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Characteristics of Ukraine water resources based on global database of informational system FAO-AQUASTAT

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Content

- 1. Water resources of Ukraine, global database of informational system FAO-Aquastat
- 2. Retrospective analysis of river network research in Ukraine

Part 1

Water resources of Ukraine, global database of informational system FAO-Aquastat

Sustainable development goals till 2030,approved by UN 25 of September 2015

- Goal 1. No poverty
- Goal 2. Zero hunger
- Goal 3. Good health and well-being
- Goal 4. Education
- Goal 5. Gender equality
- **Goal 6. Clean water and sanitation**
- Goal 7. Affordable and clean energy
- Goal 8. Decent work and economic growth
- Goal 9. Indusrty, innovation and infrastructure
- Goal 10. Reduced inequalities
- Goal 11. Sustainable cities and communities
- Goal 12. Responsible consumption and production
- Goal 13. Climate action
- Goal 14. Life below water
- Goal 15. Life on land
- Goal 16. Peace, justice and strong institutions
- Goal 17. Partnership for the goals

Publishing house «Springer» project «Encyclopedia of the UN Sustainable Development Goals»

- We didn't have complex publications, dedicated to sustainable development goals
- Encyclopedia consists of 17 volumes, each of that dedicated to one SDG

Springer

Encyclopedia of the UN Sustainable Development Goals

Volume: Clean water and sanitation

- Electronic version of «Clean Water and Sanitation» – 2021
- Published version – 2022
- Chapter:
- Khilchevskyi V., Karamushka V. (2021) Global Water Resources: Distribution and Demand. In: Leal Filho W., Azul A.M., Brandli L., Lange Salvia A., Wall T. (eds) Clean Water and Sanitation. Encyclopedia of the UN Sustainable Development Goals. Springer, Cham. https://doi.org/10.1007/978-3-319-70061-8_101-1

Chapter: Global water resources: distribution and demand

Springer

WATER DATABASES

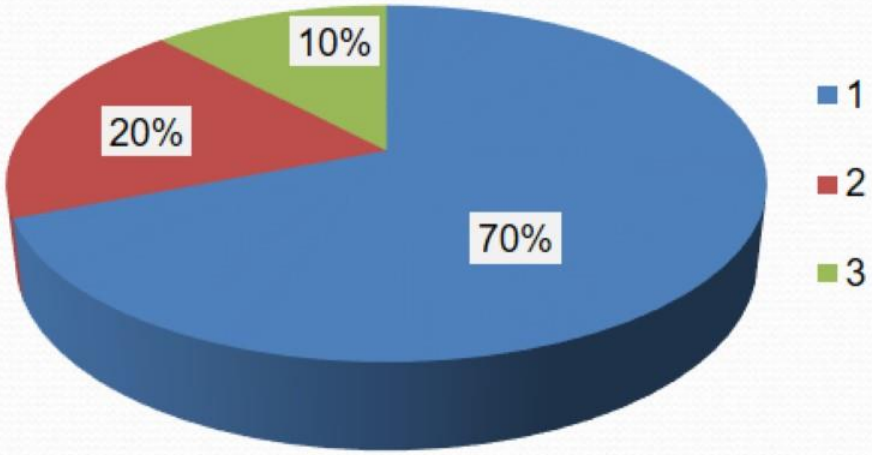
In this work we used publications of scientists and materials of universla organisations (AQUASTAT-FAO, UN-Water, WHO, UNEP etc.), and some personal conclusions.

Types of water management in the world

Main three types of water management

Which are counted by statistics:

- **agriculture and farming** (70 % world water use);
- **industrial** (20 %);
- **domestic** (10 %) (Aquastat-FAO, 2017)



- In **Asia** використанняproportion of water management for agriculture, industrial and domestic purposes are: **81, 10 і 9 %.**

