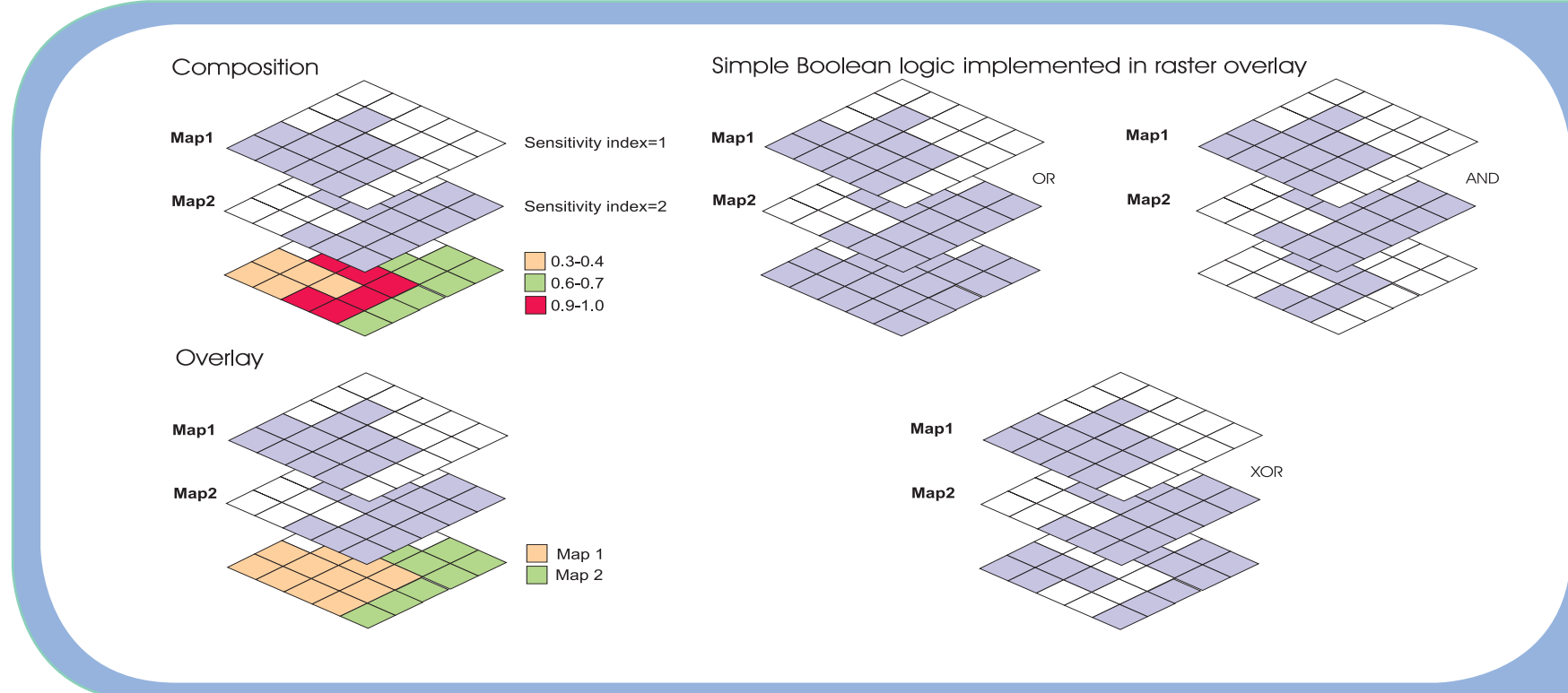# Environmental Sensitivity Mapping

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Abstract

Environmental sensitivity maps become one of the very important tools in ecology. They are finding wide use in the resource assessments, recreational planning, biodiversity conservation, environmental impact assessments, and many others areas. They are important, for example, in the oil spill contingency planning process. However, the environmental sensitivity maps are usually prepared as a hard copy. They are rather complicated, include many special symbols, a lot of intercrossing colored areas, etc. That is why, they are difficult to read and analyze, and they do not allow to see the processes in dynamics.

