БЪЛГАРСКА АКАДЕМИЯ НА НАУКИТЕ • BULGARIAN ACADEMY OF SCIENCES
ПРОБЛЕМИ НА ГЕОГРАФИЯТА • 3–4 • PROBLEMS OF GEOGRAPHY
София • 2019 • Sofia

RECONSTRUCTION MODELS OF THE SVISHTOVSKO-BELENSKA WETLAND SYSTEM DEVELOPMENT

Georgi Zhelezov[1]

The present research is related to the problem of spatio-temporal transformation of the Svishtovsko-Belenska wetland system. The investigation is based on the information generated from old maps covering different time periods. Using these data reconstruction models of the wetland system have been developed.

Keywords: reconstruction model, wetland, system

РЕКОНСТРУКЦИОННИ МОДЕЛИ НА РАЗВИТИЕТО НА СВИЩОВСКО-БЕЛЕНСКАТА СИСТЕМА ОТ ВЛАЖНИ ЗОНИ

Георги Железов

Резюме: Системите от влажни зони са едни от най-бързо променящите се природни системи. Значението на влажните зони се определя от факта, че те предоставят разнообразни екосистемни стоки и услуги. Настоящото изследване е фокусирано върху проблемите с пространствените трансформации на Свищовско-Беленската влажна система в България, която е част от водосбора на р. Дунав. Генерирането на различни пространствено-времеви модели въз основа на стари карти дават възможност за изследване на състоянието и параметрите на системата от влажните зони. Въз основа на тези резултати се генерират реконструкционни модели. Изследването на пространствените изменения във времеви порядък е надеждна платформа при процесите на планиране и оптимизиране на стопанските и природноконсервационни дейности в региона.

Ключови думи: реконструкционен модел, влажна зона, система

[1] Depatment of Geography – National Institute of Geophysiscs, Geodesy and Geography, Bulgarian Academy of Sciences, gzhelezov@abv.bg

INTRODUCTION

Wetlands are one of the most dynamic and fast changing natural systems on the Earth. They respond even to the smallest changes of the environment state. In this aspect they may be used as a reliable basis to determine the quality of the environment and the degree of anthropogenic transformation in a specific area.

Wetlands have versatile significance:

– Wetlands contain huge water masses and represent valuable fresh water reservoir.

– Wetlands take part in the water cycle and support the basic living systems on the Earth - their functioning, dynamics and productivity.

– Wetlands have important filtration and purification functions with regard to the drinking water globally.

– Wetlands are a centre of versatile business activities.

– Wetlands protect many lands from flooding.

– Wetlands are the habitat for many fish species.

– Wetlands are rich in plantation and animal species and include unique landscapes.

– Wetlands are connected with the cultural identification of many people and countries worldwide.

MODELS AND MODELING

Models in geographic researches are commonly based on analogies. Analogies with regard to natural phenomena, public and economic phenomena, alphabetic-numerical images and mathematical formulas. Haggett & Chorley (1967) determine three basic groups of models - model analogies to natural systems, models of specialized systems and models of general systems.

The model is also reviewed as a part of the bilateral link „model - theory“. The model is applicable upon verifying the evidence for specific theory. To be used correctly it must be determined which function is paramount and how to arrange data in order to complete a specifically assigned function. In this meaning an important function of the model is the theory interpretation but in such a way that it is not identified with it but turns the meaning of the model to the logic of the theory itself.

In this regard Harvey (1969, 1996) identifies prior models (direct A=B) and posterior models (A/B). Prior models are based on building a theory. In this regard the problem of interpretation of calculations is very important. These models precede the theory from cognitive point of view. Posterior models are obtained by using formalized theories. The beginning is connected with empirical observations. These models simplify the procedure for theory verification. The obtained results may be transferred to the theory. If the verification proves successful result of modelling, then this is determined as successful theory. In geography are applied mainly prior models. If the model is not good then follow wrong (incorrect) forecasts.

According to Smyth (1998) spatial (mapping) models are reviewed as abstracts of reality. The latter contain only those features of reality, which are important for

the interpreted object. The model as an abstraction presents aspects of the real world, which may be manipulated and analysed in the past, determine the present and offer opportunities for forecasts.

The condition of the systems of wetlands may be characterized theoretically through the deterministic models of Gurney, Nisbet (1998). These types of models are used upon determination of the conditions and the states of the system. The model testing is connected with the ability of the model to provide solutions.

