

# **TYPES AND CHARACTERISTICS OF THE OXBOW-LAKES IN LOWER-TISZA-VALLEY - CLASSIFICATION FROM LANDSCAPE PLANNING PERSPECTIVE**

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## **Abstract**

The study area is located in Hungary on the South of the Great Plane called Alföld in Hungarian. There are ten oxbow lakes located in the region of the Lower Tisza Valley. The quality of the area's oxbow lakes are rather different. There are protected, highly valuable sites in terms of landscape and nature conservation, yet degraded areas utilized for economic purposes can also be found. In the course of river-control in the Lower Tisza Valley was affected by the 84-90th cutoffs, therefore oxbows have been formed in the area. Four of these oxbows are on the part that is not effected by floods, and six of them are located in the active floodplain. The attributes or usage of oxbow lakes allow for a complex system of categorisation. The assessment and classification of oxbow lakes can establish the grounds for assessment, as well as for planning the interventions of landscape restoration.

*Keywords:* oxbow-lakes, landscape architecture, land use, characteristics

## **1. Introduction**

Oxbow-lakes belong to semi-natural wetlands, which are rare in Europe. Oxbow-lakes can be found along Tisza's active floodplain and in the saved pages (former floodplain); these are at different ages and their sludge-filled conditions are also different. Social and economic impacts have affected oxbow-lakes to varying degrees, therefore their natural conservation values and conditions are either different or heterogeneous. However, oxbow-lakes are valuable not only for nature conservation purposes, but also from the point of view of land use and water management. The role of the oxbow-lakes is outstanding in case of recreation and impoundment. Oxbow-lakes offer opportunity for multiple purposes and usually an oxbow-lake can be used for complex and variable purposes. On the other hand,

different uses of land and water can cause lots of problems and conflicts. Beside these, due to siltation, gradual aging, contamination and harmful effects of chemical materials, oxbow-lakes are increasingly intensified and accelerated. Solutions of these various problems and also problems concerning land use need coordinated land-analysis and rehabilitation planning. Oxbow-lakes are considered wetlands in Hungary; from the perspective of landscape architecture and land use, a comprehensive analysis has not been made yet. An approach which deals with landscape architecture and land use-analysis give a base for rehabilitation plans and interventions. The restoration of oxbow-lakes are not important just from the point of view of nature conservation, but also from the water, environmental protection, and landscape-aesthetics perspective.

## 2. Methods

### 2.1. Study area

The research area is the Lower-Tisza-Valley, which is situated from Csongrád to the Southern border of Tisza, a 94.2 kilometers long area of Tisza (between 159.6-253.8 river kilometers). In the Lower-Tisza-Valley ten oxbow-lakes can be found, which were created during the Tisza's river control, between 1855 and 1892. Today these ten oxbow-lakes are in different conditions, also there are significant differences in their sizes and usages. The ten oxbow-lakes in the Lower-Tisza-Valley: Serházzugi- oxbow, Dögfenék, Labodár, Osztorai- oxbow, Mártélyi- oxbow, Körtvélyesi- oxbow, Atkai- oxbow, Sasér, Nagyfai- oxbow, Gyálai- oxbow (Fig. 1.).

The active floodplain area of the Lower-Tisza-Valley is very narrow, which at some spots gets wider. The widest area is the area of Körtvélyesi- oxbow, where it reaches 3-4 km, but there can also be so narrow areas, where the distance between the dyke and the river is below 100 meters.

### 2.2. Classification method

The analysis of the oxbow-lakes in the Lower-Tisza-Valley provides a comprehensive overview of oxbow-lakes' landscape conservation and landscape restoration asks. In my research - as a landscape-architect - I analysed the topic from the perspective of land use, landscape-ecology and landscape characters.

The literature review was completed with several forensics and fieldwork (eg. habitat-mapping). The establishment of the former landuse was supported by research of the literature, local history texts, historical maps and archaeological research.

