SMALL RIVERS OF PODILLYA AS TERRITORIAL ELEMENTS OF REGIONAL ECOLOGICAL NETWORK

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Abstract

Description of the small rivers of Podol'ya is given in the article, hydroecology approach is taken at forming of ecological network of region, which will become making European eco-network. The complex of measures, which will improve the ecological state, rational use and guard of the small rivers with the prospect of their including to the spatial elements of regional eco-network, is recommended. It is suggested to create the new hydrological protected objects and territories which will allow to multiply the naturally-protected fund of Podol'ya from 8 to 12 %.

Key words: small rivers, ecological state, ecological network, guard, rational use, Podol'ya.

Аннотация

В статье подана характеристика малых рек Подолья, использован гидроэкологический подход при формировании экологической сети региона, которая станет составляющей европейской экосети. Рекомендован комплекс мероприятий, которые улучшат экологическое состояние, рациональное использование и охрану малых рек с перспективой их включения к пространственным элементам региональной экосети. Предложено создать новые гидрологические заповедные объекты и территории, которые позволят увеличить естественно-заповедный фонд Подолья с 8 до 12 %.

Ключевые слова: малые реки, экологическое состояние, экологическая сеть, охрана, рациональное использование, Подолья.

Introduction. One of the most urgent tasks of the present time, mentioned at the Conference of UNO on the Environment and Development (Summit “Planet Earth”) in Rio de Janeiro (in 1992) and Summit in Yoganesburzi (2002), is the conservation and balanced use of biotic and landscape variety. Till recently creation of nature protection territories has been the main and the most effective method of its conservation. However growing fragmentation of the environments of species existence did not provide their maintenance. Therefore, today there is a necessity to form the integral, self-regulative and self-restoring biotic system which functions can be executed only by the ecological network.

One of basic scientifically grounded and economically reasonable approaches for the formation of ecological network and territorial organization of the region environment is hydro-ecological one. On territory of Podillya hydrological network is developed well enough and its water objects must form ecologically safe organization of the territory of the perspective eco-network. For its creation it is not enough to have the developed theory of frameworks of ecological safety, proper laws and programs of concrete actions. In fact available land fund has already been divided into shares and unsoldered between different land users, thus very little land areas of government reserve has remained. To form optimum regional eco-network it will be necessary to revise and change the projects of landownership and land use and change the status of land use, while some of them should be bought as it is done in the countries of European Union. It mostly refers to lands of water fund which are the

basic reserve for forming eco-network from local to the national level. In particular, it refers to the bank-protection areas, off-shores, protective zones, sanitary zones and the like. There are proper norms and rules set for them and specific restrictions on the economic use are imposed. However, because of the lack of financing selected lands of this fund of Podilsky region are not marked in nature on localities, they are not mapped on the plans of land-tenure, their use is not regulated practically. Today the documents on the establishment of off-shore protective areas along the small rivers have not been developed; as a result it is impossible to carry out effective control of the use of water fund lands as territorial elements of regional ecological network. Mass building and dividing into the shares of these lands violates the integrity of river ecological corridors (connecting territories).

The purpose of the research is to study the influence of natural and anthropogenic factors on the small rivers of Podillya; on the basis of researches, to offer scientifically grounded and the economically reasonable measures, which must be executed for the improvement of their ecological state, protection and rational use, with the purpose of including into spatial elements of regional eco-network.

Materials and methods. The object of research is small rivers (river bed, flood plain, slopes, overflood plains, watersheds) of Podillya, their ecological state. The catalogue of the small rivers, ponds and storage reservoirs, basin and territorial schemes of the complex use and conservation of water resources, reference books and methods of regional eco-network formation and determination of ecological estimation of quality of surface water in accordance with appropriate categories and personal model supervisions and researches are used [2-4, 6, 13-14, 16-17].

The basic **methods of researches** are analytical, descriptive, field, comparative, statistical, experimental, expeditionary, cartographic, and monitoring.
Recently interest to small rivers had grown considerably. It is explained by their important nature-forming, sanitary-hygienic, recreational and health-improving and ecological functions. They become the environment for existence, material and energy source for economic activity. However, due to considerable anthropogenic influence they do not form spatial elements of eco-networks of Podillya (cores, eco-corridors, buffer areas, zones of renaturalization).

