivity ($F = 1.94$; $df = 3$; $p = 0.1053$) (Table 1). These results, which differed from those of Fournier *et al*. (1982), are explained by the soil properties in relationship to the mountains' gradient. Soil depth and texture did not vary significantly according to topography, because water run-off and soil erosion are very intense due to the steepness of the slopes (average gradient of 40%). Because of this hydrological erosion, the accumulation of soil particles is limited down the slopes. However, the type of exposure influenced productivity ($F = 4.47$; $df = 2$; $p = 0.0048$), with herbaceous biomass being lower on eastern than western sides although soil properties did not differ according to the side (Table 2). This difference in biomass production is explained by direct exposure of the eastern sides of the range to a cold and dry wind called "Harmattan", making the eastern sides drier than western sides. This wind is normally experienced from Nov. to March and impacts on the vegetation structure of this relatively high mountain range, as mentioned by Tchamié & Bouraïma (1997).

Table 1 Productivity (Pd (t DM/ha)) according to topography (NP: number of plots; Alt.: altitude (m); Depth: soil depth (cm); %H: grass water content (%); M. steep: middle side; L. steep: lower steep)

	NP	Alt.	Depth	Pd.	%H
Hilltop	4	450	22.0a	6.51	67.1ab
M. steep	8	400	13.5a	5.29	68.9b
L. steep	7	350	14.3a	5.84	70.7ab
Valley	3	350	33.9b	5.88	76.6a

Depth: p=0.0000; Pd: p=0.1053; %H: p=0.0345
Values followed by the same letter are not significantly different at 0.05 level based on Newman Keuls test

Table 2 Productivity [Pd (t DM/ha)] according to side exposure (E. side: east side; W. side: west side; NP: number of plots; Alt.: altitude (m); Depth: soil depth (cm); %H: Grass water content (%))

	NP	Alt.	Depth	Pd.	%H
Hilltop and valley	7	450	24.9a	6.24a	73.6a
E. side	7	400	12.7b	4.97b	66.3c
W. side	8	370	15.9b	6.10a	69.3b

Depth: p=0.0001; Pd: p=0.0048; %H: p=0.0291
Values followed by the same letter are not significantly different at 0.05 level based on Newman Keuls test

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