

The biodiversity of Bistrița city (Bistrița-Năsăud county, Romania): its evaluation in the past and recent studies

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Abstract. The biodiversity is the variety of all living things on Earth, along with all their interactions, the genetic information they contain and the ecosystems they form. Biodiversity is important to people in many ways, different species of plants, animals, fungi and micro-organisms providing us with food, medicines, fuel, building materials, fibre for clothing and industrial products. Scientists have identified about 1.75 million different species, which includes 950,000 species of insects, 270,000 species of plants, 19,000 species of fish, 9,000 species of birds, and 4,000 species of mammals. The Romanian biodiversity is high: 3795 higher plant species, 965 moss species, 8727 fungi species, over 600 algae species. As for the fauna, there have been identified 33,085 invertebrate species and 611 vertebrate species. There have been only few studies related with some aspects of the Bistrița-Năsăud county's biodiversity. Many of the papers had only general remarks, naming only few well known species. Regarding the biodiversity of the Bistrița city itself, there is one paper dealing with two protected areas within the city, where are mentioned mostly plant species inhabiting those areas, and only brief remarks about the fauna. The most recent and comprehensive attempt to assess the biodiversity of the Bistrița city has been done by an NGO, namely Asociația Harta Verde România, which projected and printed a brochure in 2011. It contains a brief presentation of the types of habitats inside and around the city, and a general presentation of the plant and animal species inhabiting the city and its surroundings. The corresponding website contains much more information, and it is updated periodically. Basically, this initiative is the single one focusing on the city biodiversity. The background is intended to be as scientific as possible, many local scientists contributing to it. But there is still no detailed scientific paper, published in an academic journal, regarding the biodiversity of the city. We really hope this will be accomplished in the near future.

Key Words: conservation, ecology, species, city, environment.

Background. The biodiversity (or biological diversity) is the variety of all living things on Earth (different plants, animals and micro organisms), along with all their interactions, the genetic information they contain and the ecosystems they form. So, biodiversity is usually explored at three levels - species diversity, genetic diversity, and ecosystem diversity. These three levels work together to create the complexity of life on Earth (Australian Museum 2015). Tropical regions have the most biodiversity, temperate regions have less biodiversity and regions with cold or dry conditions, such as mountaintops and deserts, have even less (Rutledge et al 2011).

All species are interconnected, depending one on another. With less biodiversity, these connections weaken and sometimes break, harming all the species in the ecosystem. Ecosystems with high biodiversity are generally stronger and more resistant to disaster than those with fewer species (Rutledge et al 2011).

Biodiversity is important to people in many ways (Wilson 1985), different species of plants, animals, fungi and micro-organisms providing us with food, medicines, fuel, building materials, fibre for clothing and industrial products (TEEB 2010; Rutledge et al 2011). The loss of biodiversity in various region of the Earth, mainly because of the human activities, is of highly concern nowadays (Kolbert 2006, 2014).

Scientists have identified about 1.75 million different species, which includes 950,000 species of insects, 270,000 species of plants, 19,000 species of fish, 9,000 species of birds, and 4,000 species of mammals. This is only a small portion of the total number of species on Earth; there are millions more species yet to be discovered and named (Rutledge et al 2011).

The Romanian biodiversity is high: 3795 higher plant species, 965 moss species, 8727 fungi species, over 600 algae species (Ciocărlan 2000; Ștefănuț 2008; Sabovljević et al 2008; Pricope & Paragina 2013). As for the fauna, there have been identified 33,085 invertebrate species and 611 vertebrate species (Botnariuc & Tatole 2005; Pricope & Paragina 2013).

