European
River Restoration
Conference
Featuring the IRF Riverprize

Connecting River Restoration Thinking to Innovative River Management
6th Edition | 27–29 October 2014 | Vienna
Integrated with the final event of the SEE River project

ECRR
SEE River

2014 Balkan floods – learning from disaster

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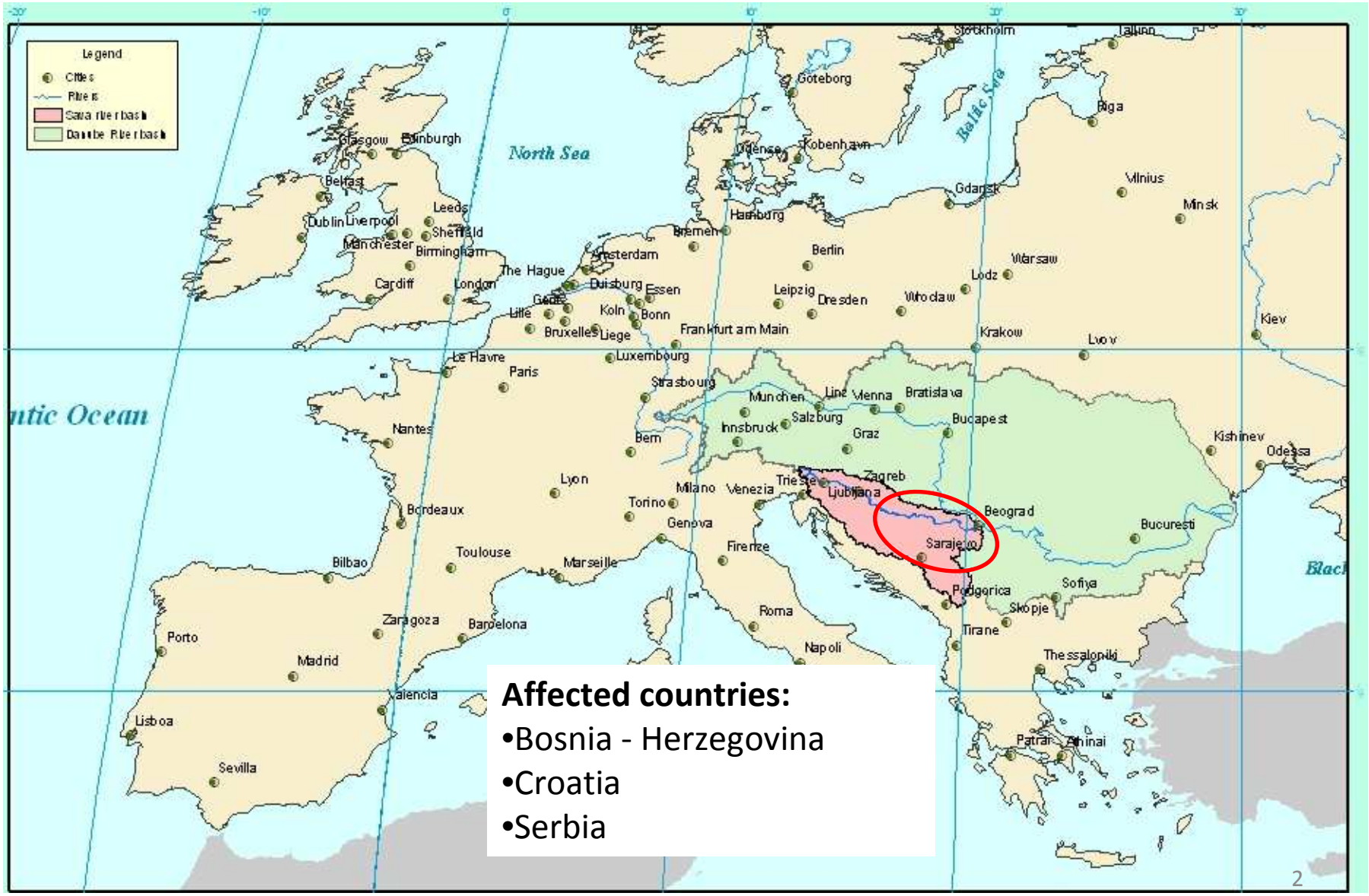
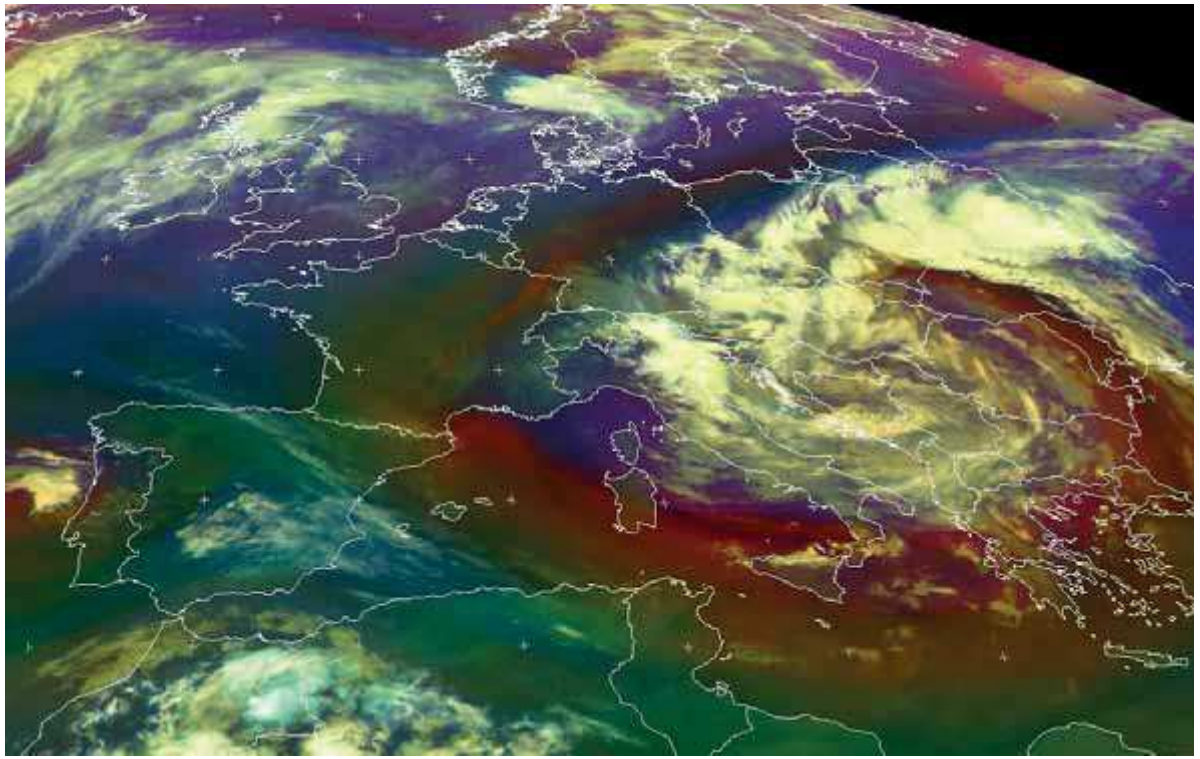
Possition of the affected area on the Balcans



