WITH FUNDING FROM
AUSTRIAN DEVELOPMENT COOPERATION

UN environment programme

Enhancing Environmental Performance and Climate Proofing of Infrastructure Investments in the Western Balkan Region from an EU Integration Perspective

REGIONAL STRATEGY FOR CLIMATE-RESILIENT ROAD INFRASTRUCTURE

Disclaimers

The designations employed and the presentation of the material in this publication do not imply the expression of any opinion whatsoever on the part of the Secretariat of the United Nations concerning the legal status of any country, territory or city or area or its authorities, or concerning the delimitation of its frontiers or boundaries. For general guidance on matters relating to the use of maps in publications please go to http://www.un.org/Depts/Cartographic/english/htmain.htm

*References to Kosovo shall be understood to be in the context of UN Resolution 1244 (1999) and the ICJ Opinion on the Kosovo Declaration of Independence

Mention of a commercial company or product in this document does not imply endorsement by the United Nations Environment Programme or the authors. The use of information from this document for publicity or advertising is not permitted. Trademark names and symbols are used in an editorial fashion with no intention on infringement of trademark or copyright laws.

The views expressed in this publication are those of the authors and do not necessarily reflect the views of the United Nations Environment Programme. We regret any errors or omissions that may have been unwittingly made.

Acknowledgements

UN Environment gratefully acknowledges the generous contributions of many colleagues and experts who invested time and effort to provide invaluable advice and inputs to this document throughout its lengthy preparation process.

Management and Coordination at UNEP:

Sonja Gebert, Harald Egerer (Vienna office)

Lead Authors of the *Regional Strategy for Climate Resilient Road Infrastructure Development*:

Sanda Midžić-Kurtagić, Harisa Muratović, Amina Begić, Šejla Mahmutović, Maja Kurtagić-Hadžić – Center for Energy, Environment and Resources (CENER 21), BiH

WB National Consultants (NC), on behalf of CENER 21:

- Besim Islami (Energy Environmental Consulting Group) – NC for Albania
- Amir Sinanović – NC for Bosnia and Herzegovina

- Valbona Berisha and Arben Kelmendi – NCs for Kosovo*
- Vasilije Gazivoda (E3 Consulting) – NC for Montenegro
- Vasko Popovski – NC for North Macedonia
- Aleksandar Simić (Ekokons) – NC for Serbia

Margreet van Marle, Mike Woning, Thomas Bles – Deltares, The Netherlands
Jeroen Trimpe Burger, Michel Leushuis – Rebel Group

Reviewers and Contributors:
Herbert Formayer, Barbara König – Institute of Meteorology and Climatology (BOKU-Met), Austria
Laureta Dibra, Biserka Ivanovic Sarkanovic, Olivera Kujundzic, Teodora Obradova Grncarovska, Danijela Bozanic in collaboration with Mariachiara Alberton – Eurac Research, Italy
Mladen Marković – Public Enterprise Roads of Serbia, Serbia
Dušan Stokić – Chamber of Commerce and Industry of Serbia
Ljubinka Ivanović – Ministry of Capital Investments, Directorate for State Roads of Montenegro
Nikola Arnaut - Ministry of Transport and Maritime Affairs, Transport Administration of Montenegro
Imer Fejza, Qamil Feka – Ministry of Environment, Spatial Planning and Infrastructure of Kosovo*
Edin Honić – Public Enterprise Motorways of the Federation of Bosnia and Herzegovina
Senad Smajlovic – Public Enterprise Roads of the Federation of Bosnia and Herzegovina
Sandra Andovska – Government of North Macedonia, Office of the Deputy of the Prime Minister in charge of economic affairs, coordination of economic sectors and investments
Nedim Begović, Nerejda Hoxha – Transport Community, Serbia

* This designation is without prejudice to positions on status, and is in line with UNSCR 1244 and the ICJ Opinion on the Kosovo Declaration of Independence

Executive Summary

This document is the result of joint efforts and cooperation between Western Balkan (WB) stakeholders, national and international consultants in collecting, reviewing and structuring the country-specific inputs that are presented and summarized in this document. Building on these inputs, this Regional Strategy aims to adapt the road infrastructure in the WB to current and future climate conditions based on a set of tools, regional measures and recommendations. It seeks to complement national strategies and policy initiatives set forth in the Western Balkans Green Agenda and Economic and Investment Plan for the Western Balkans.

With the aim of improving the information base on future climate and weather patterns in the WB region, Chapter 2 summarizes several tools developed within the ClimaProof project: climate change projections (high resolution, localized, bias-corrected scenarios for the entire region) and a set of climate-based indicators to be used to identify areas that are vulnerable to specific processes under current climate conditions and to quantify the impact of climate change on those processes.

Chapter 3 provides an overview of the vulnerability of each WB country's road infrastructure to climate change. Floods are currently the most frequent and costly natural hazard in the region and have severely impacted the existing road infrastructure. Although road infrastructure has been rapidly developing in the WB as part of the region's socio-economic development, substantial interventions in its road network are indispensable. The lack of systematically collected data on past road damage and hazardous events in a centralized database makes an evaluation of the region's current climate situation and the status of roads far more difficult.

Chapter 4 examines the region's resilience planning in road infrastructure development from the perspective of climate change policy and data management. It describes the relevant regulatory framework (strategies and policies) in place in each of the WB countries, the key institutions involved in the process of resilience planning and road infrastructure development as well as the efforts undertaken so far (incentives and projects implemented). Both the institutional and policy gaps are identified on a regional scale as are the resulting deficiencies in the development of hazard and risk assessments.

A brief overview of some case studies and best practices in risk assessment and management implemented in the region through various projects is presented in Chapter 5. These projects provided much-needed assistance in assessing and identifying specific climate risks to the road network and in mapping specific vulnerabilities (such as landslides, floods, wildfires, rockfall, snow cover, etc.), thus determining the most effective risk management options and establishing the necessary collaboration channels and mechanisms for data collection and exchange.

Chapters 6 reviews the current state of climate proofing in the region, followed by a set of regional and country-specific recommendations in Chapter 7. The recommendations are grouped into three main thematic clusters in line with the state of climate proofing of roads in the WB region.

The key takeaways of this Regional Strategy is the roadmap for adaptation planning presented in Chapter 8. This roadmap consists of a set of defined governance measures and an accompanying Action Plan. The Action Plan reflects the inputs obtained from the national consultants and project stakeholders; the proposed timeframe is only indicative. As a guiding document for the preparation

of national strategies and action plans, the roadmap is supplemented by insights on the potential scope for regional cooperation and the establishment of a regional fundraising mechanism.

ACRONYMS AND ABBREVIATIONS

AADT	Annual Average Daily Traffic
ADC	Austrian Development Cooperation
AED	Expected Annual Damages
ARA	Albanian Road Authority
ASIG	State Authority for Geospatial Information
BD	Brčko District
BEI	Baseline Emissions Inventory
BiH	Bosnia and Herzegovina
BiH ESAP 2030+	Environmental Strategy and Action Plan of Bosnia and Herzegovina
CBA	Cost-benefit analysis
CO_2	Carbon dioxide
CoM	Covenant of Mayors
CRISIS	Comprehensive Risk Assessment of Basic Services and Transport Infrastructure
DRR	Disaster Risk Reduction
EBRD	European Bank for Reconstruction and Development
ECILS	European Center on Vulnerability of Industrial and Lifeline Systems
EIA	Environmental Impact Assessment
EMA	Emergency Management Agency
EPPA	EU Environment Partnership Programme for Accession
FBIH	Federation of Bosnia and Herzegovina
FBUR	First Biennial Update Report on Greenhouse Gas Emissions
FRMP	Flood Risk Management Plan
GCF	Green Climate Fund
GDP	Gross domestic product
GEF	Global Environment Facility
GHG	Greenhouse gas
GIS	Geographic Information System
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit

GNTP	General National Territorial Plan
IFI	International Financing Institutions
IGEWE	Institute of Geosciences, Energy, Water and Environment
IHMA	The Institute of Hydrometeorology of Albania
IHMS	The Institute of Hydrometeorology and Seismology
IMWG	Inter-Ministerial Working Group
INDC	Intended Nationally Determined Contribution
KEPA	Kosovo Environment Protection Agency
MARDWA	Rural Development and Water Administration
MESPI	Ministry of Environment, Spatial Planning and Infrastructure
MIA	Ministry of Internal Affairs
MIE	Ministry of Infrastructure and Energy
MoFTER	Ministry of Foreign Trade and Economic Relations
MoTC	Ministry of Transport and Communications
MSPCEE	Ministry of Spatial Planning, Civil Engineering and Ecology
NAP	National Adaptation Plan
NDC	Nationally Determined Contributions of Bosnia and Herzegovina
NECP	National Energy and Climate Plans
NERP BiH	National Emissions Reduction Plan
NREAP BiH	National Renewable Energy Action Plan
NSDI	National Strategy for Development and Integration
PC Roads	Public Company Roads of the Federation of Bosnia and Herzegovina
PCM	Project cycle management
PEMP	Public Enterprise “Makedonija Pat”
PERS	Public Enterprise “Roads of Serbia”
PESR	Public Enterprise for State Roads
PESR	Public Enterprise for State Roads
PGA	Peak Ground Acceleration

PSHA	Probabilistic Seismic Hazard Assessment
RAMS	Road Asset Management System
RHMI	Republika Srpska Hydro-Meteorological Institute
RS	Republika Srpska
SBUR	The Second Biennial Update Report on Greenhouse Gas Emissions
SEA	Strategic Environmental Assessment
SECAP	Sustainable Energy and Climate Action Plan
SEETO	South-East Europe Transport Observatory
SuDS	Sustainable Drainage System
TNC	Third National Communication
UN	United Nations
UNDP	United Nations Development Programme
UNFCCC	United Nations Framework Convention on Climate Change
VRA	Vulnerability and Risk Assessment
WB	Western Balkans
WBIF	Western Balkans Investment Framework

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

1 Introduction

Climate change is one of the greatest challenges humanity faces today as it affects all aspects of the environment and of the economy and threatens the sustainable development of society. It is increasingly recognized that climate change affects the frequency and intensity of extreme weather events. The effects of climate change are visible worldwide, and it is being predicted that these effects will intensify in coming decades. Thus, climate change is not only a future problem, but an integral part of our present, with an impact on the economy and traditional development models. The temperatures in the Balkans are rising and are projected to continue rising in line with the expected increase in global temperatures. At the same time, precipitation in the region has seen a decline and is projected to decrease further, despite the fact that precipitation patterns will continue to vary depending on terrain, elevation and proximity to the sea. The effect of warmer temperatures on evaporation, together with the decrease in precipitation, will make the region hotter and drier.

Road infrastructure is extremely vulnerable to climate change. Higher temperatures can cause pavement to soften and expand, creating rutting, blowups, potholes and stress on bridge joints. An increase in the frequency of weather phenomena that pose a significant threat to road infrastructure is expected as a result of climate change, such as: floods, landslides, washouts and forest fires. **Adaptation measures are urgently needed, especially in the transport sector. The integration of climate change projections and resilience measures** in both the planning and implementation phase of large infrastructure projects will protect populations and the environment from further environmental degradation, while ensuring economic viability and the long-term sustainability of infrastructure

In view of the above defined needs, the ClimaProof Project *Enhancing Environmental Performance and Climate Proofing of Infrastructure Investments in the Western Balkan Region from an EU Integration Perspective* was launched in December 2016. The project is financed by the Austrian Development Cooperation (ADC) and implemented by the United Nations Environment Programme. ClimaProof's long-term objective is to contribute to the reduction of climate change risks in the WB region while raising awareness, strengthening capacities and creating an enabling environment for investment in green infrastructure. Through its three carefully designed components that build on each other, the project aims to improve the technical capacities of the WB (Albania, Bosnia and Herzegovina, Croatia, Kosovo*, Montenegro, North Macedonia and Serbia) in climate proofing their investments in road infrastructure while developing national and international frameworks by integrating European Union (EU) best practices.

Component 1 entails the strengthening of national capacities to better understand climate change and its related risks in the region by improving the information base. By developing several tools, ClimaProof aims to enable countries to use climate projections to plan for the most pressing climate change issues.

* *This designation is without prejudice to positions on status and is in line with UNSCR 1244 and the ICJ Opinion on the Kosovo Declaration of Independence.*

Component 2 focuses on strengthening national capacities to integrate climate change projections and climate proofing and green infrastructure in development at the regional and national level. Accordingly, background reports (focus reports and policy guidelines) have been prepared to better identify focal areas in the individual countries based on their needs.

Component 3 creates an enabling environment for regional cooperation and investment in climate resilient road infrastructure in the WB by empowering regional actors to take action and integrate climate proofing measures in existing and future infrastructure projects.

Figure 1: ZOI, Synthesis Report

This document is one of the strategic outputs of the ClimaProof project's Component 3 *Building infrastructure adapted to the future climate and weather patterns: creating an enabling environment for regional cooperation and investments in climate resilient infrastructure in the Western Balkans*.

The *Regional strategy for climate resilient road infrastructure* is the result of joint efforts and collaboration between WB stakeholders (representatives of the competent ministries of infrastructure, climate change, spatial planning and environment, representatives of the competent road directorates, etc.) and national and international consultants in collecting, reviewing and structuring the country-specific inputs that are presented and summarized in this document. Building

on the inputs received, this Regional Strategy aims to adapt road infrastructure in the WB to current and future climate conditions based on a set of regional tools, measures and recommendations. It seeks to complement national strategies and policy initiatives in the WB by integrating climate proofing in development projects, facilitating the process of planning climate-resilient infrastructure and selecting the appropriate funding sources.

It builds on the results of the previous Project Components 1 and 2, which entailed the preparation of climate projections – high resolution, localized, bias-corrected scenarios for the entire region (Component 1), and assessments of both the climate change adaptation policies and environmental impact assessment (EIA) and strategic environmental assessment (SEAs) procedures in place in the countries of the WB region (focus reports, one for each participating country, developed under Component 2).

The methodological approach of the *Regional Strategy* was based on close collaboration between the relevant WB stakeholders in the participating countries (through a number of meetings and events) in parallel with step-by-step capacity development activities based on the resulting feedback and inputs received. These activities were carefully tailored to follow the Strategy's substantive inputs, step-by-step. In the course of the preparation of this document, 18 official national and regional meetings (including capacity development components) took place, in addition to a number of unofficial, one-on-one national meetings, all of which were of an instructive and consultative nature.

Communication between the stakeholders and the coordination of feedback received was facilitated by the National Consultants (one in each of the countries included) whilst the capacity development programme was developed and delivered by the International Consultant. The International Consultant provided expertise in the two main pillars of Project Component 3: technical (climate resilient infrastructure) and financial (financing of resilient infrastructure).

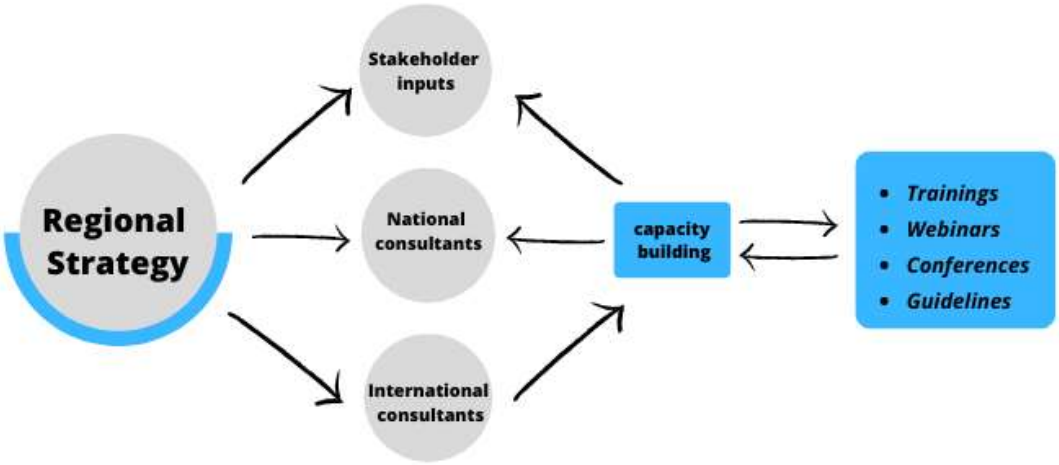


Figure 2: Preparation of the Regional Strategy

2 Climate change projections in the region (BOKU)

2.1 Climate of the observational period (1981-2010)

The impact of climate change on a specific area is highly dependent on the current climate conditions. The WB region covers a wide range of landscapes with very specific local climate conditions, and reaches from the coastal areas of the Adriatic Sea, the highly complex topography of the Dinaric Alps with elevations of up to 2,700 m, to the strongly continental-influenced lowlands of the Sava, Morava and Danube Rivers.

The annual mean temperature and annual precipitation shown in Figures 1 and 2 highlight the climate's strong spatial variability in the region. The highest annual mean temperatures of around 15 °C are recorded along the Adriatic coast, while Montenegro and Albania's highest average annual temperature may even reach 16 °C. The annual average temperature in the Dinaric Alps decreases by 6 °C per 1,000 m increase in elevation. In the lowlands of the Danube and Sava Rivers, the annual mean temperature is 13 °C, but the seasonal temperature distribution differs significantly compared to that of the Adriatic coast. The temperatures in the summer are similar in both regions, while temperatures at the coast in the winter time are much warmer and mostly remain above freezing. Along the Danube, Morava and Sava Rivers, the average minimum temperatures are below 0 °C during the winter months (December, January and February).

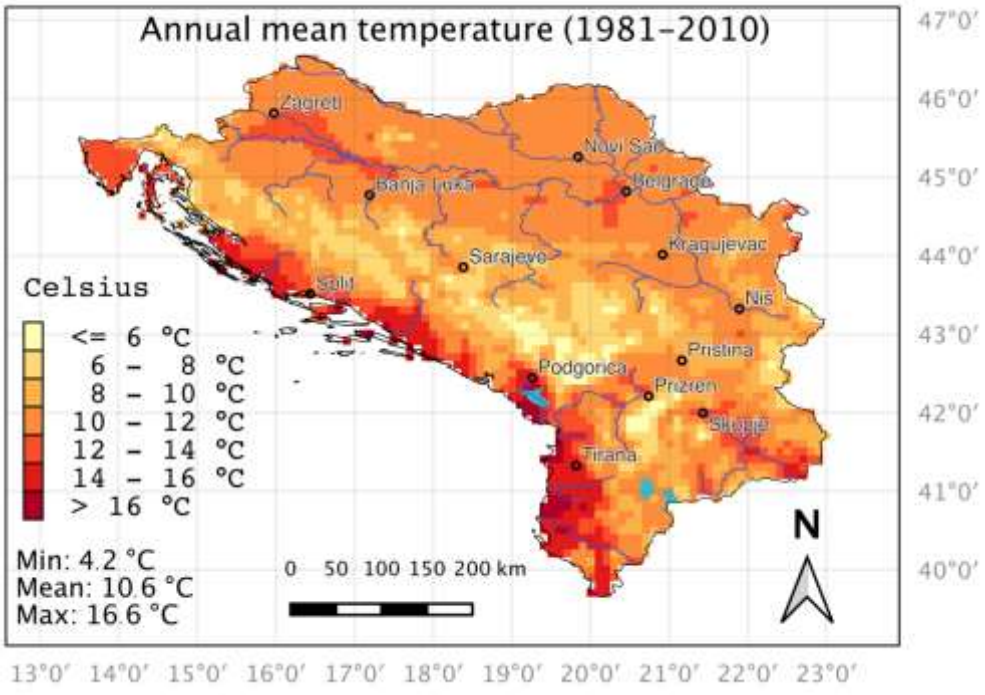


Figure 3: Annual mean temperature, averaged for the period 1981–2010 from observational data

The amount of precipitation shows even higher spatial variability than the temperatures. The Dinaric Alps are among the wettest areas of Europe, with large areas reaching over 1,500 mm of annual precipitation. The wettest areas are located in the mountains of Montenegro and in northern Albania,

where the amount of precipitation exceeds 2,000 mm annually. The main moisture source is the Adriatic Sea, with very pronounced luv-lee effects and strong spatial differences in precipitation. The amount of precipitation strongly decreases on the eastern side of the Dinaric Alps and the minimum precipitation along the Danube Valley is less than 750 mm.

The entire region is influenced by the Mediterranean climate with maximum amounts of precipitation recorded in the winter months and frequent hot and dry conditions during the summer months. In the region's coastal areas, all precipitation falls as rain, while in the Dinaric Alps, snowfall is quite frequent during the winter months, with the amount of snow the number of days with snow cover increasing at higher elevations.

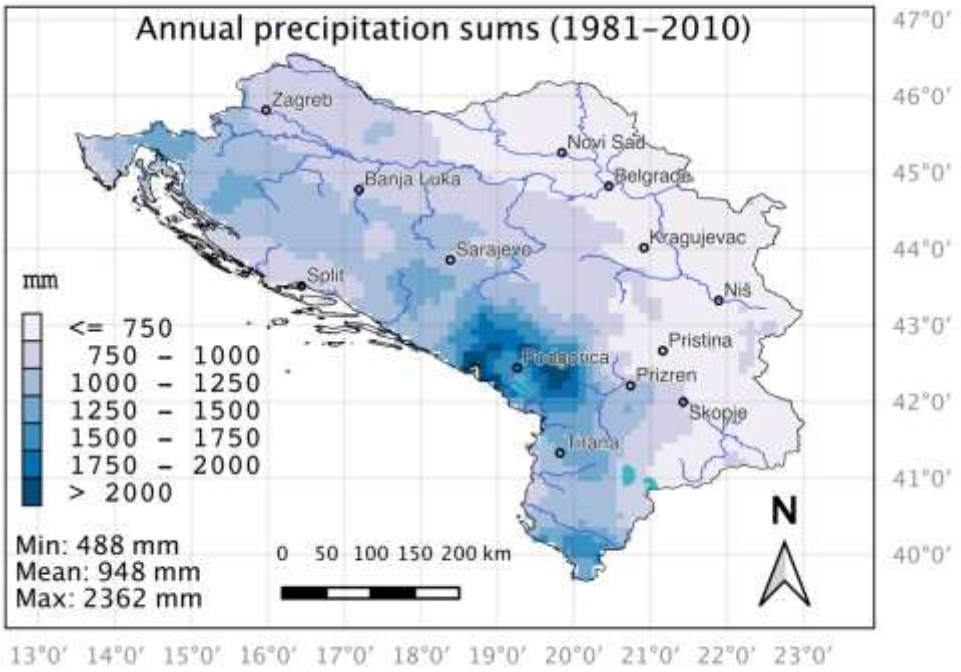


Figure 4: Annual amount of precipitation, averaged for the period 1981–2010 from observational data

2.2 Climate change scenarios

The impact of anthropogenic climate change will strongly depend on the future behaviour of humans and the level of greenhouse gas (GHG) emissions. Three different emission scenarios are illustrated in Figure 5. If we strongly reduce GHG emissions in accordance with the Paris Agreement (RCP 2.6, green), the annual mean temperature in the WB will continue rising by 0.5 °C until the middle of the century and then stabilize (Figure 5, left side). The amount of precipitation will also increase by between 5 per cent to 10 per cent and then stabilize (Figure 5, right side).

If we only moderately reduce GHG emissions (RCP 4.5, blue) the rise in temperature will not stabilize during the 21st century and global temperatures will increase by 2 °C over the current level. In this scenario, no clear trend for annual precipitation levels is evident, but most models expect a weak increase until the end of the century.

If we do not reduce GHG emissions (RCP 8.5, red), global warming will not only continue but will accelerate further in the second half of the 21st century, with global temperatures rising close to 4 °C at the end of the century. In this scenario, the amount of precipitation will decrease by 5 per cent in the second half of the century.

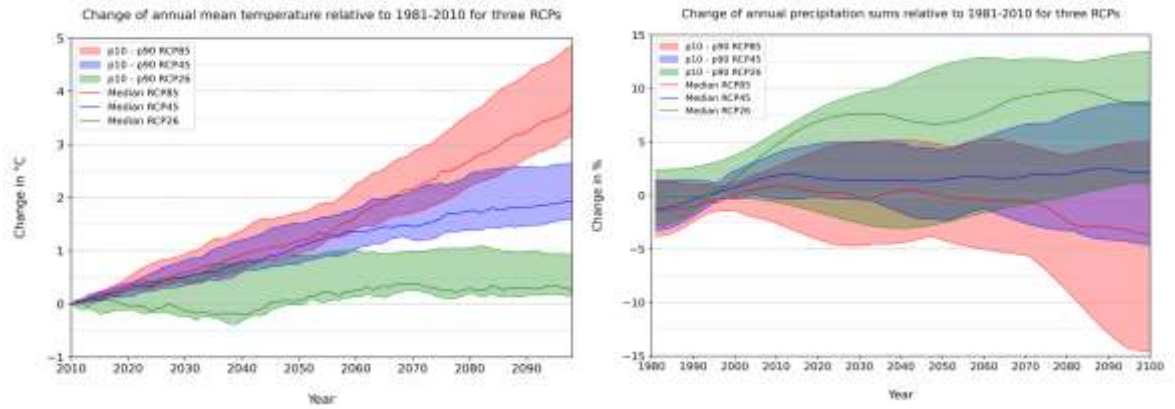


Figure 5: Climate scenarios for annual mean temperatures (left) and the amount of annual precipitation (right), averaged across the WB region. The time series show anomalies relative to the period 1981–2010 in °C (left) and per cent (right). Coloured areas represent values between the 10th and 90th percentile of all models under a certain RCP. The median of all models under this RCP is shown as a thick coloured line.

Figure 5 illustrates the average climate change trend for the entire WB region, but the changes are not homogeneous in space. Figure 6 presents the change in the annual mean temperature for the extreme scenario RCP 8.5 at the end of the 21st century compared to current climate conditions. The lowest level of warming will occur along the coast and the northernmost areas with values of around 3.5°C. In the southernmost area at the border with Greece, values of up to 4.5 °C will be reached.

In terms of precipitation, a north-south gradient is evident (Figure 7). In the northernmost area of the Danube and Sava Valleys, a moderate increase in the amount of precipitation will occur, while in the coastal areas, the Dinaric Alps and in particular along the border with Greece, the amount of annual precipitation will decrease by more than 15 per cent. This combination of higher temperatures and changes in precipitation provide some insights into the general change of climatic conditions in the region. To gain a better understanding of the effects of these changes, how they are influenced by the current climate and how they might impact the region's infrastructure, specific climate indicators are discussed in the next section.

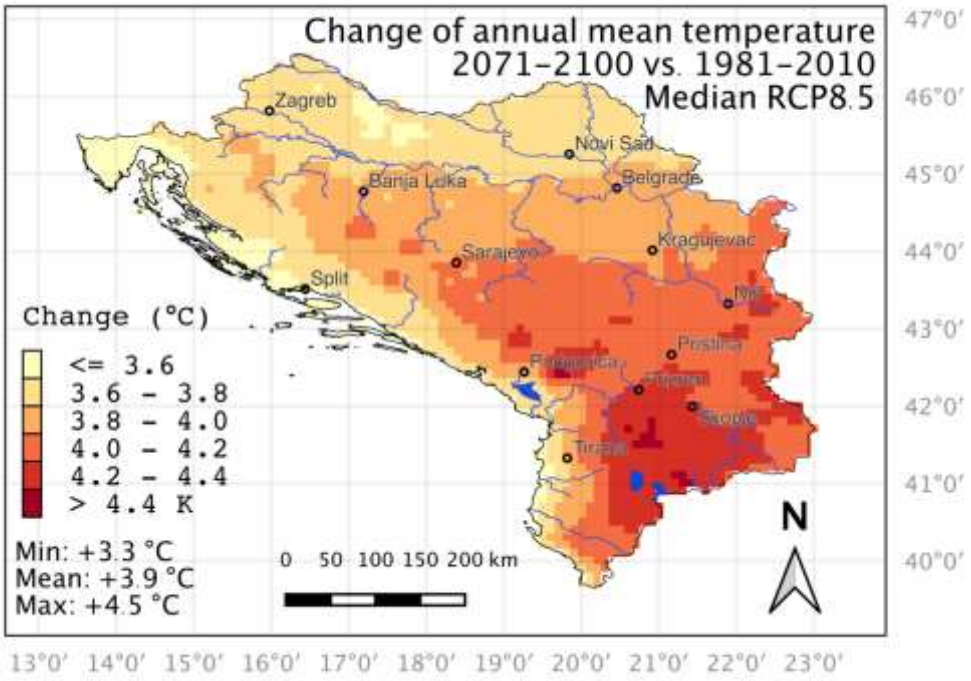


Figure 6: Climate change trend of the annual mean temperature for the periods 1981–2010 and 2071–2100. The values show the median of all climate scenarios under RCP 8.5.

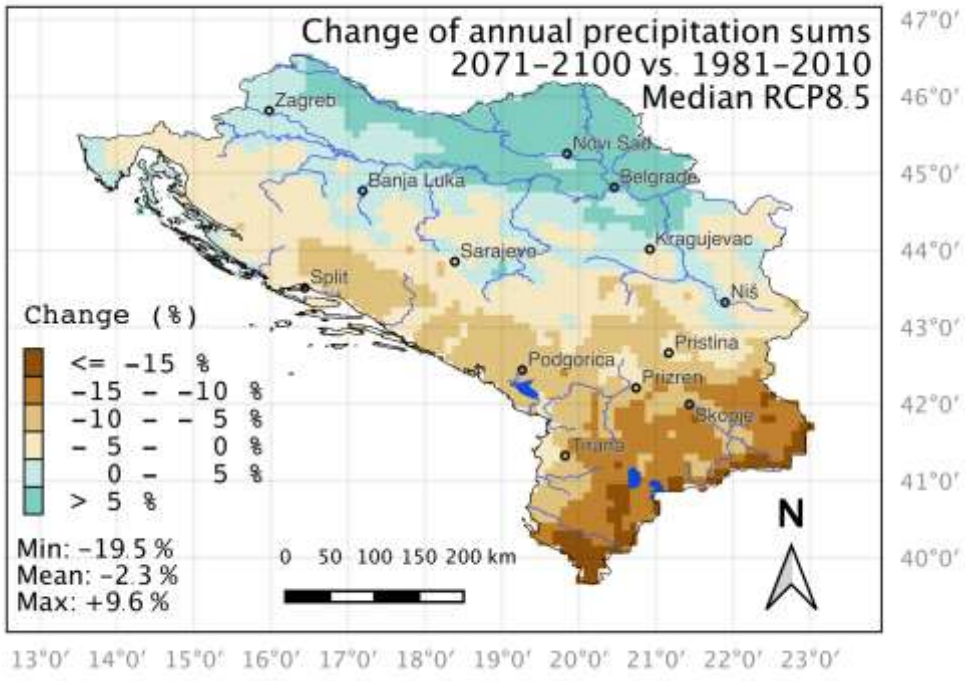


Figure 7: Climate change trend of the amount of annual precipitation between the periods 1981–2010 and 2071–2100 in per cent. The map shows the percentile change relative to the average amount of precipitation during the period 1981–2010 for the climate scenarios under RCP 8.5. A median is calculated from all of the models.

2.3 Climate indicators

In collaboration with local stakeholders, a series of relevant meteorological indicators were identified and calculated to determine current climate conditions and conduct future climate projections. These indicators provide insights on heat and drought conditions and the impact of extreme precipitation, wind, snow and freezing. Table 1 present the complete list of indicators and their definition. In the following section, we discuss four indicators as examples. Figure 8 illustrates the present situation of the four indicators to highlight the areas in which the specific process is relevant under the current conditions. The climate change trend for the extreme RCP 8.5 scenario up to the end of the 21st century is presented in Figure 9, illustrating where the most significant changes will occur. Figure 10 shows the temporal development of the indicators, averaged for the entire WB region throughout the 21st century for three emission scenarios, including climate model uncertainty based on ensemble analyses of the median and of the 10th and 90th percentile of all models.

Table 1: Climate indicators developed in the project

Indicator name	Climate Parameter	Definition	Timesteps
Droughts	**Pr**	*Consecutive 5- and 7-day periods of less than 1 mm of daily precipitation between April and September (days in periods, maximum period length)*	**Annual**
Droughts and Heat	**Pr, Tmax**	*Days during 5- and 7-day drought periods on which the daily maximum temperature exceeds 30°C*	**Annual**
Extreme Wind	**Wind**	*Days on which the 99.9-percentile of the daily mean wind speeds of the observation period 1981–2010 are exceeded*	**Annual**
Freeze-Thaw-Cycles	**Tmin, Tmax**	*Days with Tmin ≤ 2.2 °C and Tmax ≥ 0°C*	**Monthly**
Heat Days	**Tmax**	*Days on which the daily maximum temperature exceeds 30°C/ 40°C*	**Monthly**
Landslides	**Pr**	*Days on which precipitation intensity thresholds are exceeded based on the Moser-Hohensinn approach (M = 41.66 * (h-0.77) * h) for h = 24, 48 and 72 hours*	**Annual**
Precipitation Intensity	**Pr**	*99.9 percentile of daily amounts of precipitation (3-yearly event)*	**Annual for 30-year periods**
Snowfall	**Pr, Tmin, Tmax**	*Days with an amount of precipitation of more than 1 mm/ 10 mm and a daily mean temperature of <= 0°C*	**Monthly**

The “Droughts and Heat” index (8a, 9a, 10a) indicates areas with dry conditions in combination with high temperatures (Tmax ≥ 30 °C). Areas with high index values are prone to experiencing heat and droughts, which in turn has an impact on vegetation, such as forest dieback and wildfires.

The highest values under the current climate conditions are recorded along the Adriatic coast and in the Vardar Valley south of Skopje (Figure 8a), with 50 days of hot and dry conditions per year. the Danube Valley experiences over 20 such days annually. The average drought and heat index for the entire WB region is 15.8 days. During the 21st century, heat and droughts will increase in all three emission scenarios (Figure 10a). If the goals of the Paris Agreement are met (RCP 2.6), drought and heat days will increase by ~ 5 days, but even in the moderate emissions scenario (RCP 4.5), this value will double; in the extreme scenario RCP 8.5, this value will increase by ~35 days (230 per cent). In the extreme scenario (Figure 9a), the value will increase by at least 5–6 days throughout the entire region. The Danube and Sava Valleys will witness an increase in heat and drought days of 1 month, leading to widespread areas with absolute values similar to the most extreme areas under current climate conditions. In the coastal area and along the border with Greece, the value will increase by more than 50 days, leading to an absolute value of over 100 days of hot and dry conditions per year on average.

The extreme heat index for days with a maximum temperature greater than 40 °C (Figure 8b, Figure 9b, Figure 10b) indicates areas with extremely high temperatures which could have an impact on pavements and bridges. The Vardar Valley south of Skopje experiences extreme heat events every year under current climate conditions. In some parts of Montenegro and Albania as well as in the Morava Valley, such high temperatures occur every 3 to 5 years. This indicator increases in all emission scenarios but is still a rare event under RCP 2.6. Under RCP 4.5, such events would remain far below one event per year, on average, throughout the entire region. Under RCP 8.5, this changes dramatically, with an average increase to 2.5 events in the WB, which is much higher than the values in the currently hottest areas of the region. Temperatures above 40 °C will occur across the entire WB annually, except for the mountainous areas, and the hottest areas will experience more than 10 such events per year.

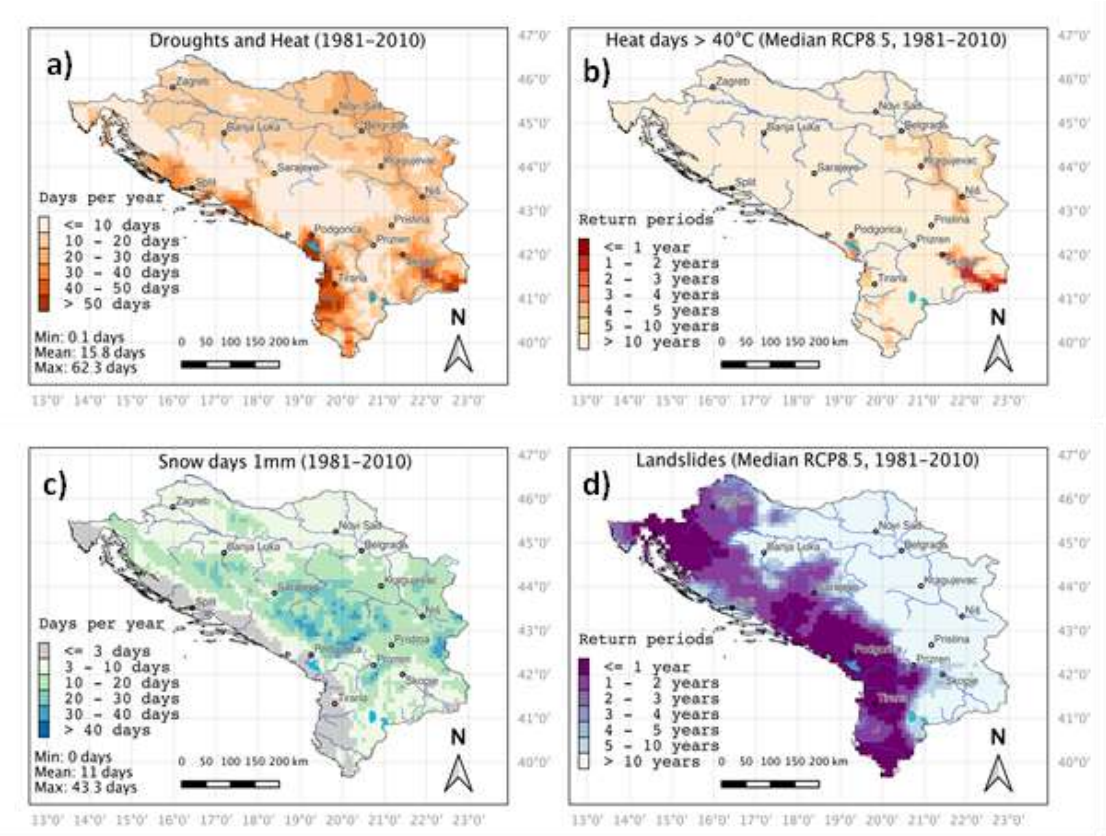


Figure 8: Four climate indicators developed in the project: a) Droughts and heat, b) Heat days of at least 40 °C, c) Snowfall days with at least 1 mm precipitation, and d) Landslides. The definitions of the climate indicators are listed in Table 1. Maps show values from observational data (a and c) and the median of climate scenarios under RCP 8.5 (b and d) averaged over the period 1981–2010. The maps on the left (a and c) show absolute days per year, those on the right (b and d) show return periods, meaning that the event occurs on average every [x] years.

The third indicator (Figure 8c, Figure 9c, Figure 10c) represents the number of days with snowfall of at least 1 mm snow water equivalent. Under current climate conditions, snow falls in the entire region, but is quite rare along the Adriatic coast and along the border with Greece at low elevations because it is too the. The Sava and Danube Valleys witness less than 10 snowfall days per year, the reason being the low frequency of precipitation events during the winter season, not the temperatures. In the mountainous areas, snowfall days at higher elevations exceed 40 days annually. The average number of snowfall days under current climate conditions is 11 days. The days of snowfall will decrease in all three emission scenarios. Under RCP 2.6, the spatial average will decrease by ~ 2.5 days; under RCP 4.5, the current snowfall days will reduce by more than half, and under RCP 8.5, snowfall will become a very rare event outside the mountainous areas below elevations of 1,000 m. The number of snowfall days will decrease by half even at very high elevations above 2,000 m in the mountainous areas.

The final indicator represents extreme precipitation events that may trigger landslides (Figure 8d, Figure 9d, Figure 10d). Due do the high precipitation rates in the Dinaric Alps and at the luv side of the Adriatic coast, such events occur once a year or more frequently. At the lee side east of the main ridge of the mountains, the values of this indicator drops sharply to less than once every ten years in the Sava, Danube, Morava and Vardar Valleys. No major differences will occur under the three scenarios; the increase in extreme precipitation events will be strongest under the RCP 2.6 scenario. This seems

to be related to the general precipitation trends under the different scenarios, with an increase in extreme precipitation under RCP 2.6, no change under RCP 4.5 and a decrease under RCP 8.5. Such events widely occur in the mountainous areas once a year. In the valleys east of the main ridge of the mountains, the return period increases to between once every 3 years up to once every 10 years.

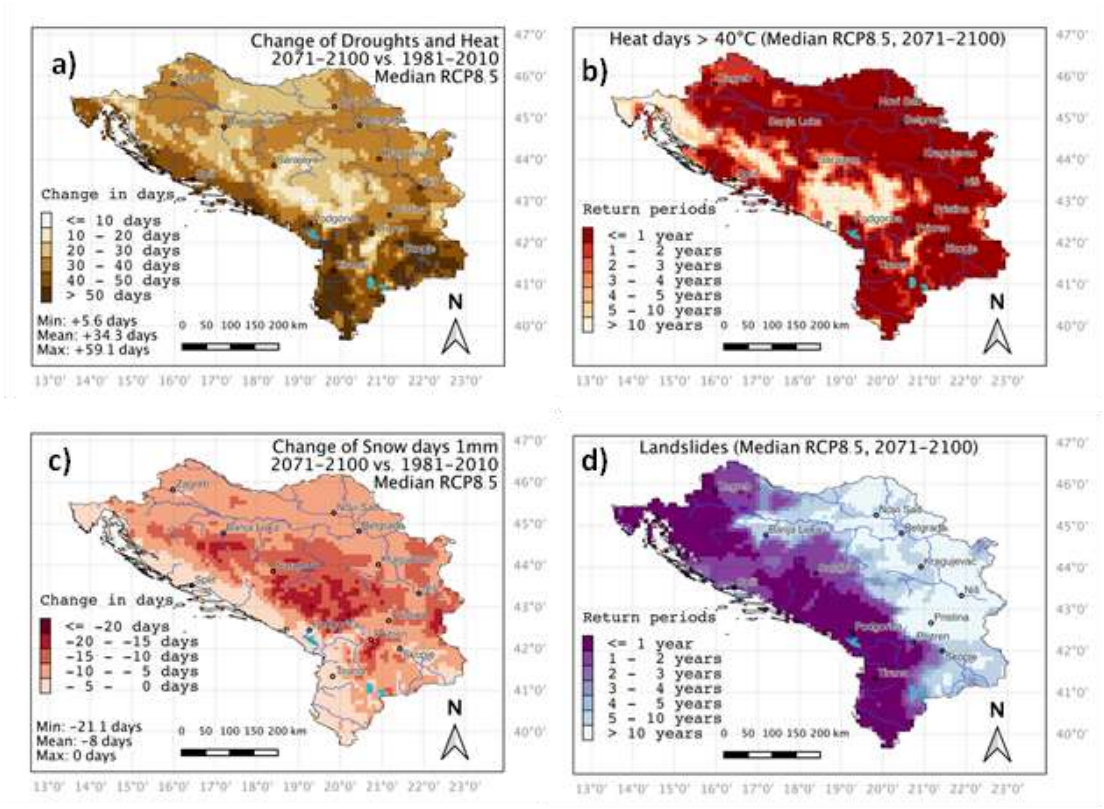


Figure 9: Climate change trend of the four indicators developed in the project: a) Droughts and heat, b) Heat days of at least 40 °C, c) Snowfall days with at least 1 mm precipitation, and d) Landslides. The definitions of the climate indicators are listed in Table 1. Maps on the left (a, c) show the absolute change in days between the periods 1981–2010 and 2071–2100 for the climate scenarios under RCP 8.5. Maps on the right (b, d) show return periods for the timeframe 2071–2100 for the climate scenarios under RCP 8.5 on the same scale that is used in Figure 6 (b, d) to make both timeframes directly comparable. All subplots show the median of climate scenarios under RCP 8.5.

