Session 'Describing biodiversity patterns' / ORAL

CALCULATING GENERALIZED ENTROPY AS A MEASURE OF LANDSCAPE DIVERSITY IN AN OPEN SOURCE SPACE

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Landscape diversity generally relates to species diversity at a range of ecological levels, such as species community diversity and genetic diversity. Species-based measures of diversity such as species richness or species turnover are the most commonly used metrics for quantifying the diversity of an area.
Nonetheless, the assessment of species diversity in relatively large areas has always been a challenging task for ecologists, mainly because of the intrinsic difficulty in judging the completeness of species' lists and in quantifying the sampling effort. Since the variability in the remotely sensed signal is expected to be related to landscape diversity, it could be used as a good proxy of diversity at the species level.
However, free and open source tools (tools that allow access to the source code) for assessing landscape heterogeneity at different spatial scales are still lacking today. In this study, we aim to achieve the following: i) provide a theoretical background of the most commonly used diversity indices stemming from information theory that are commonly applied to quantify landscape heterogeneity from remotely sensed data and ii) propose a free and robust Open Source tool (r.diversity) consisting of source code (running in GRASS GIS) for calculating diversity indices. In particular, we will focus on Rényi generalized entropy as a continuum of diversity measures. While traditional metrics supply point descriptions of diversity, in Rényi's framework, there is a continuum of potential diversity measures, which differ in their sensitivity to rare and abundant.
As far as we know, this is the first example in which Rényi entropy is provided in an open source framework. Hence, r.diversity's code is available from the GRASS GIS source code repository (http://svn.osgeo.org/grass/grass-addons/raster/r.diversity/) for further modifications and for potential re-use in the development of new indices based on new or underused mathematical theory.
We expect that the theme proposed in this study will stimulate discussions regarding the opportunities offered by free and open source Software to calculate landscape diversity.

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ROOT SEQUENCING DOUBLES SMALL-SCALE PLANT RICHNESS MEASURES AND ALTERS DIVERSITY PATTERNS

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Plant species richness data exclusively describes aboveground vegetation; roots and rhizomes have never been included in richness measurements of natural plant communities. We measured the total number of coexisting plant species as well as the aboveground richness and the number of species additionally identified belowground. We made direct comparisons between above- and belowground richness of vascular plants in identical volumes (0.1 x 0.1 x 0.1 m) above and below the soil surface, using conventional species identification to measure aboveground richness and 454 sequencing of the chloroplast *trn*L(UAA) intron to measure additional belowground richness. Taxa detected using DNA-based identification of roots increased total small-scale plant richness up to two times that of aboveground richness alone. Newly-detected belowground richness increased strongly with soil fertility, a result contrary to the negative productivity-diversity relationships that are widely reported for aboveground vegetation. Our results indicate that conventional approaches to plant diversity measurements may overlook many species coexisting at a small scale. We also show that belowground diversity becomes relatively more important in conditions where aboveground diversity decreases. Measuring plant belowground diversity will profoundly alter perceptions of biodiversity and its response to both natural and anthropogenic factors.