Specific cyclon 13-18 May 2014

- On 13 May, a low-pressure area formed over the Adriatic Sea, as polar air from Central Europe penetrated into the Mediterranean basin. The cold polar air mass met with humid subtropical air, leading to very low pressure.
- On 14 May, the low-pressure area drifted across the Balkans, and than become stationary for next few days
- **Result:** extremely heavy and continuous rain over whole river basins

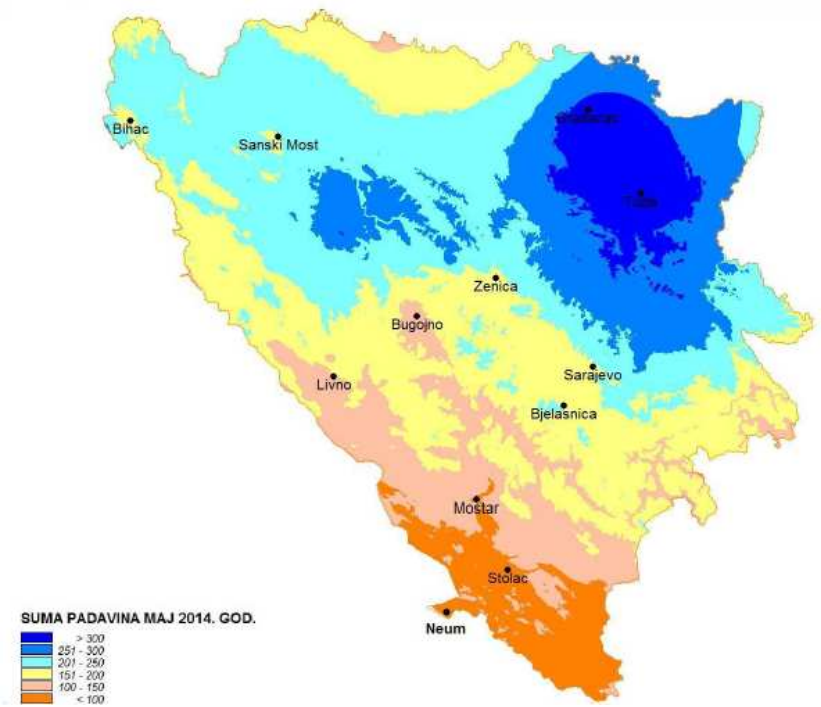


EUMETSAT, 16.05.2014. 00 UTC

Extreme meteorological event

Rainfall in 3 days ~ 300 mm (> P_{1000y})

