

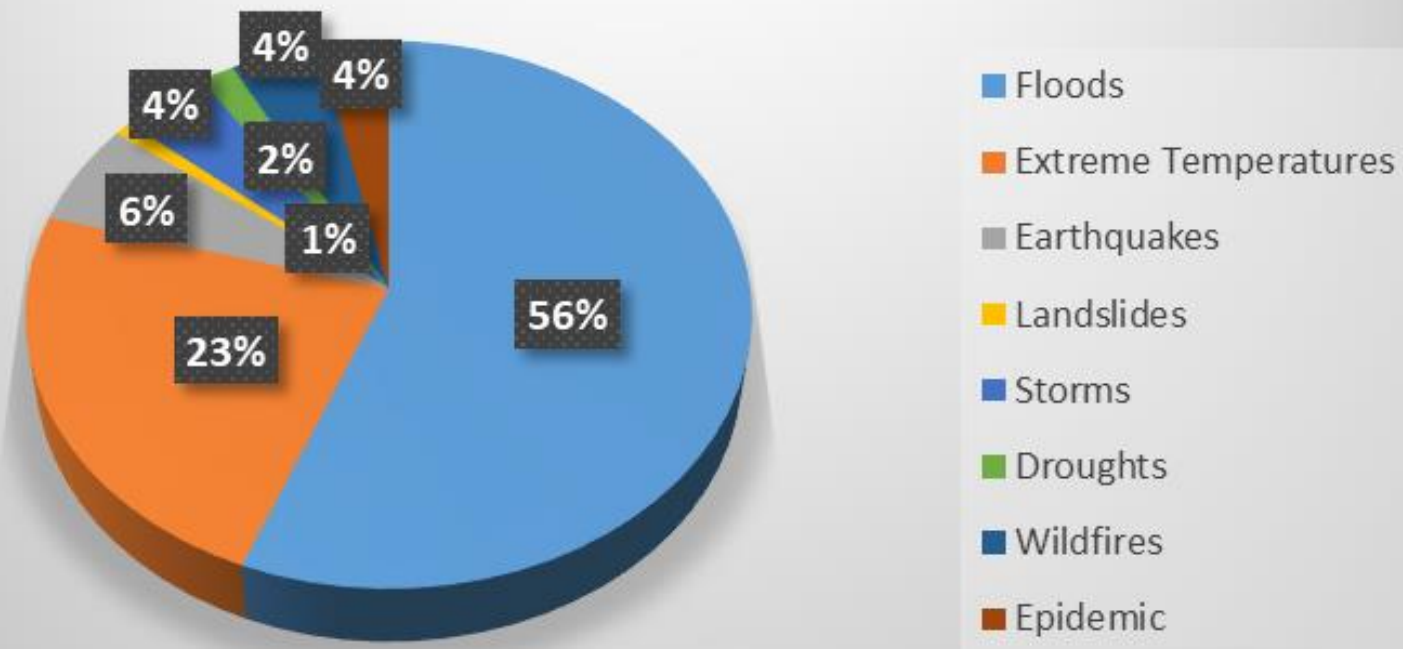


# The impact of climate change on the Western Balkans - risks and economic consequences

13 April 2022

# WESTERN BALKANS – Hazard Profile

## Western Balkans - Disasters Frequency 2000 - 2020



## WESTERN BALKANS – Major disasters impacts on transport infrastructure

### ➤ BIH Floods May 2014: 2.416 B USD

- Transport & communications: D = 261.7 M \$, L = 86 M \$, Total: 347.7 M \$.

### ➤ Serbia Floods May 2014: 1.809 B USD

- Transport & communications: D = 124.4 M \$, L = 84.8, Total: 209.2 M \$.