Results of researches. Analysis of the literary-fund and cartographic sources and usage of field researches have enabled to establish that hydrographical network is developed well enough on the territory of Podillya. Thus, in the eastern part of Podillya (Vinnitchynna) there are 3594 rivers and streams with the total length 11,8 thousand km. Among them there are 3368 streams with the length that is less than 10 km and total length of 6400 km, 226 small rivers that are more than 10 km long with the total length of 4535 km. The total length of the small rivers is 10935 km. 65 storage reservoirs are created on the rivers with the area of water mirror 11167 ha and 4033 ponds – 20552 hectares, total area is 31719 ha. River network density is 0,45 km/km^2. The hydrographical network of Central Podillya (Khmelnytchyna) is presented by over 3 thousand rivers with the general length of nearly 10 thousand km. However, only 1650 rivers are over 10 km long each and 10 rivers are more than 100 km long.The small rivers are tributaries of the Southern Bug (Riv, Zgar, Buzhok, Vovk and others), the Dnister (Zbruch, Smotrych, Ushytsia, Zhvanchyk, Zhornivka, Studenytsia, Kalyus, Ternava, Muksha but others) and the Goryni. 1858 ponds and storage reservoirs are

made on the rivers with the area of water mirror 22092 ha. The hydrographical network of Western Podillya (Ternopilschyni) is presented by the rivers, lakes, ponds and storage reservoirs. The total number of rivers and streams is 2400, 120 of them are more than 10 km long. 1542 of them belongs to the river basin of the Dnister (Zolota Lypa, Koropets, Strypa, Dzhuryn, Seret, Nichlava, Zbruch and others) with the length of 5385 km, and 108 – to the river basin of the Prypyat (Gorin, Ikva, Viliya and others) with the length of 630 km, in quantitative correlation 4/5 to 1/5. The rivers of the Dnister basin are deeply cut into river valleys, and the rivers of the Pripyat basin are wide and swamped valleys. it is 912 storage reservoirs and ponds are located in their basins. The total area of water mirror is 17,3 thousand ha. Average density of hydrographical network is 0,48 km/km^2. On the whole there are 7644 rivers and 6868 ponds and storage reservoirs which have mixed nutrition – rain, snow and underground and occupy 8,4 % of territories of Podillya region [2, 7, 17].

Using hydroecological approach for the formation of ecological network of the region it is necessary to take into account such features [11]:

– an ecological network must be created only on the completely new ecocentrical conception – it should cover all heterogeneity of living and lifeless nature in its relatively static and dynamic state;
– existing and perspective eco-networks must make the unique a single representatively completed system of the natural and artificial protected objects and territories;
– formation of the perspective eco-network must be carried out on the basis of professional scientific and methodical provision;
– protected territories selected for the perspective must be simultaneously accompanied by the geosozological provision (to improve old or develop new categories of testament, set the mode of conservation, define the type of ecological monitoring and so on;
– perspective eco-network must be a part of the existing system of the unique general management and audit of natural reserve fund of Ukraine;
– objects and territories of the perspective eco-network must be scientific grounds for the study of the state and dynamics of different types of ecosystems and landscapes;
– perspective eco-network must be organized not only on unchanging natural territories but also in places where ecosystems and landscapes are on the stages of insignificant anthropogenic degradation or where ecological conflict situations may occur.

Well developed hydrographical network of Podillya allows using small rivers of the region as ecological corridors of ecological network. The criteria of selection of connecting territories (ecological corridors) are less developed nowadays than the criteria of natural cores of eco-network. It is explained by the novelty of conception of eco-corridor and absence of normative legal documents which regulate their creation. The basic functions of ecocorridors are the following: 1) provision of species distribution; 2) maintenance of the processes of species reproduction and assistance to genetic material exchange; 3) provision of species migration; 4) species sheltering and helping them to overcome unfavorable terms; 5) maintenance of ecological equilibrium. Ecological corridors are large-scale territories that can be represented by some forest belts that connect two biocenters and river valleys. Every ecocorridor is quite unique under condition of species migration and settling apart, its water protecting, anti-erosive, slope-stabilizing, aesthetical and other functions, that is why their planning must be connected with local characteristics. It is desirable, that the width of local hydroecocorridor was not less than 500 m. In general, the wider ecocorridor, the better it executes its functions, and the narrower it is – the worse [6]. Although ecocorridors are appointed to execute various functions, their basic purpose is to provide spatial connections between biocenters and natural cores of eco-networks. Therefore the dominant criterion of

their selection is a migratory one: ecocorridor is a natural habitat or their aggregate, along which exchange of genetic material is possible as well as migrations between the biocenters (by regional and natural cores) of eco-networks. It is possible if the following basic conditions are maintained [6, 14]:

– the length of ecological corridor does not exceed the distances for which most species living in biocenters migrate or settle apart;
– the width of ecological corridor allows populations to use it effectively as a channel of migration and settling;
– the edaphic conditions of ecological corridor territory are analogical or close to the edaphic conditions of biocenters (natural cores) which connect them;
– the territory of ecocorridor must be continuous or discontinuous, but the length of breaks in the middle of ecological corridor must not hinder migration and settling of most species;
– an ecological corridor must necessarily include areas (territories) that have species of plants, animals, mushrooms listed in the: a) Red List of the International Union of Nature and Natural Resources Conservation that are under the threat of disappearance in the world scale (International Union for Conservation of Nature and natural resources, IUCN, 2004); b) European Red List of Plants and Animals which are under the threat of disappearance in the world scale accepted by the European Economic Commission of UNO in April 1991; c) Red Book of Ukraine (2009); d) International Conventions (Convention on Wetlands of International Importance especially as Waterfowl Habitat, Ramsar, 1971; CITES – Convention on International Trade in Endangered Species of Wild Fauna and Flora, 1973; Convention on the Conservation of European Wildlive and Natural Habitats, Bern, 1979; Bonn or CMS – Convention on Migratory Species, 1979; Convention on Biological Diversity, CBD, 1992) and agreements of EUROBATS – On Bat Protection in Europe, 1994; AEWA – On the Conservation of African-Eurasian Waterbirds, 1999); e) local Red Books of Ternopil, Khmelnytsky and Vinnytsya regions (there are 369 plant species and 419 types of animal species that are regionally rare in Podillya); f) species that are on verge of natural habitat; g) endemic and relict species; h) typical species that degrade; i) territories which are vanishing and vulnerable environments for the existence of the above-mentioned species [6, 9, 10].

Except for connecting function, the contiguous biocenters of ecocorridors can have an independent value as the centers of biotic and landscape variety. For example, many river-beds and river valleys in general do not link natural cores between themselves because of considerable anthropogenic influence, however they have high biovariety. It caused by that fact that river-beds and river valleys are powerful channels of migration of many species, mainly – rarity water-bog fauna and flora. Biovariety of such linear prolate natural habitats can be conserved by the maintenance of species migration especially within its boundaries. So by the place of location and connection of regional biocenters of eco-network hydroecological corridors of Podillya are divied into river-beds, streamsides, overflood plains, slopes, watersheds. The distribution of aquatic lives, amphibious, mammals, seasonal migration of aboriginal ichthyofauna and ornitofauna to the places of feeding, spawning, calving, wintering and so on takes place though them. Thus, the base criteria ecocorridors selection is naturalness of boundaries, sufficiency of the width and length to provide species migration, their reproduction and overcoming of unfavorable conditions [12, 14]. The ecological state of water objects of the perspective eco-network region is determined both in quantitative and qualitative relation between the components of natural environment (by composition, structure and soil and breed characteristics, intensity and variety of plant cover, by relief forms) and economic activity of man (regulation of slope and river flow, water-air regime of

soil and under-surface layer, ploughing of river basins, intensive haymaking, grazing of livestock, deforestation, agrarian and industrial mastering of water-accumulation, creation mature and rubbish stores as well as summer camps to locate their cattle and the like in off-shore protective areas). When dislocating in the small river basins of water intakes of water supplying systems the following factors are not always taken into account: possible violation of hydrological mode of water drains, violation of ecological connections, attitude of population to the river (lake, pond), that formed here historically, as to the object which satisfies recreation needs. It results in exhaustion, degradation of small rivers, change of all hydroecological network.

