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Editorial

Grassland Fragmentation: Introduction to the Special Issue

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The fragmentation of natural environments is one of the most cited causes of the loss of biological diversity, and consequently it has received a great deal of attention from the scientific community for decades [1–3]. In its simplest definition, fragmentation is the disruption of continuity [4]. Some authors consider fragmentation independent of habitat loss, and define it at the landscape scale as a pattern of spatial arrangement of the remaining habitat after anthropogenic disruption [5]. This concept has been so widely adopted that it has become an entrenched paradigm in conservation studies [6]. Authors often emphasize the dependence of changes on the amount of habitat remaining and the spatial display of the fragments, and define fragmentation as a process by which habitat loss results in the division of a continuous natural environment into two or more smaller fragments, separated from each other by a matrix of modified habitat [7,8]. Fragmentation affects natural environments through the reduction in area of the remaining habitat, the isolation of the fragments and the influence of the matrix through the resulting edges [4,9]. These changes drive alterations in species richness, reductions in population sizes, loss of genetic diversity and changes in landscape structure, among other effects [2,3,9]. The small size of the fragments, their isolation, the edge effect and the increased vulnerability to extrinsic disturbances have been postulated as forces that are key to the loss of biodiversity [4].

Fragmentation has been extensively studied in forest ecosystems, in which the most common process is the transformation of the landscape into a matrix of savannas or shrub lands that surrounds and isolates forest remnants [10–12]. Much less is known about the consequences of the subdivision of natural grasslands. Grassland ecosystems are essential for sustaining ecological services such as soil protection and prevention of erosion, the maintenance of the water cycle, the regulation of atmospheric gases, pollination and food production, in addition to hosting a great genetic diversity [13]. In spite of this, grasslands are recognized as the terrestrial biomes that are most at risk worldwide due to the great disparity between the rate of habitat loss and the degree of effective protection [14–16]. Due to the aptitude of their soils, natural grasslands of temperate and subtropical regions of the world have been almost completely transformed into agricultural fields [17], and remnants persist as archipelagos of ever smaller and ever more isolated patches [2].

This Special Issue of *Diversity* brings together two studies that approach this problem from different perspectives. They both refer to Eastern European grasslands which are not exempt from the situation described above. Previously, they occupied wide extensions in the Biogeographical Region of Pannonia, and at present they have been reduced to fragments that are considered biodiversity hotspots.

The paper by Szentes et al. [18] focuses on grassland verges. Using floristic and coenological surveys, they found that the age of verges is not the primary cause explaining the composition of plant communities; instead, landscape use and the width and position of the verges are responsible for these changes, and so are of primary importance for management decisions.

Szirmai et al. [19] studied the recolonization ability of forest steppe species, a transitional stage between forests and grasslands. They examined changes of species during

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secondary succession after different land uses. They found an increase in the number, proportion, cover and diversity of forest steppe species, which further strengthens the importance of these habitats, despite their highly fragmented state.

In the current scenario of global change, threats to biodiversity are expected to increase in number and magnitude [20], and in this context the ability of the remaining grasslands to sustain biodiversity and ecosystem services will depend on the quantity and quality of habitat remnants, their degree of connectivity and how they are affected by other anthropogenic disturbances, such as biological invasions [2].

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