SETOF Soil Erosion and TOrrential Flood Prevention: Curriculum Development at the Universities of Western Balkan Countries

Prioritization of Torrential Floods Vulnerable Watersheds Upstream from the "Rovni" Water Reservoir Using TOPSIS Method

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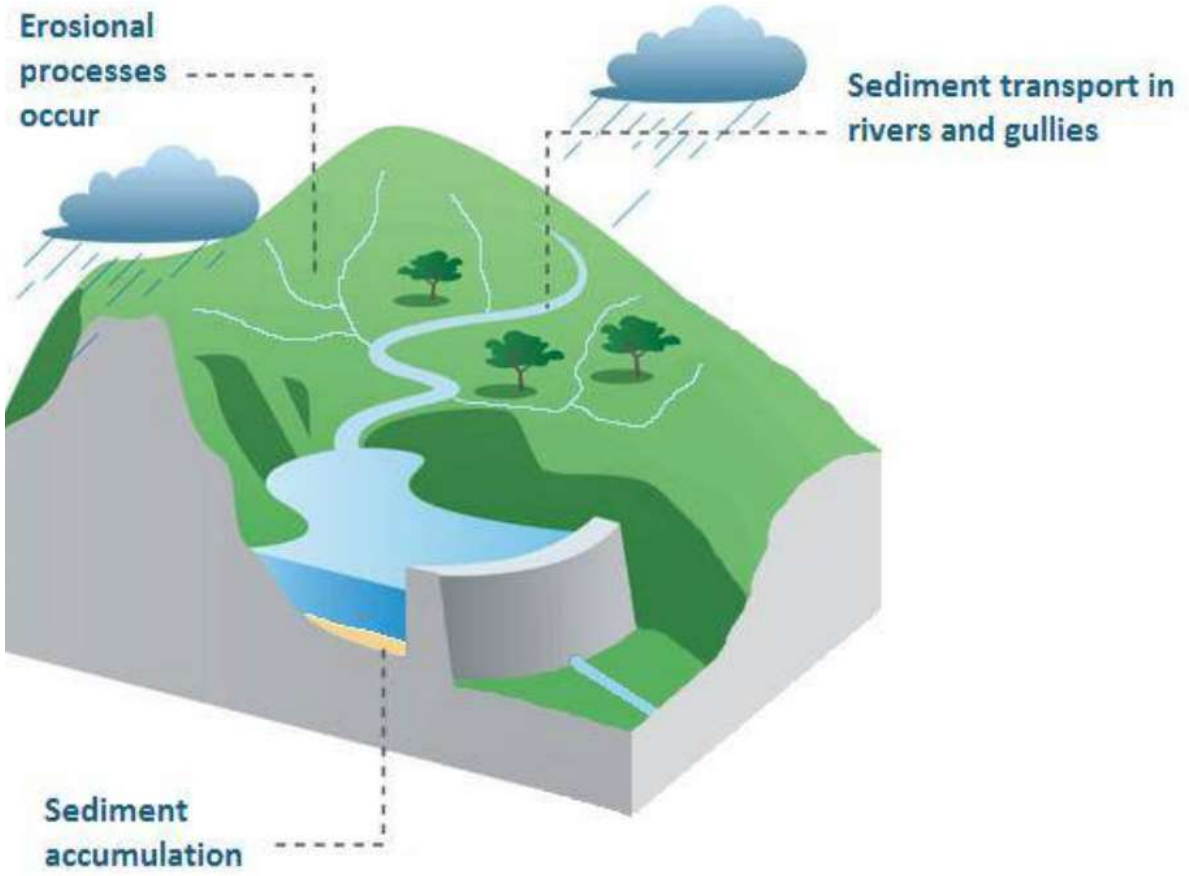
1. Introduction

- **Torrential floods**
- **Water reservoirs** represent the most sensitive water management facilities to the erosion processes.
- **The purpose** of this paper is prioritization of sub-watersheds upstream from the "Rovni" water reservoir for conservation measures.



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2. Study area

The “Rovni” Water Reservoir

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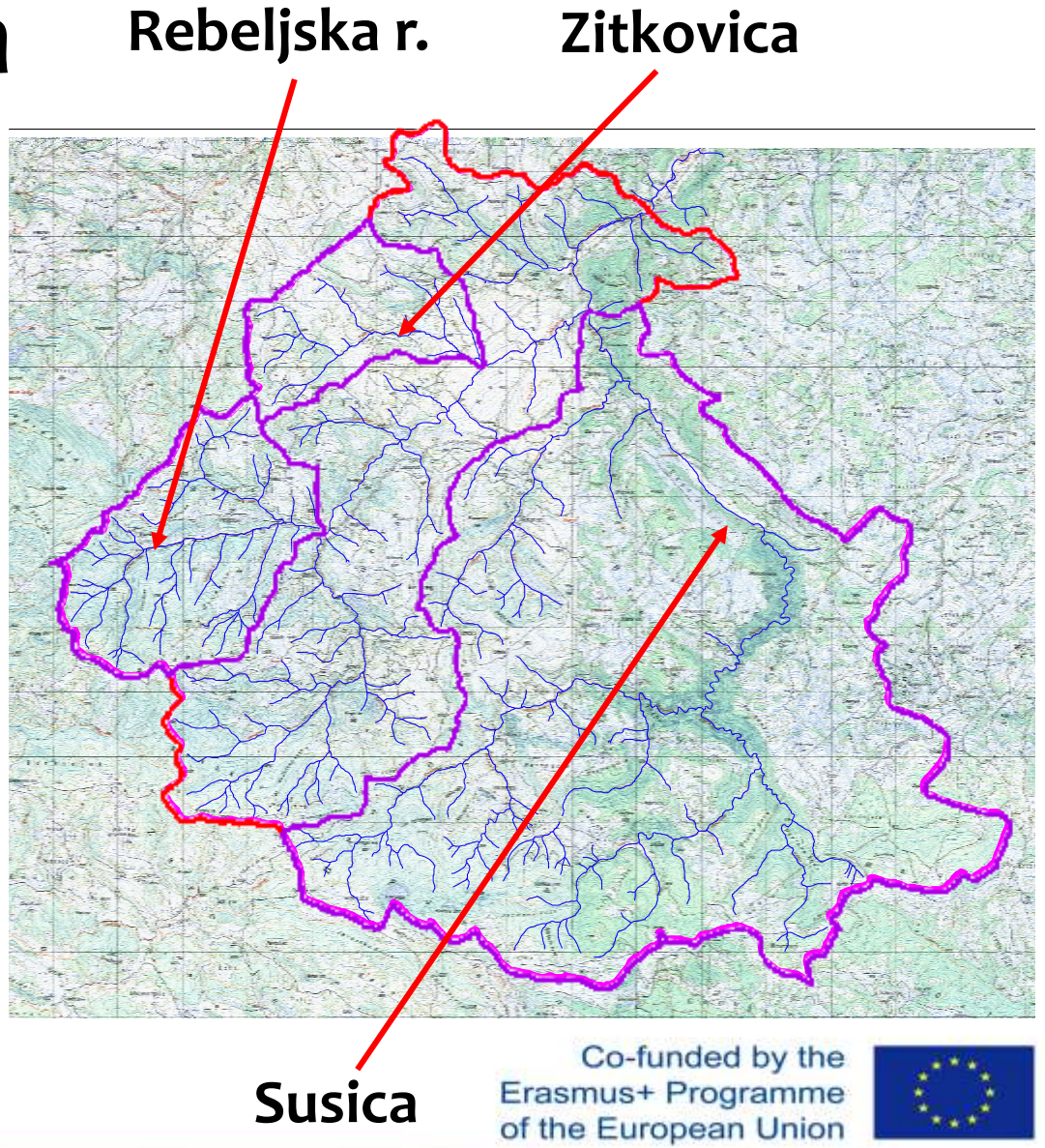
2. Study area

- The total catchment area is 110.70 km²
- The length of the main stem is 15.18 km
- Sub-watersheds which are sensitive to erosion proceses are the following :

	Basic Parameters	Susica	Zitkovica	Rebeljska r.
1.	Watershed surface area A (km²)	61.42	6.20	10.53
2.	Watershed perimeter P (km)	42.71	11.84	14.45
3.	Watershed length Lb² (km)	18.72	4.51	5.34
4.	All Channel Lengths Lu(km)	90.28	13.96	33.13



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3. Material

Criteria		Alternatives		
		Susica A1	Zitkovica A2	Rebeljska r. A3
C1	Watershed shape coefficient	0.445	0.512	0.528
C2	Form factor	0.175	0.305	0.370
C3	Drainage density	1.470	2.251	3.147
C4	Mean watershed slope	32.79	26.530	50.520
C5	Mean slope of the main channel	4.160	9.980	14.800
C6	Percentage of forest area	53.770	27.720	70.590
C7	Basin relief	433.360	234.200	362.320
C8	Torrential rain flood potential	722.620	168.830	273.540
C9	The erosion energy coefficient of the relief	87.984	90.274	138.797
C10	Geomorphological erosion coefficient of the watershed	129.334	203.178	436.856

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4. Method

- **A**nalytic **H**ierarchy **P**rocess

(Thomas Saaty '70)

Steps:

1. Structure the problem into a hierarchy having different levels
2. Make pair-wise comparison matrice
3. Calculate the relative weights (priorities)
4. Make synthesis of the priorities.

	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10
C1	1	3	1/3	1/5	1/5	1/5	5	1	1	1
C2	1/3	1	1/3	1/5	1/7	1/7	3	1/3	1/3	1/3
C3	3	3	1	1/5	1/5	1/5	5	1	4	5
C4	5	5	5	1	1	1/5	7	3	5	5
C5	5	7	5	1	1	1/5	6	3	5	5
C6	5	7	5	5	5	1	7	7	9	9
C7	1/5	1/3	1/5	1/7	1/6	1/7	1	1/5	1/5	1/4
C8	1	3	1	1/3	1/3	1/7	5	1	1	2
C9	1	3	1/4	1/5	1/5	1/9	5	1	1	2
C10	1	3	1/5	1/5	1/5	1/9	4	1/2	1/2	1

Intensity of importance	1	2	3	4	5	6	7	8	9
Definition	Equal imp.	Weak or slight	Moderate imp.	Moderate plus	Strong imp.	Strong plus	Very strong or demonstrated imp.	Very, very strong	Extreme imp.

4. Method

- The **T**echnique for **O**rder **P**reference by **S**imilarity to **I**deal **S**olution (Yoon and Hwang, 1981)

Steps:

1. Formulate decision matrix $A=(a_{ij})_{nxm}$, $i=1,2, \dots ,n; j=1,2, \dots ,m$
2. Normalize matrix $N=(n_{ij})_{nxm}$, $i=1,2, \dots ,n; j=1,2, \dots ,m$
3. Weighted normalize matrix $T=(t_{ij})_{nxm}$, $i=1,2, \dots ,n; j=1,2, \dots ,m$
4. Finiding positive I^+ and negative ideal solutions I^-
5. Distance from the positive ideal solution and the negative ideal solution
6. Relative closeness to the positive ideal solution and ranking of alternatives

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5. Results

- Calculated weights

	Watershed shape coefficient	Form factor	Drainage density	Mean watershed slope	Mean slope of the main channel	Percentage of forest area	Basin relief	Torrential rain flood potential	The erosion energy coefficient of the relief	Geomorphological erosion coefficient of the watershed
C	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10
Wj	0.05	0.03	0.09	0.16	0.17	0.34	0.02	0.06	0.05	0.04

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5. Results

- The **T**echnique for **O**rder **P**reference by **S**imilarity to **I**deal **S**olution (Yoon and Hwang, 1981)

Steps:

1. Decision matrix A
2. Normalize matrix N
3. Weighted normalize matrix T
4. Positive I^+ and negative ideal solutions I^-
5. Distance from the I^+ and I^-
6. Relative closeness to the positive ideal solution and ranking of alternatives

Si+	Si-
0.15	0.08
0.09	0.17
0.16	0.12

	Sub-watersheds	R_i	Rank
A1	Susica	0.311	3
A2	Zitkovica	0.645	1
A3	Rebeljska r	0.442	2

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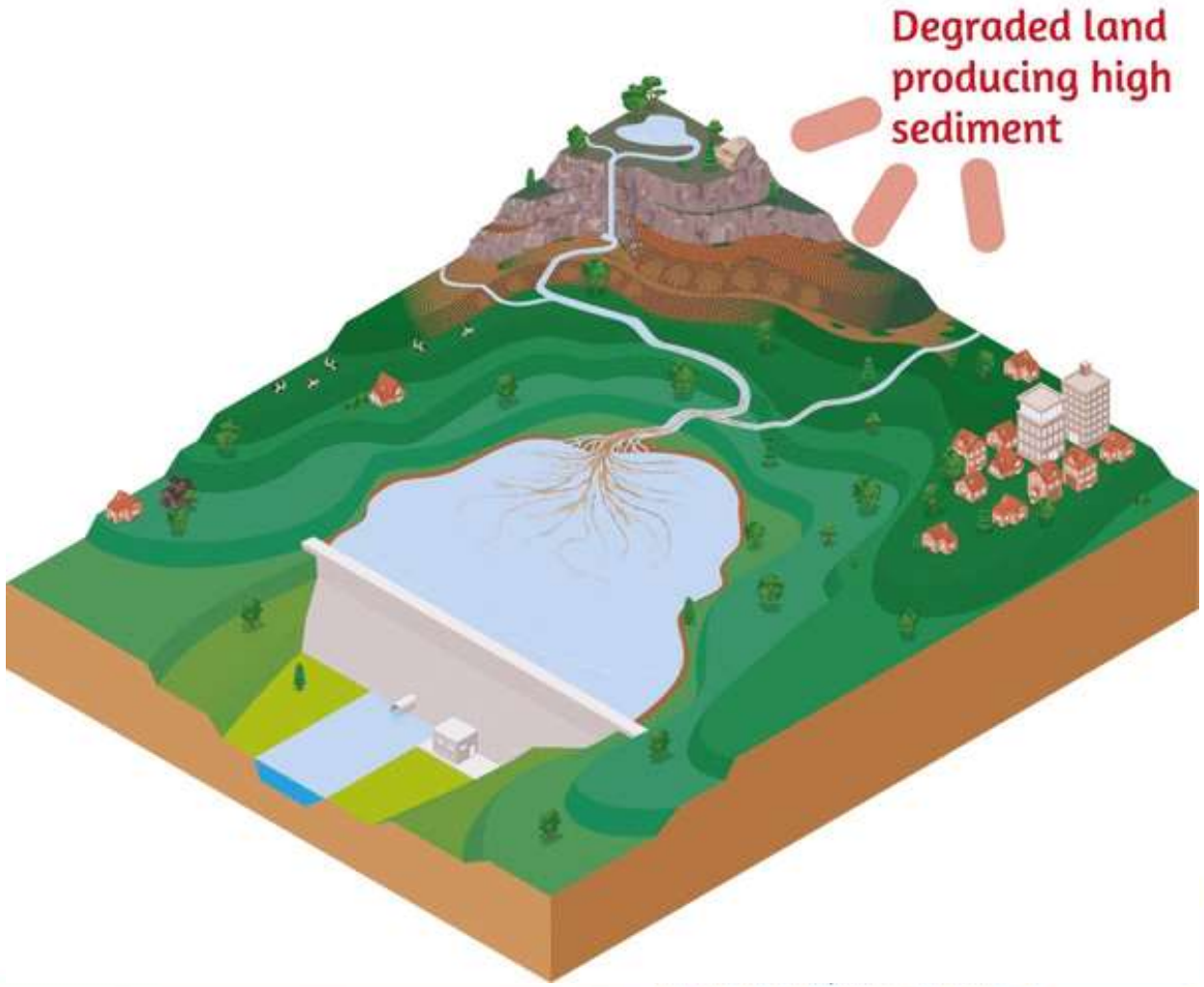
6. Conclusions

- ✓Sub-watersheds can be prioritized through geomorphological parameters complemented with percentage of forest land area for the selection of conservation measures.

- ✓TOPSIS method can be applied for ranking watersheds according to torrential floods vulnerability.



Thank you for your attention!

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