



SETOF

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

EROSION Study and Action Plan for the City of Skopje

Workshop on Bachelor and Master Curriculum Best Practices - North Macedonia
28-29 October 2019, Skopje

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Dept. of Land and Water
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EROSION Study on Erosion and Action Plan for the City of Skopje



Ivan BLINKOV



SETOF Workshop
October 28-29 , 2019, Skopje, North Macedonia

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INTRODUCTION

- Torrent floods bring enormous harm to people and nature, but also can make long-term consequences and usually return development a few years back.
- These natural hazards origin from the mountainous regions but their consequences are usually felt in downstream sections, particularly in our case, consequences from flood event were felt in the settlements in Skopje region.
- Level of destruction of the natural disasters damages depend on the natural but also depend on socio-economic conditions.

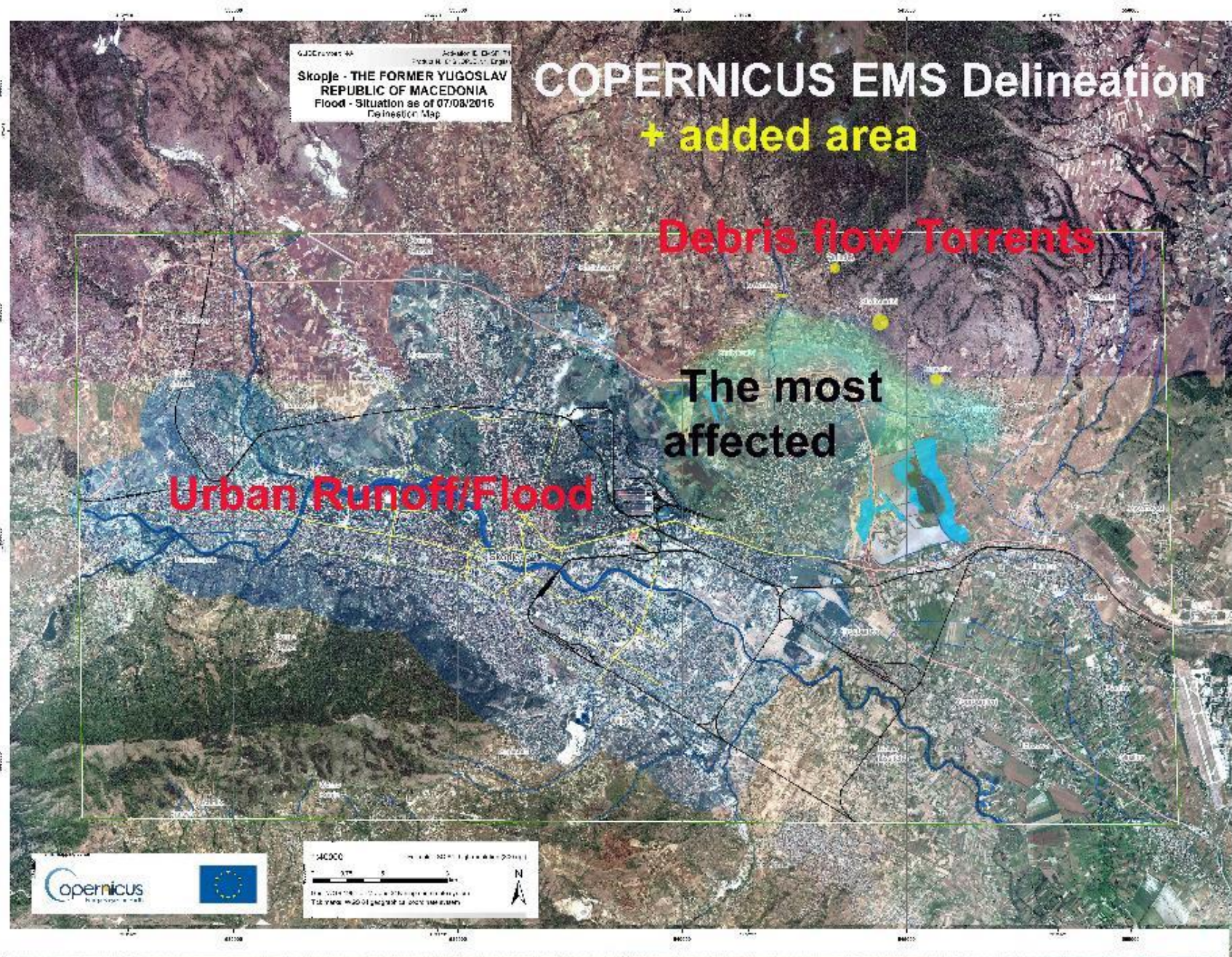
6 AUGUST 2016 - “Black day” for SKOPJE





COPERNICUS EMS rapid Estimation

- Affected almost all Skopje city and part of surrounding
- Area - 170 km²
- Cca 450 000 citizens
- 22 fatalities
- Cca 100 ME Costs of L%D





- The project “Erosion Study and Action Plan for the city of Skopje” was initiated by the administration and expert community after catastrophically disaster that occurred on August 2016 in the Skopje region.
- Project was financed by UNDP through the project
- “ICT for Urban Resilience”.
- Contract Period: 24 July 2017 - 30 October 2017 (3 months)
- Beneficiary: AULSG City of Skopje and AULSG of municipalities within the Skopje region, Crises Management Center





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- The project was realized by the team from the :
“Ss. Cyril and Methodius University” in Skopje – Faculty of Forestry – Dept. of Land and Water:
- Prof. Ivan Blinkov PhD, Team leader, erosion and torrent control expert, team leader
- Prof. Aleksandar Trendafilov, PhD, erosion and torrent control expert
- Ass. Prof. Ivan Mincev, PhD, Expert for GIS modeling related to erosion
and
- Ass. Prof. Igor Gievski, PhD, expert for landslides, Faculty of Civil Engineering
- With symbolic but important participation of 12 students

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- Legal base for the project is Law on Water, where according to the article 135:
- “On the basis of technical documentation, the state administrative body competent for environment, the council of the municipalities, of the City of Skopje and the water management enterprises for their respective area shall determine the boundaries of both the erosive area and the area endangered from erosion, and specify the measures and the activities pertaining to the protection of land from erosion and regulation of torrents”.
- The project is connected to the approaches and principles in the following World and EU policy documents :
- Eco-DRR , Climate changes and DRR, UNCCD, UNFCCC , FE - Warszawa resolution 2 – Forest and Water, IWRM

and national documents as follow:

NAP CCD, III NC to UNFCC, NPDRR, Water strategy (WS) , SSDF, Spatial Plan of the Skopje Region (SPSR), Action Plan to Adaptation to Climate Changes in Skopje (APACC)





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The project is consisted of 4 parts:

- Study on erosion and torrents
- Action Plan for erosion and torrent Control
- Creation and uploading a relevant database for erosion and torrents on Web-Application
- Preparation of methodology to be used in preparation future studies and plans in RM.

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- The study region is the Skopje region that consists of the city of Skopje and the following municipalities: Arachinovo, Chucher-Sandevo, Ilinden, Petrovec, Sopishte, Studenichani and Zelenikovo.
- Municipalities within the city of Skopje are: Saraj, Gjorche Petrov, Karposh, Butel, Shuto Orizari, Chair, Centar, Kisela Voda, Aerodrom and Gazi Baba.