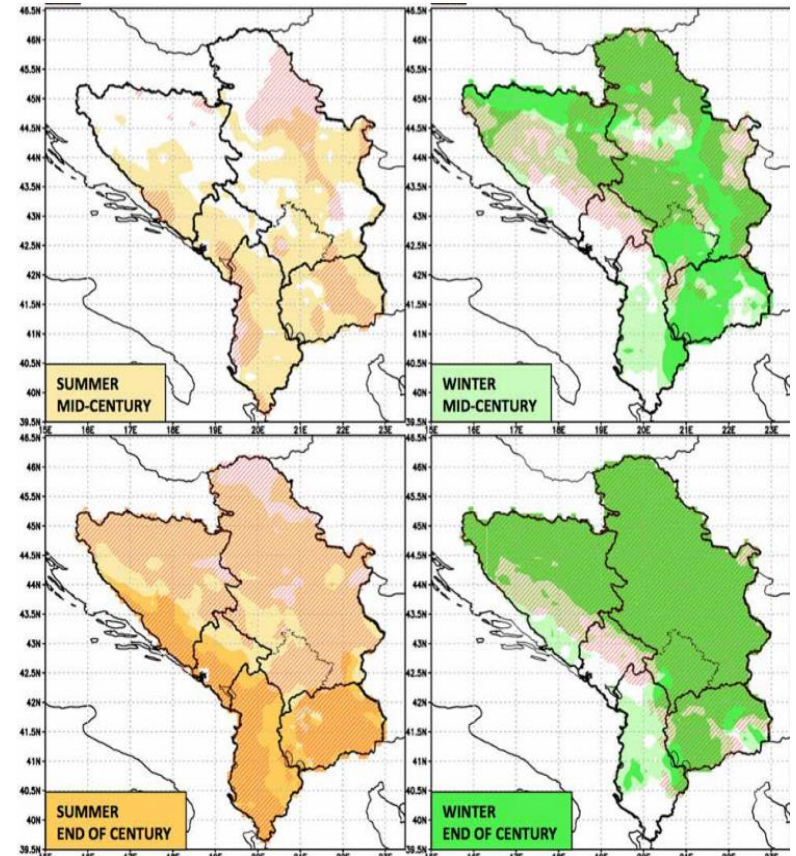
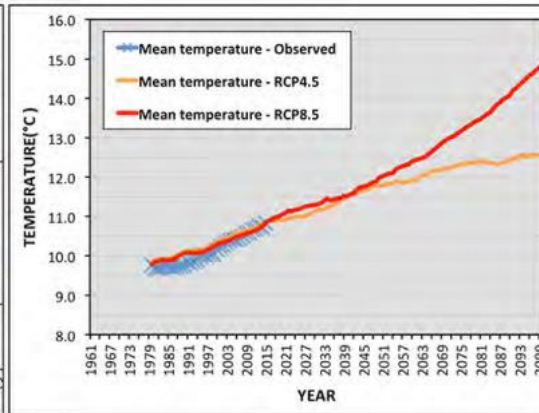
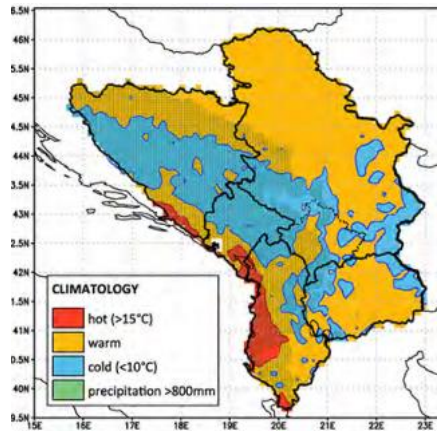
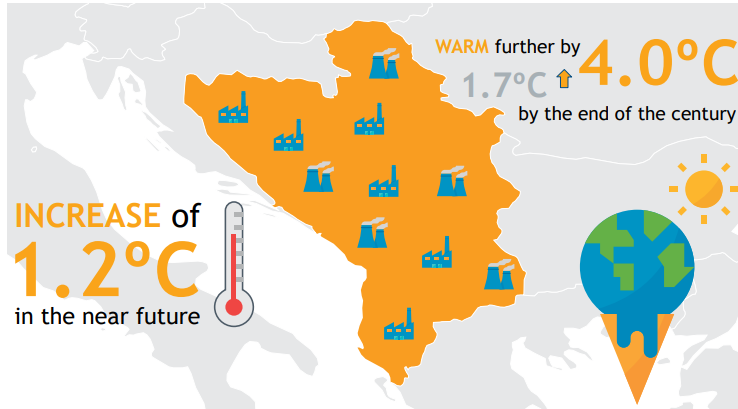
### ➤ North Macedonia Flash Floods 2016: 36.37 M USD

- Infrastructure sector: D = 14.74 M \$, L = 3.96 M \$, Total = 18.7 M \$.