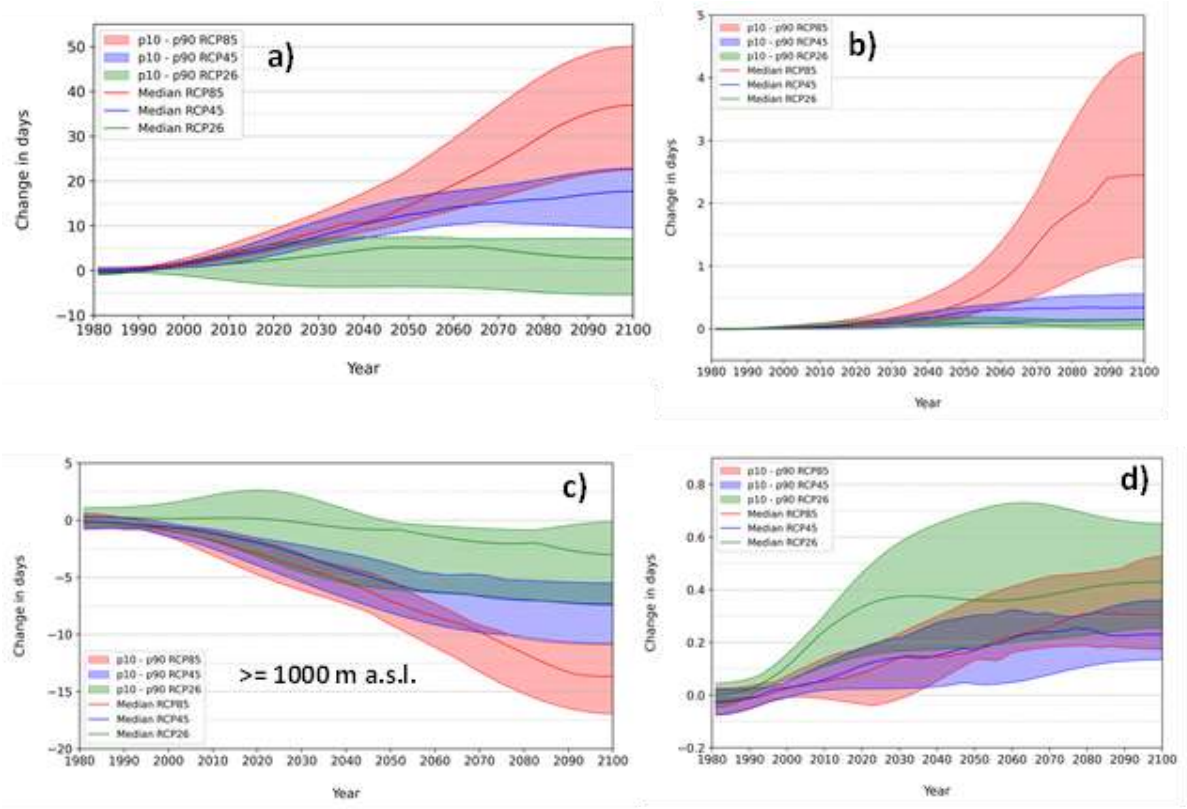


Figure 10: Climate scenarios for the four climate indicators developed in the project: a) Droughts and heat, b) Heat days of at least 40 °C, c) Snowfall days with at least 1 mm precipitation, and d) Landslides, averaged over the WB region. The values for c) only consider regions above 1,000 m. The definitions of the climate indicators are listed in Table 1. The time series show anomalies relative to the period 1981–2010 in absolute days per year. Coloured areas represent the values between the 10th and 90th percentile of all models under a certain RCP. The median of all models under this RCP is shown by the thick coloured line.

The four selected indicators highlight the ability of these climate-based indicators to identify areas vulnerable to specific developments under current climate conditions as well as to quantify the impact of climate change on these developments. In general, climate change will exacerbate extreme events in most areas of the WB region, particularly extreme drought- and heat-related events.

3 Vulnerability of road infrastructure to climate change

3.1 Albania

The overall length of the road network in Albania amounts to approximately 18,000 km. The main network consists of the national road network of 3,700 km, managed by the Ministry of Infrastructure and Energy (MIE) through the Albanian Road Administration (ARA). The national road network can be divided into a primary network of around 1,370 km, and a secondary network of about 2,100 km, while the remaining 230 km are newly planned roads.

The national road network under the jurisdiction of ARA also includes a total of 590 bridges (each bridge has an overall length of over 10 m) and over 3,000 culverts. This network carries most of the country's traffic, an average of 6,700 vehicles per day for primary and primary secondary roads, and 1,705 vehicles per day for the rest of the network.

Figure 11: Map of Albania's primary and secondary road network[1]

The International Disaster Database shows that floods accounted for the major share of natural disaster events (38 per cent) during the period 1979–2019, followed by earthquakes (15 per cent). According to the annual World Risk Report, which calculates the Disaster Risk Index for 180 countries based on exposure, susceptibility, vulnerability and coping and adaptive capacities, Albania ranks first in Europe and 61st in the world. 86 per cent of the total territory of Albania is prone to natural disasters; this area generates 88.5 per cent of the country's gross domestic product (GDP). Average annual losses due to natural disasters amount to around 2.5 per cent of GDP, or about USD 68.7 million per year. Albania experiences approximately one natural disaster annually.

[1] Deltares, Climate Resilient Road Assets in Albania, 2018.

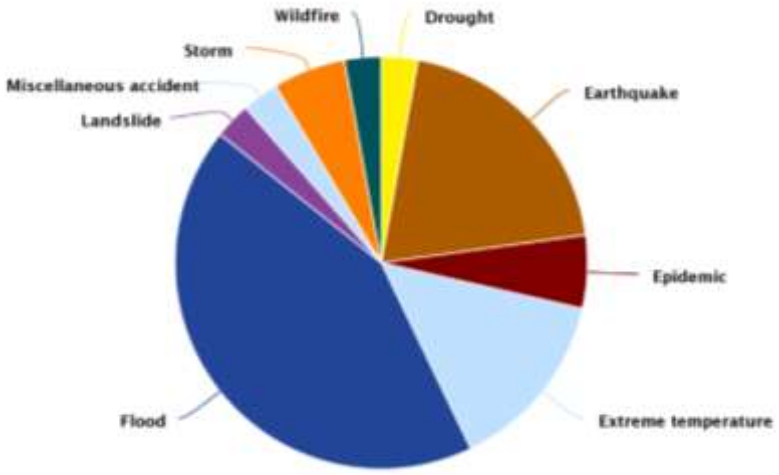


Figure 12: Average natural hazard occurrence in Albania for the period 1980–2020[2]

This highlights the need for Albania to take a proactive approach to minimize the risk of exposure to such events through various adaptation mechanisms. Albania's most common natural hazards include floods, storms, droughts and sea level rise. According to the *Climate risk country profile for Albania*, the key observations in relation to vulnerability are as follows:

- Intense rainfall events caused by strong storms in addition to poor land use practices and increasing deforestation, which may lead to severe and damaging floods across the country.
- Heavy seasonal rainfall and resultant floods have had an impact on the country over the past three decades. Between 1980 and 2010, 9 floods and 2 storms affected over 600,000 people, causing economic damages of more than USD 24 million.
- Coupled with excessive pumping of groundwater, over-exploitation of surface and groundwater for municipal use and saltwater intrusion into the aquifer system from the projected sea level rise poses a severe risk to the country's urban areas.
- Road, water and electric energy supply infrastructure have suffered damages every year, especially due to sea surges (as a result of storms and high tides) and river flooding during frequent and often intense rainfall periods.

[2] World Bank.

Table 2: Natural disasters in Albania, 1900–2020[3]

Natural Hazard 1900–2020	Subtype	Events Count	Total Deaths	Total Affected	Total Damage ('000 USD)
Drought	Drought	1	0	3,200,000	0
Earthquake	Ground Movement	6	47	8,429	0
Epidemic	Viral Disease	1	7	66	0
Extreme Temperature	Heat Wave	2	3	150	0
	Severe Winter Condition	3	79	237,085	0
Flood	Coastal Flood	1	0	8,000	0
	Flash Flood	2	12	56,002	15,900
	Riverine Flood	8	4	134,484	17,673
Landslide	Avalanche	1	57	26	0
Storm	Convective Storm	2	8	525,000	0
Wildfire	Forest Fire	1	0	75	0

Nearly 5,000 households in Albania were damaged by floods due to torrential rainfall in December 2017. Around 600 families are still homeless after being forced to evacuate their homes. Over 100 road sections and dozens of bridges were damaged, along with infrastructure such as power and water supply stations. According to the latest assessment, an area of around 15,000 hectares was under water.

[3] Climate risk country profile Albania, WB, 2021.

Figure 13: Flooded areas in Albania, 2017

The 2019 earthquake damaged 1,528 buildings and destroyed 50 residential buildings, 34 schools, 13 public university buildings, one health care centre and two bridges.

Figure 14: Damaged roads and other infrastructure in Albania after the earthquake, 2019

3.2 Bosnia and Herzegovina (BiH)

The total length of BiH's road network amounts to 24,796 km. The main network consists of 3,970 km of roads (16 per cent), of which 128,7 km are classified as motorways (120 km of motorways and 28.7 km of roads reserved for motor traffic), which meet high quality standards (2x2+1 emergency lane). Secondary/regional roads with a total length of 4,611 km make up a total of 18.6 per cent of BiH's road network; the largest share of the country's road network with a length of 14,200 km (57.3 per

cent) consist of local roads.[4] According to the Framework Transport Strategy of Bosnia and Herzegovina for the period 2016–2030, the road network's critical sections are many main and regional roads that require significant interventions; traffic bottlenecks in larger cities; critical factors in the road network including black dots, poor geometry, level of the country's development which does not allow proper reconstruction as well as the fact that a significant section of local roads are still unpaved.

Figure 15: Map of BiH's road network

BiH experiences floods, earthquakes, droughts and landslides. The country is particularly vulnerable to extreme precipitation and river basin flooding, resulting in very high financial losses, damage to infrastructure and food insecurity. More than 20 per cent of BiH's territory is prone to flooding; on average, flooding affects about 100,000 people and causes losses of about USD 600 million in GDP annually. In 2014, unprecedented rainfall affected 25 per cent of the population and severely disrupted the economy. River floods inundated fields in 81 municipalities, with severe consequences to population employed in the agricultural sector, which accounts for 20 per cent of the country's total workforce. Flooding also triggered more than 3,000 landslides, impacting nearly 15 per cent of GDP. BiH also faces seismic risks; its predominantly mountainous geography, aging infrastructure and high urbanization rate are the main causes for BIH's vulnerability to earthquakes and consequentially to landslides. In 1969, a magnitude 6.0 earthquake resulted in 14 deaths and over USD 300 million in damages. It is estimated that the same earthquake occurring today would cause over 400 deaths and more than USD 4 billion in damages.[5]

[4] Council of Ministers BiH, Framework Transport Strategy of Bosnia and Herzegovina, 2016–2030.
[5] World Bank, 2021, Diagnostic Report Emergency Preparedness and Response Assessment for Bosnia and Herzegovina.

The following figures present hazard maps for BiH. Nine out of 143 municipalities in BiH are currently categorized as being at very high and high risk of flooding and 13 are categorized as municipalities with a very high and high risk of landslides. Southwest BiH has the highest degree of risk in terms of earthquakes and fires. These maps should be used in the risk assessment process when considering road rehabilitation and construction.

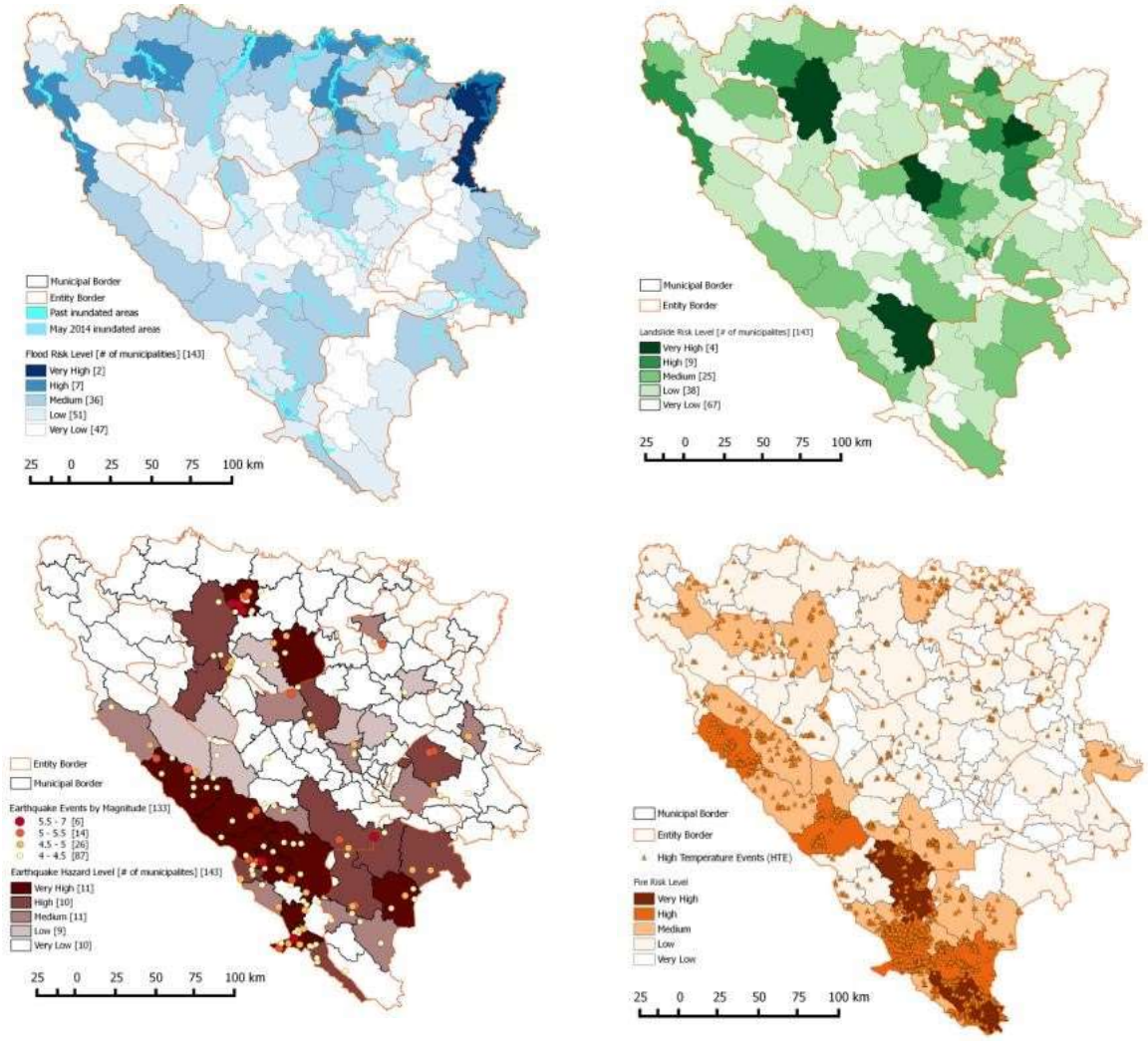


Figure 16: Hazard maps of Bosnia and Herzegovina: flood (blue); green (landslide); earthquakes (brown) and fire (orange)

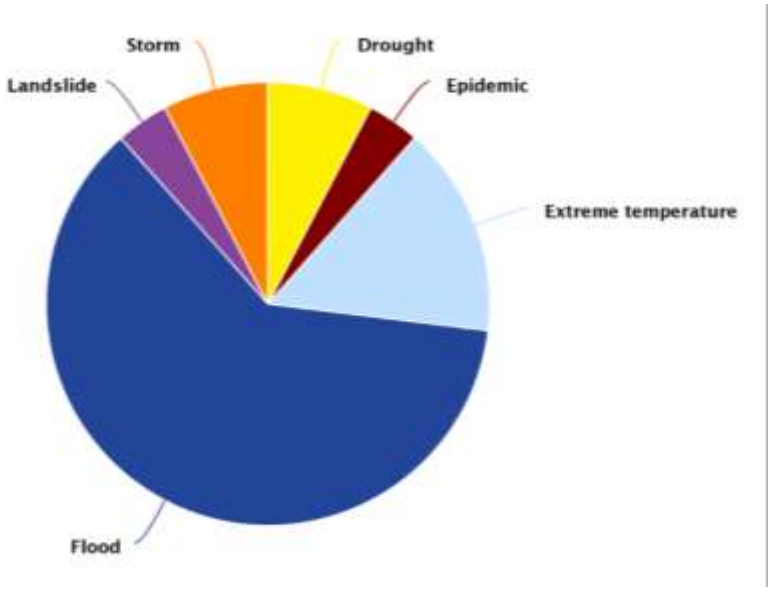


Figure 17: Most frequent natural disasters in Bosnia and Herzegovina for the period 1980–2020[6]

The projected climate change impacts are increasing BiH's vulnerability to natural hazards, including droughts, heat waves, heavy precipitation, landslides and floods. The most common natural disasters are associated with heavy rainstorms that may cause mudslides and flooding of large areas of agricultural land, affecting houses and industrial buildings, and leading to other detrimental changes of the environment. According to the World Bank Climate Knowledge Portal, the key observations are as follows:

- Precipitation patterns and increased variability, land use, wind, glacial and snow melt will affect the country's river systems. BiH has experienced catastrophic floods with increasingly dangerous and disruptive flooding and heavy rainfall, leading to built-environment destruction, fatalities and significant economic losses. BiH's most common natural disasters include heavy rainstorms, mudslides and landslides.
- Flooding, land use change, increased aridity and deforestation are impacting land stability, particularly in BiH's central, northern and eastern zones. This results in a high degree of vulnerability to and risk of landslides.
- Climate change threatens to exacerbate hydrometeorological risks such as recurring floods and drought. Prolonged drought is projected to exacerbate forest fires and shorten growing seasons.
- Given the country's number of rivers, catchments and aquifers, changes to precipitation may also result in high-risk flooding scenarios. The river flood hazard is classified as high for BiH, with potential for damaging river floods occurring across the country.

The frequency and intensity of natural hazards has already increased in BiH, evidenced by more frequent floods, e.g. in 2014, resulting in 20 deaths, 90,000 displaced persons and billions of dollars in damages. Floods in BiH represented over 50 per cent of internationally reported hazard losses

[6] Source: World Bank.

between 1990 and 2014, followed by extreme temperatures and droughts. Similarly, floods caused 62.2 per cent of mortality cases and 63.7 per cent of economic losses over the same period. The average annual loss due to floods in BiH was around USD 55 million.

Photographs that show the severity of these events in some of the selected road sections are shown below.

Figure 18: M18_007 Živinice 1 – Vitalj Flooding 14.05.2014 (left); M18_008 Vitalj – Olovo landslide 17.05.2014 (right)[7]

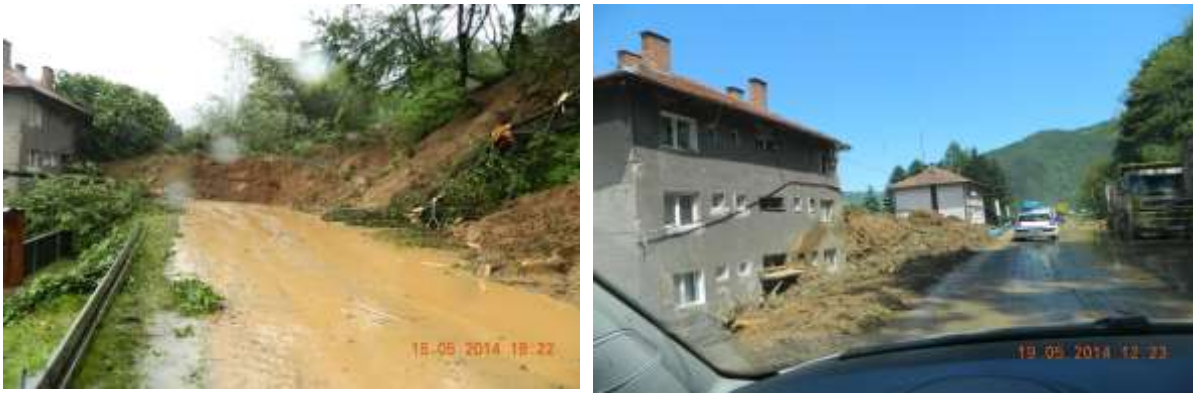


Figure 19: M17 006 Ozimica - Topčić polje landslide 15.05.2014 (left); M17 006 Ozimica - Topčić polje landslide 19.05.2014 (right)[8]

[7] JP Ceste Federacije BIH.
[8] Ibid.

Figure 20: M4 009 Doboj - Donja Orahovica Flooding 20.05.2014 (left); M4 009 Doboj - Donja Orahovica flooding 06.08.2014 (right)[9]

Figure 21: M17 005 Karuše - Ozimica landslide 19.05.2014 (left); M17 005 Karuše - Ozimica flooding 06.08.2014 (right)[10]

Figure 22: M5 016 Azize Šaćirbegović - Korija – Ljubogosta Landslide/rockfall 11.07.2013. (left); M16 006 Crna Rijeka - Jajce Jug road subsidence 08.08.2014 (right)[11]

[9] Ibid.
[10] Ibid.
[11] Ibid.

Figure 23: M16 006 Crna Rijeka - Jajce Jug rockfall 04.12.2013 (Source: JP Ceste)

Data from the Emergency Event Database: EM-Dat, presented in Table 3, show that the country has experienced various natural hazards, including droughts, epidemic diseases, floods and landslides.

Table 3: Natural disasters in BiH, 1900–2020

Natural Hazard 1900–2020	Subtype	Event Count	Total Deaths	Total Affected	Total Damage ('000 USD)
Drought	Drought	2	0	62,675	298,000
Epidemic	Viral disease	1	0	400	0
Extreme Temperatures	Cold wave	2	6	10,347	0
	Heat wave	1	0	0	0
	Severe winter conditions	1	1	10,000	0
Flood	Flash flood	2	0	0	0
	Riverine flood	11	29	1,329,340	523,580
Storm	Convective storm	1	4	0	0

3.3 Kosovo*

Kosovo's* road infrastructure is suitable for conducting various business activities. The road network consists of 630 km of main roads. The country's road infrastructure is well developed and the roads are generally in very good condition. Many major roads connect Kosovo's* major cities. The road that connects Kosovo* with Albania, e.g. is a 4-lane highway. The highway passes through a 5.5 km-long double-bore tunnel across Mt Runes. Kosovo's* Route 6 highway links Pristina with North Macedonia. This is the first third of the 60 km highway that will eventually connect Kosovo's* capital Pristina with neighbouring North Macedonia. The Kosovo*-North Macedonia highway project entails the upgrading

* *This designation is without prejudice to positions on status and is in line with UNSCR 1244 and the ICJ Opinion on the Kosovo Declaration of Independence.*

to the motorway standards of the existing road between Skopje and Blace, from Stenkovec Interchange (Skopje bypass) to Blace, the border crossing point between Kosovo* and North Macedonia. This road is part of the indicative extension of the TEN-T core network (Orient/East-Med Corridor) in the WB, Route 6a, which runs between Ribarevina (Montenegro), Ribarice (Serbia), Prishtina and onwards to Skopje, connecting Routes 4 and 7 with Corridor VIII. This investment plays a crucial role in the economic and social development of the north-eastern region of the country, and will facilitate international transport and trade in the region by linking domestic markets to the Port of Thessaloniki.

Figure 24: Kosovo's road network map*

Kosovo* is exposed to both hydrometeorological and geological hazards, namely floods, heavy snowfall, droughts, forest fires and earthquakes. Flash floods are common in mountainous areas, sometimes leading to mudslides. Kosovo* is also exposed to landslides, particularly Mitrovicë, Prishtinë, Peja and Shtërpcë. At least one quarter of the communities are vulnerable to landslides and rock falls. Other hazards that threaten Kosovo* are riverine floods (in plains) and cloudbursts (in Prishtinë, Mitrovicë, Podujevë and Gjakovë due to the structural vulnerability of dams in these areas). In some highly exposed river basins (such as the Drini Basin in the western half of the country), floods occur every two to three years. Between November 2007 and June 2008, three floods displaced 3,500 people, causing damage to homes and agricultural land, eventually necessitating humanitarian

* *This designation is without prejudice to positions on status and is in line with UNSCR 1244 and the ICJ Opinion on the Kosovo Declaration of Independence.*

assistance from the international community. Seasonal fluctuations in precipitation can severely affect agricultural production in regions that depend on rainfall for growing crops and have no alternative irrigation system. Kosovo* has experienced several droughts in the last two decades (in 1993, 2000, 2007 and 2008). In 2000, moderate to severe droughts affected most of the territory of Kosovo*. Since 2004, 80 per cent of Kosovo's* municipalities have, at one time or other, suffered from water shortages owing to inefficient water management systems. Forests comprise 43 per cent of the territory of Kosovo* and are especially prone to fires during the dry summer season. Since 2000, the number of forest fires has increased; fire brigades and other relevant operational teams carry out 2,000 to 3,000 interventions in a single year. It is anticipated that exposure to hazards such as droughts, floods and wildfires will increase due to climate change and a greater frequency of extreme climate events is expected. [12]

The January 2021 floods were caused by heavy rainfall and increased snow melt due to a sudden rise in temperatures. Many riverside roads were inundated, bridges destroyed, water supplies interrupted (in Pristina, Drenas, Obiliq). Residents of Fushë Kosovë, Gjilan, Malishevë and elsewhere had to be evacuated.

Figure 25: Road status after floods in 2021[13]

Heavy rainfall and snow caused floods in many villages and cities throughout Kosovo* in 2010, including Prishtina, Kamenice, Viti, Gjakova, Dragash and Skenderaj and their surrounding villages. Some of the villages are located in the rural and poorer areas of Kosovo* and floods are an additional burden in their already difficult situation. The increased water levels of the Rivers Morava e Binqes, Kaqareva, Krena, Ereniku and Prishtevka damaged houses and personal belongings, agricultural land and equipment.[14]

[12] World Bank, 2021, Diagnostic Report Emergency Preparedness and Response Assessment for Kosovo.
[13] pristinainsight.com
[14] DREF Operation, 2010, Kosovo Floods.

Figure 26: Road status after floods in 2010

Kosovo's* worst earthquake since 1900 occurred in 1911. Its epicentre was in Ochrida, which is now North Macedonia.

The recent July–August 2021 fires consisted of around 473 active sources across the Pejë Prizren, Gjilan and Mitrovica regions. Such fires further deplete forests, Kosovo's* most important resource in reducing carbon dioxide and fighting climate change.

The drought of July 2017 decreased agricultural production, specifically cereals (by 20-30 per cent) and maize (by 60 per cent). The estimated EUR 13 million in damages were far from covered by the EUR 500,000 allocated for agricultural damage compensation, leaving many farmers destitute.

The reports on the main hazards and the most vulnerable roads segments have been submitted to the Ministry of Environment and Spatial Planning of Kosovo*. These data should be used to create a server and database of the tracked impacts of natural hazards on both society and the economy; moreover, hazard maps should be developed and updated. The server could be developed in a way to allow all institutions involved access to upload and read data, whilst allowing automatic inclusion of data on a map. Thereby, all stakeholders can monitor and track the actual situation.

3.4 Montenegro

Montenegro is a tourism-oriented country, and a large part of its economy depends on the unrestricted flow of people and goods along its road network.
Montenegro's road network consists of 2,100 km of state roads that are divided into three groups:

- Highways: 52 km;
- Trunk roads: 950 km;
- Regional roads: 1,110 km.

* *This designation is without prejudice to positions on status and is in line with UNSCR 1244 and the ICJ Opinion on the Kosovo Declaration of Independence.*

* *This designation is without prejudice to positions on status and is in line with UNSCR 1244 and the ICJ Opinion on the Kosovo Declaration of Independence.*

Unreliable roads would have significant consequences for Montenegro's economic growth. At the same time, fast and uninterrupted transport plays a crucial role in building climate-resilient communities and enhances tourist inflow during the summer and winter seasons.

Figure 27: Map of Montenegro's road network

The main natural hazards Montenegro faces are floods and earthquakes. Flooding affects 10,000 people, on average, annually and causes a loss of around USD 90 million in GDP. Over the past 20 years, Montenegro has seen six destructive floods; the three most destructive ones occurred in 2000, 2010 and 2011. Earthquakes affect around 9,000 people, on average, and cause damage of approximately USD 70 million in GDP annually. The most devastating earthquake occurred in 1979 and remains etched in national memory as a watershed event. It is still used as a baseline in discussions on emergency preparedness and response (EP&R). In addition, Montenegro is susceptible to heavy rainfalls, flash floods (typically in urban areas), melting snow, landslides and wildfires. These events have an impact on settlements, industrial facilities and agricultural land. Despite the country's limited share of agricultural land, agriculture is still the most important sector for those residing in rural areas. Forests cover about 60 per cent of Montenegro's territory, and the country takes pride in its coastline which is key to its tourism industry; hence, wildfires and maritime incidents are notable hazards. The most vulnerable areas include the Skadar Lake region, the Bokana River and the capital, Podgorica, because of its dense population. River valleys are relatively small but home to the largest settlements.[15]

[15] Diagnostic Report Emergency Preparedness and Response Assessment for Montenegro, World Bank, 2021.

Figure 28 shows the level of GDP by province in Montenegro, with greater colour saturation indicating higher GDP level within a province. The blue circles indicate the risk of floods and the orange circles indicate the risk of earthquakes in terms of normalized annual average of affected GDP. The largest circles indicate the greatest normalized risk. The risk is estimated using flood and earthquake risk models. In relative terms, the province with the greatest flood risk is Bijelo Polje, and that with the greatest earthquake risk is Budva. In absolute terms, the province with the greatest risk of both floods and earthquakes is Podgorica.[16]

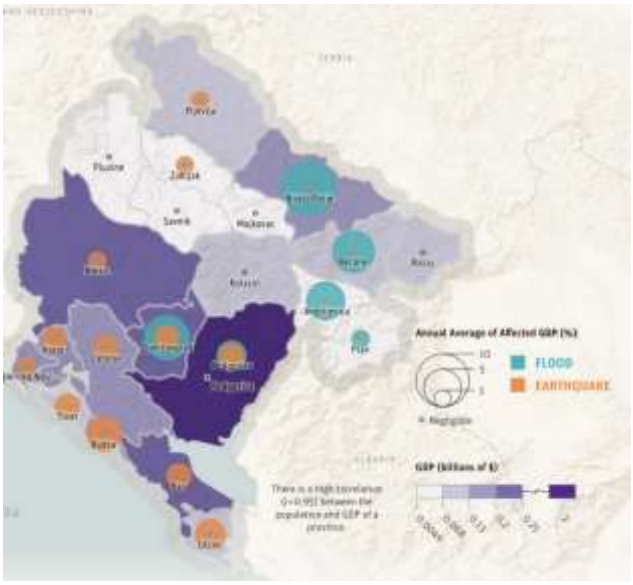


Figure 28: Flood and earthquake risk map for Montenegro[17]

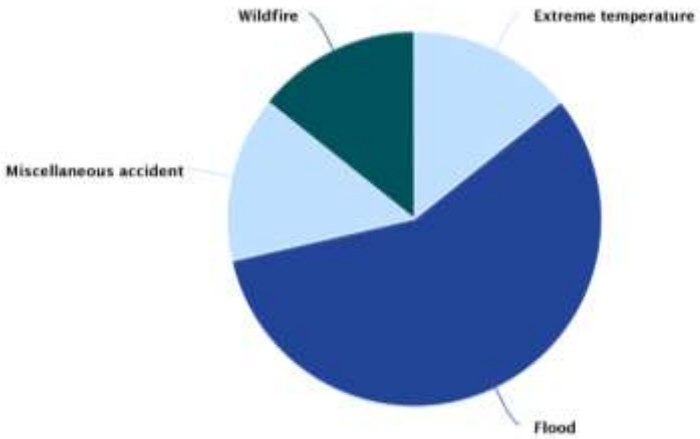


Figure 29: Most frequent natural disasters in Montenegro for the period 1980–2020[18]

[16] Disaster Risk Profile for Montenegro, World Bank.
[17] World Bank, 2017.
[18] Ibid.

Based on recent projections and the current situation, the forecast for natural hazards can be described as follows:

- Pluvial flooding, fluvial flooding – taking into consideration that no clear pattern is evident for an increase or decrease in precipitation/m^2, it should be noted that the last devastating flood occurred in 2010, yet several areas in Montenegro are severely affected by flooding, namely:
    - Municipality of Cetinje: locality "Zabljak Crnojevica" due to the high level of the Skadar Lake;
    - Municipality of Podgorica: region of Zeta due to the high level of the Skadar Lake;
    - Municipality of Danilovgrad: Danilovgrad due to the high level of the River Zeta and of the Skadar Lake;
    - Municipality of Niksic: region of "Strasevina" and "Klicevo" due to the high level of the artificial lakes "Slano" and "Krupac";
    - Municipality of Berane: due to the high level of the River "Lim";
    - Municipality of Bijelo Polje: due to the high level of the River "Lim".
- Landslides and rock falls that block roads and railways in Montenegro occur almost every year. Bearing in mind the vulnerability of the main and regional road network as well as the railway network in Montenegro and already formed landslides/rock falls along major roads, the scale and potential causes of new volatilities need to be considered. By taking appropriate action, the risk of landslides can be easily managed.
- Coastal flooding is directly connected with the tide levels of the Adriatic Sea during situations of excessive rainfall. Bearing in mind the factual rising of sea levels, this is a crucial issue to take note of in future. More precisely:
    - Municipality of Kotor, location: old town, due to the high level of the Adriatic Sea during high tide in parallel with high levels of precipitation;
    - Municipality of Kotor, location: Risan, due to the high level of the Adriatic Sea during high tide in parallel with high levels of precipitation.
- Heat waves are especially prevalent in the region of Podgorica but also occur in the seaside region of Montenegro. Temperatures are reaching over 40 °C in the shade which translates into approximately 70 °C on the asphalt.
- Wildfires are present in Montenegro during periods of low precipitation levels. They often occur in early spring or during the summer. Wildfires usually occur in uninhabited areas where roads are afflicted by rock fall from the slopes or burned trees falling on roads.
- Heavy snowfall is very common and occurs nearly every year in the northern part of Montenegro. It is not unusual for the municipalities of Pljevlja, Zabljak, Savnik, Pluzine, Kolasin, Mojkovac and Rozaje to experience heavy snowfall from the month of December up until the end of March.
- Avalanches also occur in specific locations and under specific weather conditions (sudden rise in temperature after heavy snowfall):
    - Municipality of Pluzine, location: national road M-3 section Scepan polje – Pluzine;
    - Municipality of Mojkovac, location: regional road R-3 section Mojkovac - Djurdjevica Tara.
- Landslides also occur as a result of an increase in the level of saturation of soil following a rise of underground waters resulting from seismic activity. The threat of landslides can be managed more effectively when appropriate action is taken.

Figure 30: Landslide on the main road Cetinje Budva, 2015

- Earthquakes occur in Montenegro as well. Since Montenegro is positioned on the Balkan tectonic plate, which is in constant motion, earthquakes are constantly being registered. The largest earthquake occurred in 1980, and it was catastrophic, with human casualties and severe material damage to the cities of Herceg Novi, Kotor, Budva, Tivat and Bar. The earthquake caused over 120 fatalities and close to USD 13 billion in damage. Other earthquakes that had a serious impact in Montenegro during the 20th century were the earthquakes in 1905 and 1968.

The floods in 2010, which the country's government declared to be the "worst floods ever recorded", affected over 5,000 people in Montenegro. In 2014, another devastating flood affected Montenegro, although its impacts have not yet been fully quantified. During the 2010 flooding, numerous local roads were closed and many villages were cut off from the rest of their municipalities. Several bridges (in Bijelo Polje, in Berane and in Andrijevica) were damaged. The main road Podgorica – Nikšić was closed for traffic because it had been completely flooded. Heavy rains that lasted over one month caused floods across Montenegro. In total 6,630 persons (1,600 families) were evacuated from their homes.

Figure 31: Flooding in Montenegro in 2010

A database of historical road damage and hazardous events would be useful to evaluate the current climatic situation and status of roads. Unfortunately, the operators of the national road network in Montenegro do not systematically register this type of nor in a database format. The data that can be

obtained from the Transport Administration of Montenegro, "Monteput AD" and the National Weather Institute of Montenegro as well as from the Directorate for Emergency Situations is only relevant for time periods in which road damage occurs, i.e. during the occurrence of a specific natural hazard.

Since there is a clear need for a systematic approach to the collection of historical records of road damage to fight the effects of climate change, a proposal for the road network operators in Montenegro will be submitted, addressing the need to develop and implement a functional database for historical records of road damages as a result of climate change.

The road authorities' current practice to deal with the impact of natural hazards on the road network and its assets is based on the preparation of reports on the conditions of roads. The reports are prepared daily by the maintenance contractor (Crnagoraput AD Podgorica). Unfortunately, the said reports are not being analysed or organized in any type of database.

3.5 North Macedonia

The Republic of North Macedonia has a surface area of 25,713 km and a population of 1,836,713 according to the most recent census of 2021.

North Macedonia has a road network with a current total length of 14,182 km and consists of 242 km of motorways, 911 km of national roads, 3,771 km of regional roads and 9,258 km of local roads. The country's road network represents a solid starting point for the country's further development.

North Macedonia is strategically positioned on the Balkan Peninsula and two of the Trans-European Corridors, i.e. Corridors VIII and X, intersect it, thereby providing a connection to neighbouring countries and connecting Europe with the Middle East. Furthermore, the road network of North Macedonia is part of the SEETO[19] comprehensive regional network and should be viewed as a multimodal regional transport network, which is the basis for implementing transport investment programmes.

North Macedonia's hazard profile follows the regional one and is characterized by the impact of an array of natural and human-made hazards ranging from floods, earthquakes, extreme temperatures and storms to droughts, landslides, epidemics and technical/ technological ones. Floods have become frequent with a high intensity and magnitude, weather-related events are on the rise with greater magnitudes, wildfires are increasing in frequency and have consequences for nature and biodiversity, while earthquakes could potentially have the biggest impact on the country and its residents in terms of loss of life and long-term damage and losses.[20] Table 4 presents the country's natural disasters over the period 2000–2021.

[19] A regional transport organization established in 2004 by a Memorandum of Understanding for the development of the Core Regional Transport Network by the Governments of Albania, Bosnia and Herzegovina, Croatia, North Macedonia, Montenegro and Serbia and the United Nations Mission in Kosovo* and the European Commission.
[20] Vasko Popovski. *DRR Chapter for the 4th National Communication on Climate Change (Report)*. UNDP.2021. p. 4.

Table 4: Overview of natural disasters in the country over the period 2000–2021[21]

#	Year	Disaster type	Date	Total deaths	Population affected	Total damages ('000 $)	Source
1	2000	Wildfires	08.2000	/	/	13,563	2
2	2001	Extreme temperatures	1.12.2001	15	/	/	1
3	2003	Flood	8.1.2003	2	4,000	/	1
4	2004	Extreme temperatures	1.7.2004	15	/	/	1
5	2004	Flood	4.6.2004	/	100,000	5.661	1
6	2005	Storms	1.1.2005	1	/	/	1
7	2005	Flood	4.8.2005	/	2,000	/	1
8	2007	Wildfires	07.2007	1	1,000,000	/	1
9	2008	Flood	4.12.2008	2	30,000	4,842	2
10	2012	Extreme temperatures	1.1.2012	1	5,100	/	1
11	2012	Wildfire	23.07.2012	4	/	/	2
12	2013	Flood	24.2.2013	1	4,911	/	1
13	2014	Extreme temperatures	28.12.2014	/	8,800	/	1
14	2015	Flood	01/03.2015	2	170,000	40,421	2
15	2015	Flood	3.8.2015	7	2,116	87,000	2
16	2016	Flood	6.8.2016	22	33,582	50,000	2
17	2016	Earthquake	11.9.2016	/	/	10,000	2
18	2017	Extreme temperatures	5.1.2017	5	2,220	/	2
19	2021	Wildfires	06/09.2021	1	80,000	42,653	3

The chart below provides an overview of the most frequent natural disasters in the country and illustrates the impacts of those disasters on the country's population.

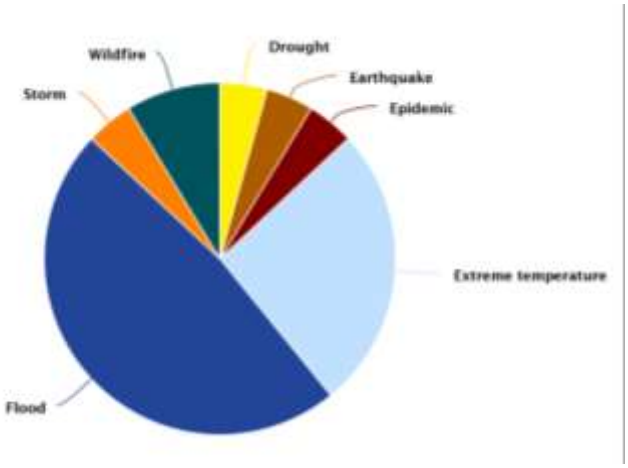


Figure 32: Most frequent natural disasters in North Macedonia for the period 1980–2020[22]

[21] Prepared by the author using the following data: 1) *Plan for Readiness and Response of the Health System in Dealing with Urgent Crisis Situations and Disasters,* Ministry of Health, 2018; 2) *International Disaster Database* EM-DAT https://www.emdat.be/emdat_db/> and 3) http://www.stat.gov.mk/pdf/2021/5.1.21.15_mk.pdf

[22] Source: World Bank.

As mentioned above, floods represent the biggest hazard in the country and alongside other weather-related events, have a serious impact on the resilience of communities. The most recent flood events impacted the road transport sector. For example, the January – February floods of 2015 caused damages in 43 municipalities, damaging 200 regional and local road sections and damaging or destroying 53 bridges with a total damage of EUR 15.3 million[23] or 42.8 per cent of all damages and losses from that event.

Figure 33: Flooding in North Macedonia, 2015

The Skopje 2016 flash floods resulted in significant damage to 92 km of roads (0.65 per cent of the total national road network). Except for the 2 km section of the Skopje by-pass motorway, other local roads and streets in the following municipalities were affected as well: Gazi Baba (55 km), Arachinovo (22 km), Butel (11 km) and Kisela Voda (2 km). About 92 km of the motorway of the TEN-T Corridor VIII were also impacted by the flood. Some of the affected sections of the road were closed for a few days following the floods. Road closures are associated with indirect losses because they imply interruption of traffic or detours to longer, more expensive routes. The damage and losses in the transport sector were estimated at MKD 732.3 million, of which 99.5 per cent were due to damages to the physical infrastructure as presented in Table 5.