The basic state is defined as Xt– a given state in a given model. The resulting state is defined as $Xt+\Delta t$. Ensuing from this formalistic state, it may be determined that:

$$Xt+\Delta t= f(Xt)$$

The subsequent state is always a result from the impact and influence of different groups of factors. Generating the spatial models is achieved by the application Head-up Digitizing technology and direct extraction of the output mapping materials.

The reconstruction models are reviewed in this aspect. Their options give real opportunities for restoration of the state of specific mapped objects for past periods of time and their presentation in accessible form. They provide a real platform for tracking the dynamics and the evolution of the systems in space and time. A specific research is focused on the systems of transformation and main reasons for changes of the landscapes in Svishtovsko-Belenska lowland.

RESEARCH OBJECT

The Svishtovsko-Beleneska lowland is a part of Danube plain in northern Bulgaria (Fig. 1). The lowland stretches between the Danube River, the northern slopes of Nikopolsko Plateau to the southwest and south and the Svishtov Plateau to the southeast. To the west it reaches 4 km to the east of the town of Nikopol and to the east to the town of Svishtov. The length of the lowland from the west to the east is 38.2 km and the width is 5 - 6 km with total area171 km².

The lowland is divided on two general parts. The lower part is a floating terrace on the Danube River and is divided into two distinct parts: Belene valley to the west and Svishtov valley to the east (Svishtovsko-Belenska lowland). It is built of river beds and has a high level of groundwater. Somewhat higher is to the north to the Danube coast, and in the southern part, where it is lower in the past, there were situated wetland area (Svishtov marsh and Belene marsh). Drainage activitiess and river dike have taken place and now only the protected area „Kaikusha“ is left wandering. The soils are presented basically by Fluvisols. The region actively used for agriculture activities.

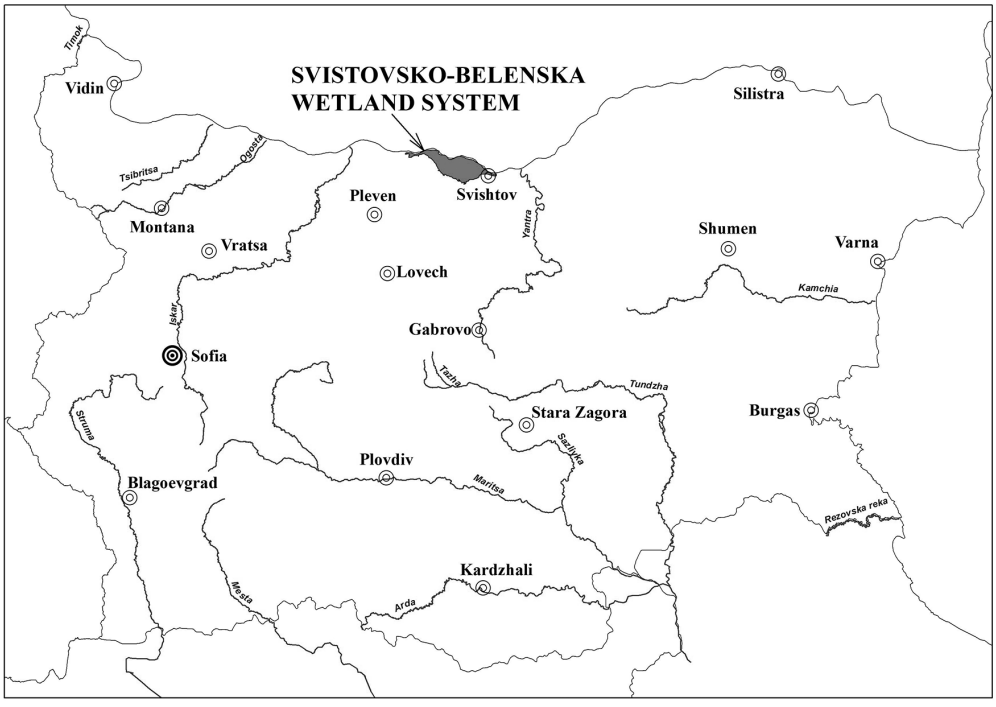

Fig. 1. Position of the Svishtovsko-Belenska lowland with wetland system

RECONSTRUCTION MODELS OF THE LANDSCAPES IN SVISHTOVSKO-BELENSKA WETLAND SYSTEM

The reconstruction models show specific states of the natural and social systems. They enable recovery of the system state in past periods of time. Another aspect of the work of the reconstruction models is the ability to track the dynamics of the system development (evolution and degradation). In combination with the potential of the spatial models is achieved a real ideas about the spatial - temporary dynamics and the processes running in the systems.