### ➤ Albania Earthquake November 2019: 1.9 B \$

- Infrastructure sector: D = 38.08 M \$, L = 3.65 M \$, Total = 41.73 M \$.

# WESTERN BALKANS – Climate Change



Source: *Study on Climate Change in the Western Balkans Region*. Regional Cooperation Council. 2018.

# ALBANIA - Risk assessment for floods, landslides and earthquakes

Annual Expected Damages	Floods	Land sl.	EQ	Total
01 Milot - Morine New	16,737	324,373	6,079	347,188
02 Q. Qele - Puke	13,396	112,808	14,194	140,398
03 Milot - Shkoder	1,540,190	90,040	177,787	1,808,017
04 Tirana - Durres	1,793,170	116,378	191,444	2,100,991
05 Durres - Fier	9,981,132	513,307	350,730	10,845,169
06 Tirana - Elbasan	3,004,926	456,556	127,413	3,588,895
07 Fier - Tepelene	1,252,073	105,858	61,559	1,419,491
08 Sarande - Greqi	40,927	39,710	5,553	86,189
09 Elbasan - Gramsh	717	26,243	27,484	54,444
10 Lushnje - Berat	254,003	93,458	42,334	389,796
11 Rrogozhine - Elbasan	6,332	29,090	49,935	85,357
12 Shkoder - Hani - Hotit	190,376	97,336	31,355	319,066
13 Milot - Peshkopi	517,200	198,058	27,417	742,675
14 Vlore - Sarande	136,023	178,477	23,513	338,012
15 Pogradec - Korce	-	67,172	86,054	153,225

- Annual Expected Damages per hazard and corridor
- Earthquakes excluded from action planning due to dispersed impact and limited AED/km



## ALBANIA - Landslide risk

### Annual damages from interruption of services and repair costs per corridor from landslides (€)

Landslides	Repair Costs (€)	Interruptions (€)	Total (€)
Annual Expected Damages			
01 Milot - Morine New	286,714	37,659	324,373
02 Q. Qele - Puke	109,519	3,289	112,808
03 Milot - Shkoder	38,473	51,567	90,040
04 Tirana - Durres	44,776	71,602	116,378
05 Durres - Fier	150,035	363,272	513,307
06 Tirana- Elbasan	200,240	256,316	456,556
07 Fier - Tepelene	60,806	45,052	105,858
08 Sarande - Greqi	39,453	257	39,710
09 Elbasan - Gramsh	24,677	1,566	26,243
10 Lushnje - Berat	63,581	29,877	93,458
11 Rrogozhine - Elbasan	17,366	11,724	29,090
12 Shkoder - Hani - Hotit	76,293	21,043	97,336
13 Milot - Peshkopi	123,935	74,123	198,058
14 Vlore - Sarande	146,329	32,148	178,477
15 Pogradec - Korce	22,438	44,734	67,172



## BOSNIA AND HERZEGOVINA – Flood protection measures

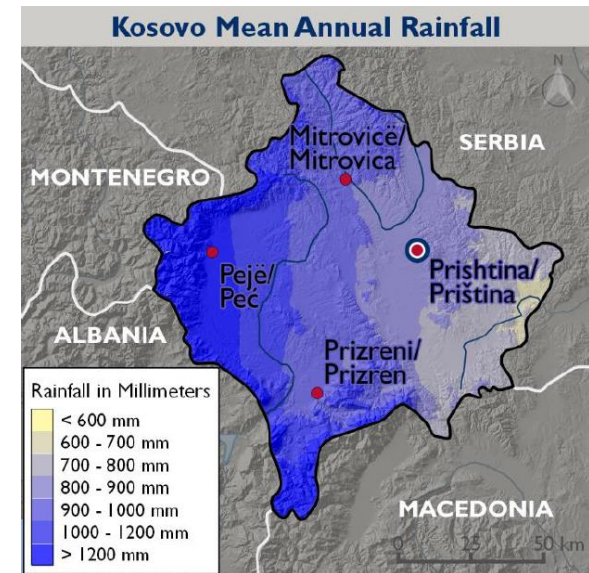
- Rehabilitation of damage existing protective water bodies, riverbeds and canals in the affected areas.
- Harmonization of the flood protection system in BiH with the EU Directive 2007/60 / EC on flood risk assessment and management.
- Development of technical solutions for protection against floods, erosion and torrents for settlements and cities and construction of new facilities.
- Establishment of a hydrological forecasting system in BiH.
- Strengthening the capacity of institutions responsible for water management and flood protection in BiH.
- Enhanced water management.