[23] RDNA report: EU recovery floods program. 2015.CMC.

Table 5: Damages and losses in the transport sector[24]

	Damages		Losses	
	MKD	**EUR**	**MKD**	**EUR**
Main roads	306,914,813	4,987,403.12	-	-
Secondary roads	8,328,333	135,336.43	-	-
Local roads and streets	396,119,789	6,436,994.85	-	-
Other structures	15,960,000	259,351.95	-	-
Passenger cars (private)	2,000,000	32,500.24	-	-
Clean up costs	-	-	5,000,000	81,251
Total	**729,322,935**	**11,851,587**	**5,000,000**	**81,251**

The removal and disposal of vehicles and flood debris as well as the cleaning of road surfaces were first response works and the costs amounted to an estimated EU 81,000. The restoration and reconstruction of a 7 km section of damaged motorway included the following works: removal of damaged pavement and its restoration, replacement of material in embankments and the restoration of drainage channels, the replacement of a noise protection fence, the reconstruction of a retaining wall, the reconstruction of horizontal, vertical traffic signage and road equipment, drainage reconstruction and road lighting reconstruction. The contractual value of the urgently needed repair works was estimated at EUR 2.7 million. Rehabilitation works were implemented during the period October 2016–February 2017.[25]

Figure 34: Affected Road network following the Skopje 2016 flash flood

Because this section of the road was temporarily closed, traffic was detoured to alternative more expensive routes via Skopje's city street network or local roads. The Annual Average Daily Traffic

[24] *Post Disaster Needs Assessment August 2016 Floods Former Yugoslav Republic of Macedonia* (Draft Report). p. 27.
[25] Zoran Krakutovski, Vasko Popovski. *Transport Challenges and Solutions Case Studies from Western Balkans. Workshop presentation*. January 2020.

(AADT) on this section of the road is around 4,500–5,000 vehicles per day (in 2015). This detour of traffic caused a rise in direct traffic operator costs and in external transport costs, because this section of the ring road was temporarily closed, although no estimates of the direct and external transport costs are available.

A number of smaller flood events with lower intensities and magnitudes, but with a greater impact on the resilience of municipalities and their local road infrastructure. They included the 2008 Radovish flood, which resulted in the demolition of two bridges and the damage to one bridge; the 2015 Tetovo flash flood, which destroyed 6 bridges and damaged 10 km of the local road network.

Based on the findings of the "Technical Assistance Preparation of Climate Resilience Design Guidelines for the Public Enterprise for State Roads in North Macedonia" project, a total of 11 km of state roads have very low exposure to flood hazards, 1,681 km have a low, 1,708 km a medium, 734 km a high and 507 km a very high exposure to flood hazards.[26] Nevertheless, according to the climate change projections for 2071–2100, road sections that are vulnerable to floods will be more adversely affected because those currently classified as being at high risk will be at very high risk as shown in Table 6.[27]

Table 6: The increased vulnerability of roads due to climate change[28]

Flood vulnerability	Length of roads in km (Baseline)	Length of roads in km cumulative >90th percentile change 2071–2100
Very low	11	7
Low	1,681	1,418
Medium	1,708	1,642
High	734	923
Very high	507	652

250 landslides have occurred across the country, with nearly two-thirds caused by heavy precipitation. The landslide spatial probability was developed using specific proxies, namely lithological units, elevation, slope angle, distance from the stream, land cover and depth to bedrock.[29]

[26] Technical Assistance Preparation of Climate Resilience Design Guidelines for the Public Enterprise for State Roads in North Macedonia". *Guidelines for the Public Enterprise for State Roads in North Macedonia. Part B Climate Resilience Design Guidelines*. July 2019. p. 27. [Online] Available at: https://tinyurl.com/4p9jpsz8

[27] Technical Assistance Preparation of Climate Resilience Design Guidelines for the Public Enterprise for State Roads in North Macedonia". *Guidelines for the Public Enterprise for State Roads in North Macedonia. Part B Climate Resilience Design Guidelines*. July 2019. p. 30. [Online] Available at: https://tinyurl.com/4p9jpsz8

[28] Ibid. p. 30.

[29] Ibid. p .44-45.

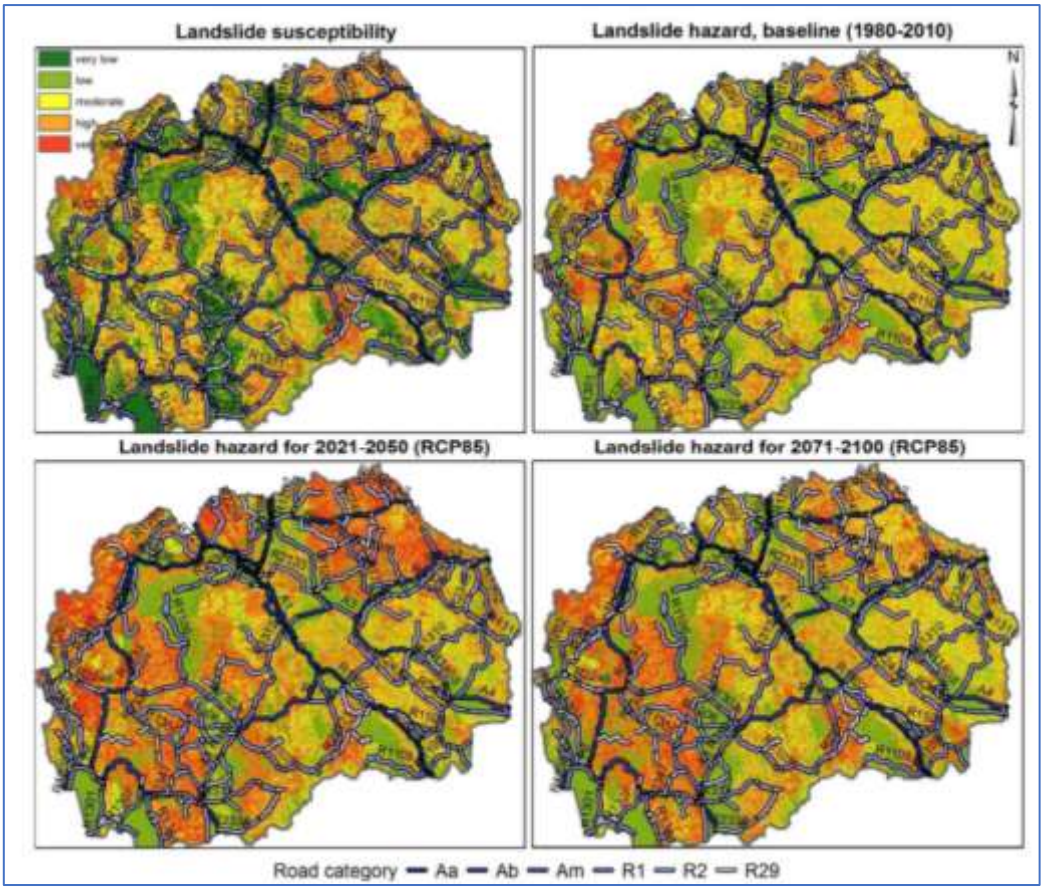


Figure 35: Baseline and projections of landslide susceptibility and hazard maps[30]

The landslide hazard map shows that western, southwestern north-eastern and some parts of the central and southern areas of the country have very high to high exposure to landslide hazards, with the A2 road and some of the regional R1 and R2 roads heavily exposed. The short-term hazard projection refers to the high exposure of the A2 and A3 roads, moderate exposure of the A1 road section and very high to high exposure of the R1 and R2 roads. In the long term, the A2 road will still be exposed as will the R1 and R2 roads in the western part of the country.[31] The Public Enterprise for State Roads (PESR) spends large amounts of funds annually on the preparation of design documentation and construction works for landslide remediation.

There is currently no systematic database on historical data of disasters and emergency events that have impacted the critical transport infrastructure. The PESR does not have a spatial historical database, and the Disaster Risk Reduction (DRR) agencies—the Protection and Rescue Directorate and the Crisis Management Centre—do not receive digital information. Nevertheless, the E-Assessment Platform[32] of the North Macedonian Crisis Management Centre, which is used to conduct municipal and national risk and hazard assessments based on systematic data on the country's critical

[30] Ibid. p. 48.
[31] Technical Assistance Preparation of Climate Resilience Design Guidelines for the Public Enterprise for State Roads in North Macedonia". Guidelines for the Public Enterprise for State Roads in North Macedonia. Part B Climate Resilience Design Guidelines. July 2019. p. 48. [Online] Available at: https://tinyurl.com/4p9jpsz8
[32] http://procena.cuk.gov.mk/Login.aspx?ReturnUrl=%2f

infrastructure, including road assets and facilities, is an excellent example of a structured disaster database. For most of those identified, e.g. tunnels, bridges, etc., essential data are collected, but the approach is nonetheless a stand-alone activity, as the PESR is not integrated and does not provide timely information on the transport-built environment and damages and losses. Additionally, as part of the United Nations Development Programme (UNDP)/ Global Environment Facility (GEF) project[33], the E-Assessment Platform was upgraded with the Sendai Framework and SDG 13 modules which are used to record events, occurrences, conditions and specific data on the events that are entered in the database contribute to systematic and improved data collection and reporting on damages and losses. For example, it can collect disaggregated data for all Sendai Framework targets. Therefore, better integration is recommended.

3.6 Serbia

Serbia's road network is 45,220 km long, of which 952,7 km are toll highways. It includes 2,960 bridges and 85 tunnels. According to the Serbian Ministry of Infrastructure, about 1,000 km of high-speed roads are currently being designed and built in Serbia. The management of the state road network is primarily carried out by the public company "Roads of Serbia". The network of municipal roads and streets is managed by the bodies of local self-government units.

The territory of Serbia is exposed to various types of natural hazards. According to previous studies, about 25 per cent of the territory is exposed to the risk of landfalls and landslides, and 35 per cent of the territory is exposed to soil erosion.[34] Around 4,000 km of roads are exposed to flood hazards. Over 17 per cent of the territory of Serbia is exposed to floods and flash floods, 21 per cent to droughts, and the risk of forest fires affects 3.6 per cent of the country's territory and has been increasing from year to year.[35] Figure 36 provides an overview of the areas that are exposed to natural hazards.[36]

[33] https://www.thegef.org/projects-operations/projects/10042
[34] Novkovic, I., Dragicevic, S., & Manic, E. Natural Hazards and Vulnerability to Natural Disasters: The Case of Serbia. Risk Measurement and Control in Insurance; Kocovic, J., Jovanovic Gavrilovic, B., Rajic, V., Eds, 41-62.
[35] Dragicevic et al., Natural Hazard Assessment for Land-use Planning in Serbia, Int. J. Environ. Res., 5(2):371-380, 2011
[36] https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=&cad=rja&uact=8&ved=2ahUKEwj_6vvzla_4AhUPgv0HHUJdBREQFnoECBAQAQ&url=https%3A%2F%2Fwww.mgsi.gov.rs%2Fsites%2Fdefault%2Ffiles%2FPPRS%2520Nacrt.pdf&usg=AOvVaw02PHS4JGWJ0G0s1Y1lXJFY

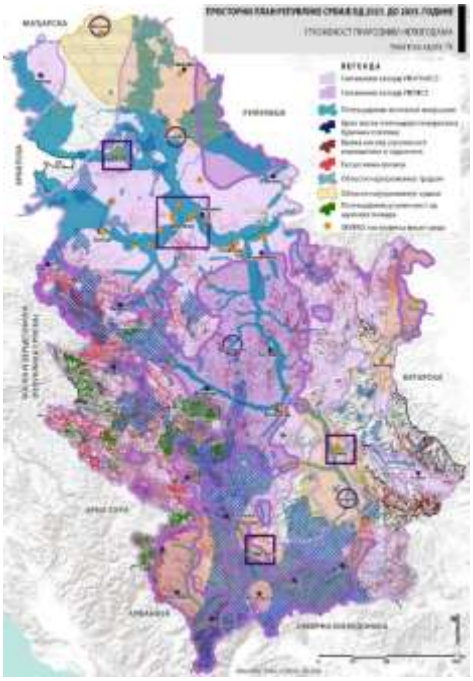


Figure 36: Map of natural hazards in Serbia[37]

The chart below provides an overview of the most frequent natural disasters in the country and illustrates the impacts of those disasters on the country's population.

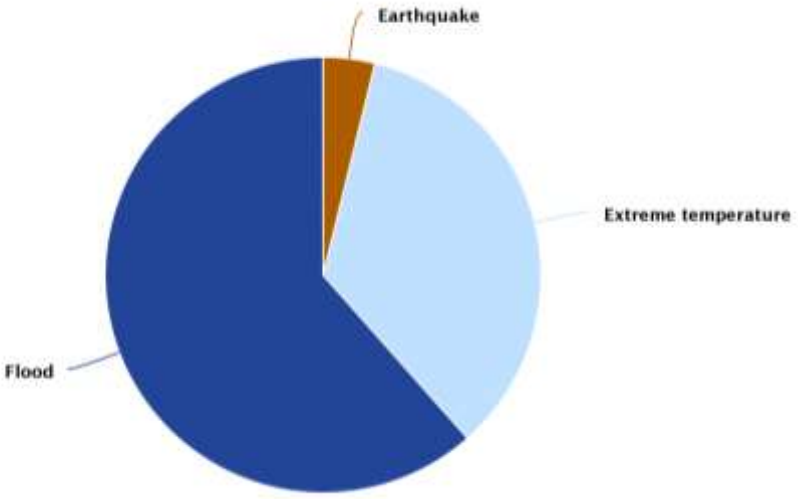


Figure 37: Most frequent natural disasters in Serbia for the period 1980–2020[38]

[37] Spatial Plan of the Republic of Serbia 2021–2035.
[38] Source: World Bank.

The following natural hazards and climatic events have the greatest impact on the country's road infrastructure:[39]

- Floods (resulting in landslides and slope instability, damage to drainage systems, soil erosion under bridge piers)
- Snowdrifts - storms (traffic disruptions and traffic safety)
- Increase in maximum temperatures (durability of pavement structures).

A significant amount of precipitation was recorded in Serbia in May 2014, causing large-scale floods. This was the most severe flood of the past 120 years and was caused by the superposition of the negative effects of soil saturation from previous rainfall, high water levels and heavy rainfall. The precipitation amounted to 250 litres, and in some cases even up to 300 litres of rain per square meter. A state of emergency was declared due to the huge impact of this flood on a large part of the territory of Serbia. It is estimated that the 2014 floods caused over 2,000 landslides on Class I and II state roads and over 3,000 landslides on the local road network.

Figure 38: Floods in Serbia, 2014

In November 2007, large floods occurred in southern Serbia, especially in the Vlasina River Basin, with torrents sweeping away 13 bridges and damaging numerous roads. In November 2009, large floods affected the Zlatibor and Raška districts, primarily Užice, Arilje, Požega, Sjenica, Novi Pazar, Prijepolje, Nova Varoš, Priboj and Raška. Those floods caused 11 landslides in the municipality of Nova Varoš. At the end of June 2009, Vrnjačka Banja and the surrounding settlements experienced heavy flooding due to strong rainfall and the overflow of the River Goč. Twenty local bridges were damaged or completely destroyed. At the end of Decemberof that same year, the River Crni Timok overflowed and a flood protection emergency measure was introduced in the municipality of Zaječar.

In the period following the heavy floods of 2014, a state of emergency was declared in eastern and western Serbia during different months of the year, depending on climatic event. These events were

[39] Report on the Impact of Climate Change on Road Infrastructure with a Proposal for Adaptation Measures, UNDP, 2021.

sometimes atypical for a certain season, which further confirms the hypothesis of an evident change in climatic conditions.

In addition to floods, a phenomenon that has a significant impact on road infrastructure and is also caused by climate change are snowstorms, which affect both road safety and lead to traffic disruptions. Therefore, a state of emergency was declared in the municipality of Sjenica in February 2015, and in 22 municipalities in the territory of southeast Serbia, Pešter, and in western Serbia in 2012. In January 2017, traffic in the section of the E-75 road between Leskovac and Aleksinac completely collapsed due to snowdrifts. In January 2019, a state of emergency was declared for the entire territory of the municipality of Lučani.

Around 25-30 per cent of the territory of Serbia is characterized by unstable terrain with the occurrence of landslides, cliffs and the collapse of riverbeds of various dimensions. The phenomena of terrain instability in the form of landslides are mostly present in terrains that consist of lake sedimentary complex (hills of Neogene basins), of rocks of a diabase-hornblende formation (Lima Valley), of flysch rock complex (mountainous area of Šumadija), metamorphite (north-eastern Serbia), the Vlasina Basin, upper Ibar and Drina Basin, etc. The causes of the landslides mostly include changes in soil tension due to oscillations in surface and groundwater and a reduction in soil shear resistance.

Landslides affect around 20-25 per cent of the total territory of Serbia. The phenomena of terrain instability in the form of landslides and debris in broken limestones and serpentinites are found in gorges of river valleys as well as in unsecured slopes close to roads.

Landslides are usually 5-10 m deep, within which shallower, secondary and active landslides appear, with acute kinematic status. In the bound petrified rocks, landslides are limited to the disintegrated rock mass and the diluvial zone, while in the Neogene rock complex, they are mostly of greater distribution and depth (often over 10 m). The deepest landslides were formed in the immediate banks of the Danube and Sava Rivers (northern slopes of Fruška gora, Duboko and Umka, Karaburma, Vinča-Ritopek-Grocka stretch, Smederevo). The largest landslides recorded so far are the landslide in the Village of Berkovac on the slopes of Maljen, which occurred in 1933 and blocked the Berkovačka River in the Kolubara Basin, the landslide “Zavoj” on Stara Planina and the landslide “Jovac” near Vladicin Han.

Rockslides are usually connected to gorges, i.e. to broken rock mass, mainly limestone and serpentinite (Đerdap Gorge, gorges: Ibra, Nišava, Jerme, Lima, Drina, Zapadna Morava). They usually impact roads and rivers, blocking them. The consequences of landslides in some gorges have been catastrophic. They are especially pronounced in case of inadequate execution of works in unstable slopes close to roads (Ovčar Banja, Jerma near Zvonačka Banja, Joc near Golubac, etc.).

Erosion areas and zones are equally represented. Erosion zones are areas that are affected by various classes and categories of erosion, catalogued in accordance with appropriate methods of mapping of erosion processes, while erosion areas refers to areas where the erosion process has not yet started, but could become erosion hotspots if certain factors change. In other words, erosion can affect areas of land with visible erosion processes as well as areas of land where no erosion processes are visible,

but where visible erosion processes may arise due to changes in land use. Serbia has a relatively high presence of erosion areas. The areas of Grdelica Gorge, Deliblato Sands, Ramsko-Golubac and Subotica Sands are completely eroded. A relatively small part of the territory of Serbia has a low level of erosion areas.

The most common wind with storm surges is the 'košava', which occurs in the area of Pomoravlje and Podunavlje. Košava is strongest in southern Banat and in the Danube Valley, between Veliki Gradište and Novi Sad.

The areas most threatened by drought are Nis-Leskovac, Dobric, Belopalanac, Aleksinac, Vranje and Gnjilan Valleys, the Negotin region and north-eastern Backa with northern Banat.

The Highway Institute in Belgrade prepared a study on snow accumulation on Class I state roads in 2016 for the PE "Roads of Serbia". The study analysed about 4,800 km of Class I state roads and concluded that a length of 678.1 km of the road network was exposed to snow accumulation.

According to the Think Hazard database, Serbia faces a high risk of wildfires. In 2021, there were 75 fires in an area of 1,633 hectares (local information). According to the European Forest Fire Information System, there were 139 fires in an area of 7,708 hectares. EU data are more accurate because they include private forests. Bearing the high risk of wildfires in mind, the areas actually affected by wildfires are relatively small. This may lie in the fact that only 30 per cent of the territory of Serbia is forested and that forests are often intersected by meadows and agricultural fields which prevent the spreading of fire. Since 95 per cent of the cause of wildfires is the human factor, large forested areas (southern part of Serbia) have not been strongly affected. Nevertheless, changes in some climatic indicators (drought, heat days) will lead to a higher risk of wildfires in the future.

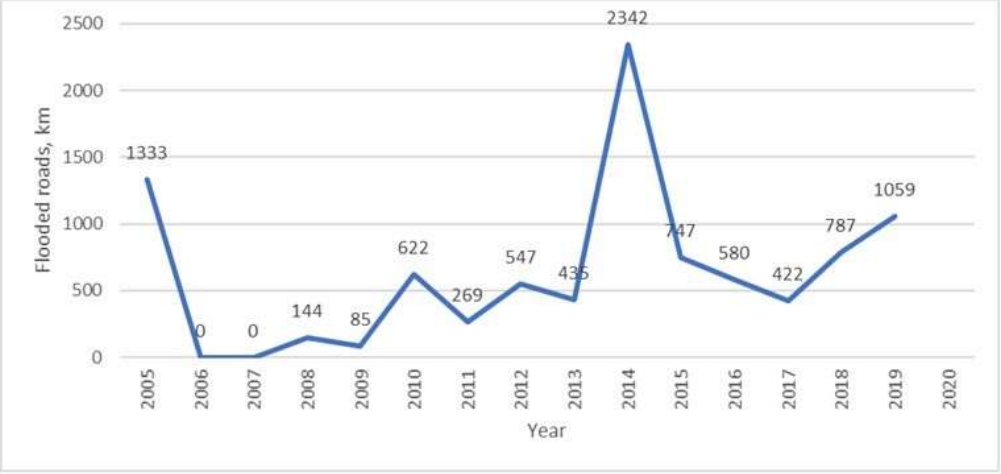


Figure 39: Historical overview of road length exposed to floods[40]

[40] Statistical Yearbooks of the Republic of Serbia 2006-2020, Statistical Office of the Republic of Serbia, 2020

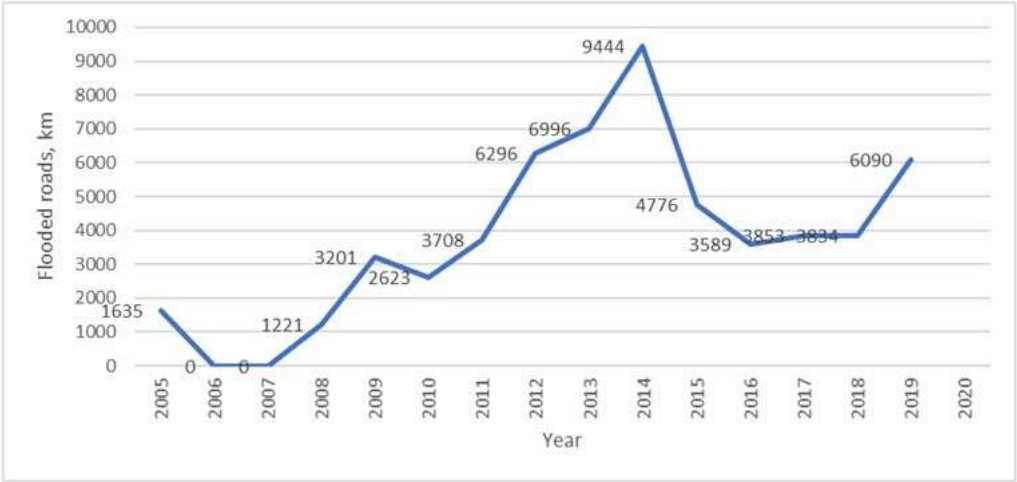


Figure 40: Historical overview of road length exposed to soil erosion[41]

No comprehensive database on historical road damage and hazardous events in Serbia exists. Different authorities hold different types of information, e.g. data on the times and locations of hazardous events, assets characteristics and their location and the duration of disruptions are collected by the road authority, the public enterprise "Roads of Serbia", while data on the types of hazards and their intensity are collected by the Hydrometeorological Service of Serbia. The number of people affected by natural hazards can be calculated based on Annual Average Daily Traffic (AADT) on the relevant sector of roads ("Roads of Serbia"), while their costs (based on road disruptions and damage) are usually omitted, unless major damage occurs. The collaboration of all competent institutions is necessary to create a comprehensive database.

3.7 Regional Overview

Floods are the most serious hazard in each WB country and consequently have the biggest impact on road infrastructure. For example, the 2015 floods in North Macedonia caused damages in 43 municipalities, including 200 regional and local road sections and damaging or destroying 53 bridges with a total damage of EUR 15.3 million[42] or 42.8 per cent of all damages and losses from that event. It is estimated that the 2014 flood in Serbia caused over 2,000 landslides on Class I and II state roads and over 3,000 landslides on the local road network.

Based on recent climate projections and taking the present situation into consideration, the forecast of natural hazards in WB countries can be summarized as follows:

- Flooding will increase as precipitation intensity will rise by 5-10 per cent. Increasing precipitation means higher amounts of water in the watercourse, and an overflow of the watercourse from the riverbed, which can lead to damage to road infrastructure.
- Climate change is likely to alter slope and bedrock stability through changes in precipitation and/or temperature. Continued GHG emissions will cause further warming, and it is highly likely that more frequent hot temperature extremes will be the norm in the next 50 years. Warming

[41] Ibid.
[42] RDNA report: EU recovery floods program. 2015. CMC.

will not be regionally uniform. Modelled projections of future climate conditions predict a likely increase in the frequency of wildfires in this region, including an increase in temperatures and a greater variance in rainfall. The wildfire season is likely to increase in duration in areas already affected by wildfire hazards, and will include a greater number of days of weather that supports the spread of wildfires due to longer draught periods. Climate projections indicate that the WB region might also witness an increase in the severity of wildfires.

- As the climate continues to warm and the amount of ice reduces in some places and increases the water mass (e.g. of oceans, precipitation), the stress on tectonic plates might change — sometimes abruptly. Earthquakes in the WB region will likely increase.
- Coastal flooding is already present in Albania, BiH and Montenegro and is on the rise. Due to global warming, land ice and ice shelves are melting, with the melted water flowing into the world's oceans. The volume of water itself expands when it warms up. These two factors contribute to sea level rise.
- More snowfall during winter storms is also expected due to climate change. This is attributable to the fact that a warmer planet evaporates more water into the atmosphere. The added moisture means more precipitation in the form of heavy snowfall or downpours.

Table 7: Presence of natural hazards in WB countries

Natural Hazard	Presence of natural hazards in WB countries					
	Albania	BiH	Kosovo*	Montenegro	North Macedonia	Serbia
Pluvial flooding	Yes	Yes	Yes	Yes	Yes	Yes
Fluvial flooding	Yes	Yes	Yes	Yes	Yes	Yes
Landslides (precipitation-induced)	Yes	Yes	Yes	Yes	Yes	Yes
Coastal flooding – storm surges and sea level rise	Yes	Yes	No	Yes	No	No
Heat waves	Yes	Yes	Yes	Yes	Yes	Yes
Wildfires	Yes	Yes	Yes	Yes	Yes	Yes
Water scarcity	Yes	Yes	Yes	No	Yes	Yes
Heavy snowfall	Yes	Yes	Yes	Yes	Yes	Yes
Avalanches	Yes	Yes	Yes	Yes	Yes	Yes
Landslides (seismic-induced)	Yes	Yes	Yes	Yes	Yes	Yes
Earthquakes	Yes	Yes	Yes	Yes	Yes	Yes

Although the road infrastructure has been developing in the WB as part of the region's socio-economic development, some critical factors related to the region's road network call for substantial interventions: traffic bottlenecks in larger cities; black dots, poor geometric design and unpaved local

* *This designation is without prejudice to positions on status and is in line with UNSCR 1244 and the ICJ Opinion on the Kosovo Declaration of Independence.*

roads. These factors make the region's road infrastructure more vulnerable to the climate change impacts discussed above.

A database of historical road damages and hazardous events is useful for evaluating the current climatic conditions and the status of roads. Unfortunately, such data are not collected in a systematic database covering the WB countries.

The database should comprise the following data:

- Name and type of road;
- Road sections;
- Time indication of hazardous events;
- Hazard intensity;
- Location of hazardous events;
- Assets involved and location of assets;
- Asset characteristics (e.g. type of hazard, type of pavement);
- Duration of disruption;
- Economic damage;
- Number of people affected.

The database should cover the entire territory of each country, i.e. it should cover the region's entire road network.

4 Resilience Planning in Road Infrastructure Development

4.1 Albania

Many different institutions are involved in Albania's road planning, design, construction and maintenance. **The Ministry of Infrastructure and Energy (MIE) together with the General Directorate of Road Transport Services and the Albanian Road Authority** are directly responsible for road regulation, planning and management. The Ministry coordinates transport-related, cross-cutting activities with other ministries and represents Albania in international bodies dealing with transport issues. The MIE is also responsible for the development of energy and climate policies and mid- and long-term strategies for the integrated energy and climate sector.

Other institutions including the **Institute of Geoscience, Energy, Water and Environment, Albanian Geological Service, National Agency for Water Management, State Authority for Geospatial Information (ASIG)** are mostly in charge of collecting data and information relevant for road infrastructure planning and design, such as spatial data, water and environmental management data. The **Institute of Geosciences, Energy, Water and Environment (IGEWE)** is in charge of monitoring and issuing warnings on natural hazards, including floods, wildfires and earthquakes. The **Institute of Hydrometeorology of Albania (IHMA)** is responsible for planning and supervising the meteorological and hydrological observation systems and the collection, processing and management of all meteorological and hydrological data. The Institute prepares studies and reports on national, regional and river basin scale on time-space climatological and hydrological characteristics and water resource assessments.

The **Ministry of Agriculture, Rural Development and Water Administration (MARDWA**) is responsible for the planning and design of flood protection infrastructure and the maintenance and rehabilitation of existing flood protection assets. The **National Agency for Water Management** is the main institution in charge of implementation of the EU Floods Directive.

The **Ministry of Tourism and Environment** is a department of the Albanian government and is in charge of regulations related to the environment, the sustainable use of natural resources, the promotion of renewable resources, the protection of nature and biodiversity, the sustainable development and management of forestry and pastures, and quality monitoring of water resources. The **National Environmental Agency** under the Ministry is in charge of environmental impact assessments and licensing, inspection and control of compliance with legal requirements and environmental conditions.

In 2019, the government endorsed the **National Climate Change Strategy**, which is the country's low carbon development strategy within the meaning of the Paris Agreement. A **Climate Change Law** was adopted in December 2020. A law on fluorinated gases is currently under preparation. The Ministry of Tourism and Environment is currently drafting a secondary legislation relevant to a mechanism for monitoring and reporting of GHG emissions to be approved by the government in the fourth quarter of 2022, including the institutionalization of a national GHG inventory system (currently project-based). The Climate Change Law establishes the legal basis for the National Energy and Climate Plans (NECPs).

The **General National Territorial Plan (NTP) "Albania 2030**" is the most important instrument of territorial planning in Albania. The NTP is the foundation for the harmonization of cross-cutting

sectoral policies and provides the strategic framework for sustainable development of the territory for the next 15 years, including road infrastructure development. The NTP addresses climate change mitigation in transport, aiming to reduce final energy consumption in the sector as well as the carbon footprint, but does not include climate hazards and risk assessments and appropriate adaptation measures.

The Ministry of Infrastructure and Energy adopted the **National Transport Sector Strategy** and its **Action Plan 2016–2020**. The overall objectives of the National Transport Strategy and Action Plan for the period 2016–2020 was to (i) further develop the national transport system, and (ii) significantly improve its sustainability, interconnectivity, interoperability and integration with the international and European wider transport system and region. The strategy passed through the process of drafting the Strategic Environmental Assessment, which is integrated into the Strategy. The SEA Objective 4 calls for the adaptation of transport infrastructure to climate change and the reduction of annual quantities of GHG emissions below the target values set by the **National Strategy for Development and Integration** (NSDI). The SEA Environmental Outcome O11 aims to increase the use of more sustainable materials and reduce the contribution of transport to GHG emissions caused by fuels in transport; O12 seeks to adapt to the impacts of climate change; O13 to reduce the contribution of transport to air pollution and other harmful emissions; O14 to improve the impact of transport on the local environment.

The **Sustainable Transport Plan for 2016–2020** was prepared by the Ministry of Infrastructure and Energy to help meet the targets of reducing energy consumption and improving the transport sector's overall sustainability. It includes nine measures, some of which have direct, quantifiable impacts in terms of energy savings and pollutant reductions (e.g. road capacity expansion, improvement of road pavement conditions and renewal of the car fleet stimulated by efficiency-based fees and incentives).

The draft **National Integrated Water Resource Management Strategy**, designed for the period 2018–2027, developed under the leadership of the Ministry of Agriculture, Rural Development and Water Administration, has been adopted. This document focuses on measures that deal with climate change and the effective prevention of flood risks.

Albania does not have a country-wide **disaster risk management plan**. The World Bank Diagnostic Report on Emergency Preparedness and Response Assessment concludes that Albania's emergency preparedness and response system is well set up for everyday response. However, it also has some clear development needs. The major challenges of the system include fully implementing ongoing legislative changes, building institutions, elaborating necessary emergency plans and establishing a joint national training centre for emergencies. The system should seek to move away from an ad hoc, reactive approach and instead work in a systematic, consistent and integrated way, building on a long-term strategic vision. It is recommended that before the system is further specialized to address specific hazards, investments should focus on the fundamental components so Albania can respond to its main risks: earthquakes, floods, forest fires and landslides. At the same time, the risk environment also entails new challenges such as climate change, migration, pandemics and increasing tourism.

Albania has no **flood risk maps**. However, the EU-supported Programme for Improving National Early Warning System and Flood Prevention in Albania with the overall objective to ensure increased resilience to floods by strengthening Albania's National Early Warning System and improving disaster prevention in line with EU good practices. One of the project components, beside the strengthening of

the legal framework, is to produce regional flood hazard and risk maps for the main river basins in accordance with the provision of the EU Floods Directive. The project was launched in 2021.

The preparation of the road infrastructure project's design on the primary national road network was followed by separate background documents providing input data for the design of infrastructure facilities (drainage, bridges, tunnels, etc). The studies on climatological data provide data on temperatures, precipitation and winds. The hydrological studies collect input data on river flow and level, while geological-geotechnical data provide information on soil stability and landslide risks.

Albania is a Balkan country with a high rate of seismicity, and earthquake risk reduction has been an important ongoing socioeconomic concern. In 2004, the experience and methods used for Canadian seismic hazard maps was used to present, for the first time, probabilistic spectral hazard maps for Albania. Ten seismic source zones were used to define the country's seismicity. The resulting four probabilistic seismic hazard maps for Albania were based on spectral parameters. The improved seismicity source model, the new ground motions adopted and the use of spectral parameters for the first time have allowed for site-specific uniform hazard spectra to be constructed for the entire country and were proposed as the basis for the next version of the KTP-N.2-89 Technical Aseismic Regulations to improve Albania's earthquake-resistant design code.

The CRISIS ("Comprehensive RISk assessment of basic services and transport InfraStructure") project, supported by the Union Civil Protection Mechanism, was launched in November 2020 with the aim of providing a qualitative basis for the development of a collaborative approach to the prevention of and preparedness for disaster risks and management in cross-border countries located in the Western Balkan Region. It aims to improve the current disaster (both natural and man-made) and emergency management system in the cross-border area consisting of North Macedonia, Albania and Greece. Eleven districts in Albania that are characterized by a great variety of natural hazards, especially seismic and landslide hazards, have been included among the focus areas within the three countries.

The CRISIS project intends to build a harmonized and efficient system to assess the risk of basic services (e.g. health facilities, educational facilities, etc.) and transport infrastructure in the project area. This system will be represented by a geo-referenced web platform (WBP), which aims to collect, organize and visualize data of structures and infrastructure located in the target region, including their vulnerability parameters, and will be able to provide rapid risk information in line with the identified exposure model. It will also allow to predict possible losses and identify potential disruptions of critical infrastructure. The final results of the CRISIS project will benefit the national civil protection and disaster management authorities in the cross-border region.

4.2 Bosnia and Herzegovina

BiH is a decentralized country that consists of two entities (Republika Srpska and the Federation of Bosnia and Herzegovina (FBiH)) and of the Brčko District (BD) of BiH. The FBiH is divided into three levels: the entity level, the cantonal level (10 cantons) and the municipal level.

The **Ministry of Traffic and Communications of Bosnia and Herzegovina** is responsible for the preparation and execution of regulations on the establishment and functioning of international and inter-entity roads, rail, air and pipeline transport, the preparation and monitoring of the implementation of bilateral and international agreements, cooperation with other countries and foreign institutions BiH is a member of. The planning and management of roads at the entity level are

the responsibility of the entity ministries in charge of transport. The cantons in the FBiH are responsible for magistral roads. Local government units (cities and municipalities) in BiH are responsible for funding and the maintenance of local roads and bridges.

Entity levels and BD: at the entity levels and in the BD, the Ministry of Environment and Tourism of the FBiH, the Ministry of Spatial Planning, Civil Engineering and Ecology in Republika Srpska, and the Department for Spatial Planning and Infrastructure in the BD are responsible for environmental issues, including environmental permits (EIA, SEA).

Cantonal level: In the FBiH's 10 cantons, the cantonal governments are in charge of several environmental, climate change and road infrastructure issues. They include the **Cantonal Ministries of Health,** the **Cantonal Ministries for Physical Planning and Environmental Protection,** the **Cantonal Ministries of Transports,** the **Cantonal Ministries of Agriculture, Forestry and Water Management** and the **Cantonal Ministries of Industry, Energy and Mining**.

The **FBIH Hydrometeorology Institute** and the **Republika Srpska Hydro-Meteorological Institute** (RHMI) are responsible for data processing in the fields of meteorology, seismology, hydrology and water resources, as well as for air and water quality monitoring.

BiH is a signatory party to a number of international conventions, such as the United Nations Framework Convention on Climate Change, Rio de Janeiro, the Vienna Convention for the Protection of the Ozone Layer (1992), the Montreal Protocol on Substances that Deplete the Ozone, the Convention on Long-Range Transboundary Air Pollution, the Kyoto Protocol, the United Nations Convention on Biological Diversity, the United Nations Convention to Combat Desertification, the Vienna Convention for the Protection of the Ozone Layer, the Aarhus Convention, the Paris Agreement, the Barcelona Convention and the Convention of the Migratory Species. BiH also participates in the EPPA (EU Environment Partnership Programme for Accession) programme.

Since ratifying the United Nations Framework Convention on Climate Change (UNFCCC), BiH has submitted its initial (2010), 2nd (2013) and 3rd (2017) **National Communication of Bosnia and Herzegovina under the UNFCCC**. The Fourth National Communication was finalized in October 2021 and submitted to BiH authorities for adoption. In April 2021, BiH presented its second national climate pledge to the UNFCCC, i.e. the **Nationally Determined Contributions of Bosnia and Herzegovina** (NDC) for the period 2020–2030. BiH is committed to reducing GHG emissions by one-third by 2030, and by nearly two-thirds by 2050 (about 66 per cent) compared to its 1990 levels. The First Biennial Update Report of **Bosnia and Herzegovina on Greenhouse Gas Emissions (FBUR) was submitted in 2014**. **The Second Biennial Update Report on GHG Emissions** (SBUR) **of Bosnia and Herzegovina under the UNFCCC** was adopted by the Council of Ministers of BIH on 23 May 2017 and submitted to the UNFCCC Secretariat, along with the **Third National Communication** (TNC).

The Climate Change Adaptation and Low-Emission Development Strategy for Bosnia and Herzegovina was adopted by the Council of Ministers of BiH on 8 October 2013, with the strategic aim of increasing the country's resilience to climate variability and climate change, preventing environmental degradation and gradually decreasing GHG emissions.

The new Climate Change Adaptation and Low Emission Development Strategy of Bosnia and Herzegovina for the period 2020–2030 was prepared and is currently in the process of adoption by the BiH institutions.

In 2019, under the project "**Advance the National Adaptation Plan (NAP) process for medium-term investment planning in climate sensitive sectors in Bosnia and Herzegovina**", BiH began developing its **National Adaptation Plan** (NAP), thus working towards achieving the targets defined in the Paris Agreement and the Sustainable Development Agenda until 2030. The project is being implemented by UNDP in partnership with the **Ministry of Spatial Planning, Civil Engineering and Ecology** (MSPCEE) and the **Ministry of Foreign Trade and Economic Relations** (MoFTER) as the ministries in charge of coordination of climate change adaptation activities throughout the country, and is expected to be completed in 2022.

BiH has taken other steps to address climate change. Four strategic documents have been adopted for the energy sector aiming to improve energy efficiency and reducing carbon emission:

- **National Emissions Reduction Plan** (NERP BiH), adopted on 30 December 2015
- **National Renewable Energy Action Plan** (NREAP BiH), adopted on 30 March 2016
- **Energy Efficiency Action Plan of Bosnia and Herzegovina for the period 2016–2018**, adopted on 4 December 2017
- **Framework Energy Strategy of Bosnia and Herzegovina until 2035**, adopted on 29 August 2018.

Bosnia and Herzegovina submitted the **National Energy and Climate Plans** (NECP) to the Secretariat of the Energy Community at the end of 2021.

An **Environmental Strategy and Action Plan of Bosnia and Herzegovina (BiH ESAP 2030+)** is currently being developed. Climate change resilience and mitigation will be addressed by the Action Plan of the ESAP as separate thematic areas, as well as cross-cutting issues along other sectoral thematic areas.

With the assistance of the GIZ, BiH is currently preparing a medium-term decarbonization strategy that integrates sectoral energy and climate strategies by the year 2030. The strategic and legal framework promoting the decarbonization of the country's energy sector has, however, not yet been sufficiently implemented. Little progress has been achieved in the fields of energy-efficient building renovations, energy generation from renewable energy sources (beyond large-scale hydro power) and citizen participation in energy transition.

The Framework Transport Strategy in Bosnia and Herzegovina (2016–2030), as well as the action plans for the implementation thereof were adopted by the Council of Ministers of BiH.

In response to climate change challenges, the GIZ has assisted the Canton Sarajevo in the preparation of the **Sustainable Urban Mobility Strategy** as well as a number of other municipalities in preparing SECAP – Sustainable Energy and Climate Action Plans. The UNDP, through projects funded by the Green Climate Fund (GCF) and the GEF, continued in 2021 to support the implementation of the SECAP, developed for 37 partner local governments in BiH.

BiH does not have a country-wide **disaster risk management plan**. However, the ongoing joint programme of the Government of Switzerland and the UN's "Reducing Disaster Risk for Sustainable Development in Bosnia and Herzegovina" places particular emphasis on improving local coordination mechanisms in DRR, as well as on affirmation of the strategic risk planning process with an emphasis on the most vulnerable population groups. At least 10 local government units will adopt **local DRR**

strategies, establish partnerships for effective intervention in DRR, and fund activities that build community resilience.

The recently completed WBIF project **'Flood Hazard and Flood Risk Maps'** resulted in the development of maps for the entire territory of BiH in accordance with the EU Floods Directive. The project applied state-of-the-art scanning techniques and customized transformation software to map out 5,500 km^2 of land and survey 5,253 river cross-sections and hydraulic structures all over the country. These data were used to develop 93 advanced hydraulic models which served as the basis for the production of 136 flood hazard maps and 152 flood risk maps as well as 93 depth and velocity maps. These maps are crucial for reducing and managing the risks posed by flooding to humans, the environment, cultural heritage and the economy. These project outputs represent the basis for creating flood risk management plans, which, relying on these maps, shall establish regulations for land use in flood-prone areas and identify appropriate measures to help reduce vulnerability and increase BiH's resilience to flood disasters. Preparation of these plans started in 2020.

