

Hydrological heritage in the geoheritage and nature protection system of Serbia

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Abstract

This paper deals with nature protection system in Serbia with activities for protection of nature sites and their complex contents, management, expert surveillance, education and promotion. Special attention is paid to protection of surface waters in the light of great strategic significance of water resources and absolutely certain drinking water crisis in near future.

*A new term has been introduced as well – **hydrological heritage** and its place in the Serbian and European geoheritage frame; within categories of protected natural properties a new one is proposed – **water reserve** with the aim to emphasize the importance of direct protection of surface waters as the result of evident increase of the need for drinking water as a global trend.*

In the Summary of Protected Natural Properties of Serbia, where the water has a dominant role, it is pointed to the current conceived importance of surface waters protection as well as the need to pay to this subject adequate and great attention. Introduction of new terms in the nature protection concept of Serbia, protection of new sites with the aim of conserving reserves of drinking water for the future generations has been proposed as well.

Key words: hydrological heritage, water reserve, nature protection, protection of water resources

Introduction

In the 20th century awareness arose on the need of water protection in the most general sense, as an answer to the problem of water shortage and its excessive pollution. At first glance it seemed that water problem appeared out of nowhere, not only at national level of certain states, but as a global problem of the whole humanity.

Majority of the world water reserves (97,6%) are found in oceans and seas, and only 2,4% on land. Majority of waters on land are found in cryosphere (74,4%), and of total waters in the land hydrosphere 25% are ground waters, of which only a smaller part is actually accessible and available (Dukić D, Gavrilović Lj, 2006). The United Nations started to deal with this problem most seriously, and the **UNESCO** began in 1994 the world campaign of sustainable (reasonable) water management, emphasizing priority themes for every year (1994 - "Taking Care of Water Resources is Everybody's Job"; 1995 - "Women and Water"; 1996 - "Water and Thirsty Cities"; 1997 - "The World's Water: Is There Enough?"; 1998 - "Ground Water: The Invisible Resource"; 1999 - "Everyone Lives Downstream"; 2000 - "Water for the 21st Century"; 2001 - "Water for Health"; 2002 - "Water for Development"; 2003 - "Water for the Future"; 2004 - "Water and Catastrophes"; 2005 - "Water for Life"; 2006 - "Water and Culture"; 2007 - (in cooperation with FAO) "Coping with Water Scarcity"). Parallely with this campaign, a UNESCO International Hydrologic Program with a wider theme: "Global Changes and Water Resources" was initiated. The main principle of this program is the sustainability principle, which means conservation of drinking water for future generations, with the main task of protection of habitats and landscapes where the rivers are "ecological arteries"; thus, the decade 2005-2015 has been proclaimed to be the International Decade for Action, "Water for Life". The **Agenda 21**: Chapter 18. Protection of the Quality and Supply of Freshwater Resources: Application of Integrated Approaches to the Development, Management and Use of Water Resources", and its constituent part (item C) named "**Protection of water resources, water quality and aquatic ecosystems**", deal with the same problems as well. At the same time, numerous NGOs are struggling for water conservation

and protection. The best example for this is the American national organization "American Rivers", which offers help in protection of national rivers and return to their natural state under the motto "Rivers connect us to future generations" because "rivers form the most beautiful landscapes in the world". Beside development of the registry of the most endangered rivers, a campaign has been initiated "River Heritage" with the aim to protect permanently "the original wilderness" along the river course from source to mouth. Under the title "Where the Rivers are Made" scientific imperative has been formulated for conservation of small river courses from their source as well as marshes along the river banks. Furthermore, Australian Heritage Commission was established in 1993, within which acts the "Wild Rivers" environmental movement, with the aim to protect original values of rivers and their banks as well as swamps and marshes.

In Europe already exists the widest possible framework for action related to water protection and management, the **EU Water Framework Directive**, with the basic starting point: "**Water is not a commercial product like any other, but rather a heritage which must be protected, defended and treated as such.**" This document includes the generally known positions on importance of water - component of the global ecosystem for human life and health, and it emphasizes that less than 1% of water on the planet is available to people (for use), and that more than 1,2 billion people on our planet do not have access to safe drinking water. In Europe, key facts concerning the water situation are the following: 20% of surface waters in the European Community are seriously endangered by different pollution aspects; ground water reserves participate with a 65% share in the European drinking water reserves; 60% of European cities have passed the limits of reasonable exploitation of ground waters; 50% of wetlands are endangered due to highly disturbed state of ground waters, which are overexploited. Because all of this the Directive introduces a new approach: protection of all waters - rivers, lakes, coastal waters and ground waters with primary task to ensure "good status" for all waters till 2015; it also stipulates that all sources of pollution have to be managed in a sustainable way.

