

## ANALYSING OF LAND USE IN RIVER BASIN HORNÁD FOR POSSIBILITIES OF RECREATION

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### Abstract

Climate change and land use affect the hydrological cycle and water resources and recreation opportunities. The researched area is located in eastern Slovakia in the Hornád river basin. Land use for the reference years 1990, 2000 and 2012 was evaluated using CORINE Land Cover. the assessed area is suitable for recreational purposes, because it has a suitable location attractive for tourists.

**Key words:** Kysak, Land Cover, Recreation

### Introduction

Global climate change is not an abstract of future risks, it is already happening. Climate change mitigation and adaptation measures therefore need to be seriously considered (Zeľeňáková et al., 2015, Zeľeňáková, et al., 2018). This applies not only to agriculture, forestry and water management, but also to other areas such as nature conservation, recreation, healthcare, urban planning, transport and tourism. These areas are under increasing pressure to adapt to climate change as well as to contribute to climate change mitigation through appropriate measures.

CORINE Land Cover (CLC) is the standard for monitoring land use and land cover at a pan-European level. CLCs are set up by national agencies and coordinated by the European Environment Agency (EEA). The data sets are created according to a common standard and represent the situation for the reference years 1990, 2000, 2006, 2012 and 2018 (Feranec, 2016).

### Materials and methods

#### Study area

The studied area is located in eastern Slovakia in the Hornád basin of the Kysak sub-basin. The Kysak sub-basin starts from the Kysak Hydrological Station (8565). In the given sub-basin there is a water reservoir Ružín and various tourist and recreational attractions e.g. Sivec with a view of the Ružín reservoir, Jánošíková bašta and many others. The area of the sub-basin is 582,3 km<sup>2</sup>.

#### Methods

Land cover changes that have occurred over the last two decades have been made using the proven CORINE Land Cover (CLC) inventory. [2,3,4] CLC technical specifications state a minimum area of 25ha, with a width required for linear phenomena. at least 100 meters. The CLC categorizes land cover based on a 3-level hierarchical classification system that has 44 classes at the third and most detailed level. The second level, which has 15 classes, was used in this study.

### Results

The land cover in the Kysak sub-basin consists mainly of forests and agricultural land, as we can see in Figure 1.

In Figure 2, the land cover for the reference year 2000 change compared to 1990 is that the area of forests increased at the expense of pastures and heterogeneous agricultural areas.

For the reference year 2012, it can be seen that the forest area increased again by 1% and the arable land area decreased. The area of Urban fabric increased to 4% of the area compared to 1990.

In Table 1. we see a summary of land use change in the Kysak sub-basin. Land use changes are not so significant. The biggest change was in the Forest class where the area increased by 5.7%. The increase in area was still in urban fabric, in other classes there was a decrease in the area of land used

