

HUMAN IMPACT AS A TRIGGER FOR RICHER BIODIVERSITY: THE CASE OF THE SAZLIYKA RIVER CATCHMENT IN SOUTH BULGARIA

DOI: <http://dx.doi.org/10.18509/GBP.2020.08>
UDC: 502.172:574.1(497.2)

Dimitar Zhelev

Department of Landscape Ecology and Environmental Protection, Faculty of Geology and Geography, Sofia University "St. Kliment Ohridski", **Bulgaria**

ABSTRACT

Generally, human impact is related to destruction and degradation of natural geosystems: landscapes, habitats, ecosystems. The diversity of manmade interactions may include physical, chemical, biological, radioactive, etc. influence over the nature. Usually, we consider the anthropogenic factor as a reason for a habitat lose, decline of ecosystems and degradation of landscapes. However, there are cases in which the human impact might be a trigger for richer biodiversity as well as for establishment of protected areas (Natura 2000 sites) in the hearth of an industrial cluster. The article focuses on the influence on the biodiversity by the thermal pollution of the waters in the catchment of the Sazliyka River in South Bulgaria. The specific cases of the research are focused on the population of the local European otter (*Lutra lutra* L.) and the native bird fauna (*Aves* L.) as well as the distribution of invasive species such as the Zebra mussel (*Dreissena polymorpha* Pallas) in rivers and dams.

Keywords: habitats, landscapes, ecosystems, invasive species, thermal pollution

INTRODUCTION

Human activities affect the nature in many ways. They cause serious environmental changes in terms of landcover, chemical composition, physical properties, natural habitats, etc. The term anthropogenization on landscapes refers to the state of human impact on nature in all aspects. Logically, it could be claimed that as stronger the human footprint is, the bigger the environmental damage is.

One of the most affected by human impact areas in Republic of Bulgaria is the catchment of the Sazliyka River in South Bulgaria. It is a left tributary of the bigger Maritsa River. The river begins from the slopes of Sredna Gora Mountain and it passes through the eastern side of the fertile Upper Thracian Plain (Starozagorsko Pole). The catchment area encompasses mostly urban, industrial, mining, and agricultural lands. However, there are several Natura 2000 sites protecting biodiversity amidst some of the most environmentally damaged territories in the whole country. Moreover, the present-day faunistic biodiversity is richer and it is determined by the human activities in the last decades. There is positive human impact on biodiversity and ecosystems in the researched area.

METHODOLOGY

The research object of this study is the catchment area of the Sazliyka River (3239 km²) and the research subject is the positive human impact on biodiversity within. The main goal of the paper is to outline the controversial effect of particular human activities for enriching the modern-day fauna in the researched area.

The aspects of anthropogenization within the river catchments are assessed by three different approaches. Firstly, the research applies geospatial data obtained as a result of the CORINE land cover remote sense observations on Earth. Secondly, the results are based on field work mapping of landscapes as a tool of verification. Thirdly, documentary research is conducted in order to find out cases of environmental issues within the river catchment.

The assessment of modern-day biodiversity is based on the official reports made by the Ministry of Environment and Waters (MEW) and NGOs as well as the official profiles of the Natura 2000 sites and the science articles published on this topic.

RESULTS AND INTERPRETATION

The CORINE landcover data (2012) [1] provides results that clearly outline the anthropogenic profile on the territory (Table 1). The used approach for assessment of human impact is applied in other studies on the landscapes in Bulgaria and it is considered as highly reliable [3, 14]. About only 20% of the territory in the researched areas could be considered as relatively natural landscapes. The relativeness is due to the facts that some of the deciduous forests are planted by people as a governmentally-led forestation programs; the natural grasslands and scrublands are actually degraded forest landscapes due to ancient human activities; some of the swamps are caused by human interactions; etc. All the other territory is deeply affected by a various range of activities conducted by people.