The first examined state of the Svishtovsko-Belenska wetland system (Fig. 2) is based on analysis of a map of 1880. Wetlands are presented as a water body with open water table without identifying hydrophytic formations. To a great extent it may be considered that this state is a result of the natural evolution of the system and cleary shows the connection between the Danube river and wetlands in the lowland.

The second examined state of the Svishtovsko-Belenska wetland system (Fig. 3) is based on analysis of a map of 1903. It shows the overall spreading of the wetland system and it coincides with the flooding zone of the Danube River. There is clear information for flow of river waters in the wetland system.

The third examined state of the Svishtovsko-Belenska wetland system (Fig. 4) is based on analysis of a map of 1920 . Similarly to the state two, it presents the natural parameters of the system of wetland system.

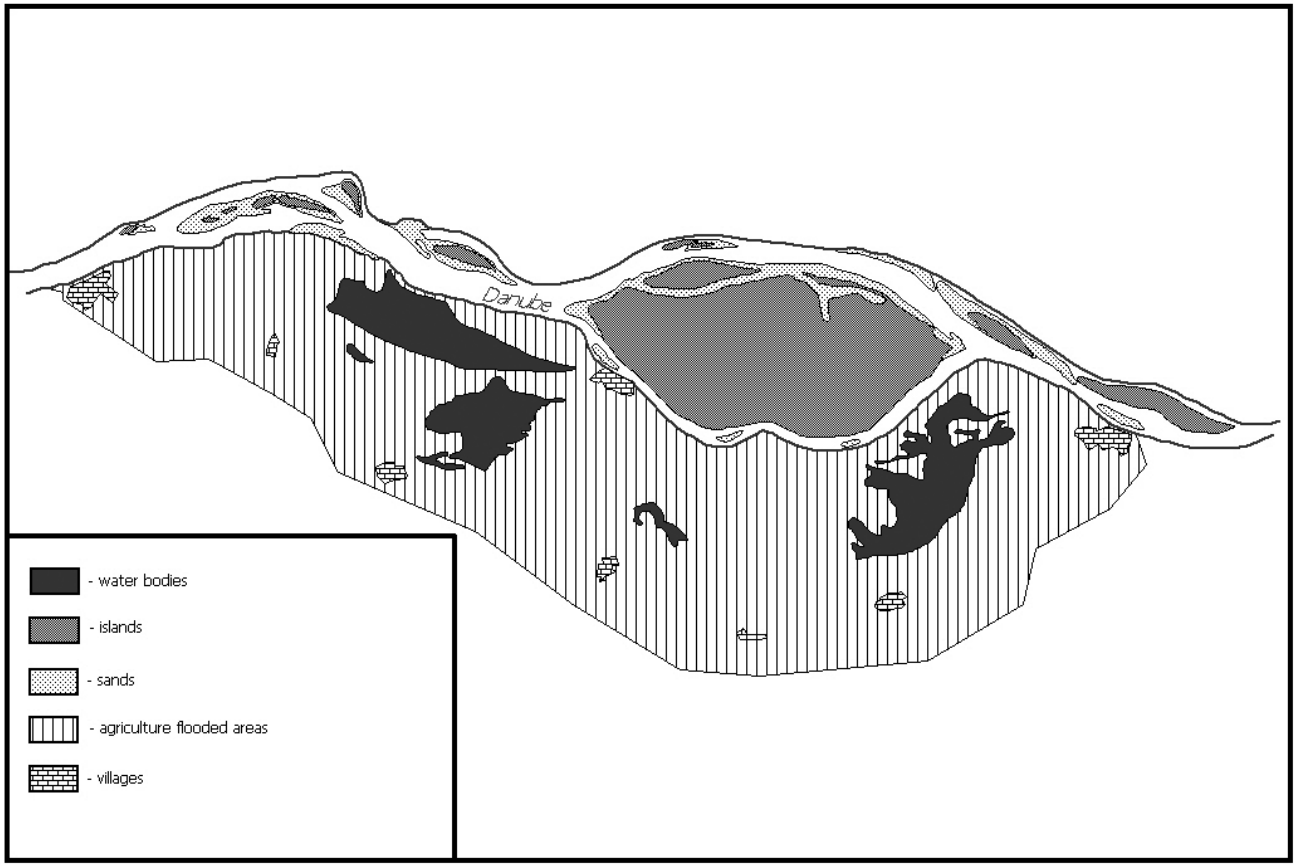

Fig. 2. Spatial model of the Svishtovsko-Belenska wetland system based on the map from 1880

