Water Risk Filter

Hungary – Local dataset documentation

WWF Water Risk Filter 2021

The WWF Water Risk Filter local dataset for Hungary was completed within a project supported by the LIFE Fund of the European Union

Basin Risk Indicators - Descriptions, Sources and Links

Risk type	Risk category	#	Risk indicator	Description	Source	Link
Physical Risk	**1. Water Scarcity**	**1.0**	Aridity Index	Aridity Index (AI, according to UNEP, 1997). Similar to the global WRF parameter, but based on more detailed information about Hungary. Special sub-categories for humid regions are applied considering Hungarian conditions. Meteorological parameters (P, PET) for HydroSHEDS_12 are spatial averages of the corresponding grid values of the basic meteorological maps.	Meteorological parameters: CarpatClim database. 15x15 km grid. Data are processed in the frame of National Adaptation Geo-information System (NAGIS).	https://map.mbfsz.gov.hu/nater/
		1.1	Sensitivity to Water Scarcity	The total runoff per capita index (RCAPI) is an universally applied parameter for characterising general water availability and indicating the sensitivity to water scarcity. RCAPI = 1000·A·(P – AET)/HAB [m3/year/cap] A: area of the H12 catchment [km2], P: average annual precipitation [mm], AET: annual actual evapotranspiration [mm] using the Turc formula, both for the period 1991 - 2020 , HAB: habitants of the HydroSHEDS catchments of level 12 (2017). Meteorological parameters (precipitation, temperature) for HydroSHEDS_12 are spatial averages of the corresponding grid values of the basic meteorological maps.	Meteorological parameters. CarpatClim database. 15x15 km grid. Data are processed in the frame of National Adaptation Geo-information System (NAGIS). Population by settlements, 2017: Central Statistical Office, database.	https://map.mbfsz.gov.hu/nater/
		1.2	Availability of Groundwater Resources	Availability of groundwater resources is characterised by a combination of the exploitation index corresponding to water abstraction (WEIabs) and free water resources (FWR). WEIabs = ABS/GWRav ABS: average water abstraction of the period 2007 - 2013 GWRav: available groundwater resources as long-term average recharge decreased by water demand of groundwater dependent ecosystem, according to Water Framework Directive (WFD) FWR = GWRav - ABS The risk scoring is developed for WRF, taking into account that risk is determined by both WEI (competition and conflicts) and FWR (amount of water). Risk is the highest if WEI is close to 1 and FWR is insignificant, and it decreases with decreasing WEI and increasing FWR. Risk scores determined for relevant group of groundwater bodies are transformed to HydroSHEDS_12 as rounded spatial averages.	Available groundwater resources and abstractions by water bodies, Annex 6.5 in River Basin Management Plan of Hungary, OVF, 2015.	https://www.vizugy.hu/index.php?module=vizstrat&programelemid=149
		1.3	Availability of Surface Water Resources	Availability of surface water resources in critical month (August), is characterised by a combination of the exploitation index corresponding to total upstream consumption (WEIcons) and free water resources (FWR). WEIcons = CONS/SWRaug CONS: average consumption (i.e. considering return flow), 2013 SWRaug: discharge of 80 % probability in August with corrections of artificial modifications and ecological flow FWR = SWRaug - CONS The risk scoring is developed for WRF, taking into account that risk is determined by both WEI (competition and conflicts) and FWR (amount of water). Risk is the highest if WEI is close to 1 and FWR is insignificant, and it decreases with decreasing WEI and increasing FWR. Risk scores determined for surface water bodies are transformed to HydroSHEDS_12 as rounded spatial averages.	Available surface water resources, and consumption by water bodies, Annex 3.10 in River Basin Management Plan of Hungary, OVF, 2015.	https://www.vizugy.hu/index.php?module=vizstrat&programelemid=149