Fine example of work on water protection is international cooperation of countries in the Danube region (**ICPDR** - International Commission for the Protection of the Danube River); also, a more concrete example is signing of the **Water Protection Declaration** by 16 states in the Danube and Black Sea Regions, among which Serbia is as well (on February 23, 2007, in Bucharest). Furthermore, for Serbia may be interesting the idea on cooperation of the Balkan countries, with the help of France, to initiate the Water Observation and Information System for Balkan Countries - (**BALWOIS**), with network for sustainable management of water resources as response to climate changes and ever stronger anthropogenic pressure on water resources.

In Serbia the situation is not much better. Waterflow formed on this territory is 16 billion m³ on annual basis, i.e. 1500 l/inhabitant x years of domicile waters, which classifies Serbia among water-poorer European regions (Djordjević B, 1997). In comparison with neighbouring countries (Hungary, Romania, Bulgaria, Macedonia), when total water resources are in question, status of Serbia is better, but the uneven distribution of water resources and temporal (seasonal and lasting several years) uneven flow are most unfavourable (Gavrilović Lj, 2001). Quantity of transit waters is 162 billion m³ per annum, and they make 90% of all waters in our Republic; there is also this problem of the water quality (which cannot be influenced) and small quantity, namely, there is no water when it is needed the most (Djordjević B, 1997). Because all of this, it could be concluded that the situation with water in Serbia is far more serious than it seems at first glance. Water crisis is on the threshold, and we can prepare for the upcoming water crisis only with timely measures, enhanced water infrastructure, transition to more rational technologies and by implementation of consistent protection of present and future sources of top quality water (Djordjević B, 1997). It is necessary to introduce rational use of water and water saving, redistribution of water resources, protection of water against pollution, and primarily change public awareness that water resources are not inexhaustible, and that it is necessary to make clean water reserves (Gavrilović Lj, 2001).

Surface water protection status in Serbia

Water, as essential precondition for life and survival of human beings and all ecosystems in the nature, and the most significant ecological factor and necessary pre-requirement of any economic development, is protected primarily through statutory regulations. The Water Law ("Official Gazette of the Republic of Serbia", No. 46/91) and by-laws which regulate water protection (Decree on Categorization of Watercourses, "Official Gazette of the Republic of Serbia", No. 5/68; Decree on Water Classification, *ibidem*; The Law on Exploitation and Protection of Water Resources, "Official Gazette of the Republic of Serbia", No. 27/77; Rulebook on the manner of determining and maintenance zones and belts of sanitary protection of facilities for the supply of drinking water, "Official Gazette of the Republic of Serbia", No. 33/78) are all very clear in stipulating protection of water supply sources. However, these regulations offer only unilateral solution of the problem, solely from the aspect of water management needs of our country, not taking into consideration the essential need of preventive protection of the waters found in nature, no matter if they are envisaged (future prospects) for the population water supply. This is the only way to preserve water in original form for future generations in clean natural environment.

In the Law on Environmental Protection ("Official Gazette of the Republic of Serbia", No. 66/91) water issues are regulated in a special chapter, among environmental elements, and water is protected by classification, categorization of watercourses and systematic testing of its quality; however, in the part which explains meaning of the Law related terms, under the term "**Natural Monument**" water is defined as category of natural property, *inter alia*, as "**object or phenomenon clearly distinguished and recognizable, with representative hydrographic and other features, as a rule of attractive and stunning appearance or involving unusual ways of appearance**" (Article 13 of the Law on Environmental Protection). Until now, hydrological phenomena and objects have been protected in the aforementioned way, as natural rarities of outstanding scientific, educational and aesthetic value, and the main criteria for their qualifying have been originality and authenticity. Main features of natural monuments with hydrological value are certain specific water phenomena in nature, most frequently springs, founts, waterfalls and lakes, and watercourses have been protected until now mainly within protection of watercourse valleys (Vasiljević B, 1983). This protection includes major karst springs and all known intermittent springs (Gavrilović D, 1967). However, it is necessary to emphasize an important fact that protection of major natural areas within national parks, natural parks, outstanding landscapes and nature reserves (general and special) includes protection of all surface waters, although it has never really been specifically emphasized anywhere. Natural properties in Serbia, which include water as one of fundamental natural values, are:

- **National Parks**
(Djerdap, Tara, Mt. Šar-Planina);
- **Natural Parks**
(Golija, Mt. Stara Planina, Sićevo Gorge, Begečka Jama, Ponjavica, Palić, Jegrička);
- **Landscapes of Outstanding Natural Beauty**
(Valley of the River Pčinja, Gorge of the River Gradac, Miruša, Vlasina, Ovčar-Kablar Gorge);
- **Area of Outstanding Natural Beauty**
(Resava);
- **Special Nature Reserves**
(Gornje Podunavlje (Upper Danube Region), Gorge of the River Resava, Gorge of the River Suvaja, Gorge of the River Osanička Reka, Stari Begej - Carska Bara, Gorge of the River Trešnjica, Marsh Koviljsko - Petrovaradinski Rit, Gorge Jelašnička Klisura, Uvac, Hajdučka Česma, Bog Obedska Bara, Zasavica, Lake Ludaško Jezero, Lake Rusanda, Slano Kopovo);
- **Natural Monuments**
(The Sopotnica Cascades, Spring Krupajsko Vrelo, Spring Krupačko Vrelo, Spring of the River Mlava, Bjeluška Potajnica, Homoljska Potajnica, Promuklica near Tutin, Veliko Vrelo in Strmosten, Beli Izvorac, Velika and Mala Ripaljka, The Lisina Waterfall, Natural Bridge Valja

Prerast, Tunnel Cave Prerast in the River Zamna Canyon, Canyon of the River Vratna with natural bridges, Canyon Lazarev Kanjon, Gorge of the Sikolska Reka with Waterfall at the Mokranjska Stena, Valley of the Stream Bigar, Ribnica, Cave Lazareva Pećina, Cave Ravanička Pećina, Cave Pećina Samar, Cave Mermerna Pećina, Cave Petnička Pećina, Cave Radavačka Pećina) (Belij S, Simić S, 2007).

Many other natural properties include interesting hydrological phenomena, and they are distinguished as particularly valuable, primarily because of their hydrological diversity. Undisputably, water in these natural properties is one of the fundamental natural values, which could be already concluded from their name, although hydrological phenomena have not been particularly evaluated nor protected. Internationally significant natural properties, whose main value is diversity of wetland habitats - **RAMSAR SITES**, in Serbia are the following: Lake Ludaško Jezero and Bog Obedska Bara, whose protection was proclaimed already in 1977, later on Stari Begej - Carska Bara, Slano Kopovo, Labudovo Okno and the Pešter Plateau, while Vlasina and Gornje Podunavlje have been nominated for protection; their fundamental values are high population and ornithofauna and ichthyofauna diversity. Their natural value and specificity are mostly the result of specific habitat conditions, of which water is the determining one (maybe the primary one), although its importance and role have not been practically mentioned at all.

Hydrological heritage

Protected natural properties are national heritage, heritage to be left to future generations to enjoy and use, and it is our responsibility to leave the entire heritage in an unchanged, if not even improved state in comparison to some zero level during the first research activities, identification and evaluation. Such heritage is a representative sample of the overall environmental surrounding, and it is of utmost importance to conserve (at least) in these natural areas the present original ecosystems. If this is an obligation, determined and clearly defined in numerous international and national documents, than it is even more our moral and civilization obligation to conserve natural waters, both surface and ground ones, in their diversity: springs and founts, sinking rivers, waterfalls, cascades, (sources) of watercourses and sparse lakes, against pollution and degradation – completely clean, Class I¹.

This is where originates the idea of paying appropriate attention to protection of hydrological phenomena and their appropriate place in the geoheritage system and nature protection of Serbia. Until now protection of hydrological phenomena was partial and unsystematic. In a great many protected natural properties, from the biggest - National Parks to the smallest - Natural Monuments, water is a basic natural value, although its importance was not always emphasized, and was most frequently treated only as a habitat element. In time, clear necessity of precise classification of water phenomena has emerged as well as the need of defining their place in the geoheritage system.

One of first steps in doing this has been forming of a Hydrology Working Group within the National Geoheritage Council of Serbia, consisting of 16 working groups, including eminent experts in different disciplines (historical geology and stratigraphy, petrology, paleontology, geomorphology, speleology, neotectonics, geophysics, hydrogeology, pedology, archaeology, etc.). The task of the Hydrology Working Group is development of the **Serbian Inventory of Hydrological Heritage Objects**, which would be evaluated according to standard criteria of the

¹ „Class I – clean water, suitable in its natural state for use in public plumbing installations, plumbing installations of food and pharmaceutical industry and all other industries, which need quality "drinking water". Class I waters are only disinfected, if necessary. In the rivers of this class, whose water is rich with oxygen, live the most noble fish species of the Salmonidae Family: Trouts, Huchen, Marbled Trout, Salmon. According to saprobiological classification, Class I belongs to oligosaprobic waters“ (Dukić D., Gavrilović Lj, 2006).