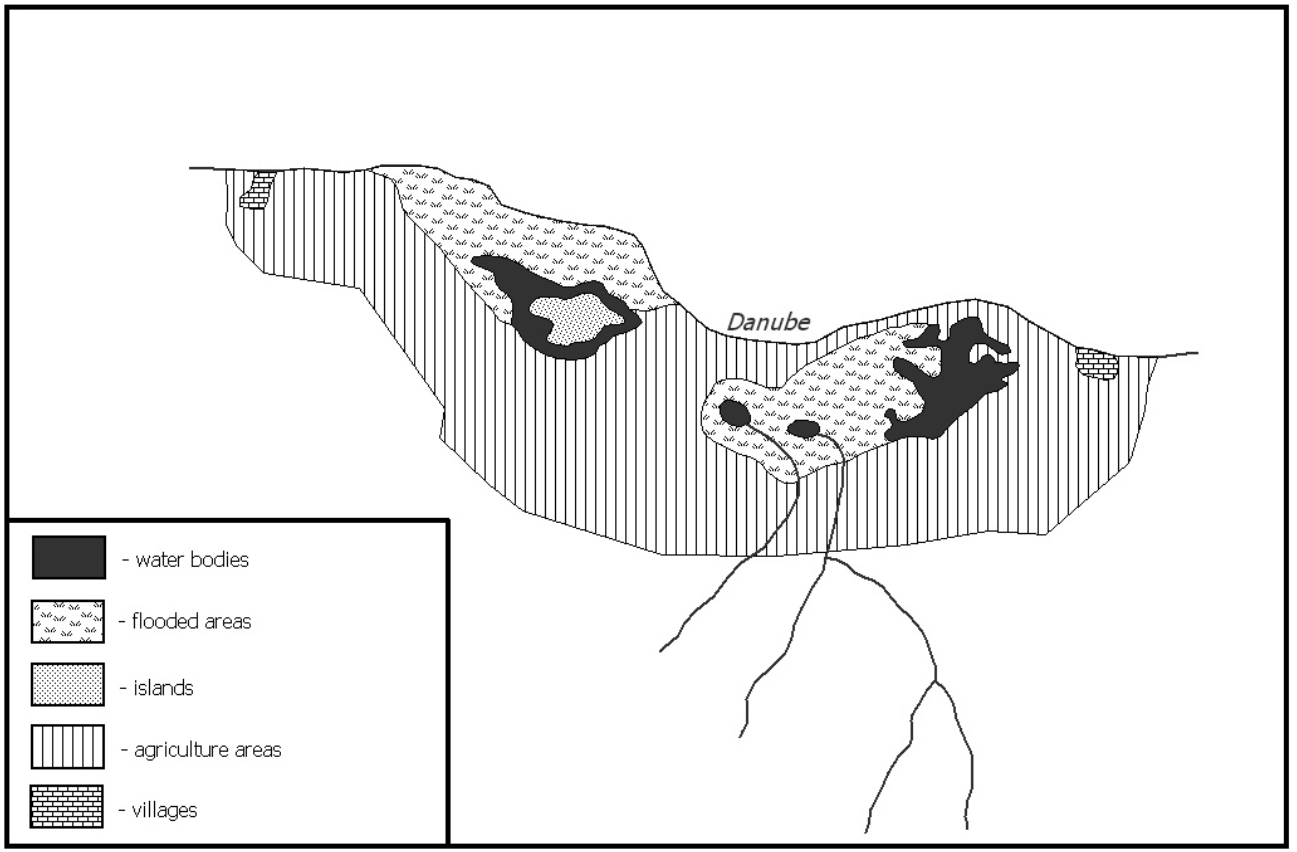

Fig. 3. Spatial model of the Svishtovsko-Belenska wetland system based on the map from 1903