With the support of the Government of Japan and the UNDP, the **Landslide Risk Management Study** was prepared within the Landslide Disaster Risk Management project. The study resulted in the modelled hazard map. This modelled **landslide hazard map** is based on an analysis of four variables of landslide susceptibility including lithology, slope, precipitation and land cover use to create area polygons representing the relative level of risk. The data sets were summed and weighted at the municipal level to create a composite risk index represented by colour coding of municipalities.

It is the responsibility of each country that introduces Eurocodes in national standardization to develop national annexes to Eurocodes that regulate nationally determined parameters in elements specific to each country. The Institute for Standardization of Bosnia and Herzegovina launched this process in 2013. The most specific aspect for each country is related to the effects of natural events on structures, such as snow, wind, seismic and thermal loads. The Institute for Standardization of Bosnia and Herzegovina through its Technical Committee BAS TC 58 – Structural Design – Eurocodes EN 1990, 1, 7, 8 and 9 and supported by partners from Czechia and the Hydrometeorological Institutes of BiH produced, adopted and published national annexes to Eurocodes 1 and 8 that define natural events that affect structures. [43] Eurocode 1 addresses actions on:

- Part 1-3: Snow loads
- Part 1-4: Wind action
- Part 1-5: Thermal action

The Institute for Standardization of Bosnia and Herzegovina developed maps with snow loads with a return period of 50 years, a map on basic wind velocity with a return period of 50 years, and two isotherm maps on the minimal and maximal air temperatures in the shade with a probability of exceeding the annual minimum (maximum) of 0,02 (corresponding to the 50-year return period). The most recent national annex to Eurocodes that was adopted as the official standard in BiH is BAS EN 1998-1/NA 2018 Eurocode 8: Design of structures for earthquake resistance – Part 1: General rules,

[43] *National Annexes to Eurocodes 1 and 8 in Bosnia and Herzegovina*. Available at: https://www.researchgate.net/publication/333044180_National_Annexes_to_Eurocodes_1_and_8_in_Bosnia_and_Herzegovina[accessed Jun 26 2022].

seismic actions and rules for buildings – National annex. The maps of the seismic hazards of BiH are based on the **Probabilistic Seismic Hazard Assessment** (PSHA) approach. In accordance with Eurocode 8, seismic hazards are represented in terms of Peak Ground Acceleration (PGA) and seismic action in terms of the value of the reference PGA on type A ground, which corresponds to the return period of the seismic action of 475 (and 95) years. [44] This enables structural and civil engineers to develop a unique approach to the design of load bearing engineering structures by applying the most modern codes for structural design and highest level of safety in construction practice.

When preparing the road infrastructure project design of the primary national road network, the designers considered climatological data such as data on temperatures, precipitation and winds. The hydrological studies collected input data on river flow and level, while geological-geotechnical data covered soil stability and landslide risks. These data are used in the analysis of road route selection, as well as for dimensioning objects on the road (bridges, viaducts, culverts, drainage). Since the flood risk and earthquake risk maps have only recently been completed, they have not been widely applied in road design.

4.3 Kosovo*

The **Ministry of Environment, Spatial Planning and Infrastructure** (MESPI) is responsible for environment and climate policy, while the **Kosovo* Environment Protection Agency** (KEPA) monitors the state of the environment. Within the MESPI structure, the Department of Environment Protection leads national activities on drafting of strategic climate change documents and the establishment of the **National Committee for Climate Change**. The **Ministry of Environment, Spatial Planning and Infrastructure** (MESPI) carries out EIA and SEA procedures. MESPI screens projects, shares opinions about the type of information applicants need to provide and issues environmental permits. Other important departments of MESPI for the environment and spatial planning include the Department for Environmental Inspection, Nature, Water, Construction and Spatial Planning, the Department of Spatial Planning, Housing and Construction, the Department for European Integration and Politics Coordination and the Institute for Spatial Planning. The Department of Road Infrastructure and the Department for Road Management are involved in road infrastructure.[45] The Road Infrastructure Department is one of the six departments of the Ministry of Infrastructure in charge of road infrastructure planning and management. The Directorate of Roads of Kosovo* as well as a division and the following sectors operate within this Department:

- Project Division
- Sector for road safety
- Sector for road belt
- Sector for environment
- Sector for policies and programmes
- Sector for training and communications

[44] http://eurokodovi.ba/?page_id=48

[*] *This designation is without prejudice to positions on status and is in line with UNSCR 1244 and the ICJ Opinion on the Kosovo Declaration of Independence.*

[45] During 2021, the Ministry of Environment and Spatial Planning (MESP) and the Ministry of Infrastructure (MI) merged into the Ministry of Environment, Spatial Planning and Infrastructure (MESPI).

- Sector for bridges
- Sector for planning, and
- Sector for Geographic Information System (GIS).

MESPI, in collaboration with many other stakeholders, has drafted the **Strategy of Development for Multimodal Transport for the period 2014–2025**[46]. This strategy envisages models of transport infrastructure development, the implementation of which will enable Kosovo* to develop its transport infrastructure and, simultaneously, open easier access to international markets for goods, services and labour. The Strategy also defines the objectives for sustainable development of transport infrastructure in general, for building modern roads, linked with the pan-European corridors, building modern railways, air and maritime infrastructure and electronic communication infrastructure, by creating conditions for the safe transport and observance of international standards for preserving the environment. However, the Strategy does not address climate change resilience and adaptation.

An Inter-Ministerial Working Group (IMWG) enhances Government coordination on climate change policies to ensure it recognizes the country's vulnerability towards the adverse effects from climate change, and develops appropriate short-, medium- and long-term mitigation and adaptation measures and activities to ensure that the country is able to cope with climate change impacts.

The Ministry of Internal Affairs (MIA) **and the Emergency Management Agency** (EMA) are responsible for disaster risk reduction policy. The **Disaster Risk Reduction Strategy and Plan of Action** was prepared in 2016 and lasted until 2020. The main goals of this Strategy (2016–2020) were as follows:

- Integration of risk reduction in development policies and plans;
- Strengthening of risk management capacities;
- Creation of safe and resilient communities from disasters;
- Awareness raising among institutions and entities about the risks from disasters.

The Strategy recognized several weaknesses:

- DRR was not sufficiently included in government plans and policies;
- DRR was not yet a government priority and the necessary means had not been allocated from the national budget, including for prevention, preparedness, response and recovery;
- DRR statistics and the database were still very limited;
- Lack of access to live data, including location and space data, such as a GIS on DRR.

The Strategy recognized the fact that Kosovo* developed seismic hazard maps in line with Eurocode 8 as an opportunity. In accordance with Eurocode 8, seismic hazards are represented in terms of PGA and seismic action in terms of the value of the reference PGA on type A ground, which corresponds to the return period of the seismic action of 475 (and 95) years.

[46] https://kryeministri.rks-gov.net/repository/docs/SECTORIAL_STRATEGY_AND_MULTIMODAL_TRANSPORT_2015-2025_AND_ACTION_PLAN_FOR_5_YEARS.pdf

* *This designation is without prejudice to positions on status and is in line with UNSCR 1244 and the ICJ Opinion on the Kosovo Declaration of Independence.*

The role of the **Hydrometeorology Institute of Kosovo*** is limited to providing information on temperature variations over time, surface and ground water quality data, flow rates of the main rivers in Kosovo* and precipitation levels.

Flood risk management in Kosovo* is the responsibility of the **Ministry of Environment and Spatial Planning** according to the Law on Waters of Kosovo (No. 04 / L-147 of 29 April, chap. I). A first study on "Flood Hazard Assessment" including a "Preliminary Flood Assessment of the Drini River Basin" and a "Local Flood Risk Map of Skenderaj" was developed in 2008/2009 by an international consortium of consultants (GFA/BRLingenirie/OIE) within the framework of the project 'Institutional Support to the **Ministry of Environment and Spatial Planning** (MESP)', financed by the EU (GFA, 2009). In 2021, Kosovo* finalized the Preliminary Flood Risk Assessment for the River Basins in Kosovo* in line with the EU Flood Directive. This programme was funded by the EU.

4.4 Montenegro

The **Ministry of Ecology, Spatial Planning and Urbanism of Montenegro** is the main national entity responsible for national environmental and climate change policy and the National Focal Point to the UNFCCC. Montenegro ratified the UNFCCC by succession in 2006, and thus became a non-Annex-1 party to the Convention on 27 January 2007. The Kyoto Protocol was ratified on 27 March 2007, and Montenegro became a non-Annex-B party on 2 September 2007. On 11 October 2017, the Parliament of Montenegro enacted a law ratifying the Paris Agreement. Montenegro has committed itself to reducing GHG emissions by at least 1,572 kt to the level of 3,667 kt or less. Montenegro's contribution to international efforts to address climate change issues, expressed through the **Intended Nationally Determined Contribution** (INDC) to GHG emission reductions, is set at a minimum of 30 per cent by 2030 compared to 1990 as the baseline year.

With the presentation of the **TNC**[47], Montenegro has fulfilled its international obligations under the UNFCCC. The report presents the country's climate profile, highlighting the sectors and regions most vulnerable to climate change impacts, while providing an analysis of potential adaptation measures. The vulnerability analysis and proposed adaptation measures by sector include the water sector, forestry, agriculture, fisheries, public health, coastal and urban areas. Transport infrastructure vulnerability in urban areas is analysed. The list of identified adaptation measures for urban areas does not contain any measures that directly address road infrastructure, but indirectly support improved decision-making and the design of climate-resilient road infrastructure. Among the technical measures and research and capacity development promotion of green infrastructure is included as is a selection of methodological procedures for a comprehensive analysis of short-term, heavy rainfall in Montenegro, with a focus on analysing climate change risks and impacts in urban areas and considering the conditions for continuous monitoring and updating of ITP curves (rainfall–duration–return period). The list also includes guidelines on the use of climate information such as projected short-term rainfall data.

---

* *This designation is without prejudice to positions on status and is in line with UNSCR 1244 and the ICJ Opinion on the Kosovo Declaration of Independence.*

[47] https://www4.unfccc.int/sites/SubmissionsStaging/NationalReports/Documents/8596012_Montenegro-NC3-1-TNC%20-%20MNE.pdf

Montenegro has published its **National Strategy on Climate Change 2015–2030**. The National Climate Change Strategy identifies transport as a priority sector for climate change activities and outlines a number of measures and targets related specifically to increasing the use of public transport and the promotion of more energy efficient vehicles and electric vehicles for public and individual transportation. The Strategy also highlights the need to increase the resilience of the transport sector to projected climate impacts due to its vulnerability and the key role it plays in the country's economic and social development. In 2019, the Parliament of Montenegro adopted the Law on Protection against Adverse Impacts of Climate Change (Official Gazette of Montenegro 073/19). The Law prescribes the obligation to develop the long-term Low Carbon Development Strategy, the National Adaptation Plan, the GHG emission inventory and projections, as well as related reports.

The Ministry of Capital Investments performs administrative tasks related to the preparation and evaluation of development investment projects in Montenegro in the field of energy, mining, transport and maritime affairs, as well as preparing development policies, monitoring the situation and taking measures in the above areas of work. The **Directorate for Road Transport** performs activities related to the preparation and evaluation of development investment projects for Montenegro, and prepares development policies, monitors the situation and adopts measures in the field of road transport.

Montenegro has adopted a **Strategy for Disaster Risk Reduction for 2018–2023**; but to effectively move from response-concentrated habits to a culture of prevention and preparedness, it needs to implement the Strategy further and increase awareness of DRR in general.[48]

The **Strategy for the Development of Transport of Montenegro for the period 2019–2035** was adopted in July 2019. The Strategy does not include any measures directed towards the improvement of road resilience. In parallel with the process of drafting the Strategy, the SEA[49] was prepared in accordance with the Law on Strategic Environmental Impact Assessment. The first part of the Strategic Environmental Impact Assessment provides a description of the existing state of the environment, which also includes air quality and climate change. However, the climate change aspect was not elaborated from the perspective of climate hazard impacts on road infrastructure but rather as an impact of transport to climate change, i.e. GHG emissions.

The **Climate Resilience Strategy and Action Plan for Montenegro**, developed in December 2019 by the European Bank for Reconstruction with expertise provided by SWECO, is a key document that addresses the climate resilience of Montenegro's road network[50]. The overall objective of the Climate Resilience Strategy was to improve the climate resilience of Montenegro's road infrastructure by introducing climate resilience elements in project planning and design and establishing an institutional framework for all future and existing projects. The Strategy emphasizes the significance of institutional cooperation among the relevant stakeholders and a focus on an interdisciplinary approach to facilitate the most effective planning and implementation of a climate change adaptation strategy. The Strategy's main principle is to increase the cooperation and coordination of the institutions performing climate impact assessments among institutions involved in planning and maintenance of

[48] Emergency Preparedness and Response Assessment Diagnostic Report for Montenegro, World Bank, 2021.
[49] https://www.gov.me/dokumenta/9cc9307c-b46b-47e7-82b8-af24cae0485c
[50] https://uzs.gov.me/uprava

road infrastructure by introducing robust internal processes and delegating responsibilities and ownership. The Strategy lists several gaps within the following categories:

a) Technical issues:

- No system for monitoring data
- No centralized database
- No system for coordination
- Road quality

b) Financial issues:

- Capacity needs
- Lack of funding

c) Regulatory issues:

- Lack of climate resilience standards
- Lack of long-term budgetary planning
- Non-existent smart policymaking

d) Institutional issues:

- Lack of inter-sectoral cooperation
- Insufficient coastal zone management
- Lack of ownership of institutions

e) Social issues.

Montenegro's progress in terms of data collection on climate risk hazards as a basis for climate resilient project design is slow.

The EU Floods Directive has been fully transposed into the legislation of Montenegro through the Law on Water and the Rulebook on the Preliminary Flood Risk Assessment and the Flood Risk Management Plan ("OG MNE"69/15). Activities in the implementation of the Floods Directive in Montenegro started in November 2019 through the IPA 2016 Project – IPA II (2014 – 2020): *Support to Implementation and Monitoring of Water Management in Montenegro*. The project will run for three years (until November 2022), and includes:

- Inventory of Montenegro's existing flood protection infrastructure
- Preparation of a Preliminary Flood Risk Assessment – PFRA
- Determination of Areas of Potential Significant Flood Risk – APSFR
- Flood Hazard and Flood Risk maps – FH&RM
- Preparation of Flood Risk Management Plans – FRMP for both river basin districts.

The Inventory has been completed and the **Preliminary Flood Risk Assessment is currently in the proposal phase.**

The **Institute of Hydrometeorology and Seismology** (IHMS) participates in several projects on flood risk management. A large part of these projects concerns the Adriatic Basin, with a focus on areas close to Skadar Lake and the Zeta Valley. Two UNDP projects (Integrated Flood Risk Management in the Drin River Basin and Enhancing Montenegro's Capacity to Integrate Climate Change Risks into Planning Implemented) are currently ongoing, with the objective of improving human and technical capacities. These projects will rely on the results of GIZ's activities implemented through the Climate Change Adaptation – Transboundary Flood Risk Management project in the Western Balkans (CCAWB III), which is in its final stages. In the area of the Danube Basin, IHMS is an active participant in the project implemented by the International Sava River Basin Commission *Flood forecasting and warning system*.[51]

The Institute for Hydrometeorology and Seismology provides climatological-meteorological data. Currently, there is no implemented system for real-time monitoring, forecasting and reporting of climate data on road sections and climate events.

Much like in other WB countries, Montenegro participated in the joint project supported by partners from Czechia aiming to introduce Eurocodes in national standardization and to align national annexes with Eurocodes that regulate nationally determined parameters in elements specific to each country. The Institute for Standardization of Montenegro with the support of the Institute for Hydrometeorology and Seismology has adopted and published national annexes to Eurocodes 1 and 8, defining natural actions to the structures (Eurocode 1 addresses actions on structures: Part 1-3: Snow loads, Part 1-4: Wind action, Part 1-5: Thermal action, while Eurocode 8 covers the design of structures for earthquake resistance, National annex – seismic hazard maps[52].).

4.5 North Macedonia

The institutional framework of North Macedonia for the road infrastructure network includes three main players:

- The **Ministry of Transport and Communications (MoTC)** is responsible for strategic guidance and policy and normative development and managing the road sector. The State Transport Inspectorate, which is a body within the MoTC, supervises the implementation of the relevant laws and regulations.
- The **Public Enterprise for State Roads (PESR)** is responsible for the operation, maintenance, construction and rehabilitation of the network of state roads, as well as other related responsibilities.
- The **public enterprise "Makedonija Pat" (PEMP)** is responsible for the maintenance of roads, including regular and irregular maintenance, urgent maintenance, placement and maintenance of horizontal and vertical road signalization, etc.

In addition, the local self-government units are responsible for construction, reconstruction, maintenance, protection of local roads, streets and other road infrastructure facilities, the regulation of traffic regime, the construction and maintenance of street traffic and signalization, etc. The municipality may delegate the performance of certain activities of public interest and of local

[51] https://www.ipaff.eu/montenegro-ongoing-projects-and-initiatives-regarding-flood-risk/
[52] http://eurokodovi.ba/wp-content/uploads/2018/06/9_ISME_Montenegro.pdf

importance to other legal entities based on an agreement for the performance of activities of public interest in line with the law.

North Macedonia is a party to the UNFCCC, has ratified the Kyoto Protocol and supports the Copenhagen Accord (2009). The country has submitted its Intended Nationally Determined Contributions for Climate Change, as well as the Enhanced Nationally Determined Contribution within the framework of the Paris Agreement.[53] North Macedonia is a non-Annex I country to the UNFCCC (developing country) and at the same time, has the status of a candidate country for EU membership, and must therefore adhere to the EU Climate and Energy Policy, which covers the commitments of Annex I countries. This is also part of the requirements of the Energy Community Treaty. North Macedonia aims to integrate both aspects (UNFCCC/EU) in its national reports on climate change.[54] . It must be pointed out that so far, within the National Plans (Communications) on Climate Change, infrastructure has not been considered in the analyses of the country's most vulnerable sectors. Consequently, there are no activities in place for a more resilient infrastructure. There is no reference to green infrastructure in the areas of spatial planning, transport, waters and nature conservation.

The Government of the Republic of North Macedonia has adopted the following documents:

- Enhanced Nationally Determined Contribution to the Paris Agreement (eNDC)[55] (April 2021)
- Third Biennial Update Report (3rd BUR) on climate change[56] (April 2021)
- Long-term Strategy on Climate Action and Action Plan[57] (August 2021).

The **Law on Climate Action** is still in the procedure of adoption by the government and Parliament. Nevertheless, climate resilience is not mainstreamed accordingly. So far, the country has not engaged sufficiently in resilience-building of the critical road infrastructure and related disaster and climate risk reduction, but "plans to develop a National Adaptation Plan (NAP) based on nexus approaches in the following areas: water, food, energy, health, biodiversity, tourism, forestry, DRR, loss and damage and built-in infrastructure."[58] NAPs can ensure coherent integration of climate change adaptation and DRR. Additionally, the country does not have a national DRR strategy to strategically position risk reduction during uncertain times where systemic risks are guiding risk governance.

The National **Transport Strategy for North Macedonia 2018–2030**[59] addresses climate change through specific objectives and activities focused on the reduction of GHG emissions and the carbon footprint of the transport sector by greening mobility and logistics through environmentally-friendly and low-carbon transport systems and by stimulating the modal shift. In terms of adaptation to climate change, the Strategy introduces medium-term priority measures, such as:

---

[53] https://tinyurl.com/3fbsfcre
[54] United Nations in North Macedonia, Government of the Republic of North Macedonia. *Sustainable Development Goals. Voluntary National Review North Macedonia*. 2020. p.76. https://tinyurl.com/zu5pskrz
[55] https://klimatskipromeni.mk/data/rest/file/download/060cb9db7eeedc24bae3c127f2afb7139283bec07324b04956c364a7e9868f2b.pdf
[56] https://klimatskipromeni.mk/data/rest/file/download/10570a8a0a52fe235c083ebbbbf7045926511ff4e4478fbf5e1feb17757bd5c4.pdf
[57] https://klimatskipromeni.mk/data/rest/file/download/61ae4e7b2a98595427e5ab19a736414084e75ba743df2165f80dba996a82eb62.pdf
[58] Enhanced Nationally Determined Contribution (NDC) of the Republic of North Macedonia, 2021, p. 24.
[59] http://www.mtc.gov.mk/media/files/2019/NTS-final%20MK.pdf

- Modification of national transport infrastructure standards with regard to environmental sustainability and climate change;
- Preparation of a comprehensive study for quantifying the impacts of climate change, climate variability and extreme weather events on infrastructure and services (network resilience).

The Strategy also identified a lack of road assets management. In fact, the **Public Enterprise for State Roads** (PESR) has not yet implemented a Road Asset Management System (RAMS) in the process of maintenance management planning and decision. A methodology, software and database for collecting and analysing specific data (measurements of infrastructure conditions, type of executed maintenance works in the past, traffic evolution, technical characteristics of infrastructure, climate data) need to be developed to facilitate the planning of asset management and decision-making processes.

As regards DRR, the following gaps and challenges were identified: insufficient inclusion of DRR in sector strategies and programmes, as well as priorities for activities of the i institutions involved at the national and local level; insufficient coordination and communication among the institutions involved at the national and local levels; accelerated urbanization and built environment; insufficient financial support for the implementation of activities and measures; low level of application of gender practices in risk reduction management; insufficiently developed culture of prevention and cooperation with the private sector.

However, as North Macedonia has adopted all global agreements on climate change and DRR as well as several other relevant global policies, and there is great potential for the country to fully utilize them in its approaches to meet its global commitments. Accordingly, North Macedonia has taken an active role in the establishment and attainment of the objectives, as well as the practical implementation through policies, measures and activities.[60] The two latest EC North Macedonia reports on the progress of EU accession and integration (the 2021 Report[61] and the 2022 Report[62]) conclude that the country is moderately prepared in the area of transport, with limited progress having been made during the reporting period. Connectivity was improved, but the administrative and operational capacities and political commitment to deliver the planned sectoral reforms are still lacking. In the area of the road sector in particular, the essential normative framework has been adopted, but without closer alignment with the EU acquis. North Macedonia is one of 187 countries that adopted the Sendai Framework for Disaster Risk Reduction 2015–2030 during the Third World UN Conference on Disaster Risk Reduction of March 2015 in Sendai, Japan. It is the main driver for the development of national disaster risk management. [63] The country has a National Platform for Disaster Risk Management which was adopted in 2010 and revised in 2019.

[60] Vasko Popovski. DRR Chapter for the 4th National Communication on Climate Change (Report). UNDP.2021.
[61] European Commission. COMMISSION STAFF WORKING DOCUMENT North Macedonia 2021 Report. Strasbourg, 19.10.2021 SWD(2021) 294 final. [Online] Available at: https://tinyurl.com/3h5dkx5f
[62] European Commission. COMMISSION STAFF WORKING DOCUMENT North Macedonia 2021 Report. Strasbourg, 12.10.2022 SWD(2022) 337 final. [Online] Available at: https://neighbourhood-enlargement.ec.europa.eu/north-macedonia-report-2022_en.
[63] https://sendaimonitor.undrr.org/

Nevertheless, the country lacks a national disaster risk strategy in line with the Sendai Framework[64], as previously stated.

North Macedonia is only making slow progress in implementing the EU Floods Directive. The country has started preparing a Preliminary Flood Risk Assessment and PFRAs have been prepared for the Strumica, Bregalnica, Polog and Drim watersheds. The preparation of the national flood risk management strategy is ongoing and is currently in the consultation phase. The country's flood hazard map was developed within the "Technical Assistance Preparation of Climate Resilience Design Guidelines for the Public Enterprise for State Roads in North Macedonia" project[65] along with the exposure of the road transport network. In 2017, North Macedonia was included in the Assessment of Flood Risk and Economic Impact, Drin River Basin project. The project resulted in the preparation of the flood hazard map for the Drin River Basin.[66]

The Hydrometeorological Service of North Macedonia provides hourly measurements and observations of all meteorological parameters (temperature, relative humidity, atmospheric pressure, wind direction and speed, precipitation quantity and intensity, insolation, evaporation, soil temperature) from six meteorological stations. Continuous measurements have been performed since 1947 at all of these stations.

North Macedonia has endorsed the Eurocodes in national regulation. National annexes to Eurocodes 1 and 8 have been adopted (Snow loads, Part 1-4: Wind action, Part 1-5: Thermal action, while Eurocode 8 covers structures for earthquake resistance, National annex –seismic hazard maps).

4.6 Serbia

In the past 10 years, Serbia has transformed the key institutions of the transport sector. Under the relevant Ministry, two enterprises are active in the road sub-sector: Corridors of Serbia and the public enterprise "Roads of Serbia" (PERS). PERS is responsible for the management, maintenance, construction, reconstruction, toll collection and development of Category I and II state roads, while Koridori Srbije Ltd. is an infrastructure development unit responsible for the construction of specific motorway sections.

The **Ministry of Construction, Transport and Infrastructure of Serbia** is developing a **new National Transport Strategy for the period 2022–2030**.

The **Disaster Risk Assessment in the Republic of Serbia** (2018) covers scenarios for landslides, rockslides, erosion, floods and extreme weather events.

By 2020, the PE "Roads of Serbia" had financed the preparation of nine studies on flood risk analysis for Class I and II roads in river basins in Serbia. The Highway Institute in Belgrade prepared a study on

[64] UNDP. *Country programme document for the Republic of North Macedonia (2021–2025)*. p. 4. https://tinyurl.com/2p9xnt2b .

[65] "Technical Assistance Preparation of Climate Resilience Design Guidelines for the Public Enterprise for State Roads in North Macedonia". *Guidelines for the Public Enterprise for State Roads in North Macedonia. Part B Climate Resilience Design Guidelines*. July 2019. p.26. [Online] Available at: https://tinyurl.com/4p9jpsz8

snow accumulation on Class I state roads in 2016 for the PE "Roads of Serbia". The study analysed around 4,800 km of Class I state roads and concluded that a length of 678.1 km of the road network was exposed to the effects of snow accumulation. These studies were prepared on the basis of the current situation or recorded occurrences in the past, but do not include the impact of climate projections.

A methodology for assessing the vulnerability of roads to climate change was developed within the **World Bank Study *Mainstreaming Climate Resilience in the Road Transport Management in Serbia***. The methodology was applied within a pilot project on the territory of the wider area of Valjevo and included the impact of foods, flash floods, landfalls, landslides, wildfires and snow accumulation on the state of roads (about 500 km of Class I and II roads).

Within the Climacor II project, a study on the impact of climate change on the Road Corridor X was conducted.[67] The study applied a modified Roadapt/Rimarocc methodology for the rapid assessment of the impact of climate change based on an expert survey in terms of the most severe threats, possible effects (in terms of availability), the probability of occurrence, and finally defined adaptation measures for individual risks.

The study on the impact of climate change for the City of Belgrade[68] is the only study that deals with local infrastructure and provides a general overview of the impact on the city's traffic infrastructure.

The Ministry of Environmental Protection produced a ***Report on the Impact of Climate Change on Road Infrastructure with a Proposal for Adaptation Measures***.[69]

The Law on Climate Change was adopted in 2021. The **Low Carbon Development Strategy** and its **Action Plan** have not yet been adopted. There are not many sectoral policy documents containing references to climate change issues; the existing ones only include climate change as a formal reference, they do not address the issue in more practical and concrete terms; an assessment of vulnerability and of the possibilities for enhancing the adaptive capacity for each sector is missing.

The Law on Environmental Impact Assessment and the Law on Strategic Environmental Impact Assessment have not yet been amended.

Climate resilience has been a crucial component of the design in all regional infrastructure projects financed by international financing institutions (IFIs), therefore this aspect is thoroughly covered in all new projects. What is lacking is a systematic approach to climate resilience and climate proofing within documents produced by the relevant ministries and primary institutions of the transport sector (i.e. guidelines for design, construction and maintenance from a climate adaptation perspective).

[67] Report on the Impact of Climate Change on Road Infrastructure, with a Proposal for Adaptation Measures, p. 9.
[68] Climate Change Adaptation Action Plan and Vulnerability Assessment, City of Belgrade, Secretariat for Environmental Protection, 2015.
[69] https://adaptacije.klimatskepromene.rs/wp-content/uploads/2022/03/Infrastructure-Impacts-of-Climate-Change-on-Road-infrastructure.pdf

4.7 Regional overview

INSTITUTIONAL GAPS:

From the perspective of policy development and relevant data management, the institutional frameworks of the six WB countries have many similarities. The competencies are divided between government institutions such as ministries, agencies and public enterprises tasked with ensuring the well-organized and competent functioning of the policymaking and implementation system. The institutional set-up within and between those institutions should avoid significant gaps and overlaps and should not be overly fragmented.

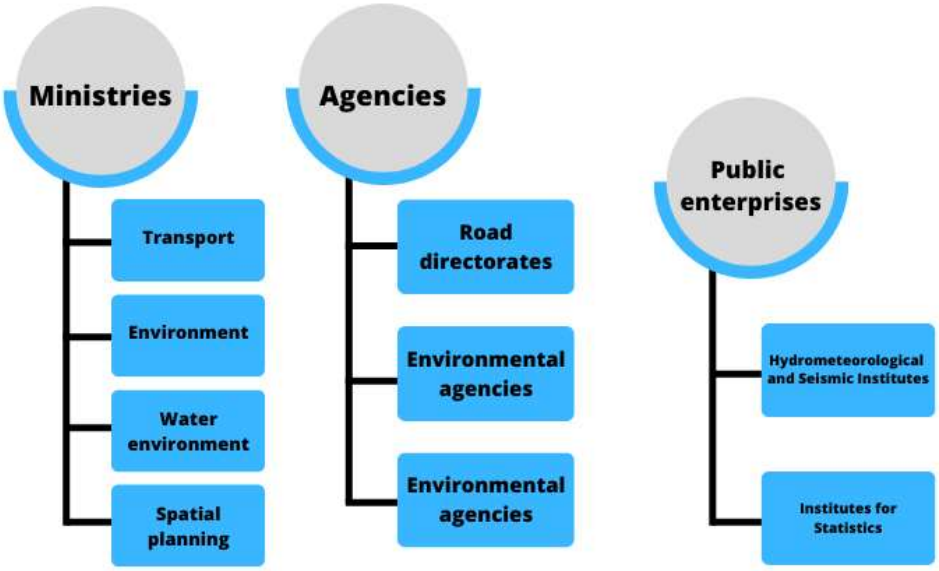


Figure 41: Resilience planning – Institutional framework

In the course of the current project implementation, many gaps and shortcomings of the above system have been exposed, in particular during the activities of collecting the relevant data in cooperation with government stakeholders/ institutions. Some of the institutional gaps identified are:

- Weak institutional cooperation of relevant stakeholders;
- Lack of professional in-house expertise;
- Lack of focus on an interdisciplinary approach to enable effective planning and implementation of the climate change adaptation strategy;
- Insufficient level of cooperation and coordination of the institutions performing climate impact assessments with institutions tasked with planning and maintenance of the road infrastructure;
- Lack of robust internal processes and delegation of responsibilities and ownership.

The above gaps affect policymaking processes in the areas of environmental protection and climate change adaptation, as well as the implementation of relevant laws, rules and regulations. Improved horizontal and vertical cooperation, coordination and information exchange, professional in-house expertise, sufficient financial and technical resources, educated staff, better information flows as well

as transparent and participatory processes involving public participation in all phases of the policy discussions are prerequisites for improving institutional and professional capacities and taking the entire process of climate change adaptation to the next level.

POLICY GAPS:

The WB countries are making progress in climate change adaptation and mitigation, but the climate change policy documents in place focus primarily on mitigation.

BiH does not have a spatial plan in place, while the spatial planning documents for Kosovo*, Montenegro and North Macedonia are no longer effective (as of 2020). Effective spatial planning documents do not take the climate change risk assessment aspect or the adaptation strategy into account. The preparation of a new spatial plan is ongoing in North Macedonia, including the application of the methodology for the integration of climate change in spatial and urban plans.

The transport strategies in place are mostly focused on improving existing transport infrastructure as well as developing a new one, with very little consideration of climate change resilience in the process.

A climate change adaption plan is in place only for Albania, while BiH is in the process of preparing one.

Table 8 provides an overview of existing climate change policies and related documents in place in the six WB countries.

Table 8: Overview of policies in place in WB countries

Country / Type of policy document	Albania	Bosnia and Herzegovina	Montenegro	North Macedonia	Serbia	Kosovo*
Spatial plan	National Territorial Plan of Albania 2030	No, only for the Republika Srpska entity	Effective until 2020	Effective until 2020	Effective until 2035	Spatial Plan of Kosovo 2010–2020+
National Transport Strategy	National Transport Sector Strategy and its Action Plan 2016–2020	Framework Transport Strategy in BIH for the period 2016–2030	Strategy for the Development of Transport of Montenegro for the period 2019–2035	National Transport Strategy for Macedonia 2018–2030	National Transport Strategy for the period 2022–2030 – under preparation	Strategy of Development for Multimodal Transport for the period 2014–2025

* *This designation is without prejudice to positions on status and is in line with UNSCR 1244 and the ICJ Opinion on the Kosovo Declaration of Independence*

Country Type of policy document	Albania	Bosnia and Herzegovina	Montenegro	North Macedonia	Serbia	Kosovo*
National Climate Change Adaptation Plan	National Climate Change Strategy 2019	Climate Change Adaptation and Low Emission Development Strategy of Bosnia and Herzegovina for the period 2020–2030 Nationally Determined Contributions of BiH (NDC) for the period 2020–2030 Third National Communication on Climate Change National Energy and Climate Plan (NECP) – submitted to the Secretariat of the Energy Community	Third National Communication National Strategy on Climate Change 2015–2030 Climate Resilience Strategy and Action Plan for Montenegro 2019 (EBRD)	Enhanced Nationally Determined Contribution Third National Communication on Climate Change; Fourth National Communication in final stage of adoption Long-term Strategy on Climate Action of the Republic of North Macedonia	Climate Strategy and Action Plan Republic of Serbia, effective until 2030	Climate Change Strategy 2019–2028
Climate Change Legal framework	Law on Climate Change	**No**	Law on Protection against Adverse Impacts of Climate Change 2019	Law on Climate Action – in parliamentary procedure, to be adopted	Law on Climate Change adopted in March 2021	**Concept Document on Climate Change 2019**
National Climate Change Adaptation Plan	**Yes**	**In preparation**	**No**	**No**	**No**	**No**
Disaster risk reduction plan (DRR)	**No**	**No** (under development in 10 municipalities)	Strategy for Disaster Risk Reduction for 2018–2023	Disaster Risk Reduction 2021–2025 for 9 municipalities National Platform of the	Yes	Disaster Risk Reduction Strategy and Plan of Action was developed in 2016 and

Country Type of policy document	Albania	Bosnia and Herzegovina	Montenegro	North Macedonia	Serbia	Kosovo*
				Republic of Macedonia for Disaster Risk Reduction 2019 No national DRR Strategy		effective until 2020.

HAZARD AND RISK ASSESSMENT IMPLEMENTATION GAPS:

The WB countries are making progress towards the development of hazard and risk assessments. The results achieved so far are primarily due to EU integration requirements (EU Flood Directive + Eurocodes) and the requirements of IFIs.

However, it is not easy to access available data and maps, as these are not part of integrated national GIS databases. The data is usually project-based and dispersed across various sources (e.g. risk assessment probability maps can be found in different projects or international risk assessment web pages). Table 9 provides an overview of the available hazard and risk assessment data by each WB country.

Table 9: Overview of available hazard and risk assessment data per countries

Country Hazard/risk map	Albania	Bosnia and Herzegovina	Montenegro	North Macedonia	Serbia	Kosovo*
Landslide	CRISIS ("Comprehensive RISk assessment of basic services and transport Infrastructure") supported by the Union Civil Protection Mechanism. EU landslide susceptibility MAP. ELSUS d base- 170	Yes, UNDP programme	No Analysis of flood and landslide risks for Montenegro (with an emphasis on the catchment area of Bojana River and the Skadar Lake) FLAT project – Flood and	Yes Technical Assistance Preparation of Climate Resilience Design Guidelines for the Public Enterprise for State Roads in North Macedonia". Guidelines for the Public Enterprise for State Roads in	Yes	No

* *This designation is without prejudice to positions on status and is in line with UNSCR 1244 and the ICJ Opinion on the Kosovo Declaration of Independence*

Country Hazard/risk map	Albania	Bosnia and Herzegovina	Montenegro	North Macedonia	Serbia	Kosovo*
	landslides along Albanian highways over the last three years		Landslide Assistance and Training, Interreg IPA CBC	North Macedonia. Part B Climate Resilience Design Guidelines. Resilient Polog supported by SDC and SECO and implemented by UNDP (for the Polog Region) CRISIS ("Comprehensive RISk assessment of basic services and transport Infrastructure") supported by the Union Civil Protection Mechanism		
Flood hazard and flood risk maps	No EU-supported Programme for Improving National Early Warning System and Flood Prevention in Albania, launched in 2021	Yes Climate Resilience Risk Assessment for the main road network in FBiH	Preliminary Flood Risk Assessment is in the proposal phase	Yes Flood hazard map of the country. Technical Assistance Preparation of Climate Resilience Design Guidelines for the Public Enterprise for State Roads in North Macedonia. Guidelines for the Public Enterprise for State Roads in North Macedonia. Part B Climate Resilience Design Guidelines. Draft FRM Strategy Preliminary flood risk assessments for the Strumica,	Flood hazard and risk maps for 75 Areas of Potentially Significant Flood Risk (APSFR) previously identified in the Sava, Danube, Morava, Ibar Basins covering 16 per cent of the territory Nine studies on flood risk analysis for Class I and II roads in river basins in Serbia	Preliminary Flood Risk Assessment for river basins in Kosovo*

Country Hazard/risk map	Albania	Bosnia and Herzegovina	Montenegro	North Macedonia	Serbia	Kosovo*
				Bregalnica watersheds, Polog (Upper Vardar), Drim Assessment of flood risk and economic impact, Drin River Basin, Balkans: Albania, North Macedonia, Montenegro, Serbia, Kosovo*		
Seismic (probability map)	Yes, since 2004	+, Eurocode 8	+, Eurocode 8	+, Eurocode 8	+, Eurocode 8	+, Eurocode 8
Snow loads (probability map)	No	+, Eurocode 1	+, Eurocode 1	+, Eurocode 1	+, Eurocode 1 Study on snow accumulation on Class I state roads in 2016 for PE "Roads of Serbia" - about 4,800 km of Class I state roads analysed; 678.1 km are exposed to the effect of snow accumulation	No
Wind (probability map)	No	+, Eurocode 1	+, Eurocode 1	+, Eurocode 1	+, Eurocode 1	No
Thermal (probability map)	No	+, Eurocode 1	+, Eurocode 1	+, Eurocode 1	+, Eurocode 1	No

5 Risk Assessment and Management – Case Studies

5.1 Albania

The project *Climate Resilient Road Assets in Albania* supported Albanian authorities in the prioritization of current and future climate and seismic resilient investments in the road sector. The project used climate and seismic vulnerability assessments and proposed mitigation measures to improve the climate and seismic resilience of the Albanian road network. The report *Climate Resilient Road Assets in Albania* concludes that investment in resilience and mitigation measures for Albania's national road network is cost effective and is much lower than the estimated annualized cost of the damages and loss that would accrue if mitigation measures had not been put in place and maintained.[70]

Part 1 of the project provides information on the locations of the road network with the highest risk to different hazards, and includes an overview of:

- The hazards that present the greatest risk
- The locations that are the most vulnerable to a specific hazard
- The probability of a hazard affecting a specific road section
- The impact of the different hazards expressed in repair costs and losses due to road disruptions (in euro).

A risk analysis (i.e. determination of network vulnerability, criticality and risk assessment) is performed for the primary road network and of the flooding, seismic and landslide hazard.

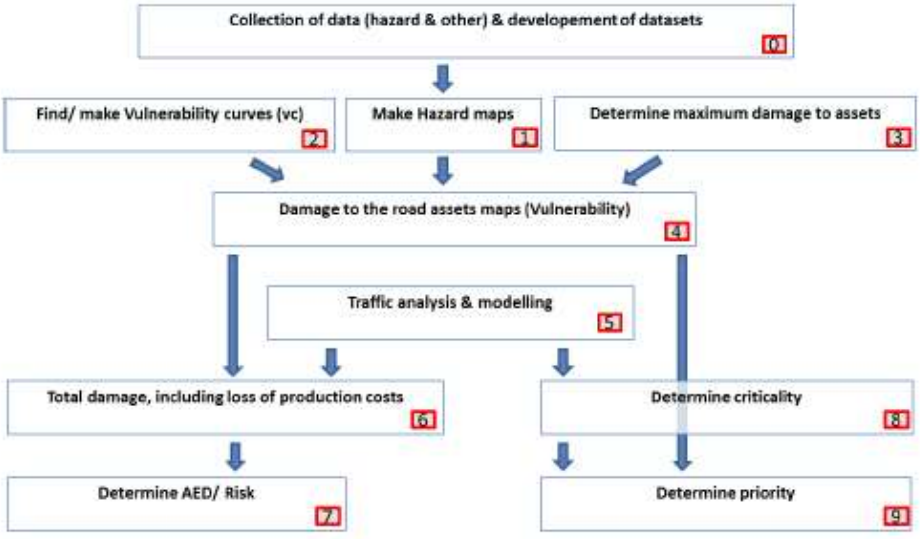


Figure 42: Approach concept to risk analyses

[70] Climate Resilient Road Assets in Albania. World Bank, Washington, D.C., 2019.

The economic impact of the disruption of the corridor depends on both traffic intensity and the duration of the disruption and the additional distance to be travelled on the detour. The calculation of expected damages resulting from the interruption of services due to the natural hazards was prepared by taking the following components into account:

- A network and zoning system – to determine the primary road network of Albania in corridors, to establish origin/ destination matrices, including border crossings;
- Traffic demand analyses – to determine the current use (demand) and forecast future demand, the traffic volume of the corridors, transport characteristics such as travel motive, vehicle types;
- Economic factors for valuation – to be able to assess the increased travel time and distance to a monetary value;
- Natural hazards – the effects of the different hazards on the corridors in terms of impact, duration of disruption of services and probability of the event.

