ANALYSIS OF SEASONAL DRYING IN INTERMITTENT WATERCOURSES

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ABSTRACT

This analysis examines drought periods in intermittent streams of the Slovak Republic during the 2022 hydrological year. The research aimed to determine the duration and intensity of minimum and zero flow conditions at 22 gauging stations, defined by discharges ≤ 0.001 $m^3 \cdot s^{-1}$. The analysis focused on spatial and temporal patterns of drought events and their links to climatic, pedological, topographic, and anthropogenic factors. Meteorological data on precipitation and temperature were collected from stations within 25 km of the profiles, while supplementary information included soil properties, slope gradients, and land use derived from the Corine Land Cover 2018 database. Results revealed a clear seasonal trend, with the highest incidence of dry days in summer, indicating a summer low-flow regime. Several catchments experienced extended drought periods, associated with shallow soils, steep terrain, low retention capacity, and rainfall deficits. The findings underscore the vulnerability of intermittent streams to climatic extremes and highlight the importance of hydrological, pedological, and landscape characteristics in identifying drought-prone areas. This research provides a foundation for future studies.

METHODS AND DATA

Hydrological and climate data from 22 gauging stations on intermittent streams across Slovakia were analysed for the hydrological year 2022. Dry periods were defined by a daily discharge ≤ 0.001 $m^3 \cdot s^{-1}$. The study combined streamflow and meteorological records with detailed physical-geographic attributes, including soil types, elevation, relief, and land use. All spatial analyses and final map visualizations were performed in ArcGIS Pro, while statistical relationships between dry events and environmental factors were evaluated using MS Excel. This comprehensive approach enabled precise identification of temporal and spatial drought patterns with respect to climatic, geographic, and land use conditions.

Names of gauging stations and watercourses	Months								
	2	3	6	7	8	9	10	12	Total sum
Bohdanovce, Olšava					1				**1**
Brestovec, Brestovský potok			6						**6**
Brezová pod Bradlom, Brezovský potok			1	12	15	2			**30**
Buková, Trnávka			21	24	14				**59**
Divín, Budínsky potok			11	25	19				**55**
Divín/Z VN Mýtna/, prevod vody		2	22	31	21	29	12		**117**
Gemerská Ves, Turiec					15				**15**
Kosihy nad Ipľom, Veľký potok			9	19	5				**33**
Kremnické Bane, prevod z Turca			2	19					**21**
Lopašov, Chvojnica				24	31	30	31		**116**
Lučenec, Tuhársky potok				1					**1**
Michalovce-Žabjany, prítok do VN	4		1	1				7	**13**
Moldava nad Bodvou, Bodva			9	27	24	8			**68**
Pečenice, Jabloňovka				5					**5**
Pov. Bystrica-Mošteník, Mošteník				8	8	5			**21**
Pstruša, Kocanský potok			23	27	18				**68**
Spariská, Vydrica				3	14				**17**
Svinica, Svinický potok				1	12				**13**
Tuchyňa, Továrský potok				10	8	2			**20**
Turá Lúka, Svacenický jarok			20	31	30	22	11		**114**
Vrbovce, Teplica				10	17				**27**
Zemplínsky Branč, Chlmec				12	26	12			**50**
Total sum	**4**	**2**	**125**	**290**	**278**	**110**	**54**	**7**	**870**

Fig 2. Number of days with flow rates of 0.000 and 0.001 m3 s-1 at selected gauging stations (Note: zero flow did not occur in the unlisted months (1, 4, 5 and 11)).