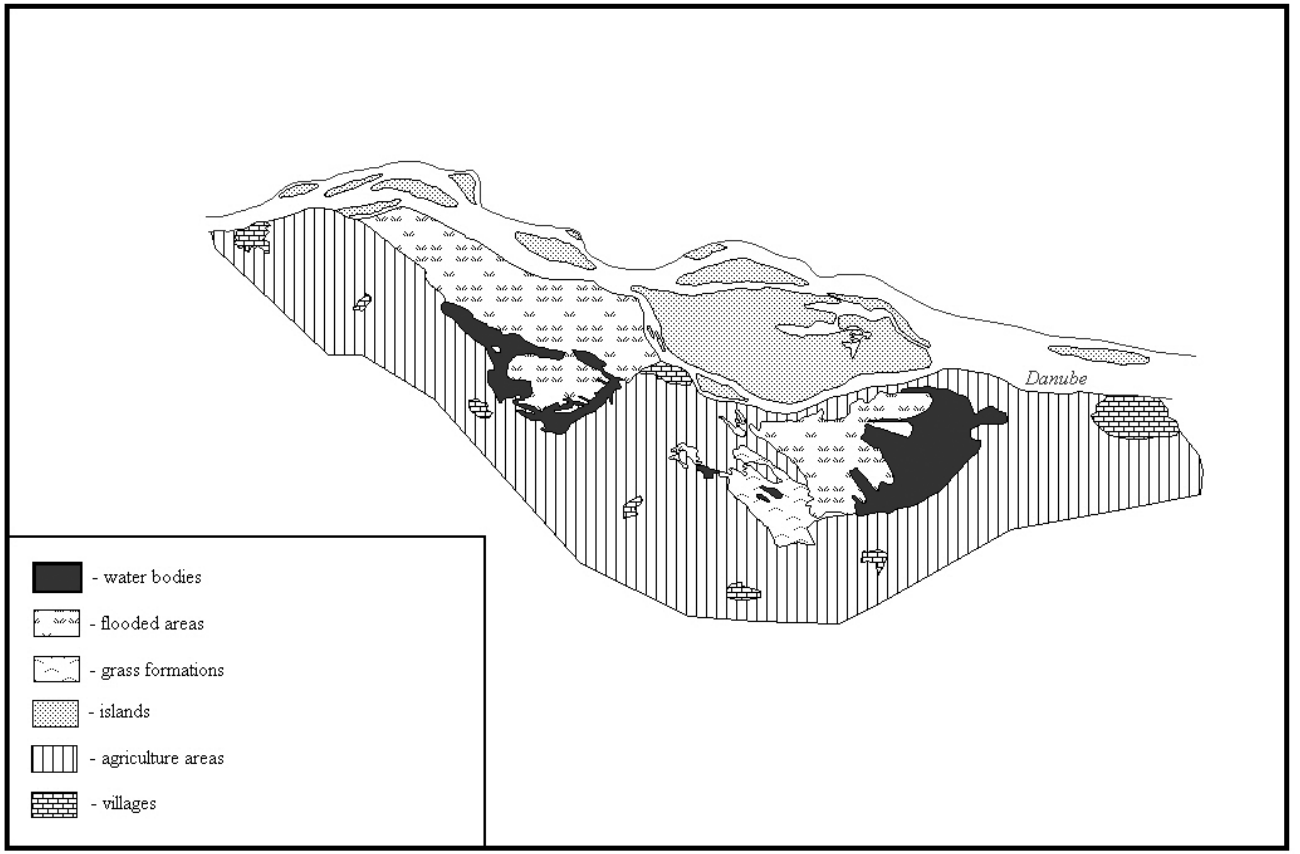

Fig. 4. Spatial model of the Svishtovsko-Belenska wetland system based on the map from 1920

The fourth examined state of the Svishtovsko-Belenska wetland system is (Fig. 5) based on analysis of a map of 1940. It also shows the natural evolution and development of the wetland system.

The fifth examined state of the Svishtovsko-Belenska wetland system (Fig. 6) is based on a map of 1948. It shows an identical situation with the states two, three and four.

The sixth examined state of the Svishtovsko-Belenska wetland system (Fig. 7) is based on a map from 1988. It shows the transformations in the wetland system as a result of anthropogenic impact.