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		1.4	Projected Change in Total Runoff	Impact of climate change on water resources is characterised by the change ratio of the total runoff (see also Indicator 1.1, about recent condition): (P - AET)CC /(P - AET)basic P: average annual precipitation [mm], AET: average annual actual evapotranspiration [mm], CC indicates the values corresponding to the period 2021 - 2050 according to the Aladin RCM and considering moderate climate scenario, while 'basic' indicates the period 1961 - 1990. Meteorological parameters (precipitation, temperature) for HydroSHEDS_12 are spatial averages of the corresponding grid values of the basic meteorological maps.	Meteorological parameters for the period 1961-1990: CarpatClim database. Dataset for period 2021-2050: Aladin RCM considering moderate climate scenario. 15x15 km grid. Data are processed in the frame of National Adaptation Geo-information System (NAGIS).	https://map.mbfsz.gov.hu/nater/
		1.5	Sensitivity to Dryness	A special index has been developed for Hungarian conditions. The Pálfai Drought index (PAI) is named as 'drought index', however it rather characterises the dryness of the year or a longer period according to a classification, uniformly applied for the whole country: PAI = 100·(TIV-VIII/PX-VIII)· kt·kp·kgw TIV-VIII: average temperature between April and August [oC], PX-VIII: sum of precipitation between October and August [mm], kt, kp, kgw: coefficients depending on number of days with heat, on number of days without precipitation and on shallow groundwater level during spring, respectively. All data correspond to the period 1991-2020. PAI values for HydroSHEDS_12 are spatial averages of the corresponding grid values of the PAI maps.	Meteorological parameters: CarpatClim database. 15x15 km grid. Data are processed in the frame of National Adaptation Geo-information System (NAGIS).	https://map.mbfsz.gov.hu/nater/
		1.6	Projected Change in Sensitivity to Dryness	Impact of climate change on sensitivity to dryness is characterised by the change ratio of the Pálfai Drought Index (PAI) (see indicator 1.5): PAIcc/PAIbasic , where CC indicates the values corresponding to the period 2021 - 2050 according to the Aladin RCM and considering a moderate climate scenario, while 'basic' indicates the period 1961 - 1990. Values of PAICC and PAIbasic for HydroSHEDS_12 are spatial averages of the corresponding grid values of PAICC and PAIbasic.	Meteorological parameters for the period 1961-1990 : CarpatClim database. Dataset for the period 2021-2050: Aladin RCM considering moderate climate scenario. 15x15 km grid. Data are processed in the frame of National Adaptation Geo-information System (NAGIS).	https://map.mbfsz.gov.hu/nater/
	2. Flooding	**2.1**	Threats of Inundations	This indicator combines the threat of inundation by extreme floods and/or excess waters in plains and from flash floods in hilly and mountainous regions. Threat in plains is determined as probability of inundation weighted by the depth and duration of the inundation. Inundation by floods from large rivers is considered in the polders due to overtopping or breach of dykes, while inundation by excess waters according to its occurrence. Representative threat for HydroSHEDS_12 in plains is the spatial average of the corresponding grid values of basic threat maps. Characterisation of the risk from flash floods is based on the map of threat to flash floods of 5 classes, considering soil, slope and vegetation. Representative threat for HydroSHEDS_12 in hilly and mountainous regions is the spatial average of the corresponding polygons of threat classes. In HydroSHEDS_12 catchments having parts in plains and hills, the higher threat is taken.	Threat maps of flooding of different depth: shapes. Grid of 100 x 100 m is prepared for WRF. Probability of occurrence of excess waters: grid of 100 m x 100 m. Both from Flood risk Management Plan of Hungary, OVF, 2015. Threat map of flash floods: shape. Atlas, MTA Institute of Geography, 2018.	https://www.vizugy.hu/index.php?module=vizstrat&programelemid=145 http://www.nemzetiatlasz.hu/MNA/MNA_2_13.pdf