BA



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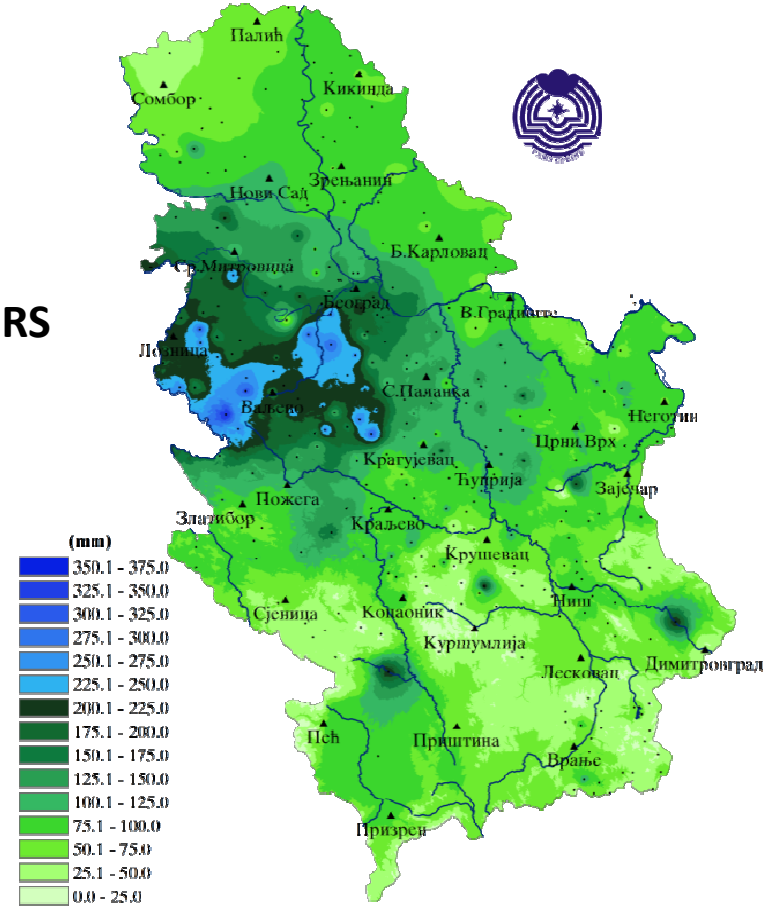
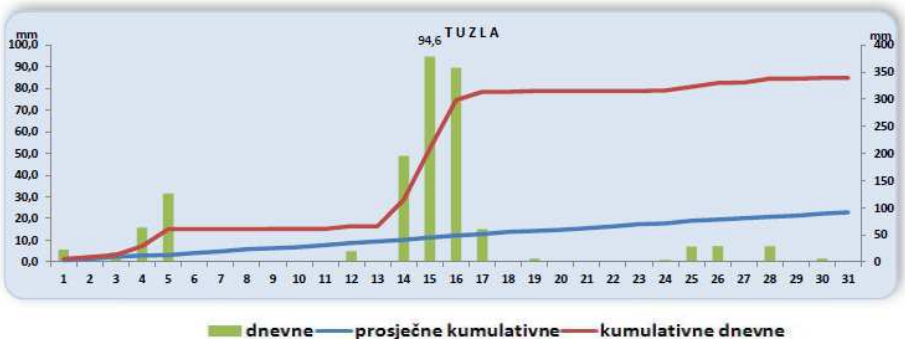
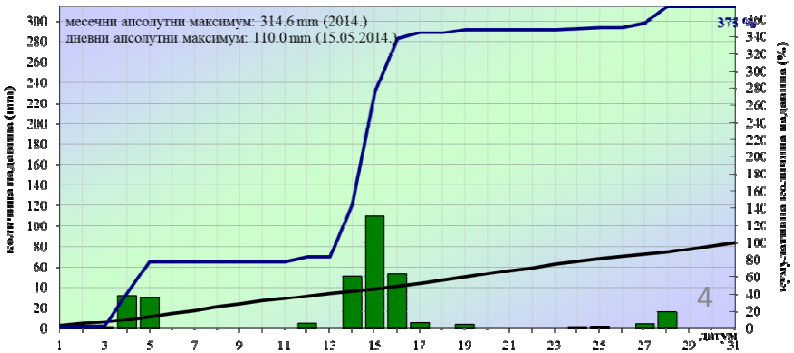




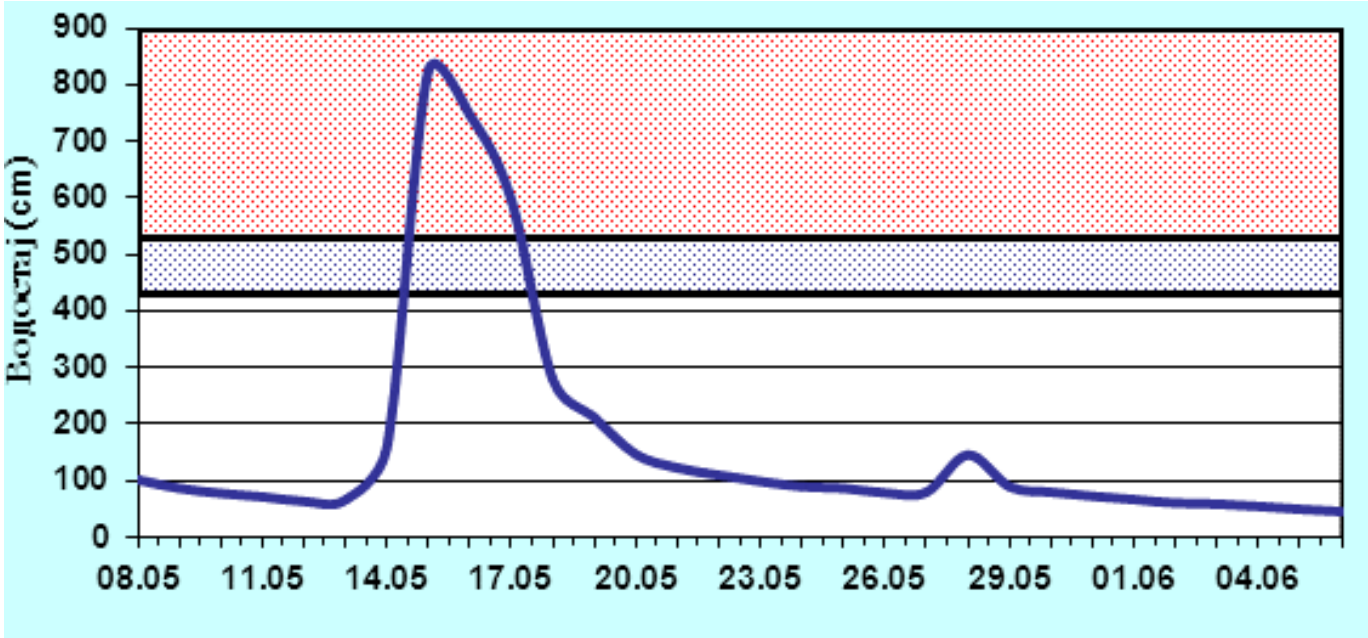


Extreme hydrological situation

- Already saturated soil due to prolonged rain in April and first half of May
- Extreme rainfall