Figure 43: Amount of damages from pluvial floods t=50 due to insufficient capacity of bridges and largest culverts

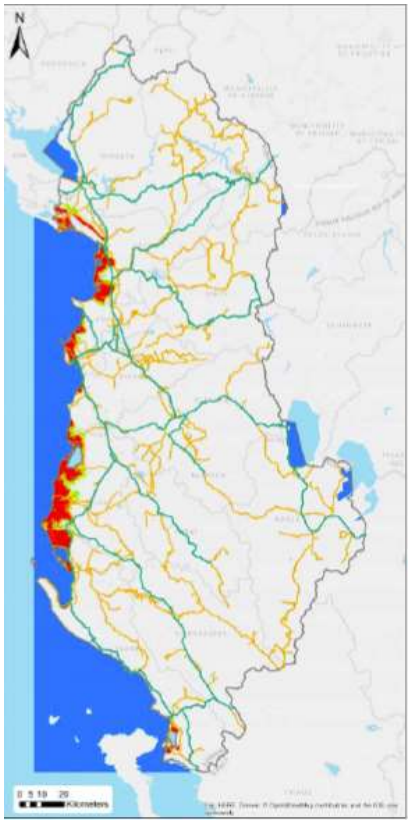


Figure 44: Flood depth for coastal floods, extreme events 3 m

Figure 45: Seismic hazard map, mean PGA, return period 479 years

Figure 46: Landslide susceptibility (landslide/km/year)

The project resulted in the calculation of total annual damages expressed as the Expected Annual Damages (AED) euro/km.

Figure 47: Cumulative risk assessment – total annual damages euro/km

To prioritize where to focus resilience-building activities, the importance or criticality of the roads has been considered. The criticality takes various criteria into account and can be combined with the AED to prioritize actions. A workshop with all stakeholders was organized to assess the criticality of the different corridors, where a scoring table was prepared in which stakeholders could indicate the importance of several criteria for the different corridors.

Corridor	Length (km)	AED (€/km) ('000)	Criticality	Floods		Land slides	
				Damage	Intervention	Damage	Intervention
01 Milot - Morine New	104	3.3	42			✓	✗
02 Shkoder - Puke - Kolsh	126	1.0	24	✓	✓	✓	
03 Milot - Shkoder - Muriqan	127	12.8	37	✓			
04 Tirana - Durres	32	59.1	53	✓	✓		
05 Durres - Vlore	152	69.0	52	✓	✓	✓	✓
06 Tirana - Elbasan - Pogradec	139	24.9	42	✓	✓	✓	✓
07 Fier - Gjirokaster - Kakavi	128	10.6	37	✓	✓		
08 Gjirokaster - Sarande - Ksamil	58	1.4	39	✓			
09 Elbasan - Gramsh	41	0.7	26				
10 Lushnje - Berat - Çorovode	86	4.1	24	✓	✓		
11 Rrogozhine - Elbasan	40	0.9	37				
12 Shkoder - Hani i Hotit - Vermosh	125	2.3	40	✓	✓		
13 Milot - Peshkopi	136	5.3	30	✓	✓	✓	✗
14 Vlore - Sarande	131	2.4	39	✓	✓	✓	✗
15 Pogradec - Korce - Kapshtice	69	1.0	45				

Figure 48: Summary of risk analyses (AED), prioritization (criticality) and benefit/cost ratio of proposed measures

The tick marks and crosses in the 'interventions' column indicate whether a cost-benefit analysis (CBA) was carried out and whether the CBA was positive or not. A green tick mark indicates a B/C ratio > 1 (i.e. a positive CBA), an orange tick mark denotes a B/C ratio that indicates a positive CBA under specific circumstances and a red cross signifies that the B/C ratio was too low to warrant taking measures from a CBA point of view.

5.2 Bosnia and Herzegovina

Mainstreaming climate resilience risk in road management in Bosnia and Herzegovina is the World Bank project (2018) that provided technical assistance to the Public Company Roads of the Federation of Bosnia and Herzegovina (PC Roads) which is responsible for the management and maintenance of the main road network in the FBIH.

The consortium carried out a systematic review of the available data on hazard and risk assessments, developing a suitable GIS structure for viewing hazard data, evaluating current disaster management procedures, and identifying future actions to improve the resilience of the FBiH's road network. Building the local capacities required to carry out hazard and risk assessments was an integral part of the project, aimed at improving the work on climate resilience and mitigating the impact of such hazards. The following hazards have been taken into account:

- Fluvial floods
- Landslides
- Rock fall
- Snow cover
- Wildfires.

The results of the risk assessment are presented in the maps below.

Figure 49: Risk assessment map for floods

Figure 50: Risk assessment map for landslides

Figure 51: Risk assessment map for rock fall

Figure 52: Risk assessment map for snow

Figure 53: Risk assessment map for wildfires

The risk assessment resulted in defining risk assessment benchmarking values divided into five categories from low risk to very high risk. The overall risk assessment score of 130 magistral road sections showed a high risk for 32.2 magistral road sections. The other road sections indicated moderate risk.

Parameter	Unit	Value range	No Risk	Low Risk	Moderate Risk	High Risk	Very High Risk	Max Value
Flood risk assessment	Value range	0-140	0	1-35	35-70	70-105	105-140	140
Rock fall risk assessment	Value range	0-80	0	1-20	20-40	40-60	60-80	80
Landslide risk assesment	Value range	0-100	0	1-25	25-50	50-75	75-100	100
Wild fire risk assessment	Value range	0-80	0	1-20	20-40	40-60	60-80	80
Snow risk assessment	Value range	0-40	0	1-10	10-20	20-30	30-40	40
Road condition IRI	IRI range		<1.2	1.2-2.5	2.5-3.7	3.7-4.9	≥ 4.9	
	Value range	1-10	0	2	5	8	10	10
	Total value	**MAX**	**0-7**	**7-112**	**112-225**	**225-338**	**338-450**	**450**

Figure 54: Summary of calculations of risk assessment results

The method also applied the criticality assessment which consisted of two elements: i) demographic vulnerability, and ii) social impact. Demographic vulnerability and social impact data were used to assess the criticality of the strategic importance of each road section in terms of most significant impact on residents and their livelihoods with special attention to vulnerable groups identified within each area along the road section.

Figure 55 illustrates that most road sections were classified as high risk in terms of social impacts, followed by very high and medium risk. No road sections were classified as low or no risk.

Figure 55: Criticality assessment map for social impacts

Figure 56 shows that most road sections were classified as medium risk in terms of demographic vulnerability, followed by high and low risk.

Figure 56: Criticality assessment map for demographic vulnerability

5.3 Montenegro

In 2019, the European Bank for Reconstruction and Development (EBRD) provided a loan of EUR 40 million for the rehabilitation of three road sections, Rozaje-Spiljani, Tivat-Jaz and Danilovgrad-Podgorica. Since there is growing awareness among road infrastructure stakeholders of the impact of climate change on the road network, the project not only aimed to supervise the implementation of rehabilitation measures, but also to advise on the introduction of climate resilience elements in project planning and design. As a result, the Climate Resilience Strategy and Action Plan were developed.

The Strategy states that Montenegro is likely to experience a dynamic growth of motorization in the future. Montenegro's road network is not fully prepared for the expected climate change and climate impacts, putting human lives at risk and involving economic costs.

Based on the initial climate assessment of 52 road sections, carried out by the working group in July 2019, Montenegro is vulnerable to climate impacts resulting from climate change.

The working group has identified:

- 9 road sections with an extreme risk score of 256
- 19 road sections with a very high risk score of 20
- 11 road sections with a higher risk score of 16
- 4 road sections with a high risk score of 15
- 9 road sections with a high risk score of 12
- 0 road sections with a low risk score of less than 12.

The average score is above 12 for all main roads.

The 9 road sections most susceptible to risk are outlined below, with the specific climate risks defined.

Table 10: List of Montenegro's road sections with an extreme climate risk score[71]

Road Section/Area	Climate Risks
M2 | Petrovac (junction with M1) – Sotonici-Virpazar 1 (junction with M1.1)*	• Extreme precipitation • Flash floods • Weather storms • Landslides • Wildfires (especially for this section of the M2)
M2 | Virpazar 1 (junction with M1.1) – Virpazar 2 (junction with R15)	• Wildfires • Extreme heat • Wind • Flash floods
M2 | Virpazar 2 (junction with R15) – Golubovci (detour) – Podgorica 1 (junction with M3)	• Wildfires • Extreme heat • Wind
M2 | Podgorica 1 (junction with M3) – Podgorica 2 (junction with M4)	• Wildfires • Extreme heat • Wind • Flash floods
M2 | Podgorica 2 (junction with M4) – Bioče (junction with R13)	• Natural rock falls • Wildfires • Extreme heat • Wind • Flash floods
M2 | Bioče (junction with R13) – Mioska (junction with R21)	• Snow • Flash floods
M2 | Mioska (junction with R21) – Kolašin (junction with R13)*	• Snow • Natural rock falls • Landslides • Flash floods
M2 | Kolašin (junction with R13) – Mojkovac (junction with R10)*	• Snow • Natural rock falls • Landslides • Flash floods
M2 | Mojkovac (junction with R10) – Slijepač Most (junction with R11)*	• Snow • Natural rock falls • Landslides

[71] Climate Resilience in the Montenegrin Road Network. Climate Resilience Strategy and Action Plan. September 2019. p.5. [Online] Available at: file:///C:/Users/pc/Downloads/d4-climate-resilience-strategy-and-action-plan-v13-final.pdf

* At the time of writing, this Case Study (2019) and the technical documentation was being developed.

*At the time of writing this Case Study (2019), the technical documentation was being developed.

The Strategy identified several existing issues that impede improvements in the climate resilience of Montenegro's roads. These can be divided into five specific groups:

1. Technical issues
   - No system for monitoring data
   - No centralized database
   - No system for coordination
   - Road quality
2. Financial issues
   - Capacity needs
   - Lack of funding
3. Regulatory issues
   - Lack of climate resilience standards
   - Lack of long-term budgetary planning
   - Non-existent smart policymaking
4. Institutional issues
   - Lack of inter-sectoral cooperation
   - Insufficient coastal zone management
   - Lack of ownership of Institutions
5. Social issues
   - Lack of awareness and understanding that building climate resilient roads is more cost-effective than rebuilding them after climate impacts/ events.

Table 11 links the key objectives to the specific road sections (based on an initial assessment) with outlined adaptation responses that need to be implemented to offset the negative effects. Resolving these issues would greatly improve resistance to climate impacts.

Table 11: Key objectives of the specific road sections and adaptation response[72]

KPI	Coverage	Adaptation Responses	Outcome
Ensure the continuity of road traffic in the coastal region during all seasons as sea levels are expected to rise by +65cm by 2050	11 road sections	Construction of seawalls, jetties, offshore breakwaters, groins, ripraps to protect shorelines from coastal erosion and submersion and re-siting of critical infrastructure from areas that are forecast to be most at risk from rising sea	Most vulnerable road sections become climate resilient. Reduction of fatal road accidents caused by non-resilient & unsafe road infrastructure. Reduction of the expected increase in annual maintenance costs of EUR 3.3 million and a reduction of the expected increase in annual maintenance & reconstruction increase of EUR 10.2 million (by 2050).

[72] Climate Resilience in the Montenegrin Road Network. Climate Resilience Strategy and Action Plan. September 2019. p.12. [Online] Available at: file:///C:/Users/pc/Downloads/d4-climate-resilience-strategy-and-action-plan-v13-final.pdf

KPI	Coverage	Adaptation Responses	Outcome
		levels, especially on 11 road sections (with high exposure to sea level rise)	Ensure the continuity of road traffic in the coastal region. Decreased occurrence of severe climate events (fires, landslides, flooding, rock falls) currently imminent on 53 per cent of all road sections. Reduction of severity of impacts on the population and only limited disruption of services (allowing swift re-opening of a closed road section).
Decrease the occurrence of severe climate events:			
Flooding	41 road sections	Increasing the water retention capacity by introducing natural or bioengineered systems and water storage systems and the construction of levy banks with drainage on 41 of all main road sections (with very high exposure to flooding)	
Wildfires	37 road sections	Use of heat and fire-resistant materials & coverage of firefighting equipment on 37 road sections (with very high exposure to fires)	
Extreme heat and droughts	35 road sections	Implementation of resilient materials with heat resistant properties on 35 road sections	
Wind	25 road sections	Installation of windbreaks on 25 road sections (with very high exposure to high wind speeds) and implementation of forecasting of wind speeds in a website for drivers	
Snow and avalanches	12 road sections	Use of a pavement surface with a high albedo (surface solar reflectivity) to minimize heat transfer to the underlying subgrade and using materials to protect against avalanches on 12 road sections	

KPI	Coverage	Adaptation Responses	Outcome
Natural rock falls and landslides	30 road sections	Introduction of debris flow barriers and enhancement of slope stability and the prevention of landslides and rock falls on 30 road sections (with very high exposure and sensitivity)	

Nine road sections have been defined as the most vulnerable to climate change and climate impacts. the Strategy thus proposes the following measures to be introduced:

Table 12: Adaptation responses for the nine extreme risk road sections in Montenegro[73]

Road Section/Area	Climate Risks	Adaptation Responses
M2 | Petrovac (junction with M1) – Sotonici-Virpazar 1 (junction with M1.1)*	• Extreme precipitation • Flash floods • Weather storms • Landslides • Wildfires (especially for this section of the M2)	Increasing water retention capacity by introducing a water storage & drainage system Enhancement of slope stability & debris flow barriers Use of heat-resistant surface materials & increase in fire extinguisher coverage
M2 | Virpazar 1 (junction with M1.1) – Virpazar 2 (junction with R15)	• Wildfires • Extreme heat • Wind • Flash floods	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
M2 | Virpazar 2 (junction with R15) – Golubovci (detour) – Podgorica 1 (junction with M3)	• Wildfires • Extreme heat • Wind	
M2 | Podgorica 1 (junction with M3) – Podgorica 2 (junction with M4)	• Wildfires • Extreme heat • Wind • Flash floods	
M2 | Podgorica 2 (junction with M4) – Bioče (junction with R13)	• Natural rock falls • Wildfires	Use of heat-resistant surface materials

[73] Climate Resilience in the Montenegrin Road Network. Climate Resilience Strategy and Action Plan. September 2019. p.13. [Online] Available at: file:///C:/Users/pc/Downloads/d4-climate-resilience-strategy-and-action-plan-v13-final.pdf
*At the time of writing, this Case Study (2019) and the technical documentation was being developed.

Road Section/Area	Climate Risks	Adaptation Responses
	• Extreme heat • Wind • Flash floods	Installation of rockfall netting Construction of windbreakers Installation of strength mesh suitable for the reinforcement and protection of slopes
M2 | Bioče (junction with R13) – Mioska (junction with R21)	• Snow • Flash floods	Use of a pavement surface with a high albedo (surface solar reflectivity) to minimize heat transfer to the underlying subgrade Use of heat drain to facilitate heat extraction from the embankment during winter
M2 | Mioska (junction with R21) – Kolašin (junction with R13)*	• Snow • Natural rock falls • Landslides • Flash floods	Avalanche protection by concrete galleries Tunnel structures protecting from landslides & rock falls Installation of rock fall netting Construction of debris flow barriers
M2 | Kolašin (junction with R13) – Mojkovac (junction with R10)*	• Snow • Natural rock falls • Landslides • Flash floods	
M2 | Mojkovac (junction with R10) – Slijepač Most (junction with R11)*	• Snow • Natural rock falls • Landslides	

5.4 North Macedonia

The Polog region is located in the north-western part of the Republic of North Macedonia with an area of 2,420 km, a population of 304,125[74] and nine municipalities, including two densely populated cities (Tetovo and Gostivar). The terrain is primarily mountainous, with the fertile Polog Valley located between the two mountain ranges. Floods, including flash floods, represent the main hazard due to the numerous torrential streambeds and torrents, landslides and erosion, storms, heavy snowfalls and blizzards, etc. On 3 August 2015, a severe flash flooding event occurred in the broader region of the City of Tetovo and its mountainous part, i.e. the Village of Shipkovica, affecting over 80,000 residents and resulting in 6 human casualties and causing over EUR 30 million in damages. Nevertheless, floods that are much smaller in scope and impact regularly affect the communities, and considering the

*At the time of writing, this Case Study (2019) and the technical documentation was being developed.

[74] https://tinyurl.com/2p9apv9e

potential climate change, it would be expected that their frequency, intensity and magnitude would increase.

Following the August 2015 flash flood, UNDP, alongside its national and local counterparts, conducted a series of assessments aimed at identifying the causes of the disaster and recommending measures to prevent similar events in the future. Accordingly, the following key causes of the disastrous consequences of the flood event were identified:

- inadequate public investment in maintenance of existing and construction of new infrastructure, including road infrastructure as needed;
- disregard of safety regulations on the location of houses and other buildings and facilities;
- failure to apply flood risk-based urban planning principles (even basic urban planning requirements are generally not applied in most rural and often in many urban locations, making urban development a largely uncontrolled and unsustainable activity);
- disposal of garbage without regard for health, safety or environmental concerns, which also reduces the discharge capacity of torrential streams and regulations at critical sections, contributing to enhanced harmful debris flow; and
- major systemic deficiencies in the overall governance system for flood preparedness and DRR.

Consequently, the comprehensive programme “Improving Resilience to Floods in the Polog Region”, funded by the Swiss Development Cooperation and implemented by UNDP is being implemented, aiming to achieve:

- an improved knowledge of the region’s flood risk, causes and appropriate responses by authorities and other stakeholders;
- an inclusive approach to flood risk management planning in line with EU legislation that is sensitive to the specific needs of different vulnerable social groups;
- better preparedness for flood risks and strengthened recovery capacity owing to improved governance;
- progress towards flood risk-based urban and economic development;
- a reduction in the adverse consequences of future floods in high-risk areas of the basin through the repair or construction of flood control infrastructure in line with contemporary approaches and techniques, as well as the demonstration of contemporary approaches to flood control in different types of settings (e.g. rural and urban) ; f) creation of a basin-scale flash-flood early warning and public alert system; and g) progress in the adoption of the objectives and principles of the EU Floods Directive.

The resilience-building of road infrastructure is integrated in the implementation of flood resilience measures and takes an integrated approach to understand the hazards and exposure and vulnerability of infrastructure, implements innovative approaches and proposes measures and actions for resilience-building. In that sense, a series of actions was implemented:

- Defining the hydrological model of the Polog region, including the calculation of the flooded area and impact on the road network with different scenarios.

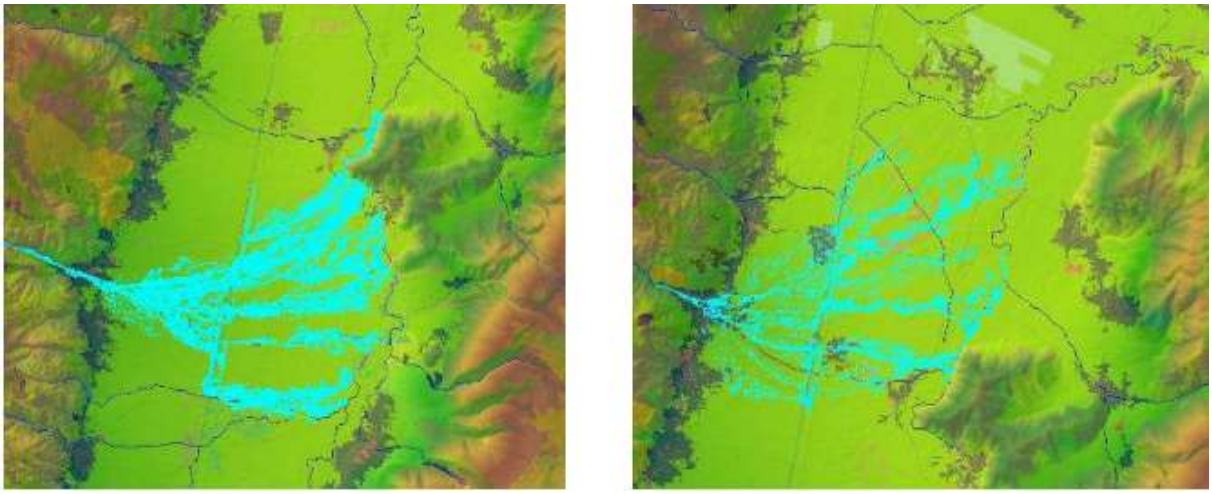


Figure 57: Hydraulic model – sections of the road infrastructure at risk of flooding in the Polog region[75]

- Flood risk mapping with exposure of the road network to the risk of flooding.

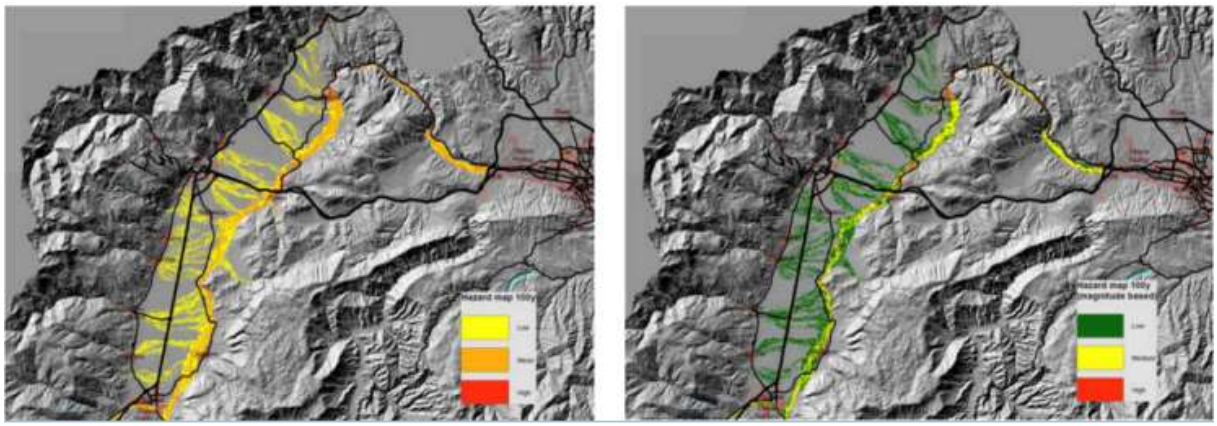


Figure 58: Flood risk exposure of the road network in the Polog region (100 years)[76]

- Flood criticality mapping – presented above in the text, i.e. flood damage as a percentage of GDP (per municipality) and affected users on the state road network, Upper Vardar (100year) and affected population and infrastructure (per municipality) Upper Vardar (100year).
- Landslide susceptibility assessment

[75] "Technical Assistance Preparation of Climate Resilience Design Guidelines for the Public Enterprise for State Roads in North Macedonia". *Guidelines for the Public Enterprise for State Roads in North Macedonia. Part C: Summary of Engineering Measures and Project Level Non-engineering Measures*. July 2019. p. 34. [Online] Available at: https://tinyurl.com/2xxmhx2z

[76] Ibid.p. 35.

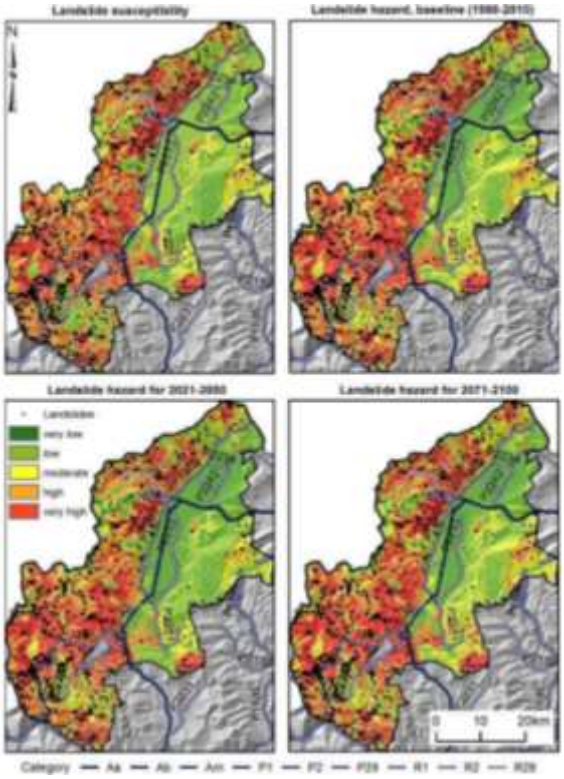


Figure 59: Landslide susceptibility and hazard models of the Polog region for the respective periods[77]

- Vulnerability and risk assessment at the local or site-specific location, Polog study area

[77] Technical Assistance Preparation of Climate Resilience Design Guidelines for the Public Enterprise for State Roads in North Macedonia". Guidelines for the Public Enterprise for State Roads in North Macedonia. Part C: Summary of Engineering Measures and Project Level Non-engineering Measures. July 2019. p. 53. [Online] Available at: https://tinyurl.com/2xxmhx2z

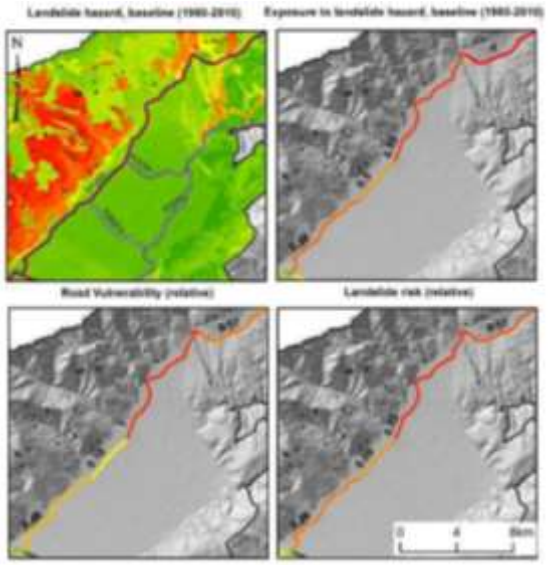


Figure 60: Example of calculation of road exposure, vulnerability, and risk[78]

- Multi-criteria assessment.

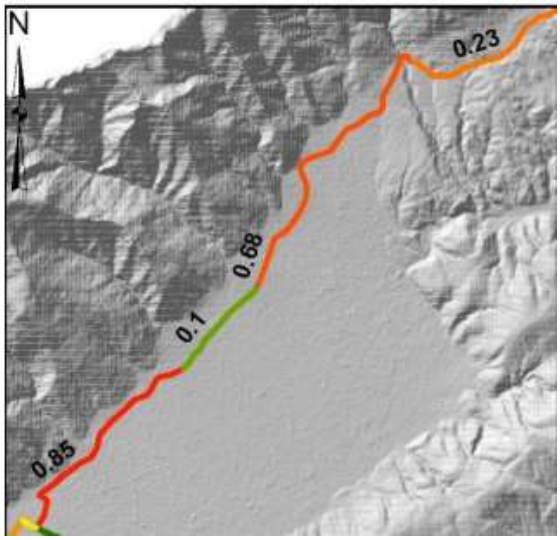


Figure 61: Example of multi-risk for road section (in the Polog region)[79]

5.5 Serbia

In 2018, the City of Belgrade signed the Initiative Covenant of Mayors (CoM) for Climate and Energy. Within two years of becoming a signatory, the Sustainable Energy and Climate Action Plan (SECAP) was submitted to the CoM. The SECAP defines climate mitigation and adaptation objectives for the

[78] Technical Assistance Preparation of Climate Resilience Design Guidelines for the Public Enterprise for State Roads in North Macedonia". Guidelines for the Public Enterprise for State Roads in North Macedonia. Part C: Summary of Engineering Measures and Project Level Non-engineering Measures. July 2019. p. 55. [Online] Available at: https://tinyurl.com/2xxmhx2z

[79] Ibid. p. 66.

municipality to achieve its commitments to the CoM. Accordingly, the City is required to report progress using the SECAP monitoring template, and to adjust its priorities accordingly. The City made a commitment to:

- Reduce its carbon dioxide (CO_2) emissions by at least 40 per cent;
- Increase its resilience to the impacts of climate change;
- Provide secured access to sustainable and affordable energy by 2030.

Belgrade's SECAP comprises:

- Inventories, including a comprehensive Baseline Emissions Inventory (BEI) for climate change mitigation and a Vulnerability and Risk Assessment (VRA) for climate change adaptation;
- Actions featuring an overview of aggregated data on climate mitigation and adaptation and specific key and non-key actions for climate mitigation and adaptation in the municipality;
- An overview of the strategy to implement the SECAP, including targets, roles and responsibilities of authorities involved, financial capabilities, public involvement and a monitoring process.

The SECAP document contains the aforementioned assessments of different sectors: residential buildings, municipal buildings, public lighting and transport. Among other targets defined according to the sectors, SECAP includes defined adaptation and mitigation targets for urban planning and mobility.

Towards urban planning and mobility

Strategic objective	Mid-term target
S.O.T1 – Improve city mobility and reduce congestion	Cut journey times around the city so that the average commute for citizens is below 30 minutes (currently 32.5)
S.O.T2 – Enhancing Green Mobility in Central City Area	Improve green mobility in the central area by increasing the share of trips by green modes (walking, cycling) by 5% (currently <2%), with share of 80% for cycling and 20% for walking and 100% "clean" public transport in the central area
S.O.T3 – Increasing use of alternatively fuelled vehicles	Encourage a transition to e-vehicles, achieving 40% for bus, 80% for taxi, 100% for city owned vehicles, 80% of commercial transport vehicles and 20% in private vehicles of vehicle fleet by 2030

Figure 62: Climate change mitigation targets – urban planning and mobility

Towards urban planning and mobility

Strategic objective	Mid-term target
S.O.L1 – More intensive use of existing underused urban structures by increasing compactness, density and overall urban quality on selected planned locations/zones (along the main public transportation corridors)	Champion reuse of land in urban areas over greenfield development. On average 40% of development should be on brownfield land by 2025 raising to 50% by 2030.
S.O.L2 – Preventing sprawl by limiting unnecessary suburban land take and expansion of construction land.	Limit expansion of urban development into green areas such as forests, agricultural areas, and important ecosystems to no more than 5% of total development per year.
S.O.L3 – Substantially increasing the role of Green City Infrastructure	Develop a planned network of urban green infrastructure and open space to provide ecological (e.g. Climate Resilience) and social benefits (e.g. access) to achieve at least 20% of the cities total area but with at least 7% of each municipality being green.

Figure 63: Climate adaptation targets – urban planning and mobility

SECAP identifies 36 different measures to be taken/ currently underway in Belgrade to address climate change. These include:

- 19 measures to reduce net GHG emissions – either through direct investments or policies that will encourage more sustainable/ low emissions behaviour and investment;
- 17 measures to increase the city's resilience / adapt to climate change. These are mostly focused on the water sector, but also include measures in land-use, afforestation, etc.

The following 11 measures are specifically focused on the sector of urban planning and mobility and need to be completed by 2030.

Table 4-2 Impacts of urban planning and mobility actions in 2030, as compared to the baseline scenario

No	Action	Energy savings	Renewable energy production	CO_2 reduction
		MWh/a	MWh/a	t CO_2/a
1	T1- Extension and development of the Belgrade Metro and train	3,577,649	0	684,861
2	T3 - Purchase of electric buses/trams and busses that use RES with infrastructure development	236,449	55,180	44,265
3	T4 - Bicycle-Sharing System	676,628	0	158,339
4	T5 - Encouraging walking and/or cycling within the city through improved pedestrian facilities and cycle ways			
5	T6 - Commercial transport policy – City logistics	111,469	3,497	67,320
6	T7 - Plan for a network of public chargers for electric vehicles			
7	T8 - Incentives and financing of e-vehicles for public and private commercial vehicles (range 200km/day)			
8	L1 - Linear Park	Not estimated, supporting measure		
9	L2 - Brownfield Development Programme	Not estimated, supporting measure		
10	L4 - Study for a City-wide programme for urban green infrastructure development	Not estimated, supporting measure		
11	L5 – Study on Urban Land Management Policies and Instruments	Not estimated, supporting measure		
	Total effect of all actions	**4,490 741**	**58,677**	**1,070,993**

Figure 64: Measures proposed in urban planning and mobility

In the document, an overview of the SECAP sectors' vulnerability to climate hazards is provided. An overview of the transport sector's vulnerability is presented in the Table 13.

Table 13: Overview of the transport sector's vulnerability to climate hazards from the SECAP of Belgrade

Hazards	Vulnerability indicators	Risk of impact
Extreme heat	Damages; maintenance and fuel costs, rebuilding costs; lower mobility (transport infrastructure)	High risk of impact in summer months. Throughout the city, roads, railways and waterways are at greatest risk. Congested routes are at highest risk (e.g. main roads passing through the city and main traffic intersections)
Extreme cold	Damages; maintenance costs, rebuilding costs; changes to consumption patterns affecting demand and supply	Medium risk of impact in winter months. Throughout the city, roads, railways and waterways are at greatest risk. Congested routes are at highest risk (e.g. main roads passing through the city and main traffic intersections)
Heavy precipitation and floods	Damages; impediment to traffic flow; maintenance costs, rebuilding costs; lower mobility	Very high risk of impact in summer months, high risk in winter months. Throughout the city, roads, railways and waterways are at risk. Congested routes are at highest risk (e.g. main roads passing through the city and main traffic intersections)
Droughts & water scarcity	Challenges transporting bulk material (linked to transport infrastructure); inland navigation on rivers might be difficult or impossible	Medium impact risk in summer months, low in winter months. Throughout the city, roads, railways and waterways are at risk. Congested routes are at highest risk (e.g. main roads passing through the city and main traffic intersections)
Storms	Damages; impediment to traffic flow; maintenance costs	High risk of impact in summer months, medium impact risk in winter months. Throughout the city, roads, railways and waterways are at risk. Congested routes are at highest risk (e.g. main roads passing through the city and main traffic intersections)

6 Summary of the State of Climate Proofing in the Western Balkans

This chapter provides a brief summary of the state of climate proofing of roads in the region, with a focus on the three main issues identified and analysed during project implementation: (i) availability of data (collection and analysis), (ii) resilience assessment, and (iii) institutional framework. The findings of the analysis are presented on a regional scale and cover an overview of available data and skills and expertise required to perform the resilience assessment, as well as the role of the institutional framework in facilitating the achievement of results in the region.

6.1 Data availability

Information gathering is the first critical step in conducting a risk assessment. Data collection is a very lengthy process since one needs to know from where to collect data, how to collect data, involve all relevant stakeholders, and how to interpret the data collected. At the outset, it is essential to know from where the specific data needed can be obtained. This step has been performed by each country. It is useful to have a clear overview of where data are available with corresponding formats and brief descriptions. Thereby, one can determine which data are available and which data are lacking. Such an overview can also promote usage of the data for other projects or additional improvements. Yet even if a vast amount of data are available, if one is not able to interpret or rely on the retrieved information, then the purpose of data collection becomes futile. Agencies must be capable of using the data they rely on to provide explanations. This can include interpretations of legends, scope, limitations, and how the data were processed. Data need to be reliable: the user needs to be certain that the available data set is complete and concise. If this is not the case, the data sets may need to be cleaned up and/ or completed for use in an analysis. Through explanations of the date, information can be effectively conveyed to users. This can also serve as a foundation for how to properly manipulate the data.

The data required to perform a resilience assessment are:

1. climate data,
2. hazard data,
3. exposure data, and
4. vulnerability/ resilience data.

Differences in the availability of each of these datasets between the countries are evident. The observed differences imply that each country will have different priorities in terms of data collection, but it also suggests that no single or unified approach can be used for all countries in the WB. Depending on the data available, each country needs to take a tailored approach to perform a resilience assessment.

A short description of the observed data types—hazard data, climate and weather data, exposure data, vulnerability data and traffic data—.

6.1.1 Hazard data

Some countries have maps with intensity and return periods for several natural hazards, while others do not have any data on the given hazard, or data that are only based on susceptibility maps. This

influences the approach to how the impact of natural hazards is estimated, but also how to include climate variables in the potential impact of these natural hazards (Table 14).

Table 14: Overview of how to include climate variables in natural hazard risk assessments

	Remodelling the hazard (making use of climate data directly)	**Change in probability of occurrence based on statistics. Only possibility for precipitation-related events (based on rainfall statistics and return periods)**	**Based on climate data and expert judgement: identify a range of expected changes in occurrence and/or intensity**
	Intensity + probability of changes in occurrence	Probability of changes in occurrence	Probability of changes in occurrence
i. Hazard maps with different return periods with models	X	X	X (less accurate)
ii. Hazard maps with different return periods without models		X	X (less accurate)
iii. Susceptibility map with susceptibility without intensity and return periods			X

6.1.2 Climate and weather data

To estimate the climate change effects on infrastructure, the current climate variability should be the starting point. This includes information about, for example, the number of consecutive dry days, the return periods of different rainfall events in intensity (mm/day) and/or duration (hours). These climate variables influence the potential impact of natural hazards. Most countries collect weather station data. The quality of that data remains unclear, however. Occasionally, single Intensity-Duration-Frequency (IDF) functions, describing the behaviour of precipitation events, are available for a single location. However, a complete picture of precipitation patterns throughout the countries is missing and it is recommended to gather such data, potentially in collaboration with each country's meteorological service.

All countries have access to the same climate change data, which are made available within the ClimaProof project. Not all countries have made use of the data, however, therefore it is recommended to make use of such data and enable additional training on how to derive climatic trends from them, if necessary.

6.1.3 Exposure

This includes geographic data collection on the characteristics and assets of the infrastructure in each country, which serve as input for impact analyses. Data can only be considered reliable if it is accurate.

It should closely reflect the actual situation if exact recordings cannot be presented. Reliability can be ensured by validation and counter-checking. Consistency is of great importance especially in terms of names, stations and boundaries since this can affect the results of the analyses to be performed using the data. One small discrepancy can lead to a completely different outcome. This can be applied both in the manual collection of data, and the entry of data in the GIS. The boundaries, in particular, should be uniform for different agencies. One common geographic projection should be applied to avoid any unmatched confines. It is recommended to check the completeness and quality of the data. For example, most of the countries have data on their road networks. However, the characteristics of the road are not always clear (e.g. pavement type, road type) and whether the road assets are available in a GIS-type format. Such data are needed to determine the exposure of the roads and their assets.

In some countries, parts of the risk assessment has already been carried out in previous studies. For example, in BiH and Albania, exposure maps exist for different types of natural hazards. Most of the maps shared by the National Consultants include the main transportation network.

It is recommended to check whether bridges and culverts and/ or other assets are also available and included.

6.1.4 Vulnerability

The ability to estimate the value of the exposed assets and the expected degree of damage—the so-called vulnerability—from different hazards is central to the estimation of damage to the roads or their assets. The vulnerability data needed include data on historical records of road damages related to specific climate-induced events, and data needed to create vulnerability functions. Hardly any country has an extensive record on road damages. This means that vulnerability functions should be determined in collaboration with the road authority based on replacement costs and the percentage of damage due to a specific hazard event or per event. It is therefore recommended that the recording of information on construction and repair costs in the event of natural hazards is collected in a database. Ideally, such an inventory correlates the repair costs and physical damages with the hazard, exposure level and the characterization of the road. This can help determine the vulnerability, but will also be an important source for validating the results and increase the quality of the output.

6.1.5 Traffic data

Traffic survey data is useful for establishing the criticality of the roads which subsequently becomes the basis for prioritization of their improvement or expansion. This is also used as a basis for determining the probable cost of disruption in case of occurrence of a disaster such as flooding along the road. However, to obtain useful estimates, accurate and reliable survey data should be obtained by conducting proper traffic count surveys. Several countries provided an overview of traffic counts, while others are still lagging behind. For those countries that have such data available, it is recommended to validate the results. For countries that do not have traffic data available, it is recommended to conduct proper traffic surveys, which includes identification of proper locations, directions and time of measurements and a clear distinction of vehicle types.

The calculation of losses due to disruption of the road network builds on the determination of road network exposure and traffic information. The ability to accurately estimate the duration of

interruptions for each asset type and for each hazard level is key to performing accurate loss estimations.

It is recommended that information on the duration of interruptions due to natural hazards is recorded in a database. Ideally, such an inventory correlates the duration of the disruption and asset type and condition with the hazard level.

6.2 Resilience assessment

All of the above-mentioned data are needed to perform a resilience assessment. Resilience assessments are used to generate insights on the potential impact of natural hazard events, but—more importantly—help identify potential adaptation measures and activities. Performing a resilience assessment builds on an exposure analysis and vulnerability functions to determine the potential damages and losses for communities, but also includes the prioritization of hotspots, the identification of measures and ultimately, adaptation planning. Expertise are required to perform such assessments, and the results should be used by the government and implemented in current practice and policies.

6.2.1 Availability of expertise

Specific expertise is required to be able to develop an adaptation plan. Some of this expertise is likely already present in the given country. For example, expertise on specific hazard modelling or GIS to perform exposure analyses are needed. Similarly, some activities can only be performed within the country (e.g. data collection for the different analyses).

Other expertise is often quite specialized and facilitation will often be necessary. This includes expertise on decision-making in cases of uncertainty which covers expertise on how uncertainties (in socio-economic trends, climatic trends, data uncertainties, for example) can be taken into account in the decision-making process, expertise on the translation of changes in the climate to changes in hazard intensity and risk evaluation.

It is recommended for every country to provide an overview of expertise needed and to match this with the expertise available within the country and determine what type of expertise is still needed.

6.2.2 Evaluate resilience and adaptation planning

To evaluate the results of a resilience assessment, the involvement of government institutions is critical. Not only in terms of implementation, but also to determine the level of acceptable risk. The level of acceptable risk refers to the level of damages and losses and/ or a combination of both that is acceptable for the relevant stakeholders (e.g. government, ministries, road authorities). This is necessary for deciding how and where adaptation measures should be implemented. The evaluation of risk to the road network and the prioritization of roads for future interventions builds on all of the preceding information and methods. This means that any uncertainty in previous calculations and data proliferates into the risk evaluation and should be included in the analyses.

It is also recommended that a prioritization matrix is defined with the involvement of all relevant stakeholders. Thereby, effective prioritization can be achieved, reflecting the most important issues for those affected and resulting in locations where more or less urgent action is needed.

6.3 Role of institutional framework

Effective communication with national agencies and appropriate channels for the exchange of information are crucial. A process of alignment between national agencies, governments and road authorities should be pursued to enhance and expedite the data collection process. Furthermore, the evaluation of risk and prioritization of roads for interventions should be defined in consultation with the relevant stakeholders to reflect the most important issues for decision-making.

7 Recommendations

The above analysis was used as a basis for the development of a set of regional- and country-specific recommendations. The recommendations are classified into three main thematic groups/ categories in accordance with the state of climate-proofing of roads in the WB region:

- Data availability;
- Skills and expertise required to perform resilience assessments; and
- Institutionalization and mainstreaming of climate-proofing measures in the countries.

7.1 General regional recommendations

The recommendations in this section are provided on a regional scale, are reflected in the accompanying Action Plan and derive from the analysis of the current state of data availability in the WB region:

➢ *Operationalize institutional cooperation for relevant data collection and risk assessment:*

1. Hydrometeorological institutes in cooperation with road agencies shall develop a hazard/ risk assessment methodology, including a list of necessary data for its development.
2. Hydrometeorological institutes in collaboration with road agencies shall develop missing probability hazard/ risk maps and diagrams.
3. The responsible ministries of transport and environment shall, in close cooperation with road agencies and hydrometeorological institutes, establish national integrated information systems with all available data/ hazard/ risk maps and diagrams.

