Ecological Connectivity in the Carpathians
GIS model to detect the permeability of the Carpathians for particular "Umbrella Species"

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The Carpathian countries are on the way to modernize their infrastructures since the end of Communism. 1700 km of new motorways are expected to be constructed until 2013 in Czech Republic, Hungary, Romania and Slovakia. This run-to-development creates isolated natural areas, limiting dispersal and genetic exchange of some wildlife species. Large carnivores and herbivores, due to their habitat requirements and low densities of occurrence, react sensitively to landscape fragmentation. Thus, they are appropriate for designing a GIS habitat suitability model that covers their ecological preferences, which are assumed representative for other Carpathian species, too. Picking up that thematic issue, following the JECAMI (Joint Ecological Continuum Analyzing and Mapping Initiative) approach from the Alpine Space Project Econnect, BioREGIO, a project from the ETC South East Europe, aims to give a contribution to maintain biodiversity in the Carpathians. To explore the distribution of potential suitable habitats and the permeability of landscape, we have adapted a GIS suitability model in a three-step approach following the ecological characteristics of seven umbrella species for the Carpathians. The first step – the suitability model - identifies patches of suitable habitats by assigning different suitability values to topographic factors for each species. The factors regarding the ecological preferences of each umbrella species received biological weights, which were taken from published habitat model results. In a rule-based model approach, the geometric mean for each pixel is calculated from the values of each factor and of their weights. Hence the model designed for each umbrella species returns the suitability value (0-100%) indicating the appropriateness of a particular land cover patch (pixel) for dispersal. The second step reclassifies the suitability value from the first step, assigning a new weight, considering the proximity or the presence of an essential ecological factor for each species. The last step, the permeability model, sets a GIS moving window to analyze the spatial distribution of appropriate land cover patches for dispersal (neighborhood effect). The most probable corridors are identified applying a minimum cost analysis that calculates the less-costs-path for passing through the land cover matrix. This enables the detection of primary ecological corridors, core areas and stepping stones across the Carpathians. Wildlife observation and presence data are integrated to validate the model and the derived dispersal paths for each umbrella species. The expected results will be visualized through a web-GIS application highlighting also the physical barriers hindering the free movement of the considered species. It is assumed that the overlap of each umbrella species will locate the crucial parts of the Carpathians ecological network in which physical barriers are limiting dispersal and where ecological structures are necessary to be maintained to enable wildlife genetic exchange. The main advantages of this method are the possibility to consider the habitat factors' preferences in different classes, to combine habitat suitability evaluation for several species and to weight different factors in different ways, integrating expert knowledge and empirical models.