Spelling out alpha-, beta- and gamma-diversity in coniferous forests of the American Pacific Northwest

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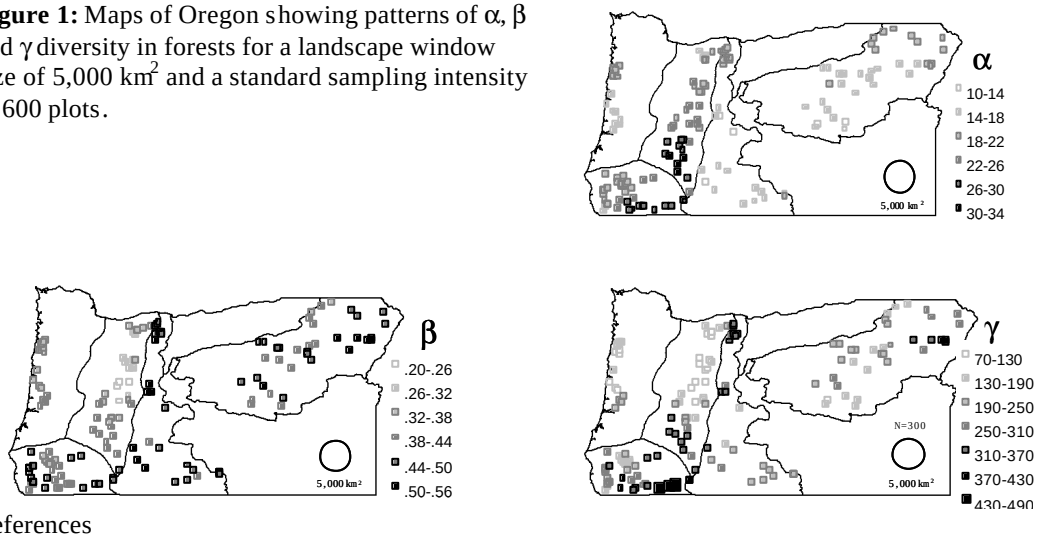
To make α-, β- and γ-diversity [1] of forest communities and landscapes amenable to quantitative comparison we defined them as parameters of species accumulation curves of a power function type. Curves were estimated for focal positions from a databank [2] of ca. 7,000 phytosociological plots in forests throughout Oregon (USA). Landscape grain was varied from 500 to 10,000 km^2. Estimated diversities were mapped for each grain, compared and related to climatic heterogeneity and to observed plot richness.

Maps of α- and β-patterns allow recognition of four types of forest landscapes: The Siskiyou Mts., the adjacent Southern Cascades and part of the Columbia Gorge with high α and β form obvious hot-spots. Moderate α and low β are combined in the rather species-poor forests of the Coast Ranges. The western Cascades have quite high α, but small turnover among stands, resulting in moderately rich floras. Large areas of Oregon's dry interior combine low α with quite high β, giving rise to secondary hot-spots as the Wallowa Mts.

Explanations of diversity from climatic heterogeneity was most successful at the 5,000 km^2 grain. Against expectations length of climatic gradients and geological diversity were more strongly correlated with α- than with β-diversity. Species turnover among stands depended most strongly on the range of aridity conditions present within landscapes. To understand environmental controls of diversity methods of measuring environmental heterogeneity require further development.

Figure 1: Maps of Oregon showing patterns of α, β and γ diversity in forests for a landscape window size of 5,000 km^2 and a standard sampling intensity of 600 plots.



References

[1] Whittaker, R. H. (1960): Vegetation of the Siskiyou Mountains, Oregon and California. Ecological Monographs 30:279-338.

[2] Ewald, J. (2002) A probabilistic approach to estimating species pools from large compositional matrices. Journal of Vegetation Science 13: 191-198.

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