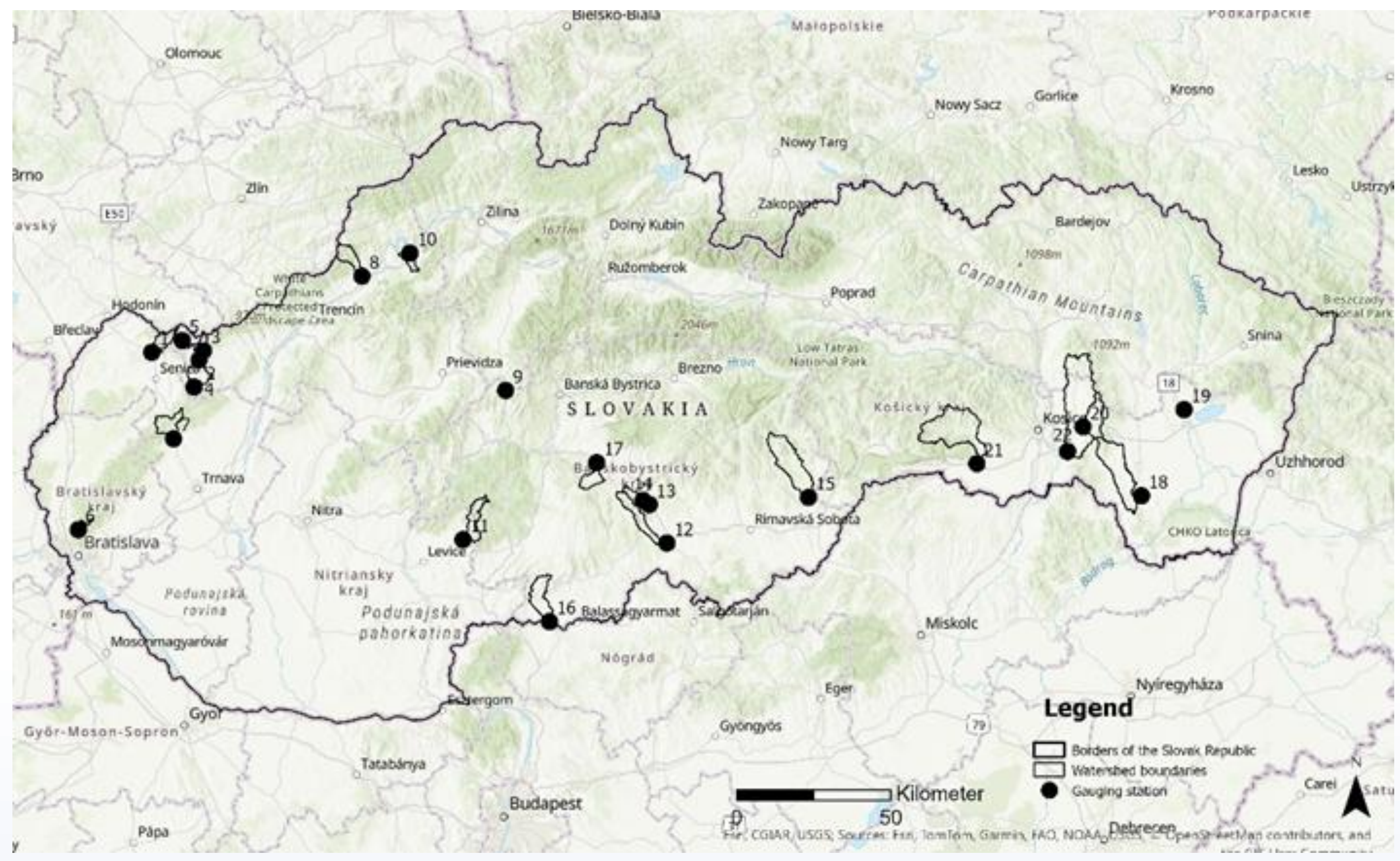

Fig. 1. List of water gauging stations 1. Lopašov, 2. Turá Lúka, 3. Brestovec, 4. Brezová pod Bradlom, 5. Vrbovce, 6. Spariská, 7. Buková, 8. Tuchyňa, 9. Kremnické Bane, 10. Pov. Bystrica - Mošteník, 11. Pečenice, 12. Lučenec, 13. Divín /Z VN Mýtna/, 14. Divín, 15. Gemerská Ves, 16. Kosiha nad Iplom, 17. Pstruša, 18. Zemplínsky Branč, 19. Michalovce - Žabjany, 20. Svinica, 21. Moldava nad Bodvou, 22. Bohdanovce.

Fig. 3. Average monthly flow in water gauging stations.

