

Spatial Analysis of Groundwater Regime in Lowland Forest Areas in Croatia using GRASS GIS

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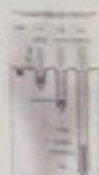
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INTRODUCTION

Pedunculate oak (*Quercus robur* L.) forests cover 10% of the total forested area in Croatia, approximately 210 000 hectares, mainly in the lowlands in floodplain regions along the Sava, Drava and Danube Rivers. The main ecological factor, which determines their survival and productivity, is the abundance of soil water. High groundwater tables and groundwater regime on these sites have a key role in maintaining sufficiently high soil water content. The monitoring of groundwater levels was established in major forest complexes where measurements were taken at a large number of piezometric stations on a weekly basis and have been collected for over a decade.



Piezometric stations on different sites



STUDY SITES

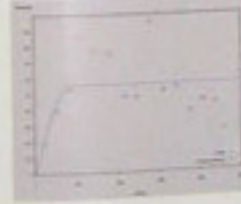
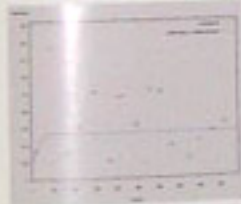
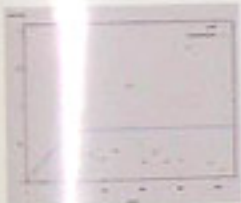
This research was performed by undertaking long term groundwater monitoring at 59 piezometric stations in tree forest complexes in the floodplain forest area in Croatia. The forest areas under consideration are situated in: Kupčina in the north-western, Nasice in the eastern part and Cesma in the mid-region of Croatia. The Kupčina and Cesma Forests belongs to the pluvial climatic regime of Sava River catchment and Nasice Forest to the glacial regime of Drava River catchment. The accompanied soils are mainly gleysols, fluvisols and gleic luvisols.

THE AIM OF THE RESEARCH

•The aim of the research was to explore the spatial structure of piezometric data and to predict groundwater table on tree different lowland forest complexes under consideration.

•According to these results the general differences in the groundwater table characteristics which occurred in similar forest types of floodplain forests in two different water regimes were distinguish.

Semivariograms of groundwater data



METHODS

•Monitoring groundwater levels in forest areas of Kupčina (1994-1997) at 15 stations, Cesma (1995-2000) at 22 piezometric stations and Nasice (1997-2001) at 22 piezometric stations twice a week.

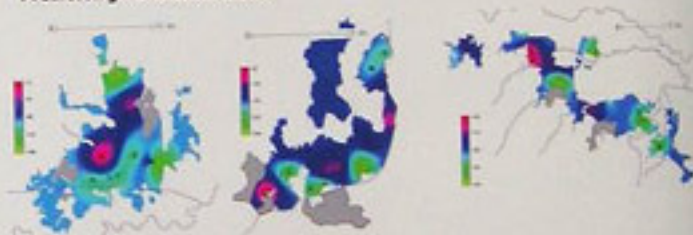
•Averaging the collected data i.e. calculation of averages during the growth season (1.4.-30.10.)

•Undertaking spatial analysis through the use of GRASS (Geographical Resources Analysis Support System) and Gstat (geo statistical package)

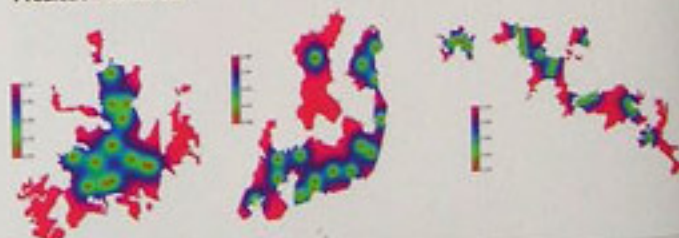
•Calculating semivariogram on log-transformed data, and for predictions ordinary kriging was used.

•Analysing histograms of layers interpolated through the use of Inverse Distance Weighted Average (Idwa) method to accomplish knowledge of groundwater table distribution and basic groundwater parameters.

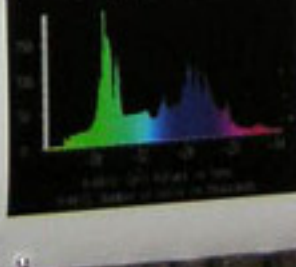
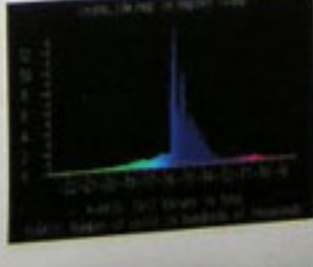
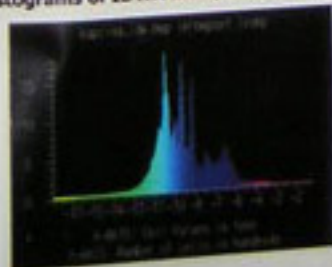
Predicted groundwater tables



Prediction variances



Histograms of IDWA interpolated maps



THE RESULTS AND DISCUSSION

1. The variograms showed spatial dependence of groundwater levels of approximately up to 3000 m in Kupčina, 700 m in Cesma and 5000 m in Nasice.
2. Modeling of spatial variability of groundwater tables is under the strong influence of site specific factors such as soil heterogeneity and forest stands evapotranspiration. Therefore the use of predicted maps can be unsatisfactory in some degree i.e. greater care should be taken regarding outliers.
3. From histograms of Idwa maps was established that the highest groundwater levels were in Kupčina, intermediate in Cesma and the lowest in Nasice. These results follow the difference in soil physical properties, mostly soil permeability which is most favourable in the Nasice area and least favourable in the Kupčina basin.