➢ *Build and strengthen institutional capacities for infrastructure risk assessments, resilience planning and mainstreaming of climate adaptation measures across infrastructure sectors*:

1. Continuous training of national stakeholders on how to mainstream climate proofing measures into national infrastructure planning procedures while ensuring the data made available through the ClimaProof project is used.
2. In terms of the resilience assessment, refer to the GAP analysis produced within the ClimaProof project as well as the Focus and Policy Recommendations reports to address the gaps identified and to take further actions in accordance with the recommendations (https://climaproof.net/publications).
3. The responsible ministries of transport and environment shall, in close cooperation with road agencies, hydrometeorological institutes and the private sector engaged in EIA and SEA, organize in-depth climate resilience trainings for future members of climate resilience teams within all relevant stakeholders (including trainings on EU Technical Guidance on Climate Proofing of Infrastructure).

➢ *Strengthen the normative and institutional framework for resilience planning and design:*

1. The responsible ministries of transport and environment shall, in collaboration with statistics offices, develop cooperation mechanisms among institutions and standard operating procedures (SOP) for data exchange and elaboration.

2. The responsible ministries of transport and environment shall, in cooperation with international institutions, prepare guidelines for mainstreaming climate risks in sectoral policies and programmes, EIA, SEA, as well as in project design.
3. Road agencies in cooperation with hydrometeorological institutes shall prepare national methodological guidelines/ technical standards on infrastructure risk assessments.

7.2 Country-specific recommendations

The country-specific recommendations presented in this section are based on inputs prepared and delivered by the ClimaProof National Consultants in each WB country in cooperation with stakeholders.

While the country-specific inputs follow, where applicable, the same structure as that set out in the Regional Recommendations (relevant to the three thematic groups), the content differs in level of detail and quality. The reasons behind these differences include variation in the amount of specific national data available, but also institutional engagement and whether previous technical studies have been performed.

7.2.1 Albania

- Data:

The National Environment Agency (NEA) is in charge of developing and managing the National Environmental Information System as well as the National Forest Inventory. The Institute of Geosciences, Energy, Water and Environment (IGEWE) complements NEA by collecting meteorological, climatological and hydrological data (excluding data on air and water quality). IGEWE and other public or private research institutes and academia that carry out climate-related measurements, research or studies, share their data with the Ministry of Tourism and Environment (MoTE) and NEA. However, the agencies' databases are not aligned (neither with each other nor with socio-economic databases from other ministries), and much of the data IGEWE has collected over the last century only exists in paper form. There is an evident lack of institutional management capacity and clear processes for the collection and updating of data on risk and vulnerability, and consequently for the elaboration and prioritization of adaptation measures.

Recommendations:

- *MoET, in cooperation with NEA should foster the development of a web-based national database where the integrated collection of environmental and climate data of all competent and contributing institutions is stored and maintained as an effective solution to the issue of fragmented and dispersed data collection and storage;*
- *IGEWE should further strengthen its human capacities in telecommunication, data management and information technology in close cooperation with NEA and MoET.*

- Analyses:

Due to the lack of data quality control, proper data management and appropriate staff, the hydrometeorological data collected by IGEWE are inadequate for use in scientific analyses and risk

assessments. Although IGEWE's operational staff (meteorology and hydrology) possess a solid scientific background and knowledge, there are very limited staff who can produce weather forecasts, generate critical data for risk analyses to strengthen multi-hazard early warning systems and conduct risk assessments.

The capacity to produce relevant scientific information and analyses on vulnerability, impacts and adaptation in infrastructure projects is very limited at both the national and local levels. Efforts undertaken during the preparation of the national communication and implementation of climate change projects with donor support did not create sufficient capacity in the scientific community, public administration and in other private organizations. This lack of capacity is reflected in the low level of mainstreaming of adaptation measures in sectoral policies and respective implementation.

Recommendations:

Strengthening the role and mandate of the Albania Institute of Geosciences, Energy, Water and Environment (IGEWE) as the central agency responsible for hydrometeorological climate data collection, processing and dissemination should be a priority:

- *IGEWE should reorganize the national hydrological and meteorological services to become a public service in accordance with the World Meteorological Organization's (WMO) standards, and strongly promote national and regional disaster risk reduction (DRR) management;*
- *IGEWE should develop standard operating procedures (SOP) to clarify its own role and responsibilities as well as the cooperation mechanisms for the development, issuance and dissemination of warning products and services;*
- *IGEWE should further develop its capacities to support DRR through nowcasting and improve the training programmes for staff in the hydrometeorological sector on products and services related to DRR, especially in forecasting and operational hydrology. Human capacities in telecommunication, data management and information technology should be enhanced to reap the benefits of modern technology;*
- *It should strengthen climate-related monitoring systems for sectoral implementation activities and digitize and improve the collection and sharing of climate risk data. These measures should be coordinated jointly with the National Environmental Agency (NEA) under the Ministry of Tourism and Environment;*
- *IGEWE should institutionalize its cooperation with MoET; a memorandum of understanding on information exchange and support for MoET in the collection of climate-related data should be concluded.*

- Implementation:

The incorporation of climate change-related risks and adaptation in planning processes and budgets (at the national, sectoral and local planning levels) is very limited. Climate change adaptation work is often outsourced to external consultants, resulting in a protracted lack of domestic capacity development and fragmented efforts at the planning stage. One key objective is to include climate change issues in development planning and budgeting processes. Integrating climate change entails a series of steps that provide guidance on how different measures should be implemented.

Awareness of climate change adaptation among the technical staff in line ministries and others working in the field of climate change is limited. In addition, there is a lack of technical capacity to design, fund and manage climate change adaptation programmes and projects at both the national and local levels. The government does not systematically implement measures to improve education and to raise awareness on climate change mitigation, adaptation and impact reduction. Administrative capacity must be strengthened considerably, financially sustainable climate investments must be made and awareness raising campaigns must be implemented.

Recommendations:

- *The Government of Albania should develop guidelines for the integration of climate change in sectoral plans and budgets.*
- *Capacity development on climate change adaptation and the mainstreaming of climate change should be provided at the national and sectoral planning stage for the technical staff at the Ministry of Tourism and Environment and priority sector ministries (the Ministry of Infrastructure and Energy, the Ministry of Agriculture and Rural Development, the Ministry of Interior);*
- *The Government of Albania should establish a monitoring and evaluation system to determine progress made in the implementation of adaptation-related policies, plans, interventions and investments, as well as the results of those efforts;*
- *The Ministry of Tourism and Environment should carry out a thorough capacity assessment to identify gaps at the subnational level in climate adaptation knowledge and the ability to carry out and update vulnerability assessments and formulate, prioritize, evaluate and implement climate adaptation measures; it should prepare guidelines and templates on how to develop local climate adaptation plans and, through different donors, initiate projects to support local staff in the development of adaptation plans (including capacity development activities for staff).*

7.2.2 Bosnia and Herzegovina

- Data:

The national strategy of BiH contains all publicly available data. However, the process of data collection and analysis is often encumbered due to the multi-layered government with fragmented and dispersed powers on climate issues at the national and subnational levels. Horizontal and vertical communication, cooperation, coordination and information exchange on climate change issues between the authorities, including information gathering from verified sources, the use of standardized methodologies, standardized monitoring and reporting and public consultations with relevant stakeholders need to be further addressed, strengthened, simplified and synchronized. In addition, financial constraints related to the non-use of financial instruments for climate change issues need to be addressed.

Recommendations:

- *Bosnia and Herzegovina should invest additional efforts in the education of staff, including relevant research techniques and analysis capacities, as well as legislative skills to resolve the lack of adoption of appropriate by-laws and strategic policies related to the transposition of EU directives and the preparation of medium-term strategic documents.*
- *All institutions engaged in climate issues[80] should be involved to the extent possible in the collection and analysis of data related to climate risk assessments. The Ministry of Foreign Trade and Economic Relations of Bosnia and Herzegovina (MOFTER) should assume a more proactive role in improving communication, cooperation, coordination and information exchange and foster professional and institutional development. One location/ website where the integrated collection of environmental data of all competent institutions is stored and maintained would be an effective solution to the issue of fragmented and dispersed data collection and storage.*

➢ Analyses:

In 2015 and 2018, JP Ceste FBIH (*Public Company Roads of FBIH – PC Ceste FBIH*) was supported by the EBRD in performing vulnerability analyses as well as in improving cooperation with stakeholders/ partners identified as the most important in terms of addressing adaptation to climate change – the Federal Hydrometeorological Institute, the Sava River Basin Agency, the Adriatic Sea Watershed Agency and the Federal Administration for Civil Protection. the same is missing at the state level, however. It is assumed that other institutions could achieve the same outcome (for example, at the level of Republika Srpska, Brčko District).

In 2018, the Swedish National Road Consulting AB (SweRoad) prepared the Report on Climate Resilience of the Bosnian Road Network.[81] However, this Report only focuses on FBiH. Among others, the Report provides an Action Plan for adaptation to climate change for JP Ceste FBIH as well as a risk and resilience assessment of three pilot stretches (i) M 1.8 Pelagićevo – Srebrenik, (ii) M 4 Donja Orahovica – Šićki Brod, and (iii) M 17 Karuše – Ozimica.
It is unknown whether information (results of the risk assessment; action plan for adaptation to climate change) and materials (templates for database of weather-related events on the road network; proposed collaboration agreements) provided by the Report have been put to use.

[80] For example, the Ministry of Foreign Trade and Economic Relations of Bosnia and Herzegovina, the Ministry of Traffic and Communications of Bosnia and Herzegovina, the Ministry of Foreign Affairs, the Ministry of Justice, the Ministry of Civil Affairs, the Ministry of Environment and Tourism in the Federation of Bosnia and Herzegovina, the Ministry of Spatial Planning, Civil Engineering and Ecology in the Republika Srpska, the Department for Spatial Planning and Infrastructure in Brčko District, the Protection Fund of the Environment of the Republika Srpska, the Fund for Environmental Protection of FBiH, the Federal Hydrometeorological Institute, the Cantonal Governments, Local Governance Level.
[81] https://jpcfbih.ba/assets/upload/dokumenti-klima/Climate_Resilience_BiH_EBRD_Sw.pdf

Recommendations:

- *Similar reports at the level of Republika Srpska and BD should be developed. Apart from vulnerability and resilience assessments, these reports should include terms of collaboration between key stakeholders (hydrometeorological institutes, river basin agencies, civil protection units and entity ministries of transport and communication);*
- *If not already, information and materials from the Report on Climate Resilience in the Bosnian Road Network (2018) should be put to use by JP Ceste FBIH for the further development of company and infrastructure projects.*

BiH does not have a country-wide disaster risk management plan. However, following catastrophic floods in 2014, the government endorsed the Action Plan for Flood Protection and River Management for BIH for the period 2014–2017 and the Programme for Development of Protection and Rescue System and the Protection and Rescue Plan from Natural or Other Disasters at the level of institutions and entities of BiH for the period 2018–2022 which are in line with the EU Floods Directive 2007/60/EC.
It is unknown whether the damages and losses specifically for road infrastructure have been evaluated. There are several road management institutions in BiH.[82] Those institutions should be involved when prioritizing locations where damages and losses are known. The said road management institutions have the knowledge and capacity to identify which measures are best suited, whereas some of the available measures are presented in the national strategy.

Recommendations:

The road management companies JP Autoceste FBIH, JP Ceste FBIH (Federation of Bosnia and Herzegovina, Public Company Motorways and Public Company Roads of RS (Republika Srpska) should closely collaborate with:

- *The Federal Hydrometeorological Institute BiH and the Hydrometeorological Institute of the Republika Srpska, sharing the latest hydrometeorological data and expanding the network of climate stations to include stations in critical road stretches, especially those where winter operation is difficult;*
- *The Sava River Basin Agency and the Adriatic Sea Watershed Agency, sharing the latest data to be used in the design and project documentation of (re)construction projects;*
- *The Federal Civil Protection Administration and Administration of Civil Protection, jointly identifying and prioritizing high-risk roads and alternative routes.*

➢ Implementation:

BiH is a decentralized state consisting of two entities (Republika Srpska and the FBiH) and the Brčko District (BD) of BIH. The two entities and the BD address climate change issues by applying laws, regulations and standards.

[82] In BiH, the management of the main roads is the responsibility of (JP Autoceste FBIH and JP Ceste FBIH. In Republika Srpska (RS), these are the Public Company Motorways and the Public Company Roads of RS. Regional roads in BIH are managed in two different ways (e.g. the Cantons in FBIH and the Public Company Roads in RS).

The country has a multi-layered government with fragmented and dispersed powers on climate issues at the national and subnational levels. The institutions BiH face significant challenges that lead to a reduction in adaptation capacity and the ability to implement and further develop strategies, plans and programmes for adaptation to climate change. BiH does not have a climate change law, neither at the state nor at the entity levels or the BD level. To bridge this gap, UNDP commissioned the development of the Adaptation Strategy for Climate Change and Low Emission Development for Bosnia and Herzegovina.

To address the above-described institutional barriers, the institutional framework must link the institutions and clearly identify their roles, responsibilities, mandates and partnerships. Institutions will need to strengthen their capacity to carry out assigned tasks. A revision of the legislative framework will be necessary to ensure clarity, focus and the ability to address the risks arising from the consequences and opportunities related to climate change. High-level strategies need to be adapted to the local level and need to be developed into sectoral climate change adaptation plans.

Recommendations:

- *The Ministry of Foreign Trade and Economic Relations of Bosnia and Herzegovina (MOFTER) and the Ministry of Civil Affairs (MCA) should join forces to define and formulate policies and use a more comprehensive and broad-based approach. The introduction of climate proofing for infrastructure projects requires close collaboration with the Ministry of Traffic and Communications of Bosnia and Herzegovina (MTC). Invitations to participate in policy definition and formulation should be forwarded to university experts, the BIH Academy of Science and Art, academics and researchers, environmental NGOs and representatives from specialized institutions (hydrometeorological institutes, river basin agencies). The government should include public participation in policymaking (in policy definition and formulation processes), inviting the general public not only through public calls announced on official web pages, but using various channels of communication (including TV and daily newspapers).*
- *The Ministry of Environment and Tourism in the Federation of Bosnia and Herzegovina, the Ministry of Spatial Planning, Civil Engineering and Ecology in Republika Srpska, and the Department for Spatial Planning and Infrastructure in BD should continue developing their technical expertise, including research capacities, analytical capacities, and drafting and presentation skills so the collected information can be used as a basis for policy briefs, public statements or for medium- and long-term strategy development.*

7.2.3 Kosovo*

- Data:

Based on the National Climate Change Strategy 2019–2028[83], it appears that institutions often fail to create and implement measures to collect specific sets of data, or that data is collected but neither published nor analysed.

The Ministry of Environment, Spatial Planning and Infrastructure (MESPI) has assumed the leading role for the coordination of national activities related to climate change and the coordination of activities of the Government of Kosovo* to cope with anticipated climate change impacts.[84] Data are available at MESPI for internal use, however, there are no publicly available databases.

Data on the location and characteristics of assets and of all infrastructural assets that are part of the road infrastructure are available. However, no reliable reports were found on the actual status of road infrastructure (network exposure) and no historical database on the road damages resulting from hazardous events related to climate change is available in Kosovo*.

So far, no FRM plans have been prepared, but a summary of measures and priorities have been drafted in accordance with existing laws or guidelines.[85] Some flood hazard assessments have been performed[86] and seismic hazard data are available, albeit with limited return periods. Data on other hazards are more limited and very difficult to access as they are not publicly available. The Hydrometeorological Institute should store data on historic events and other reliable data. However, data remains unavailable (not published online) and no hazard maps with return periods were found.

* This designation is without prejudice to positions on status, and is in line with UNSC 1244 and the ICJ Opinion on the Kosovo Declaration of Independence.

[83] https://konsultimet.rks-gov.net/Storage/Consultations/14-13-59-04102018/Climate%20Change%20Strategy%20and%20Action%20Plan_sep_2018.pdf

[84] Within the MESPI structure, the Department of Environment Protection leads the national activities in the drafting of strategic documents for climate change and the establishment of the National Committee for Climate Change. Other important departments of MESPI engaged in environment and spatial planning include: the Department for Environmental Inspection, Nature, Water, Construction and Spatial Planning, the Department of Spatial Planning, Housing and Construction, the Department for European Integration and Politics Coordination and the Institute for Spatial Planning, while those that focus on road infrastructure include: the Department of Road Infrastructure and the Department for Road Management. During 2021, the Ministry of Environment and Spatial Planning (MESP) and the Ministry of Infrastructure (MI) merged into the Ministry of Environment, Spatial Planning and Infrastructure (MESPI).

[85] The Ministry of Environment and Spatial Planning issued the Administrative Instruction on Protection from Harmful Water Activities in 2015 (No. 19/2015). This administrative instruction is in compliance with the EU Floods Directive. A concept for the first flood risk management plan is part of the administrative instruction (Art. 7). Conclusions of the preliminary flood risk assessment shall include a summary map of the river basin region indicating the areas of potentially significant flood risk (APSFR). Flood hazard maps and flood risk maps shall be prepared (Art. 8). Flood risk management objectives shall be established (Art. 9).

[86] "Preliminary flood assessment of the Drini River Basin" and a "Local flood risk map on Skenderaj" was developed 2008/2009 by the international consortium of consultants GFA/BRL ingenirie/OIE.

Recommendations:

- *The Ministry of Environment and Spatial Planning (MESPI) should focus on data collection in cooperation with the Meteorological Institute and on the development of a publicly available database that includes historic data on climate, precipitation, temperatures as well as data on annual maintenance costs arising from natural hazard events, vulnerability curves and Intensity Duration Frequency (IDF) curves for precipitation for the main climate regions;*
- *Institutional capacity development is essential for the successful creation and maintenance of the online database. To determine capacity development needs, the roles and responsibilities of institutions (primarily the Ministry of Environment, Spatial Planning and Infrastructure, the Kosovo* Environmental Protection Agency and the Hydrometeorological Institute) must be defined and their capacities and needs assessed in detail. Once the roles and responsibilities of institutions have been legally defined, individual capacity-building plans should be developed for all actors.*

➢ Analyses:

Expertise is required for the performance of analyses to increase the resilience of road infrastructure (e.g. vulnerability assessments, resilience assessments, risk evaluations and identification). Moreover, no risk evaluation framework has been established by the Government of Kosovo*. Kosovo* has a limited capacity and track record in dealing with climate change due to other priorities in recent years.[87] In terms of adaptation, there is a clear need for financial support to build and strengthen institutional capacities. Investing in climate resilience is also financially efficient for development partners since up-front investment in protection is often less expensive than humanitarian relief and reconstruction after a disaster has occurred. Developed and emerging countries can empower the capacity of human resources in developing countries by providing training and customized courses in climate change mitigation and adaptation.

Recommendations:

- *Expertise and training of staff is needed in all analyses, as well as in terms of risk evaluations and the identification of measures. The Kosovar national experts could benefit substantively from working together with international experts on an adaptation plan to increase road resilience;*
- *The socio-economic impact of natural hazards should be regularly tracked and analysed by the Ministry of Environment, Spatial Planning Infrastructure and consolidated in one place. The Emergency Management Agency within the Ministry of Internal Affairs should conduct damage assessments, and publish the results in a database.*

* This designation is without prejudice to positions on status, and is in line with UNSC 1244 and the ICJ Opinion on the Kosovo Declaration of Independence.

[87] "Climate Change Strategy 2014-2024, Risk and resilience assessment Kosovo (WB 2019).

- Implementation:

As climate risks in infrastructure projects are gaining in importance, both in environmental and social terms, IFIs are screening for climate risks, thereby providing analytical tools on how to measure such risks, how to design measures, including innovative adaptation approaches and measures. Kosovo* should make use of the available approaches by seeking IFIs' support to implement such measures within its projects to ensure the climate resilience of its infrastructure by reducing long-term impacts.

Inter-ministerial cooperation with all agencies in relation to the collection of data, analysis and use of results would remove several obstacles to implementation. This also includes transparency in the publishing of data on the official websites of the competent ministries and municipalities. In addition, the Kosovar institutions lack expertise and human capacities. This should be further addressed through qualitative trainings aimed at developing capacities within the institutions and increasing the quality of their work in climate resilience. The MESPI should identify international experts who can provide such services and organize in-depth capacity development exercises.

Furthermore, new policy papers should be developed and/ or the existing policy framework should be amended to include climate change mitigation and adaptation measures within the legal framework and within the overall national development strategy.

Recommendations:

- *The capacity development needs should be determined through a detailed assessment of staff's capacities and customized capacity development plans and programmes, in cooperation with foreign experts/IFIs, should be delivered;*
- *Investments in future benefits should be made: scholarships offered by the government for master's degrees in specific fields of climate change studies would be a solid investment in the future. Greater engagement of public and private universities could help contribute to the expertise currently lacking within government institutions;*
- *Climate change mitigation and adaptation measures should be included in the legal framework and within the overall national development strategy, more specifically referring to:*
  - *Adopting the Law on Climate Change*
  - *Developing secondary legislation based on the Law on Climate Change*
  - *Updating existing EIA guidelines*
  - *Improving the quality of project-specific EIAs on road and land-use planning*
  - *Updating the Disaster Risk Reduction Strategy.*

* This designation is without prejudice to positions on status, and is in line with UNSC 1244 and the ICJ Opinion on the Kosovo Declaration of Independence.

7.2.4 Montenegro

- Data:

The Institute of Hydrometeorology and Seismology (IHMS) is responsible for monitoring and assessing the state of the climate, climate change and extreme weather events. IHMS is also the competent institution for the analysis of climate data and trends, is in charge of monitoring water regimes and is a main contributor to the adaptation section of national communications to the UNFCCC.

The main instrument for cooperation, communication and the exchange of information on climate change is the National Council for Sustainable Development, Climate Change and Integrated Coastal Management, which was created to foster inter-institutional cooperation in Montenegro. Although the Council strives to ensure that climate change issues remain high on the political agenda and gain political support, it lacks capacity to serve as a focal point for systematic data collection and dissemination among a large group of stakeholders.

Several sets of data needed for resilience analyses are available, with much of the necessary data sets still missing, such as hazard maps for different hazards, vulnerability data needed to estimate damages to road structure (sub-base, base, asphalt layers, embankments, road shoulders); road signalization (vertical and horizontal); road objects (bridges, tunnels, walls, culverts), and drainage elements. Existing data are not organized in a systematic way (no existing database), they are not easily accessible and require a compliance and completeness check before they can be put to use for further analyses.

Recommendations:

- *An information focal point should be created with the capacity to (i) collect all relevant data on climate change issues (with a focus on the adaptation component) in one location (web-portal, depository or similar); (ii) provide regular updates and create a platform for public discussions on the strategic framework; integrate the adaptation component in debates. The Ministry of Sustainable Development and Tourism (MSDT) should lead this process in close collaboration with the National Council for Sustainable Development, Climate Change and Integrated Coastal Zone Management;*
- *The following institutions should cooperate and be actively involved in the process of collecting and delivering data that are crucial for resilience and hazard assessments:*
  - The Institute of Hydrometeorology and Seismology of Montenegro (data on hazard maps, return periods and climate scenarios);
  - The Transport Administration (data on the hazard impact on roads, such as vulnerability data and data needed for criticality and socio-economic losses);
  - The Water Administration (data on the hazard impact on roads);
  -The Forest Administration (data on the hazard impact on roads).

- Analyses:

In Montenegro's current institutional set-up, it is not always clear where the expertise lie, and which institutions are in charge of performing different types of analyses. This indicates the need to further define the institutional framework which will allow for a clear distribution of responsibilities and accompanying actions and the scope of work within the competent institutions in Montenegro.

The institutions are, to some extent, capable of performing vulnerability assessments however, the lack of both expertise and capacities for resilience assessment is evident. A climate resilience assessment of the entire road network of Montenegro is non-existent. Risk evaluations of sections of the road network on the basis of a defined list of hazards have been carried out in collaboration with the Transport Administration of Montenegro.

Recommendations:

- *To be able to perform analyses and assessments of climate data, the Directorate for Climate Change of the Ministry of Sustainable Development and Tourism (MSDT) should plan and organize vulnerability and resilience capacity development for staff. Trainings on data collection and analysis should also be organized for the staff of local authorities at the municipal level.*
- *A climate resilience assessment of the entire road network of Montenegro should be conducted, preferably in cooperation with foreign experts, which will also include the capacity development aspect and customized trainings for local government staff.*

- Implementation:

The Ministry of Sustainable Development and Tourism (MSDT) is the administrative body responsible for climate change issues. It develops climate policy and the regulatory framework in this regard. It also holds the key competences in environmental issues and is primarily responsible for the preparation, coordination, adoption and implementation of relevant policies, strategies, implementation plans and legislative acts related to environmental protection. MSDT is also responsible for coordinating other ministries and public institutions involved in the transposition of EU environmental legislation and in the practical implementation and supervision of the implementation of certain pieces of national legislation.

The Directorate for Climate Change and Mediterranean Affairs operates within the MSDT and is divided into two units: the Climate Change Unit (CCU) focuses on climate change issues and the second unit focuses specifically on Mediterranean affairs. The Climate Change Unit is currently understaffed because it has taken over twofold responsibilities under UNFCCC and subsequent agreements, and due to the EU approximation process, must align policies and strategies with the climate acquis.

There is no clear and stable institutional framework in Montenegro as the number, composition and competences of ministries frequently change and the competent authorities, especially those

at the local level, are understaffed. In addition, the legal and policy frameworks related to climate change and adaptation are still being developed, and climate change and adaptation objectives are not integrated in all relevant sectoral policies.

Recommendations:

- *Adopting secondary legislation to the Law on Protection against Adverse Impacts of Climate Change to achieve further alignment with the EU acquis;*
- *Developing the National Adaptation Plan and integrating adaptation measures into sectoral policies, providing support for the development of local adaptation policies;*
- *Integrating the adaptation policy into the Spatial Plan of Montenegro by 2040.*

7.2.5 North Macedonia

➢ Data:

North Macedonia lacks higher resolution maps with return periods for floods, extreme weather events, landslides and snowfalls. Following the 2015 and 2016 flood events in the country, detailed flood maps were developed, but only for the affected regions and selected parts of the country. Maps for the rest of the country have not yet been produced. Landslide susceptibility maps and erosion maps exist but for the national context only, as these are not systematically prepared for all exposed and vulnerable regions/ areas/ locations.

In general, risk and hazard maps are not being systematically prepared and compiled, as they are developed by different institutions for different hazards and are not easily and publicly accessible. In addition, most of the maps are not publicly available in shapefiles. Natural hazard maps are not sufficiently overlaid with socioeconomic data. A good set of maps and analysis of the country's road infrastructure and the impact of floods and landslides is presented in the report "Technical Assistance Preparation of Climate Resilience Design Guidelines for the Public Enterprise for State Roads in North Macedonia", as well as within the framework of the project "Improving resilience to floods in the Polog Region" implemented by UNDP and financed by SDC and SECO.

The Crisis Management Centre has a GIS platform with spatial representation of web-based databases on the exposure and vulnerability of the population and critical infrastructure. Alongside the municipal and national risk and hazard assessment, it has the most structured data platform in the country.

Recommendations:

- *The Crisis Management Centre should be involved in joint data collection and should actively participate to deliver and make risk and hazard assessments publicly available.*
- *The Ministry of Environment and Spatial Planning needs to be involved in data collection and should actively participate to deliver the flood risk data sets and flood risk management plans.*
- *The Public Enterprise for State Roads should collect and share data on road infrastructure.*

- *It is recommended for the HydroMeteorological Service (HMS) to be involved in data collection and to actively participate in delivering hydrological-meteorological monitoring.*

➢ Analyses:

North Macedonia does have sufficient expertise in the country to conduct proper analyses. Such expertise is usually found both in the competent institutions and the private sector and academia. However, for resilience assessments, much needs to be done in terms of additional capacity development of both the private and public sector.

The country can prioritize locations where damages and losses due to natural hazard events are known. Even though this process might not be fully systematized with the competencies and expertise of the competent institutions, some examples of prioritization exist. Following the floods in 2015 and 2016, some flood and landslide risk assessments were performed and followed by the prioritization of the locations and identification of mitigation measures.
There is a methodological framework for risk and hazard assessments in the country which is applied by the Crisis Management Centre to prepare municipal and national risk and hazard assessments. Moreover, the hazard and risk assessment framework is digitalized within the established GIS platform.

Adaptation of the road infrastructure has not been fully mainstreamed and no systematic measures are in place for all natural hazards. There is no single catalogue for adaptation measures and activities. However, within the framework of the project "Technical Assistance Preparation of Climate Resilience Design Guidelines for the Public Enterprise for State Roads in North Macedonia", a list of climate resilience measures to address flood and landslide risks was compiled, along with an indication as to which of the projected climate change effects in North Macedonia the measures would be most useful in mitigating.

There is limited awareness and capabilities to perform cost-benefit analyses (CBA)/ multi-criteria analyses (MCA) within the national DRR and road authorities. The existing expertise is mainly found in the private sector and academia. Following the floods in 2015 and 2016, case study examples of applications of CBA/ MCA on the calculation of road exposure, vulnerability and risk or the MCA in the Polog Region[88] as well as in other parts of the country have been developed.

Recommendations:

- *The Public Enterprise for State Roads needs to develop its capacities in the management of risks across assets' lifecycles;*
- *Risk and hazard assessment needs should be fully mainstreamed across critical infrastructure sectors and the respective entities need to be included in the process of*

[88] Technical Assistance Preparation of Climate Resilience Design Guidelines for the Public Enterprise for State Roads in North Macedonia". Guidelines for the Public Enterprise for State Roads in North Macedonia. Part C: Summary of Engineering Measures and Project Level Non-Engineering Measures.

assessment and the assessment results need to be utilized more comprehensively. Support is needed in the mainstreaming of CBA/MCA across the sector and risk and hazard assessments.

- Implementation:

Institutional challenges and barriers in implementation are mainly reflected in the existence or non-existence of data, type and format, data sharing and access to data, weak administrative capacities of the national institutions, insufficient capacities in resilience-building of the road infrastructure, lack of specialized knowledge and practices in resilience-building of critical infrastructure and lack of proper coordination between the institutions.

Recommendations:

- *Establishment of inter-institutional channels for the facilitation of data collection, sharing and application, in addition to using the GIS platform of the Crisis Management Centre and the National Spatial Data Infrastructure;*
- *Providing in-depth capacity development for authorities and practitioners engaged in resilience-building of road infrastructure;*
- *Strengthening government capacities to be allocated to critical infrastructure through improved professional training, enhanced practices and procedures, better planning and distribution, as well as designing of supportive ICT solutions.*
- *Encouraging local self-government units to develop local strategies and to decentralize DRR activities locally alongside the provision of training and knowledge transfer.*

7.2.6 Serbia

- Data:

Raw climate data sets that are of relevance for road infrastructure in Serbia are quite comprehensive, with good coverage and with ample long-term data availability. The majority of this information is collected and stored by the Hydrometeorological Service of Serbia. PE “Roads of Serbia” maintains data on road infrastructure characteristics, including pavements by sections, age, bridges and tunnels.

Vulnerability maps to natural disasters are part of the Spatial Plan of the Republic of Serbia 2021–2035. It is unclear whether these maps account for the different climatic projections within the timeframe covered by the Spatial Plan or whether these focus on road infrastructure only. The maps are provided in an image format and are summarized, not developed separately for different types of hazards (landslides, floods, wildfires, etc.). Flood risk studies have been formulated for different river basins by PE “Roads of Serbia”. Disaster risk assessments in the Republic of Serbia (2018) cover scenarios for landslides, rockslides, erosion, floods and extreme weather events.

The biggest institutional barrier to data collection is the absence of delegated responsibilities regarding climate resilience within ministries and state organizations (primarily PE “Roads of

Serbia"; excluding the Ministry of Environmental Protection and the Hydrometeorological Service of Serbia).

Recommendations:

- *The Ministry of Construction, Transport and Infrastructure, in cooperation with national experts/ academia and international organizations should develop a comprehensive database that includes vulnerability functions, describing the connection between climate hazards and road damage and disruption;*
- *The Ministry of Construction, Transport and Infrastructure should make CAD vulnerability maps of natural disasters available in the Spatial Plan of the Republic of Serbia 2021–2035;*
- *The vulnerability maps of natural disasters in the Spatial Plan of the Republic of Serbia 2021–2035 should be upgraded and adapted for use for road infrastructure.*

➢ Analyses:

The Republic of Serbia possesses the individual expertise necessary for road infrastructure and climate resilience analyses (and beyond). What is lacking is institutional organization on the level of the main stakeholders (primarily PE "Roads of Serbia" and the Ministry of Construction, Transport and Infrastructure), since climate impacts are not recognized or quantified among the main impacts on roads. It is not known whether expertise needed for climate analyses exist within the main stakeholder organizations since there are no organizational units specifically designated for and delegated with this scope of the work. Such expertise, however, exists within other organizations (i.e. CIP Traffic Institute) or the private sector (i.e. Clima Peritia), indicating that, if needed, capacity development could be easily organized.

Serbia possesses the necessary expertise needed to prioritize the locations where damages and losses due to natural hazard events are known. Such expertise is not necessary located within the road authority and one of key objectives should be to accumulate such expertise (capacity development and internal re-organization). No climate risk framework for road infrastructure exists at the national level. Even though this task could not be completed using internal (road authority) resources, the available in-country expertise would suffice.

One of the greatest obstacles in identifying potentially successful adaptation measures is the lack of a much-needed shift in mindsets towards climate resilience thinking, which is not present at the time.

As regard adaptation plans, the experience and knowledge needed for CBA and/ or MCA are available within Serbia.

Recommendations:

- *Develop and adopt a climate risk framework for road infrastructure, using available in-country expertise. The Ministry of Environmental Protection and the Ministry of Construction, Transport and Infrastructure should be in charge of implementation, while maintaining close collaboration with the PE "Roads of Serbia" and the Hydrometeorological Service of Serbia;*
- *Changes in the organizational structure of the road authority should be adopted to reflect the newly adopted approach based on climate resilience thinking. It is recommended to form organizational units within the PE "Roads of Serbia" and the Ministry of Construction, Transport and Infrastructure that will be in charge of climate change issues;*
- *Furthermore, capacity development needs should be determined through a detailed assessment of the staff's capacities and customized capacity development plans and programmes should be delivered.*

➢ Implementation:

Climate resilience is still not widely recognized in Serbia as a major issue of relevance for road infrastructure. There is no clear planning with a medium- and long-term time horizon. Therefore, the internal organization within the road authority and relevant ministries (aside from environmental protection) lacks the necessary differentiation, while management usually does not recognize the significance of climate resilience, resulting in a lack of commitment. In addition, when responsibilities are not explicitly delegated, there is usually no individual incentive for capacity development and knowledge transfer within external projects (as was the case with ClimaProof).

Recommendations:

- *To overcome the current institutional barriers, management capacity development should be provided and organizational units in charge of climate resilience within stakeholder organizations should be created or the responsibilities of existing units should be expanded;*
- *National climate proofing guidelines that would be mandatory for use by the road authority in all road life stages should be developed.*

8 Roadmap for Adaptation Planning

Throughout the project implementation, several issues that impede improvements in the climate resilience of roads in the WB region were identified. These primarily relate to institutional, policy and capacity gaps (skills and expertise). Lack of cooperation and collaboration between the relevant institutions in collecting and analysing data, lack of integrated information systems (regional and national databases) for easy access and sharing of data as well as the lack of institutional capacities (skills and expertise) in conducting road infrastructure risk assessments and resilience planning have been identified as key problems common to the region.

In parallel to the above identified issues, the WB countries are struggling to reach and adhere to the goals set out in the Western Balkans Green Agenda, as moving from the traditional economic model to a sustainable economy requires substantial financial resources. International financial assistance in the field of the environment and climate change has to date focused on the process of alignment with the EU acquis, which implies not only alignment of provisions but also their effective implementation. These processes in all WB countries are progressing slowly as the climate-proofing responsibility is distributed across sectors that do not work together. This lack of institutional governance and collaboration leads to a further lack of financial resources. There is an evident lack of both national and international budgets allocated specifically to climate change and climate proofing (with the exception of those related to the development of EIA and SEA). Financial resources are mainly restricted to loan givers – resources granted by banks that give out loans that are limited to and conditioned by their own regulations, however, those regulations are not necessarily aligned with the defined needs and/ or capabilities available within the region.

In view of the gaps identified, this chapter develops a set of defined governance measures with an accompanying Action Plan. The Action Plan reflects the inputs obtained from project stakeholders and the proposed timeframe is only indicative. Conceived as a guiding thread for the region in preparation of national strategies and plans, the roadmap is supplemented with the potential scope for regional cooperation. It outlines and explores the possibility for establishing a separate regional funding facility – a regional fundraising mechanism.

8.1 Governance measures

In consultation with project partners and stakeholders, the above institutional and capacity gaps have been summarized in a list of necessary governance measures to be taken to achieve the three overarching objectives:

Objective (O)	**Timeframe**
O1: Operationalize institutional cooperation for data collection and risk assessments	2023–2027
O2: Build and strengthen institutional capacities for infrastructure risk assessment, resilience planning and mainstreaming of climate adaptation measures across infrastructure sectors	2023–2025
O3: Strengthen the normative and institutional framework for resilience planning and design	2024–2026

The objectives are regional in nature, prioritized and common to the region. They derive from the most prominent gaps identified in the WB region. For each of the expected achievements, an indicative timeframe is proposed. To reach the long-term objectives of climate change adaptation and resilience of road infrastructure, short-term measures represent an important starting point in terms of both practical achievements and commitments made. Bearing in mind the gaps and barriers identified during the project implementation, the selected objectives are formulated in such a way that they are to a large extent feasible in the short term, and the potential results are tangible and achievable within a 4-5 year period.

The three objectives presented above have been further elaborated in an Action Plan. The Action Plan describes the objectives as a set of defined measures, grouped into four prioritized areas of action:

1) Knowledge generation, evidence and dissemination
2) Effective institutions and regulatory frameworks
3) Effective adaptation approaches
4) Adequate financing of adaptation

thereby correlating each measure with the specific objective(s) defined and delegating the implementation responsibilities.

Table 15: Action Plan for Adaptation to Climate Change

No.	Measure	Responsibility	Indicator	Relevance to the objective
	Area of Action 1: Knowledge generation, evidence and dissemination			
1.	Organize in-depth climate resilience trainings for future members of climate resilience teams within all relevant stakeholders (including trainings on EU Technical Guidance on Climate Proofing of Infrastructure)	Responsible ministries of transport and environment in close cooperation with road agencies and hydrometeorological institutes and the private sector engaged in EIA and SEA	Training records	O1, O2, O3
2.	Raise awareness of climate impacts, adaptation to climate change and climate resilience in all areas of operation of competent road agencies and relevant ministry-internal trainings	Responsible ministries of transport and environment	Training records	O1, O2, O3
3.	Set a hazard/risk assessment methodology, including a list of necessary data for its development	Hydrometeorological institutes in cooperation with road agencies	Regional hazard/ risk assessment methodology	O1
4.	Develop missing probability hazard/ risk maps and diagrams	Hydrometeorological institutes in cooperation with road agencies	Hazard/ risk maps and diagrams by country	O1
5.	Develop cooperation mechanisms among institutions and SOP for data exchange and elaboration	Responsible ministries of transport and environment in cooperation with statistical offices	Internal portal/ website for collaboration and knowledge sharing; SOPs developed	O1

No.	Measure	Responsibility	Indicator	Relevance to the objective
6.	Create an integrated information system with all data/ hazard/ risk maps and diagrams available	Responsible ministries of transport and environment in close cooperation with road agencies and hydrometeorological institutes	Climate hazard national information system	O1
7.	Develop a regional platform for climate proofing	Relevant ministries in cooperation with international organizations	Web-based regional platform	O1, O2, O3
	Area of Action 2: Effective institutions and regulatory frameworks			
8.	Define a clear division of responsibilities and a commitment to work on climate change adaptation	Responsible ministries of transport and environment	Decision on the manner of approaching adaptation to climate change – appointment of the team	O2, O3
9.	Make it mandatory to include climate resilience teams in design processes of all infrastructural objects under the relevant ministry jurisdiction	Prime Minister	Management decisions, Climate resilience proofing statements (resulting in a conclusion on climate risk assessments and possibility of resilience)	O2, O3
10.	Establish institutionalized working groups/ committees for climate-resilient infrastructural planning, including participants from relevant ministries, agencies with the most important participants/ partners	Responsible ministries of transport and environment	Meeting minutes with most important stakeholders	O2, O3
11.	Prepare national methodological guidelines/ technical standards on infrastructure risk assessments	Road agencies in cooperation with hydrometeorological institutes	Adopted guidelines/ technical standards on infrastructure risk assessments	O2
12.	Prepare national guidelines for mainstreaming climate risks in sectoral policies and programmes, EIA, SEA, as well as in project design.	Responsible ministries of transport and environment in cooperation with international institutions	Adopted guidelines for mainstreaming climate risks in sectoral policies and programmes	O2, O3

No.	Measure	Responsibility	Indicator	Relevance to the objective
13.	Conduct climate resilience risk assessments for the main road network in countries that do not have one	Responsible ministries of transport and environment in close cooperation with road agencies, hydrometeorological institutes and international institutions	Resilience risk assessment for the main road network conducted by each country	O2
	Area of Action 3: Effective adaptation approaches			
14.	Identify sensitive facilities and sections on the existing road network. Prepare vulnerability maps and climate vulnerability road studies	Road agencies in cooperation with hydrometeorological institutes and international institutions	Risk assessment method developed and scan performed; studies developed	O1, O2, O3
15.	Establish a system for storing data on road network events related to weather conditions	Responsible ministries of transport and environment	Basic database & data entry form	O1, O2, O3
16.	Formulation of guidelines for road infrastructure design, construction, operation, maintenance and monitoring in line with climate projections and climate risks	Road agencies in cooperation with hydrometeorological institutes and international institutions	Guidelines developed	O2, O3
17.	Deliver pilot projects (policy document/road design)	Responsible ministries of transport and environment in cooperation with international institutions	Project documentation developed	O3
	Area of Action 4: Adequate financing of adaptation			
18.	Assess the timelines, costs and financial possibilities for implementation of priority measures and develop accompanying financial plans on accessing funds for climate proofing, which will include both national budget assessments and needs as well as international donors	Responsible ministries of transport and environment in cooperation with road agencies	Review report	O3

The specific measures proposed within this Strategy are set to complement the existing Action Plans and boost the countries in moving towards a more sustainable and climate resilient road infrastructure, and reaching the regional goals set out in the Western Balkans Green Agenda.

The above specified objectives and accompanying measures are also aligned with the requirements of the *EU Technical Guidance on Climate Proofing of Infrastructure in the period 2021–2027*.

In line with EU Technical Guidance, climate vulnerability and risk assessment remains the foundation for identifying, appraising and implementing climate change adaptation measures. Furthermore, the

Guidance stipulates the importance of specific and credible documenting of climate-proofing practices and processes, as documentation and verification of climate proofing forms an essential part of the rationale for making investment decisions. It integrates climate proofing with project cycle management (PCM), EIA and SEA processes, and should therefore be referred to and consulted when preparing guidelines for mainstreaming climate risks in sectoral policies and programmes and technical standards for resilient road design.

When planning and developing infrastructure projects, both climate change mitigation (climate neutrality) and adaptation (climate resilience) measures need to be taken into account. However, bearing in mind the adaptation aspect as the primary focus and scope of this document, an overview of adaptation measures in line with the EU Technical Guidance is provided in Table 16.

