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Mapping of forest habitats vulnerable to fires using Corine Land Cover database and digital terrain model

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Abstract

An appropriate system of fire detection and proper preparation of the forested areas for emergency and fire extinguishing activities have a significant impact on the magnitude of losses caused by forest fires. The basis of the forest fire protection planning is the forest categorisation in the context of fire risk, which is performed on the basis of the percentage of area covered by the most vulnerable habitats: dry coniferous, fresh coniferous, fresh mixed coniferous, wet coniferous, wet mixed coniferous and riparian forest. Maps of forest habitat are available for the State Forests however for private forests this information does not exist, so the proper categorisation of fire risk in these forests is very difficult and costly. The object of the study is to develop a method for the estimation of the area cover of the above-mentioned forest habitats using open source data Corine Land Cover (CLC) database and SRTM - Digital Terrain Model in order to fill the information gaps for the private forests. Employing GIS environment the analysis of the correlation between CLC land cover classes and specific forest habitat was performed. Then, the terrain characteristics such as curvature and slope were correlated with habitat humidity. Also, the shape analysis of units was carried out. On the basis of these three parameters was estimated the areas covered by fire vulnerable habitats for forest inspectorates in central and north-west Poland where the state forests constitute 98% of the area so the ground verification data was accessible for almost the entire terrain. The overall agreement between obtained and reference maps is 89%, and the error of the estimation of the specific fire vulnerable habitats is lower than 20%. The proposed method is relatively fast and low-cost and may be used for fire risk categorisation of the forested areas where the ground verification information is not available.

Keywords: fire detection, Corine Land Cover (CLC), forest habitat

1. Introduction

The appropriate organisation of the fire detection system and preparation of forest areas to conduct prevention-extinguishing activities has a significant influence on the size of losses caused by forest fire. The basis for planning activities in the extent of forest fire protection is the forest fire risk category (KZPL). It is determined according to the requirements specified in the Ordinance of the Minister of the Environment of the 22nd of March 2006 concerning detailed principles of forest fire protection of forests (Journal of Laws No. 58 entry 405 with subsequent amendments). It concerns forests of a similar level of susceptibility to fire, established on the basis of frequency of fire occurrence, stand and climatic conditions and anthropogenic factors. This category is established on the basis of the sum of points resulting from calculations for four, following parameters:

\begin{enumerate}
  \item average annual number of forest fires in the period of the last 10 years per thousand hectares of afforested area,
  \item sums of percentage participation of stands growing in habitats: dry forest, fresh forest, moist forest, moist mixed forest and riparian forest,
  \item average relative air humidity at height of 0.5 m and percentage of days with air humidity less than 15% at the hour of 9.00,
  \item average number of inhabitants per hectare of forest area.
\end{enumerate}