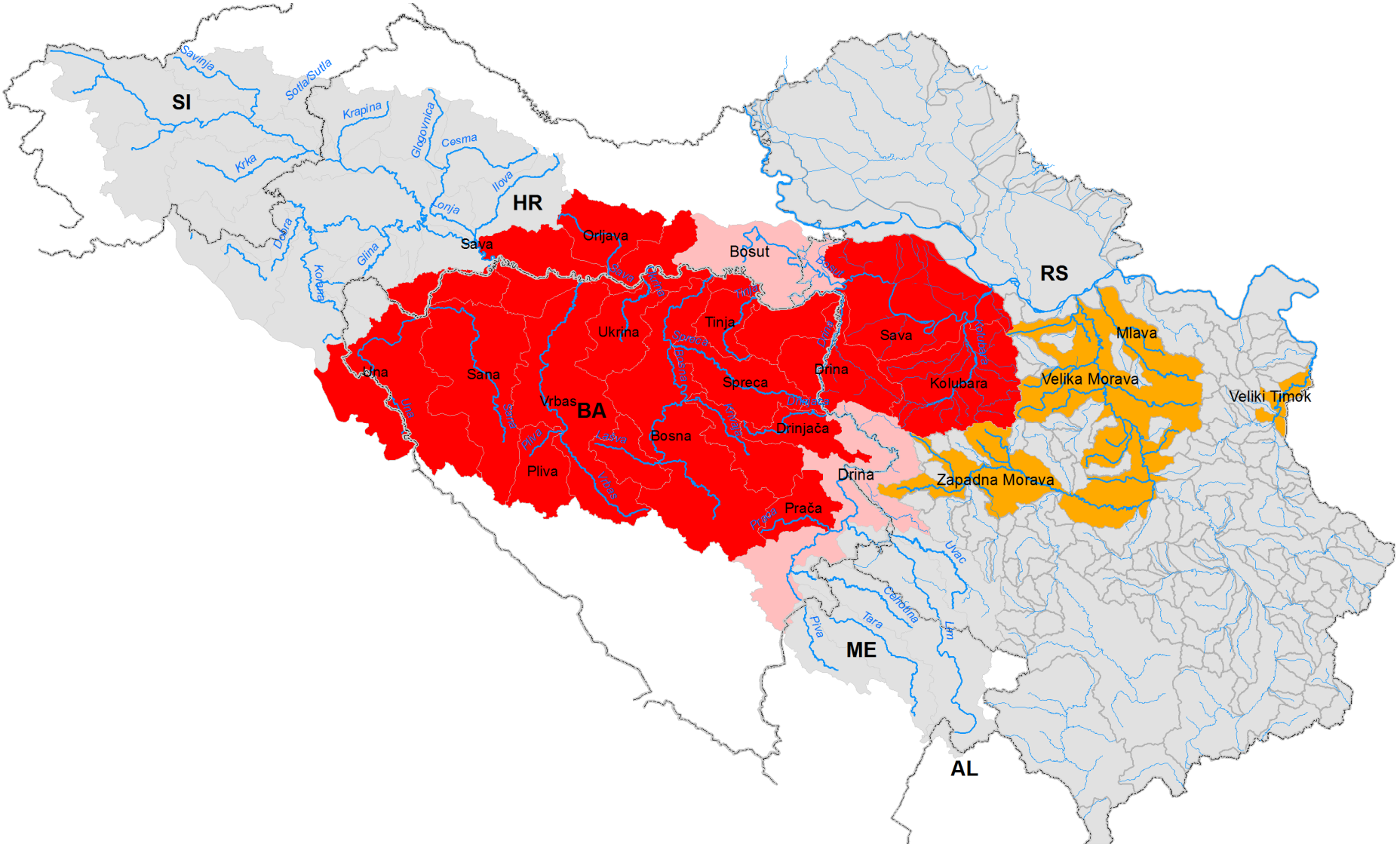
National rivers

1. **Torrents** – high flow velocities, massive sediment movement, landslides
2. **Small and medium rivers** – exceptional floods. Flood protection system **failed** on many locations. **High damages**



Sava river – extreme water levels due to high flows on all right tributaries in Croatia and Bosnia - Herzegovina