There are several general transformations as a result of the anthropogenic impact:

– The main water bodies are drained.

– The territory of the lowland is transformed in agriculture area.

– The irrigation system have been built.

– The protected dike along the Danube have been built.

– Development of two industrial zones national importance – western of Svishtov town and eastern of Belene town.

– Natural protection is also developed. The eastern part of island Persina is part of protected area – "Persina Nature Park" was declared on December 4, 2000 with a total area of 21 762,2 ha. It is located on the territory of three municipalities Nikopol, Belene and Svishtov.

The protected dike breaks natural connection between river Danube and wetlands in lowland. Only small part of Belensko marsh and Svishtovsko marsh are saved in south part of the lowland. This is wetland "Kaikusha", which is part of protected by NATURA 2000.

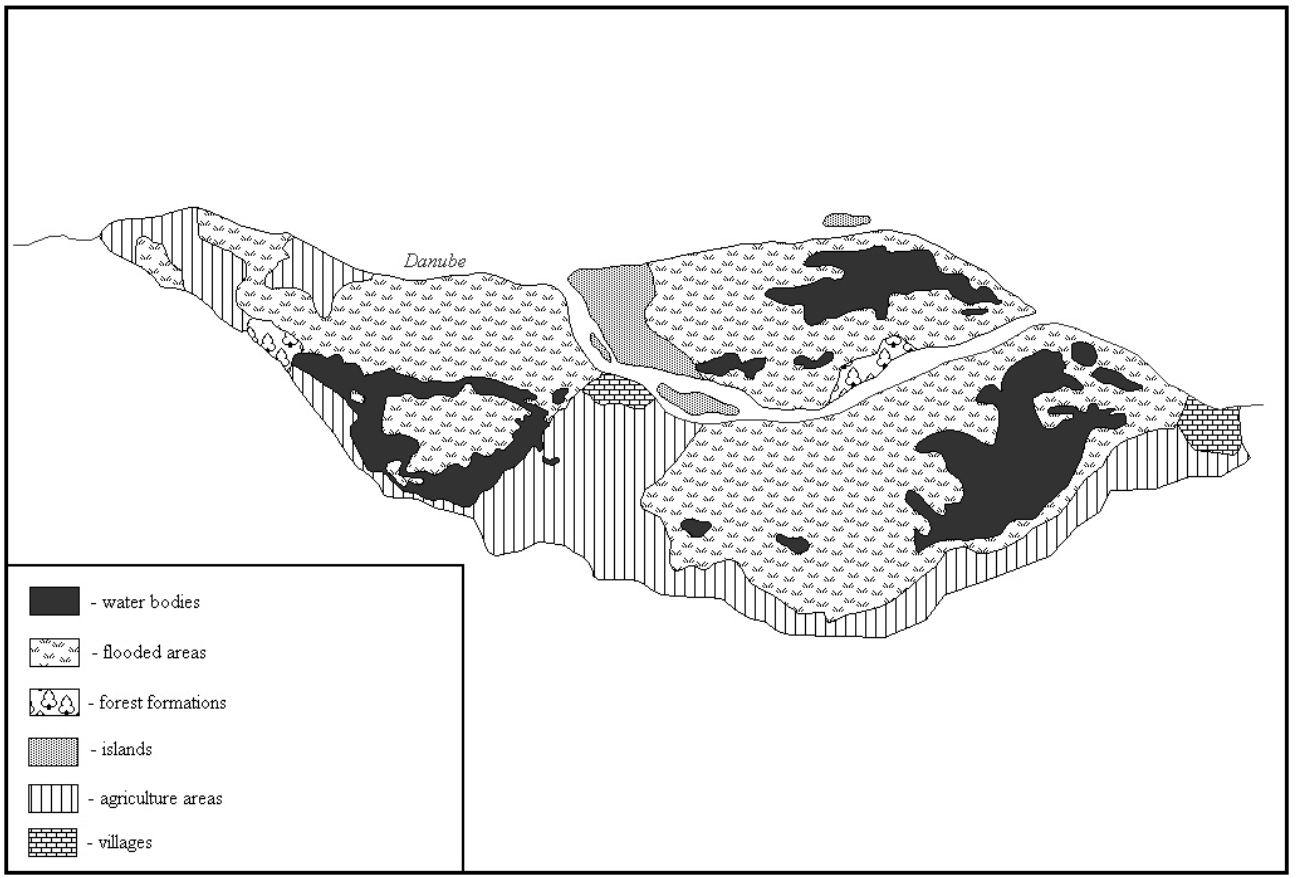

Fig. 5. Spatial model of the Svishtovsko-Belenska wetland system based on the map from 1940