# KOSOVO\* – Climate change impacts & road network

- Rising intensity and frequency of precipitation extremes like heavy rain events, as well as more severe drought, particularly since the 1980s. Flash floods are getting more common in mountain areas, while river floods occur more often in plains and lowlands;
  - Higher temperatures will make heatwaves and forest fires more likely.
  - Kosovo has been struck by drought several times in the last two decades;
  - Ecosystem degradation and reduction of ecosystem services;
  - Increase and new forms of pollution and water-related diseases.
- 
- Main roads: 630 km.
  - Road infrastructure developed & in good conditions.
  - The two routes are part of the South-East Europe Core Transport Network: Route 6 & Route 7.

**PRIORITIES IDENTIFIED IN THE TRANSPORT SECTOR  
ACCORDING TO THE NATIONAL CLIMATE CHANGE STRATEGY 2019-  
2028**



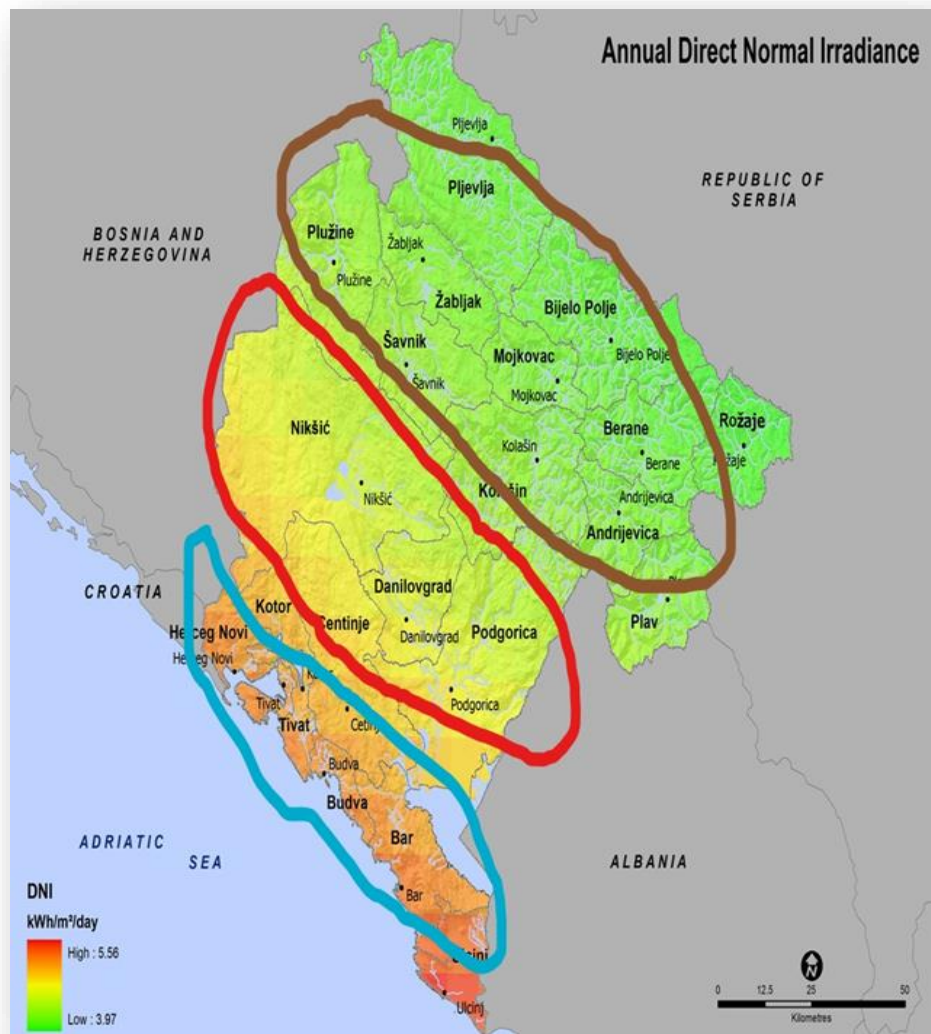
## KOSOVO\* - Economic consequences of disasters