Consequence: Floods and landslides



Affected people, casualties and damage

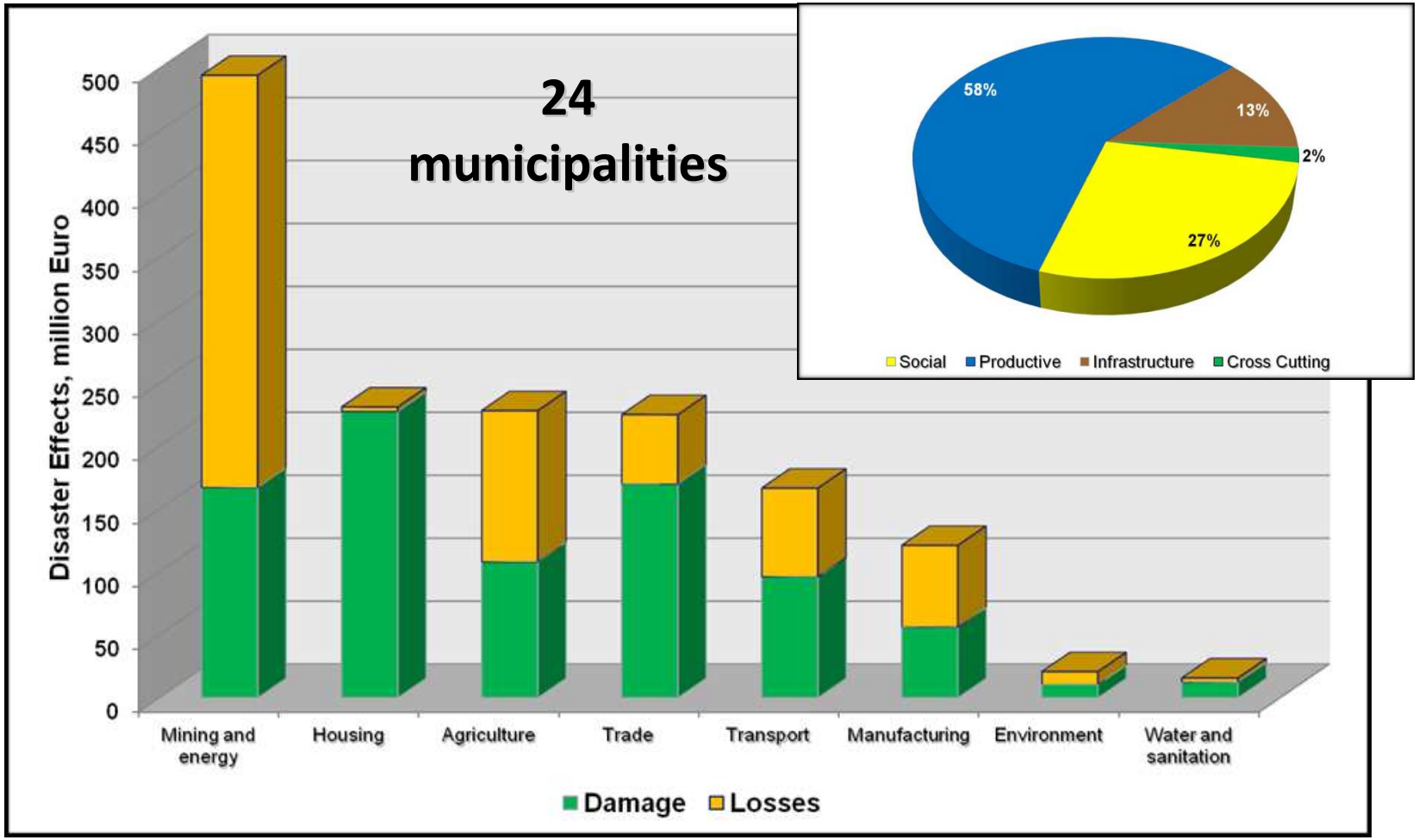
Country	Affected	Evacuated	Casualties	Damage+losses (mil €)	Cause
Serbia	1.6 million	32 000	51 (25 drown)	Damage: 860 Losses: 662 Total: 1532	Torrents, landslides, levee breach
Bosnia-Herzegovina	1 million	90 000	25	2 000	Torrents, landslides, levee breach
Croatia	38 000	15 000	3	297.6	Levee breach

Serbia

Bosnia - Herzegovina

Croatia

Serbia: Sectors affected



Source: Report on the needs assessment for reconstruction and flood relief (RNA) was produced from 10 June to 10 July 2014, according to the official assessment methodology of the European Union, the United Nations and the World Bank. The Report was presented at the Donor Conference in Brussels on 16 July 2014

