Biodiversity and structure of subtropical Boliviano-Tucumano mountain forests, depending on disturbance intensity due to forest grazing and selective timber logging

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Introduction The *Parque Natural de Flora y Fauna Tariquía*, Department of Tarija, Bolivia is dominated by the *Boliviano-Tucumano subandean semideciduous and seasonal evergreen vegetation* (Navarro, 2004). Theses forests have been used as dry season grazing area of Criollo cattle for centuries. In the last decades, easier accessible parts of the reserve were additionally affected by selective timber logging. The influence of forest grazing and selective timber logging on the plant species composition of the Boliviano-Tucumano mountain forests has not been studied before. This study investigated plant species diversity and forest structure in areas with different disturbance regime. The results can serve as a basis for decisions regarding the future management of the reserve.

Material and methods In three valleys of the mountainous nature reserve *Parque Natural de Flora y Fauna Tariquia*, with an altitudinal gradient of 990 to 1270 m a.s.l., 25 Gentry-type temporary plots each of 0.1 ha (50m×20m) were installed, and divided in 10 sub-plots of 10m×10 m. Plant species, height, diameter, infestation with lianas, and the phenological state of all woody plant species and lianas with≥2.5cm diameter (D.B.H.) were determined. Based on abundance, dominance and frequency, the Index of Importance Value (IIV) according to Mueller-Dombois and Ellenberg (1974) was calculated and used for Detrended Correspondance Analysis (DCA) to group the plots (Kent and Coker, 1992) and Canonical Correspondence Analysis (CCA) was used to determine the importance of the intervening variables.

Results Within the 49 families registered, the most frequently found families were Myrtaceae (17.1%), Solanaceae (9%), Sapindaceae (7.8%), Euphorbiaceae (5.6%), Bignoniaceae (5.5%), Melastomataceae (5.4%), Apocynaceae (4.8%), Rubiaceae (4.2%), Meliaceae (4.1%), Asteraceae (4%), Lauraceae (3.3%) and Fabaceae-Mimosoidae (3.2%). The most frequently found plant species were *Myrciaria delicatula* (10.5%), *Miconia calvescens* (5.3%), *Fosteronia glabrescens* (4.8%), *Sebastiania fiebrigii* (4.5), *Solanum symmetricum* (4.3%), *Psychotria carthagenensis* (3.6%), *Trichilia claussenii* (3.5%), *Vernonia pinguis* (3.4%) and *Blepharocalyx salicifolius* (3%). In total, 123 woody plant species and lianas were found. The Detrended Correspondance Analysis (DCA) of the plant species composition showed that the plots can be classified into five groups, according to the intensity of grazing and timber logging: In the less disturbed Group 1, the species with the highest Index of Importance Value (IVV) were *Trichilia claussenii* (8.1%), *Piper amalago* (5.5%), *Nectandra* cf. *angusta* (4.1%) and *Psychotria carthagenensis* (4.%). Group 2: *Miconia calvescens* (27.1%), *Solanum symmetricum* (8.9%), *Phoebe cf. porphyria* (7.8%), *Piper amalago* (5.7%) and *Amphilophium pannosum* (5.1%). Group 3: *Myrciaria delicatula* (15.5%), *Prunus* sp. (11.7%), *Ilex argentina* (11.4%), *Terminali triflora* (5.8%) and *Blepharocalyx salicifolius* (5.4%). Group 4: *Myrciaria delicatula* (15.5%), *Prunus* sp. (11.7%), *Ilex argentina* (11.4%), *Terminalia triflora* (5.8%) and *Blepharocalyx salicifolius* (5.4%). In the most disturbed Group 5, the species with the highest IVV were *Solanum* aff. *symmetricum* (16.9%), *Acacia aroma* (13.31%), *Vernonia pinguis* (13.84%), *Sapium haematospermum* (8.5%) and *Celtis spinosa* (5.3%). The groups 1 to 5 also differed in forest structure. Group 1 had the highest variability of diameter and height class. This variability decreased with increasing disturbance intensity, and also the mean base area decreased. The latter was 8.9 m^2/ha and 2 m^2/ha in group 1 and 5, respectively. At the same time, the number of plant individuals increased with increasing disturbance intensity. Areas with medium disturbance intensity had the highest cover percentage of lianas (almost 30%). In the Correspondence Analysis (CCA), the disturbance intensity (including both grazing and timber extraction) had a significant ($p < 0.005$) influence on the botanical composition of the different forest sites.

Conclusions The disturbance intensity had a significant influence on the botanical composition of the Boliviano-Tucumano forests. Furthermore, the number of plant individuals increased and both the mean base area and the variability of diameter and height classes decreased with increasing disturbance intensity. Further studies including controlled experiments and direct observations, are necessary to evaluate the influence of different intensities of cattle grazing on plant species composition and forest structure, and thus differentiate between the effects of timber extraction and forest grazing.

Reference

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