- In **Europe** this proportion looks different - **25, 54 і 21 %.**

Methods of water deficit evaluation

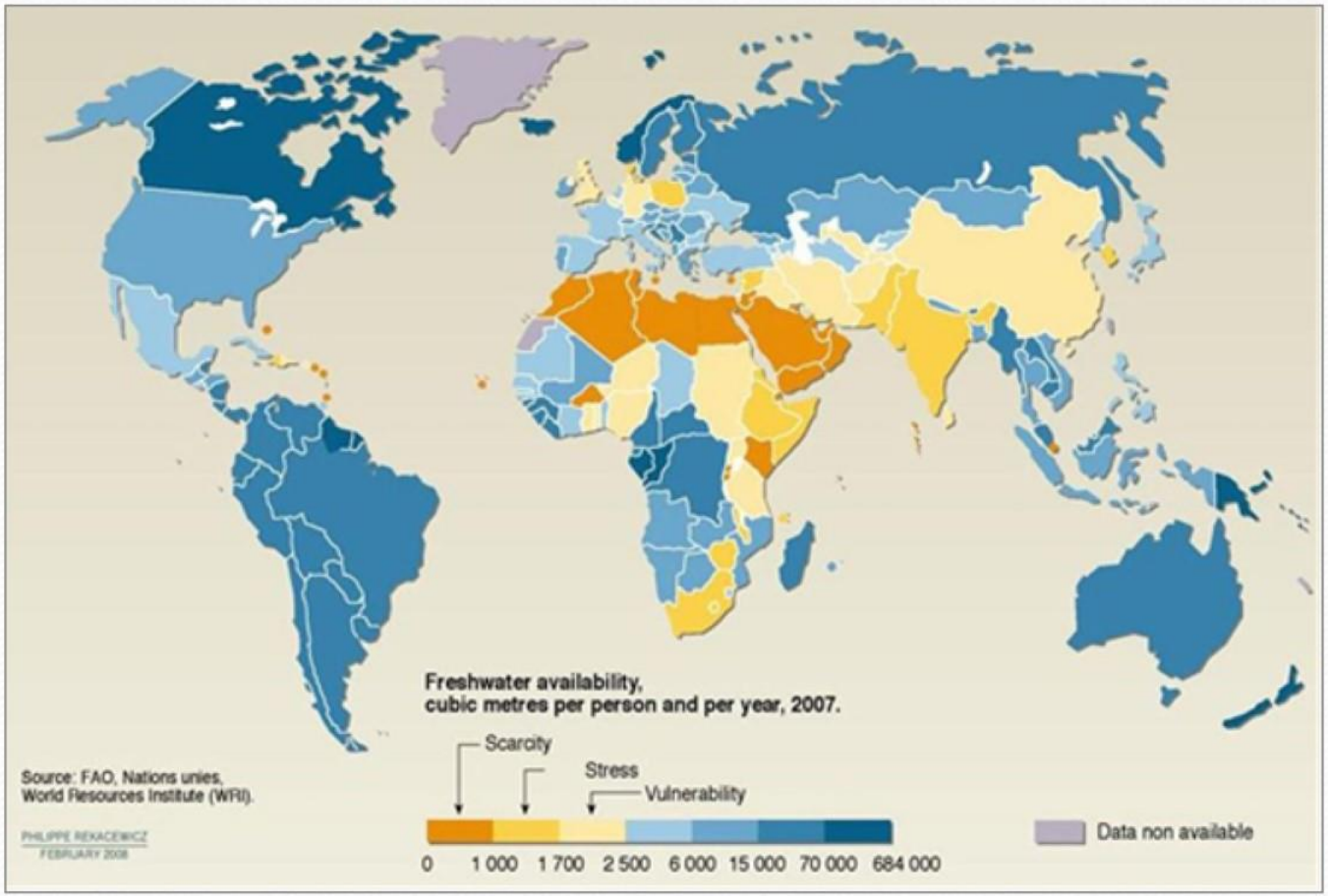
Falkenmark water stress

- There are different methods of water deficit evaluation.
- 3a According to Falkenmark water stress threshold values for recoverable water resources for countries,
- m3/year/person:
- 1) < 1700 – water stress;
- 2) < 1000 – water deficit;
- 3) < 500 – absolute water deficit
- (Falkenmark, 1995).

Malin Fredrika Sofia
Sundberg-Falkenmark

- The result 1000 m3/year/person of water resources FAO consider as satisfactory for economics and ensuring agro-processing.

Supply by water resources in different world countries



Water supply m3/year/1 person, FAO, 2007 (Ukraine: 2500-6000)

Hydrography zoning of Ukraine 2016 p.