Serbia: Recovery process initiated

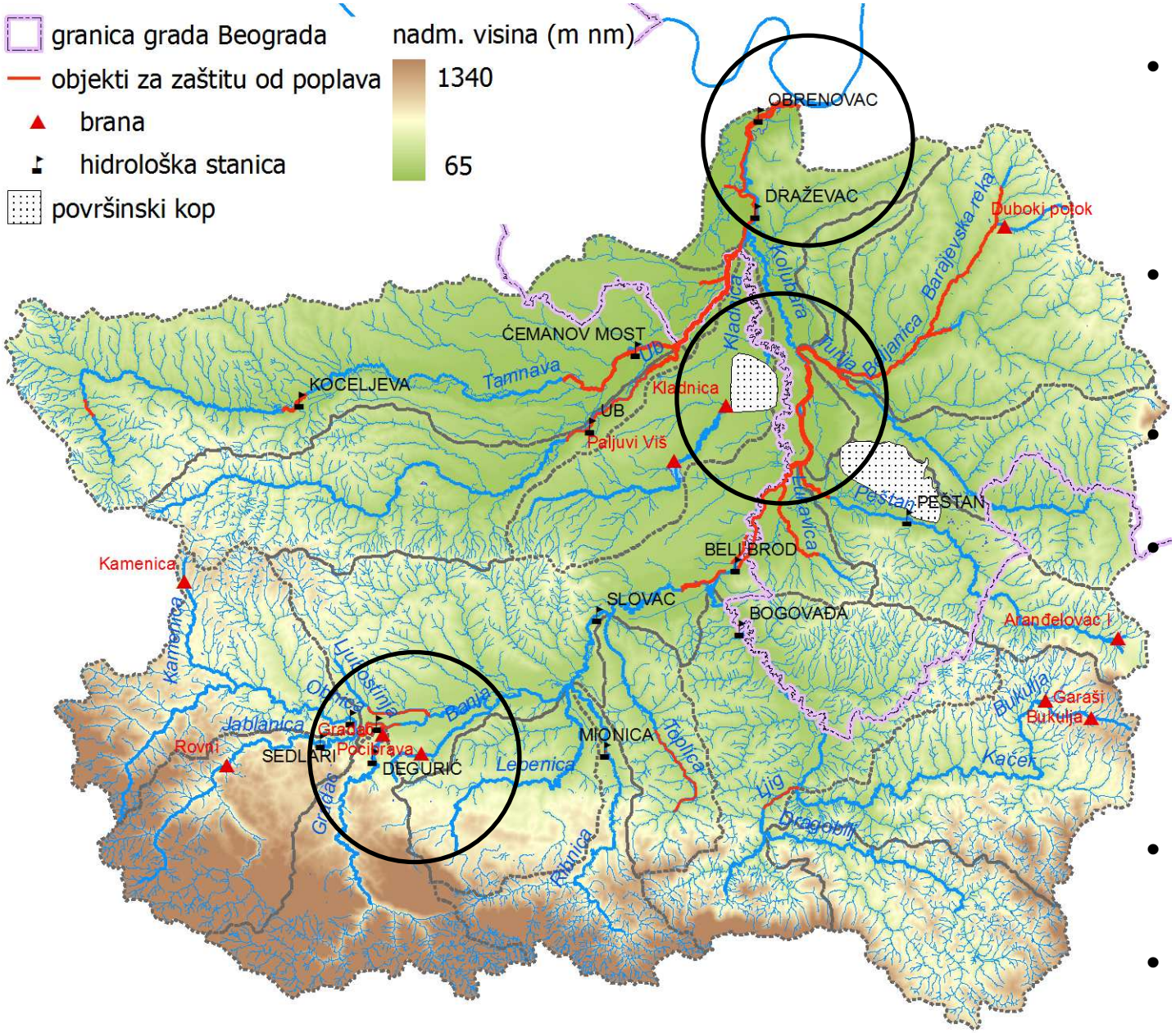
RS Government

New Law on the Post - Flood Rehabilitation in the Republic of Serbia

3 National programs for recovery of:
- Damaged houses
- Water facilities
- Transport network

Water management strategy 2014 – incl. flood management measures

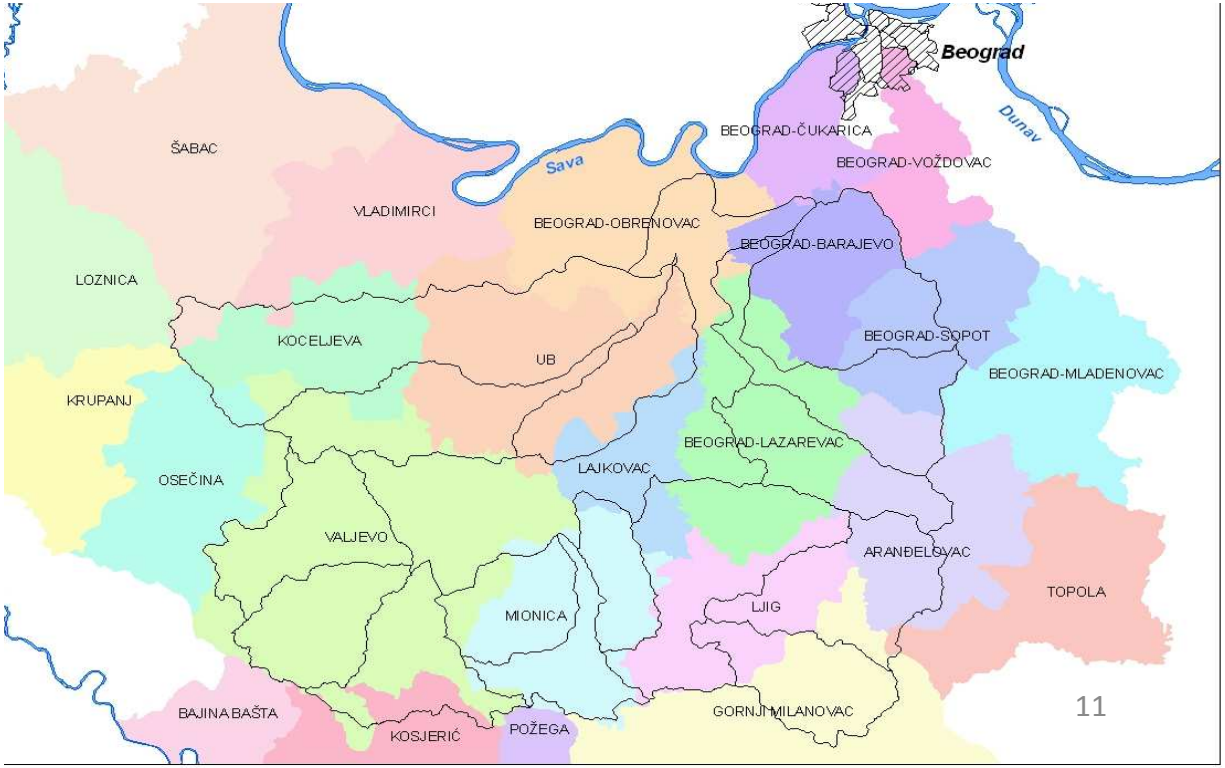
Kolubara river basin – the most affected in RS



