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Semantic-based, multi-source classification of Nature Conservation areas in Rhineland-Palatinate using conceptual modelling in combination with data mining methodologies

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ABSTRACT:

The European Environmental Agency (EEA) developed the European Nature Information System (EUNIS) to assist NATURA 2000 environmental reporting required by the EEA. Manual fieldwork for biodiversity reporting on a regional and local level is costly and time consuming. Thus, automated methods to derive information about nature conservation areas by taking into account spatially inclusive and comprehensive datasets are needed. Ontologies offer great opportunities in conceptual modelling of the EUNIS nomenclature and by using its reasoning capabilities to classify habitat areas based on various input sources. This work provides a conceptual modelling framework for EUNIS forest habitats including a shared vocabulary of biodiversity indicators stored in an OWL2 ontology. To utilise ontological reasoning for the classification process, classes of the ontology have been formalized using class restrictions (object properties and indicators or data property and value ranges). Additionally, pre-segmented geometries (stored as OWL individuals) and respective zonal statistics have to be included (stored as data property assertions) in the ontology. Moreover, the developed methodology shows possibilities of combining reasoning-based ontological classification based on various data sources (DEM indices, orthophotos, forest cadastre, etc.) and statistical data mining methods (Random Forest, Boosted Regression Trees). In this study, we first use data mining approaches to describe the suitability of data sources (feature importance) and determine relevant value ranges to develop the knowledge-based classification rules. In a next step we utilise semantic reasoning for the habitat classification. For this study forest areas of the German federal state of Rhineland-Palatinate are used as observation areas.

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