A special Environmental Sensitivity Mapping software tool that based on the raster digital maps overlay has been developed and tested using data for the Black Sea region. This interactive tool uses original method of the "waited" maps overlay. It operates an unlimited set of maps. The input maps can be taxon based or non-taxon based. One can also use jointly the maps calculated as a result of modeling and the maps based on the field observations. For each map user can define an aggregate environmental sensitivity value, which represents the integration of different parameters such as sensitivity, vulnerability etc. In contrast to the paper maps, where the values are set up by developers, this tool allows users to set values themselves according to their needs and interests. After the input maps are chosen and environmental sensitivity values are defined, the several operations can be performed. They are raster Boolean overlay operations and arithmetic overlay operations. From this a great variety of generated maps can be created, combining the various sensitivity parameters. There is a possibility to add your own color scheme for values for the resulted map. So, user can "play" with data changing weight of different species, the represented season, etc.

Introduction

Among all the inland seas, such as the White Sea, the Baltic Sea, and the Mediterranean Sea, the Black Sea is the most isolated from the world ocean and one of the most seriously threatened European seas. Pollution by land-based sources and as a consequence the destruction of habitats, over-exploitation of marine living resource, coastal degradation, water borne diseases, the introduction of exotic species and maritime pollution caused by the transportation of hazardous substances endanger the ecosystem of the Black Sea. In regions such as the Black Sea there is an urgent need to determine areas of high concern.

The usage of powerful GIS systems often requires specialized skills and training. It is frequently inappropriate technology for the scientists or managers who have to make the ultimate decision. Environmental Sensitivity Mapping tool is the first step in the direction of development the full-scale easy-operated GIS based tool for creating maps of environmental sensitivity.

Environmental Sensitivity Mapping tool shows the relative importance and priority of areas within the Black Sea region. By combining biological, physical, socio-economic etc. information the user can build a cumulative index of a region according to the issue being assessed. The objective of the Environmental Sensitivity Mapping tool is to show where the different resources are and indicate environmentally sensitive areas. It can be used by environmental scientists to respond to emergencies and make decisions about land development, disaster response and planning as well as to assess the environmental impact of real or hypothetical events.