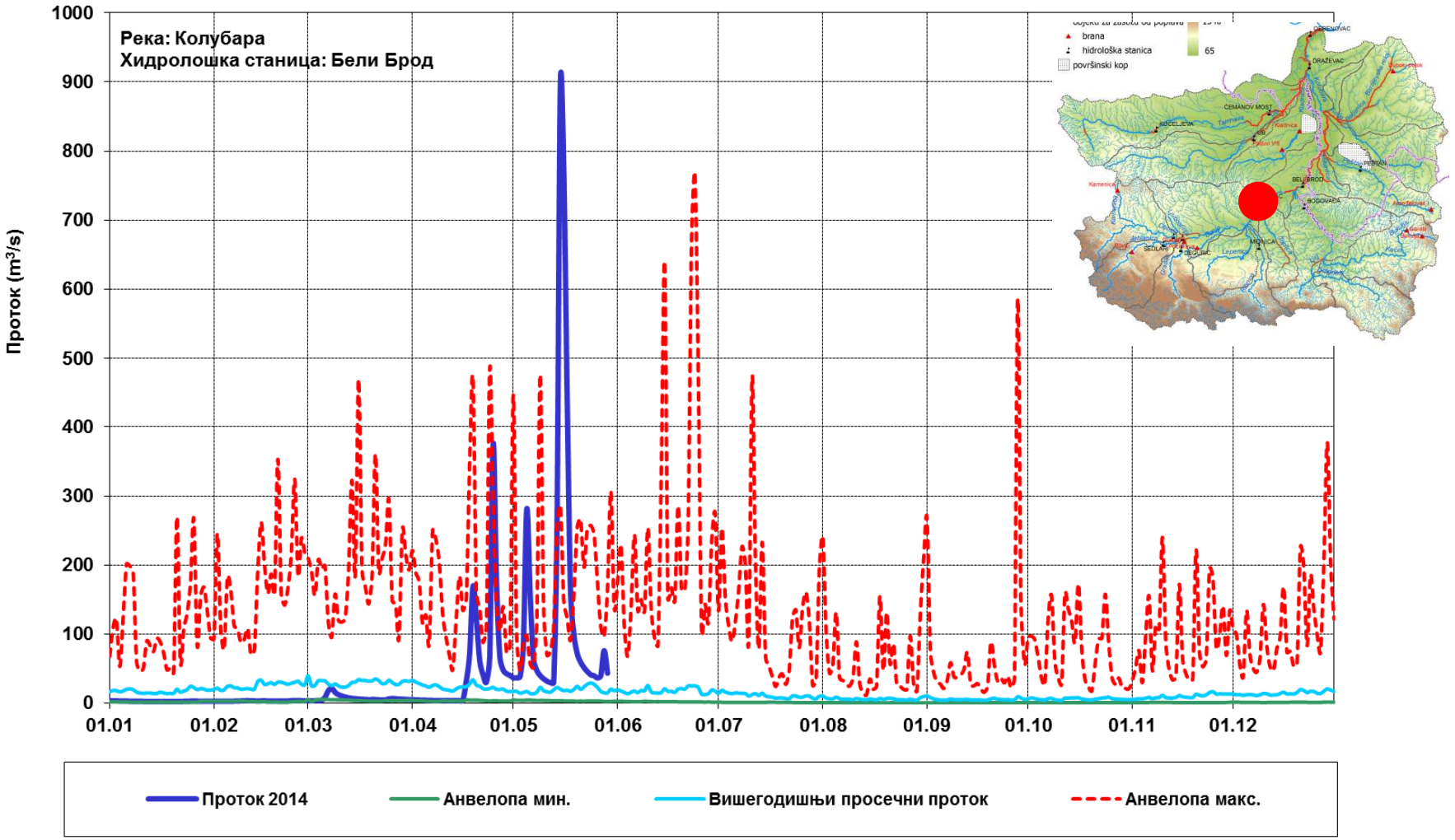
- The most downstream tributary of the Sava
- Mouth is 27 km upstream of Belgrade
- RB area = 3638 km^2
- Fan-shaped catchment with very dense hydrographic network (15 tributaries > 100 km^2)
- 16 municipalities
- Partial flood protection

Kolubara RB: Stakeholders affected by floods

- Ministries competent for Water Management, Transportation, Energy etc.
- Industry (Energy - Electrical power production, Coal mining , Thermal power plants etc)
- Mining basin Kolubara (a part of Electric Power Industry of Serbia)
- Several Counties and 16 municipalities (some are within Belgrade city limits)
- 2 Public Water Management companies (Srbijavode, Beogradvode)
- Public utility companies and public enterprises – infrastructure (Water Supply and Sewage, Sanitation, Road Maintaince etc)
- Nature protection sites (Obrenovački zabran, Gradac)
- Agriculture
- Tourism
- NGO's



Kolubara flood (return period=1000 years)