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		2.2	Projected Change in Flood Occurrence	Impact of climate change on floods is characterised by the average of the change ratios of discharges of critical floods (i.e. return period 10, 50, 100 and 1000 years). The current situation is based on the period 1970 - 1999 and the future on the period 2020 - 2049, considering a moderate climate scenario (RCP 4.5). The simulations were produced by the Potsdam Institute for Climate Impact Research (PIK). For the present evaluation almost 3000 'river sub-basins' were selected (relevant for Hungary). Results are considered only for those floodplains where threat to floods (see 2.1 indicator) is identified. Values for HydroSHEDS_12 are weighted (by flood dicharge of 10 years) averages of the ratios corresponding to 'river sub-basins' having overlap with the given catchment.	OASIS Project: Future Danube River Segment Flood Frequencies under Climate Change, Potsdam Institute for Climate Impact Research (PIK) Hattermann, F. F., Wortmann, M., Liersch, S., Toumi, R., Sparks, N., Genillard, C., ... & Hayes, B. (2018). Simulation of flood hazard and risk in the Danube basin with the Future Danube Model. Climate Services, 12, 14-26.	http://www.oasisdanube.eu/
	3. Water Quality	**3.1**	Water Quality Index (Surface and Groundwater)	Risk related to the general water quality is characterised by the risks of both surface water quality (indicator 3.1.1) and groundwater quality (indicator 3.1.2) weighted by the availability of resources (indicator 1.3 and 1.2).	Prepared exclusively for WRF. (For more information see sources for indicators 3.1.1 and 3.1.2).	
		3.1.1	*Surface water quality*	*Quality of surface water is characterised considering 4 quality elements (nutrient, organic matter, salinity and hazardous substances - see also sub-indicators 3.1.3, 3.1.4, and 3.1.5). Risk score of a water body is the maximum of the average of the risk scores of the physico-chemical elements (nutrient, organic matter, salinity) and that of the hazardous substances. Then, they are transformed to HydroSHEDS_12 as rounded spatial averages.*	Prepared exclusively for WRF. (For more information see sources for indicators 3.1.3, 3.1.4, 3.1.5) Concerning Salinity: River Basin Management Plan of Hungary, status assessment, 2019.	https://www.vizugy.hu/index.php?module=vizstrat&programelemid=149
		3.1.2	*Groundwater quality*	*Quality of groundwater is characterised considering 3 sub-indicators (high salinity, nitrate pollution, and drinking water quality problems of natural origin - see also sub-indicators 3.1.7, 3.1.8, 3.1.9). Risk score of a water body is the average of the risk scores of the sub-indicators. Then, they are transformed to HydroSHEDS_12 as rounded spatial averages.*	Prepared exclusively for WRF. (For more information see sources for indicators 3.1.7, 3.1.8, 3.1.9).	
		3.1.3	*Nutrient content of surface waters*	*High nutrient (nitrogen and phosphorus) content in surface water may cause eutrophication. Classification at water body level is done according to the Water Framework Directive using observed concentrations. In the case of missing data the risk is estimated based on load from point and diffuse sources.* *Risk scores determined for water bodies are transformed to HydroSHEDS_12 as rounded spatial averages.*	River Basin Management Plan of Hungary, status assessment, 2019, Annex 6.1 in River Basin Management Plan of Hungary, OVF, 2015. National Emission Data Base.	https://www.vizugy.hu/index.php?module=vizstrat&programelemid=149
		3.1.4	*Organic matter in surface waters*	*High organic matter in surface water may lead to reduced oxygen content causing downgrade of certain species. Therefore it is characterised considering oxygen conditions (BOD, COD, DO). Classification at water body level is done according to the Water Framework Directive. In the case of missing data, the risk factor is estimated based on the load from waste water discharges.* *Risk scores determined for water bodies are transformed to HydroSHEDS_12 as rounded spatial averages.*	River Basin Management Plan of Hungary, status assessment, 2019, Annex 6.1 in River Basin Management Plan of Hungary, OVF, 2015. National Emission Data Base.	https://www.vizugy.hu/index.php?module=vizstrat&programelemid=149