ProGEO Association; at the same time, objects of international significance and value would be singled out.

The main reason for initiating this wide action related to centring out and protection of geoheritage objects is understanding of their importance and uniqueness, but also awareness of exceptional fragility of these phenomena. As records of the history of our planet they have been preserved in the Earth's crust, rocks and relief, and are the Earth's memory of the events from near and far past, endangered today more than ever. What is lost is irretrievable and cannot be restored in any way, thus it is urgent to identify, understand and protect these objects and phenomena as our common heritage. For the same reason it is necessary to include into this huge project objects and phenomena of hydrological heritage; after all, our survival and life directly depend on **water**, which has other values as well (scientific, educational, aesthetic).

Numerous hydrological objects and phenomena in protected natural properties are the basis of the future Inventory of Hydrological Heritage, and one of the ideas for future work is **forming of new reserve types – water reserves**, as special subcategory within general and special nature reserves. Namely, in the Law on Exploitation and Protection of Water Resources ("Official Gazette of the Republic of Serbia", No. 27/77) this term has been already used ("**Surface areas of drainage basins of first-rank water sources are considered to be reserves**" (Article 3) and further "**Water source reserves are under special protection and three protection zones are established: wide, narrow and immediate protection zone**"(Article 11). In the part on the long-term water supply basic plan of the same Law, the following is emphasized: "**Pollution status of waters and environment in general requires complete reaffirmation of preventive principles of water source protection, which ensure complete security**" (Part 3.6.), and further: "**Clean water reserves are found in highland areas of east, south, west and central part of the Serbian territory, without the territory of Autonomous Provinces, with total surface area of approximately 14.000 km², where first-rank reserves encompass surface of nearly 10.000 km²**" (Part 3.8.). This term is found in expert literature as well: "**The main goal of creating clean water reserves is getting as much quality waters as possible at the water source**" (Jovičić M, 1994), and Lj. Gavrilović (2001) emphasizes: "...**everything should be done for conservation of available water resources... through unique water protection program... furthermore, clean water reserves should be created**". After all, in the Water Resources Management Basic Plan of the Republic of Serbia the following is emphasized: "**From the point of view of maintenance of water quality, national parks and their limited use have positive impact on waters**". Through cooperation with the Institute for Development of Water Resources "Jaroslav Černi", an agreement on joint protection of water sources of river courses can certainly be reached and first-class waters maintained, which would fulfill the basic protection principle, preventive action with the aim to maintain the water quality as well as protection of immediate natural surrounding areas, whose values build complementary unique landscapes of mountain river sources and harmoniously form a geodiversity, biodiversity and hydrodiversity unity.

Conclusion

World Water Day 2007 under the auspices of UNESCO stood under the slogan "**Coping with Water Scarcity**". Ever more present indicators of this premise are found everywhere worldwide - on our Planet; namely, a great many regions suffer from water shortages of different intensity. With us, water scarcity problem is not alarming yet, but it has been recorded and solutions for future water shortages have to be discovered as soon as possible. Naturally, basic solution includes construction of capital water management facilities and complex infrastructure, although preventive actions for conservation of current water resources, primarily quality drinking water, are necessary as well. Need of water protection policy is obvious bearing in mind the aforementioned, because the water, primarily as part of natural environment and as a resource, is gravely endangered. Bearing in mind that the main activity of the Institute for Nature Protection of Serbia is protection of valuable natural areas, it is necessary to begin this job as soon as

possible. Water protection does not include only protection of precious hydrological phenomena - springs, waterfalls, lakes, (parts of) river courses... this protection means also protection of certain localities, which should serve in future prospects for providing drinking water for the inhabitants (protection of water sources and waters of Class I), but other needs as well.

This is why the Institute for Nature Protection of Serbia has made the first step - establishing of the new Hydrology Working Group within the National Geoheritage Council of Serbia, with the main task to develop a Serbian Inventory of Hydrological Heritage Objects. On the other hand, in practice, protection of the very hydrological objects and the surrounding area - nature, whose integral part they are, should be implemented more persistently, by introducing new category of reserves – water reserves, in which, beside overall biodiversity and geodiversity values, hydrodiversity resources would be protected as well, primarily sources of rivers of Class I, which would make water protection more complete and improve protection of water supply sources implemented by water management organizations. After all, it is high time to approach nature protection in an integral manner, and to pay more attention to the indisputable biodiversity values, to exceptional fragility of geoheritage objects, which are irretrievably lost in case of damaging or destroying, and to objects and phenomena of hydrological heritage, both as natural phenomena and strategic drinking water reserves, which shall become ever more important in the future.

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[www. UN](http://www.UN.org) Water.org

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