- Annual average population affected by flooding in Kosovo is about 10,000 and the annual average affected GDP is about \$50 million.
- For instance, in January 2021 extensive floods occurred in Kosovo, caused by heavy rainfall and increased snowmelt due to sudden temperature increases. Many riverside roads were inundated, bridges destroyed, and water supplies cut (in Pristina, Drenas/Glogovac, Obiliq/Obilić). The Government of the Republic of Kosovo approved the decision for allocation of funds (EUR 1 million) for compensating damages that occurred in municipalities.



Road connecting Klina and Malisheve was disrupted<sup>9</sup> due to floods in January 2021

# MONTENEGRO - Climate regions, hazards and road network



# MONTENEGRO - Resilience measures

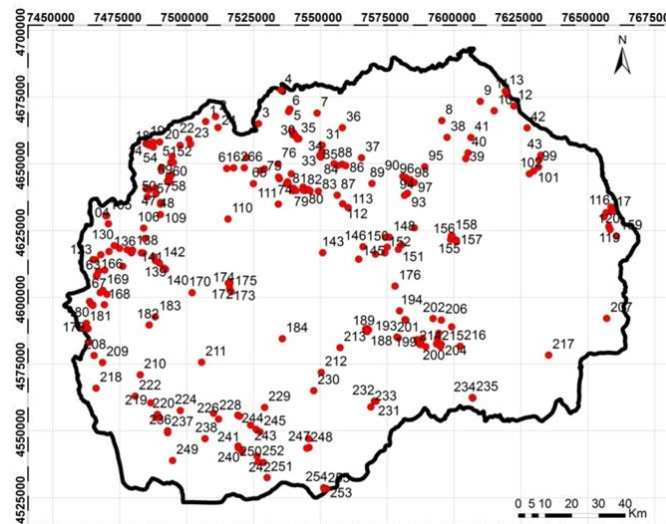
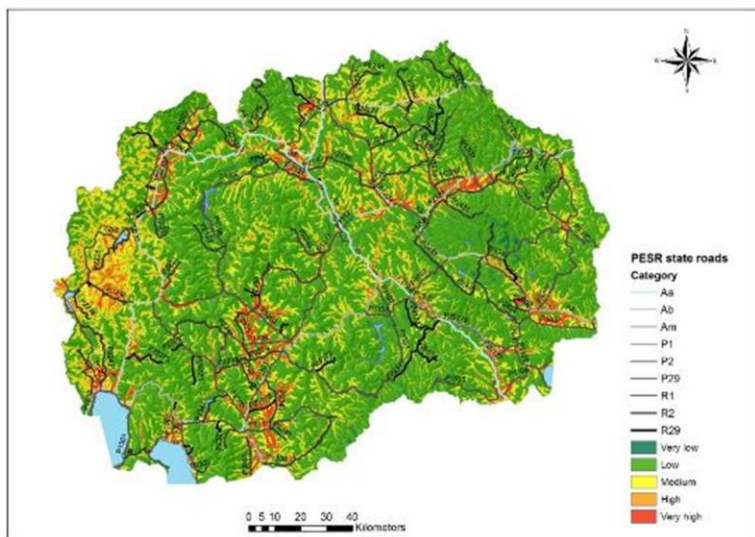
## Resilience improving measures

- Construction of embankments
- Removal of unstable material from the slopes
- Construction of drainage channels
- Construction of deep drainage
- Construction of walls
- Paving/ resurfacing of the wearing course using traditional asphalt materials
- Slope stabilization (safety nets or hydro planting)
- Construction of new gutters
- Construction of road galleries for protection from avalanches
- Construction of road galleries for protection from rock fall