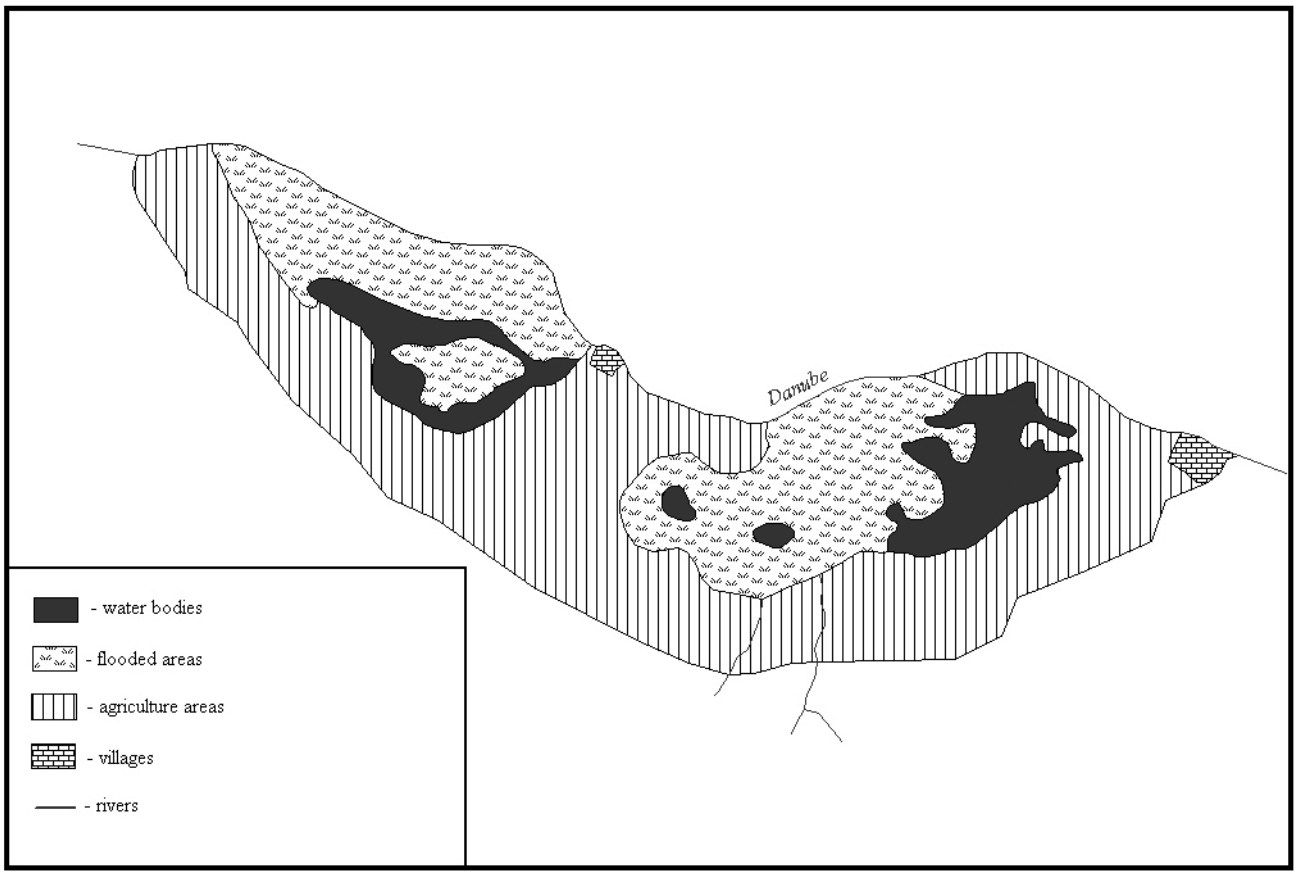

Fig. 6. Spatial model of the Svishtovsko-Belenska wetland system based on the map from 1948

