

The resource appraisal of the pools of slow water exchange of Ukraine

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Abstract: The main resources of the pools of slow water exchange in Ukraine have been appraised according to natural-economic ranges, economic parts, small (within the republic) economic ranges, physical-geographical zones, administrative regions and geographical zones. The accomplished generalization of different investigations testifies that 29497 pools of slow water exchange are concentrated on the territory. Their area is 1263.4 thous. ha; the total volume of the water resources accumulated in water bodies reaches 60.67 km³; the ratio of lake surface to drainage area of Ukraine is 2.09%. The bottom sediments of lakes (sapropels) are prospective resources for industry. The developed stores of sapropels constitute 63.9 million tn.

Key words: pools of slow water exchange, lake, reservoir, pond, resources, sapropel, natural-economic range, economic part, small (within the republic) economic range, physical-geographical zone.

The realization of land-reclamation measures, rational use of land, hydraulic engineering construction, intensive development of mineral wealth, recreational use of natural-territorial complexes and their conservation should be based on a profound knowledge of the quality and regularities of development of an environment. Thus it is necessary to take into account anthropogenic changes in order to solve the problems of rational nature management.

The actual task of modern constructive geography (in particular of its branch – applied limnology) is to form the theoretical and methodical bases of management of water ecosystems. These researches have taken on a special significance in connection with further intensification of industry, when the role of scientific investigations in the development of scientific principles of rational nature management and the enhancement of

efficiency of nature-conservation measures increases. It is possible to solve the problems connected with optimization and water conservation on condition that there is a thorough investigation of pools in different geographical zones.

The purpose of the given paper is to appraise the main resources of the pools of slow water exchange (lakes, reservoirs, ponds) of Ukraine according to natural-economic ranges, economic parts, small (within the republic) economic ranges, physical-geographical zones, administrative regions, and to consider some aspects of their rational use.

The estimation of the lake, reservoir and pond resources of Ukraine is necessary for the realization of the national programme “Ukraine 2010”, the National programme of ecological normalization of the Dnieper’s basin and for improving the quality of potable water. Besides it is necessary

for preventing negative water influence (construction of hydraulic engineering buildings, protective dikes etc.) according to the Complex programme of realization of anti-flood measures during 1994–2000 (the resolution of the Cabinet of Ukraine, dated January 26, 1994 No 37); introducing an ecological passport system for the small rivers and other water bodies according to the order of the Council of Ministers of the Ukrainian SSR, dated December 18, 1987 No 658; building an appropriate information database etc.

The problems of providing information are given especially careful attention, as the practical significance of many optimization and other management schemes, including water-economic complexes, is largely determined by the availability, reliability and form of allocation of input information.

Rational use of resources of the pools of slow water exchange (PSWE) requires a multifold knowledge of the processes taking place in pools, and connatural tendencies of the development of their ecosystems. However the limnological investigations in Ukraine are not sufficient yet. So the ecological vulnerability of the lake complexes and anthropogenic load on their basins determine the necessity of further development of the limnological researches – one of the major tasks of exploration of the natural resources of the country.

Now a tense water-economic balance is formed in Ukraine. Such a situation sets the industrial and agricultural enterprises the task of rational use of water resources. A considerable part of these resources is concentrated in lakes, reservoirs and ponds.

The geographical location, geological structure of the territory and its climatic conditions have determined the uneven allocation of water resources in Ukraine. In conditions of extremely limited water resources 1087 reservoirs (the total water capacity is 55 milliard m³, the area is 965.63 thous. ha) and 27496 ponds (the total water capacity is about 3 milliard m³, the area is 208.32 thous. ha) have been constructed for uninterrupted water-supply of the population and national economy. A special place in water-supply is occupied by the reservoirs of Dneprovsk cascade, their complete volume is 43.7 milliard m³, the area is 688.7 thous. ha.