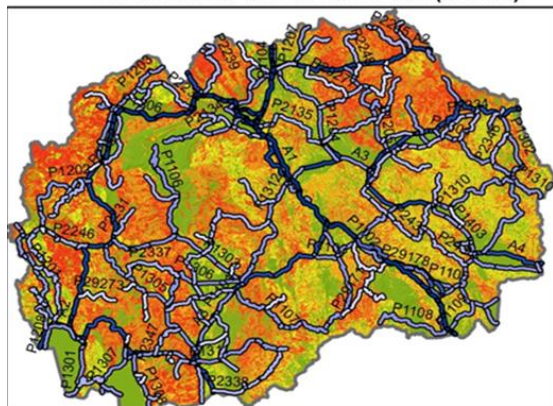
## Measures that will reduce the vulnerability

- Increasing water retention capacity by introducing water storage & drainage system
- Enhancement of slope stability & debris flow barriers
- Use of heat-resistant surface materials & increase fire-extinguisher coverage
- Use of heat-resistant surface materials
- Enhanced cooling of electrical equipment
- Construction of windbreakers
- Increased frequency of gully maintenance activities;
- Use of anti-corrosion paint due to increase in surface salt levels in some locations
- Use of heat-resistant surface materials
- Installation of rockfall netting
- Installation of strength mesh suitable for reinforcement and protection of slopes
- Use of a pavement surface having a high albedo (surface solar reflectivity) in order to minimize heat transfer to the underlying subgrade
- Use of heat drain to facilitate heat extraction from the embankment during winter
- Avalanche protection by concrete gallery
- Tunnel structures protecting from landslides & rock fall
- Construction of debris flow barriers

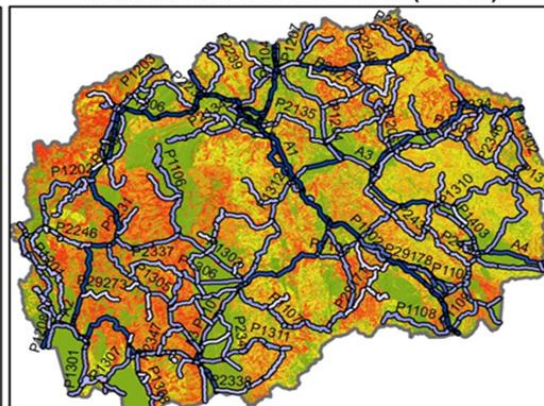
# NORTH MACEDONIA – Hazard profile



Landslide hazard for 2021-2050 (RCP85)



Landslide hazard for 2071-2100 (RCP85)



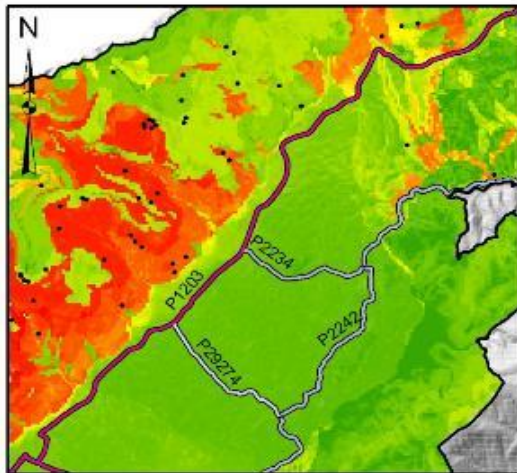
Category — Aa — Ab — Am — P1 — P2 — P29 — R1 — R2 — R29

Source: Presentation by Prof. d-r Milorad Jovanovski, Assist. Prof. d-r Igor Peshevski

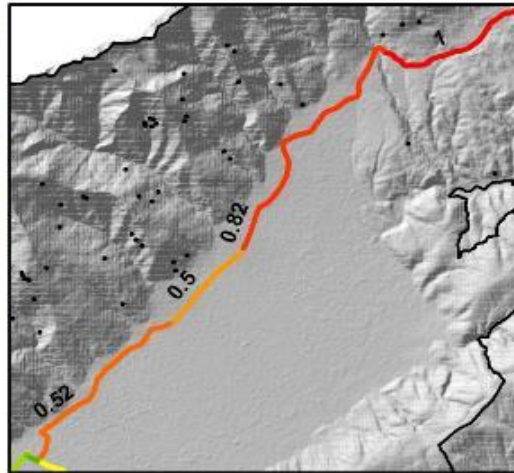
# NORTH MACEDONIA - Case with risk prognosis (Polog Region)

