**RESULTS OF A PLANT ASSEMBLAGE SURVEY**

(from supplementary material of Vanbergen *et al* (2014) *Functional Ecology* **28**: 178-189)

In each site, herbaceous understorey plant (vascular, bryophytes and macro-lichens) community composition and structure was measured in a series of six quadrats (1m2) randomly situated on the nodes of a 4 x 4 grid (15m2) situated at least 50m from the woodland edge. This sampling was carried out during July 2007 and 2008. The identity and visually estimated percentage cover of each species was determined enabling the plant species richness and percentage cover of broad plant groups (dicotyledonous herbs, graminoids, pteridophytes, and bryophytes) to be derived. The percentage cover of plant litter and bare, trampled earth was also visually estimated for each quadrat. Herbaceous understorey sward height (cm) was measured at the corners of each quadrat (24 measurements per site). Tree density and the trunk diameter at breast height (DBH) were recorded in a 25m2 plot centred on the sampling grid. Soil samples (6 bulked cores per woodland) were analysed for pH; phosphate (colorimetric PO4-P Olsen mg-1 kg-1); and total percentage of carbon and nitrogen (Elementar Vario EL elemental analyser).

**STATISTICAL MODELLING**

Plant assemblage structure was assessed using the linear ordination method of partial redundancy analysis (pRDA; CANOCO version 4·5) because of the short gradient lengths determined from a preliminary detrended correspondence analysis (DCA) (Axis 1 gradient length = 2.256). RDA identifies trends in the plant species data that are linearly related to a set of constraining, explanatory variables (ter Braak and Šmilauer, 1998). Potential explanatory variables included the presence or absence of livestock grazing (categorical variable), sampling year (categorical variable), tree density (n/25m2), sward height (cm), cover of bare and trampled soil and leaf-litter (%), pH and nutrient concentration of soil: phosphate (PO4 –P mg-1 kg-1), total carbon (%) and nitrogen (%). Variables derived from the plant species data (percentage cover of herbaceous dicots, graminoid monocots, bryophytes and pteridophytes) were fitted as supplementary variables to illustrate further trends in the plant assemblage and do not affect the variance explained by the pRDA. Prior to analysis, the percentage cover values were converted to the DOMIN scale to account for any differences due to recorder identity and then log-transformed prior to model fitting to minimise the influence of any outliers on the resulting ordination. Plant species that constituted only 1% of the total vegetation cover when summed across all sampled sites were removed from the data set to avoid the pRDA being biased by species that occurred only in a limited number of sites (ter Braak and Šmilauer, 1998). The significance of the explanatory variables in structuring the plant assemblage was determined with a forward selection procedure using Monte-Carlo tests constrained within sites (499 permutations). As the plant data had been collected in 2007 & 2008, sample year was treated as a temporal split-plot within the RDA analysis, and samples were permuted freely between whole plots (woodland site) only (ter Braak and Šmilauer, 1998). Thus, the model presented is a partial redundancy analysis (pRDA) controlling for site-level variance when assessing the impact of grazing, and covariates, on the plant assemblage.

**RESULTS***Plant Assemblages*

Total plant species richness (including wind pollinated species) tended to be greater in grazed (means ± SEM: 2007 = 31.4 ± 3.4; 2008 = 31.0 ± 3.6) than ungrazed (2007 = 24.8 ± 1.5; 2008 = 25.8 ± 1.4) sites, but these were not statistically significant in either year (GLM 2007: *F*1, 18 = 2.24 *p* = 0.1522; 2008: *F*1, 18 =1.09, *p* = 0. 3095). Plant assemblage structure was significantly modified by the presence of grazing livestock with the fitted environmental variables explaining 37% of the variance in the plant community data (Fig. 1). Grazed plant assemblages were generally more heterogeneous across sites than ungrazed plant assemblages (Fig.1). Grazed sites were characterized by dicotyledonous herb (e.g. *Trifolium repens*, *Ranunculus repens*, *Stellaria* *media*, *Prunella* *vulgaris*, *Cirsium* *arvense*, *Veronica* spp.) and grass (e.g. *Agrostis* *capillaries*, *Poa* *trivialis*, *Lolium* *perenne*) species relatively tolerant of grazing pressure (Fig 1). The ungrazed assemblages were typified by greater cover of pteridophytes (e.g. *Pteridium* *aquilinum*), sedges (e.g. *Carex* *panacea*), bryophytes (e.g. *Hylocomium* *splendens*, *Pseudoscleropodium* *purum*), and grasses intolerant of grazing pressure (e.g. *Molinia* *caerulea*, *Deschampsia* *flexuosa* (Fig 1). The pRDA axes were significantly (Monte-Carlo permutation tests of both first and all canonical axes: P = 0.002) associated with the plant species assemblage with the first axis explaining most (18%) of the total variance (Fig. 1). This primary axis of variation was positively correlated with the presence of grazing livestock (intra-set correlation coefficient = 0.96, p = 0.002), increasing phosphate load (0.63, p = 0.01) and soil pH (0.50, p = 0.04), and negatively correlated with plant litter cover (-0.72, p = 0.002) in explaining the plant species data (Fig. 1). The second RDA axis was positively and negatively correlated with soil pH (0.58) and phosphate load (-0.58), respectively, while the third axis was principally associated (0.68, p = 0.02) with unvegetated soil trampled by cattle (Fig. 1,). The sampling year (p = 0.69), size (p = 0.21) and density (p = 0.63) of trees, sward height (p = 0.39) and total percentage of soil carbon (p = 0.81) and nitrogen (p = 0.43) did not significantly structure the plant assemblages. The lack of a ‘year’ effect showed that the plant assemblage response was consistent between years.

**Figure S1** Partial redundancy analysis (pRDA) of plant understorey assemblages accounting for site-level variance (n=20) due to temporal split-plot (2007 & 2008). Forward-step wise fitted (Monte-Carlo global permutation test significance level: \*\*\*P ≤0.001, \*\* P ≤ 0.01,\* P <0.05) explanatory variables are represented by black solid arrows. Supplementary variables that did not influence the ordination are shown by black dashed arrows. Plant species vectors shown by grey dashed arrows.