Table 1. Different landcover and land use types in the catchment of Sazliyka River (2012)

Type of landcover and land use	Class of landcover and land use	Type of human interaction	Portion of total area (%)
Anthropogenic objects	Settlements	Created	4,69
	Industrial facilities	Created	1,06
	Road and railway infrastructure	Created	0,10
	Airports	Created	0,07
	Quarries and opencast mines	Created	4,10
	Landfills	Created	0,14
	Parks and green zones in urban areas	Created	0,10
	Recreational infrastructure	Created	0,07
Agricultural lands	Non-irrigated arable land	Transformed	51,54
	Rice fields	Created	0,8
	Vineyards	Created	2,26
	Orchards	Transformed	0,54
	Pastures	Transformed	4,99
	Small gardens	Transformed	1,23
	Abandoned agricultural lands	Transformed	7,23
Forests and shrublands	Deciduous forests	Relatively natural	8,68
	Coniferous forests	Transformed	1,46
	Mixed forests	Relatively natural	2,06
	Natural grassland	Relatively natural	1,50
	Forest-Shrublands	Relatively natural	6,31
	Shrublands	Relatively natural	0,17
Wet zones	Swamps	Relatively natural	0,05
Water bodies	Rivers	Relatively natural	0,01
	Dams and reservoirs	Created	0,88
Relatively natural type of land cover			20,24
Man-created type of land cover			79,76

The additional documentary investigations and the field trips in the territory obtained data in accordance to which the area is among the environmental hotspots due to air pollution, water contamination, opencast mining and quarrying, abundance of infrastructure, intensive agriculture, introduction of non-native species in the wildlife, distribution of invasive species, etc. [15].

However, among all anthropogenic actions there are specific man-caused changes of the environment that provide suitable life conditions to native species to enlarge their populations or welcome non-native species to settle down in the catchment. Moreover, some invasive species find excellent habitual conditions due to human activities [13].

Historically, the development of agriculture and settlements transforms the indigenous forests and scrublands into cultural landscapes. As a result of this, a lot of species typical for grasslands inhabit the area nowadays. At the same time, the relict forests are habitats for native species which remain part of the modern-day fauna even they number is considered in decline [5].

The human activities on the surficial water distribution cause the positive impact on the biodiversity. In 1950^s two big reservoirs, for the needs of the newly built thermal power plants, are dammed near the opencast lignite mines in the Maritsa East coal basin. Nowadays, these two manmade bodies of water, “Ovacharitsa” and “Rozov Kladenets”, are considered as important ornithological sites and they are part of the national Natura 2000 network [11, 12].

Additionally, there are more than 100 small dams alongside the tributaries of the Sazliyka River built during the same period. All of the manmade water bodies provide freshwater habitats for species, both animals and plants, that used to have significantly more limited distribution in this part of the country in the past.

Naturally, within the catchment there are no big lakes but only few small swamps caused due to natural or anthropogenic reasons. There are natural swamps in the north-east part of the catchment where the watershed line goes through a territory inclined less than 1°. There are more swampy areas caused either by meander cutoffs or infrastructure building in the last century. A very interesting case of man-caused transformation of the landscapes are some saline habitats determined by ancient people (Thracians, 5th century BC) and the tombs they made by digging and accumulating ground masses [9]. The historic activity is the reason for distribution of halophytes in the Sazliyka River catchment nowadays.

Another crucially significant man-caused influence over the environment in the research area is the interbasin transfer of water from the bigger Tunzha River catchment to the smaller and drier Sazliyka River catchment. The transbasin diversion happens via several tunneled canals that go through the Sarnena Gora Mountain. As a result of this the water volume within the researched area is doubled. The length of built irrigation canals is about 400 km [15]. The interbasin transfer of water changes the natural river regime and provides additional water volume as a freshwater habitat in rivers and canals.

