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Geodiversity of Rewilding

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Rewilding is a novel way of managing nature reserves that involves minimal management with the aim to promote self-sustaining provisioning of ecosystem services. Trophic rewilding is an approach whereby a reserve facilitates both large herbivores such as bison and deer and top predators such as wolves and bears. A famous example of trophic rewilding is Yellow Stone National Park (8983 km²) in the USA, this mountainous landscape hosts both large herbivores and large predators. In contrast, in The Netherlands the Oostvaardersplassen (55 km²) is a flat man-made marshland, hosting domestic large herbivores such as red deers and horses without large predators. The success of these rewilding schemes is generally quantitatively evaluated against biodiversity metrics, i.e. the increase of plant or bird species richness in an area. The role of the components in geodiversity that promote or demote success is underexposed. Therefore, we aim to investigate how the interaction between large herbivores and predators shape the landscape, in particular how they affect the geodiversity by changing the rate and extent of surface processes such as erosion at fine scales, the dynamics of floodplain morphology on broad scales, and the altering of soil physical and chemical properties. It has become apparent that the changes in components of geodiversity depend, amongst others, on the total number of large herbivores in an area. More grazers, for example, result in lower diversity of vegetation structural types, more compacted soils and increased erosion. Therefore, changes in grazer densities may alter the quality and areal extent of geodiversity components at multiple scales. Geodiversity components may thus affect the way large herbivores use and interact with the abiotic environment in reserves. For example, a topographically diverse landscape may host localities to shelter against harsh weather conditions, and function as safe spots against predators. Although the practise of rewilding has been implemented for several decades, it is not clear to what extent geodiversity influences rewilding success. Here, we evaluate how components of geodiversity affects rewilding success against an independent success metric, and we assess in what way geodiversity may help to identify the success or the limiting factors of potential rewilding reserves. To do this we use openly available thematic digitized spatial data to calculate a geodiversity index that includes geomorphology, topographic openness, roughness and soil diversity. We use an ArcGIS Pro environment of selected nature reserves that are managed under a rewilding regime. We include change analyses of multi temporal satellite and aerial imagery in combination with field measurements to assess how geodiversity components influence rewilding success. Ultimately, we design a geodiversity-based suitability workflow to evaluate potential successful rewilding reserves

for highly fragmented landscapes such as in North Western Europe.