Risk Assessment Modelling of Coal Fires Using Artificial Neural Networks and GIS

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Abstract

Coal fires endanger the environment including coal resources and human infrastructure. Hence, early coal fire detection as well as efficient prediction is necessary to avoid coal fires. Artificial neural networks using artificial intelligence were used for the modelling and prediction of the probability of coal fires on a country-wide scale.

Generally, artificial neural networks (ANN) are used for statistical modelling of spatial events in geosciences. The advantage of neural networks is their ability to understand and represent complex interrelations between numerous influencing parameters through learning from known (spatial) events and to apply the knowledge to areas that haven't been investigated yet.

The software advangeo® was developed to enable GIS users to apply methods of neural networks on raster geodata. The statistic modelling results can be displayed user-friendly within ESRI ArcGIS environment. The complete workflow is documented by the software.

This paper presents a case study, which dealt with spatial prediction of coal fires in the People's Republic of China on basis of existing base raster data (elevation, mean annual temperature, total annual precipitation, population), derived raster data (elevation gradient, distance to surface water, landcover, existence of Quaternary cover units), vector data of influencing parameters (coal rank / type, raw ash content, sulphur content, volatile matter) assigned to known coal field locations and selected known coal fire events.

As result, a map of probability of the occurrence of coal fires is compiled, which can be used for the risk assessment and, furthermore, for the prevention of coal fires. Based on the different weighting of the influencing factors in the developed neural network, conclusions can be drawn about the significance of certain factors for the appearance of coal fires.

Keywords: artificial neural networks, risk assessment, coal fires, advangeo ®