GIS modelling of stone aggregate extraction potential in Dalmatia, Croatia

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Geographic Information Systems (GISs) are very useful exploration-oriented tools for processing of spatial data, which enables the production of potential and predictive maps for a given commodity (e.g. stone aggregates), which can be used in spatial planning decision-making. The Dalmatian region is an area that has high production of primary and secondary aggregates (debris from dimension stone production). In the four Dalmatian counties aggregates and natural stone is quarried at 155 sites and there are 73 abandoned sites. Most aggregate producers in the study area are sited in counties with high population densities. Negligible aggregate producing operations are sited in municipalities with low population densities, reflecting the lack of a sufficient market demand for aggregate in most rural areas.

Weights of evidence analyses (WofE), modelling was used to measure associations between the sites and different spatial features in a way that their individual effects could be evaluated and used to infer relative influence on development. As transportation or population features change due to planning or actual development, the models can be easily revised to reflect these changes.

WofE is principally based on map-correlation and map-integration processes, in order to define relationships between spatial layers (e.g. GIS layers containing environmental variables) and combine predictor factors in supporting a hypothesis. In this study, the response variable is the set of point locations of current aggregate and natural stone quarries (termed training sites), and the predictor variables (termed evidence themes), are thematic map layers (scale 1:100,000) showing transportation network patterns,

population density distribution, maps of geological mineral potential, and areas of mineral exploitation restrictions defined by Master plans of the counties (protected areas and landscapes, distance to the coast) and production information,. The evidence themes have categorical values (e.g., aggregate production status), or ordered values (e.g., distance to an object such as a highway). For each evidence theme, a pair of weights is calculated relative to the training sites (aggregate and natural stone quarries), one for presence of the evidence criteria (w+) and one for absence of the evidence criteria (w-). The magnitude of the weights depends on the measured spatial association between the evidence theme and the training sites.

The results of this analysis can be used to manage better the use of mineral resources in Dalmatia based on identification of more suitable areas for stone production taking in account both environmental and marketplace restrictions.