Hydraulic engineering construction caused considerable changes in the environment and their prognosis should be considered as a part of the common prognosis or general layout which is

needed for planning the development of the national economy.

The fulfilled generalization testifies that on the territory there are concentrated 29497 PSWE and they occupy an area of 1263.4 thous. ha. The total volume of the water resources accumulated in PSWE reaches 60.67 km³, that makes 115% of the average fluctuation of river discharge.

The ratio of lake surface to drainage area of Ukraine is 2.09%. The most limnetic areas are the Odessa (3.9%), Chernovtsy (2.2%), and Kharkov (1.39%) regions. There are small indexes of the ratio of lake surface to drainage area in the Zakarpatye (0.2%), Chernigov (0.3%) and Lvov (0.5%) regions.

Pools in different geographical zones, as well as each separate pool itself, have their own specific features which determine the general directions of their rational use and conservation. The resources of PSWE are allocated in different physical-geographical zones as follows: the East Europe plain – 540.16 thous. ha (among them: reservoirs – 256.21, ponds – 199.79, lakes – 84.16), the Crimean mountains – 9.45 thous. ha (among them: reservoirs – 3.6, ponds – 3.05, lakes – 2.8), the Ukrainian Carpathians – 24.99 thous. ha (among them: reservoirs – 17.12, ponds – 5.48, lakes – 2.19) (Tab. 1).

Table 1. The pools of slow water exchange of Ukraine (according to physical-geographical zones)

Country, zone	Number, pcs.	Volume, mil. m ³	Area, thous. ha
The East Europe plain	27405	13308.5	540.16
The mixed forests	6469	2317.8	102.06
The forest-steppe	14543	4372.5	187.2
The steppe	6393	6618.2	250.9
The Ukrainian Carpathians	1192	3223.0	24.99
The Crimean mountains	894	428.7	9.45
The Dneprovsk cascade	6	43710	688.7
In total	29497	60670.2	1263.4

In natural-economic ranges the pools are allocated unevenly: Prichornomorje – 172.48 thous. ha (among them: reservoirs – 97.12, lakes – 55.17, ponds – 20.65), Levoberezhnoye Pridneprovye – 81.1 thous. ha (among them: reservoirs – 43.64, ponds – 33.86), Kiev Pridneprovye – 79.25 thous. ha (among them: ponds – 51.03, reservoirs – 23.3, ponds – 4.92), Podolye – 66.3 thous. ha (among

them: ponds – 39.71, reservoirs – 25.29, lakes – 1.2), Industrial Pridneprovye – 62.68 thous. ha (among them: reservoirs – 33.22, ponds – 28.42, lakes – 1.04), the Crimea – 9.45 thous. ha (among them: reservoirs – 3.6, ponds – 3.05, lakes – 2.8), Donbass – 37.78 thous. ha (among them: reservoirs – 25.13, ponds – 11.29, lakes – 1.35), the Ukrainian Carpathians – 35.89 thous. ha (among them: reservoirs – 21.29, ponds – 11.01, lakes – 3.35), West Polissya – 29.31 thous. ha (among them: lakes – 15.67, ponds – 9.3, reservoirs – 4.34) (Tab. 2).

Table 2. The pools of slow water exchange of Ukraine (according to natural-economic ranges)

Region	Number, pcs.	Volume, mil. m ³	Area, thous. ha
West Polissya	1148	1160.2	29.31
The Ukrainian Carpathians	2441	3406.6	35.89
Podolye	5698	1346.8	66.3
Kiev Pridneprovye	6361	1249.1	79.25
Levoberezhnoye Pridnieprovye	4552	2285.9	81.1
Industrial Pridnieprovye	4255	1755.8	62.68
Donbass	1557	1379.5	37.78
Prichornomorje	2585	3947.6	172.94
The Crimea	894	428.7	9.45
The Dneprovsk cascade	6	43710	688.7
In total	29497	60670.2	1263.4

The further development of productive forces in many respects depends on the state of a water-resource potential. Now the quality of natural waters continues to deteriorate and that causes the reduction of water-supply of the territory. Such a phenomenon may be considered as a result of the intensive technogenic impact. Besides present disproportions in water consumption and water utilization complicate the situation. For many regions of the country the water resources become a determinative factor of the economic growth. So the problem of rational water use is especially current for Ukraine. It is explained by the high level of economic land utilization and poor water resources.