The field visits were preceded by the exploration of the research works, reading literature and investigating the practical background, during that I worked on and studied professional books, scientific articles and studies. For my research I used

the hydrobiological, water and landscape literature, as well as the updated laws and plan history. I reviewed the current landscape rehabilitation principles, practices, and the antecedents of design and methodology. From the Hungarian publications I primarily had a look at the researches of Pálfi (1994, 1994a, 2001, 2002, 2004), Dévai (1994, 1998, 2000, 2004), Dévai et al. (2001), Wittner et al. (2004, 2005), László (2006), Gergely (1997). For being able to determine the definitions and principles of the practical side of landscape architecture, I used works by Csima (2008), Csima et al. (2003), in connection with surface water researches, I used works by Boromisza (2012) and Báthoryné Nagy (2007). Previously Aradi and Dévai (1997) categorized the oxbow-lakes from ecological and nature conservation point of view.

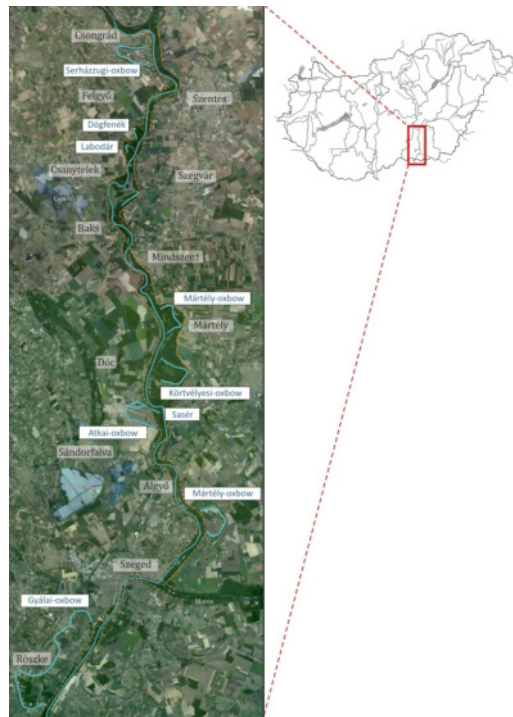


Fig. 1. The oxbow lakes' location in Hungary and the map of oxbow lakes in the Lower Tisza Valley

The objective of the research was to define the types and characteristics of oxbow-lakes. I made the classification on the basis of the landuses and the utilization of oxbow-lakes, because I found that these are the factors that

influence the oxbow-lakes' current states and the opportunities of reclamation the most. The different landuses along with the oxbow-lakes influence the oxbow-lakes' water uses and the water quality too (Fig. 3.). The landuses of landscape units which are related to oxbow-lakes are often independent from the water surface, but these affect it, and benefit from its favourable conditions. Due to favourable facilities, such as landscape diversity, varied landuses, and different landscape structures are the characteristics of oxbow-lake. Due to the favourable conditions of oxbow-lakes, their many-sided land uses, as well as water surface and also the coastal area has a high landscape potential. The spatial order and size of different land use affect the landscape structure of the active floodplain and saved page. From the landscape structure's view, the dominant land uses, the size and mosaic pattern of the semi-natural and the cultivated landscape parts; the appearing borders, and the meeting of the separate land uses are determining.

### 3. Results

I separated certain types of the oxbow-lakes, and I also determined their characteristics. The research in this area points out that the water usage of oxbow-lakes, which were formed at about the same time and the landuses of the related landscape parts may be significantly different and complex. The oxbow-lakes of the Lower-Tisza-valley were formed at around the same time, however their landscape transformation and their current states are significantly different from their formation.

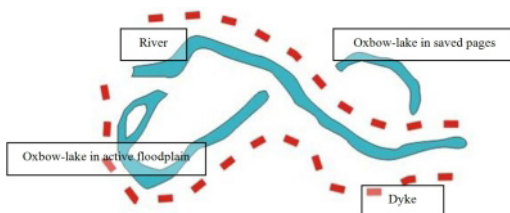


Fig. 2: Local of oxbow lakes

The location of oxbow-lakes (Fig. 2.) is crucial in determining the utilization of the oxbow-lakes. Besides the position in relation to the dam, the former landscape activities, their proximity to the settlements and conservation of nature (strictly protected) determine the landuses of the surrounding area's oxbow-lakes. The landuses, which exist in the proximity of oxbow-lakes, provided the basis of standardization – in comparison with landscape transformation.