Conclusions and recommendations. For the improvement of the ecological state, rational use and protection of the small rivers of Podillya with the perspective of their including into spatial elements of regional ecological network it is necessary to fulfill such measures:

– to make an inventory of water-bog lands of Podillya, to study their ecological state, register and give the status of nature reserves of different grade;
– to define by special land projects the water protection areas for all water objects of the region. To include flood plains in regional econetwork, and for small rivers which form framework of local econetwork – lower terraces;
– to take away in nature and appoint enterprises, establishments, organizations to be responsible for off-shore protective areas of the rivers, ponds, storage pools of Podillya on the area of 5980 ha [7];
– to grass off-shore protective areas, where a slope is to 3^0 and then forest where slopes are more than 5^0, to adhere to the norms and requirements on the storage and application of pesticides, mineral and organic fertilizers. Avoid applying fertilizers: into frozen or covered with snow land; if there is probability of heavy rains or rainfalls in the nearest two days; nearer than for 10 m from the streams and small rivers; in 20 m from lakes and large rivers; in 50 m from the sources of home water-supply; in 300 m from the sources of public water-supply. To introduce organic (biodynamic) agriculture as widely as possible [4, 16];
– to apply agrotechnical anti-erosion measures using soil-water protection contour melioration system of agriculture on the area of 1513 thousand ha, building anti-erosion hydrotechnical buildings;
– to carry out renaturalization of water-bog lands, recultivation of destructed lands of water fund, their conservation with the purpose of creation of bank-protection meadow and forest plantations and including them into the objects of regional econetwork on the basis of hydroecological approach. Promote active protection of the plant and animal world of the river, flood plains, river valley, bog. Severely limit the selection of peat in water-bog lands, to plough and litter flood plains and slopes of river valleys, cut down trees, and obtain sand, gravel, clay and other building materials in a river-bed and on flood lands [8];
– to adhere to nature protection measures in water-intake basin of a small river, graze domestic animals on flood lands only if it is allowed. It will facilitate maintenance of different mixed grasses. For the additional animal feeding on the pastures they should be located not nearer than 30-40 m from reservoirs. It is impossible to place salt for cattle next to reservoirs or directly on the soil surface – it is necessary to equip special places for this purpose. It is expedient to limit access of cattle to the reservoirs on pastures (by the enclosure of reservoirs by an electro-shepherd or other fences) and to create special watering places further from natural reservoirs with the supply of tap-water;

– to develop and introduce ecological programs on the creation of 1-2 standard river pools in every administrative district of Podillya that will become a standard for the revival of small rivers of the region;
– to erect on the water intakes water- and soil protective engineering-landscape complexes with addition of forest, shrub and meadow-bog phytocenosis, creating optimum correlation between landscape elements in the river basins: by arable, meadow, forest and water lands and protected fund. According to data given by Y.V. Hrub percentage correlation of arable land, natural forage, forest and water lands recommended for watersheds must correspond to proportion 30:30:20:20 [3];
– to create water protecting belt (up to 25 m) for small rivers and ponds up to 3 ha, for middle-size – 50 m and ponds with the area of more than 3 hectares, for large – 100 m, and if the steepness of slopes exceeds 3^{o}, the minimum width of water protecting belt is doubled. Water protecting function is executed better by the willow, black poplar, aspen, alder, birch, elm, maple, linden, pine, ash, and oak [4, 16];
– to decrease ploughed water intakes from 60-69 % to 30 % increasing woods from 13,5 % to 30 % (that would perform water intaking, soil protective and sanitary-hygienic functions) and to forbid self-willed deforestations [8];
– to renew neglected HES, mills on the rivers, log-paths with the purpose of their including to the special elements of regional cultural ecological network;
– to create favourable conditions for the recreation of fish supplies, regulation of fishing (to forbid poaching with the use of electro-fishing-rods, nets), with categorical prohibition of self-willed hydrotechnical works (especially pond draining) with the purpose of fishing;
– to issue ecological-elucidative literature (newspapers, booklets, brochures, magazines, and others) using finance of the regional fund of environment conservation to light up ecological role of off-shore protective belts, water-protection areas and water-bog lands;
– in order to form non-exhausting regional eco-network it is advisable to include into its spatial elements natural (small rivers, river-bed islands, waterfalls, reaches, rapids and rifts on them, lakes, pools, bogs, shoals, fool lands, slopes) and anthropogenic (storage reservoirs, weirs, small ponds, canals, meliorated dried areas, some overflood lands) water objects.