Table 16: Summary of climate proofing of infrastructure projects

Climate resilience **Adaptation to climate change**
Screening – Phase 1 (adaptation): Carry out a climate sensitivity, exposure and vulnerability analysis in line with this Guidance: - If there are no significant climate risks warranting further analysis, compile the documentation and summarize the analysis in a climate resilience screening statement, which in principle gives a conclusion on climate proofing as regards climate resilience; - If there are significant climate risks warranting further analysis, proceed to Phase 2 below.
Detailed analysis – Phase 2 (adaptation): - Carry out the climate risk assessment including the likelihood and impact analyses in line with this Guidance. - Address significant climate risks by identifying, appraising, planning and implementing relevant and suitable adaptation measures. - Assess the scope and need for regular monitoring and follow-up, for example, critical assumptions in relation to future climate change. - Verify consistency with the EU and, as applicable, national, regional and local strategies and plans on the adaptation to climate change and other relevant strategic and planning documents. Compile the documentation and summarize the analysis in the *climate resilience proofing statement*, which in principle gives a conclusion on climate proofing as regards climate resilience.

Source: EU Technical Guidance on Climate Proofing of Infrastructure in the period 2021–2027

8.2 Technical measures, including green infrastructure and nature-based solutions

In an attempt to identify potential solutions to climate resilience in the WB, the ClimaProof project seeks to increase the technical capacities of national authorities by guiding them in the application of

good practices, including incorporating green infrastructure and nature-based solutions into existing and future infrastructure in the region.

Table 17 presents good practice examples of climate adaptive and resilience measures when building roads, which could be applied to identify road vulnerabilities by conducting climate change vulnerability assessments as an initial step in the adaptation planning process. To better assess the value of the proposed action, each measure is accompanied by a brief overview, review of advantages and disadvantages of the proposed actions, indicative costs, timing for implementation, governance, acceptability and feasibility and technical requirements.

Measures are divided into those that can already be included in the project design and those that should be reviewed by the competent road agencies, depending on the road vulnerability assessments and other studies that indicate a need for action.

Table 17: Examples of specific road climate resilience measures that can be applied [89]

1 - Modify Pavement Design	
Overview	
There are a number of design adjustments that can be incorporated into a pavement to improve its resistance to heat, water and moisture damage. Concrete pavement materials are generally expected to be more resistant to water damage than asphalt. However, if asphalt pavement is preferred over concrete pavement, the use of different additives and fillers can increase water resistance in bituminous pavements, for example: ○ Liquid anti-stripping, such as latex polymers along with amines and polyamines agents, can be used to resist stripping damages caused by water or moisture. Latex polymers are chemical compounds that will tend to bond with water and keep it from disrupting the binder-aggregate bond; and ○ Hydrated lime is also a commonly used additive to resist water damage. The gradation of an asphalt mixture can also have a significant impact on how a pavement handles moisture. Pavement can be impermeable to water if a dense-graded mix is used and compacted to a sufficient density. Permeable pavements have the benefit of reducing splash and standing water in wet conditions. However, a drainage system must be incorporated into permeable pavement design to ensure proper drainage if the native soils below the permeable pavement system do not have sufficient hydraulic capability to recharge the entire volume of precipitation.	
Advantages	○ Some design adjustments may not require additional funding, for instance, using concrete pavement materials instead of asphalt pavement materials do not require increased CAPEX or OPEX for the subgrade materials. Concrete pavements are slightly more costly than asphalt pavements; ○ Relatively easy to implement as some options are already commonly used best-practices; ○ Adjustments generally increase or sustain the service life of a pavement and reduce the frequency of maintenance need
Disadvantages	○ Some adjustments may be costly, such as the use of liquid anti-stripping agents
Indicative Costs	○ Cost of additives if used
Timing for Implementation	○ Can be incorporated into design immediately
Governance	○ Consultation with government needed if adjustments involve increases in cost
Acceptability	○ Moderate-high acceptability as CAPEX is expected to be minimal
Feasibility and Technical Requirement	○ Technical expertise in pavement design needed to understand the chemical and physical properties of pavement.

[89] "Overarching guide for incorporating climate change adaptation in infrastructure planning and design", AECOM, USAID, 2017.

2 - Design Adequate Stormwater Drainage System to Prevent Flooding	
Overview	
There are a number of ways to improve pavement surface drainage: o Permeable pavement; o Increasing the cross-slope; o Improving the road verge. In addition to those listed above, culverts can be used to channel water under the roadway from one side to the other, which can reduce the impact caused by the "weir-flow" damage mechanism. Over-washing or the "weir-flow" damage mechanism occurs when water flows across the paved road and down the landward shoulder or slope.	
Advantages	o Reduction in the frequency and severity of maintenance, as most of the damage on roadways are caused by water; o Can be implemented in segments or corridor-wide; o Can prevent flooding and reduce contact between water and pavement; o An indirect benefit – stormwater management is a best practice that addresses multiple impacts on roadways; o OPEX reduces over time
Disadvantages	o Will increase CAPEX and OPEX in the beginning, as stormwater drainage systems generally require maintenance; however, OPEX may be reduced overall due to less damage to roadways
Indicative Costs	o Moderate increase in CAPEX
Timing for Implementation	o Timing for the installation of new drainage system depends on the size of the project
Governance	o Requires government support, local stakeholder coordination and ongoing investment in maintenance
Acceptability	o Highly acceptable at the community and government levels
Feasibility and Technical Requirement	o Moderate technical expertise needed in civil and roadway engineering, and knowledge of existing hydrogeological conditions. Most systems are easy to implement.

3 - Stabilize Adjacent Stream Banks to Prevent Erosion After Extreme Rainfall	
Overview	
A washout is the result of the combination of floods and erosion. For roads that are near stream banks or that run across streams, severe erosion may cause a washout of the road. Extreme rainfall events can cause washouts to occur more frequently as they generally introduce a heavy downpour of rain within a short period. The stabilization of stream banks can prevent washout from occurring by installing adequate drainage or the use of structural containment of stream banks. A culvert should be installed for roads that cross non-perennial streams to accommodate flows during wet weather. Stream banks can be stabilized through the use of gabion, riprap or increased vegetation.	
Advantages	o Relatively easy to implement and inexpensive; o Stream bank stabilization can have numerous environmental benefits; o Minimizing erosion can indirectly reduce the risk of flooding
Disadvantages	o Some level of maintenance needed to ensure that the infrastructure (culvert, gabion, etc.) or vegetation are not destroyed after rainstorms
Indicative Costs	o Cost of material and labour
Timing for Implementation	o Immediately
Governance	o Coordination with local government to perform bank stabilization and discuss maintenance plan
Acceptability	o High acceptability if vegetation is used as it is visually pleasing and has environmental benefits; Otherwise, moderate acceptability, as physical structure is generally associated with higher cost, is less visually pleasing and has limited environmental benefits

3 - Stabilize Adjacent Stream Banks to Prevent Erosion After Extreme Rainfall	
Feasibility and Technical Requirement	○ Minimal technical expertise required – as stream bank stabilization techniques are very common.

4- Stabilize Soil on Adjacent Slopes to Prevent Landslides Occurring After Extreme Rainfall Events	
Overview	
Landslides will create disturbances to traffic or cause a road to become inaccessible. Therefore, stabilization of slopes should be considered. Similar to the protection of stream banks, there are multiple different techniques for stabilizing slopes, including: ○ Physical support structures using various types of retaining wall – timber crib, steel bin wall, reinforced earth wall, gabion walls or soldier piles and lagging. Water drainage will be important for these types of structures as water pressure can build up behind them and lead to failure; ○ Stabilizing slopes with vegetation, cut brush layers or buttress fill can be used in combination with synthetic fabrics or polymeric geogrids for the purpose of stabilization. This is known as biotechnical slope protection. Hydroseeding is a common type of seeding used for slope stabilization purposes. This type of stabilization method is generally preferred to physical structures, as the use of vegetation is more visually pleasing and environmentally friendly. In addition, this method generally requires minimal access to equipment and workers, causing relatively minor disturbance	
Advantages	○ If using vegetation, this method is easy to implement and inexpensive; ○ Creates safer road conditions for motorists and travellers in wet weather; ○ Protects accessibility of roads during and after rainstorms;
Disadvantages	○ If physical structures are used, they may not be visually pleasing and have less environmental benefits; ○ Procedures for the harvesting, handling, storage and installation of vegetation requires careful handling for successful biotechnical construction
Indicative Costs	○ Cost of labour and materials, which can be minimized if the vegetation method is used
Timing for Implementation	○ Immediately; ○ If physical structure is used, 1-3 months depending on the size of the slope
Governance	○ Coordination with local government and community to perform stabilization and discuss maintenance plan
Acceptability	○ High acceptability if vegetation is used as it is visually pleasing and has environmental benefits; ○ Otherwise, moderate acceptability, as physical structure is generally associated with higher cost, is less visually pleasing and has limited environmental benefits
Feasibility and Technical Requirement	○ If physical structures are chosen as a solution, a level of technical expertise is needed depending on the scale of the project, size of slope and hydrogeologic conditions; ○ Otherwise, moderate technical expertise is required.

5 - Mitigate Impacts Caused by Moisture Content
Overview
Increase in moisture content is not an immediate and severe problem compared to other climate change effects; however, it should not be disregarded, and appropriate prevention and mitigation strategies should be considered. A list of options includes: ○ Extensive planting of trees and other vegetation around roadways to lower the water table – plants and trees can act as a water absorption mechanism to draw down the water table. It is also a common practice to reduce runoff; ○ Raise new or existing pavement level; ○ Design the sub-layers of the pavement to break the capillary barrier and prevent contact with groundwater table or moisture accumulation immediately below the pavement layer; ○ Design subsurface drainage system. A properly designed drainage system is critical in maintaining the optimum functionality of roadways

5 - Mitigate Impacts Caused by Moisture Content	
Advantages	○ All options reduce OPEX over time; ○ Improve the service life of pavement by reducing moisture content; ○ Minimal CAPEX required
Disadvantages	○ No significant disadvantages except possibly an increase in OPEX in the initial stage
Indicative Costs	○ Costs for planting of trees and vegetation, mostly labour costs and plants; ○ Some material cost will arise if the chosen option is to raise pavement level
Timing for Implementation	○ Immediately;
Governance	○ Planting of trees and other vegetation may require local or municipal government approvals, and approval from abutting property owners if outside of the public right-of-way
Acceptability	○ High acceptability as all options create minimal disturbance to community
Feasibility and Technical Requirement	○ Investigation would be required to determine the need for adaptation strategies; Determining the level of the groundwater table may require extensive engineering and hydrogeology inputs ○ To raise the pavement level and design a subsurface drainage system, some technical expertise would be needed; ○ No technical expertise needed for planting trees; only unskilled labour needed

6 - Implement Periodic Cooling of Pavements, Largely Using Water	
Overview	
For asphalt pavements, damage can occur during extremely hot weather when the cement binder phase (chemical cohesion) loses stiffness due to increased temperature. To reduce the temperature of the pavement surface, water can be sprayed on pavement to act as a cooling agent. Practitioners should consider using treated wastewater or grey-water as the source of cooling water. Use of potable drinking water should be avoided;	
Advantages	○ Treated wastewater or grey-water is usually discharged into water bodies. Using it as a cooling mechanism can be a useful re-application of non-drinking water; ○ Easy to implement if infrastructure is available to centralize wastewater or grey-water conveyance; ○ Usage can be selective or automatic, depending on the system installed; ○ Can be applied to existing infrastructure
Disadvantages	○ Access to centralized wastewater or grey-water can be a challenge if infrastructure is not already available; ○ A fleet of specialized vehicles are typically needed to apply water to roadways; Roads must be equipped with proper drainage system; ○ May increase degradation of roadways if cracking or potholes exist on pavement prior to applying water; ○ Effectiveness can be limited if high surface roadway heat causes rapid evaporation
Indicative Costs	○ Installation piping or water spraying system by fleet of trucks (or retrofit, for example, container mounted on pickup truck); ○ Installation of water catchment design solution including capturing water on-site
Timing for Implementation	○ Several months depending on the size of the system and source of water
Governance	○ Consultation with responsible government body ○ Public consultation if road is near residential area or if treated wastewater or grey-water is used
Acceptability	○ Concerns regarding sustainability of resource, especially if drinkable water is used and this resource is limited
Feasibility and Technical Requirement	○ A certain level of technical background needed as this technology has not been widely used thus far; ○ Communication with experienced engineers, designers and material suppliers should be the first step.

7 - Pro-active Maintenance Plan	
Overview	
More frequent maintenance can help mitigate future damages, such as cracking, potholes and rutting, directly or indirectly caused by increased temperature. Scheduling more frequent maintenance can sustain and possibly improve the performance and durability of pavement, especially for asphalt-based pavement. More frequent surfacing can prevent cracking and rutting from worsening;	
Advantages	○ Can sustain the service life of pavements and therefore reduce the CAPEX for rebuilding roads
Disadvantages	○ Increases OPEX – labour and the cost of material needed for maintenance; ○ More frequent road closures will occur as a result. Can minimize disturbance to traffic by scheduling maintenance to avoid peak traffic hours
Indicative Costs	○ Cost of labour and material needed for maintenance
Timing for Implementation	○ Immediately
Governance	○ Consultation with responsible government bodies to discuss implementation plan for the increase in road maintenance associated with traffic management
Acceptability	○ Medium to high acceptability, depending on availability of funding
Feasibility and Technical Requirement	○ No additional technical expertise required.

8 - Traffic Management	
Overview	
In addition to the adaptation strategies selected to improve the resilience of roadway infrastructure, adaptation to climate change should include coordinated traffic management across all types of roadway functions to efficiently and safely maintain traffic flow for all travel modes. Transportation or traffic officials should be pro-active in preparing for and responding to climate extremes, for instance: ○ Map vulnerable travel routes by usage and destination matrix, such as those that are more susceptible to flooding or slope failure; ○ Establish an emergency plan for maintaining communications to divert traffic to alternative routes when a primary route becomes inaccessible; ○ Create and maintain an emergency operation budget that can immediately be used for emergency response purposes. Having an emergency response plan established before a disruptive event occurs can improve the preparedness of officials to deal with the impacts of such climate extremes. In addition, emergency response planning, traffic policies can be applied to further protect roadways from damage. A number of reasonable policies can be adopted to deal with the different types of climate extremes. These include: ○ For asphalt pavement, traffic officials should consider encouraging heavy vehicular traffic to travel exclusively at night, when temperatures are generally lower, which causes asphalt surfacing to be stiffer and more rut resistant; ○ If permeable pavement is used, introduce load restrictions on vehicles to improve durability of this type of road; ○ Increase frequency of temporary road closures to perform maintenance on roads and repair minor damages before damage is made worse. **Any sort of restrictions imposed on the vehicles should be considered as the last resort in case of an extreme weather situation whose impact stretches beyond measures accounted for in the design.**	
Advantages	○ Low CAPEX; ○ Further protects roads and road users
Disadvantages	○ Requires government coordination across multiple sectors and agencies; ○ Does not address potential impacts to roadways from extreme events
Indicative Costs	○ No direct material-related costs, but can increase labour and maintenance cost
Timing for Implementation	○ Immediate or near-term implementation, if policy is already in place

8 - Traffic Management	
Governance	○ Community, provincial and national government coordination and input
Acceptability	○ High acceptability where government communication is good
Feasibility and Technical Requirement	○ Knowledge and reoccurring training in emergency or incidence response and traffic management planning are needed.

9 - Development of Guidelines for Sustainable Drainage Systems (SuDS)	
Overview	
SuDS guidelines typically address issues around water management and demand management with a strong focus on green infrastructure, while also considering the risks associated with non-potable water sources. The guidelines would include sections to guide practitioners on green infrastructure benefits, alternative water sources, risk management, site analysis and water balance assessment, and end use and treatment required. More detailed information would be developed for specific green infrastructure elements such as rainwater tanks, stormwater biofiltration and constructed wetlands. The guidelines would not provide detailed technical information but rather a general description of the key SuDS fundamentals. The guidelines would be a relatively short document with a strong emphasis on graphic display of the information and easy to understand principles. The guidelines would represent the cheapest and easier to implement options from a SuDS perspective. The benefits from an improved water management perspective would be more limited than the development of SuDS strategy	
Advantages	○ Enhances the current level of understanding of SuDS; ○ Provides a framework for consistent implementation and integration of SuDS in new developments; ○ Provides design guidance on SuDS details; ○ Identifies issues that should be considered when evaluating strategies to achieve SuDS; ○ Supplements (but does not replace) existing SuDS regulations and detailed design and implementation guidelines; ○ Directs readers to more detailed technical SuDS literature on specific issues and for location-specific advice
Disadvantages	○ SuDS guidelines would be more limited than a SuDS strategy due to their general nature; ○ Do not take site specific conditions into account, including topography, soils, landscape, services and other relevant site features and structural elements; ○ Not a stand-alone design resource
Indicative Costs	○ The cost of developing SuDS guidelines would be minimal as it would not involve any specific investigations or site-specific details
Timing for Implementation	○ The development of SuDS guidelines can be achieved in weeks to months
Governance	○ Stakeholder consultation is key
Acceptability	○ Little public opposition against, and considerable support for the use of SuDS; ○ Some aversion to new technology
Feasibility and Technical Requirement	○ Some SuDS technologies are simple to install and operate. Locals can be easily trained and construction materials are usually readily available; ○ Primarily requires common engineering practices; however, some specific engineering inputs are required for design and construction as well as for specific materials that may not be local; ○ Existing local skills associated with current facilities can be used for operational purposes; ○ May require advanced plumbing work.

10 - Raise the Elevation of Proposed Structure to Avoid Flooding
Overview
One option to protect bridges is to increase the elevation of the structure by raising it to protect against flooding. This strategy allows roads to be built and located in vulnerable and exposed areas, with a low risk of flooding or susceptibility to mud flow, geological collapse or foundation deterioration. Since the design of most structures utilizes historical climatic data, including documented peak flows, the new design elevation should be above the historical peak and projected future

10 - Raise the Elevation of Proposed Structure to Avoid Flooding	
high water level to offset the alteration brought by changes in precipitation. If raising the structure and associated approach roadways is feasible, this option can be effective in protecting against flooding	
Advantages	○ A protective measure against increased frequency of flooding, mud slides or physical deterioration of a bridge's structural systems due to climate or severe weather; ○ Allow infrastructure to be built on low-lying or vulnerable areas
Disadvantages	○ Raising the elevation of the structure can pose a design challenge to engineers; ○ Notable increase in CAPEX; substantial amount of material needed to raise the structure
Indicative Costs	○ Cost of additional building material
Timing for Implementation	○ Planning and design time required. Actual construction time needed should be similar to typical bridge projects
Governance	○ Government should be involved in the decision-making process; ○ Consultation with government needed if adjustments involve increase in cost
Acceptability	○ Highly acceptable as this strategy will mitigate future damages
Feasibility and Technical Requirement	○ Requires project engineer to consider the alternatives, technical feasibility and consequence of raising the structure.

11 - Deepen Bridge Footings to Protect Against the Effects of Changes in the Flow of Rivers (as an alternative to moving them outside of 500-year return period flood boundaries – depending on the flood risk assessment)	
Overview	
The flow of water can turn from slow to rapid in a short amount of time that can exert a strong force on a bridge foundation. A stronger foundation can protect a bridge from collapse due to the effects of the stronger flows associated with extreme precipitation events. For new bridge projects, engineers can deepen the bridge footings—the enlarged portions of bridge foundations that rest directly on soil, bedrock, or piles—to protect against the effects of changes in the flow of rivers. Designing and constructing deeper bridge footings can provide a stronger, more resilient foundation	
Advantages	○ A protective measure against unanticipated changes in the flow of rivers; ○ Protect a bridge from collapsing due to incapability of withstanding unexpected force – resulting in potential savings due to avoided damages
Disadvantages	○ May encounter design challenges if geological conditions are complex; ○ Higher CAPEX that often involves all elements of a bridge (e.g. deck, foundation, approach roadway and utilities)
Indicative Costs	○ Cost of additional material
Timing for Implementation	○ Could be incorporated into design immediately
Governance	○ Consultation with government needed if adjustments involve increase in cost
Acceptability	○ Moderate to high acceptability. CAPEX can be commensurate with bridge type, location and length
Feasibility and Technical Requirement	○ Needs to be re-designed according to professional bridge guidelines and standards, and by a licensed engineer; ○ Alteration of the roadway connecting to the bridge may be needed as well as the relocation of utilities that are often affixed to the bridge deck.

12 - Adequate Stormwater Management System on Bridges	
Overview	
Increased frequency and duration of intense precipitation events creates a greater amount of stormwater runoff coming in contact with the different components of a bridge structure, thereby creating conditions for deterioration and instability. Insufficient capacity of the drainage system can cause water to remain either on or within the bridge structure. Damage may be minimized by improving or upgrading the stormwater drainage system in the catchment draining through the bridge structure to increase water infiltration and reduce excess runoff. Improvements to bridge-related stormwater management can also reduce bridge deck runoff pollutants that flow into a receiving river and landscape	
Advantages	○ Can be integrated into existing bridge system

12 - Adequate Stormwater Management System on Bridges	
Disadvantages	○ Increase in both the CAPEX and OPEX due to costs associated with assessment, prioritization, design and installation of retrofit opportunities for stormwater system, bridge deck drainage, and the conveyance network; ○ Need careful planning and may not be suitable in all locations; ○ Maintenance is required and necessary in maintaining proper drainage
Indicative Costs	○ One-time capital and installation costs; ○ Recurring maintenance costs
Timing for Implementation	○ Installation of bridge deck drainage retrofit or other stormwater management improvement over 3 to 6 months
Governance	○ Consultation with government entities to discuss funding for required CAPEX and OPEX
Acceptability	○ Moderate acceptability from government for relatively high cost projects; ○ High acceptability from public as stormwater management systems generally cause limited disturbance and provide benefits beyond increasing the resilience of a bridge
Feasibility and Technical Requirement	○ Engineers and stormwater specialists to design stormwater management for the deck surface runoff; ○ Skilled labour to perform maintenance.

13 - Stabilize Stream Banks to Protect Against Bridge Scour	
Overview	
Bridges that are located near stream banks or traverse across streams or waterways are exposed to severe erosion that can deteriorate foundations and eventually damage a bridge. Extreme weather events can cause erosion to occur more frequently as they can generate flash floods. Stabilized stream banks can prevent erosion and protect against bridge scour. Bridge scour is one of the main causes of bridge failure and collapses; protecting bridges against scour is very important when evaluating adaptation options. Protection against bridge scour and stabilization of stream banks can be achieved by installing revetments, gabions, riprap or other measures such as an increase in vegetation	
Advantages	○ Could be implemented in the near-term as a generally cost-effective and efficient measure; ○ Stream bank stabilization can have numerous positive impacts on the environment; ○ Minimizing erosion can indirectly reduce the risk of flooding
Disadvantages	○ Some level of maintenance needed to ensure objects installed (culvert, gabion, etc.) are not damaged after rainstorms and are maintained in good working order
Indicative Costs	○ Cost of material, landscaping and professional design services
Timing for Implementation	○ Immediately
Governance	○ Coordination with local government to perform banks stabilization and determine maintenance plan
Acceptability	○ High
Feasibility and Technical Requirement	○ Technical expertise required to assess and incorporate stabilization techniques.

14 - Increase Frequency of Bridge Inspection and Repair	
Overview	
Increased frequency of bridge inspection and repair is another possible adaptation option. While some damages caused by climate stressors can cause bridges to collapse, other damages are minor in nature and would not pose an immediate threat to the structure or safety of travellers, but could build up over time and ultimately result in bridge failure. Conducting bridge inspections and repairs more frequently can ensure that incremental damages do not worsen and are repaired before causing substantial damages to the bridge	
Advantages	○ Prevent minor damages from becoming severe; ○ Protect against extreme weather conditions; ○ Preserve the expected life of bridges; ○ Eliminate the need for emergency repairs

14 - Increase Frequency of Bridge Inspection and Repair	
Disadvantages	○ Disruption to traffic during inspection and repair; disturbance to traffic can be minimized by scheduling maintenance at low traffic hours or weekends; ○ Higher OPEX – need additional workers to conduct inspections
Indicative Costs	○ Minor increase in operational costs
Timing for Implementation	○ Immediately
Governance	○ Coordinate with planning authority to discuss inspection and maintenance plan
Acceptability	○ High
Feasibility and Technical Requirement	○ Requires experienced workers to inspect and identify damages.

15 - Use Vegetation for Shading	
Overview	
Use of trees and other vegetation near roads to provide shade and help mitigate the effects of extreme heat on roads and vehicles. Trees and plants indigenous to the area are preferred since they have adapted to local soils and climate. It is important to consider other hazards when choosing vegetation and where to place it relative to the road (storm, surge winds)	
Advantages	○ Low-cost; ○ Lower energy costs; ○ On larger scales, enhance stormwater management and improve air quality
Disadvantages	○ Trees can become a hazard to buildings during wind or ice events. Must consider all hazards before selecting as appropriate measure
Indicative Costs	○ Costs associated with tree or plant purchase and planting and maintenance
Timing for Implementation	○ Immediate
Governance	○ None
Acceptability	○ High acceptability
Feasibility and Technical Requirement	○ Vegetation planting and maintenance can be done with locally available inputs and labour.

16 - Implement Good Vegetation Management Practices	
Overview	
Managing vegetation can help reduce fuel for wildfires and limit their ability to spread. Vegetation management includes hazardous fuels reduction, vegetation thinning and reduction of flammable materials to protect property. It should be practiced beyond where defensible space actions are being used on a given site, but still relatively close to vulnerable road infrastructure	
Advantages	○ Relatively low cost depending on the acreage being managed; ○ Low technology method that, in some cases, can be implemented via grazing by certain animals
Disadvantages	○ Requires continued action and maintenance. Not a one-time fix
Indicative Costs	○ Labour costs for biomass removal or conversion, mechanical treatment or otherwise reducing vegetation
Timing for Implementation	○ Immediate with recurring maintenance needed
Governance	○ May require coordinated planning, implementation or approvals by local municipal or district authorities
Acceptability	○ High acceptability
Feasibility and Technical Requirement	○ Local labour can be used to perform work;

16 - Implement Good Vegetation Management Practices	
	○ Individual property owners can implement this measure or it can be part of a coordinated effort planned for and potentially implemented by local or regional government authorities; ○ Localized and site characteristics including vegetation, topography, climate, orientation of the project site, and the likely direction and severity of the wildfire all need to be taken into consideration during project design and implementation.

17 - Modify Content of Concrete Pavement (Reduce the Amount of Water in Mixture)	
Overview	
If concrete is chosen as the pavement material, changing the content of the concrete pavement mixture to reduce the amount of water required can strengthen the pavement and increase resistance to weathering. However, too little water can destroy the chemistry of the mixture. Reducing the amount of water in the mixture increases the density and durability of the material but lowers its permeability properties.	
Advantages	○ Stronger and more durable concrete pavement
Disadvantages	○ Reduces workability; ○ Lowers permeability
Indicative Costs	○ No direct additional cost
Timing for Implementation	○ No additional time needed compared to typical pavement construction schedule
Governance	○ None
Acceptability	○ High acceptability for lower trafficked roadways
Feasibility and Technical Requirement	○ Trained worker and vendor supplier of material available in the area to ensure the right amount of water and aggregate is contained in the concrete mixture
Why this recommendation is open for discussion	○ Recommendation 1– Modify Pavement Design already states the importance of choosing the right pavement; this measure only emphasizes further improvements if choosing concrete; ○ Technical capacity of contractors; ○ Since concrete permeability is lowered by using this measure, it is necessary to account for this in the design of other resilience measures (i.e. drainage).

18 - Use Water Retention Pavements	
Overview	
Water retention within a permeable surface pavement has proved to have the ability to resist rutting, which is a common form of pavement degradation in hot climates. This type of pavement is porous asphalt pavement with the voids filled with water-retaining materials. Because water is retained within the pavement, when water is evaporated, water draws heat from the surrounding materials and therefore reduces pavement temperature	
Advantages	○ Self-cooling system utilizing the mechanism of evaporation; ○ Effective in lowering pavement temperature and resisting rutting; ○ Reduce surface runoff, which can reduce the frequency of flooding
Disadvantages	○ Traffic restrictions may be needed; ○ Possibly higher CAPEX because of the required water-retention material; ○ Possibly higher OPEX from more frequent maintenance
Indicative Costs	○ Cost of water-retention material plus typical cost for road pavement
Timing for Implementation	○ No additional time to typical pavement construction schedule
Governance	○ None
Acceptability	○ High level of acceptability due to limited disturbance to road users
Feasibility and Technical Requirement	○ Requires understanding of the proper design and application of water retention pavements

18 - Use Water Retention Pavements	
Why this recommendation is open for discussion	○ Not enough experience with this kind of pavement; ○ Additional costs.

19 - Development of a SuDS Strategy and Implementation of SuDS Options	
Overview	
A detailed site analysis and water balance assessment would be the first step of a SuDS strategy. The following site characteristics should be considered as part of a detailed site analysis: ○ Climate (rainfall - annual average, seasonal variation); ○ Topography (steep slopes, vicinity to natural waterways); ○ Soils and geology (suitability for infiltration); ○ Groundwater (depth to water table); ○ Salinity (acid sulphate soils); ○ Space (potential areas for water treatment and storage); ○ Environmental (significant species). The strategy should determine the right balance of green infrastructure to be implemented to ensure the long-term efficiency of the SuDS measures.	
Advantages	○ A SuDS strategy allows for the integration of all SuDS elements within the development; ○ A SuDS strategy would be site- and development-specific as each site has specific environmental conditions that influence implementation of SuDS, such as rainfall, topography, soils, creeks, and receiving waters
Disadvantages	○ SuDS will only have an effect with widespread uptake
Indicative Costs	○ The cost of developing a SuDS strategy and implementation of SuDS options would vary on a site-by-site basis
Timing for Implementation	○ The development of a SuDS strategy and implementation of SuDS options can be achieved in months to years, depending on site-specific details and requirements
Governance	○ SuDS would require involvement from relevant water utilities and their engineering divisions (or external procurement if they do not have internal capacity), participation of the general community is not required; ○ Stakeholder consultation is key
Acceptability	○ High acceptability – usually, SuDS does not result in significant disturbance to local communities; ○ Little public opposition against, and considerable support for, the use of SuDS; ○ Some aversion to new technology
Feasibility and Technical Requirement	○ Some SuDS technologies are simple to install and operate. Locals can be easily trained to implement such technologies, and construction materials are usually readily available; ○ Primarily requires common engineering practices, however, some specific engineering inputs are required for design and construction as well as relevant materials that may not be local; ○ Existing local skills can be used for operational purposes; ○ May require advanced plumbing work.
Why this recommendation is open for discussion	○ This measure is preferable to 9 - Development of Guidelines for Sustainable Drainage Systems, but PERS must decide should design focus on standard drainage solutions or nature-based solutions; ○ Not enough experience with SuDS.

The above list of measures is not definitive or exclusive. It provides an outline of a set of climate resilience actions that can be implemented in different stages of the road infrastructure life cycle with relevant considerations.

8.3 Scope for regional cooperation

Building on the narrative presented throughout this document, the WB are facing enormous challenges in understanding the risks of climate change, as environmental and climate change management in the countries is hampered by institutional, political and legal frameworks that are far less than optimal. As a region with a low level of economic development, investment in climate resilient infrastructure in the WB with a special emphasis on roads that are increasingly exposed to floods and high temperatures, is not satisfactory.

The complex political structure is one of the reasons behind the low number of national funds and programmes focused on climate proofing projects. However, the process of harmonization with EU standards is leading to environmental reforms, and the EU's pre-accession period has created opportunities for WB countries to start systematically adapting their laws and accessing additional resources and technical assistance, thus paving the way for regional cooperation.

A climate-proof path offers the WB the opportunity to avoid the mistakes of the past and seize the chance of leapfrogging to better growth that can deliver on both its development and climate goals. It will require investments in climate proofing measures, however. Non-investment will cost even more in the long term.

Implementing the goals set out in the Western Balkans Green Agenda requires significant financial resources. Currently, the most widely represented financial instrument that supports the implementation of the objectives of the Green Agenda is the Western Balkan Investment Framework (WBIF).

Having identified the funding aspect of climate resilience and proofing as one of the greatest potentials for systematic regional cooperation, the ClimaProof project explored the possibilities and has made recommendations for the potential establishment of a fundraising mechanism for financing climate resilience projects for road infrastructure in the WB.

The main question this review addresses is to what extent a separate financing mechanism would make sense and be feasible. This chapter concludes with several recommendations and potential actions for the way forward.

8.3.1 Key issues and challenges

The countries of the WB are making only slow progress in their reforms, especially with reference to purposeful spending of funds. Collected tolls and fuel taxes are not spent fully on highway construction. Also, the inclusion of funding for climate change recovery in the maintenance phase is often not planned at the level of annual activities of road infrastructure management companies.

An underdeveloped operating environment is a key issue in the process of withdrawing funds from bilateral, multilateral and international financing institutions. Some problems common to all WB countries are: underdeveloped institutions, low civil service capacities and a weak judiciary. Since the costs of addressing climate change in developing and emerging countries could reach hundreds of billions of USD annually in coming years, there is no doubt that appropriate reforms are needed to reduce administrative barriers for the withdrawal of international funding.

Within the transport sector, EU financial institutions are seeking to fund projects that promote sustainable transport. Such institutions have their own environmental requirements, including climate and climate change, that must be met for the project to be funded. Infrastructure and public transport should be accessible, efficient, environmentally friendly and safe.

Non-EU financial institutions very often do not have established systems of measures and controls for environmental and climate risks, and thus no relevant credit policies. This may pose a risk because mainstreaming adaptation into the transport sector should take place at the national, sector and project (donor) levels.

8.3.2 Understanding the financing need for climate resilience projects in road infrastructure

Given the population size and the respective European average, infrastructure financing gaps can be identified in the case of motorways for all WB countries (see, for example, data presented in the 2018 EIB report 'Infrastructure Investment in the Western Balkans'). Existing financing mechanisms—most importantly, the WBIF—respond to this need for financing of road infrastructure and prioritize sustainable transport investments in their plans.

However, from a financier's point of view, to understand the cost of a potential investment, both the financing need (in terms of project scope, ticket size, etc.) and the specific financing gaps for the climate proofing component of road infrastructure need to be thoroughly reviewed.

To better understand this, we need to look at the difference between greenfield and brownfield projects.

Table 18: Difference between greenfield road and brownfield projects

Greenfield road infrastructure projects	Brownfield road infrastructure projects
• New construction or major upgrade/rehabilitation of road infrastructure	• Adaptation of existing road infrastructure
• Normally, a greenfield project is part of a larger (government-led) investment planning process	• Brownfield projects are often outside typical investment cycles in road infrastructure
• Typically, large ticket sizes for projects	• Often, smaller ticket sizes for projects

Greenfield projects are not a challenge in terms of financing: climate proofing only constitutes a few percentage points of the total project costs and can be financed along with the entire project. Brownfield projects may be a different story, however, as they entail relatively small and dispersed investments typically not included in large greenfield projects. If there is a financing gap for these brownfield climate proofing projects, project development is needed, and a dedicated facility might make sense.

The advantages and disadvantages of setting up a separate financing mechanism

Designing and establishing a fund or facility is a way to ensure funds are allocated and correspond to certain targets, for example, climate adaptation. There is a range of ways to do this, depending on

type of capital (debt/ equity/ guarantees), return requirements (market-based, concessional, grants) and ownership and decision-making framework (private or public capital and managed). Criteria that guide the applicability of a certain fund or facility structure include, for example:

- Existence of other instruments that offer financing;
- Resources needed and available to set-up a mechanism.

Table 19 provides a summarized overview of the advantages and disadvantages of setting up a separate financing mechanism.

Table 19: Summarized overview of the advantages and disadvantages of setting up a separate financing mechanism

Advantages	Disadvantages
• Allows for specialized mechanism that centralizes expertise on financing aspects underlying climate proofing of road infrastructure	• Limited additionality compared to existing facilities in WB
• Provides a dedicated access point and incentive for developers (and governments) to include climate proofing in their infrastructure project	• Requires additional resources and new and/ or a change in governance structure (including obtaining political mandate)
• Can facilitate dedication of specific TA and grant resources to climate-proofing interventions	• Limited scope in the short run for private sector investment in climate proofing of road infrastructure (and thus for potential participation/ contribution in a separate mechanism)
	• Limited use of economies of scale

The overview presented above indicates that setting up a separate financing window might not be opportune in the context of the resources and efforts required to do so. What could be an alternative to a separate fund/ financing mechanism?

Climate proof components of greenfield projects will probably be covered by existing project and climate resilience requirements of financing institutions such as the WBIF/ EBRD/ EIB. The main challenge are those interventions for existing brownfield infrastructure that are needed outside of standard (greenfield) investment projects. One option would be to clearly map these brownfield road infrastructure climate adaptation interventions for the six WB countries, package them into a pool of projects that has enough size for investment support and create an additional regional add-on facility under the WBIF or a similar financier. This facility would, for example, allow specific access to dedicated technical assistance resources, targeted at project preparation and development for climate adaptation projects.

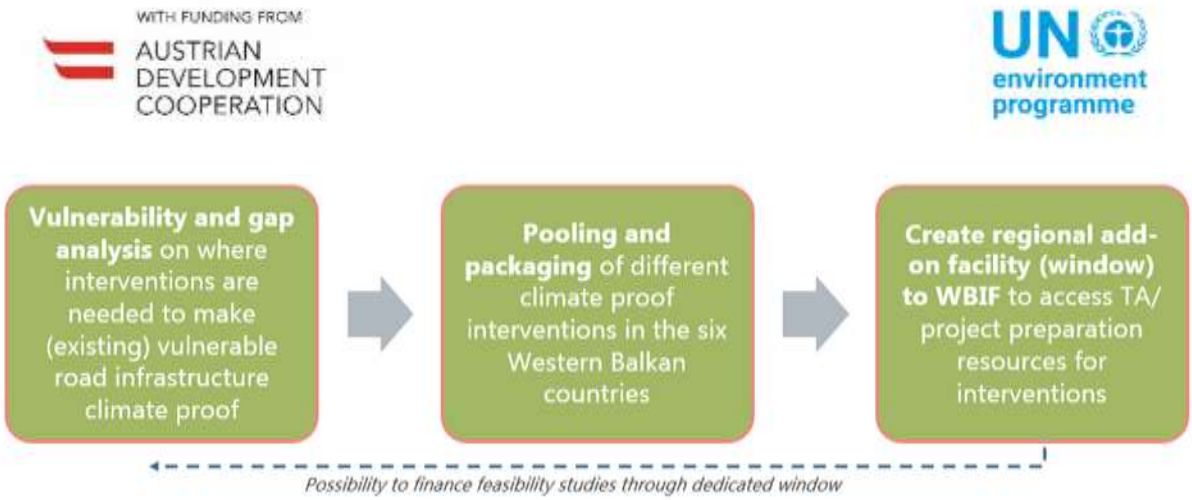


Figure 65: Project preparation and development for climate adaptation projects

8.3.3 Potential way forward

By reflecting on the possibilities for paving the way to the establishment of a fundraising mechanism in the WB, the ClimaProof project sought to rationalize whether the establishment of a separate financing mechanism for climate proofing investments would increase the likelihood of access to additional resources.

Given the fact that financing of climate adaptation components of greenfield projects is likely to be covered by the existing standards for new investments of financiers (such as EBRD, EIB, etc.), climate adaptation for the infrastructure of brownfield projects might justify the establishment of a separate facility as it requires additional financing efforts and resources. Establishing a new and separate financing mechanism would, however, offer limited additionality compared to the existing facilities in the WB and would require additional resources and a new and/ or a change in governance structure (including obtaining of political mandate).

Considering the above and reflecting on the possible way forward, three short-term actions seem feasible options to explore in the context of designing a potential financing mechanism for climate proofing of road infrastructure in the WB. These include:

1. Address the capacity gap – strengthen project development capacity in the region through dedicated TA to develop a project pipeline and attract potential financiers;
2. Consider the option of pooling and packaging the investments needed for different climate proofing interventions in the six WB countries to ensure sufficient scale for potential financiers;
3. Explore the creation of an add-on facility within the WBIF (or other potential financiers such as GCF) for climate proofing of existing road infrastructure – which would provide access to (concessional) finance and technical assistance programmes for packages of projects in the WB region. With financing from the host fund, the add-on facility could take the form of a dedicated project development and preparation facility, preparing projects for investment by existing financing windows (for example, WBIF or GCF).

9 Conclusion

The WB is highly exposed to natural hazards which may intensify in the future due to climate change. The countries in this region must adapt current and future infrastructure investments to the adverse impacts of climate change. Inadequate road infrastructure is becoming a major security problem. Thus, there is a need to better understand climate change and how to adapt to it. The development of road infrastructure, in particular, is recognized as a high priority in various regional and national strategies, whereas the adaptation to future climate change is missing in the national planning level. This is the reason the ClimaProof project was initiated.

The long-term objective of the ClimaProof project is to contribute to the reduction of climate change risks in the WB region by understanding future climate scenarios and, while raising awareness, strengthening capacities and creating an enabling environment for investment in green infrastructure.

An array of stakeholders from the government and associated agencies, private sector and academia from the WB region have received training on bias-corrected climate scenarios and tools developed within the project, general concepts of climate resilience and risk frameworks, how to quantify climate change impacts on road infrastructure, and ultimately, how this data can be used in climate adaptation planning. The technical pillar of the project was complemented with considerations and training on financing and economic instruments available for climate proofing and green infrastructure.

The Regional Strategy for Climate Resilient Road Infrastructure as one of the strategic outputs of the ClimaProof project, brings forward an overview of the current status of each country in all steps, starting from hazard and climate data towards the development of an adaptation plan, including the measures that need to be taken to increase the resilience of road infrastructure and its assets. This work has been concluded with a set of recommendations that outline the current availability of data and the skills and expertise needed. Well-trained staff and coordinated organizations are crucial in implementing climate adaptation in road infrastructure, thus reducing the potential effects of natural disasters. Therefore, this Strategy also highlights the main obstacles in terms of implementation and how to overcome them, not only in terms of technical needs and capacities, but also in terms of adequate and available financing possibilities. It integrates the results and lessons learnt on how the understanding of climate resilience of each country and the region can be enhanced by increasing the technical capacities of each of the national authorities in the field of climate change adaptation for road infrastructure.

The outcomes can be used as crucial initial steps towards a climate resilient road infrastructure network within a complex institutional setting. They serve as the baselevel indicating what level each country is currently at. The results provide insights into the needs of each country and guide them in creating a clear and concrete action plan to increase the resilience of their main road transportation network and reduce the potential impact of natural hazards.

WITH FUNDING FROM
AUSTRIAN
DEVELOPMENT
COOPERATION

UN environment programme

ANNEX I Checklist - Evaluation Mechanism for Project Proposals

WITH FUNDING FROM AUSTRIAN DEVELOPMENT COOPERATION

UN environment programme

Checklist

This is a checklist for governments and national consultants that can be used as an evaluation mechanism for project proposals and identifies what a project proposal should include when applying for climate proofing and green infrastructure investments.