Environmental Sensitivity Mapping tool implements different operations with raster maps. Despite the fact that the result of some combinations of these operations can't make sense, the great variety of maps with different environmental meaning can be created.
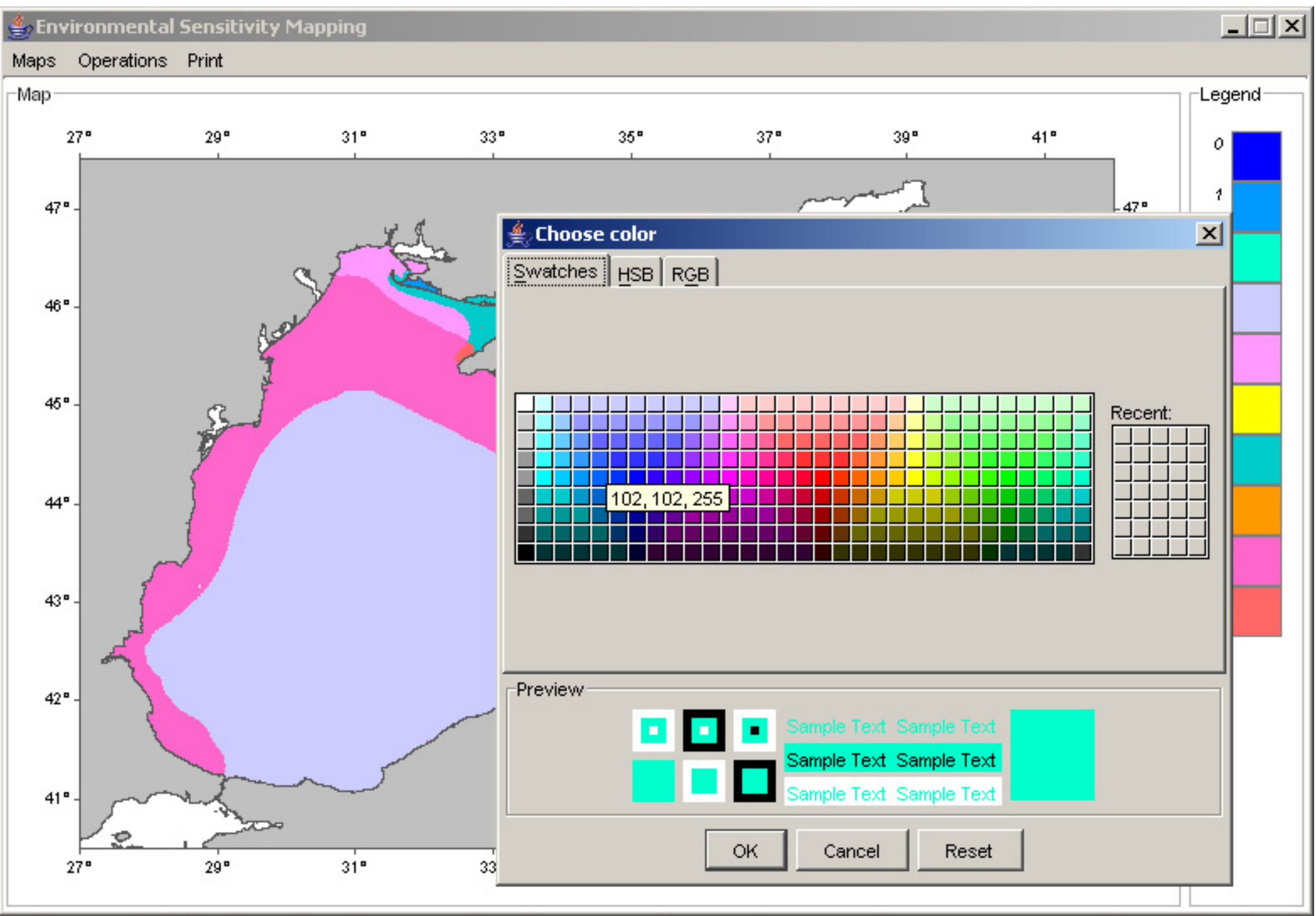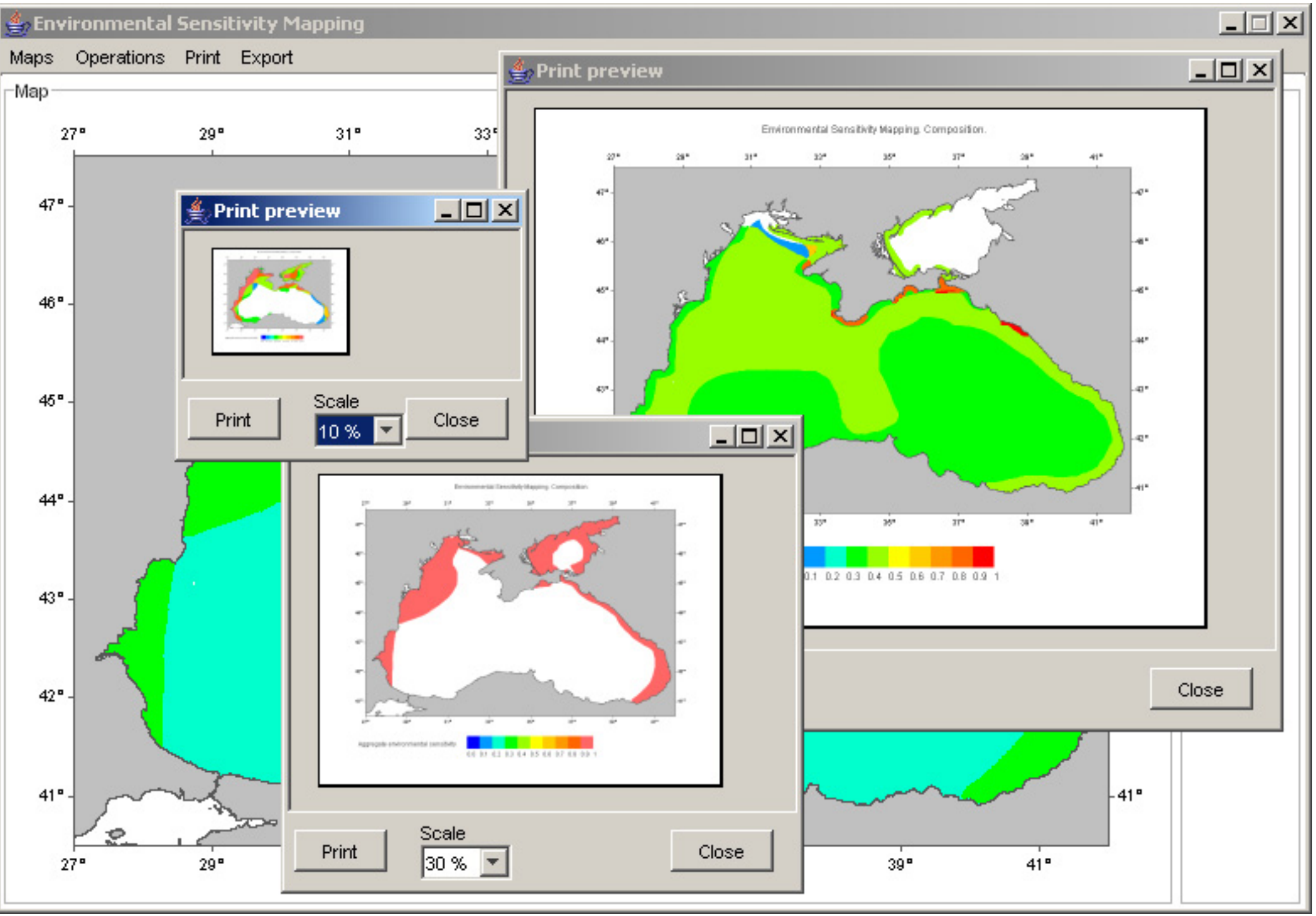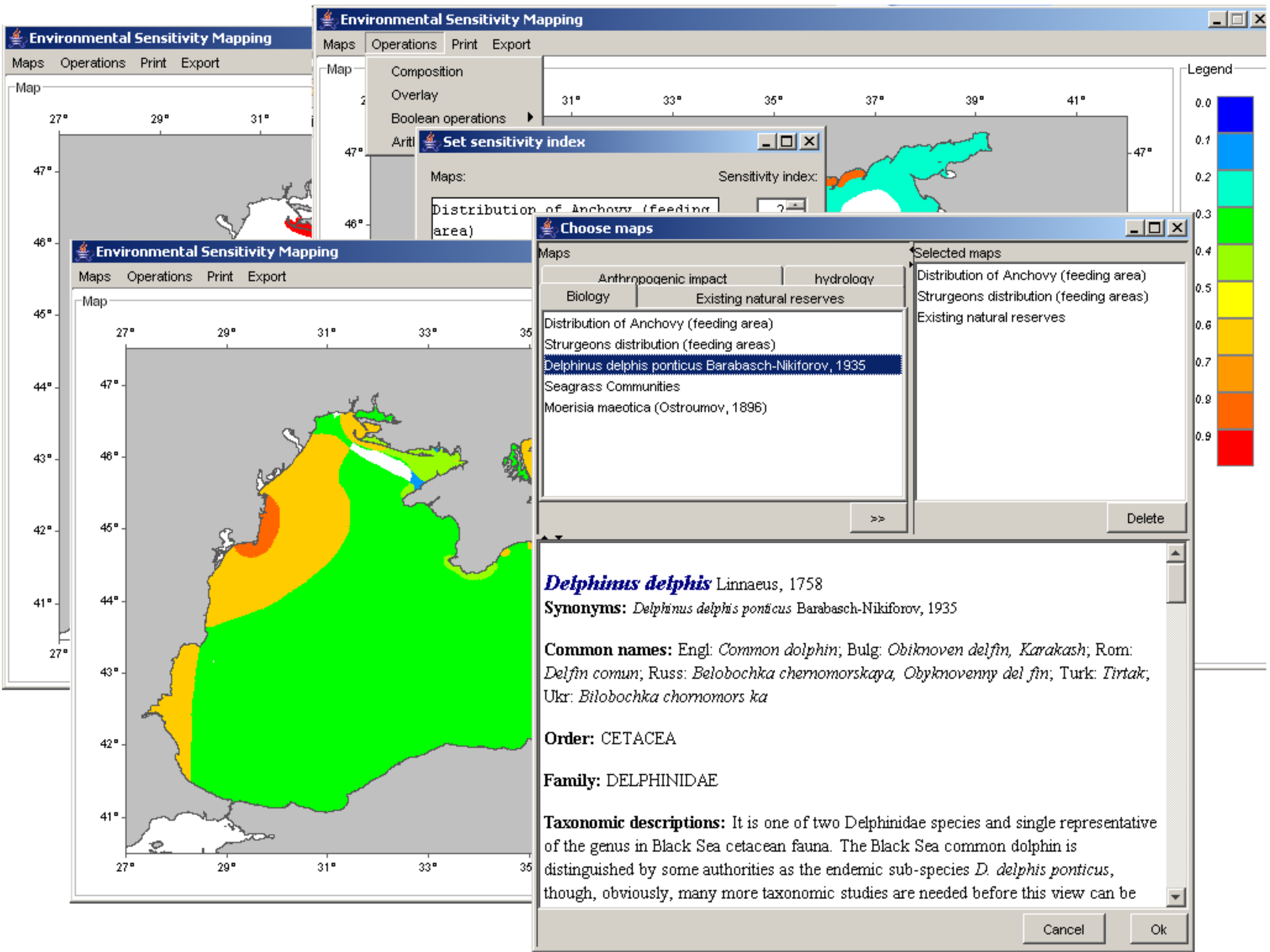

