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Geodiversity assessment of French Guiana: the need to integrate geodiversity within land-planning

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Studies on geodiversity have been gaining prominent interest among the geoscientific community over the last decades. As operational concept, geodiversity implies a measurement and its application narrowed to a given spatial area. However, such concept is often integrated to support planning perspectives that focus mostly on geoconservation, neglecting other activities that might transform, destroy or exploit georesources. Furthermore, diversity alone might not account for the actual pivotal role that abiotic and interfacial components play in socio-ecological systems and their functioning.

In a first part, the present research reviews the geodiversity concept, integrated within a framework towards its operationalization for territorial management. Geodiversity is defined as the range of abiotic and interfacial resources – lithodiversity, superficial diversity, hydrodiversity, pedodiversity, geomorphodiversity, mineral diversity, paleodiversity and climate diversity – of a given area, including their constitution, assemblages, structures, properties and contributions to socio-geo-ecological systems. Geodiversity is therefore considered both in its typological and functional diversity, the latter one being related to the geo-ecosystem services (GES) that geodiversity provides to society. The characterization of geodiversity is completed with the identification of the anthropogenic drivers linked to land-planning strategies (e.g. urban projects, mining activities, agricultural practices) and that might affect, positively or negatively, GES supply.

The second part, aims at confirming the necessity of an operational framework through the assessment of geodiversity and its spatial patterns on the French Guiana case-study, an Oversea French territory located in South America, within the Guiana Shield. Almost entirely covered by the Amazon rainforest ecosystem of exceptional biodiversity, French Guiana is considered as an international conservation and land-planning challenge which faces multiple issues (e.g. urban, agricultural and industrial growth, forest management and gold mining planning). However, French Guiana geodiversity and its management are not properly acknowledged by land-planning strategies.

The assessment of geodiversity of French Guiana was performed through the creation of a 10x10

km grid in a GIS environment. Lithodiversity and superficial diversity, hydrodiversity, geomorphodiversity and mineral diversity sub-indices were assessed based on the number of entities within each grid-cell. The four sub-indices were summed to obtain a geodiversity index. Local Moran's I was then used to identify geodiversity hotspots and coldspots.

Geodiversity hotspots were found mainly along the gold-bearing greenstone belts crossing French Guiana. However – despite the fact that further data must be integrated for soil and paleontological resources that are still little known at the scale of the whole territory – some areas showing low geodiversity are known to display important points of geological interest (from a geoheritage perspective). Therefore, this research allows to review a more comprehensive definition of geodiversity and to highlight the necessity of standardized datasets and classification methods to assess all geodiversity components. The assessment of diversity alone is not enough for geoconservation nor broader land-planning perspectives. It is pivotal to account for the contribution of geodiversity to the functioning of a given area and its interaction with anthropic activities. Geofunctionality can be assessed through proper datasets identifying and quantifying GES flows (i.e. supply-demand), for instance, through Essential Geodiversity Variables.