Studies on the biodiversity of Bistrița-Năsăud county and Bistrița city. There have been only few studies related with some aspects of the county's biodiversity. Many of the papers had only general remarks, naming only few well known species. Crăciun et al (1979) wrote a monographic paper of Bistrița-Năsăud county and they had a chapter related with the flora and fauna of the region, but no direct remarks regarding the biodiversity of Bistrița city. Ghinea (2002), in an encyclopedic paper of Romania geography mentions few data about the county's biodiversity; basically, the paper only includes the same data which were mentioned by Crăciun et al (1979), without any other new information. Chintăuan (1998, 2008) and Chintăuan et al (2004) wrote few papers regarding the protected areas of the county, mentioning few vegetal and animal species inhabiting them. Rusu & Gavrioloaie (2013) wrote a paper about the Natura 2000 network in the county, mentioning few aspects of biodiversity as well.

In our county, the ichthyological researches have been sporadic and basically there have been only two papers concerning exclusively the ichthyological fauna of the county (Rössler, 1974; Rössler, 2002), in which the second one deals only on the fish species, the first one dealing with this issue briefly. Gavrioloaie et al (2011) studied the alien fish species inhabiting the county's waters, mentioning one of them from the Bistrița river, namely *Pseudorasbora parva*, a Chinese fish introduced accidentally in Romania in 60's (Gavrioloaie & Falka 2006; Gavrioloaie 2007; Burlacu et al 2008; Gavrioloaie et al 2008) (Figure 1).



Figure 1. *Pseudorasbora parva* - individual caught on June 2005 in Bistrița river (photo by C. Gavrioloaie).

Other works are more general and reach the fish species problem in the county only tangentially: Vinulescu (1937), Bănărescu (1953), Bănărescu et al (1960), Telcean et al (2002), Telcean (2004), Gavrioloaie (2005, 2007), Gavrioloaie & Chiș (2006).

Within the important book series concerning the Romanian fauna, the papers dealing with the vertebrates mention sometimes certain species from the county and city. For fish, there is the monumental work of Bănărescu (1964), where the author mentioned the presence of the European eel, *Anguilla anguilla* in Bistrița river, near Bistrița city, this being the only mentioning of this species near the city and in Bistrița river. For amphibians we have the paper of Fuhn (1960), for reptiles we have the paper of Fuhn & Vancea (1961), for birds there is the paper of Cătuneanu et al (1978), and for mammals we have the papers of Murariu (2000, 2004), Popescu & Murariu (2001), Valenciu (2002) and Murariu & Munteanu (2005).

Regarding the biodiversity of the Bistrița city itself, there is one paper dealing with two protected areas within the city, where are mentioned mostly plant species inhabiting those areas, and only brief remarks about the fauna (Rusu & Gavrioloaie 2011). Some of

the interesting plant species are *Ginkgo biloba* (Figure 2) and *Liriodendron tulipifera* (Figure 3), both being present in both protected areas in the city.



Figure 2. *Ginkgo biloba* tree (left - source: https://en.wikipedia.org/wiki/Ginkgo_biloba); and leaves (right - source: <http://www.civonline.it/articolo/erbe-medicina-i-benefici-di-ginkgo-e-uva>).



Figure 3. *Liriodendron tulipifera* tree (left - source: <https://www.schwitter.ch/produkt/liriodendron-tulipifera-tulpenbaum/>); and leaves and flower (right - source: <https://www.amazon.com/Liriodendron-tulipifera-Poplar-flower-bonsai/dp/B01F7GRS2E>).

The most recent and comprehensive attempt to assess the biodiversity of the Bistrița city has been done by an NGO, namely Asociația Harta Verde România, which projected and printed a brochure in 2011 (Figure 4). It contains a brief presentation of the types of

habitats inside and around the city, and a general presentation of the plant and animal species inhabiting the city and its surroundings.



Figure 4. The front cover of the brochure (source: <http://harta-verde.ro/proiecte/interfata-intre-biodiversitatea-din-municipiul-bistrita-si-comunitatea-locala>).

The corresponding website contains much more information, and it is updated periodically (Figure 5). Basically, this initiative is the single one focusing on the city biodiversity. The background is intended to be as scientific as possible, many local scientists (mainly biologists) contributing to it.