Activities in the Erosion Study are separated in the following phases:

- 1) preparatory desktop analyses,
- 2) on-filed mapping and inventory,
- 3) erosion factor analyses
- 4) analyses of past and current legislation
- 5) analyses of past erosion and torrent control activities in the region
- 6) erosion modelling i.e. delineation of “Erosive Areas” and “Areas endangered by erosion” with 4 steps (Maps digitalization, Modelling Erosion Intensity, Modeling Erosive areas , Modeling Areas endangered by Erosion).





- Data collection
- Preliminary desk-top analyses
- On-field activities
- Digitalization of basic erosion related data

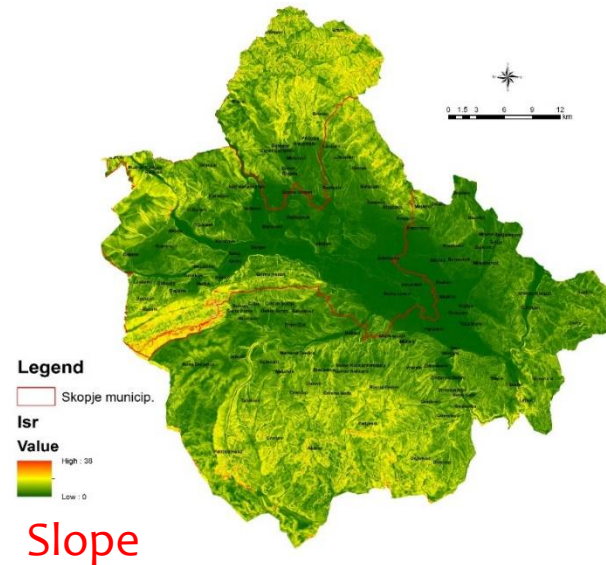
No	Catchment	Type	Coordinates	Land cover	Eros. categ.	Descript.	Photo nr.	Municipality
115	Upper Vardar	Deep	525660 – 525966 4662994-4664356	BL	1	3 W-shaped gullies	A - 1	Saraj
115	Upper Vardar	Deep		SBE	1	Upstream of G. SVilare, gullies	A - 2	Saraj

No	Catchment	Type	Coordinates	Dimension	Description	Condition	Repair.	Photo nr	Municipality
115	Upper Vardar	Check dam	523660 , 4662994	Hk – 2m	5 new stone check dams	Excellent	No	A - 3	Saraj
115	Upper Vardar	Check dam	523932, 4654186	Hk – 2m	Old stone check dam	Good	No	A - 4	Saraj

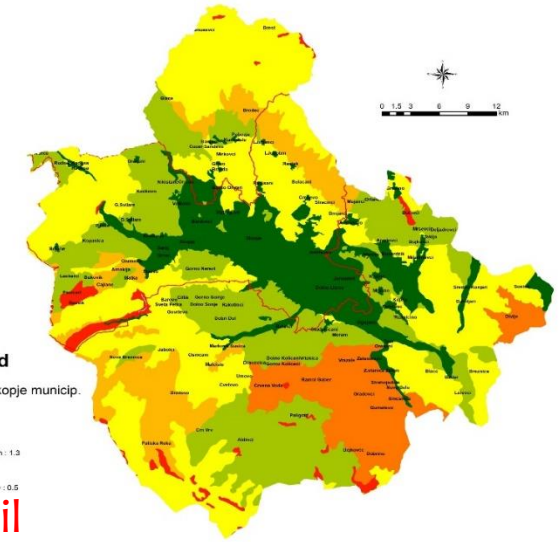
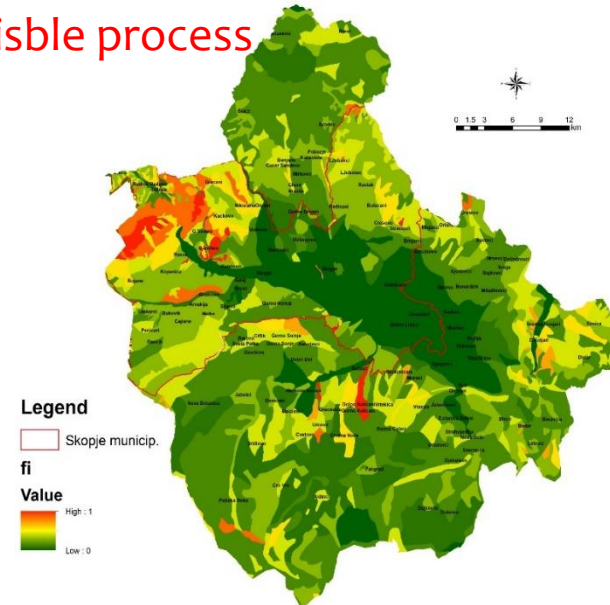




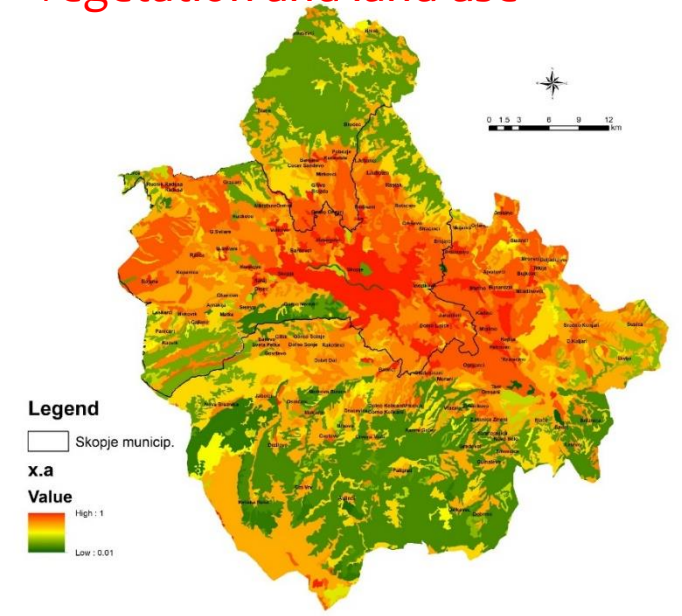
- All natural factors (relief, topography, soil and rock characteristics, climatic factors, land cover) and socioeconomic activities (land use activities), are favorable to significant erosion processes and appearance of torrent floods.
- Factors of exposure to erosion and torrents (position of settlements, infrastructure and cultural background of the citizens including various illegal activities, etc.) significantly increase the risk of erosion and torrents in the region.
- Digitalization, adding numerical values and rasterization



Visible process

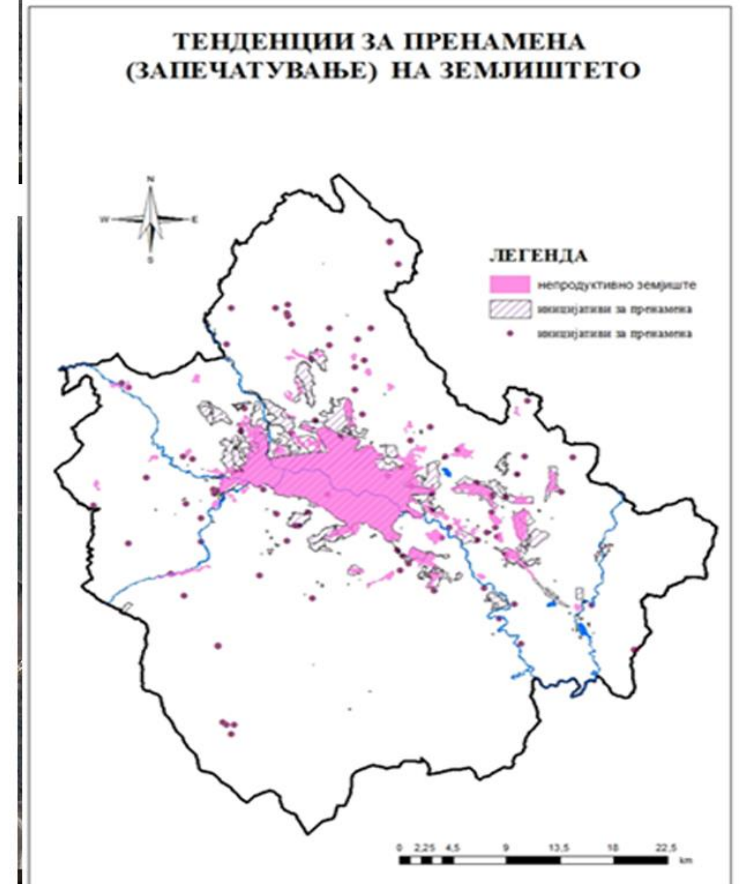
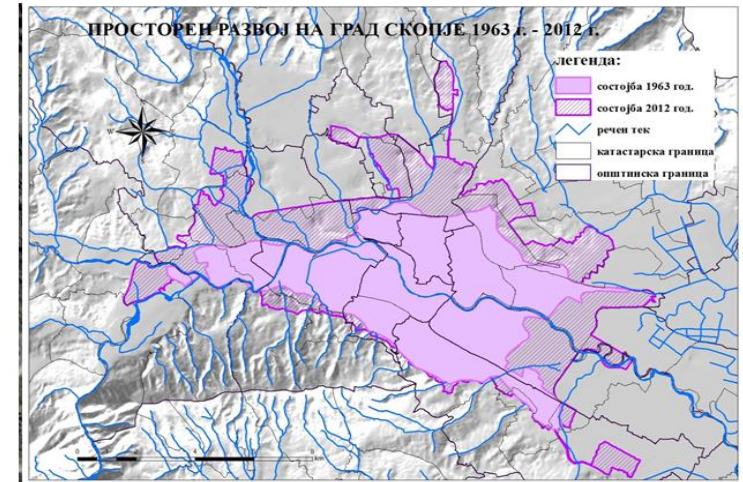
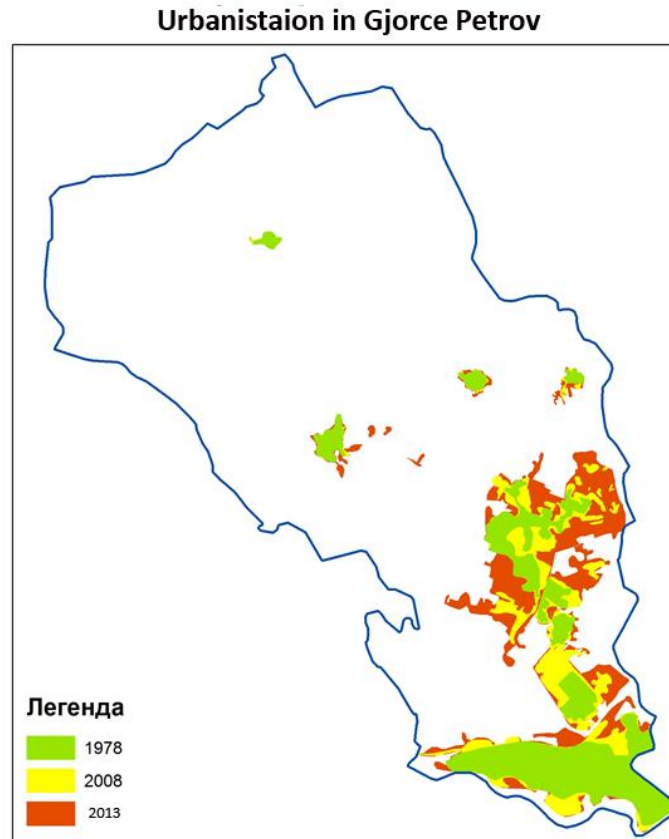
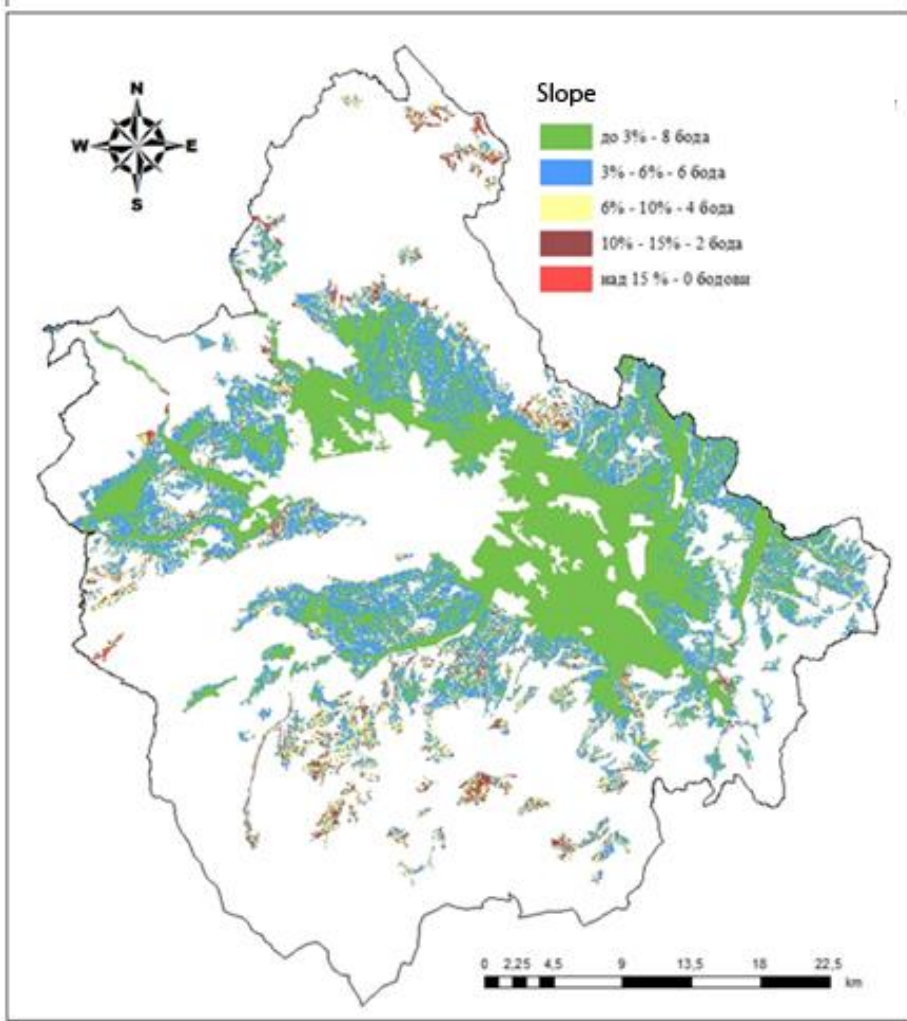


Vegetation and land use





Agriculture, Soil sealing-Urbanization





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Road construction



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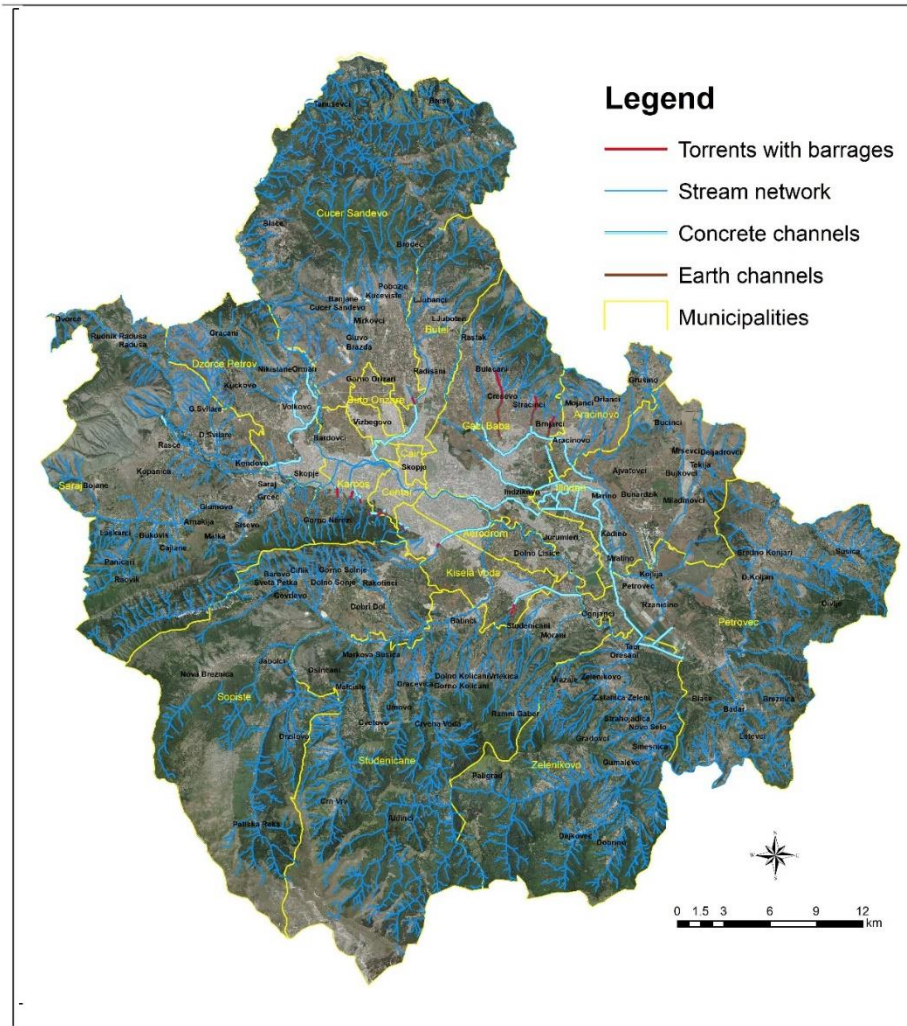
Past erosion and control activities



In the period 1919-1927 were drained 6000 ha in Skopje Valley. Significant activities were carried out for erosion and torrent control.

After the first activities in 1928, immediately after the II WW, in 1946 firstly prisoners and later from 1948 “udarnichki” actions started to afforest bare land on Vodno. Following the act from 1952, Vodno and Gazi Baba were proclaimed as “EROSIVE AREAS:





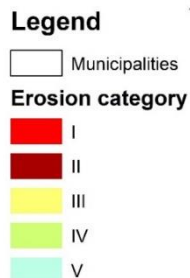
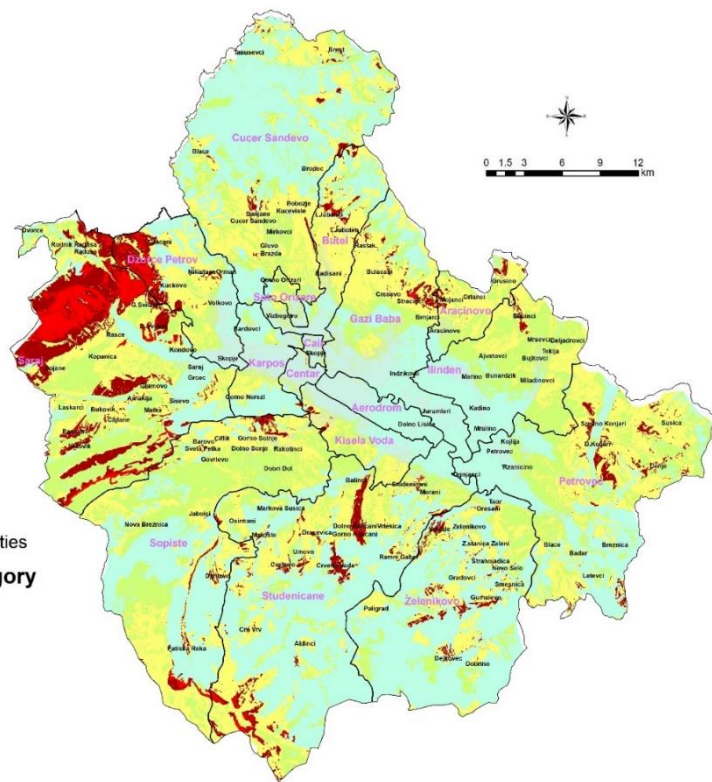
- Over 100 torrents delineated in 7 sub-watershed or areas
- Coding system
- 1 - Upper Vardar
- 2 - Treska
- 3- Lepenec
- 4 - Vodno Torrents
- 5- Serava
- 6 – Skopska Crna Gora - torrents
- 7- Kisel Voda - other
- 8 - Skopje hills
- 9 – Other municipalities



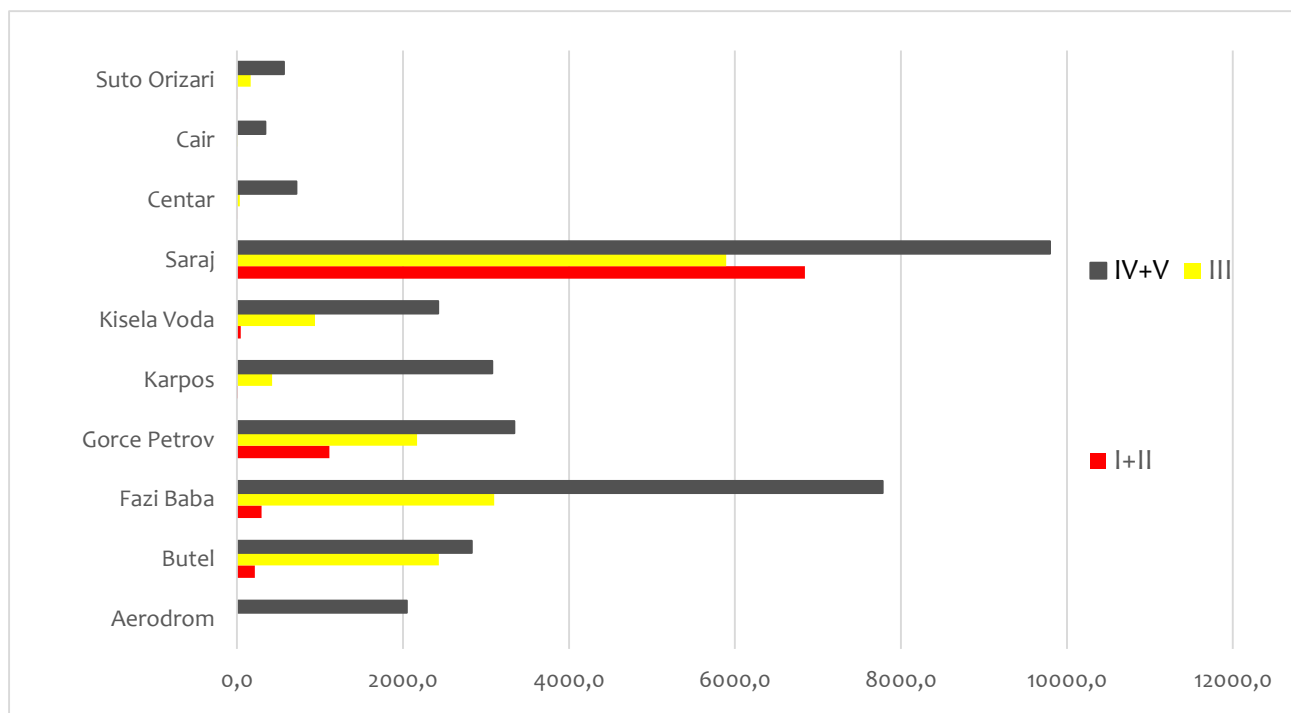


EROSION MODELLING

step 2 – Erosion intensity

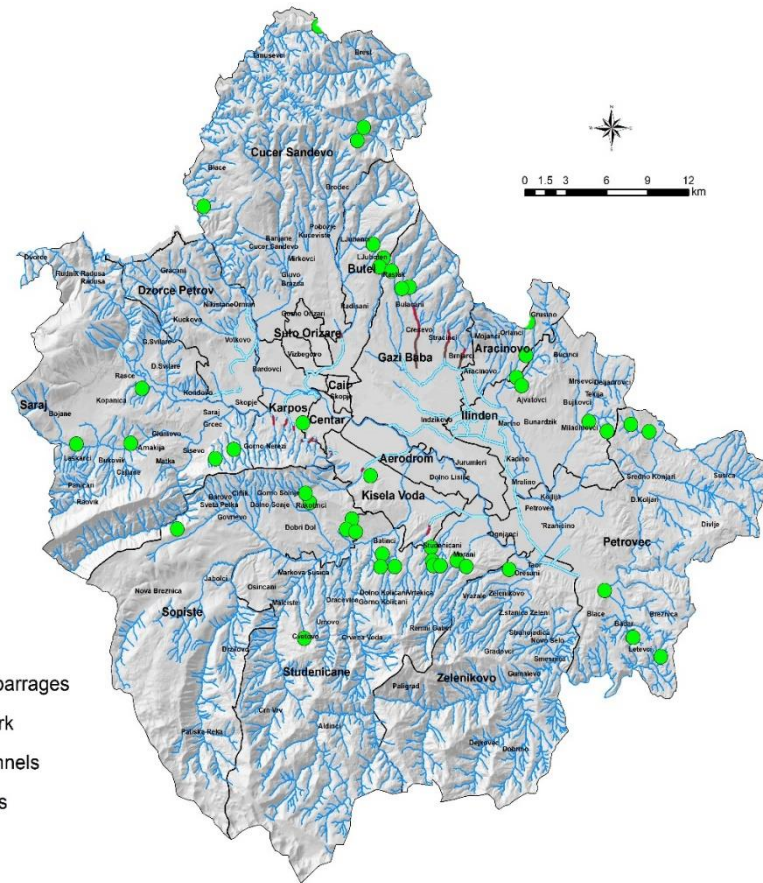


Municipality	Area per category of erosion intensity in [ha]					Coeff. of Eros. - Z
	I	II	III	IV	V	
Skopje	2622	5906	15169	12878	20042	0.40
Other	374.5	3666	36093	27975	55382	0.30
Region	2997	9573	51262	40854	75424	0.33





Landslides inventory



No.	Municip.	Settlement	Area	Cause	Depth	Impact	Measures	Mo nit
1	Butel	Unsettled	0	unknown	unknown	no infrast.	no	no
2	Butel	Unsettled	0	unknown	unknown	no infrast.	no	no
3	Butel	Unsettled	0	unknown	unknown	no infrast.	no	no
4	Centar	Kapistec Karpos	500	nasip	shalow	endang. obj.	yes	no
5	Gazi Baba	Unsettled	0	unknown	unknown	no infrast.	no	no
6	Gazi Baba	Unsettled	0	unknown	unknown	no infrast.	no	no
7	Gazi Baba	Bulach.-Rastak road	800	rainfall	shalow	endang. road	yes	no
8	Kise.	K.Voda	6000	rain+earthq	deep	endang. obj.	yes	yes
9	Saraj	Unsettled	0	unknown	unknown	no infrast.	no	no
10	Saraj	Laskarci (Hig.SK-TE)	1976	rainfall	deep	endang. road	yes	no
11	Saraj	Unsettled	0	unknown	unknown	no infrast.	no	no
12	Saraj	Unsettled	0	unknown	unknown	no infrast.	no	no
13	Saraj	Hig. SK-OH	4000	Excavat.	deep	endang. road	yes	yes





HOT SPOTS in Torrent bed

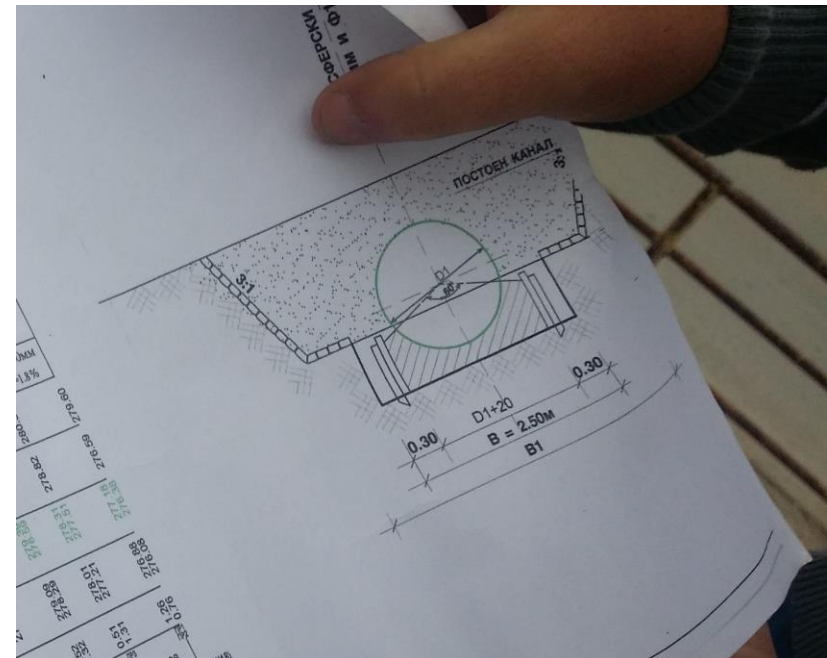


- Houses on the check dams
- (Gornovodnjanski Poroj)



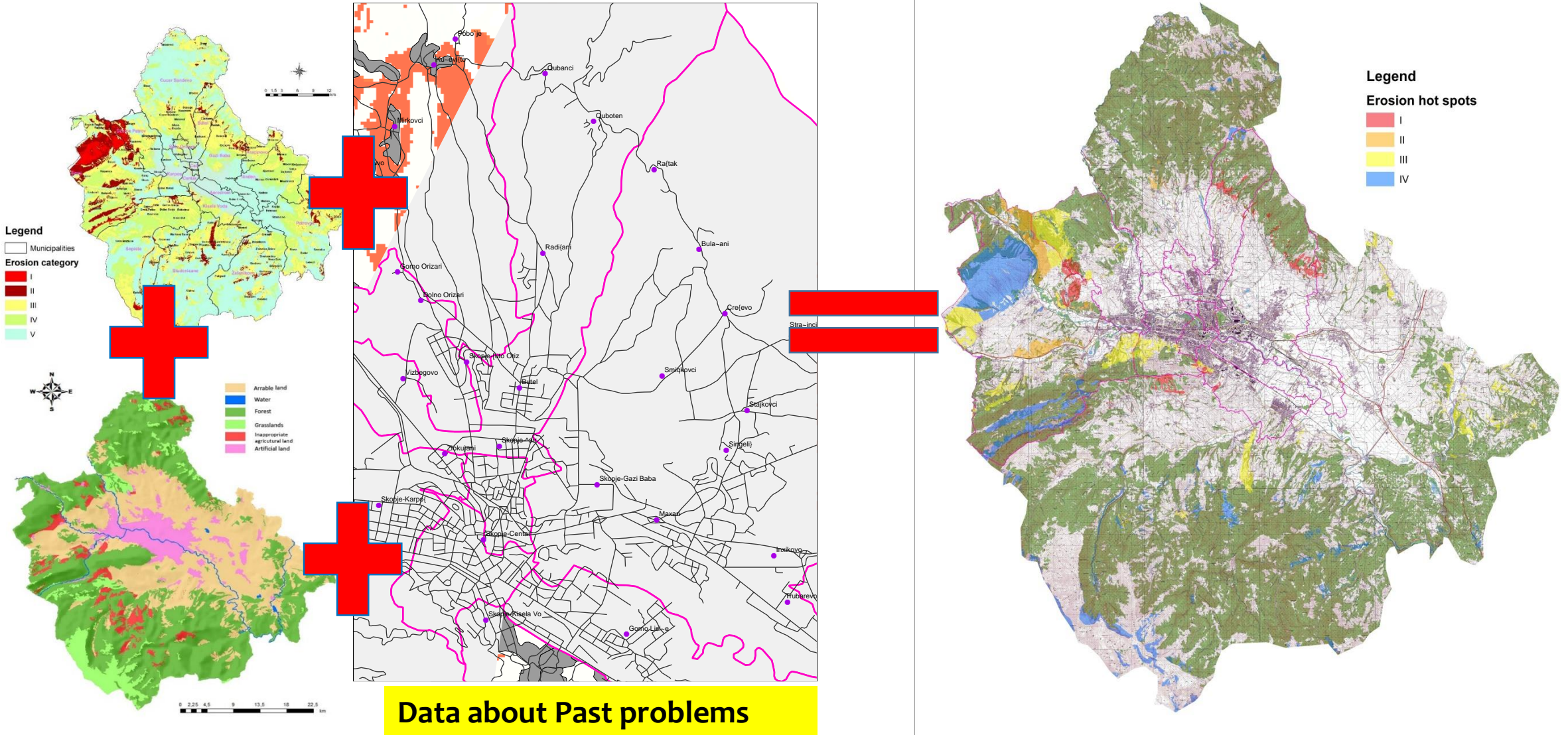


DOES ANYBODY HAS AN IDEA WHAT IS THIS? ENGINEERING DOUBT – Absence of knowledge?



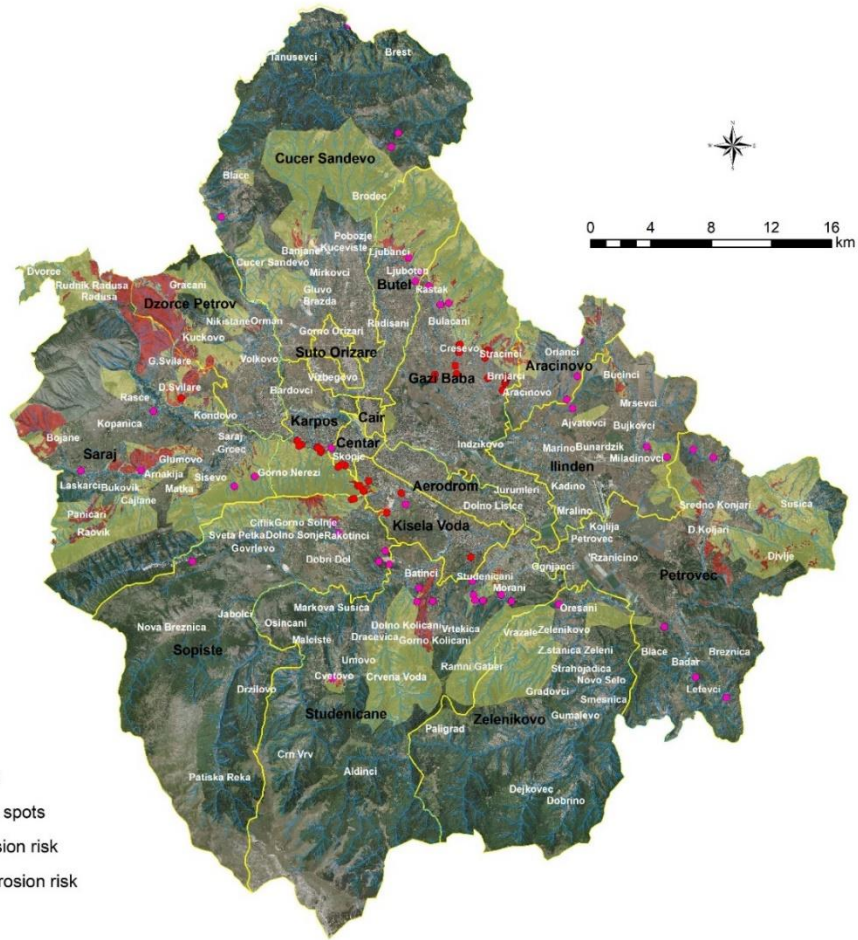


EROSION HOT SPOTS

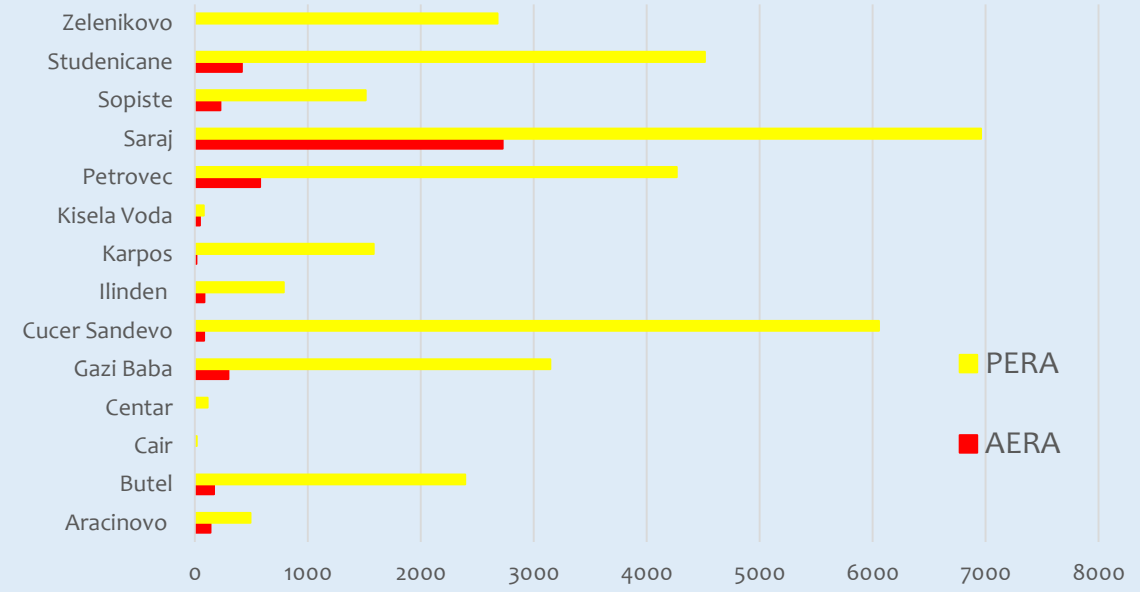


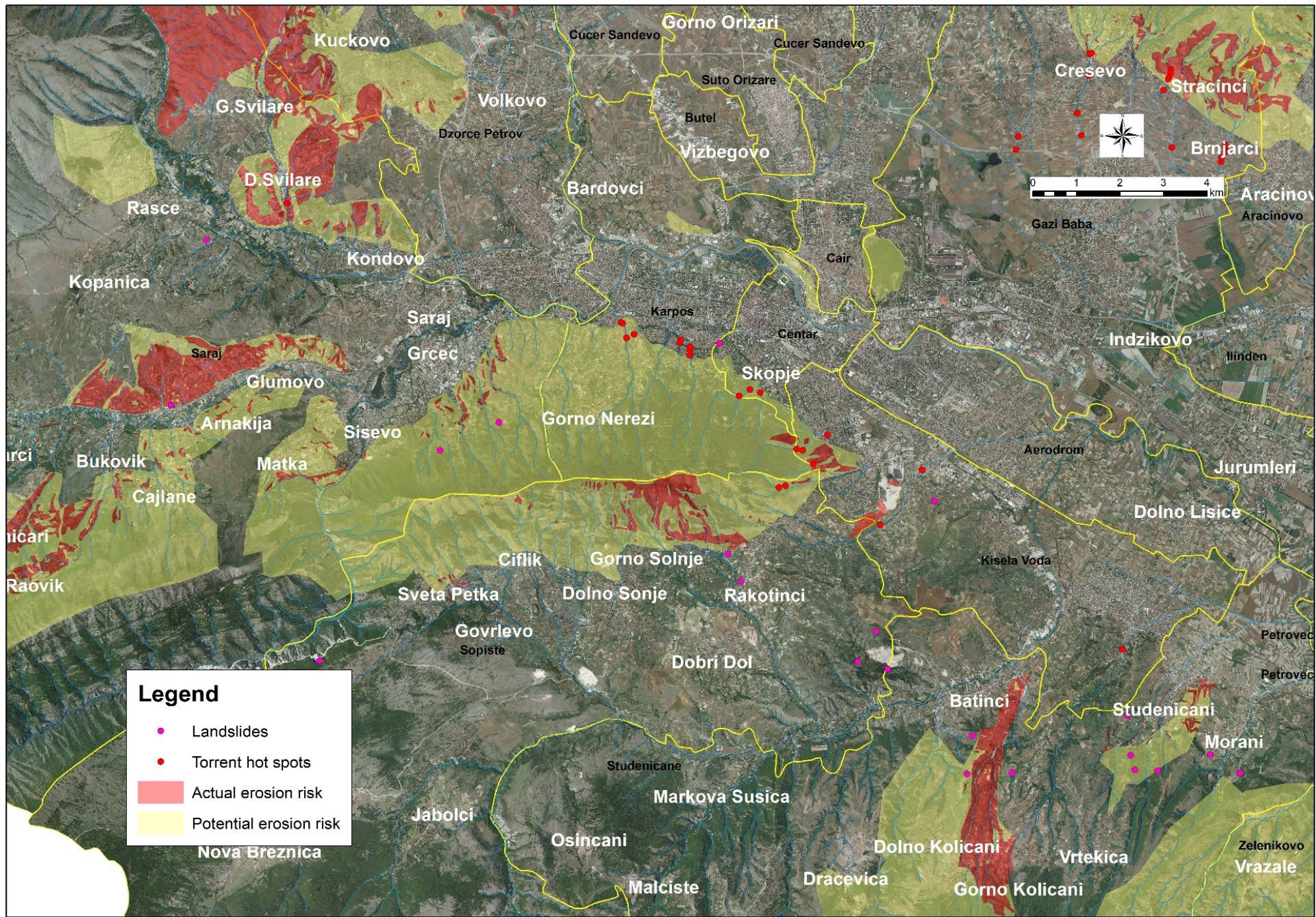


EROSIVE AREAS AREAS ENDANGERED BY EROSION



Erosion hot-spot (2 classes) - EA Erosion Potential (2 classes) - AER Hot-spots in torrent bed Landslides







GAP ANALYSIS

- Legislative and institutional gap;
- Unsustainable land management activities;
- Unsustainable construction and mining activities;
- Unsustainable Urban planning and urbanism;
- Maintenance of existed erosion and torrent control structures and measures;
- Design and Implementation of Erosion and Control Works;
- Other.

GAP ANALYSIS





Action PLAN



- General administrative measure for erosion and torrent control on Erosive Areas and Areas endangered by erosion are presented firstly.
- Based on the previous assessments, especially of the not fully developed and consistent legal and regulatory framework, the organisational structure with not fully clarified roles and responsibilities, and the institutional capacity in need for improvement, the Action Plan will be implemented based on a two-tier strategy:
- First priority will be to implement measures, which addresses the enabling environment, the institutional roles and management instruments, which will be the foundation for and the preparatory measures in relation to the more technical measures
- Parallel with this, and as the legal and regulatory framework are put into place, and the organisational structures and the institutional capacity is developed, the more technical measures will be implemented in a structured “learning-by-doing” process.





• **ADMINISTRATIVE MEASURES**

• **For Erosive areas:**

- Obligation for sustainable land use planning

Agriculture

- • Prohibition of plowing on steep terrain (in accordance with the Law on agricultural land)
- Prohibition on plowing on slope
- Prohibition of grazing of degraded pastures
- Obligation for contour plowing
- Obligation to convert degraded arable land into meadows or forests
- Obligation for the melioration of degraded pastures
- Obligation to convert perennials into vineyards or orchards

Urbanism, construction, mining,

- Prohibition of urbanization
- Obligation to raise green areas in an urban environment
- Obligation to implement the so-called “urban green infrastructure”
- Obligation to raise urban green areas in accordance with the principles of erosion control
- over a dangerous level of water

Forestry

- Prohibition of clean cut
- • Prohibition of grazing in the forest
- Ban on foliage
- The obligation to afforest the nakedness
- Obligation to declare protective forests and take appropriate breeding measures
- An obligation for sustainable forest management





Necessary preparatory measures for enabling environment

No.	Measure	Explanation	Priority	Responsible institution	Indicator	Expenses
	Amendments to the Water Law (Articles 123-131) and related laws to ensure a clear separation of responsibilities for controlling erosion and floods		1	MOEPP	Amendments adopted	0
	Adoption of by-laws for regulating some issues related to erosion and torrents (Rulebook on determining current and potential areas of risk of erosion, issues related to the differences between torrents and rivers (clear criteria for their delineation)		2	MOEPP	Adopted bylaws	0
	Changes in the statute of the chamber of certified architects and certified engineers of RM.		1	CCACEM	Adopted changes of statute	0





Technical measures

- Protection against erosion on agricultural land (2)
- Protection against erosion on forest and semi natural areas (5);
- Technical- ameliorative structures (erosion control in small streams (2); Erosion control on artificial degraded land (construction sites, excavation sites, borrow pit, ash slags (4);
- Decreasing severity of torrent flood hazard (1); .
- Increasing bed conveyance (2);
- Decrease of sediment transport (2); Decrease of exposure to hazards (2)

- Further the measures were detailed per municipality



Karposh

	Cleaning of overgrown vegetation and waste in all the channels			AULSG	Established conveyance	
	Revision of the defined hot spots in torrential beds	Doubts about the conveyance of Nereshki Poroj in the closed system	1	AULSG	Revision done	5000
	Control of the closed basin of the nameless length and deviation of the course towards the Nereshki Poroj j	If it is illegal, the material to be removed from the torrent bed	1	AULSG	Signed registry of inspection	0
	Control of objects built in and on the river bed at Trnodol and Sultan Potok	On the basis of control of future actions	1	AULSG	Signed registry of inspection	0
	Proclamation of Vodno for protective forest		1	MAFWE CSM	Proclaimed Vodno Mountain for protective forest	Level of City of Skopje
	Erosion control on erosive area that is harm for Kisela Voda		1	Investor for the road to Soncev grad		





INITIAL COSTS for MEASURES within the plan

Municipality	Afforest	Other	Total
Aerodrom			
Butel	500000	100000	600000
Gazi Baba	900000	370000	1270000
Gorce Petrov	3250000	50000	3300000
Karpos		5000	5000
Kisela Voda		255000	255000
Saraj	300000 00	370000	3037000 0
Cair		0	0
Centar		100000	100000
Shuto Orizari		50000	50000
Total Skopje	3465000 0	1300000	3595000 0

Aracinovo	250000	200000	450000
Cucer Sandevo	300000		300000
Ilinden	200000		200000
Petrovec	1800000		1800000
Sopiste	600000	400000	1000000
Studenicane	800000	200000	1000000
Zelenikovo		30000	30000
Total Other	3950000	830000	4780000
Other activities		3210000	3210000
Total Skopje Region	38600000	5340000	43940000





DYNAMIC PLAN

3.4. Erosion control on artificial degraded land (construction sites, excavation sites, borrow pit, ash slags..)																	
	Preparation an implementation Erosion and Sediment Control Plan for construction sites	1															
	Continuous inspection at the regional and local level	2															
	Reclamation of active pits, sub-lots, junctions, landfills	2															
	Reclamation of abandoned pits, sub-lots, junctions, landfills	5															
3.5 Decreasing severity of torrent flood hazard																	
	Design and construction of retention facilities and systems in the hilly and mountain parts of the catchment areas	3															
3.6. Increasing bed conveyance																	
	Continuous maintenance of regulations and cross-objects based on continuous monitoring of conditions																
	Inspection - control - communal - waste and trapping of troughs and objects	1															
3.7. Decrease of sedimnet transport																	
	Design and construction barrages or other sediment retention facilities before entering closed systems	3															
	Repair of damaged cross structures	4															





Blagodaram na vnimanieto



Last Slide

It's not over...



Thank you for your attention





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ICT for URBAN Resilience unfinished activities



Град Скопје

Регистер на Ерозии

marina

.....

Запамти ме

Логирај се >



UNDP

- UNDP and the City of Skopje in partnership with the Crisis Management Centre (CMC) implement the project: “ICT for urban resilience”.
- The main project objective is to build disaster and climate resilience by increasing institutional capacity, mobilizing knowledge and transferring appropriate best-practice innovation technologies.
- The project will result in strengthening the capacities of the local government to increase the urban resilience of the city, as well as to design and implement integrated disaster and climate risk reduction plans and programs.

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Ерозии

Додај нова

Р.б.	Локација (место)	Атар	Опис	Податок за сопственост (...)	Податок за основната на...	Последна промена	
	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>		
1	Мачево	Атар податок	Опис тест	Податок за сопственост (владение) на ерозивното земјиште (парцела)	Податок за основната намена на земјиштето со ерозивни процеси	07/19/2017 14:10	Детали
2	Берово	Атар Берово 001	Проба 001сфсдфсдсда	Податок за сопственост (владение) на ерозивното земјиште (парцела)	Податок за основната гдфдфгсдф	07/20/2017 16:34	Детали
3	Вејсели	Опис	Опис	лјдлјлјд	лјсдфлксдлј	08/10/2017 10:23	Детали
4	Злокуќани	Атар опис	Опис на ерозија	Сопственост	Намена	08/11/2017 10:26	Детали
5	Берово	берово	свлечиште	перо	земјоделско	08/13/2017 10:41	Детали
6	Будинарци	мачево	свлечиште	Перо	земјоделско	08/14/2017 21:57	Детали
7	Митрашинци	fgfd	fdgfdg	dfg	fdg	08/15/2017 16:22	Детали
8	Берово	1	1	1	1	08/30/2017 15:37	Детали





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