Variation of LDMC and SLA relationship between growth forms in natural grasslands

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Introduction In agro-ecological studies, there is a growing interest in measuring both leaf dry matter content (LDMC) and specific leaf area (SLA). This interest lies on the fact that leaf traits are linked to gradients of environmental factors and ecosystem functions. Working with three contrasting wild species, Garnier *et al.* (2001) proposed a model linking these two traits. The model shows a relatively simple non linear and negative correlation between LDMC and SLA. Nevertheless, none of the species used to build the model were *grasses* (GRA) or *forb rosettes* (ROS = i.e. dicotyledonous with large entire leaves and absence of stem at the vegetative stage); the species which make the largest contribution to the standing biomass of most natural grasslands. Furthermore, due to the divergent range of LDMC (and not SLA) values between these growth forms, Cruz *et al.* (2002) proposed that grass records alone could be used as an indicator of fertility gradients. The aim of this paper was to analyse discrepancies in the LDMC – SLA correlation with respect to model predictions in order to consider them in any development of LDMC-based tools for the management of natural vegetation.

Material and methods Data for LDMC and SLA were recorded in Pyrenean grasslands (France) growing in rich (site A = SA) and low (site B = SB) fertility levels and were compared to the model proposed by Garnier *et al.* (2001). Leaf traits were measured following the protocol proposed by these authors. The fertility level was assessed by the nitrogen nutrition index (Ni) (Duru *et al.*, 1997). Three GRA and two ROS, representing 60 and 10% of the biomass were measured in site A (Ni=88%), and six GRA and four ROS (45 and 30 % of the biomass) in site B (Ni=49%). Forty individuals were measured for each species at each site (Table 1).

Results The relationships between LDMC and SLA for grasses and rosettes diverge in opposite ways with regard to the model (Figure 1). For GRA, the model underestimates the SLA with an average root mean square deviation (RMSD) of 8.2 m^2/kg. The opposite is observed for ROS, with a RMSD of 15.6 m^2/kg. The average SLA is the same for the two groups; however the corresponding LDMCs are higher for GRA than ROS (more than 100 mg/g). Fertility had an effect on trait values but not on their relationship (Table 1).

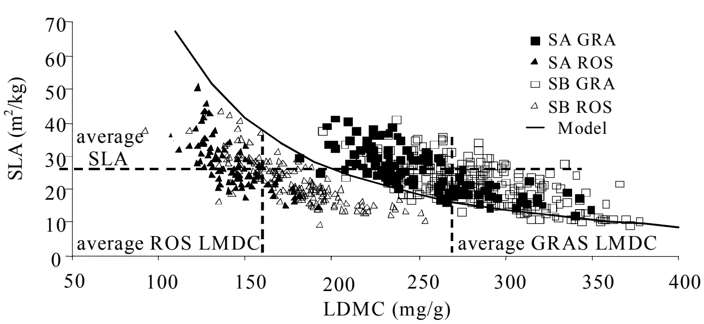

Figure 1 Relationships between LDMC and SLA for *grasses* and *forb rosettes* compared with the model curve (SLA=11.3 10^4 x$LDMC^{-1.58}$, Garnier et al., 2001)

Conclusions We conclude that there is not a single relationship between LDMC and SLA. Growth forms which are abundant in natural grasslands show very different LDMC values for the same SLA value. In order to use LDMC as an indicator of fertility gradients, we have to avoid mixing data belonging to different growth forms.

Table 1 LDMC and SLA for different growth forms in two Pyrenean sites that differ in nitrogen index (Ni)

Site/ Ni%	Growth Form	LDMC (mg/g)	SLA (m^2/kg)
A/88	Grass	252	25.70
	Rosette	143	27.44
B/49	Grass	281	22.25
	Rosette	178	22.48

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