Landslide hazard, baseline (1980-2010)

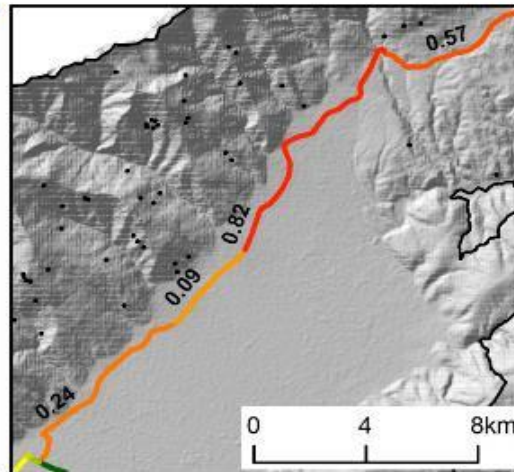
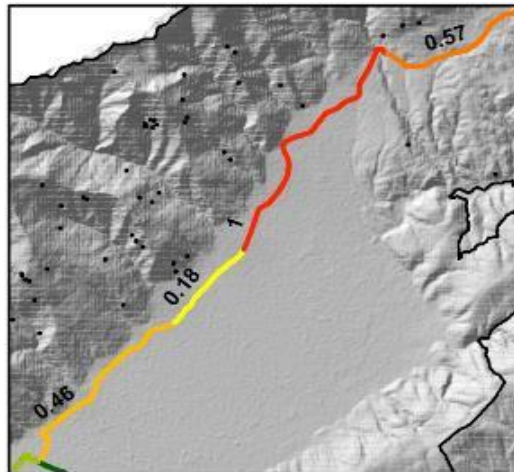
Exposure to landslide hazard, baseline (1980-2010)



Road Vulnerability (relative)



Landslide risk (relative)



The unified index can be used itself as the means to prioritise interventions, or it can be further manipulated to present, potentially more useful indices, which show the prioritisation per km or per euro.

Hazard = Haz

Average vulnerability = Vuln

Criticality = Critical01

Define factors to apply to these indices to reflect their relative importance

**Unified Index (C) = 0.33 x Haz x 0.33**

**Vuln\_01 x 0.33 Critical01**

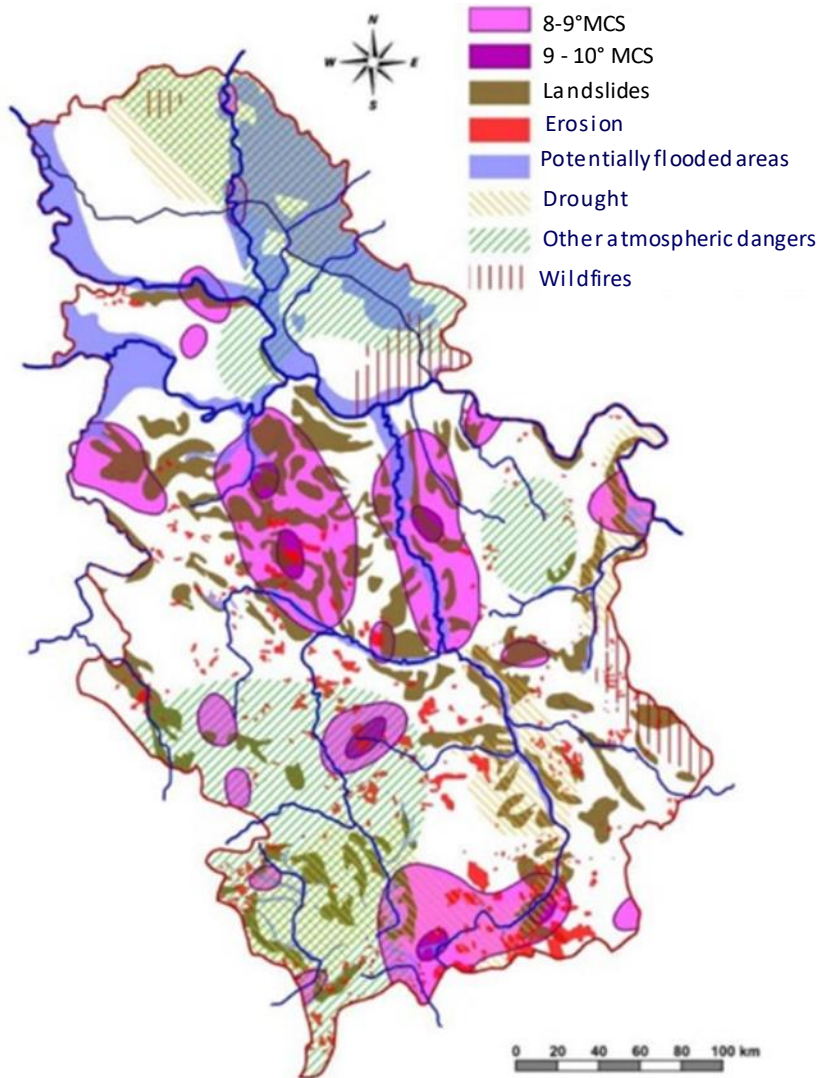
Identify the length of the road section in km  
**Unified Index per km (K) = C / length in km**