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		3.1.5	*Hazardous substances in surface waters*	*Hazardous substances may have toxic effect on the ecosystem. Two groups of substances are considered: priority substances (PS: according to WFD list) and additionally some specific pollutants relevant at Danube basin level (SPs: As, Cr, Zn, Cu). Risk scores at water body level are determined by combining the occurrence of PSs and SPs and the lack or uncertainty of monitoring data.* *Risk scores determined for water bodies are transformed to HydroSHEDS_12 as rounded spatial averages.*	River Basin Management Plan of Hungary, status assessment, 2019, Annex 6.1 in River Basin Management Plan of Hungary, OVF, 2015.	https://www.vizugy.hu/index.php?module=vizstrat&programelemid=149
		3.1.6	*Erosion*	*Soil loss - from water point of view - may cause sedimentation of lakes and reservoirs or jeopardising water quality, since it is a significant pathway of diffuse nutrient or pesticide load. The indicator is based on the soil loss value, calculated with Universal Soil Loss Equation (USLE).* *Indicator values for HydroSHEDS_12 are spatial averages of the corresponding grid values of the erosion map.*	Modelling nutrient load from diffuse sources for a 50 X 50 m grid, River Basin Management Plan of Hungary, OVF, 2015.	https://www.vizugy.hu/index.php?module=vizstrat&programelemid=149
		3.1.7	*Suitability for irrigation*	*High salinity content is unsuitable for irrigation. There are both groundwater and surface water resources in Hungary with too high salinity, limiting or making impossible their utilisation for irrigation. Sub-indicators are determined separately:* *A: for groundwater according to the ratio of area with specific conductance higher than 1000 µS/cm inside the HydroSHEDS_12 (5 classes),* *B: for surface waters in function of the observed specific conductance (5 classes) by water bodies and then these values are transformed to HydroSHEDS_12 as rounded spatial averages.* *The overall risk score is determined combining the classes determined for groundwaters and surface waters weighted by the availability of the corresponding resources (indicators 1.2 and 1.3).*	Specific conductance of surface water bodies based on Hungarian monitoring, Annex 6.1 in River Basin Management Plan of Hungary, OVF, 2015. Specific conductance of shallow groundwater in Hungary. Grid 100 x 100 m, OVF, 2017.	https://www.vizugy.hu/index.php?module=vizstrat&programelemid=149
		3.1.8	*Nitrate in groundwater*	*Nitrate pollution of groundwater is harmful for drinking water supply and for surface water quality during low flow periods, when groundwater is supplying the water courses. Nitrate pollution of groundwater is evaluated at water body scale in the River Basin Management Plan according to three aspects:* *A: polluted ratio of the water body* *B: observed increasing trend in the average concentration of the water body* *C: whether the groundwater contribute to nitrate-pollution of surface waters* *The overall treat to nitrate pollution is determined by combination of the above aspects in a scale from 1 (no pollution) to 5 (serious pollution).* *Risk scores determined for water bodies are transformed to HydroSHEDS_12 as rounded spatial averages.*	Assessment of qualitative status of groundwater. Annex 6.6 in River Basin Management Plan of Hungary, OVF, 2015.	https://www.vizugy.hu/index.php?module=vizstrat&programelemid=149
		3.1.9	*Drinking water quality problems of natural origin*	*Quality of groundwater resources, mainly in deeper aquifers are often not directly suitable for drinking water supply due to high concentration of substances of natural origin. These usually naturally protected waters need special treatment. This indicator summarises the potential problem at HydroSheds_12 as weighted occurrence of the relevant substances: arsenic + nitrite (weight: 0,4), boron + fluoride (0.3), ammonium (0,2), iron + manganese (0.1). The weight reflects the difficulties in treatment, since higher concentration than the standard in the water used for drinking purposes is not allowed. Water provided by the public network is treated, the risk is related to new water abstractions beyond the public system. The occurrence is characterised by the area of the settlements where a certain substance represents quality problem for public water supply (see source of information).*	Basic information: List of settlements where by substances where it occurs in higher concentration than the standard (thus treatment is needed) in Governmental Decree 201/2001. (X. 25.) on requirements toward drinking water quality. Program for improving drinking water quality, Several projects from 2005 until today.	http://www.ovf.hu/hu/lezart-projektek/egeszseges-ivoviz-megteremtese