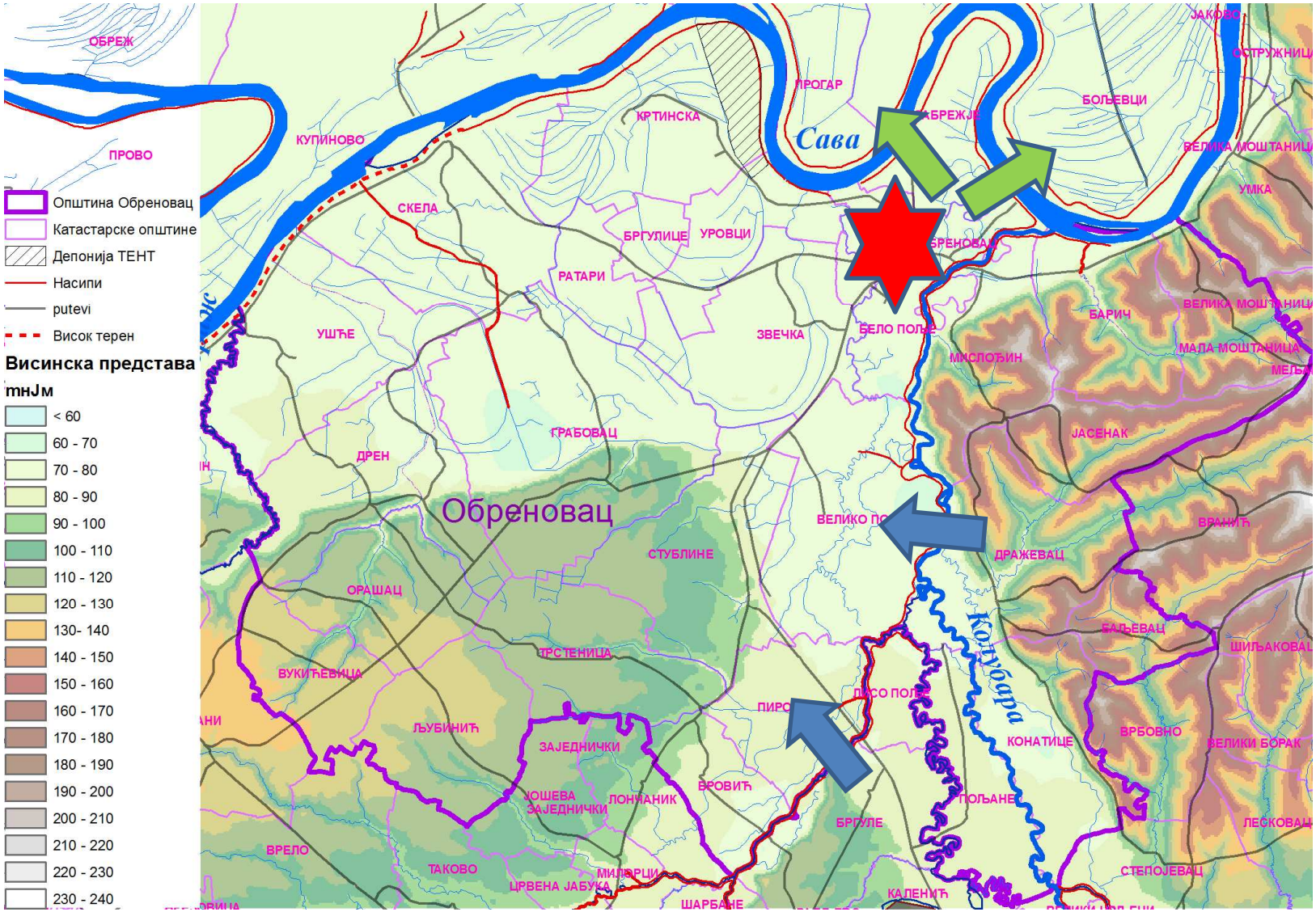
Upstream part of Kolubara RB (Valjevo city)

Total damage: 9 million €

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

187 mill m^3 of water +
3 mill m^3 of mud
Damage: 200 mil €

Lower part of Kolubara RB (Obrenovac city) - 1



Lower part of Kolubara RB (Obrenovac city) - 2

- 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)

Leasons learnt from 2014 flood (1)

River restoration

- Relocate buildings from flood-prone areas or implement local flood protection measures (on single or group of buildings)
- Modify infrastructure crossings (roads and railroads) being the obstacles in the floodway
- Sustain existing wetlands and inundated areas
- Restore natural retention areas
- Construct new flood retention capacities on smaller rivers
- Construct dry flood-retention reservoirs on large rivers
- Sustain existing forests, and afforest hilly and mountain regions

Leasons learnt from 2014 flood (2)

River/flood management

- Upgrade the flood protection level of the most important areas, using combination of permanent structures and mobile protection
- Use existing reservoirs and retentions for flood management
- Permanently monitor and inspect the erosion control and flood protection structures
- Permanently monitor erosion processes and torrential rivers
- Implement sediment management measures

Leasons learnt from 2014 flood (3)

Policy development and implementation

- Establish efficient bilateral cooperation with neighboring countries, including common actions on transboundary rivers during flood defence
- Implement results of flood hazard and flood risk mapping in spatial plans
- Limit the increase of flood risk in the actually and potentially flooded areas through special conditions and permits
- Designate erosion-prone areas, with conditions for their use
- Apply principles and methods of flood-resilient construction

Leasons learnt from 2014 flood (4)

Stakeholder involvement

- Improve the system of hydro-meteorological monitoring, forecast and early warning and issue data to relevant services in real time
- Upgrade the international exchange of meteorological and hydrological data
- Improve the alarm systems and systems for issuing timely warning to population at risk
- Strengthen the capacity of professionals and institutions
- Prepare plans for protection and rescue in emergency situations on the state level, municipality level etc.
- Training exercises

Thank you for your kind attention

Any questions?