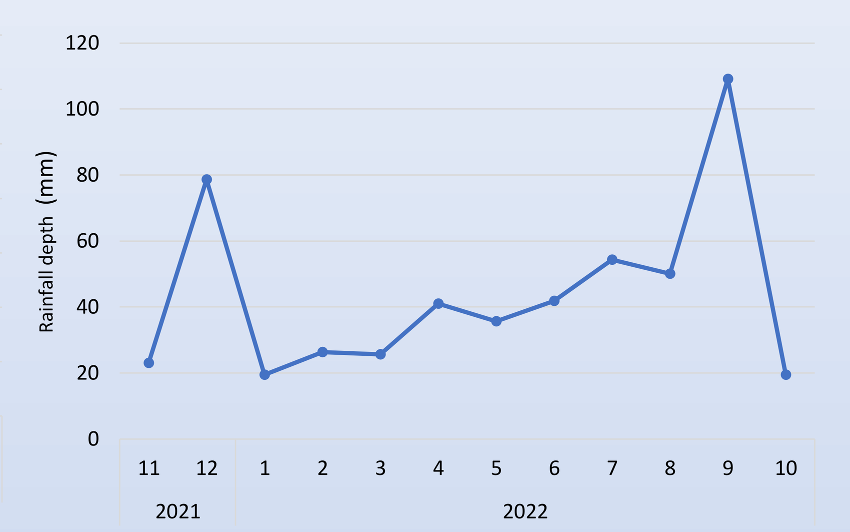

Fig. 4. Arithmetic mean of monthly atmospheric precipitation at selected meteorological stations.

CONCLUSION

Minimum flows were found to be strongly seasonal, especially during summer, which matches the typical low-flow drought pattern in Slovakia. Droughts were most pronounced in catchments with low rainfall, high temperatures, greater coarse soil fractions, steep slopes, and poor vegetation, all factors combining to reduce water retention and speed up runoff. Robust water management and long-term monitoring are crucial, as climate change is expected to increase the frequency and intensity of droughts. Strengthening natural retention — through wetland restoration, improved soil structure and landscape adaptation — will help protect water resources and increase the resilience of intermittent streams in a changing climate.

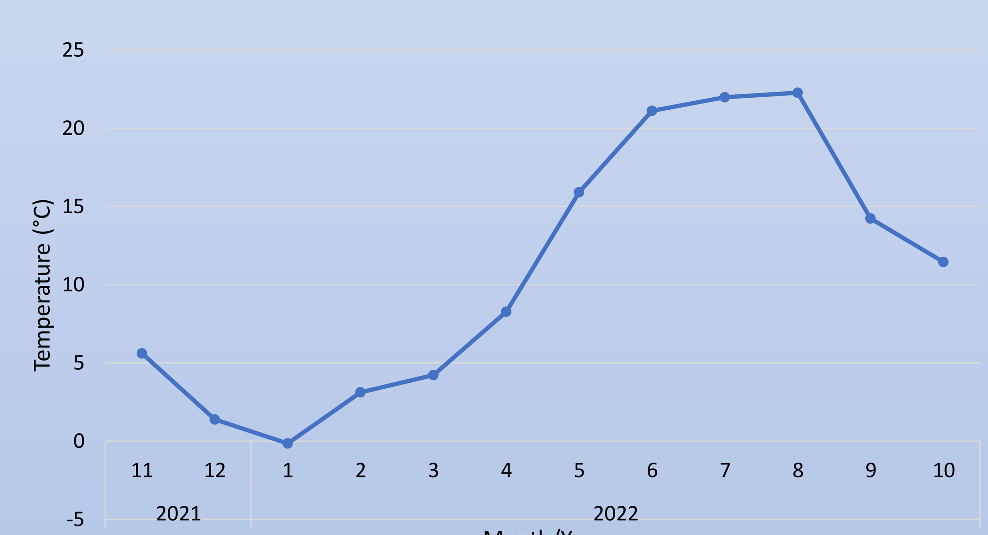

Fig. 5. Arithmetic mean of monthly temperatures at selected meteorological stations.

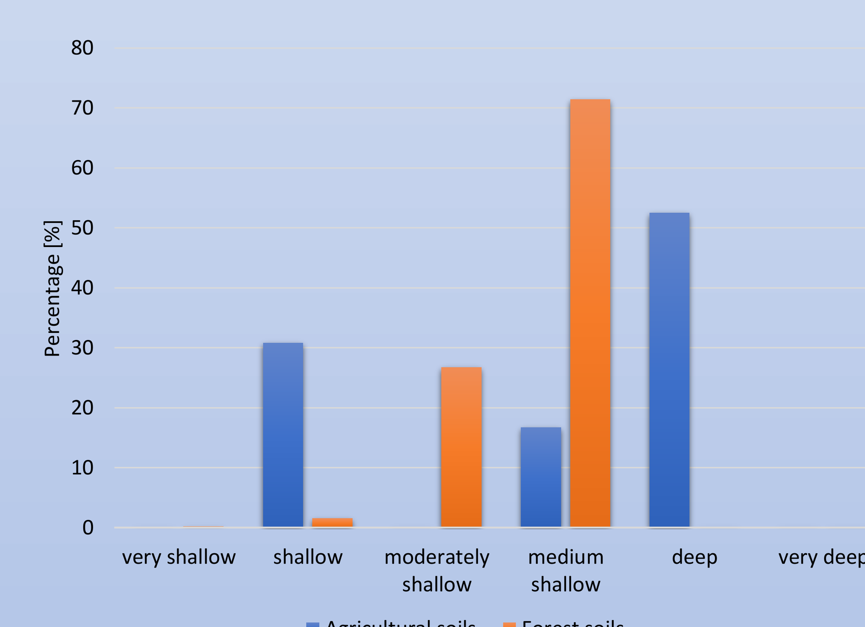

Fig. 6. Representation of soil depth categories in the catchments in percentage.

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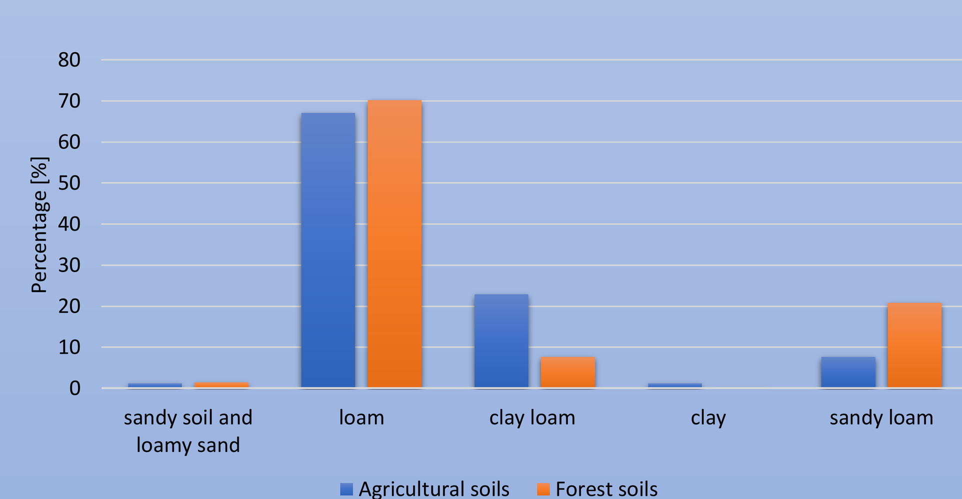

Fig. 7. Particle size distribution of agricultural and forest soils in the catchments in percentage.

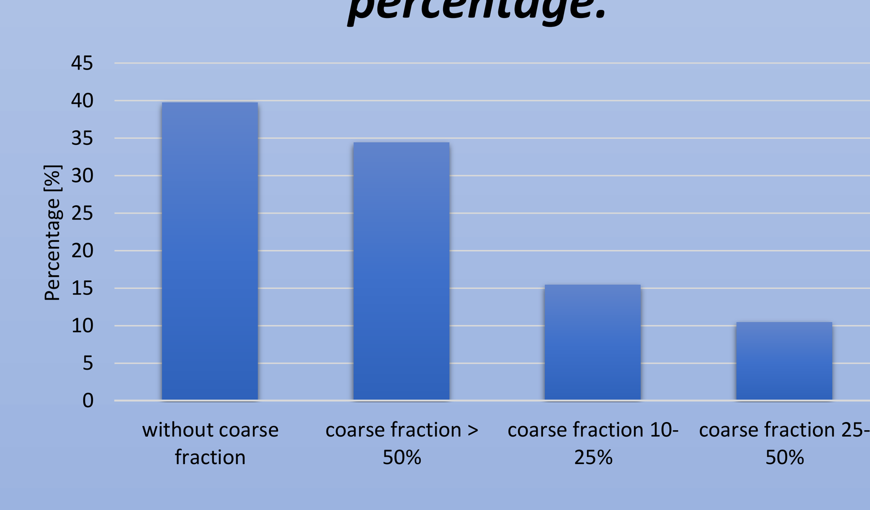

Fig. 8. Coarse fraction representation in the soil in the catchments in percentage.