The Ministry of Environment and Waters classifies the stream of Sazliyka River as one of the three national hotspots for thermal pollution of waters [15]. The sources of thermal enrichment of the main river are the three thermal power plants (Maritsa Iztok power-generating cluster) and the city of Stara Zagora. Alongside the main river some tributaries and the two big reservoirs “Ovacharitsa” and “Rozov Kladenets” are thermally polluted. The degradation of natural properties provides “convenient” environment for some species that adapt by changing behavior such as nesting habits, migratory routes, physiological activity, etc. The warmed water does not freeze in the winter. The fish and other water inhabitants are physiologically active year-round in such conditions. That is

why there are plenty of migratory birds that start to nest in the area of the reservoirs since their building. As a result of this both reservoirs are declared as Natura 2000 site for conservation of wild birds (the Directive 79/409/EEC) [6, 8]. Example of birds that started to live in the are *Gavia arctica*, *Phalacrocorax pygmeus*, *Pelecanus onocrotalus*, *P. crispus*, *Botaurus stellaris*, *Nycticorax nycticorax*, *Egretta garzetta*, *E. alba*, *Ardea purpurea*, *Ciconia nigra*, *Platalea leucorodia*, *Cygnus columbianus*, *C. cygnus*, *Branta ruficollis*, *Aythya nyroca*, *Mergus albellus*, *Haliaeetus albicilla*, *Circaetus gallicus*, *Circus aeruginosus*, *C. cyaneus*, *C. macrourus*, *C. pygargus*, *Aquila pomarina*, *Pandion haliaetus*, *Falco vespertinus*, *F. peregrinus*, *Philomachus pugnax*, *Tringa glareola*, *Larus minutus*, *Alcedo atthis*, *Dendrocopos syriacus*, *Lullula arborea*, *Sylvia nisoria*, *Lanius collurio*, *Tachybaptus ruficollis*, *Podiceps cristatus*, *P. grisegena*, *P. nigricollis*, *Phalacrocorax carbo*, *Ardea cinerea*, *Cygnus olor*, *Anser albifrons*, *A. anser*, *Tadorna tadorna*, *Anas penelope*, *An. strepera*, *A. crecca*, *A. platyrhynchos*, *A. acuta*, *A. clypeata*, *Aythya ferina*, *A. fuligula*, *Mergus merganser*, *Accipiter nisus*, *Falco subbuteo*, *Gallinula chloropus*, *Fulica atra*, *Gallinago gallinago*, *Tringa erythropus*, *Tr. totanus*, *Tr. stagnatilis*, *Tr. nebularia*, *Tr. ochropus*, *Larus ridibundus*, *L. canus*, *L. cachinnans* [11, 12]. Some of these species are globally endangered and they do survive within the heart of the biggest industrial cluster in Bulgaria.

There is a mammal that is also positively affected by the thermal pollution in the area. The largest population of European otter (*Lutra lutra*) in Bulgaria is found alongside the Sazliyka River [7, 10]. The heat-enriched waters of the river and the neighboring two industrial reservoirs provide abundant food supply during the winter season.

The thermally polluted waters in the “Ovacharitsa” and “Rozov Kladenets” reservoirs rapidly became a habitat with excellent condition for the mollusk *Dreissena polymorpha*. The specie was reported for first time in the area in 2000s. The mollusk is native for the aquatory of Danube River and Black Sea but it started its expansion into the inland water bodies in the late 80s and the 90s [2, 13]. The flourishing population of this mollusk in warm waters is a serious economic challenge. *Dreissena polymorpha* spreads among the pipes of the thermal power plant facilities and it constantly urges expensive repairs on infrastructure.

In the last decades different kinds of animal farming enable the intentional or unintentional introduction of animal species in the local fauna of the river catchment. Some of them are invasive and their number is vastly growing. Examples of non-native mammals in the wildlife are the American mink (*Neovison vison*) from North America and the coypu (*Myocastor coypus*) from South America [4]. The ichthyofauna is “enriched” with *Lepomis gibbosus*, *Ctenopharyngodon idella*, *Ctenopharyngodon idella*, etc.

CONCLUSION

The positive human impact on the biodiversity within the Sazliyka River catchment is a spatial phenomenon. It is a key perspective of the assessment of the anthropogenization of the landscapes as a bidirectional approach. Even most of the territory is heavily impacted due to various man-caused interactions in the last century the biodiversity is enriched by creating new habitats and changing life conditions.