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	4. Ecosystem Services Status	**4.1**	Ecological Status of Surface Water	Level of ecosystem services is in close relation with the ecological status of the water body. It is determined according to the EU Water Framework Directive, considering biological, physico-chemical and hydromorphological conditions, mainly based on monitoring data. In the case of missing classification, the risk factor is 4. Risk scores determined for water bodies are transformed to HydroSHEDS_12 as rounded spatial averages.	Surface water ecological status classification by water bodies, Annex 6.1 in River Basin Management Plan of Hungary, OVF, 2015.	https://www.vizugy.hu/index.php?module=vizstrat&programelemid=149
		4.2	Natural Capital Index of Watersheds	Natural Capital Index (NCI; ten Brink 2000, de Groot et al. 2003) is a biodiversity indicator, which expresses the difference of a complex landscape consisting of different habitats from its potentially most natural state, by combining the quality and extent of natural and semi-natural vegetation into one metric (Czúcz et al. 2012). The magnitude of natural capital is the available proportion in % (1 - 100) of the potential maximum natural capital (most natural state) of a complex landscape. The corresponding GIS Database (META) contains the results of a nationwide survey of habitats in form of hexagons of 35 ha. Values for HydroSHEDS_12 are spatial averages of the NCIs of corresponding hexagons and rescaled to a five-level ordinal scale.	META: GIS Database of the Hungarian Habitats. Molnár Zs, Bartha S, Seregélyes T, Illyés E, Botta-Dukát Z, Tímár G, Horváth F, Révész A, Kun A, Bölöni J. (2007). A grid-based, satellite-image supported, multi-attributed vegetation mapping method (MÉTA). Folia Geobotanica et Phytotaxonomica 42(3): 225–247. NCI: Ten Brink, B. J. E. (2000). Biodiversity indicators for the OECD Environmental Outlook and Strategy. A feasibility study. RIVM report 402001014. Czúcz, B., Molnár, Z., Horváth, F., Nagy, G. G., Botta-Dukát, Z., & Török, K. (2012). Using the natural capital index framework as a scalable aggregation methodology for regional biodiversity indicators. Journal for Nature Conservation, 20(3), 144-152.	https://www.novenyzetiterkep.hu/english/node/631
		4.3	Projected Change in Wetland Habitats	The layer characterises the maximum potential impact of climate change on the occurrence of wetland habitats in the HydroSHEDS_12 catchments. The indicator is based on the probability of potential occurrence of habitats on a five-point ordinal scale. It represents the maximum potential change in the probability of occurrence for the most important, successionally stable semi-natural wetland habitats, occurring in the given HydroSHEDS_12 (i.e. it does not cover habitats that could occur in principle but do not occur in the baseline period). Potential impact is investigated between the modelled future status for 2021–2050 and the reference period of 1977-2006, considering a moderate climate scenario (RCP 4.5) according to Aladin climate model.	META: GIS Database of the Hungarian Habitats. Molnár Zs, Bartha S, Seregélyes T, Illyés E, Botta-Dukát Z, Tímár G, Horváth F, Révész A, Kun A, Bölöni J. (2007). A grid-based, satellite-image supported, multi-attributed vegetation mapping method (MÉTA). Folia Geobotanica et Phytotaxonomica 42(3): 225–247. Somodi, I., Molnár, Z., Czúcz, B., Bede-Fazekas, Á., Bölöni, J., Pásztor, L., ... & Zimmermann, N. E. (2017). Implementation and application of multiple potential natural vegetation	

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					models–a case study of Hungary. Journal of Vegetation Science, 28(6), 1260-1269.	
Regulatory Risk	**5. Enabling Environment**	**5.1**	Freshwater Policy Status (SDG 6.5.1)	See Global Documentation on Indicators, Sources and Description		
		5.2	Freshwater Law Status (SDG 6.5.1)	See Global Documentation on Indicators, Sources and Description		
		5.3	Implementation Status of Water Management Plans (SDG 6.5.1)	See Global Documentation on Indicators, Sources and Description		
	6. Institutions & Governance	**6.1**	Corruption Perceptions Index	See Global Documentation on Indicators, Sources and Description		
		6.2	Freedom in the World Index	See Global Documentation on Indicators, Sources and Description		
		6.3	Business Participation in Water Management (SDG 6.5.1)	See Global Documentation on Indicators, Sources and Description		
	7. Management Instruments	**7.1**	Management Instruments for Water Management (SDG 6.5.1)	See Global Documentation on Indicators, Sources and Description		
		7.2	Density of Quantitative Groundwater Monitoring	Density of the quantitative groundwater monitoring (water level in wells) is determined based on the national monitoring network of Hungary.	Groundwater monitoring network of Hungary, OVF (General Directorate of Water Management).	
		7.3	Density of Flow Monitoring Stations	Density of surface water quantitative monitoring stations (water level and discharge) is determined based on the national monitoring network of Hungary.	Discharge and surface water level monitoring network of Hungary, OVF (General Directorate of Water Management).	
	8. Infrastructure & Finance	**8.1**	Access to Public Water Supply	Access to healthy public water supply for HydroSHEDS catchments of level 12 is calculated as the ratio of apartments supplied by public waterworks, compared to all apartments inside the watershed (aproximately the same as the ratio of population). Data of 2017. Settlements belonging to several watersheds are distributed proportionally to area.	Information System for Public Services, 2017.	https://ikir.bm.gov.hu