(according to requirements of EU Water Framework Directive)

- Main hydropraphy unit – RIVER BASIN: 1)Dnieper, 2) Danube 3) Dniester, 4) Pivdenny Buh, 5) Don, 6) Wisla, 7) Crimean Rivers, 8) Black Sea coast rivers, 9) Azov Sea rcoast rivers

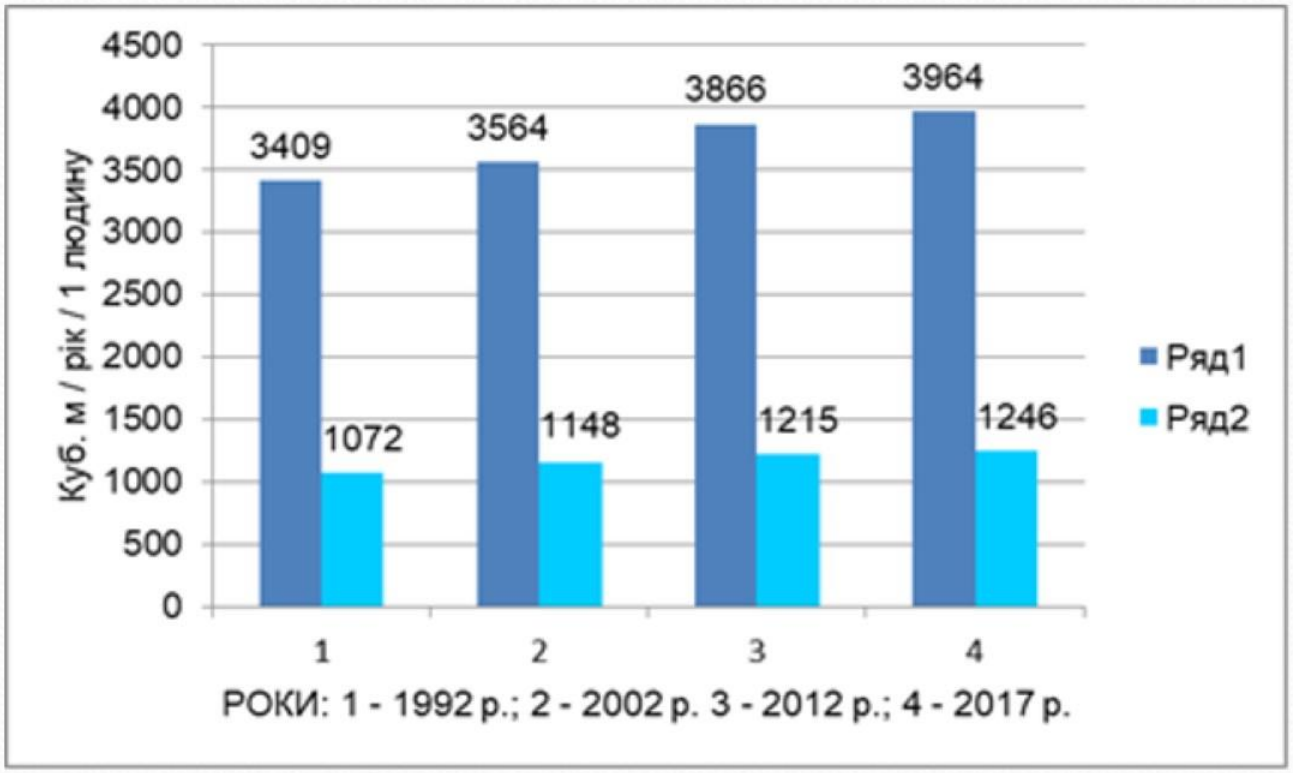
Average rate on Ukraine water resources based on global database FAO Aquastat 1992-2017

№	Rate	Measurement	1992	2002	2012	2017
1	2	3	4	5	6	7
1	Precipitation	кмм/year	565	565	565	565
2	Precipitation (amount)	km³/year	341	341	341	341
3	Internal river run-off	km³/year	50,1	50,1	50,1	50,1
4	Internal groundwater	km³/year	22	22	22	22
5	Groundwater, hidraulickly connected with surface waters	km³/year	17	17	17	17
6	Internal groundwater, available for use	km³/year	5	5	5	5
7	Internal recoverable water resources	km³/year	55,1	55,1	55,1	55,1
8	Internal recoverable water resources per 1 persony	m³/person/year	1072	1148	1215	1246
9	Infestation of river flow from Russia and Belarus	km³/year	36,13	36,13	36,13	36,13
10	Flow of river Danube	km³/year	168,1	168,1	168,1	168,1
11	Accounted flow of river Danube	km³/year	84,05	84,05	84,05	84,05
12	Overall external river-flow	km³/year	120,2	120,2	120,2	120,2
13	Flow from Ukraine to another countries	km³/year	28,9	28,9	28,9	28,9
14	Overall amount of reoverable surface water	km³/year	170,3	170,3	170,3	170,3
15	Overall recoverable water resources	km³/year	175,3	175,3	175,3	175,3
16	Reliance rate	%	68,57	68,57	68,57	68,57
17	Overall recoverable water resources per 1 person	m³/person/year	3 409	3 654	3 866	3964
18	Capacity of water reservoirs	Km³	-*		55,5	
19	Capacity pf water reservoirs per 1 persony	m³/person			1224	

Characteristics of average indicators of recoverable water resources of Ukraine based global database FAO Aquastat, 2017

Type of water resources	Components	Capacity , km^3	Notes
Surface water	Internal river flow	50,1	
	External river flow	120,2	From Russia and Belarus – 36,1 km^3
			From Romania - 84,1 $км^3$, (50% of flow Kilia-Danube Arm)
	Overall river flow	170,3	
	River flow which is not situated in Ukraine	28,9	To Poland, Slovakia, Hungary, Romania, Moldova
Groundwater	Prognosed resources	22	17 km^3 – hidraulicaly connected with river flow
	Available for use	5,0	
Internal water resources	Surface and ground	55,1	Per 1 person: 1246 m^3/person/year
Overall water resources	Surface and ground	175,3	Per 1 person: 3964 m^3/1 person/year

Dynamics rate of supply of overall (1 row) amd internal (2 row) water resourcess per 1 person in Ukraine, 1992-2017 (m^3/year/1 person)



1 row – overall water resources; 2 row – internal water resources

Rankings of Europe on overall water supply per 1 person according to global database FAO Aquastat, 2017 (I)

№	Country	Overall water resources, m^3/year/person	Внутрішні водні ресурси, $м^3$/рік/людину	Загальні водні ресурси, $км^3$/рік	Внутрішні водні ресурси, $км^3$/рік	Коефіцієнт зовнішньої залежності, %
1	2	3	4	5	6	7
1	liceland	507463	507463	170	170	0
2	Norawy	74081	72008	393	382	2,8
3	Russia	31426	29947	4525	4312	4,7
4	Croatia	25185	9000	105,5	37,7	64,27
5	Finand	19917	19374	110	107	2,7
6	Serbia	18451	956,3	162,2	8,4	94,8
7	Latvia	17918	8687	34,94	16,94	51,5
8	Sweden	17556	17254	174	171	1,7
9	Georgia	16189	14859	63,3	58,13	8,2
10	Slovenia	15322	8976	31,9	18,67	41,4
11	Ireland	10920	10290	52	49	5,8
12	Romania	10773	2154	212	42,38	80
13	Hungary	10697	617,2	104	6	94,23
14	Bosnia and Herzegovina	10693	10123	37,5	35,5	8,5
15	Albania	10307	9181	30,2	26,9	10,9
16	Estonia	9779	9702	12,8	12,71	0,75
17	Slovakia	9196	2313	50,1	12,6	74,9
18	Austria	8895	6297	77,7	55	29,2
19	Lithuania	8478	5349	24,5	15,46	36,9
20	Portugal	7493	3679	77,4	38	50,9
21	Switzerland	6312	4766	53,5	40,4	24,49
22	Greece	6129	5197	68,4	58	15,2
23	Belarus	6115	3591	57,9	34	41,3
24	Luksemburg	5998	1714	3,5	1	71,4
25	Netherlands	5342	645,7	91	11	87,9

Rankings of Europe on overall water supply per 1 person according to global database FAO Aquastat, 2017 (II)

