Evaluating Spatial and Temporal Fragmentation of a Categorical Variable Using New Metrics Based on Entropy: Example of Vegetation Land Cover †

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Associated with climate change and/or land use pressure, forest fragmentation is a spatio-temporal shrinking process that reduces the sizes of forest patches. This breaks up forest patches so increasing their number before the small ones progressively disappear. Fragmentation can be assessed spatially as a level of the current status of the fragmented spatial configuration and temporally as the level of the speed of the fragmentation process itself. Among the different landscape metrics based on patches as indicative measures for fragmentation, the Shannon entropy of the observed spatial distribution of categories has been of particular interest. Based on a recently suggested spatio-temporal entropy framework focusing on patch size and shape distributions, this paper shows how to derive useful fragmentation metrics at local and global levels, spatially, temporally or both. Moreover, it shows that using fully symmetric approaches between space, time and category within this framework, can lead to more sensitive fragmentation metrics as well as providing complementary local approach for cartographic representation. Land cover data simulations from land surface modelling to a 2100 horizon are used to illustrate the proposed fragmentation metrics.