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		8.2	Connection to Public Sewer System	Access to improved sanitation (i.e. connection to public sewer system) for HydroSHEDS catchments of level 12 is calculated as the ratio of apartments connected to sewer system, compared to all apartments inside the watershed (aproximately the same as the ratio of population). Data of 2017. Considerably lower ratios compared to public water supply is explained with the relatively big gap in the two branches of urban water inrastructure. Settlements belonging to several watersheds are distributed proportionally to area.	Information System for Public Services, 2017.	https://ikir.bm.gov.hu
		8.3	Financing for Water Resource Development and Management (SDG 6.5.1)	See Global Documentation on Indicators, Sources and Description		
Reputational Risk	**9. Cultural Importance**	**9.1**	Cultural Diversity	See Global Documentation on Indicators, Sources and Description		
	10. Biodiversity Importance	**10.1**	Freshwater Biodiversity	As a proxy to freshwater biodiversity we used the combination of two sub-indicators: A) Biological status of surface water bodies according to the EU Water Framework Directive. Status classes (1 to 5; excellent to bad) determined for water bodies are transformed to HydroSHEDS_12 as rounded spatial averages. B) Occurrence of bird species in wetlands is expressed as the ratio of observed number of species compared to the maximum number of characteristic species of wetlands with a spatial resolution of 2,5 x 2,5 km (UTM quadrat). The sub-indicator of bird occurrence is calculated for HydroSHEDS_12 as spatial averages of the corresponding UTM quadrat values. The overall risk score related to freshwater biodiversity is the higher value of the two sub-indicators. Companies operating in catchments with higher biodiversity richness are exposed to higher reputational risks.	Surface water biological status, classification by water bodies, Annex 6.1 in River Basin Management Plan of Hungary, OVF, 2015. Bird occurrence map: Tanács E. et al.: Az általános ökoszisztéma-állapot indikátorok térképezésének módszertana (Methodology of mapping the general ecosystem status indicators). Report. Ministry of Agriculture, Budapest 2020. Prepared in the framework of the KEHOP-4.3.0-VEKOP-15-2016-00001 Strategic Assessments supporting the long term conservation of natural values of community interest as well as the national implementation of the EU Biodiversity Strategy to 2020 project.	https://www.vizugy.hu/index.php?module=vizstrat&programelemid=149 http://www.termeszetem.hu/en/ecosystem-services/actions-1
		10.2	Occurrence of Protected Natural Areas	This risk indicator accounts the ratio of protected natural areas (Natura 2000 sites, areas under national level protection, ex lege saline lakes and marshlands, Ramsar sites) inside a HydroSHEDS_12 catchment. Companies operating in catchments with higher ratio of protected natural areas are exposed to higher reputational risks.	Shapes of protected areas are collected and available in digital form in the River Basin Management Plan of Hungary, 2015: Map of Natura 2000 areas; Ramsar sites. Databases maintained by the Ministry of Agriculture of Hungary (in shape format):	https://www.vizugy.hu/index.php?module=vizstrat&programelemid=149

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					Map of natural areas under national level protection; Ex lege protected areas (saline lakes marshlands).	
	11. Media Scrutiny	**11.1**	National Media Coverage	See Global Documentation on Indicators, Sources and Description		
		11.2	Global Media Coverage	See Global Documentation on Indicators, Sources and Description		
	12. Conflict	**12.1**	Conflict News Events	See Global Documentation on Indicators, Sources and Description		
		12.2	Hydro-political Likelihood	See Global Documentation on Indicators, Sources and Description		