№	State	Overall water resources m^3/year/ person	Internal water resources, m^3/year/perso n	Overall water resources, km^3/year	Internal water resources, km^3/year	External reliance rate, %
1	2	3	4	5	6	7
26	Andorra	4101	4101	0,32	0,32	0
27	Ukraine	3964	1264	175,3	55,1	68,6
28	Azerbaijan	3529	825,7	34,7	8,1	76,6
29	France	3247	3078	211	200	5,2
30	Iltaly	3223	3074	191,3	182,5	4,6
31	North Macedonia	3072	2592	6,4	5,4	15,6
32	Moldova	3029	399,9	12,3	1,62	86,8
33	Bulgaria	3006	2964	21,3	21	3,2
34	Armenia	2652	2341	7,8	6,9	11,7
35	Turkey	2621	2811	211,6	227	1,52
36	Spain	2405	2399	111,5	111,2	0,27
37	Great Britain	2221	2191	147	145	1,4
38	Germany	1875	1303	154	107	30,5
39	Belgium	1601	1050	18,3	12	34,4
40	Poland	1585	1404	60,5	53,6	11,4
41	Czech Republic	1238	1238	13,2	13,15	0,4
42	Denmark	1046	1046	6	6	0
43	Cyprus	661	661	0,78	0,78	0
44	Malta	117,2	117,2	0,05	0,05	0
45	Vatican	*				
46	Lichtenstein					
47	Monaco					
48	San-Marino					
49	Farers Island					
50	Montenegro					

Places taken by Ukraine among 50 european countries in rate of recoverable water resources

- Based on FAO Aquastat, 2017 p.

№	Name of recoverable water resources indicator	Rate indicators	Place of Ukraine in Europe
1	Overall recoverable water resources per 1 person, m^3/year/person	3964	27
2	Internal recoverable water resources per 1 person, m^3/year/person	1246	37
3	Overall water resources, km^3	175,3	6
4	Internal water resources, km^3	55,1	14
5	Rate of external reliance, %	68,6	9

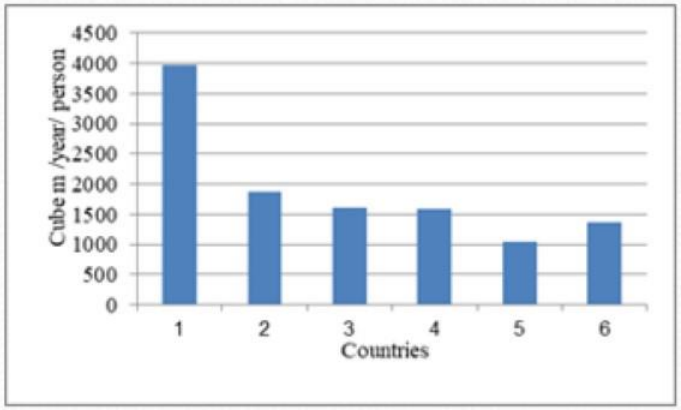
Comparative characterisitics of Ukraine and Izrael water resources relatively to Falkenmark Rate, m^3/year/1 person

Falkenmark Rate, m^3/year/person	State	Overall Water Resources of Ukraine	Internal Water Resources of Ukraine	Overall Water Resources of Izrael	Internal water resources of Izrael
< 500	Absolute water deficit	-	-	193	180
< 1000	Water deficit	-	-		-
< 1700	Water stress	-	1264	-	-
1700-2500	Water sensitiveness	-		-	-
		3964			

Not all well-developed countries has high rates of watersupply

Example of watersupply in countries (external and internal water resources: Germany, Belgium, Denmark, Poland, Republic of Korea

№	Country	General water resources, m^3/year/person:	Internal water resources, m^3/year/person:
1	Ukraine	3964	1246
2	Germany	1875	1303
3	Belgium	1601	1050
4	Denmark	1046	1046
5	Poland	1585	1404
6	Republic of Korea	1367	1272



Water supply from overal water resources from some countries resources, m^3/year per 1 person: 1 – Ukraine; 2 – Germany; 3 – Belgium; 4 – Poland; 5 – Denmark; 6 – Republic of Korea

Conclusions (part 1)

