Multivariate analyses of visible/near infrared (VIS/NIR)

information content of a sample's VIS/NIR spectrum is very not provide any significant insights) as tools with which we

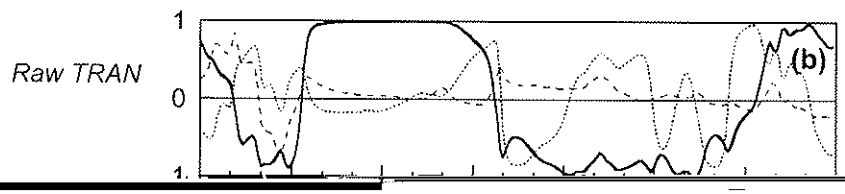
develop calibration equations to predict the chemical com- most between species, somewhat among elevations, and

position of a sample from NIR spectra (Bolster *et al.*, 1996; Reeves & Van Kessel, 2000; Reeves, 2001). Here, instead of

little (except for cellulose) between crown positions. Pigment content differed between species, and changed rapidly with

(species, crown position, mountain or elevation) a particular

New


Raw TRAN
1
0
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(b)

Table 1 *P*-values from statistical analysis of principal components derived from four sets of spectral data visible/near infrared (VIS/NIR) absorbance of dried, ground conifer foliage) in relation to experimental factors

Component	Prin 1	Prin 2	Prin 3	Prin 4	Prin 5	Prin 6
Raw STR (original, untransformed spectra)						
Species	**≤ 0.01**	0.62	**≤ 0.01**	**≤ 0.01**	0.32	**0.04**
Crown pos.	**≤ 0.01**	**≤ 0.01**	**≤ 0.01**	0.11	0.22	0.53
Elevation	**0.02**	0.26	**0.03**	**≤ 0.01**	0.29	0.18
Mountain	**≤ 0.01**	**≤ 0.01**	0.51	0.25	0.08	0.08
Raw TRAN (original spectra transformed with MSC, SNV and detrending)						
Species	**≤ 0.01**	**≤ 0.01**	**0.04**	**≤ 0.01**	0.06	**≤ 0.01**
Crown pos.	**≤ 0.01**	0.35	0.29	**≤ 0.01**	**≤ 0.01**	0.07
Elevation	**0.01**	0.14	**≤ 0.01**	0.12	**≤ 0.01**	0.84
Mountain	**0.03**	**≤ 0.01**	0.76	**0.04**	0.07	**≤ 0.01**
Species	**≤ 0.01**	0.38	0.94	**0.03**	0.61	0.76
Crown pos.	0.71	**≤ 0.01**	**≤ 0.01**	0.25	0.13	0.42
Elevation	**0.04**	**≤ 0.01**	0.35	0.17	**≤ 0.01**	0.20
Mountain	**≤ 0.01**	**0.01**	**0.03**	0.09	**≤ 0.01**	**≤ 0.01**
2nd STR (second derivative of original spectra)						
Species	**≤ 0.01**	0.32	**0.04**	0.09	0.68	0.38
Crown pos.	0.06	**≤ 0.01**	**≤ 0.01**	**≤ 0.01**	0.13	**0.01**
Elevation	**0.05**	**≤ 0.01**	0.10	0.37	**≤ 0.01**	0.98
Mountain	**≤ 0.01**	0.11	**≤ 0.01**	0.16	**≤ 0.01**	0.06

The split-split-plot experimental design is described in text. Two species (red spruce (*Picea rubens*) and balsam fir (*Abies balsamea*)), two crown positions (sun foliage and shade foliage), three elevations (low, mid and high), and three mountains (Whiteface Mt., NY, Mt. Mansfield, VT, and Mt. Moosilauke, NH, USA). Factors significant at $P \leq 0.05$ are shown in bold.

Table 2 Results of discriminant analysis of

Grouping variable	Spectrum	# Factors	RMSD	R^2	ASCC	CER

Table 3 Results of partial least squares (PLS) regression of sample characteristics against

classical methods of chemical analysis, it is necessary not only

a tool for rapid, cost-effective prediction of the composition of plant and animal tissues and aspects of animal performance. *Oecologia* 116: