

# NATURE-BASED DISASTER RISK REDUCTION SOLUTIONS IN SERBIA

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Japan International Cooperation Agency

- **PROJECT: NATURE-BASED DISASTER RISK REDUCTION SOLUTIONS IN THE WEST BALKANS**

**Chapter 1: Geography and Geological Formation of the Balkan Peninsula**

**Chapter 2: Nature-based Disaster Risk Reduction (DRR) Solutions practiced in former Yugoslavia and Albania**

**Chapter 3: Current Nature-based Disaster Risk Reduction (DRR) Solutions practiced in each state of former Yugoslavia and Albania**

**Chapter 4: Insights over the Projects**

**Chapter 5: Options for the regional network and processes under the West Balkan Cooperation Initiative in Nature-based Disaster Risk Reduction (DRR) Solutions**

# *Legislation relevant to nature-based DRR in Serbia*

Legislation	Stakeholder	Adoption	Relevance for DRR/ Nature Based solutions (Nbs)
Law on Emergency Situations (“Official Gazette of RS”, No. 111/09)	Ministry of Interior	2009	The law defines emergency management and other elements required for the operation of the protection and rescue system.
Law on Fire Protection (“Official Gazette of RS”, No. 111/09)	Ministry of Interior	2009	The law harmonized with the EU regulations and with the Hyogo Framework for Action, and provides a basis for the establishment of an integrated system of emergency management.
Law on Health Protection (“Official Gazette of RS”, No. 107/05, 72/09 – other law, 88/10 and 99/10)	Health care institution	2005/09/10	The law requires health care institutions to organize and implement measures in the case of natural and other disasters and emergencies.
Law on Water (“Off. Gazette of RS”, No. 30/2010, 93/2012 i 101/2016)	Public water management companies	2010/12/16	The law requires public water management companies to organize: flood defence for first order waters, which primarily include large waterways with developed protection systems and defence organization. Second order water flood defence, which includes mostly torrential waters, is entirely the responsibility of the municipalities.
Law on Meteorological and Hydrological Activity (“Off. Gazette of RS”, No. 88/10)	Republic Hydrometeorological Institute (RHI)	2010	The law mandates RHI to provide early warnings and alerts on meteorological and hydrological natural disasters and

# Legislative and policy framework

Strategies	Stakeholder	Adoption	Relevance for DRR/ Nature Based solutions (Nbs)
Nature Based Solutions (NBS)	GEF, UNDP, Ministry of Environmental Protection of Republic of Serbia	2019	Foresees use ecosystems and the services they provide to address societal challenges such as climate change, food security or natural disasters
NBS - GHG emissions	Nationally Determined Contribution – NDC, UNFCCC, Republic of Serbia	2015	Pledges to reduce GHG emissions by 9.8% by 2030 compared with the 1990 levels. -
Water Management Strategy	Directorate of waters. MAFWM	2016	Sets out the water management strategy of the territory of the Republic of Serbia.
Biodiversity Strategy	Government	2011-2018	Pays special attention to the climate change, including the issue of climate change within the sectoral policies and programs
Agriculture and Rural Development Strategy, (IUCN, 2014),	Government	2014-2022	Foresees sustainable management of natural resources and emphasizes the “necessity of responding to climate change”.
Sustainable Urban Development Strategy (IWMI, 2019)	Government	2019	Foresees mitigation of climate change by improving the quality of the environmental parameters, and adaptation to climate change and establishment of a system of rapid response to risks and hazards in urban

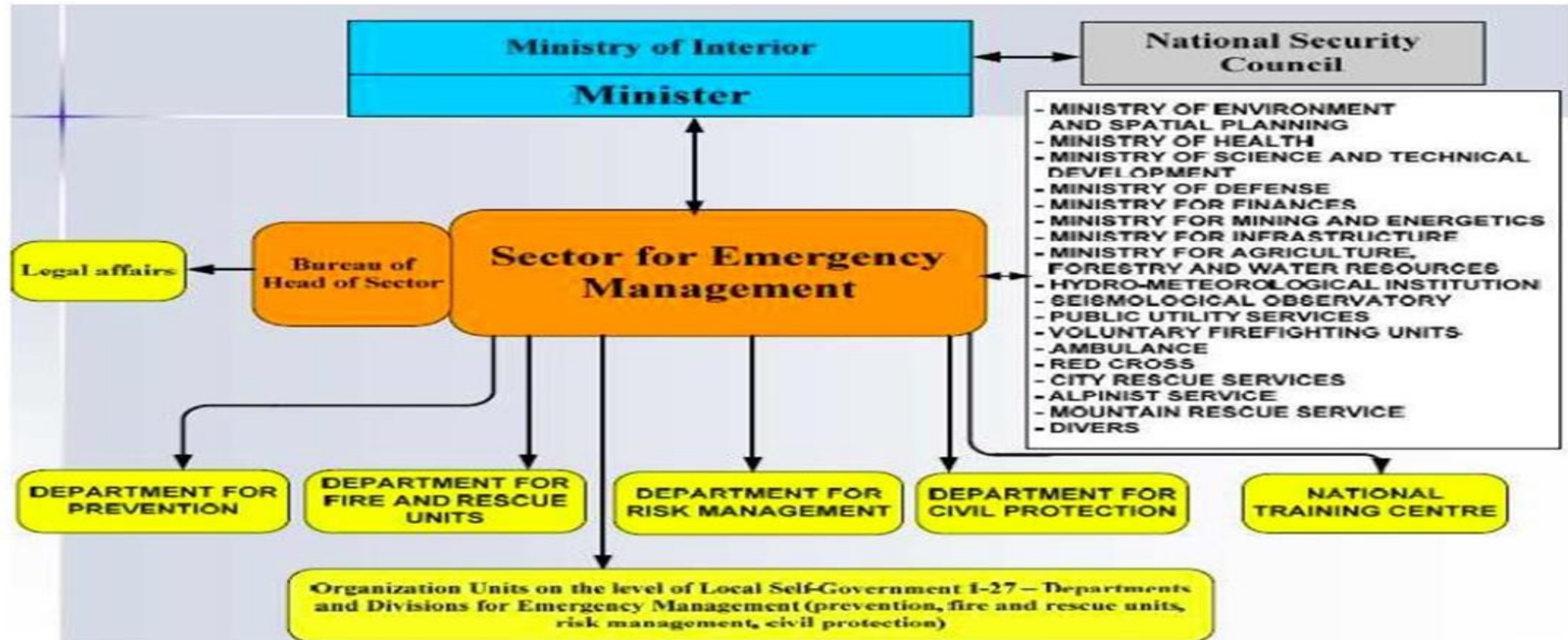


# *Legislation and strategies currently being developed relevant to nature-based DRR in Serbia*

National Forest Programme	NFP) is under development, with the support of the GEF-funded project “Contribution of Sustainable Forest Management to a Low Emission and Resilient Development (IEEP, EU).
Draft Nature Protection Programme of the Republic of Serbia for the 2020 – 2022	Brings together climate change and biodiversity, emphasizing that the “preservation of natural ecosystems and restoration of the degraded ecosystems are important for achieving the goals of the UN Convention on Biological Diversity (CBD) and UNFCCC.
Draft Low Carbon Development Strategy with Action Plan	A comprehensive national strategic and legal framework for climate action (mitigation and adaptation) in compliance with its international obligations and GHG reduction.

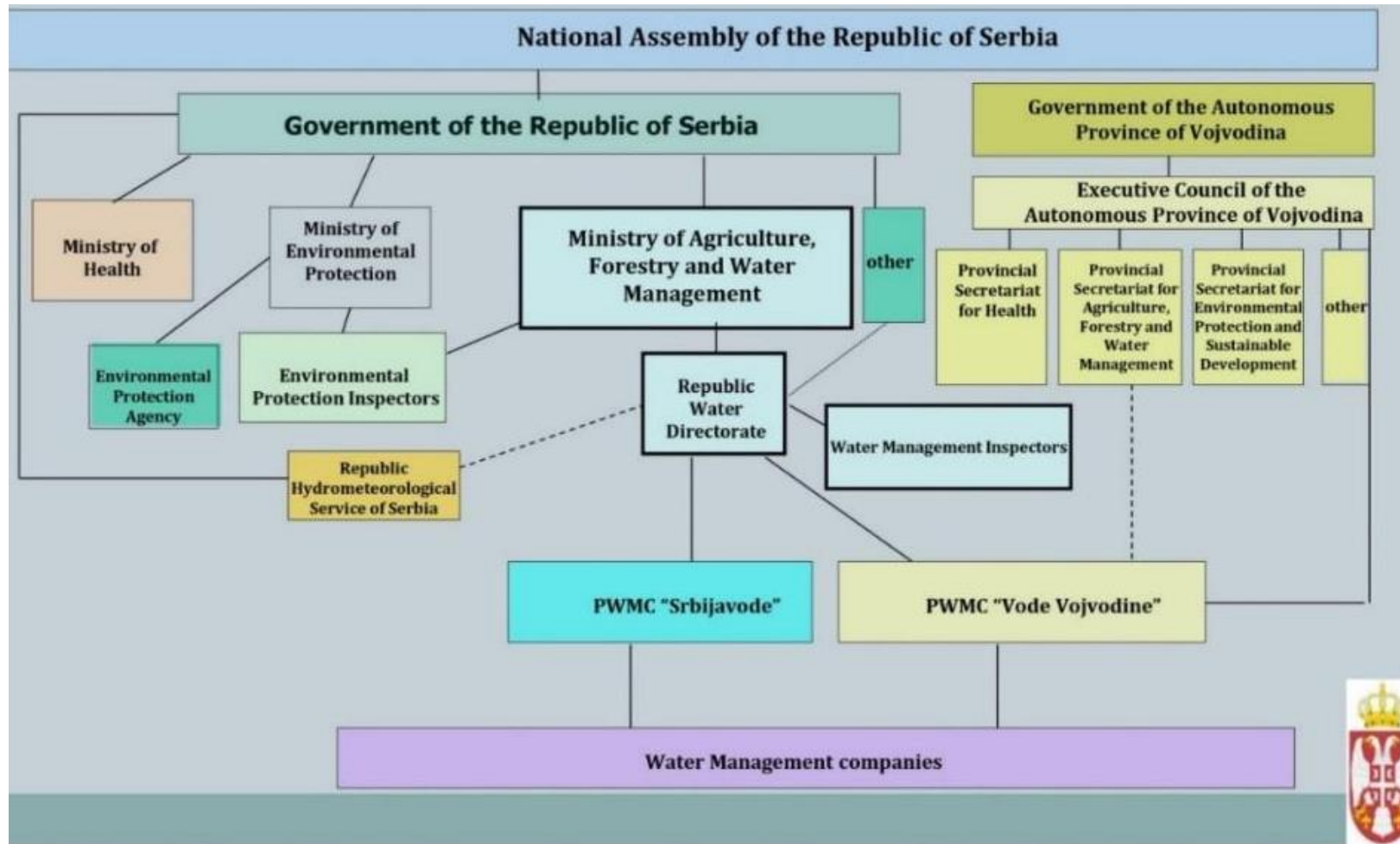
# *Institutional Set up*

## *Ministry of Interior of the Republic of Serbia*



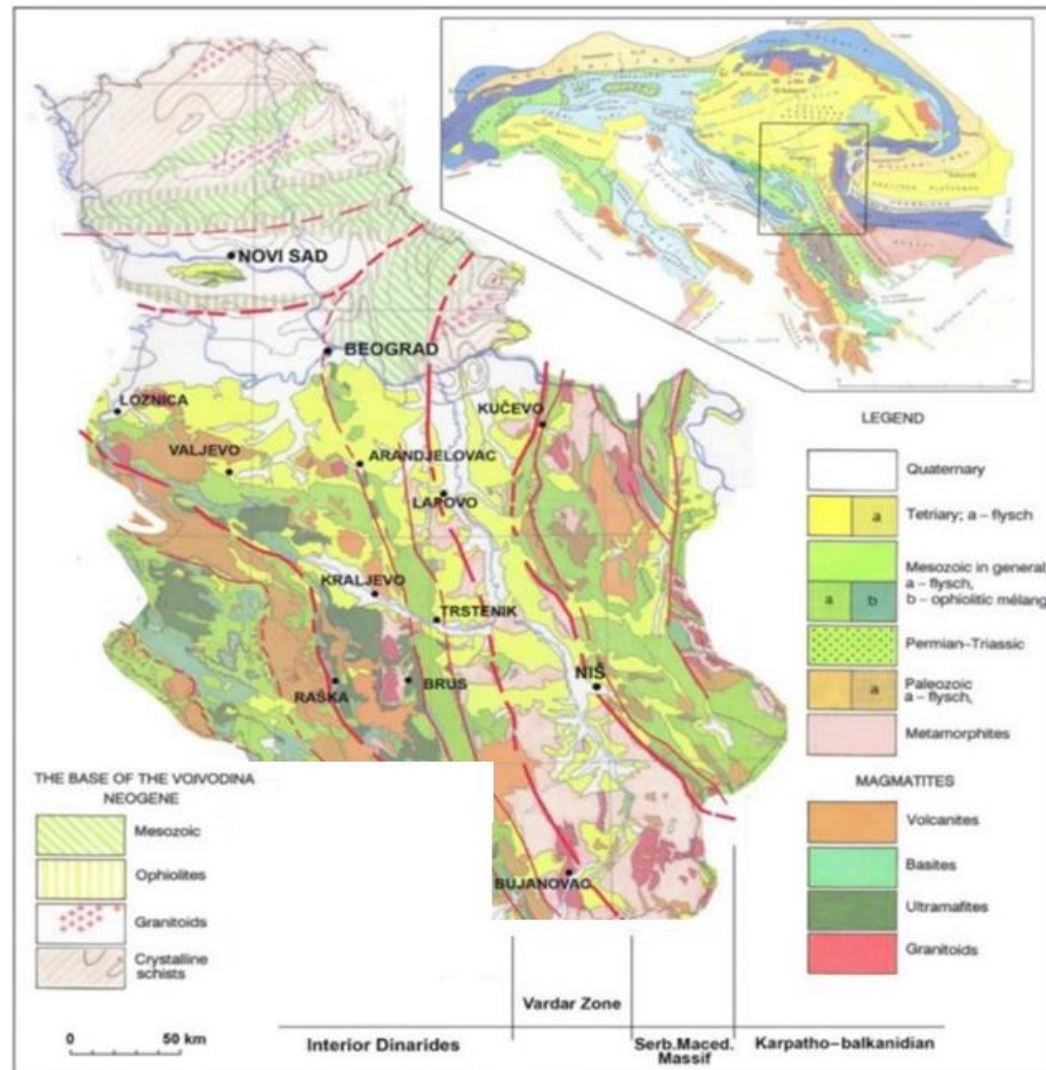
The Ministry of Interior leads the National Emergency Management Headquarters, which is in charge of the protection and rescue management activities as well as the mainstreaming of DRR policy in the country.

# Institutional framework of water management



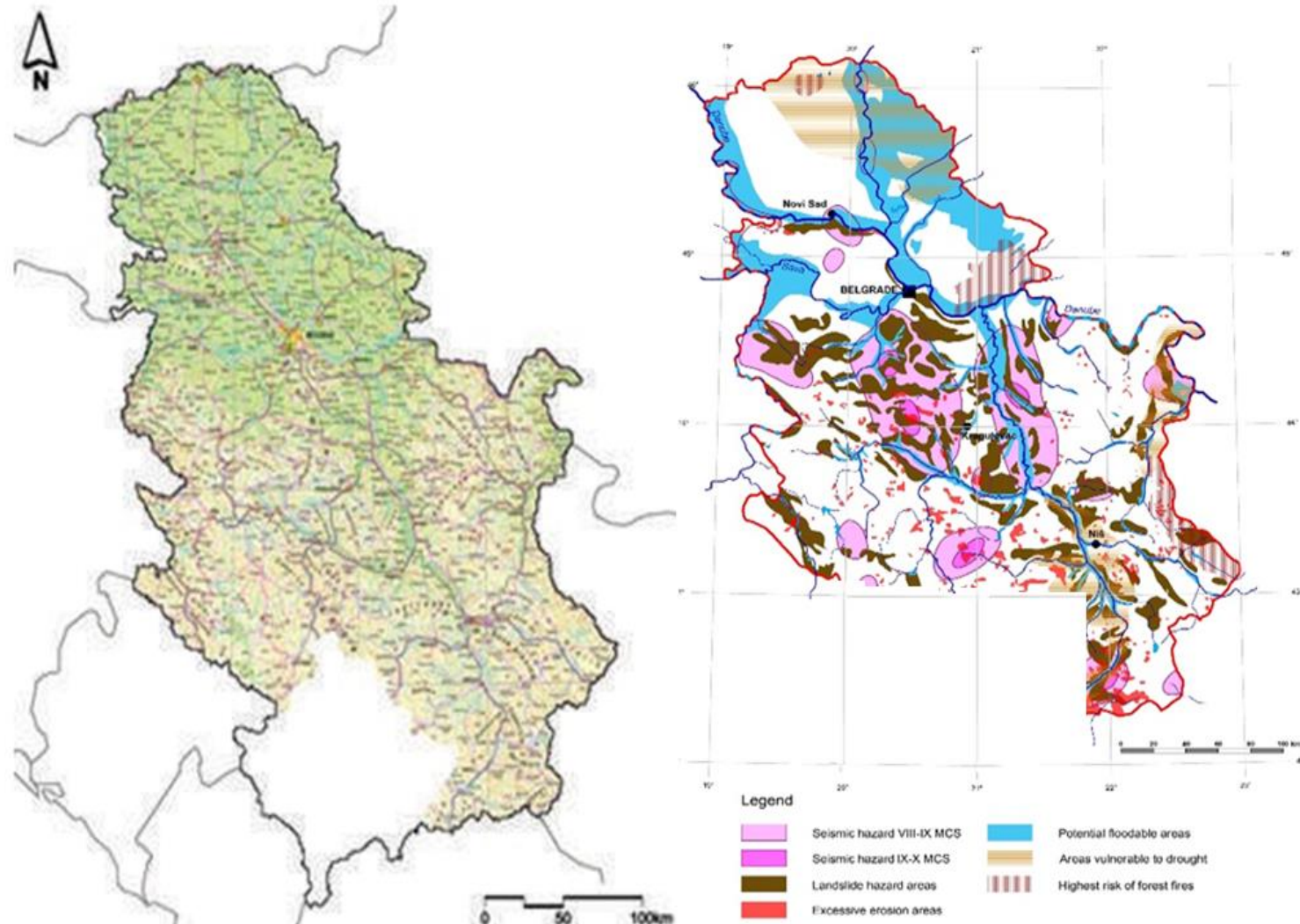
**Republic Water Directorate:** The Republic Water Directorate performs state administration tasks and professional tasks related to: water management policy; multipurpose use of water; water supply, except water distribution; water protection; implementation of water protection measures and planned rationalization of water consumption; regulation of water regimes; monitoring and maintaining the transboundary water regimes; inspection supervision in the field of water management, as well as other tasks determined by law.

# Disaster risks (related to geology and geography) in Serbia

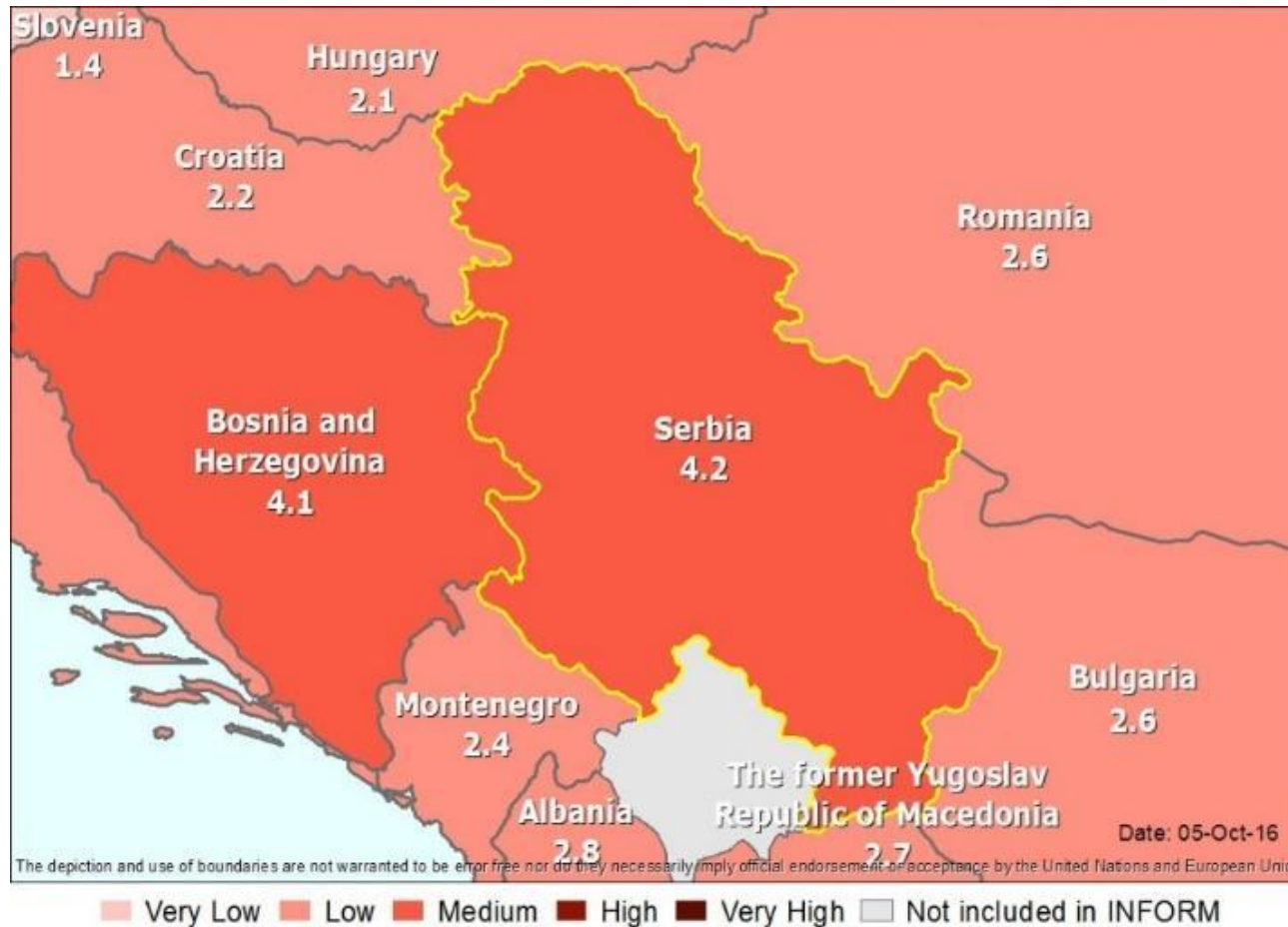




*Physical map of Serbia in the territory of Serbia (Source: GIZ, 2017) and (right) edited integral vulnerability map of the natural hazards (source: Dragicevic, 2011)*



# *INFORM Risk Index in the Western Balkan countries (source: INFORM, 2014)*



# *Soil degradation / erosion*

Category	Erosion Processes Intensity	Area	
		km2	%
I	Excessive Erosion	2,888.0	3.27
II	Intensive Erosion	9,138.0	10.34
III	Medium Erosion	19,386.0	21.94
IV	Weak Erosion	43,914.0	49.78
V	Very weak Erosion	13,035.0	14.75
Total		88,361.0	100

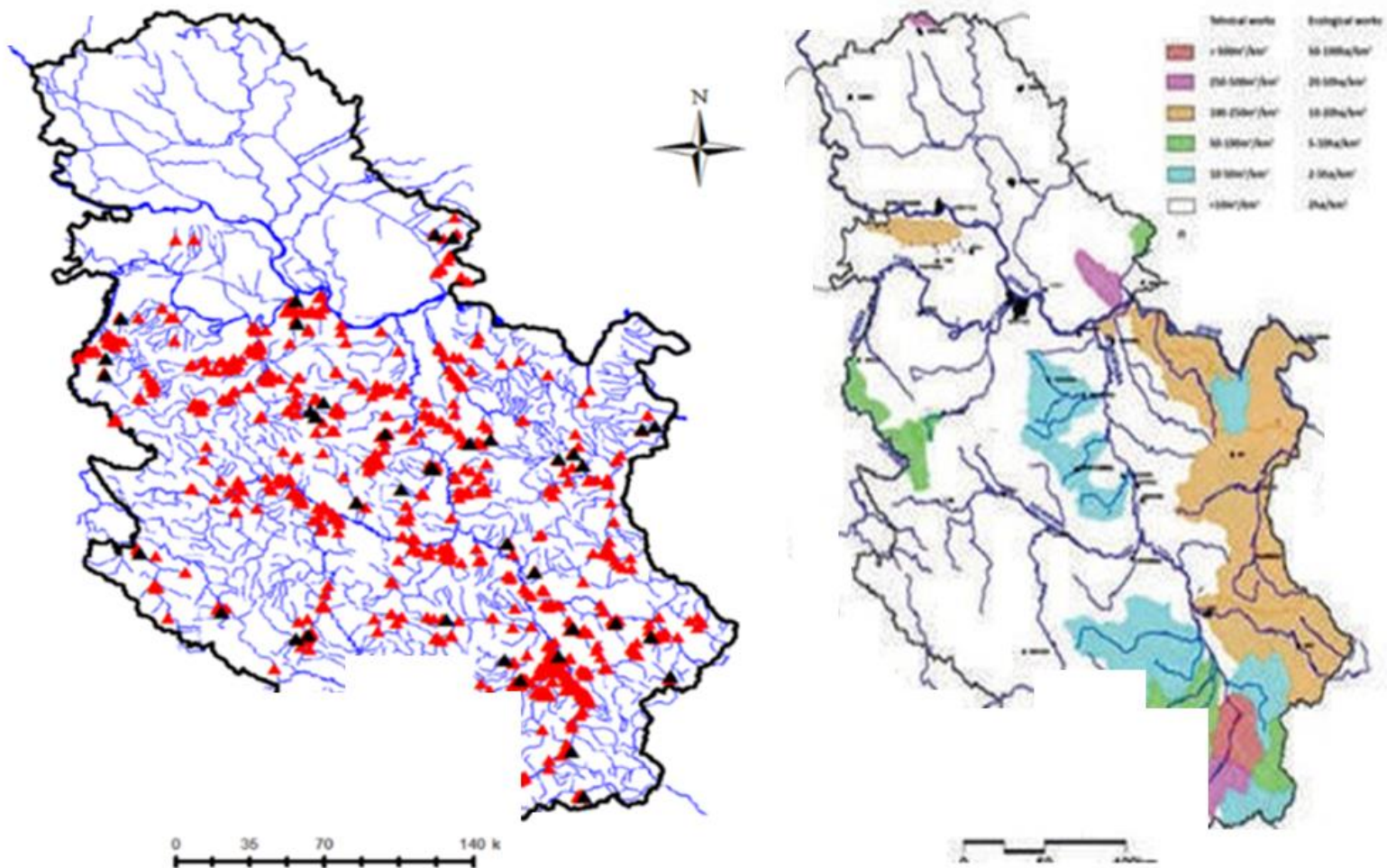
# Torrential floods

Main characteristics of reconstructed some torrential floods

Water course	Profile	Date of appearance	Magnitude [km <sup>2</sup> ]	Q <sub>max</sub> [m <sup>3</sup> ·s <sup>-1</sup> ]	q <sub>maxsp</sub> [m <sup>3</sup> ·s <sup>-1</sup> ·km <sup>-2</sup> ]	Duration/ Intensity
Lestarska Valley	Vladicin Han	25.07.1982	2.64	16.16	6.12	90 min; 1.17 mm·min <sup>-1</sup>
Timjanicka River	Negotin	1995	17.80	220.0	12.36	165 min; 1.06 mm·min <sup>-1</sup>
Kalimanska River	Vladicin Han	Summer 1929	16.04	149.0	9.3	/
Sejanicka River	Grdelica	02.07.1983	12.51	62.75	5.02	90 min; 1.01mm·min <sup>-1</sup>
Manastirica	Brezdje	13.06.1996	29.5	154.9	5.25	180 min; 0.75mm·min <sup>-1</sup> <sub>1</sub>
Ribnica	Pastric	13.06.1996	104	418.08	4.02	180 min; 0.75mm·min <sup>-1</sup> <sub>1</sub>



# Locations of the most destructive torrential flood events in Serbia in the period 1915-2013 (left) and (right) Technical and ecological works

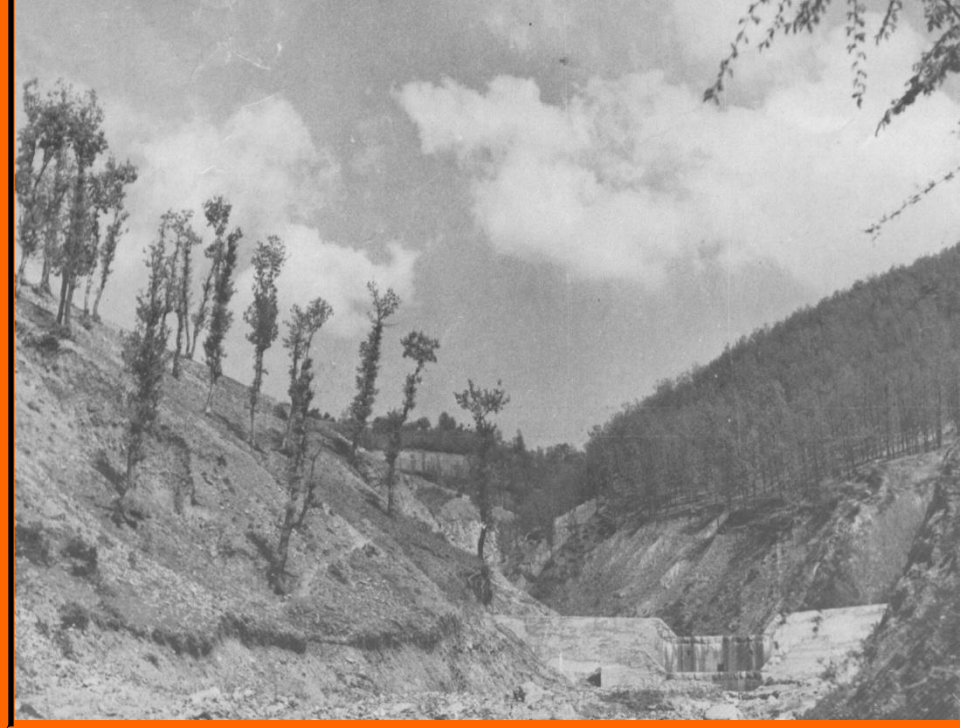


# **FLASH FLOODS ARE NATURAL AND ANTHROPOGENIC HAZARD**

Anthropogenic aspects of flash floods in Serbia are reduced to human activities in rural and urban areas.

This activity can be negative and positive.

(1) Negative activity in respect of the use of land resources is reduced to a disproportion arising between the agricultural population and land surface and the way the agricultural economy.







Stara Planina – summer, 2006.





Stara Planina – May, 2007.





Stara Planina – July, 2007.





Sara Planina, August, 2007.





Stara Planina, September 2007.



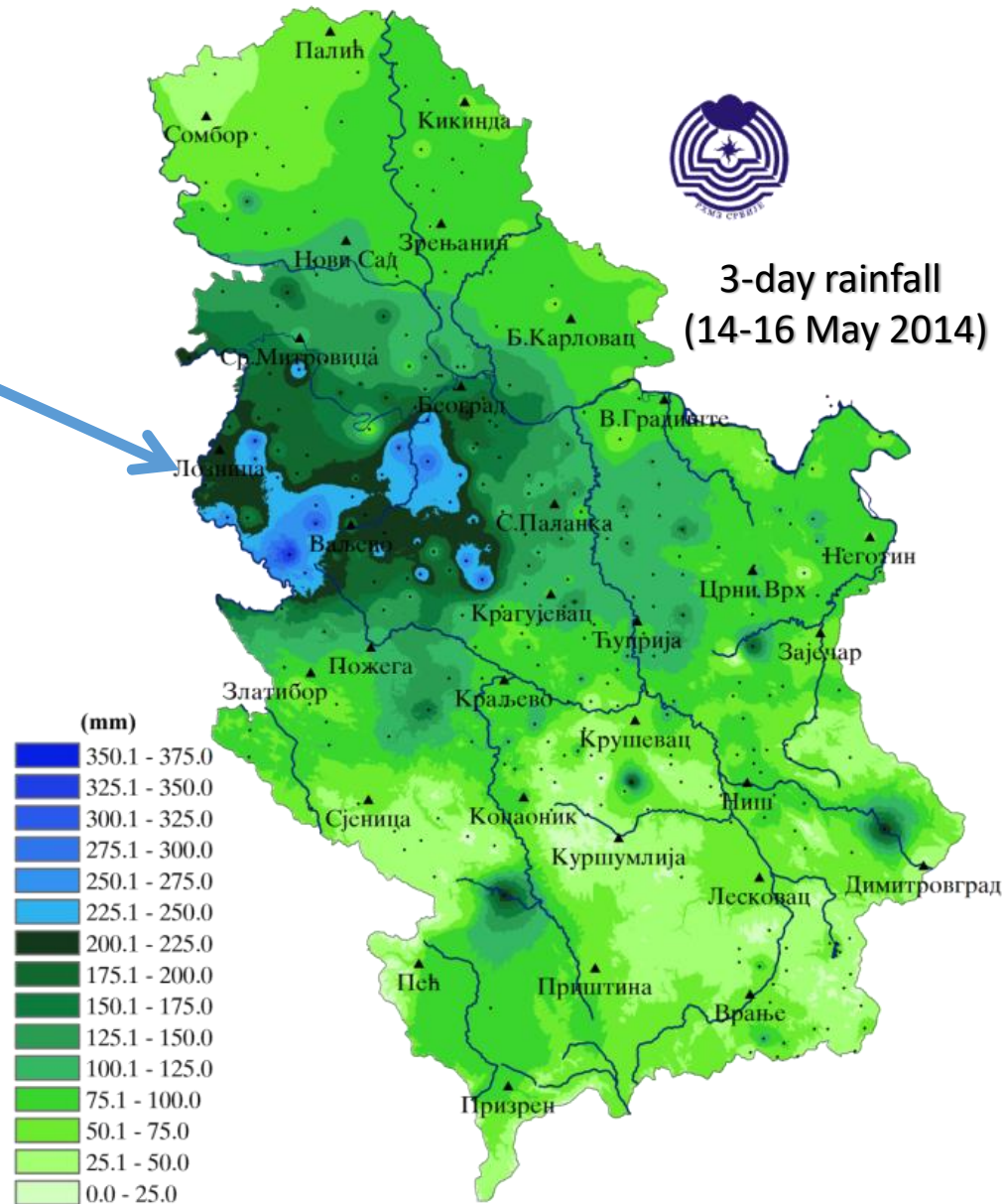
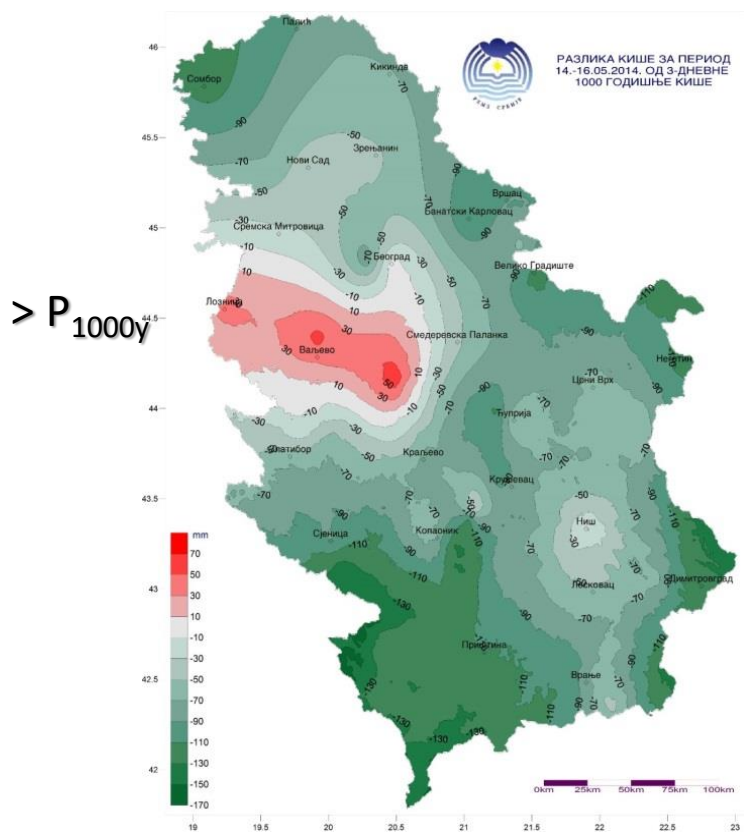
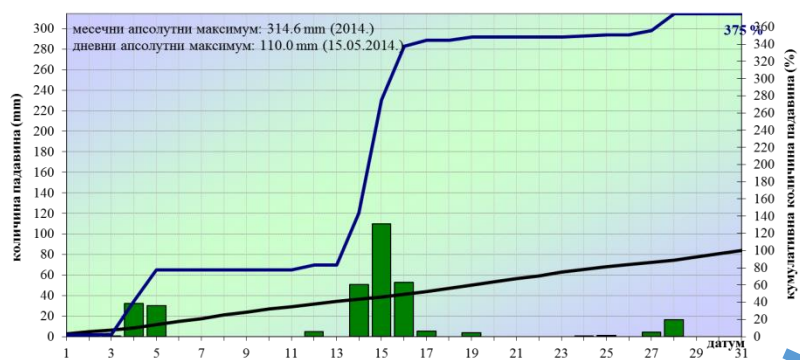


**GREAT FLOODS IN SERBIA IN MAY 2014**





# Extreme meteorological event



# Upstream part of Kolubara RB (Valjevo city)



Total damage: 9 million €





# Middle part of Kolubara RB (open-pit coal mines flooded)



187 mill m<sup>3</sup> of water +  
3 mill m<sup>3</sup> of mud  
Damage: 200 mil €





## Lower part of Kolubara RB (Obrenovac city)



- 80% territory of Obrenovac city was flooded
- Water depth in some parts was 5m
- Evacuated: 25,000
- Partially or totally devastated houses: more than 1,000
- Damage to transport and communications: 17,000,000 €
- Endangered TPP Nikola Tesla (the largest in Serbia, installed power 1.650 MW)





KRUPANJ: Čadjavica river  
- May, 2014 -



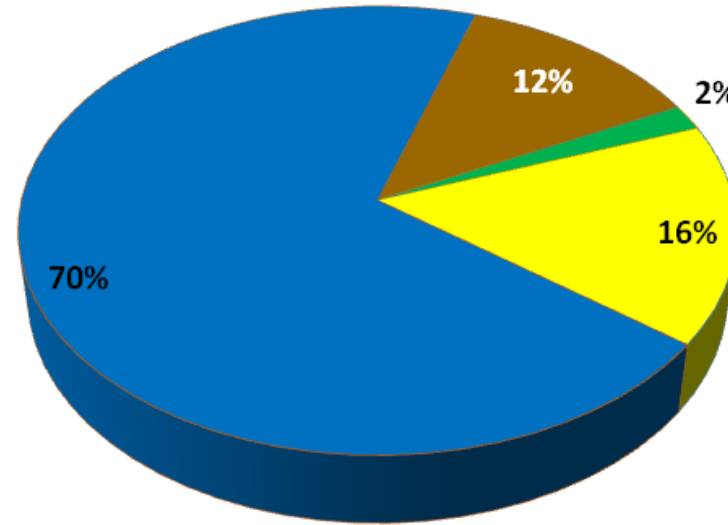


KRUPANJ: Čadjavica river  
- May, 2014 -





# Serbia: Sectors affected



24 municipalities

■ Social ■ Productive ■ Infrastructure ■ Cross-Cutting

Productive: 1,064 mill € (Energy and Mining 488, Agriculture 228, Trading 225, Manufacturing 121 and Tourism 2)

Infrastructure: 192 mill € (Transport 167, Water supply and Sanitation 16, Communication 10)

Social: 242 mill € (Housing 231, Education 3, Health 6, Culture 2)

Cross-Cutting: 28 mill € (Environment 21, Governance 7)



Unsustainable  
development



**Uncontrolled forest cuts**









Nonadequate tillage





House on Sopotska river (Сопот, 2004.)





Restaurant on river Štira in Loznica, May 2014.

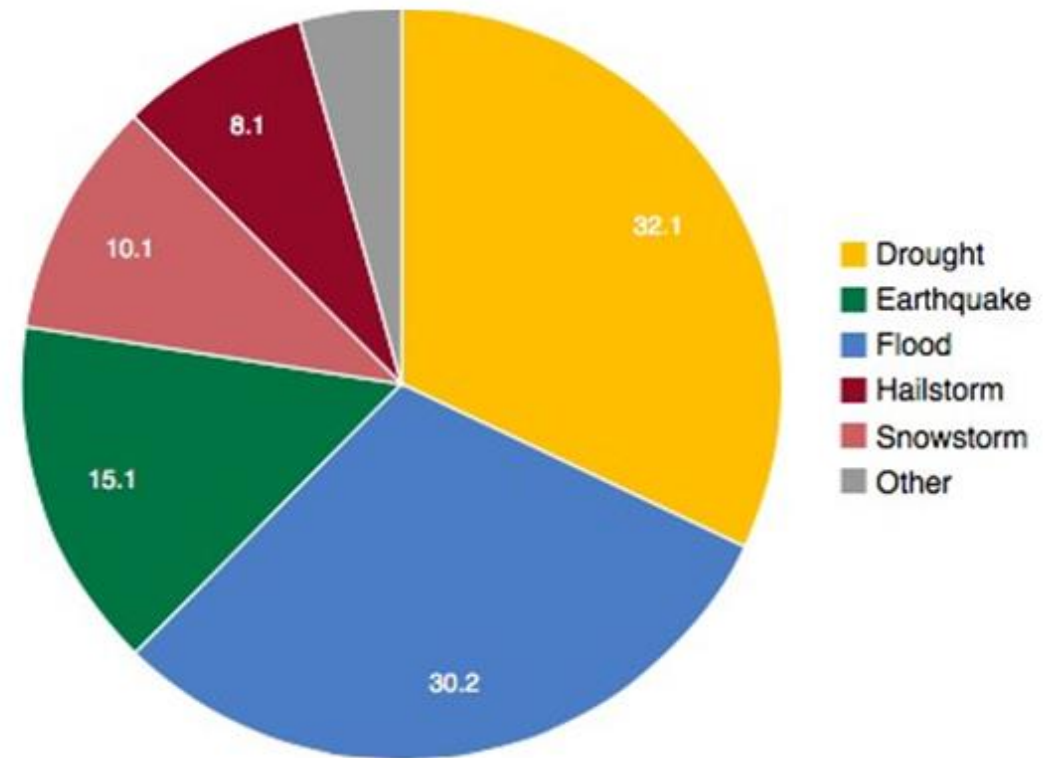
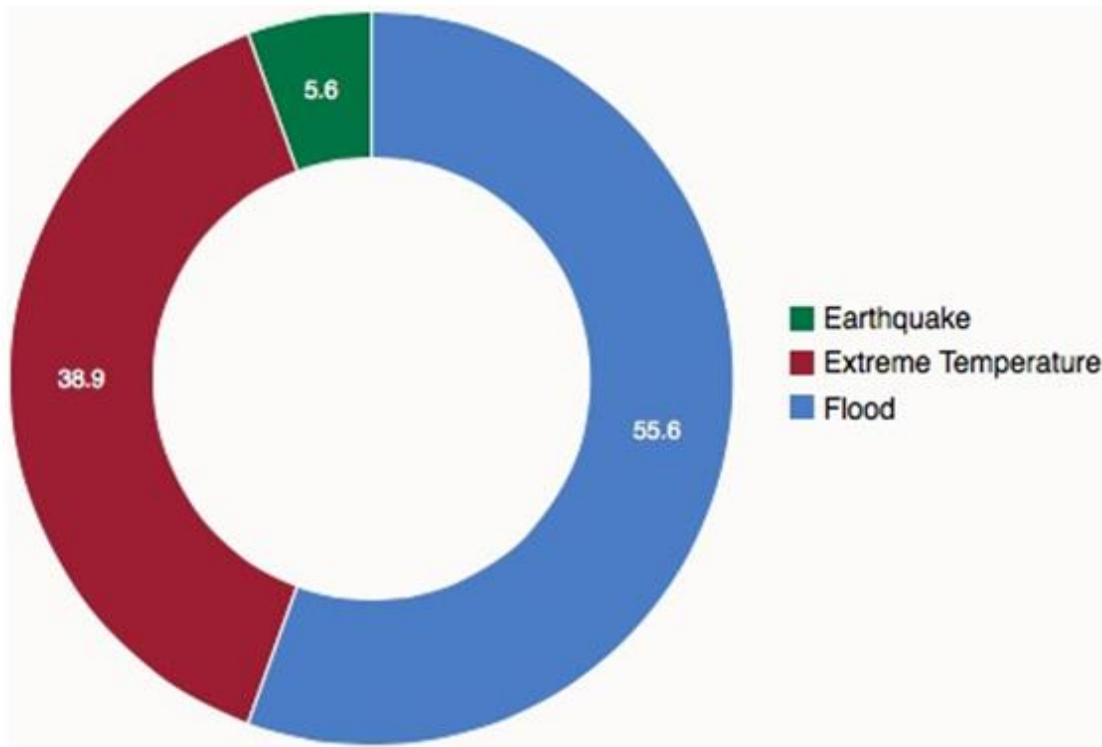




**Топчидерска река у Рипњу**



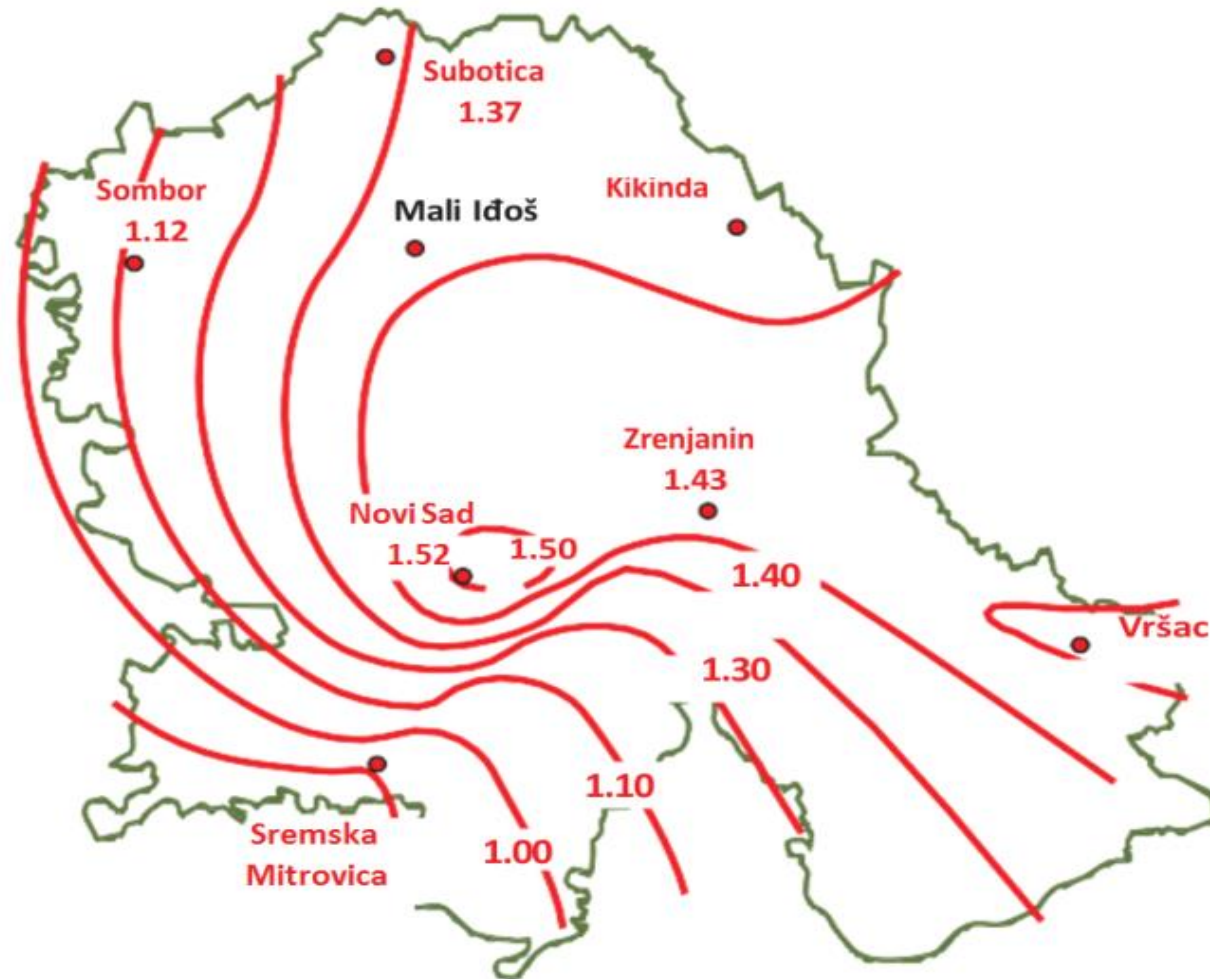
*Frequency by type of hazards in Serbia, 1990-2014 (left) and (right) combined economic losses by type of hazards*





# Wind erosion

Wind erosion intensity in the territory of Vojvodina, based on Pasak method (t/ha)



# Overview of nature-based DRR projects implemented in Serbia

Project Title	Implementation period	Description
“Introduction of Innovative Management Planning in Forestry“	On-going	<p>Founded by the Government of Germany.</p> <p>Provision of ecosystem services for developing a new system of planning and monitoring of forests.</p> <p>Preparation forestry to climate change.</p>
the “Preparation of the Water Management Information System for the Republic of Serbia“ (WMIS)	2007 – 2009	<p>Funded by the EU.</p> <p>Establish and modernise water sector collecting information and data management</p> <p>Flood action plans; support to water inspection activities</p>
“Increased Resilience to Respond to Emergency Situations“	2015 – 2017	<p>Founded by Government of Japan</p> <p>Recovery, reduce vulnerability and increase resilience in 27 flood affected municipalities.</p> <p>Reparation and improvement of small-scale infrastructure elements, wastewater treatment and improving public utility damaged infrastructures.</p>
“Establishing the Conditions, the Level of Soil Pollution and Chemical Degradation of Soil in the Industrial Zone of Pancevo and Sabac and at the Fire Site on the Mount Tara“	2016 – on-going	Funded by the Ministry of Agriculture, Forestry and Water Management of the Republic of Serbia.
Blue-green corridors case (Belgrade, Serbia): mitigating natural hazards and restoration of urbanised areas	On-going (for at least 10 years)	Funded by the Ministry of Environment of the Republic of Serbia
„Strengthening capacities for implementation of international environmental agreements“	On- going	Funded by the Global Environmental Facility (GEF), and implemented by UNDP in cooperation with the institutions of the Republic of Serbia.

# Natural hazards that are not being managed using nature-based solutions but could be in Serbia

No.	Location	Scope of site intervention	Risk description	Expected consequences	Type of intervention
1	Upper watershed Vranjsko – Banjska river, above the dam and water reservoir “Prvonek”.	Protecting water reservoir by prevention of erosion and torrential floods.	Very steep slopes, low vegetation cover, frequent high intensity rainfalls.	Filling water reservoir with sediment	Various structural and non-structural measures, silvicultural measures on slopes, hydraulic structures in torrent bed (check dams).
2	Upper watershed Toplica river, above the dam and water reservoir “Selova”.	Reducing soil erosion and sediment transport, prevention of torrent floods.	High intensity rainfall, intensive erosion, torrential floods, rocky debris swept into water reservoir.	Filling water reservoir with sediment	Afforestation on steep slopes, agricultural good practices, bioengineering measures for rill and gully erosion, hydraulic structures (check dams).
3	Upper part of river Likodra watershed, above city Krupanj in West Serbia.	The four torrents that join in the centre of Krupanj, to form the Likodra river, are a permanent risk of torrential floods.	Very steep slopes of the watersheds of the torrents, high intensity of rainfall, very often provoke torrential floods of the city.	Great damages caused torrential floods, and sometimes casualties	Biological and biotechnical works (afforestation, grassing, establishment of orchards with terraces, check dams, landslide stabilization.
4	Watershed of Ljubovidja river above the city Ljubovija in West Serbia.	Before the mouth of Drina river Ljubovidja passed through City Ljubovija , and very often provoked catastrophic floods.	Watershed of Ljubovidja river is typical torrential watershed, with steep slopes, with insufficient per cent of forest cover, high intensity of rainfall. These are very conducive conditions for frequent torrential floods.	Great damages due to torrential floods and sometimes casualties.	Biological and biotechnical works (afforestation, grassing, establishment of orchards with terraces, check dams, landslide stabilization. Building of small water reservoir in the watershed.  Correction of lower part of Ljubovidja river through the city Ljubovija.
5	Arable land in Vojvodina, especially Banat region.	Protect arable land from wind	Main part of Vojvodina, especially Banat region, are endangered by wind erosion.	Soil loss, reducing soil moisture, reducing agricultural production.	Establish windbreakes



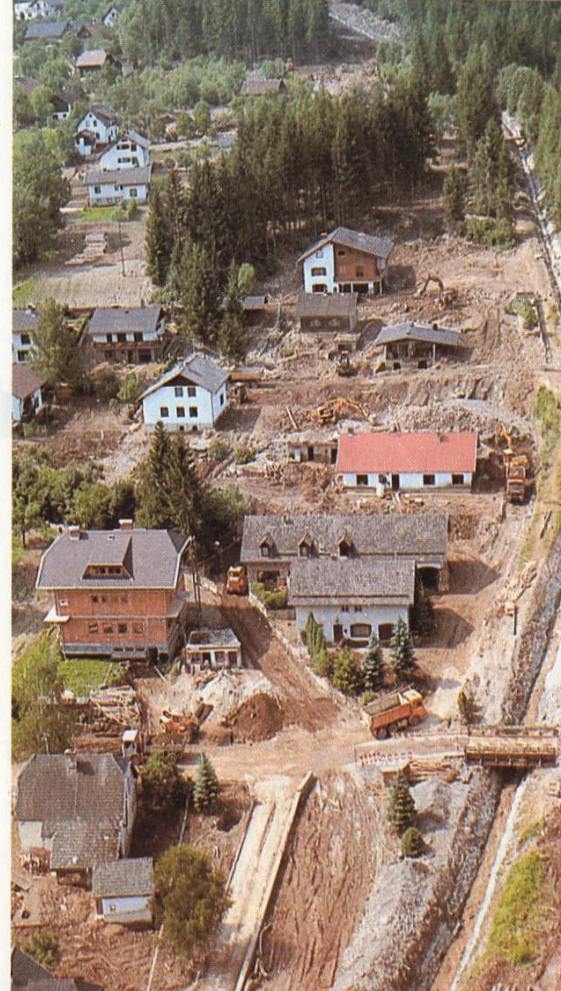
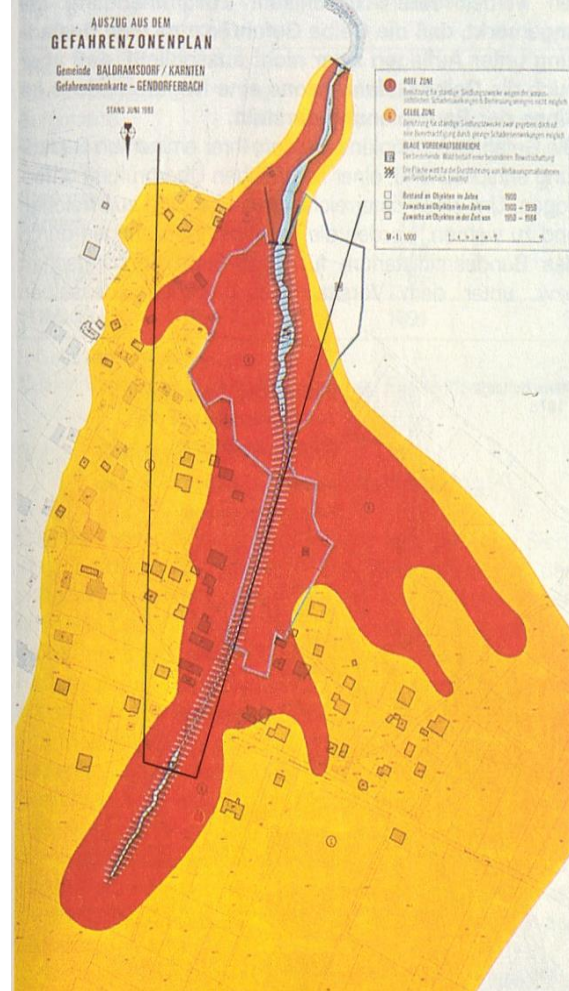




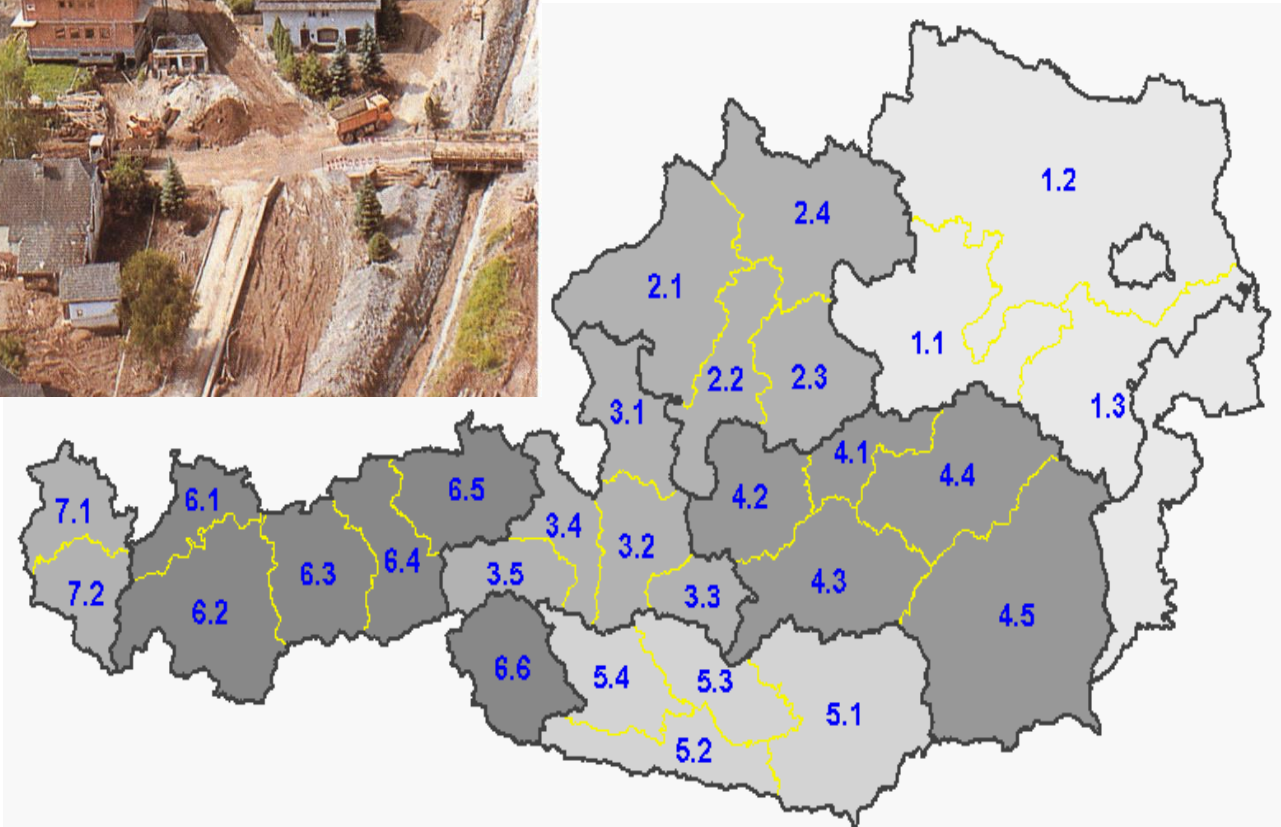
## South Serbia experience in torrent control – Grdelicka Gorge





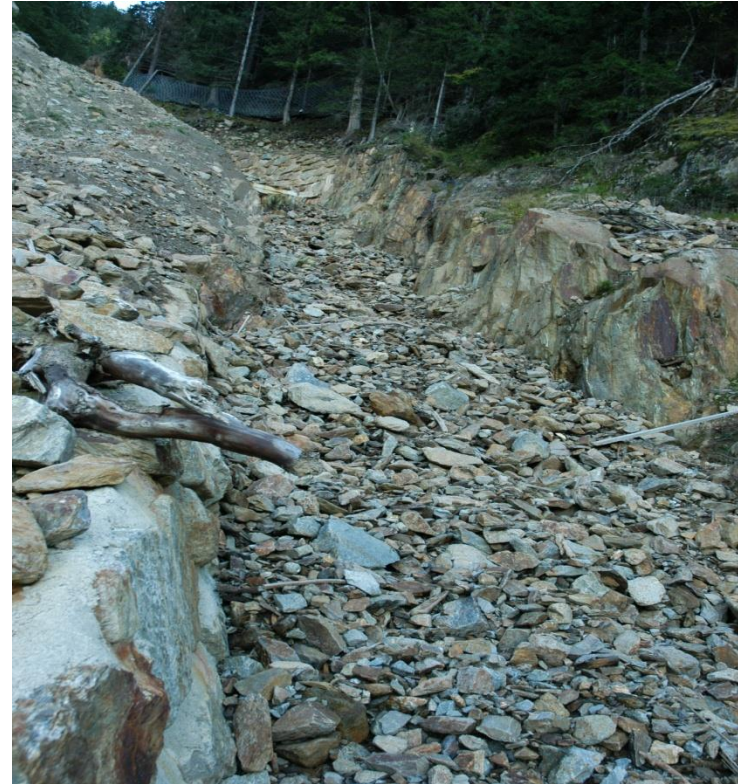
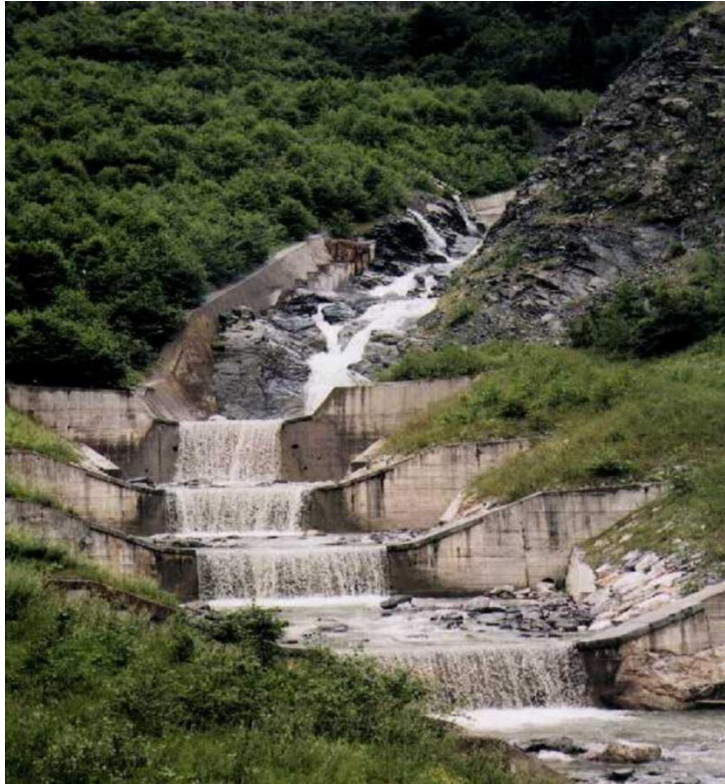


# Austria risk zones





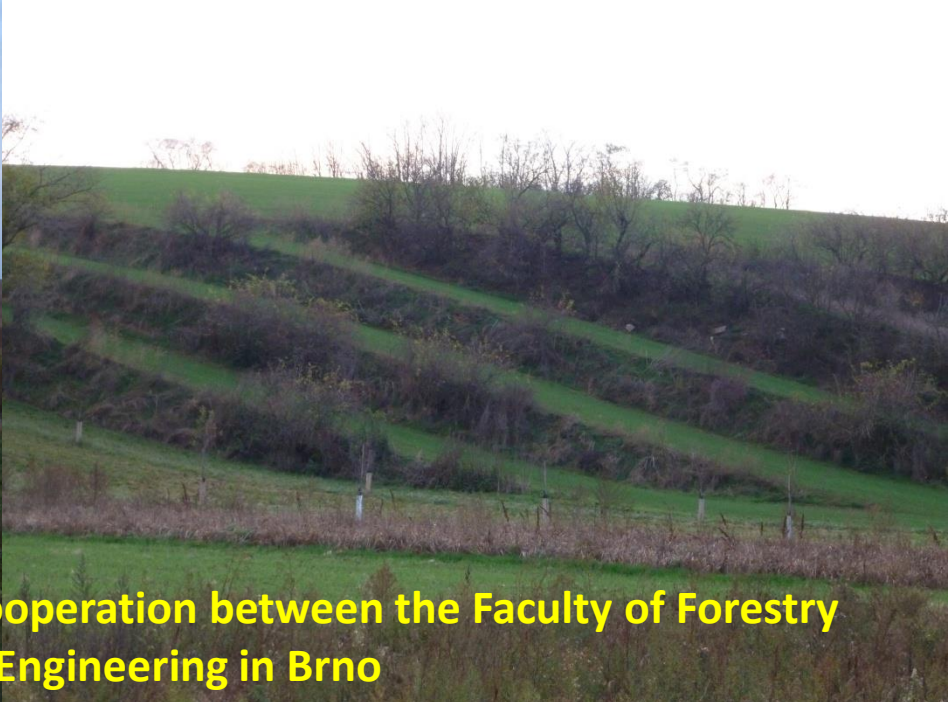
- Stabilization trough (a longitudinal structures)











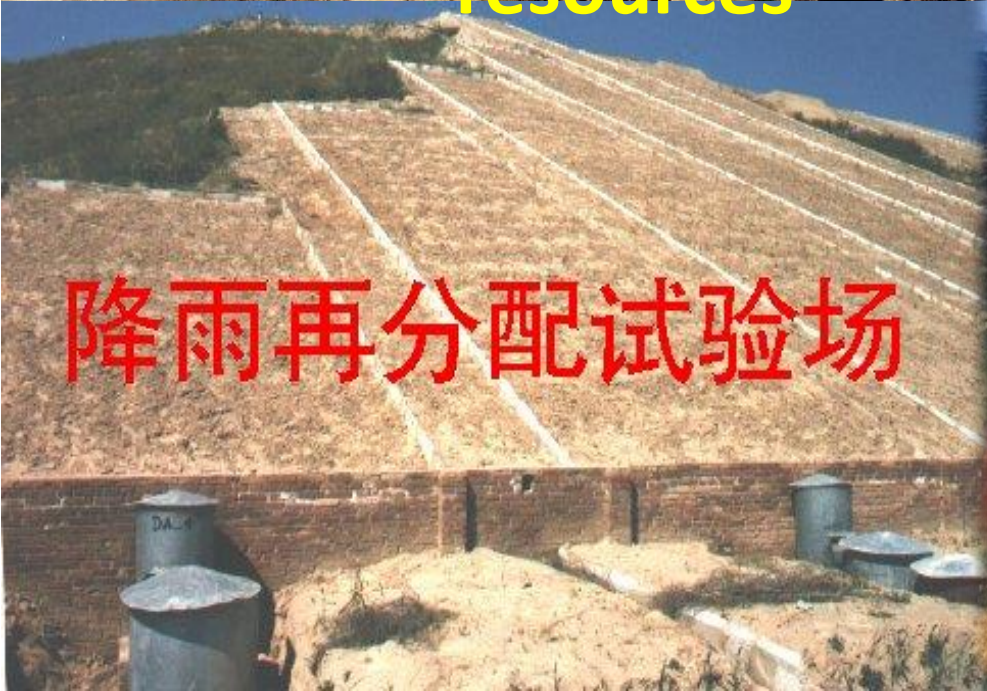
**Czech access to the protected landscape - Cooperation between the Faculty of Forestry in Belgrade and Civil Engineering in Brno**







**Chinese access to conservation land resources**



**降雨再分配试验场**



**Bilateral cooperation with China**



## *Gaps*

- Lack of horizontal communication between relevant ministries and sectors that are involved in spatial planning strategies.
- Lack of funding for nature-based DRR activities.
- Lack of capacities (drastic reduction of enterprises in the field of erosion and torrent control in comparison with earlier period).
- Low public awareness among farmers at lower altitudes who mainly do the tillage down the slope, which drives erosion processes.



# ***Recommendations***

- Strengthen horizontal communication between relevant ministries and sectors that are involved in spatial planning strategies.
- Establish effective forest protection, mobilise private forestry and develop an information system for forestry, as a key pillar of a sustainable forest management system.
- Establish interactive GIS database of all sectors data, with specific emphasise on torrential catchments.
- Harmonize domestic and international methodologies for assessing all types of degradation with specific points of vulnerability to water erosion, wind erosion and flash floods.
- Establish a comprehensive torrential flood inventory covering a long period in the past, using information from multiple sources.
- Create an interactive torrents cadastre and cadastre of performed erosion and torrent control works.
- Create an interactive landslides cadastre.
- Revise method for creating an interactive map of soils, forests, and soil erosion.
- Advance general cross-sectorial cooperation among forestry, water, and soil sectors.
- Promote awareness raising in natural resources protection.
- Public participation in SLM

NGO CASE STUDY: “PUBLIC PARTICIPATION IN DECISION-MAKING OF SUSTAINABLE LAND RESOURCES MANAGEMENT IN GRDELICKA KLISURA GORGE”

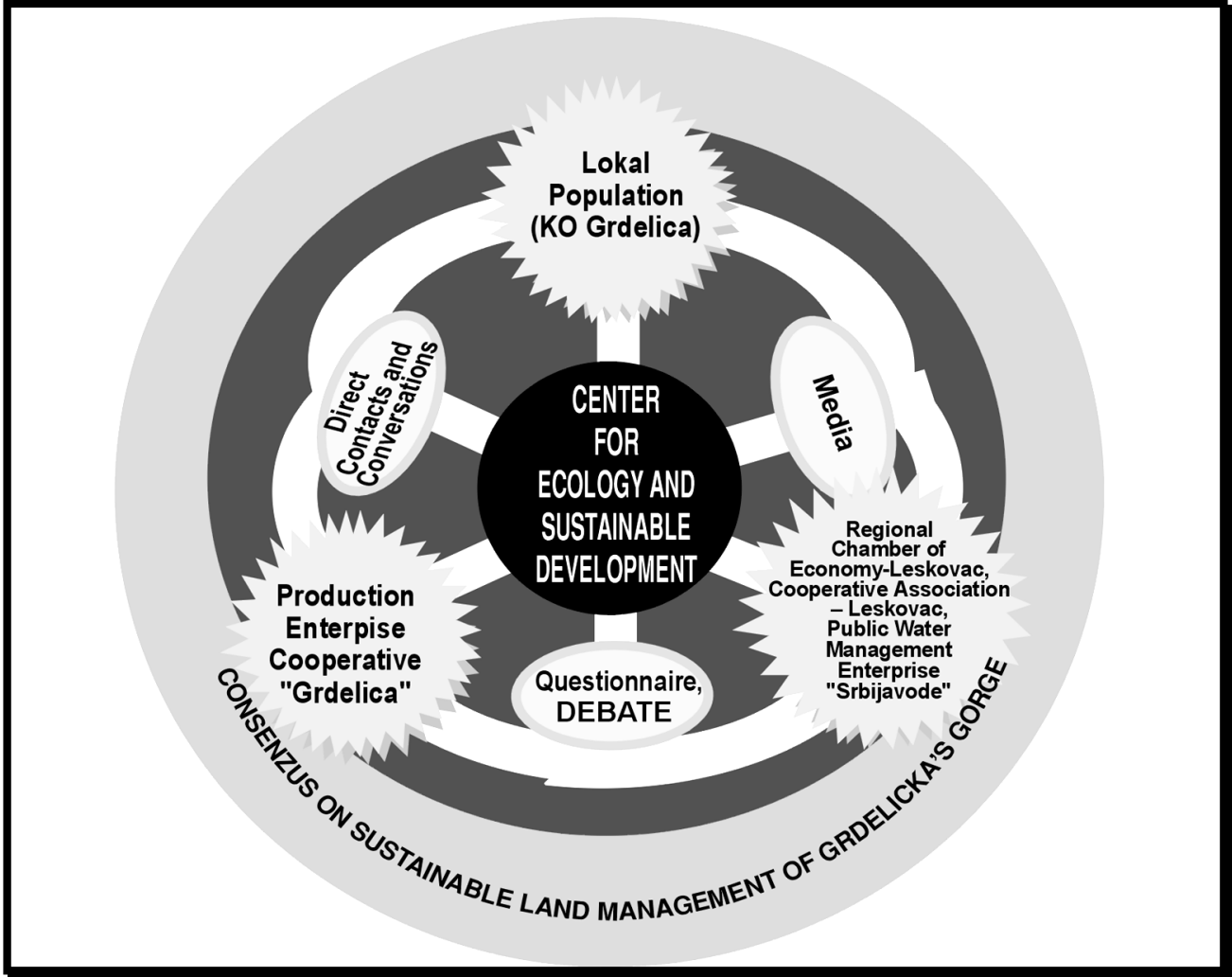
Public participation in decision making of sustainable land resources management.



Hilly mountainous area on private and restituted land.



# Process of public participation



## Choice of target groups and locality on the private and restituted land





# CONTACTS

In direct contacts with the farmers in Grdelica it was taken into account their significant experience in sustainable production on steep slopes, as well as their positive opinion about project establishing



# вечерње НОВОСТИ

МЕШТАНИ НАСЕЉА У ГРДЕЛИЧКОЈ КЛИСУРИ  
ОДЛУЧУЈУ О ЖИВОТНОЈ СРЕДИНИ

## ВИНОГРАДИ ПРОТИВ ЕРОЗИЈЕ

ЛЕСКОВАЦ - Професори Шумарског факултета из Београда представили су наредних дана свој пројекат заштите земљишта од ерозије "Грделичка клисура - 2000". Ова иницијатива је део програма учешћа јавности у одлучивању о животnoj средини Регионалног еколошког центра. Обухвата трибине и анкету кроз коју ће жители овог краја изразити своје мишљење о сањирању проблема ерозије која наноси велике штете земљишту и саобраћајним токовима Грделичке клисури.

На основу истраживања, стручњаци су утврдили да би воћарска и виноградарска производња на нагнутим теренима сачувала и

обогатила земљишне површине, које се, иначе, не обрађују. Запослила би се радна снага, нарочито из бедјаице настањене у овим крајевима, а развила би се и прехрамбена индустрија.

За спровођење пројекта већ су заинтересовани земљорадничка задруга "Грделица" и Регионална привредна комора Лесковац, а свој пристанак дао је и део локалног становништва. Замислило је да власници земље устуне површине за обраду, редовно је окопавају, а производе продају задузи, док би она припремала терене, изградила терасе, набавила садни материјал и - гарантовала откуп.

# ПОЛИТИКА

## ЗАШТИТА ГРДЕЛИЧКЕ КЛИСУРЕ Зауставити ерозију али и миграцију становништва

Професори Шумарског и Пољопривредног факултета у Београду иницијатори заштите Грделичке клисури. - Предвиђају учешће јавности и еколозија, виру таквог програма је и пољопривредна иницијатива за заштиту Грделичке клисури, а пројекат је у складу са програмом од ерозије на Шумарском факултету.

Лесковац, 19. јануара. - Пројекат заштите Грделичке клисури је годинама изложеног и, није нова. У последњем изданју, у више наврата, предузете су спорадичне мере заштите. Стручњаци ФАО и других организација долазили су да истраже и оценивали квалитет земљишта. Пројекат заштите Грделичке клисури је годинама изложеног и, није нова. У последњем изданју, у више наврата, предузете су спорадичне мере заштите. Стручњаци ФАО и других организација долазили су да истраже и оценивали квалитет земљишта.

## УЧЕШЋЕ У МЕДИЈИМА

TV LESKOVAC  
16. 02. 2001.

Dnevnik u 19 časova:  
Širi prikaz tribine o učešću  
javnosti u odlučivanju  
o održivom upravljanju  
zemljišnim resursima  
na području  
Grdeličke klisure.

# Participation in medias:

- Newspaper: Evening News
- Newspaper: Politics
- Local TV Leskovac



## Questionnaire regarding acceptance of the programme

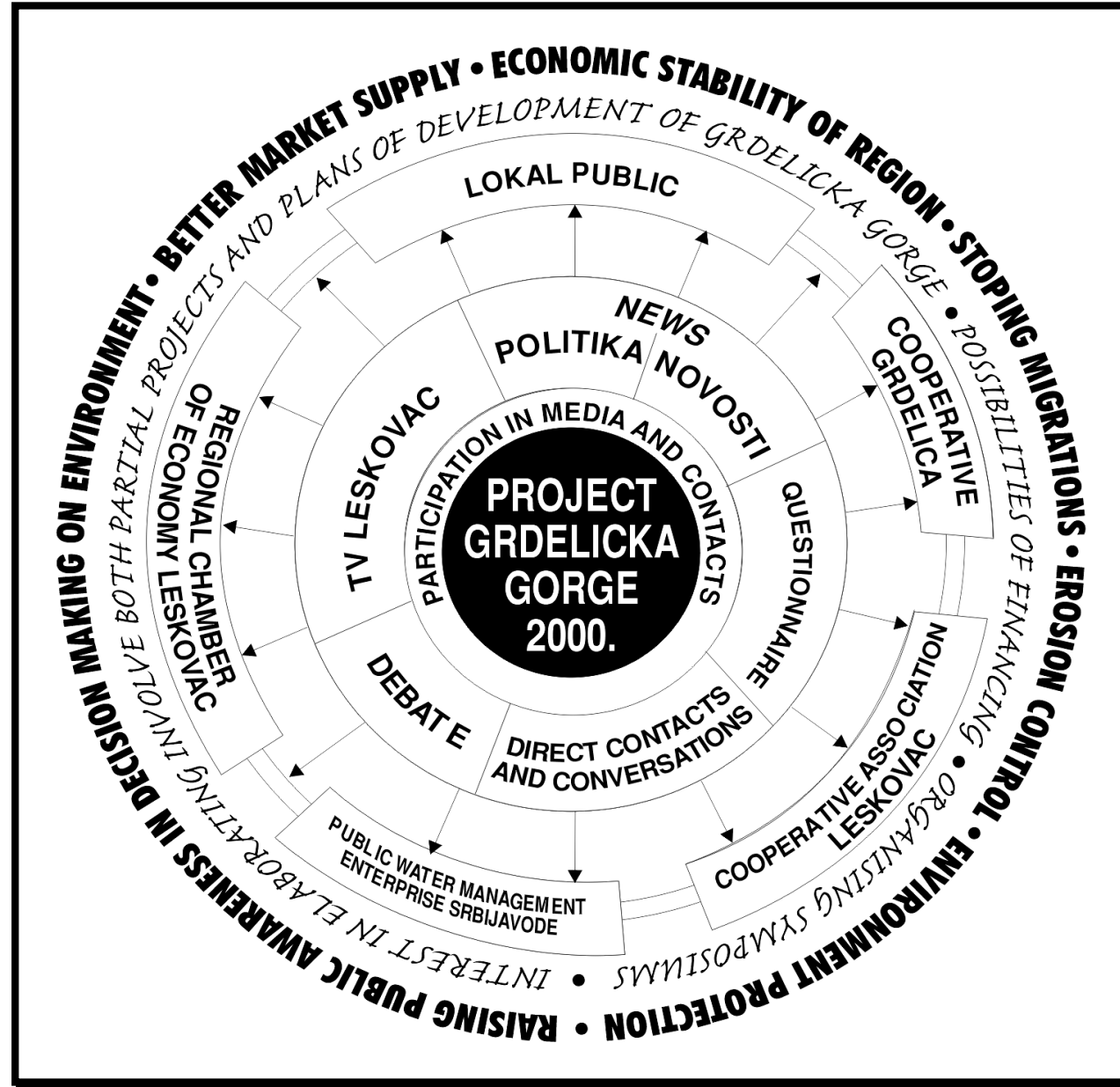


## Project acceptance by local stakeholders/farmers





# Influence of public participation in Grdelicka Gorge





**Thank you for your attention**