Wildlife adapts to the environmental changes. Birds can reroute migratory directions and they can reestablish nesting habits; mammals can find the richer source of food in warm waters and they can “forget” the winter strategies for survival; fish and mollusk can spread uncontrolled if there are suitable conditions. All of these may happen in terms of

several years. The catchment of the Sazliyka River is an example of such a geographical process.

REFERENCES

- [1] CORINE landcover (2012) <https://land.copernicus.eu/pan-european/corine-land-cover/clc-2012>
- [2] Hubenov Z. 2005. Dreissena (Bivalvia: Dreissenidae) – systematics, autochthonous and anthropogenic areas. *Acta zoologica bulgarica*, 57 (3): 259-268.
- [3] Kitev, A. (2017) Mapping and assessment of the landscapes with conservational values in South Pirin and Slavyanka Mountains based on remote sensing data. Bulgarian academy of science, PhD thesis, p. 3/Китев, А. (2017) Картографиране и оценка на ландшафтите с природозащитна стойност в Южен Пирин и Славянка с използване на данни от дистанционни изследвания. Дисертация, НИГГГ, БАН, С.
- [4] Minks attack animals in farms - <https://agri.bg/novini/nova-napast-norki-napadat-selskostopanski-zhivotni-2>, accessed on 1 February 2020.
- [5] National system for monitoring of biological diversity/Национална система за мониторинг на биологичното разнообразие <http://eea.government.bg/bg/bio/nsnbr/>, accessed on 1 February 2020.
- [6] Natura 2000 – Ovcharitsa Reservoir/ Язовир Овчарица <http://natura2000.moew.government.bg/Home/ProtectedSite?code=BG0002023&siteType=BirdsDirective>, accessed on 1 February 2020.
- [7] Natura 2000 – River Sazliyka/Река Сазлийка - <http://natura2000.moew.government.bg/Home/ProtectedSite?code=BG0000425&siteType=HabitatDirective>, accessed on 1 February 2020
- [8] Natura 2000 - Rozov kladenets Reservoir/Язовир Розов кладенец - <http://natura2000.moew.government.bg/Home/ProtectedSite?code=BG0002022&siteType=BirdsDirective>, accessed on 1 February 2020.
- [9] Penin, R., D. Zhelev (2015) Geochemical research of azonal landscapes in the Starozagorsko Pole, originated as a result of ancient human activities. *Problems of Geography*, is. 1-2. Bulgarian academy of science. p. 124/Румен Пенин, Димитър Желев, Геохимични проучвания на азонални ландшафти в Старозагорското поле, възникнали вследствие на антропогенна дейност в античността, Проблеми на географията, 1-2, 2015,
- [10] Red Book of Bulgaria, *Lutra lutra*, <http://e-ecodb.bas.bg/>
- [11] State Gazette of Republic of Bulgaria (2007), is. 21/9 March 2007/Държавен вестник бр. 21 9 март 2007 г.
- [12] State Gazette of Republic of Bulgaria (2008), is. 83/23 Septmeber 2008/Държавен вестник бр. 83 23 септември 2008 г
- [13] Trichkova T., D. Kozuharov, Z. Hubenov, S. Cheshmedjiev, I. Botev, M. Zivkov, L. Popa, O. Popa 2009. Current distribution of Dreissena species in the inland waters of Bulgaria. *International Scientific Publications: Ecology and Safety*, 3 (1): 507-516.
- [14] Vatsева, R. (2015) Dynamics of the urbanized territories of the Black Sea coastal zone between 1977-2011 based on remote sensing. Bulgarian academy of science. Sofia, p. 13/Вацева, Р. (2015) Динамика на урбанизираните територии на Черноморската крайбрежна зона в България за периода 1977-2011 г. по данни от дистанционни изследвания. БАН-НИГГГ, С.
- [15] Zhelev, D. (2016) Contemporary landscapes and anthropogenization within the catchment of Sazliyka River. Sofia University. PhD thesis, pp. 87-11/ Желев, Д. (2016) Съвременни ландшафти и антропогензация в басейна на р. Сазлийка, СУ "Св. Климент Охридски" дисертация, София, 2016