The accomplished estimation testifies to the uneven allocation of resources of PSWE in small (within the republic) economic ranges and administrative regions (Tab. 3). The pools are allocated in economic parts of the country as follows (disregarding the reservoirs of the Dneprovsk cascade): the West – 17652 pools (the volume of water mass is 7627.4 mil. m³, the area of the water plane is 233.15 thous. ha); the East – 8360 pools (4956.5 mil. m³, 159.06 thous. ha); the South – 3479 pools (4376.3 mil. m³, 182.39 thous. ha).

Table 3. The pools of slow water exchange of Ukraine (according to small (within the republic) economic ranges)

Small (within the republic) economic ranges	Number, pcs.	Volume, mil. m ³	Area, thous. ha
1	2	3	4
Donetsk range	1557	1379.5	37.78
Donetsk region	1162	1983.5	28.11
Lugansk region	395	296.0	9.67
Pridneprovsk range	2251	1291.1	40.18
Dnepropetrovsk region	1370	1102.2	30.13
Zaporozhye region	881	188.9	10.05
North-East range	4552	2285.9	81.1
Poltava region	1288	354.5	21.42
Sumy region	1277	282.6	15.83
Kharkov region	1987	1648.8	43.85
Central Polissya range	4044	875	56.92
Zhitomir region	857	295.0	18.56
Kiev region	2473	438.5	28.65
Chernigov region	714	141.5	9.71
Prichornomorje range	3479	4376.3	182.39
The Crimean Autonomous Republic	894	428.7	9.45
Nikolaev region	929	426.7	16.1
Odessa region	892	3225.7	132.94
Kherson region	764	295.2	23.9

1	2	3	4
The Carpathian range	2441	3406.6	35.89
Zakarpate region	81	64.9	2.64
Ivano-Frankovsk region	620	103.5	4.5
Lvov region	1249	183.6	10.9
Chernovtsy region	491	3054.6	17.85
Podolsk range	5698	1346.8	66.2
Vinnitsa region	3304	907.1	35.0
Ternopol region	497	131.5	8.78
Khmelnitskiy region	1897	308.2	22.42
Central-Ukrainian range	4321	838.8	44.83
Kirovograd region	2004	464.7	22.5
Cherkassk region	2317	374.1	22.33
West-Polissya range	1148	1160.2	29.31
Volyn region	633	989.6	17.78
Rivne region	515	170.6	11.53
The Dneprovsk cascade	6	43710	688.7
IN TOTAL	29497	60670.2	1263.4

In Ukraine the investigation of lacustrine deposits was fulfilled basically in the 50s by the Ukrainian Academy of Sciences. The Kiev prospecting expedition began the geological explora-

tion of stores of sapropels in 1980. Up to the present 234 deposits have been investigated. The balance of stores of sapropels are 63882.8 thous. tn (Tab. 4).

Table 4. The developed stores of sapropels of Ukraine (according to the materials of the Kiev prospecting expedition)

Administrative Region	Stage of investigation, category of stores	Number of deposits	Balance of stores of sapropels, thous. tn
Volyn	Detailed A	76	32094.1
	Reconnaissance-estimated C ₂	115	20903.9
Rivne	Detailed A	19	6229.2
	Reconnaissance-estimated C ₂	18	2151.9
Kiev	Detailed A	2	1290.7
Sumy	Detailed A	3	1180.0
Chernigov	Reconnaissance-estimated C ₂	1	33.0
In total		234	63882.8