Fig. 2 Customizable color scheme of the sensitivity map

Fig. 3 Environmental Sensitivity Mapping tool in work

Fig. 4 "Playnig" with maps and indexes

Using maps prepared for the Environmental Sensitivity Mapping tool in 4 main categories (hydrology, biology, anthropogenic impact, and existing reserves) user can obtain a great number of sensitivity maps. An expert or scientist chooses the number of maps and index with a relative value between 1 (least) and 10 (most) is assigned to each map to reflect the degree of sensitivity. The areas outlined on the sensitivity maps represent an aggregate environmental sensitivity value.

The main advantages of Environmental Sensitivity Mapping tool is that it can be used by scientist and expert without special GIS skills. At the one touch of the button they can create the great number of sensitivity maps. The information needed for sensitivity maps can be obtained from existing, scientific publications, topographic maps, photographs and environmental data held by organizations such as government departments, universities, conservation groups.

Objectives for the future development

Develop vector based Environmental Sensitivity Mapping tool for the Black Sea region

Identify types of information which could be included on maps

Develop the set of symbols for sensitivity mapping.

Taking into consideration that the sensitivity of many of the resources may vary seasonally, and it is useful to include seasonal information on sensitivity maps, develop methods of doing this.

Identify what kind of textual or tabular information should be linked to the maps.

Realization

Environmental Sensitivity Mapping tool is written in Java language. Information about maps categories, maps and maps metadata is stored in HSQLDB. HSQL Database is a relational database engine written in Java, with a JDBC driver. The database engine is the part of the application program in the same Java Virtual Machine, so there is no need to install Database Engine.

For the existing version of Environmental Sensitivity Mapping tool several raster maps were prepared using different sources of information.