Effect of Cattle Grazing on Native Forage Biomass Yield in Extensive Grazing Systems of Southern Bolivia

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Introduction Boliviano-Tucumano mountain forests in Southern Bolivia are used for grazing Criollo cattle . Great parts of these grazing areas are located in the nature reserve *Parque Natural de Fauna y Flora Tariq*uía . Near the villages , grazing pressure can be high , especially during the rainy season , whereas remote forests are only utilized for grazing in the dry and pre-humid season . Grazing and browsing might affect biomass production of specific plant species in the Boliviano-Tucumano forest , however , this has not been investigated . The objective of this study was to determine the effect of different grazing intensities of Criollo cattle on forage biomass production during the grazing period and in the subsequent year , and the contribution of different vegetation types to the overall forage supply .

Materials and methods The experimental site El Meson" (S21° 45′ 06″ , W64°12′ 16″) is located at an altitude of 1280 masl near the village of Salinas in the Department of Tarija , Bolivia , and belongs to the Boliviano-Tucumano formation (Navarro and Maldonado , 2004) . The annual precipitation is 1 .334 mm (need to check this value) . Three intensities of grazing were randomly assigned to three plots , 3 ha each . Treatments were : low (L) , medium (M) and high (H) grazing intensity , with 0 . 8 , 1 .3 and 2 .2 animal units/ha , respectively (au=300 kg live weight mature criollo cow) . The grazing period in 2006 and 2007 was from March to June . Yield was measured before (PRE) and after the grazing experiments (POS) in both years . Forage was harvested utilizing different techniques according to the vegetation types ; in grasslands , all forage plants present in 30 randomly distributed quadrants (0 .5 m^2) were harvested ; in forested areas , the herbaceous plants were harvested in 18 (5×5 m^2) quadrants . In shrubs , the reference unit technique was used (Bonham 1989) . Data were analyzed utilizing the Mixed model (LS Means) and results were reported in kg of dry matter per ha .

Results Principal forage species were ; *Paspalum notatum* , *Panicum laxum* and *Axonopus compressus* in grasslands ; *Pseudechinolaena polystachya* , *Pteris deflexa* and *Panicum sp* . in forest ; and within the woody plants *Barnadesia odorata* , *Ocotea cf . puberula* and *Allophylus edulis* . Herbaceous species contributed most to the total available forage . POS shows significantly ($P<0.05$) less defoliation effects for the low grazing intensity plot in both years . The only pre-grazing mean significantly lower than the POS was in the high grazing intensity plot in the second year of the experiment , suggesting a heavy grazing accumulated effect from the previous year . PRE and POS differed significantly , except for the low grazing intensity treatment in the first year of the experiment . On the low grazing intensity plot , the effects of defoliation on biomass production were not severe . In general , on the high grazing intensity plot , herbaceous plants had a significantly lower yield than under medium and low grazing intensity . However , higher yields in these treatments in the second year of the experiment suggest a remarkable re-growth capacity of these plant species . Overall , woody plants contributed less to the forage yield than the herbaceous plant species . Interestingly , there were no significant differences among the plots grazed with different intensities (POS treatments) .

Conclusions Grazing intensities higher than applied here could reduce biomass production in subsequent years . However , the herbaceous plant species showed a remarkable resilience capacity when moderate grazing intensities are applied . The result may contribute to decisions regarding the sustainable management of the nature reserve by adapting grazing intensities to the specific conditions of a grazing site , in order to ensure both ecological and economic sustainability .

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