I determined five types, and I summarized their main characteristics and problems. The five types are:

- Saved page oxbow-lakes in complex, intensively used landscapes part;
- Saved page oxbow-lakes in intensively used landscape part;
- Active floodplain oxbow-lakes in complex, extensively used landscape part;
- Active floodplain oxbow-lakes in extensively used landscape part;
- Active floodplain oxbow-lakes in which is solely used in natural conservation landscape part.

#### 3.1. Saved page oxbow-lakes in complex, intensively used landscape part

Oxbow-lakes of the types: Gyálai-oxbow, Serházzugi-oxbow.

The main characteristics:

- the oxbow-lakes are near to the settlements in complex, intensively used landscape part;
- modified, degraded or built shore zone;
- reduced buffering capacity and unfavorable water-quality;
- the land use: agricultural, settlement, recreation, water-management, nature-conservation;
- water use: stormwater and wastewater induction, agricultural irrigation water use, flood and inland water impoundments, fishing, recreation (e.g. water sports), reed management.



Fig. 3: Land uses along the oxbow-lakes

### 3.2. Saved page oxbow-lakes in intensively used landscape part

Oxbow-lakes of the types: Atkai-oxbow, Nagyfai-oxbow.

The main characteristics:

- the oxbow-lakes are far from the settlements;
- the oxbow-lakes are basically in simple, intensively used landscape part;
- narrow, disturbed shore zone;
- dominant land use is agriculture;
- the land use: agriculture, water management, recreation;
- water use: agricultural irrigation water use, flood and inland water impoundments, fishing, recreation, reed management.

### 3.3. Active floodplain oxbow-lakes in complex, extensively used landscape part

Oxbow-lakes of the types: Mártélyi-oxbow, Osztorai-oxbow.

The main characteristics:

- the oxbow-lakes are in active floodplain, but near to the settlements;
- basically the vegetation of the shore zone is semi-natural;
- is the dominant land use on the active floodplain areas is forestry;
- the land use: forestry, conservation, water management, recreation, agriculture;
- water use: agricultural irrigation water use, flood and inland water impoundments, fishing, water sports.

### 3.4. Active floodplain oxbow-lakes in extensively used landscape part

Oxbow-lakes of the types: Körtvélyesi-oxbow, Dögfénék.

The main characteristics:

- the oxbow-lakes are in active floodplain;
- the oxbow-lakes are in protected area;
- wide, semi-natural vegetation shore zone;
- the land use: conservation, water man-

agement, forestry, agriculture;

- water use: flood and inland water impoundments, fishing.

### 3.5. Active floodplain oxbow-lakes in which is solely used in natural conservation landscape part

Oxbow-lakes of the types: Sasér, Labodár.

The main characteristics:

- the oxbow-lakes are in active floodplain, in in highly protected area;
- in the related area there is no management, "no action" principle is applied;
- wide, semi-natural vegetation shore zone;
- the land use: natur conservation, water management;
- water use: flood water impoundments.

I found that the saved page oxbow-lakes, which lie near to the settlements are the most modified ones, and these are in the worst ecological condition. The causes of these bad condition are the intensively used landscape areas, the proximity of the built up areas, the complex and ignoring uses of oxbow-lakes.

## 4. Conclusion

The examination and classification of oxbow-lakes can establish the grounds for state assessment, as well as for planning the interventions of landscape rehabilitation. Today only the variable width active floodplain is able to fill the ecological and water management role of the previously extensive floodplains. Therefore the protection of oxbow lakes and active floodplain, (which evolved in the course of the river control), stopping the degradation of natural values in this area, the protection of wetlands, habitat reclamation and oxbow-lake reclamation are very important tasks.

The rehabilitation of the oxbow lakes and floodplain habitat should be concerted action coordinating environment, conservation and water management sciences. The primary aim is to achieve an optimum ecological condition of the oxbow lakes and the shore-

zones. In the second step, the treatments and the long-term tasks according to the natural functions should be defined and planned, in order to ensure the conditions for sustainable development.

Possibilities include continuing research: the methods and principles applied for other oxbow-lakes in other areas, or assessment, rehabilitation similar conditions of water.

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