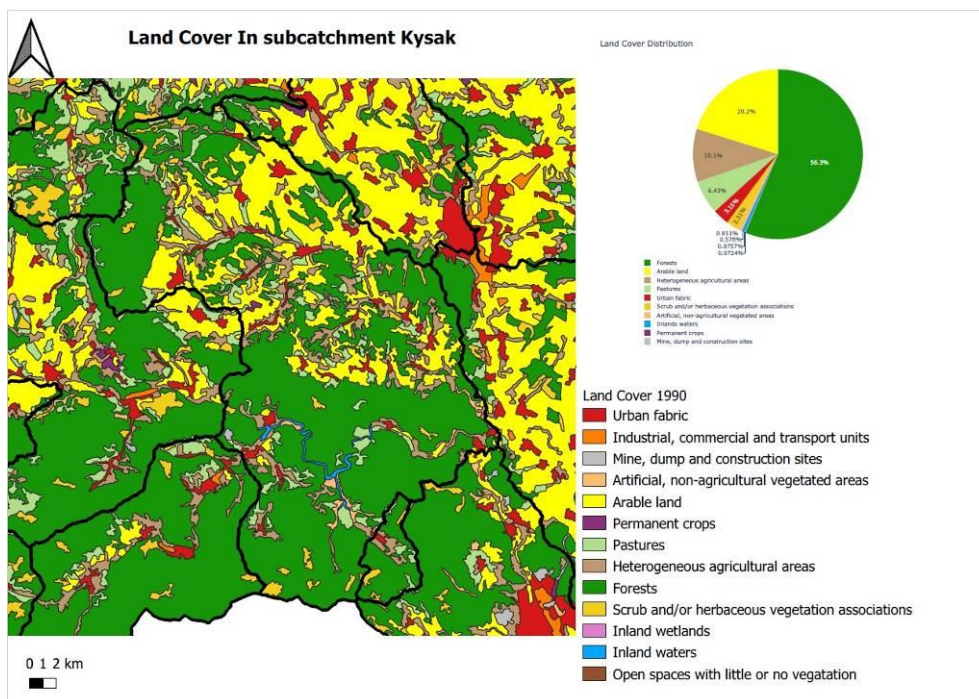


Fig. 1: Land Cover in Subcatchment Kysak 1990

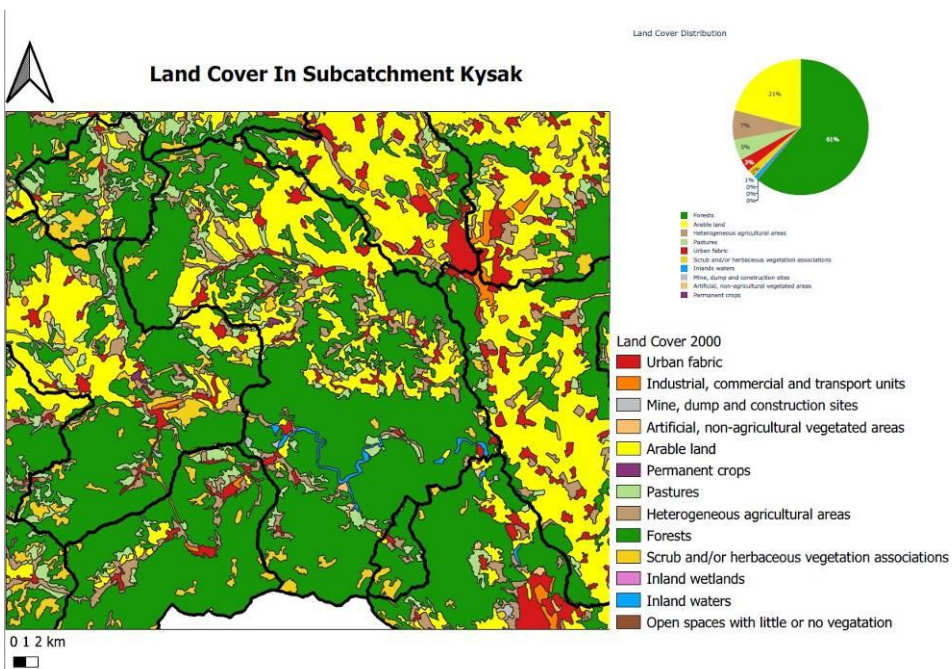


Fig. 2: Land Cover in Subcatchment Kysak 2000

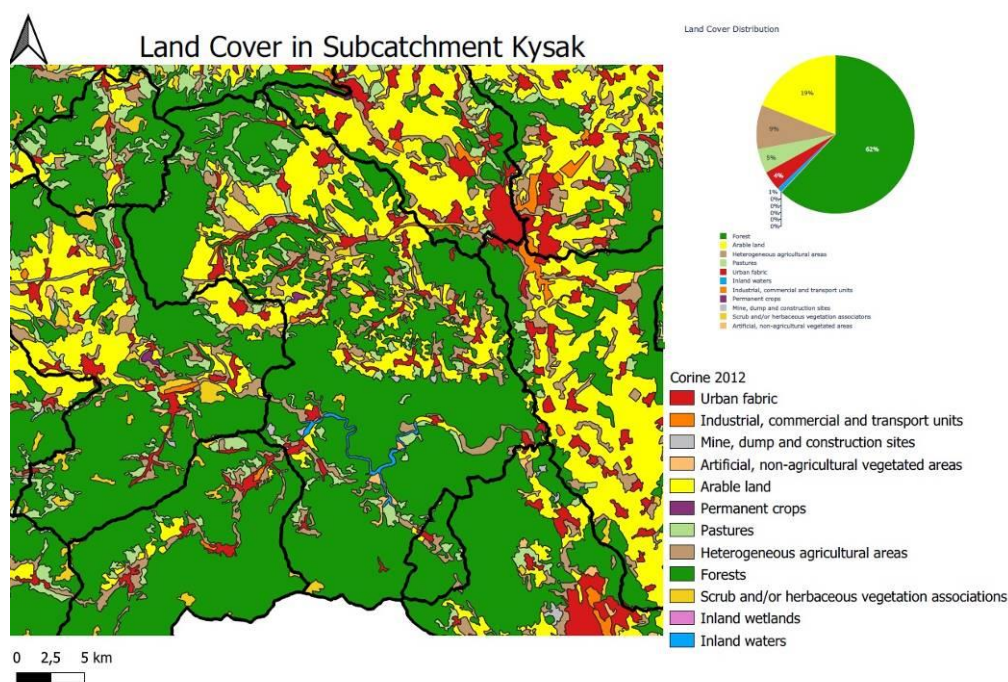


Fig. 3: Land Cover in Subcatchment Kysak 2012

Tab. 1: Summary of land use over the years 1990,2000 and 2012

Year Land Cover	1990 [%]	2000 [%]	2012 [%]
Forest	56,3	61	62
Arable land	20,2	21	19
Heterogeneous agriculture area	10,1	7	9
Pastures	6,43	5	5
Urban fabric	3,15	3	4
Scrub and/or herbaceous vegetation associations	2.31	2	0
Inlands waters	0,57	1	1

## Discussion

By changing land use, we can mitigate climate change, for example by increasing the forest areas and parks suitable for recreation. Parks can be part of a climate solution. Parks reduce harmful carbon pollution, reduce the temperature of the area, the area does not overheat, retain water in the country, protect people and infrastructure, and can be used for recreation. The Ružín reservoir is located in the Kysak sub-basin, which is used for recreational purposes but also for industry as a water reservoir and electricity generation. Water is crucial for many recreational activities from boating and fishing to mountain biking and hiking.

## Conclusion

The impact of climate change on natural resources is everywhere, specifically on recreational resources (Junáková et al., 2020). The demand for recreation depends on the climate, the increase in air temperature and longer summers should increase the demand for recreation in nature, from hiking, fishing and camping to simple visits to the beach by the water. The Kysak sub-basins can be used for these activities because the area has the potential for recreation in nature and land use indicates this.