Only bog lands with a rare biovariety on Podillya make more than 10 thousand ha that must become the standard core (biocenters) of regional eco-network. “Hangings bogs” of Pridnisterya must become the interesting original protective objects of local econetwork. They are formed on the lime “pillow” and where water and wells come out. Such bogs can belong both to meadow-steppe areas on the stony slopes and in the field that occupy insignificant arears – from 0,02 to 2 ha. In Pridnisterya they are called “rudki”, “rutki”, “obocha”. The following items should become perspective hydrological protected objects of the designed ecological network of Podillya: 1) geopark “Large Canyon of the Dniester” – the system of canyons of Pridnisterya formed by the Dniester together with the left tributaries the Koropets, Stryp, Dzhurin, Nichlava, Zbruch, Smotrych, Zhvan, Karaets, Lyadova, Nemii, Murafa, Rusava which cross the Tovtrova ridge.

The representatives of UNESCO offer to include the Large Canyon of the Dniester, which depth sometimes reaches 150-180 m, into the register of “100 Great Wonders of the World” (in the competition “Seven Wonders of Ukraine” it got the second place after the biosphere nature reserve “Askaniya-Nova”). This geopark with the area of more than 200 thousand ha has hydrological, geological, stratigraphic, paleontological, speliological, botanical, zoological, landscape and sozological value and it must be created together with the republic of Moldova which falls under the action of Ramsar convention on the conservation of water-

bog lands of international value [7, 15]; 2) regional landscape parks (RLP) "Gorinskiy" with the area of 300 ha, "Seredneseretskiy" (1500 ha), "Nadzbruchanske Podillya" (500 ha); 3) national natural park (NPP) "Overhead Pobuzhzhya" (central part of Khmelnytchyna, riverhead of the Southern Bug with the total area 108710 ha within the boundaries of Letichivskiy, Derazhnya, Khmelnytsky, Starokostyantinivsky and Krasiliv districts) [1, 17]; 4) NPP "Small Polissya" (northern part of Khmelniytchyna with the area of 25905 ha within the boundaries of Izyaslav and Slavuta regions [5]; 5) expansion of RLP "Dniester" with the area of 4670,33 ha to 18230 hectare (sothern part of Vinnytchyna – Murovano-Kurilovecki, Mogiliv-Podilskiy districts); 6) expansion of RLP "Middle Pobuzhzhya" with the area of 2527 ha to 16730 ha in the middle part of the river basin of the Southern Bug within the boundaries of Vinnytsya region (from village Sutysky of Tivrivsky district to village Raygorod of Nemyrivsky district); 7) RLP "Ditch" with the area of 6532 ha (Zhmerinskiy district in Vinnytchyna); 8) RLP "Snivodskiy" with the area of 1530 hectares (IVA of territory of Khmilnytsky district in Vinnytchyna fall under the action of Ramsar convention); 9) hydrological recreation territory "Mykolaiv" with the area of 250 hectares (Kozyatinsky district in Vinnytchyna); 10) RLP "Mikulinecki small pools" with the area of 1550 hectares (IVA of the territory of Litinsky district in Vinnytchyna fall under the action of Ramsar convention); 11) RLP "Garmakivski small pools" with the area of 1550 hectares (IVA of territory of the Lordly district in Vinnytchyna, fall under the action of Ramsar convention); 12) RLP "Buzko-Sobskiy" with the area of 1580 ha (Haisyn district of Vinnytchyna). On the whole, it is planned to create near 100 new protected hydrological objects;

– to develop and confirm new category of nature protection territories "reservoir for natural ecosystem recreation" and "landscape of the small river valley", the lands of which would not be a subject for privatization or would be made private on special terms [13];
– to conduct ecological expert examination and test organization of land exploitation of eco-network and dangerous objects which influence on a small river basin, and carry out the water inventory, certification, audit and management of the rivers and reservoirs by the basin principle. For this purpose it is necessary to conduct constantly ecological monitoring of parameters of water-keeping basin to conserve biotic variety.

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