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Floristic composition and herbage quality changes with tree cover and grazing in NW Patagonia, Chile

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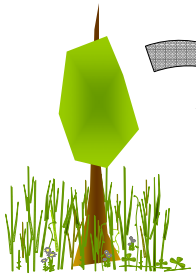
Introduction

Aimed at establishing the scientific basis for silvopasture management in Chilean Patagonia with the native tree species lenga (*Nothofagus pumilio* [Poepp. et Endl.] Krasse), we studied the understorey grasslands in a lenga woodland with varying canopy openness in the Aysén region. In the present work we examine the influence of tree cover on herbage quality. Nutritive quality can be influenced by the presence of trees due to changes in the **relative abundance of the species** (floristic composition) or to morphological and physiological **adaptations of the individual species** (chemical composition). Which one of these factors drives the changes in herbage nutritive quality across the lenga tree cover gradient?

Trees may influence herbage quality through changes in:



shade
H_2O
litter

or

Floristic composition
(changes at the community level)
Less legumes? Grasses?
Composites?

Chemical composition
(changes at the species level)
More protein, fibres?
Less sugar?

Methods

- Fifteen sites (20x20 m) were distributed in **5 classes of tree cover (3 sites per tree cover class)** in a lenga woodland grazed by cattle.
- At the peak of the season (January 2008), herbage was harvested by cuttings at ground level four subplots (100x50 cm) at random in each plot for estimating **biomass production** & **quality analyses**. **Floristic composition** of the samples was assessed by manual separation.
- Green fully extended leaves of the selected species *Dactylis glomerata* L. and *Trifolium repens* L. were collected from each site.
- Quality analyses were conducted in both general samples and in green leaves of the selected species.
  - water soluble carbs (**WSC**) → Anthrone method
  - N content → Kjeldhal method
    crude protein (**CP**) = *nitrogen content x 6.25*
  - Fibres → acid detergent method (**ADF**).

In Chilean Patagonia, extensive areas of native forests were converted into grasslands in the 1930-40s. We aim at establishing the scientific basis for silvopastoral management within the remnant woodlands.

Results

Biomass production (DM) was highest at intermediate tree cover (Table 1). Differences in floristic composition were not significant for grasses or composites, although these and the legumes reduced its growth under dense forests, where other families (which include many of the native species) dominate.

Table 1. Total biomass production (DM g · m^{-2}) and floristic composition (% of the DM) across the tree cover gradient. Mean average for the three replicates per class. Different letters denote statistically significant differences between tree cover classes (rows).

	DM	Grasses		Composites	Legumes *	Others
		All	*D.glomerata*			
Open areas	151.3 ^{ab}	31.5	11.7	27.1	10.3 ^{ab}	23.5 ^{b}
Scattered trees	192.0 ^{a}	36.2	12.4	24.2	15.0 ^{ab}	13.9 ^{b}
Low-density	191.3 ^{a}	47.0	24.5	16.1	14.3 ^{ab}	9.5 ^{b}
Medium-density	153.2 ^{ab}	36.0	15.3	13.0	24.5 ^{a}	21.4 ^{b}
Dense forests	80.0 ^{b}	25.8	24.5	9.5	1.5 ^{b}	62.5 ^{a}

* Most legumes stand for *T. repens*; occasionally the rare species *Vicia nigricans* Hook et Arn. occurs at a negligible abundance.

A general decrease in WSC with increasing tree cover was observed (Table 2), while the opposite was found for CP and ADF. Therefore, a loss in WSC under shade would diminish a more nutritive (higher CP) though less digestible (higher ADF) pasture in woodlands.

Table 2. Concentration (g · kg^{-1} DM) of water soluble carbohydrates (WSC), fibres by the acid detergent method (ADF) and crude protein (CP) in the general herbage sample (DM) and in green leaves of the two selected species across the tree cover gradient. Different letters denote statistically significant differences between cover classes (rows).

	DM			*D. glomerata* L.			*T. repens* L.		
	WSC	ADF	CP	WSC	ADF	CP	WSC	ADF	CP
Open areas	9.7	29.5	9.05	14.1 ^{a}	26.2 ^{b}	14.6	10.3	12.9 ^{b}	15.6 ^{c}
Scattered trees	7.5	31.0	10.0	11.5 ^{a}	26.9 ^{b}	17.4	8.8	13.6 ^{b}	20.3 ^{b}
Low-density	7.1	32.7	10.3	8.4 ^{b}	31.0 ^{a}	16.6	6.9	16.0 ^{a}	22.1 ^{ab}
Medium-density	6.7	33.9	10.8	7.1 ^{b}	31.2 ^{a}	17.3	7.8	16.6 ^{a}	21.7 ^{ab}
Dense forests	5.7	34.9	11.1	6.1 ^{b}	32.5 ^{a}	16.1	5.8	18.2 ^{a}	23.1 ^{a}

Conclusion

The significant variation in the quality parameters measured in green leaves of the individual species (*D.glomerata* and *T.repens*), together with the lack of significant variation in the relative abundance of the most profuse families (grasses and composites) suggested that the **variation in herbage quality across the tree cover gradient is more related to the individual species' chemical composition than to changes in herbage floristic composition.** In any case, pasture in woodlands was more nutritious though less digestible and probably less desirable (but had more native plant species, which might encourage biodiversity conservation). However, the actual response of herbivores to quality changes by lenga canopy openness is unknown.