The basic amount of the developed sapropels is concentrated in the Volyn region (52998 thous. tn), much less is concentrated in the Rivne (8381.1 thous. tn), Kiev (1290.7 thous. tn), Sumy (1180 thous. tn) and Chernigov (33 thous. tn) regions. According to the classification of bottom sediments of the geological enterprise "Torfgeologiya" (Moscow), the following species of sapropels dominate on the territory: organogenous-limestone, limestone, organogenous-ferruginous, organogenous-clay and organogenous-sandy (Tab. 5). These species are the most useful for agriculture as fertilizer, alimentary components of animal feed and as medical muds. Also they may be used to neutralize acid soils.

Nowadays it is vital to understand the gravity of the problem of the profound rationalization of nature management and conservation of the biosphere, the requirement of the considerable enhancement of efficiency in production development, and the necessity of the implementation of intensive methods of resource use in combination with resource-saving technology. All these points contribute to the necessity of intent attention to PSWE, and to the development of the scientific basis of their management, use and conservation. Due to slow water exchange and accumulative capacity the original half-closed cycle of matter and energy is formed in PSWE. Therefore pools are a fundamental factor in the

landscape-forming processes. Such a concept should be taken as a foundation of the develop-

ment of the theory of natural lake geosystems in limnology.

Table 5. Balance of stores of sapropels of Ukraine, thous. tn (according to the materials of the Kiev prospecting expedition)

Species of sapropels	Administrative region					In total
	Volyn	Rivne	Kiev	Sumy	Chernigov	
Cuanophhuta	–	–	–	18	–	18
Mixed algae	1741.1	280.2	11.4	–	–	2032.7
Peat	756.2	226.3	–	–	–	982.5
Zoon–algal	5148	166	–	–	–	5314
Diatomaceous	1030.8	142	–	–	–	1172.8
Organogenous–sandy	3766.9	1732.4	119.9	–	–	5619.2
Organogenous–clay	5097.9	1940.7	709	187	–	7934.6
Organogenous–limestone	15344	262	450.4	975	–	17031.4
Limestone	12070.4	609.3	–	–	33	12712.7
Organogenous–ferruginous	7811.7	1949.8	–	–	–	9761.5
Limestone–ferruginous	231	–	–	–	–	231
Diatomaceous–clay	–	61.5	–	–	–	61.5
Clay–limestone	–	1010.9	–	–	–	1010.9

Intensification of the use of local water resources and the increase of the economic load on water, land, forest and other natural resources have aggravated the problem of use of lakes, ponds, reservoirs and other natural and artificial elements of the hydrographic network. In different regions of the country PSWE have been exposed to unfavorable

changes in the characteristics of physical, chemical and biological processes in water masses. Therefore the primal problem of scientific research for a solution to the present task of rational use of PSWE is the security of water management which will ensure the enhancement of efficiency of resource use and conservation of PSWE.

Streszczenie

W artykule dokonano zestawienia zasobów wód stojących na Ukrainie. Zasoby te przyporządkowano regionom ekonomicznym, administracyjnym i fizyczno-geograficznym. Autor obliczył, że na obszarze Ukrainy znajduje się 29497 różnych akwenów wodnych (jezior, zbiorników i stawów). Ich łączna powierzchnia wynosi 1263,4 tysięcy ha, co stanowi 2,09% powierzchni Ukra-

iny, natomiast całkowita objętość 60,67 km³. Wyniki badań akwenów wodnych Ukrainy wykazały, że znajdujące się w nich osady (sapropel) mogą stanowić w przyszłości bazę surowcową dla przemysłu. Szacunkowe zasoby osadów wynoszą ok. 63,9 milionów ton. Określenie zasobów wód stojących jest niezbędne dla realizacji programu narodowego "Ukraina 2010". Jednym z ważnych celów tego programu jest polepszenie warunków ekologicznych w dorzeczu Dniepru m.in. w zakresie podwyższenia jakości wody.