Identify the total cost of interventions on road section in euros

**Unified Index per € (E) = C / total cost in euro**

Source: Presentation by Prof. d-r Milorad Jovanovski, Assist. Prof. d-r Igor Peshevski

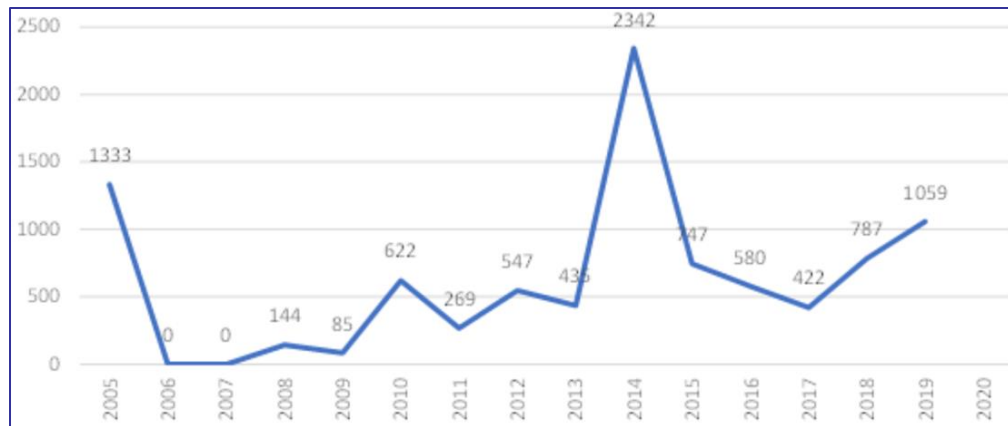
## SERBIA – Hazard profile



- Landslide risk – approx. 25% of the territory.
- Soil erosion - 35% of the territory.
- Floods & torrential floods - more than 17% of the territory.
- 4,000 km of roads are exposed to floods.
- Droughts - 21% of the territory.
- Forest fire risk - 3.6% of the territory & it is increasing.

## SERBIA – Recent disaster impacts


- Extreme weather events damages 2000/2019: more than 5 billion USD.
  - Floods (landslides/slope instability, damage to drainage systems, bridge scour),
  - Snow deposits - storms (traffic disruptions and traffic safety),
  - Increasing maximum temperatures (durability of pavement structures).
- May 2014 Floods – activation of more than 2000 landslides on the state roads I/II network and over 3000 landslides on the local road network.
- Heavy snow storms (02/2015, 2012 in 22 municipalities, 2017 0 collapse of E-75).





NOTHING  
LASTS  
FOREVER

NOT EVEN THE  
CORONAVIRUS



Komuna e Zhelinës

**Thank you!**  
**Questions?**