Application of R in Remote Sensing and Spatial-Temporal Assessment of the Dynamics of Forest Ecosystems in Croatia

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Abstract

R is a programming language and open-source environment which integrates data management, calculations and graphical interpretation of results (https://cran.r-project.org/). Development of R began at Bell Labs in 1992 and the first stable version came out in 2000. R was originally intended as a statistical and graphical system and eventually progressed into a consistent system with practical applications in many analytical disciplines (envirometrics, econometrics, genetics, biometrics, social analytics, etc.). One of the most pronounced possibilities of R comes to the fore in analysis of spatial time series data, where R concurrently represents database management system and a functional geographic information system with advanced capabilities for statistical learning and processing, making it an extremely powerful tool for modern geoinformation research. R is currently being applied within the project of the Croatian Science Foundation AFORENSA (Advanced Forest Ecosystem Services Assessment), which is collaboration between the Croatian Forest Research Institute and the Faculty of Geodesy, Department of Geoinformatics. The project aims to determine dynamics of the functional state of forest ecosystems in Croatia using multispectral satellite data series (AVHRR, MODIS, Landsat), analyze the impact of climatic drivers (changes) and predict future development of forests with respect to the progression of climate change. The basis for the implementation of the project is a static map of forest ecosystems in Croatia, produced on the basis of several decades of field surveys and research studies regarding forest types in the Croatian Forestry Institute. Field maps obtained from the forest typological research were integrated into the "Dynamic geoinformation system of the forest ecosystems in the Republic of Croatia" within the technological project STIRP, funded by the Ministry of Science and Technology, 2003-2007 (Faculty of Geodesy and Forest Research Institute Jastrebarsko). This paper presents the results of present research within the HRZZ project AFORENSA concerning the application of R to integrating time series of satellite images (AVHRR, MODIS), series of daily raster data of European climate database (ECA & D), static vector maps and raster coverage (DTM, soil map, hydrography, etc.) with the aforementioned map of forest ecosystems in Croatia as the basic cartographic layer.

Keywords: R, spatial time series analysis, forest dynamics, remote sensing, map of forest ecosystems in Croatia