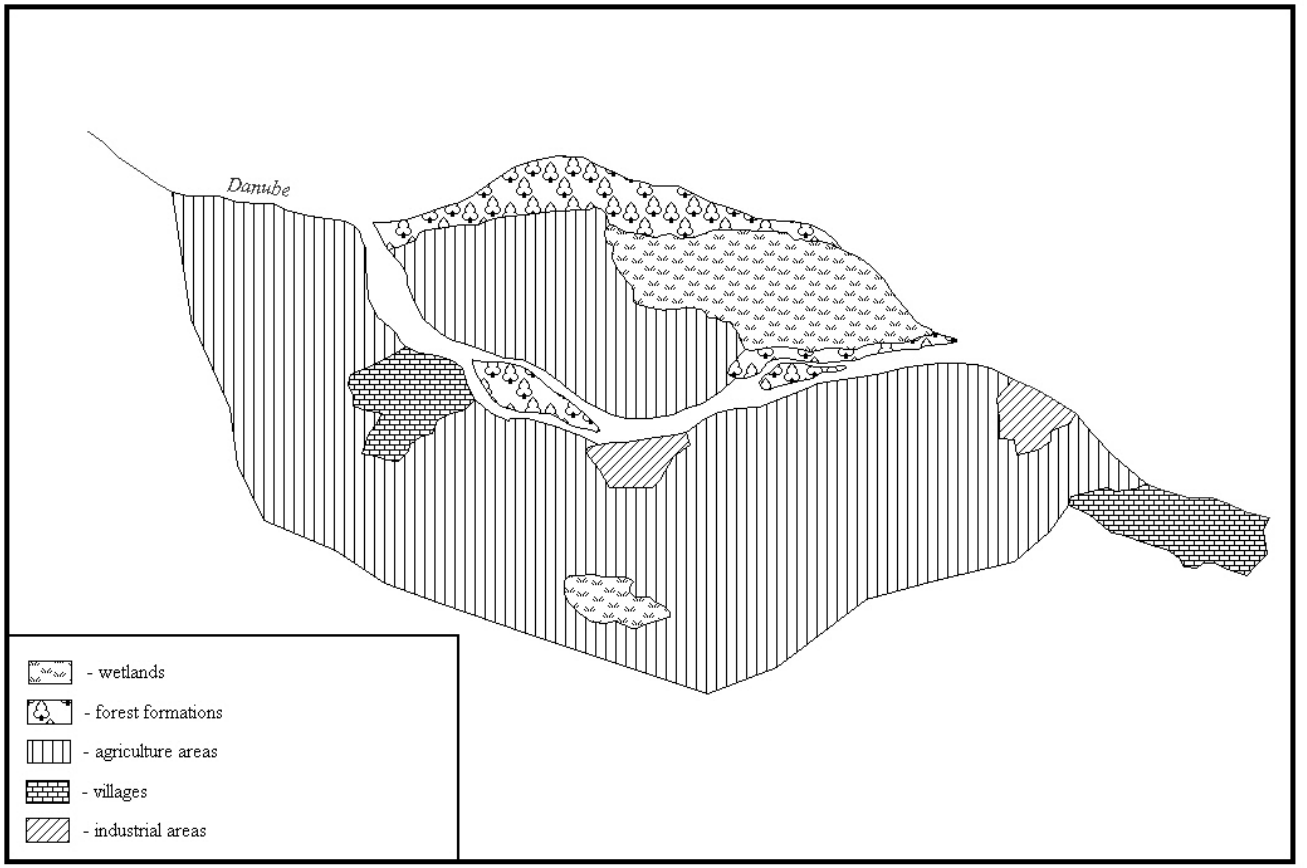

Fig. 7. Spatial model of the Svishtovsko-Belenska wetland system based on the satellite image from 1988

CONCLUSIONS

As a result of the research, the spatial modelling and analysis are identified considerable transformations of the Svishtovsko-Belenska wetland system. The general factor for these transformations of the natural system is the anthropogenic intervention. The main part of the wetland in the valley is transformed into farming land. The flooding zone of the Danube River is brought under control by dikes. The other fac-tor is building of irrigation system and drainage of the wetlands.

These main activities have brought changes in the landscape diversity. It may be assumed that these acts is a reason for changes in the biological and landscape diversity. They also reflect to natural attractiveness and potential of the region.

The results of the study will be possible used in the process of development of plans for the restoration of the wetland system.

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