## References

- Feranec, J. (2016). Project CORINE Land Cover. *European landscape dynamics: CORINE land cover data*, 9-14.
- European Union, (1990). Copernicus land monitoring service 1990, European Environment Agency (EEA). Corine Land Cover (CLC) 1990, Version 1990\_20u1

European Union, (2000). Copernicus land monitoring service 2000, European Environment Agency (EEA). Corine Land Cover (CLC) 2000, Version 2000\_20u1  
European Union, (2012). Copernicus land monitoring service 2012, European Environment Agency (EEA). Corine Land Cover (CLC) 2012, Version 2012\_20u1  
Junáková, N., Zeleňáková, M., Mihaľová, N. (2020). Recreational potential of the Lower Zemplín region in the Bodrog river basin. In: J. Fialová (Ed.). Public recreation and landscape protection – with nature hand in hand? Conference proceeding. Brno: Mendel University in Brno, 2020: 397-400.  
Zeleňáková, M., Purcz, P., Hlavatá, H., Blišťan, P. (2015). Climate Change in Urban Versus Rural Areas. *Procedia Engineering*, 119: 1171-1180.  
Zeleňáková, M., Junáková, N. (2018). Environmental impact assessment of Vecheč flood protection. In: J. Fialová (Ed.), Public recreation and landscape protection - with nature hand in hand: Conference proceeding. Brno, Czech Republic: Mendel University, 2018: 148-153.

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### **Souhrn**

Změna klimatu a využívání půdy ovlivňují hydrologický cyklus a vodní zdroje a rekreační možnosti. Studovaná oblast se nachází na východním Slovensku v povodí řeky Hornád. Využití půdy v referenčních letech 1990, 2000 a 2012 bylo posouzeno pomocí CORINE Land Cover. Posuzované území je vhodné pro rekreační účely, protože má vhodnou turisticky atraktivní polohu.

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