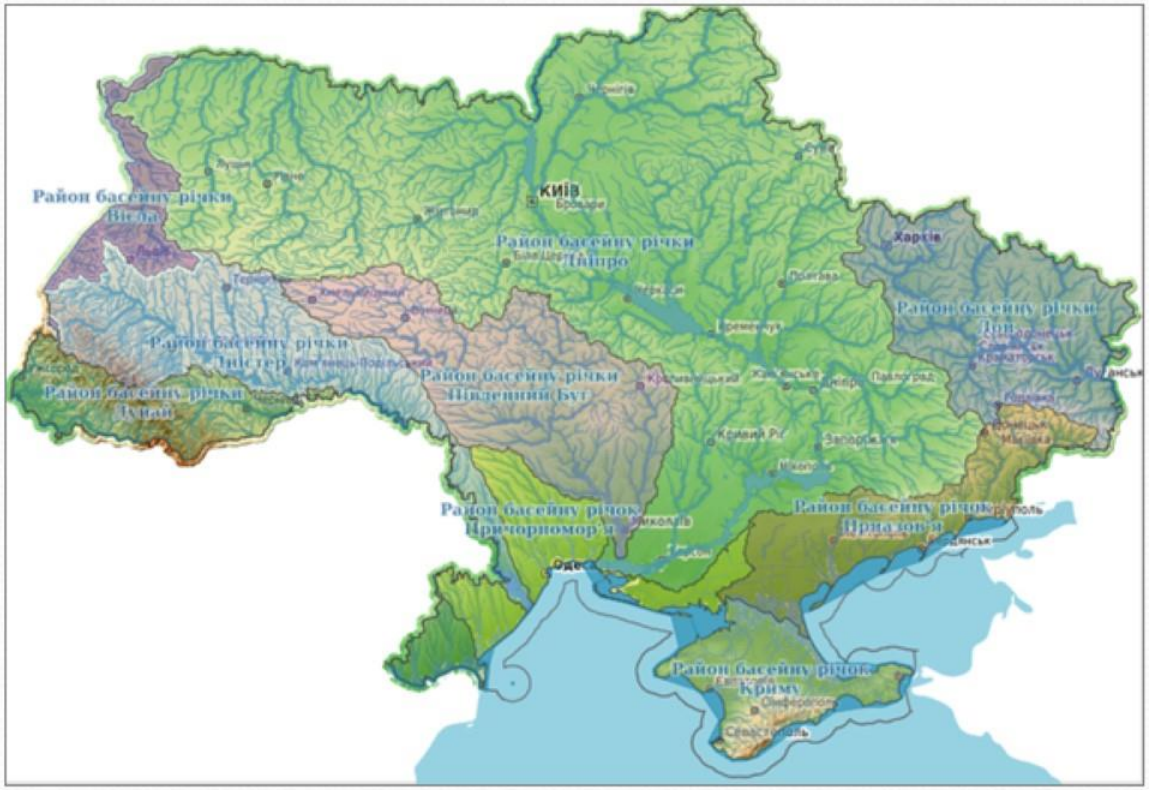
- 1). Exist global problem of water resources.
- 2). Ukraine is not a country which is indigent by water resources.
- 3). Ukraine is not rich in water resources.
- 4). Ukraine has high rate of external reliance of water resources, which charakterizes an overall part of renewable water resources, which is formed by boundaries - 9 place in Europe (Reliance rate = 66,8%, 46,8% of it – depends on river flow from Romanian territoryї Румунії, 20% - from Russia and Belarus. This factor has to influence Ukraine to the qualitable cooperation in transboundary river basins.
- 5). All numbers on pecularities of water resources in Ukraine which are in FAO Aquastat are different unlike in ukrainian sources, consider that one of the FAO sources are national governmental organisations. Pointed methodological problem should be taken into consideration by scientists and experts from governmental organisations.

Part 2

Retrospective analysis of river network research in Ukraine

River network of Ukraine

- In Ukraine are 63 119 rivers



Analyse of rivers amount in Ukraine made by different authors (1953-2001)

№ п/п	Name of work	Year of publication	Amount of rivers in Ukraine
1	Материалы по типизации рек Украинской ССР / Под ред. *Г.И. Швеца.* - К.: Изд-во АН УССР, 1953	1953	22197
2	Каталог річок України / За ред. *В.І Мокляка.*- К.: Вид-во АН УРСР, 1957	1957	> 22000
3	Гідрологічні розрахунки для річок України / За ред. *Г.І.Швеця.* – К.: Вид-во АН УРСР, 1962	1962	> 23000
4	Ресурсы поверхностных вод СССР. – Том 6. Украина и Молдавия. - Вып. 1-4	1966 - 1971	72779
5	*Левковский С.С.* Водные ресурсы Украины. – К.: Вища школа, 1979	1979	> 73 000
6	Мелиорация на Украине / Под ред. *Н.А. Гаркуши.* – К.: Урожай, 1985	1985	22600
7	*Русинов О.О.* Комплексне використання водних ресурсів УРСР. – К.: Вища школа, 1986	1986	> 22500
8	Справочник по водным ресурсам / Под ред. *Б.И. Стрельца.* – К.: Урожай, 1987	1987	> 71000
9	Малі річки України: Довідник / За ред. *А.В. Яцика.* – К.: Урожай, 1991 [9]	1991	63029*
10	*Паламарчук М.М., Закорчевна Н.Б.* Водний фонд України: посібник.- 2001; 2-е вид. – К.: Ніка-Центр, 2006	2001, 2006	63119 (63029 + 82 + 8)
11	Водний фонд України: Штучні водойми - водосховища і ставки: Довідник / За ред. *В.К. Хільчевського, В.В. Гребеня.* – К.: Інтерпрес, 2014	2014	63119

Reasons of different evaluation results in Ukraine during 1953-2001.

- In guide «Small ukrainian rivers» (1991) – 63029 small rivers (with water intake under 2000 sq. km)
- Whereas on previous published materials „Resources of surface water in USSR”(1971), „Guide on water resources”(1987), in „Small ukrainian rivers” observed network situated on Ukrainian territory.
- Rivers, who are flown into upper Dnieper (Belarus) hasn’t been taken into account.

8 largest rivers in Ukraine – > 50 000. sq. km

River	flow (river, sea)	Square, thousands. km^2		Length, km		flow capacit, km^3	Water mineralisation, g/dm^3
		overall	Ukraine	overall	Ukraine		
1. Danube	Black Sea	817	32,4	2960	174	210	0,40
2. Dnieper	Black Sea	504	292,7	2201	1121	52	0,32
3. Tisza	Danube, Black Sea	153	11,3	966	201	29,2	0,22
4. Pripyat	Dnieper, Black Sea	121	69,1	761	290	13,8	0,30
5.Seversky Donets	Don, Black Sea	98,9	54,5	1053	700	5,0	0,81
6. Desna	Dnieper, Black Sea	88,9	33,8	1130	575	10,9	0,29
7. Dniester	Black Sea	72,1	52,7	1362	925	11,3	0,37
8. Pivdenny Buh	Black Sea	63,7	63,7	806	806	3,0	0,63

Western Bug (flows into r. Narew, basin river Wisla) – basin square 39 420 sq. km. In 1962 year in polish hydrographs changed the order of river Narew (changed from the second order into first). Till that time Narew was considered as flow of river Western Bug, after — opposite. Due to that fact the square of Western Bug basin has been decreased (before 1962 it was 73 470 км^2).

Basin of r. Wisla (r. Narew, r. Western Bug) – Baltic Sea basin

- r. Wisla – F= 194 424 sq. km,
- L = 1047 km
- r. Narew – F= 75 200 sq. km,
- L = 484 km.
- r. Western Bug - F= 39 420 sq. km
- L = 772 km
- (in Ukraine 392 km).

Conclusions (to the part 2)

- 1) Amount of rivers in Ukraine – 63119 (1991 p.) .
- This number can be changed if modern technologies of research will be used – satellite footages and geographic information system technologies.

- 2) Possible changes can be discussed due to results of 2014 research provided with State Water Resources Agency of Ukraine about amount of streams and water reservoirs in Ukraine.

- Since 2001 was considered nearly 28 000 streams in Ukraine.
- Research 2014 (with clarification in 2019) has shown more than 30 000 streams. Increased in 78% !!!

Thank you for attention

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