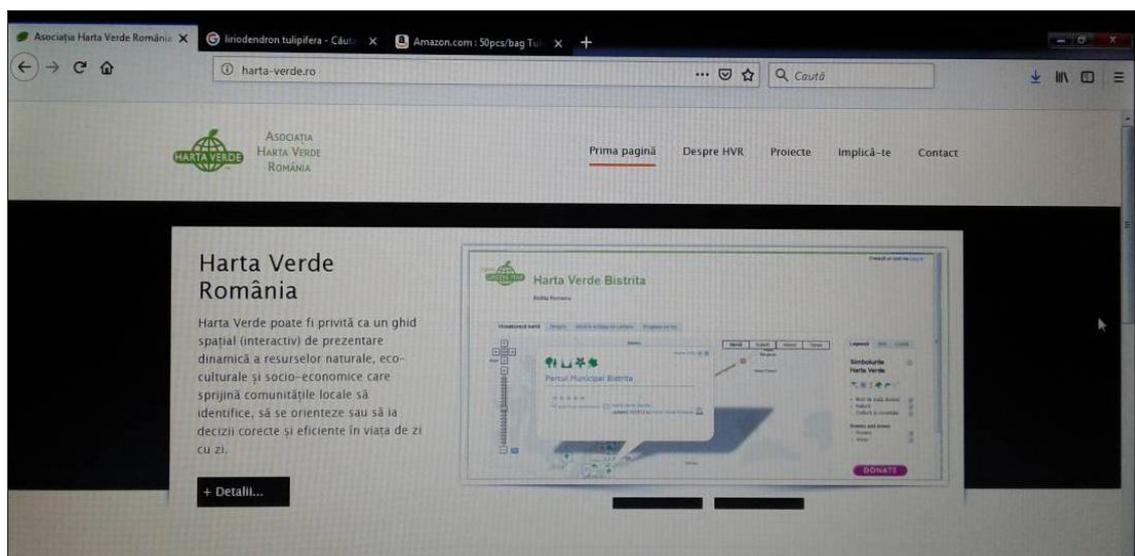


Figure 5. The Home page of the Harta Verde website.

During the years, we noticed the presence of the following vertebrates in the city, some of them in the Central Park. So, regarding the fish, in the lake inside the Park there are

few hundreds of goldfish and carps (*Carassius auratus* and *Cyprinus carpio*, respectively, Figure 6), which winter in the lake, and they also breed during the hot season.



Figure 6. Individuals of *Carassius auratus* in the Park lake (photo by C. Gavriiloaie).

In Bistrița river, along its course through the city, we noticed the presence of *Orthrias barbatulus*, *Pseudorasbora parva*, *Gobio gobio*, *Carassius gibelio*, *Barbus barbus*, *Phoxinus phoxinus*, *Rutilus rutilus*, *Chondrostoma nasus*, *Squalius cephalus*, *Alburnus alburnus*, *Perca fluviatilis*. We did not see any amphibians or reptiles, but this does not mean they are not present in the city. Regarding the birds, we noticed many passeriformes and corvides, and from the mammals we observed the European hedgehog (*Erinaceus europaeus*) (Figure 7), *Sciurus vulgaris*, *Rattus norvegicus*, feral dogs and cats, and few bet species.



Figure 7. European hedgehog (*Erinaceus europaeus*) in the Park (photo by C. Gavriiloaie).

Of course, these are only some periodically and spontaneous observations. But there is still no detailed scientific paper, published in an academic journal, regarding the biodiversity of the city. We really hope this will be accomplished in the near future.

Conclusions. There are only few general studies regarding the biodiversity of Bistrița city. Anyway, there is a growing interest in the evaluation and knowledge of this aspect among the local scientists. So far it seems the city has a moderate to high biodiversity taking into account its dimensions. We really hope to have more papers dealing in detail about the biological diversity of the city in the near future.

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