The checklist follows the general steps of a resilience assessment which starts with the identification of natural hazards and exposure of the relevant assets and ends with adaptation planning based on identified measures that reflect a country's objective. These steps are supported by governance, which includes a proper overview of the institutional framework and the role of the different institutions in each step of the resilience assessment. Every step in the checklist is accompanied by a bullet on data collection and governance where relevant.

Figure 1 Schematic overview of the main steps for increasing resilience of infrastructure networks. Central to these steps is a risk-driven approach. Each step provides risk information that the parties involved can evaluate and ultimately use to strengthen their infrastructure.

1. Hazards

This step identifies the natural hazards that occur in each country, the current probability of occurrence and the potential effects of climate change on the probability of occurrence of each natural hazard. This step concludes with an exposure assessment that identifies which parts of the road network and its assets are potentially affected by each hazard.

1. Overview of the relevant natural hazards
    a. What natural hazards potentially affect the road infrastructure in each country? The table below provides an overview of potential natural hazards.

   b. Determine which climate change indicators are relevant for each natural hazard. Appendix A demonstrates how this can be done.
2. Data collection
   a. Identify which data are already publicly available.
   b. Collect hazard maps in an editable format: e.g. shapefile, tiff and not an image. This is a prerequisite for the risk assessment.
   c. Identify whether the hazard maps include return periods and how intensity is expressed (Appendix A).
   d. Hazard maps consist of different types and formats. The type of hazard map introduces uncertainty, but also partly defines the approach of how to consider climate change projections in risk determination.
3. Overview of current variability in current climate conditions
   a. Define the current climate variability and the occurrence of extremes.
   b. Identify the relevant climate indicators.
   c. Gather data via the national weather services and/ or climate models and/ or global field observations and/ or other national stakeholders.
4. Overview of trends in climate change indicators
   a. Based on the identified relevant natural hazards, identify which climate indicators are relevant.
   b. Use climate models to identify trends in the climate indicators, focusing on the median results, but also on extreme events.
5. Define an approach on how to translate the climate change indicators to a change in the natural hazard (probability of occurrence and intensity level). Depending on the type of hazard data available, we listed a few options that are divided into three types of hazard data (see the following table) and the potential of including climate change data (Table 1):
      i. Hazard data are available with a return period and intensity and there is also the possibility of remodelling the hazard.
      ii. Hazard data are available with a return period and intensity, but there is no possibility to remodel the hazard.
      iii. Hazard data are only available in the form of susceptibility maps without a return period or intensity.

	Remodel the hazard (making direct use of the climate data)	Change in probability of occurrence based on statistics. Only possibility for precipitation-related events (based on rainfall statistics and return periods)	Based on climate data and expert judgement: identify a range of expected changes in occurrence and/or intensity
	Intensity + probability of occurrence changes	Probability of occurrence changes	Probability of occurrence changes
i. Hazard maps with different return periods with models	X	X	X (less accurate)
ii. Hazard maps with different return periods without models		X	X (less accurate)
iii. Susceptibility map with susceptibility without intensity and return periods			X

Table 1 Overview of ways to include climate change indicators in natural hazard risk assessments

6. Geographic data collection that can serve as an input for impact analyses (vulnerability and cascading effects)
    a. Define which assets are at risk and collect the data from the relevant stakeholders (e.g. road authorities). The data should be made available in an editable format (e.g. shapefiles, or tables with coordinates and characteristics).
    b. Collate data of the road network and its characteristics in a uniform way and convert it into a GIS type file. The final result will be that the road, its specifications (e.g. road type, type of pavement, etc.) and assets are digitalised (e.g. bridges, tunnels, culverts).
    c. The result will be used for the estimation of the road's vulnerability as well as the cascading impacts (Step 3).
7. Exposure analysis
    a. For every map, an exposure map will be created to express each stretch of road and every asset to determine whether that location is vulnerable, and if possible, what the expected hazard intensity is during each return period (where hazard maps with return periods are available).

2. Vulnerability

To estimate the potential damages that could arise from the identified natural hazards, the road's vulnerability and its assets need to be assessed.

8. Create historical records of previous road damages that have been registered. Ideally, these records consist of the following data:
    - Time and date
    - Hazard intensity
    - Location of hazardous events
    - Assets involved and location of assets

- Asset characteristics (e.g. type of asset, dimensions, type of pavement)
- Duration of disruption
- Economic damages that have been observed
- Number of people affected

9. Create vulnerability curves. Ideally, the vulnerability curve consists of a relationship between damage and hazard intensity. However, when making use of susceptibility maps instead of hazard maps, certain assumptions need to be made.
    a. When hazard maps with return periods are available: create vulnerability functions that are expressed as a percentage of damage to replacement costs. Replacement costs should be estimated in collaboration with the road operator. Also, the costs related to the construction and repairs itself should be included.
    b. When susceptibility maps are available: create vulnerability functions based on an estimated damage per event. This can be based on replacement costs and an expected % of damage to the road and its assets. The historical records of previous damages may be helpful to estimate/validate this.

3. Cascading effects

The socio-economic losses due to disruption of the road network are assessed during the cascading effects per hazard scenario. Different analyses can be performed depending on the quality of data. We divided this step into a fully quantitative approach and a semi-quantitative approach (Table 2):

10. Fully quantitative step. This requires the highest amount of data. Economic losses are calculated as the multiplication of the following components:
    a. Duration of disruption: how long will it take until the road is operational again and is expressed in hours. This can be modelled or identified during stakeholder workshops with the road operator.
    b. The usage of the road: Ideally, information at the road segment level is provided and subdivided into traffic counts of different vehicle types per road segment.
    c. The extra costs per vehicle to change the route, which is the multiplication of:
        i. The value of time per vehicle or per user expressed in monetary values per type of road user (similar to the types in the usage of the road, previous step);
        ii. Extra distance: the time to cover the extra distance due to the disruption of part of the road network. This is at the road segment level and can be based on traffic modelling or on single-link redundancy analyses.
11. Semi-quantitative: this approach requires less data but needs more stakeholder input. Economic losses are assessed in multi-criteria analyses (MCA) which account for:
    a. The usage of the road. When traffic counts are available at the corridor or segment level, these can be used. Alternatively, usage is estimated in a qualitative manner making use of stakeholder meetings with experts on the local situation (e.g. road operator).
    b. Network criticality is assessed during a stakeholder meeting with a MCA to define network criticality based on economic significance at the corridor level and divided into different categories (e.g. ports, agriculture, tourism, industry, hub connection, evacuation routes, etc.).

	Road usage/ traffic data	Value of time	Network criticality/ extra distance	Duration of disruption
i. Fully quantitative	Traffic model output specified by type of road user for each stretch of road. Or traffic counts at the segment level.	Specified by type of road user or value per vehicle	Time delay when a road stretch is disrupted and a detour has to be taken. This is expressed in hours (or in distance translated into time)	Hours per type of natural hazard and hazard intensity (when intensities are available)
ii. Semi-quantitative	Traffic counts at the large corridor level or alternatively based on stakeholder meetings	During stakeholder meetings, define network criticality based on each corridor's economic significance and divided into different categories (e.g. ports, agriculture, tourism, industry, hub connection, evacuation, etc.)		

Table 2. Overview of how to assess cascading effects with different data needs and approaches

4. Risk assessment

As regards the possible annual investment to be made for each hazard, the annual expected damages and losses need to be calculated. This will be based on the outputs from the vulnerability and cascading effects. Subsequently, these will be used to prioritise locations for interventions. The quantification of annual expected damages and losses is only possible when monetary values have been assessed based on vulnerability and cascading impacts. If these are not available, prioritisation must be made based on MCA.

12. Risk assessment: this requires different approaches, depending on whether hazard maps or susceptibility maps are being used.
    a. When hazard maps are available with return intervals, the damage for each stretch of road will be calculated as a sum of all damages and losses for the road itself and the damages to the assets related to this stretch of road (e.g. bridges, tunnels, culverts, etc.). This is conducted for each hazard type. The annual expected damages in each hazard scenario can be estimated by using the return period. The combination of these annual values will make the annual expected damages and losses.
    b. When making use of susceptibility maps, an estimation must be made of an event's return period. Based on the return period, the annual expected damages and losses can be identified.
13. Climate change effects can be considered by changing the return period and re-assessing the risk.
14. The final step of the risk assessment is to prioritise locations for interventions. This can be done by making use of a priority matrix (Figure 1) that compares the damages and losses. Depending on the different stakeholders, the focus may be more or less on the costs related to damages to the road (operator costs) or on the costs related to the losses by the road users due to disruption (societal losses). When both the damages and losses are high, these locations should be the focus for the identification of measures.

		Damage Category				
		C1	C2	C3	C4	C5
Losses Category	C1	1	1	2	2	3
	C2	2	2	3	3	4
	C3	3	3	3	4	4
	C4	3	4	4	5	5
	C5	4	4	5	5	5

Figure 1. Priority matrix that helps prioritise the road segments or road corridors to focus on while identifying investments.

5. Objective and measures

The ultimate goal of these studies is to increase the road network's resilience to the current climate as well as to future conditions. The input for this final step is the risk level. The difference between risk and resilience is that resilience includes the capacity to return to the status quo that existed before the disruptive event. This step describes how to determine the level of resilience the government would like to achieve, how measures can be identified and how this can be assessed (Figure 2).

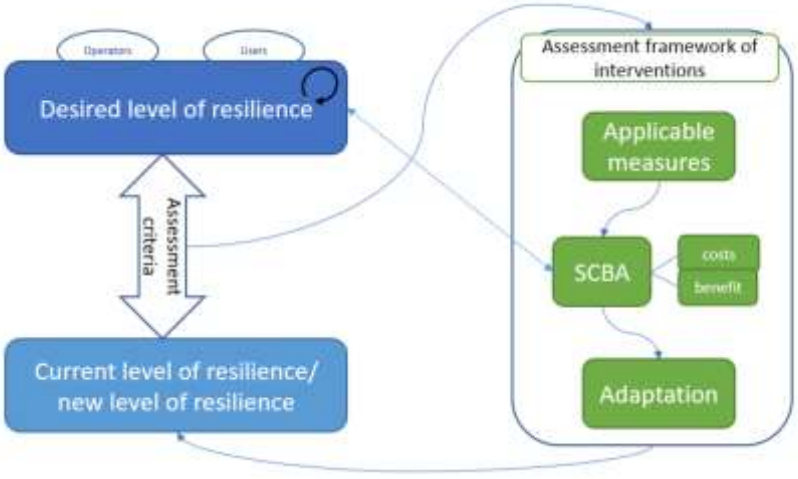


Figure 2 Schematic overview of process to achieve the desired level of resilience. The process starts with a comparison between the desired and current level of resilience (left side of figure). Assuming there is a difference between the desired and current level of resilience, interventions are needed (left side of figure). This requires identification of a list of possible measures, comparing (social) costs and benefits, choosing and implementing measures and then comparing the new level of resilience to the desired level. It is an iterative process.

Determine the objective: what is the required level of resilience?

a. Identify all relevant stakeholders related to the institutional implementation of climate resilience. This input is necessary (users, operators and government);
b. Identify unacceptable situations and thereby identify the desired level of resilience. This can be expressed in monetary values, but also through more qualitative approaches.

15. Identify measures including green infrastructure and nature-based solutions
    a. Identify a long list of resilience-improving measures for each prioritised location and hazard. This can be based on existing resources. Include relevant stakeholders that need to implement these measures in their current practices.
    b. Evaluate the performance of the different measures based on:
        i. Costs: lifetime, estimation of investment costs
        ii. Benefits: effectiveness, the potential benefits of reducing damages and losses
        iii. Divide the costs/benefits to determine the cost-benefit ratio. This can only be carried out when it is expressed in monetary values. Cost-benefit analyses can also be performed semi-quantitatively during stakeholder meetings through multi-criteria analyses.
16. Formulate an adaptation and implementation strategy through policy and regulation
    a. Involve all relevant stakeholders in implementation based on the identified measures, decide on a strategy for investments taking uncertainty, implementation time and expected change in damages and losses in an uncertain future into account.

Appendix A: Overview of natural hazards and data collection of hazard maps

Natural hazard	**Relation to climate change indicators**	**Present in country**	**Expected change in climate indicators**	**Return period or susceptibility map available**	**Intensity (for example, flood depth in meters)**	**Source**
Hydro-meteorological						
Pluvial flooding	Precipitation					
Fluvial flooding	Precipitation					
Landslides (precipitation-induced)	Precipitation					
Coastal flooding – storm surges and sea level rise	Sea level rise (global temperature)					
Heat waves	Temperature					
Wildfires	Temperature, precipitation					
Water scarcity	Temperature, precipitation					
Heavy snow fall	Temperature, precipitation, (wind – snow drifts)					
Geophysical						
Landslides (seismic-induces)	-					
Earthquakes	-					
Tsunami	-					
Volcano	-					

ANNEX II Guideline on Best Practices for Financing Climate Proofing Measures

WITH FUNDING FROM
AUSTRIAN
DEVELOPMENT
COOPERATION

UN environment programme

Guideline on Best Practices for Financing Climate Proofing Measures

WITH FUNDING FROM AUSTRIAN DEVELOPMENT COOPERATION

UN environment programme

Table of Contents

WITH FUNDING FROM AUSTRIAN DEVELOPMENT COOPERATION

UN environment programme

List of Figures

List of Tables

List of Abbreviations

ADFD	Abu Dhabi Fund for Development
BD	Brcko District
BMZ	Federal Ministry for Economic Cooperation and Development
CBC	Cross- Border Cooperation
CEB	Council of Europe Development Bank
CEF	Connecting Europe Facility
COP26	UN Climate Change Conference
CSO	Civil Society Organisation
EBRD	European Bank for Reconstruction and Development
EIB	European Investment Bank
EIF	European Investment Fund
EIP	Economic and Investment Plan
ERDF	European Regional Development Fund
ESPON	European Spatial Planning Observation Network
EU	European Union
FBiH	Federation of Bosnia and Herzegovina
GCF	Green Climate Fund
GEF	Global Environment Facility
GFDRR	Global Facility for Disaster Reduction and Recovery
GHG	Greenhouse Gas Emissions
GIZ	German Development Agency
ICF	International Climate Fund
IFC	International Finance Corporation
IKI	International Climate Initiative
IPA	Instrument for Pre-Accession Assistance
IPARD	Instrument for Pre-Accession Assistance for Rural Development
IRENA	International Renewable Energy Agency
KfW	German Development Bank
LAF	Local Administration Facility
LDCF	Least Developed Countries Fund
MDB	Multilateral Development Bank
MIS	Management Information System
MoU	Memorandum of Understanding
NDA	National Designated Authority
NGO	Non-Governmental Organisation
NIPAC	National IPA Coordinator
OCTs	Overseas Countries and Territories
PFG	Project Financiers' Group
PG	Paris Group
RAMS	Road Asset Management System
RS	Republic of Srpska
SCCF	Special Climate Change Fund
SEETO	South-east Europe Transport Observatory
Sida	Swedish International Development Agency
SIFEM	Swiss Investment Fund for Emerging Markets
SME	Small- and Medium-Sized Enterprise
SPP	Single Project Pipeline
TAIEX	Technical Assistance and Information Exchange
TEN-T	Trans-European Transport Network

UK	United Kingdom
UN	United Nations
UNDP	United Nations Development Programme
UNDRR	United Nations Office for Disaster Risk Reduction
UNFCCC	United Nations Framework Convention on Climate Change
UNEP	United Nations Environment Programme
UNIDO	United Nations Industrial Development Organisation
USAID	United States Agency for International Development
WB	World Bank
WBIF	Western Balkans Investment Framework

1 Introduction

The Western Balkans are increasingly being exposed to the effects of climate change. In coming years, a rise in the frequency and intensity of extreme weather and climate phenomena is predicted in all seasons, including increases in precipitation, which can cause torrential floods, as well as more frequent and prolonged droughts. Climate scenarios are also predicting a rise in the frequency of heat waves in Southeast Europe in coming decades. The economic consequences of climate change will have a substantial impact.

The **Paris Agreement**, the international treaty on climate change, covers climate finance flows that are consistent with a climate-resilient and low-emission pathway with the aim of achieving long-term climate objectives. The signatories of the Paris Agreement (including Albania, Bosnia and Herzegovina, Montenegro, North Macedonia and Serbia) have committed to limiting global warming to temperatures "well below 2 °C", but also **to strengthen the capacity of countries to fight the effects and impacts of climate change** and to develop new *green technologies*.

The guiding document for achieving the goals of climate neutrality in the countries of the Western Balkans is the **Green Agenda for the Western Balkans**. The Green Agenda is a strategic document to promote growth in the Western Balkan region and focuses on moving from the traditional economic model to a sustainable economy in line with the European Green Deal. Accordingly, the key areas of action are: (i) climate measures including decarbonization, energy and **mobility**; (ii) circular economy, (iii) biodiversity, (iv) fighting air, water and soil pollution, and (v) promoting sustainable rural areas and food production chains.

One of the top priorities in terms of smart and sustainable mobility is the **promotion of a greener and more sustainable transport network (roads)**.

Implementing the goals set out in the Green Agenda requires substantial financial resources. The level of economic development in the countries of the Western Balkans is low. Investments in climate resistant infrastructure, particularly for roads which are increasingly exposed to floods and high temperatures, are insufficient. Awareness of the role of international financing for climate change projects in developing and emerging economies must be increased among Western Balkan policymakers and the private sector.

International financial assistance in the field of environment and climate change in the Western Balkans has to date been focused on the process of alignment with the European Union (EU) acquis. These processes are progressing very slowly in the Western Balkan countries.

The EU is the Western Balkans' main political, economic and trade partner. In line with the European Green Deal, protecting the environment and tackling climate change lie at the heart of the EU's support and investment and the EU's Green Agenda for the Western Balkans.

EU and Western Balkan leaders reaffirmed the region's European perspective and commitment to the enlargement process at the European Union-Western Balkans Summit in Slovenia in October 2021. They agreed on the Action Plan for the Green Agenda, which will be a key driver in the transition to modern, carbon-neutral, climate-resilient and resource-efficient economies. In the Brdo's Declaration, the leaders agreed to implement the Economic and Investment Plan (EIP) with a focus on concrete deliverables of the EU's engagement in the region and setting out shared EU – Western Balkan priorities for the coming years to move forward together towards more innovative, greener and digital economies.

The EU will provide substantial financial support to the region through the EIP, mobilising around EUR 30 billion over the next seven years. It focuses on strategic investments in the region's transport and energy networks, green and digital agenda the private sector and the building of a Common Regional Market based on EU regulations to unleash the region's economic potential and make it more

attractive to investors. The EIP will be complemented by a range of new initiatives to support the green and digital transition, regional integration, connectivity and social and economic recovery.

According to the Green Agenda for the Western Balkan, the focus in coming years will be expanded to include broader sustainable economic development issues. Moreover, one of the COP26 summit's outcomes is to increase climate finance in developing and emerging countries.

A range of financial resources can be used to provide climate finance and secure the implementation of climate proofing measures. Climate proofing refers to a process that integrates climate change mitigation and adaptation measures in the development of infrastructure projects.[90] It enables institutional and private investors to make informed decisions on projects that qualify as compatible with the Paris Agreement. The process is divided into two pillars (mitigation and adaptation) and two phases (screening and detailed analysis). Accordingly, the European Commission has published the Technical Guidance on the Climate Proofing of Infrastructure in the Period 2021–2027 to mainstream climate considerations in future investments and in the development of infrastructure projects from buildings, network infrastructure to a range of built systems and assets. The Technical Guidance should be considered while developing infrastructure projects in the Western Balkans before applying for climate finance.

Currently, the most widely used financing instrument to support the implementation of the Green Agenda's objectives is the Western Balkan Investment Framework (WBIF). The WBIF was established at the end of 2009 as a so-called 'blending instrument', providing grants and loans as well as technical assistance in the infrastructure-relevant areas of energy, environment and transport. The WBIF is a cooperation between the Council of Europe Development Bank (CEB), the European Bank for Reconstruction and Development (EBRD), the European Investment Bank (EIB), the Kreditanstalt für Wiederaufbau (KfW) and the World Bank (WB) as well as bilateral donors. Up to 2018, 146 WBIF projects in the infrastructure-relevant areas of energy, environment and transport generated an investment volume of EUR 10.9 billion in the Western Balkans. Most of the funding consisted of loans (EUR 7.9 billion) while grants only accounted for a smaller share (EUR 796 million) and the remainder consisted of national co-financing.[91]

The purpose of the present Guideline is to provide an inventory and review of best practices for financing climate proofing measures in the countries of the Western Balkans. It provides an overview of the most suitable and promising mechanisms and relevant conditions for financing infrastructure projects that integrate a climate proofing aspect. Bearing in mind that climate proofing in infrastructure is still relatively unknown and is insufficiently implemented in the Western Balkans, this document supports the integration of climate proofing in development projects, facilitating the process of planning climate-resilient infrastructure and selecting the appropriate funding sources.

The key takeaway of the Guideline is the overview of eligibility criteria for available financing instruments for climate proofing measures in road (re)construction.

In addition, the Guideline provides a summary of options for establishing a regional fund-raising mechanism to climate proof investments in road infrastructure, which can be used as a basis for discussions on financial flows for climate-proof future infrastructure projects.

This Guideline targets all relevant stakeholders in the Western Balkans (government representatives, authorities, the private sector, research institutes, universities, civil society organisations (CSOs), non-

[90] Commission Notice — Technical Guidance on the Climate Proofing of Infrastructure in the Period 2021–2027 (2021/C 373/01)
[91] https://www.eib.org/attachments/efs/infrastructure_investment_in_the_western_balkans_en.pdf

government organisations (NGOs)) with the aim of increasing awareness and knowledge about financing possibilities for climate proofing measures in infrastructure. It seeks to contribute to the implementation of the Green Agenda for the Western Balkans, as well as of EU and United Nations (UN) goals and policies in the field of climate action and sustainable development.

2 Financing climate proofing in the Western Balkans region

2.1 Overview of financing instruments available in the EU

The type of financing a project attracts largely depends on the applicable ownership (and/or management) model (i.e. public or private) and the size of the intervention. In publicly owned and managed infrastructure projects, any investment in climate proofing existing infrastructure projects is typically made by the corresponding government agency using funds that derive from either fiscal revenues or commonly used debt instruments (municipal bonds, municipal loans where possible, and/or sovereign bonds).

Many interventions such as the construction of enhanced storm drainage systems are often associated with a relatively small investment/ expenditure; they may therefore be too small to justify the establishment of a special financing instrument to attract project funding. Furthermore, smaller interventions are less likely to be able to source financing from public debt markets in the form of project bonds because the amount needed is typically too low to justify the transaction costs. In such cases, the climate-proofing exercise would be financed through the project sponsor's balance sheet (the private owner or manager of the relevant infrastructure).

Key financial instruments:

- Grants: financing for climate change activities, which does not need to be repaid.
- Concessional loans: loans provided for climate change activities, characterised by longer repayment terms and lower interest rates.
- Non-concessional loans: loans provided for climate change activities at a market-based interest rate.
- Equity: investment in projects that represent a stake in a business.
- Guarantees (or development guarantees): legally binding agreements in which the guarantor agrees to pay (a share of) the amount due on a loan, equity or other instrument in the event of non-payment by the obligor or loss of value in case of investment.

There is a lack of consensus on the extent to which different financial instruments should be considered as contributing to the scaling-up of international climate finance. Based on climate finance experiences across the globe, this chapter provides an overview of various financial instruments:

- Non-concessional and concessional loans
- Multilateral and bilateral funds that provide an incentive for private financing by funding activities with the lowest return
- Insurance instruments
- Carbon taxes
- Bonds:
- Green bonds which are only available for large-scale investments targeting energy efficiency, renewable energy projects, etc. Widely used for mitigation only (e.g. renewable energy, green buildings), possibly including adaptation/resilience (e.g. Belgium Green Bond)
- Impact bonds outcome-based finance mechanism, which requires evidence that the initiative is effective
- Resilience bonds linked to catastrophe (CAT) bonds, but 'proceeds' are used for resilience
- Adaptation bonds challenges related to revenue streams
- Climate bonds initiative developing water standards.

2.2 Overview of financing climate proofing in the Western Balkans

This chapter presents a summary of the current state of financing for climate proofing and resilience in the Western Balkans based on individual countries' inputs. It describes the available financial instruments (fees and taxes) and funds (environmental protection fund, economic development funds, infrastructure development funds, etc.) to finance climate change proofing measures used in the individual countries. The chapter specifically focuses on investing in climate-resilient road infrastructure, but also touches on other relevant areas related to road infrastructure (afforestation programmes near roads, programmes for cleaning watercourses, etc.).

Considering the complex political situation and the slow progress being made, investments in climate change adaptation and mitigation projects in the Western Balkan countries continue to be inadequate. National programmes with a focus on climate change are rare, primarily due to the lack of funding. National financial instruments are primarily aimed at raising funds through fees and charges, as well as through public-private partnerships. The state of financing for climate resilience activities and projects in each Western Balkan country is analysed in more detail below.

Each project approved by a foreign investor includes climate proofing measures. According to the Green Agenda and its Action Plan for the Western Balkans, all countries must include climate proofing activities in all future projects.

To date, however, only a relatively small number of national, state and local governments have carried out systematic assessments of the potential impacts of climate change on their infrastructure in general, and on transportation infrastructure in particular.

The costs of climate proofing measures depend on the scope of the area of interest, the length of the road network covered by the adaptation intervention, the level of climate change risks the road transport infrastructure is exposed to and the specific typology of adaptation measures considered. Financing resources are usually provided by road authorities; they might be co-funded from public budgets targeting climate change adaptation and infrastructure development with possible support from European financial instruments.

The lack of financial resources poses a serious obstacle to climate change adaptation activities. Funding for climate adaptation strategies and related projects requires contributions from public as well as private sources as these projects are, more often than not, inter-sectoral by nature.

The purpose of developing the Transport Community Permanent Secretariat's (TCPS) Sustainable and Smart Mobility Strategy for the Western Balkans is to reflect the EU's Sustainable and Smart Mobility Strategy, to adjust the goals, milestones and measures of the EU to the realities in the Western Balkans region, and to provide the region with a roadmap for decarbonisation and digitalisation of its transport sector.

The Western Balkans are vulnerable to extreme weather events, particularly: i) landslides and unstable slopes along highways, major roads and railways; ii) transport infrastructure in the vicinity of river flows which may be impacted by floods; iii) rising groundwater levels; iv) floods in spring and summer and snowdrifts in winter periods.

Transport emissions in Western Balkan countries are dominated by the share of CO_2 emissions from road transport (above 90 per cent in the Regional Parties[92]). The COVID-19 pandemic has intensified the operational and financial difficulties faced by transport/ logistics operators, affected transport workers' rights and their employment, and has led to long waiting times at external border crossings with the EU.

Albania, Bosnia and Herzegovina, North Macedonia and Serbia have started introducing road tolls. Montenegro has a tolled tunnel while Kosovo* is assessing the introduction of road tolls.

Table 1: Policy measures/incentives to boost the uptake of alternative fuels vehicles

Regional Parties	***Policy measures/incentives to boost the uptake of alternative fuels vehicles***
Albania	Exception from VAT on electric vehicles (in the case of the supply of new electric vehicles not previously registered in any other country). Registration tax or electric vehicles (based on cylinder capacity) count as 0 lek. Registration tax calculated on cylinder capacity (for hybrid vehicles).
Bosnia and Herzegovina	No special incentives for electric and hybrid vehicles related to customs rate and VAT, (except for a customs rate of 5 per cent on vehicles operating on electricity only, if they originate from countries which are not members of the European Union, or signatories of CEFTA and EFTA agreements, or from Turkey).
North Macedonia	Exemption from Motor Vehicles tax for fully battery-electric vehicles (defined by law). Motor vehicles tax reduced by 50 per cent for plug-in hybrid vehicles. No subsidies for citizens to buy electric or hybrid vehicles in state budget for 2021. Subsidy in place for installation of gas in old vehicles.
Kosovo*	No regulations with respect to incentives for import or purchase of electric vehicles or hydrogen fuel cell vehicles.
Montenegro	Exemption from tax duties for electric motor vehicles.
Serbia	Annual tax on use of motor vehicles not paid by owners of electric vehicles and hybrid vehicles. No incentives for electric, i.e. hybrid vehicles in respect of customs rate and VAT. Regulation on conditions and manner of implementation of subsidised purchase of new vehicles with exclusively electric drive, and vehicles with hybrid drive (adopted in March 2020). Subsidy amount for purchase of e-vehicles and hybrid vehicles, hybrid passenger vehicles and hybrid light truck with CO2 emissions up to a maximum of 100 g/km – 2,500 EURO, Plug In Hybrid Electric Vehicle (PHEV) and light truck, as well as electric vehicle and light truck with range extender with CO2/km emissions up to a maximum of 50 g/km – 3,500 EURO, totally electric passenger vehicle and totally electric light truck – 5,000 EURO. Incentives for public transport sector (introduced by adoption of Regulation on conditions and manner of conducting). Subsidies for purchase of passenger vehicles for renovation of taxi fleet as public transport.

[92] Defined under the Transport Community Treaty as Albania, Bosnia and Herzegovina, North Macedonia, Kosovo*, Montenegro, Serbia.
* *This designation is without prejudice to positions on status and is in line with UNSCR 1244/1999 and the ICJ Opinion on the Kosovo declaration of independence.*

The deployment of Intelligent Transport Systems (ITS) in the region's road networks is still patchy, project-based and lacks a strategic approach. The need for a strategic framework and the adoption of an EU ITS architecture and standards are key issues to ensure interoperability across the region. The Road Action Plan addresses these issues by including concrete actions on how to set up a strategic and legal framework. The deployment of an ITS on the Indicative Extension of Road Core/Comprehensive Network in the Western Balkans has been estimated at around EUR 775 million (cost of implementation), and at approximately EUR 1.5 million for operations and maintenance costs.[93]

According to the United Nations Framework Convention on Climate Change's (UNFCCC) definition, climate finance refers to the financial resources dedicated to adapting to and mitigating climate change in the context of financial flows to developing and emerging countries.

Climate finance entails both public and private resources. Public development assistance is key for financing development. It is widely recognised, however, that additional private resources need to be mobilised to unleash the potential of international financial flows

2.3 Albania

The Inter-Ministerial Committee on Civil Emergencies is the highest body for coordinating the activities of state institutions and private entities, as well as of material and financial resources to cope with natural disasters (including climate change disasters).

The Ministry of Finance and Economy is responsible for drafting and approving the system of regulations, standards and procedures to ensure efficient and effective administration of public financial resources. The Ministry of Finance allocates and re-allocates national revenues through the collection of income taxes and the programming and budgeting of public expenditures and establishes financial information systems. It developed a *Guideline on the Preparation of the Mid-Term Budget Programme 2018–2020* which addresses cross-sectoral issues related to climate change resulting from the ratification of the Paris Agreement, and all lines of ministries within one or two of the relevant budgetary programmes were required to define/identify appropriate and measurable objectives, detailed in products/activities/costs related to climate change. Moreover, the *Law on Energy Efficiency* sets out the establishment of a new *Energy Efficiency Fund*, which will provide grants and loans or financial guarantees for the implementation of energy efficiency projects in Albania.

The National Climate Change Strategy was adopted by the Decision of the Council of Ministers in 2019 and includes both the national climate change mitigation plan and the national climate change adaptation plan. The ***National Mitigation Plan*** identifies 222 measures, 71 of which **focus on the transport sector**. The total costs for implementing the plan up to 2021 were also calculated, as were the financial resources allocated and/or committed so far from the state budget, donors and other sources.[94]

The National Adaptation Plan (NAP) was drafted by the German Development Agency (GIZ) as a stand-alone document in the form of the Climate Adaptation Strategy (CAS), together with the Adaptation

[93] CONNECTA, "Final Report on Strategic Framework for Deployment of ITS in Western Balkans", 2018.
[94] ClimaProof Project, Focus Report Albania – Baseline Assessment and Gap Analysis of Climate Change Framework, EIA and SEA Requirements, with a particular focus on road infrastructure, June 2020.

Plan of Measures. The Adaptation Plan (or The Plan of Priority Actions) was eliminated from this document and fully integrated into the NSCC document.

Albania has not adopted a separate National Adaptation Strategy on climate.[95]

Albania's NAP provides an implementation framework to facilitate the integration of climate change adaptation in development planning; the Albanian government has also developed an NAP financing document. It provides guidance on how to finance prioritised climate change adaptation activities based on two sources and channels: 1) domestic government revenues, and 2) international funds and resources.

Following Albania's ratification of the Paris Agreement in September 2016, the Albanian Ministry of Finance issued a requirement for all line ministries to define and identify appropriate and measurable objectives, outputs, activities and costs related to climate change within their budget programmes as part of their preparations of the Medium-Term Budget Programme (MTBP) 2018–2020 (Çili, 2017).

The Ministry of Tourism and Environment (MoTE) is coordinating the implementation of the Nationally Determined Contribution (NDC) and of the NAP and is supporting the climate risk identification and management process. With support from the NAP GN, MoTE will continue to concentrate its efforts on mainstreaming adaptation in the Medium-Term Budget Programme and in different sectoral strategies.

Climate adaptation has been integrated in Albania at the levels of:

- The policy and annual objectives of the Management of Drainage and Irrigation Infrastructure Programme
- The annual objectives, projects, outputs and activities of the Water Management Programme
- The annual objectives of the Agricultural Advisory and Information Programme
- The annual objectives and projects of rural development by supporting the Agriculture, Livestock, Agro-industry and Market Programme
- The annual objectives and outputs of the Civil Emergencies Programme
- The outputs of the Urban Planning and Housing Programme
- The policy, objectives and outputs of the Environmental Protection Programme.

Environmental financial instruments are not based on an assessment of environmental damage or externalities but encourage consumers and producers to behave in an eco-friendly way. Environmental taxes only provide a soft incentive for eco-friendly behaviour by individuals and organisations. Tax rates have mostly been set without any consideration of the impact and effects of emissions on the environment in terms of externalities or environmental damage to individuals and firms.

Albania lacks climate change adaptation policies in different economic sectors and in infrastructure, as well as in terms of other natural and anthropogenic hazards. The country has only few financial resources to invest in activities and measures on climate change mitigation and adaptation. Implementing policies and building and strengthening resilience to climate-related and natural hazards would be an important step towards making progress in this regard.

[95] Monitoring of the Action Plan of the National Strategy on Climate Change, 2020-2030, Resource Environmental Center, ALBANIA, January 2022.

Most public investments in Albania (about 55 per cent of total public investments) are concentrated in road infrastructure, the main mode of freight and passenger traffic. Major funding is needed to improve the services, and the majority of funds will need to come from foreign donors.

The strategic priorities of the 2016 National Transport Strategy and Action Plan for the period 2016–2020 include developing co-modal solutions by optimising individual modes of transport and focusing on energy-efficient and environmentally friendly modes of transport, introducing measures to reduce energy consumption and costs per unit of transport service and increasing the use of ITS.

Albania has limited experience with carbon pricing instruments to promote decarbonisation, including with the EU Emissions Trading Scheme. Some essential adaptation measures involving, among others, climate-proofing infrastructure or disaster risk management, are not highlighted as having a "very high priority", mainly due to their high technical complexity and costs. Environmental taxes are considered a financial instrument for controlling pollution and managing natural resources, and are designed to influence the behaviour of businesses, producers and consumers. Environmental taxes are part of the country's system of environmental economic accounting, a satellite system of national accounts. Albania has introduced transportation and pollution taxes.

Albania is currently implementing a total of 5 Trans-European Transport Network (TEN-T) projects, with a combined value of EUR 479 million (EUR 264 million on the Core Network and EUR 215 million on the Comprehensive Network).

2.4 Bosnia and Herzegovina

Bosnia and Herzegovina submitted its Third National Communication in 2017, calling attention to the lack of institutional, legal, financial and technical capacities to address climate change issues.

Current economic instruments aimed at climate change mitigation and adaptation mainly focus on fuel taxes and excise duties, natural resource consumption tax and forest taxation.

Bosnia and Herzegovina adopted the **Environmental Approximation Strategy** in 2017, with the aim of addressing air quality and **climate change issues** as one of eight sub-sectors of the EU environmental acquis. The economic and financial aspects of each sub-sector were analysed and recommendations for short- and medium-term measures were provided.

The *Law on Roads in FBiH*, the *RS Law on Public Roads* and the *Law on Roads in BD* specify the rules on the management, planning, **financing**, construction, reconstruction, maintenance and protection of public roads, public private partnerships and monitoring, but climate proofing measures have not yet been integrated.

The Fund for Environmental Protection and Energy Efficiency of RS and the *Environmental Protection Fund of the FBiH* were established to develop and finance programmes, projects and similar activities in the field of environmental protection, energy efficiency and the use of renewable energy sources.[96] Special environmental fees for air pollution are being collected from certain polluters as well as for motor vehicle pollution.

Bosnia and Herzegovina is currently implementing a total of 20 TEN-T projects, with a combined value of EUR 2.277 billion.

[96] ClimaProof Project, Focus Report Bosnia and Herzegovina – Baseline Assessment and Gap Analysis of Climate Change Framework, EIA and SEA Requirements, with a particular focus on road infrastructure, June 2020.

2.5 Kosovo*

The Ministry of Environment, Spatial Planning and Infrastructure has assumed a leading role among the Kosovo* institutions for the coordination of national climate change activities and the coordination of activities of the Government of Kosovo* to cope with the expected impacts of climate change. The **Strategy for Environmental Protection** emphasises the lack of financing for environmental protection in general.

The majority of local competences are implemented with assistance and financial support from various international donors. However, stable funding must be ensured through central/local budgets.

Finding ways to finance climate change adaptation plans, operations, infrastructure and projects is considered one of the main challenges for implementing the *Kosovo* National Adaptation Component*. To ensure implementation, monitoring and reporting on the achievement of the goals set out by the *Climate Change Strategy*, a detailed *Action Plan for Climate Change Strategy* was developed.[97] The *Action Plan's* general objective is to facilitate the achievement of the *Climate Change Strategy* goals step-by-step, enabling better strategic and financial planning, monitoring and reporting on implementation, setting priorities and recognising redundancies among the two components of the *Climate Change Strategy* and relevant strategic documents. One of the specific objectives of the *Action Plan* is to ensure investment in relevant infrastructure and the development of appropriate financial instruments to achieve the *Climate Change Strategy* goals.[98]

Kosovo* has introduced an environmental tax for air pollution which can be used as a source for climate proofing measures for infrastructure projects.

Kosovo* is currently implementing a total of 3 TEN-T projects, with a combined value of EUR 520 million (EUR 320 million on the Core Network and EUR 200 million on the Comprehensive Network).

2.6 Montenegro

As stated in the *National Strategy of Sustainable Development by 2030*, there is an evident lack of financial resources in Montenegro for remediation, recovery, rehabilitation and reconstruction of damage caused by natural (including climate change) and anthropogenic hazards.

The country's policy on disaster risk management is elaborated in the *Disaster Risk Reduction Strategy (2018–2023)* and the *National Strategy for Emergency Situations*. In 2014, Montenegro adopted the **National Platform for Disaster Risk Reduction** in line with the global Hyogo Framework for Action. The Platform has no specific budget, and all activities are financed from the government's budget and by international organisations through different projects. Some of the Platform's objectives and tasks are: (i) preparing the technical foundations for a dialogue of all stakeholders to achieve the highest quality response to threats and risks of disasters, (ii) promote initiatives among different public administrations and the private sector to implement activities that contribute to the improvement of disaster risk prevention and mitigation, and (iii) stay informed about programmes, projects, reports and recommendations issued by UN or United Nations Office for Disaster Risk Reduction (UNDRR)

[97] https://mmph.rksgov.net/assets/cms/uploads/files/Publikimet/Action_Plan_for_Kosovo_Climate_Change_Startegy_296697_193403.pdf

[98] ClimaProof Project, Focus Report Kosovo* – Baseline Assessment and Gap Analysis of Climate Change Framework, EIA and SEA Requirements, with a particular focus on road infrastructure, June 2020.

* *This designation is without prejudice to positions on status and is in line with UNSCR 1244 and the ICJ Opinion on the Kosovo Declaration of Independence.*

institutions. The Platform's activities include: (i) contributing to needs assessment studies for disaster risk reduction activities and policies and making proposals for national action plans on disaster risk reduction, (ii) implementing targeted, scientific and technical programmes for the prevention of emergencies, and (iii) support activities to increase the public's awareness of disaster risk reduction.[99]

Eco-taxes have been introduced for all natural and legal persons to use road motor vehicles and their auxiliary vehicles on the territory of Montenegro, and environmental taxes have been introduced for polluters.

Montenegro is currently implementing a total of 5 TEN-T projects, with a combined value of EUR 1,133.39 million.

2.7 North Macedonia

The lack of financial capacities at the national and local level to comply with environmental preparedness requirements, policies and laws is one of the most serious strategic problems in planning at the national and local level.

The responsibilities and tasks of the Ministry of Finance include the financial, tax- and customs-related components of climate activities.

The *Law on Environment* sets out the adoption of a *National Plan on Climate Change*, an *Action Plan* for the prevention of causes and mitigation of the negative effects of climate change. The **Action Plan on Climate Change** shall contain, among others, a financial plan for the implementation of anticipated measures and activities.

The development of the new *Law on Climate Action* and *Long-term Strategy on Climate Action* (covering the Energy and Climate Package 2030 to 2050) began in February 2019. A roadmap for achieving long-term climate-related objectives has been developed; the three key climate-related objectives are: (i) full transposition and implementation of the EU climate acquis; (ii) achieving a low-carbon economy; and (iii) **achieving a climate-resilient society**.[100]

North Macedonia has introduced an environmental tax for air pollution which can be used as a source for climate proofing measures for infrastructure projects.

North Macedonia is currently implementing a total of 8 TEN-T projects with a combined value of EUR 999.31 million (EUR 942.71 million on the Core Network and EUR 56.6 million on the Comprehensive Network).

2.8 Serbia

All climate change-related documents have been developed with the use of multilateral and bilateral funds. A national budget is dedicated for such purposes, i.e. for climate finance in general. Due to limited technical capacity and finances, fighting climate change and implementing adaptation measures represent a serious challenge for Serbia.

[99] ClimaProof Project, Focus Report Montenegro – Baseline Assessment and Gap Analysis of Climate Change Framework, EIA and SEA Requirements, with a particular focus on road infrastructure, June 2020.
[100] ClimaProof Project, Focus Report Republic of North Macedonia – Baseline Assessment and Gap Analysis of Climate Change Framework, EIA and SEA Requirements, with a particular focus on road infrastructure, June 2020.

The *Draft Law on Climate Change* prescribes the development of the **National Adaptation Plan**, including **financial resource needs for priority measures**[101] (only the first draft is available).

Serbia has introduced an environmental tax for air pollution which can be used as a source for climate proofing measures in infrastructure projects.

Serbia is currently implementing a total of 6 TEN-T projects, with a combined value of EUR 2.7 billion (EUR 1.349 billion on the Core Network and EUR 1.351 billion on the Comprehensive Network).

[101] ClimaProof Project, Focus Report Republic of Serbia – Baseline Assessment and Gap Analysis of Climate Change Framework, EIA and SEA Requirements, with a particular focus on road infrastructure, June 2020

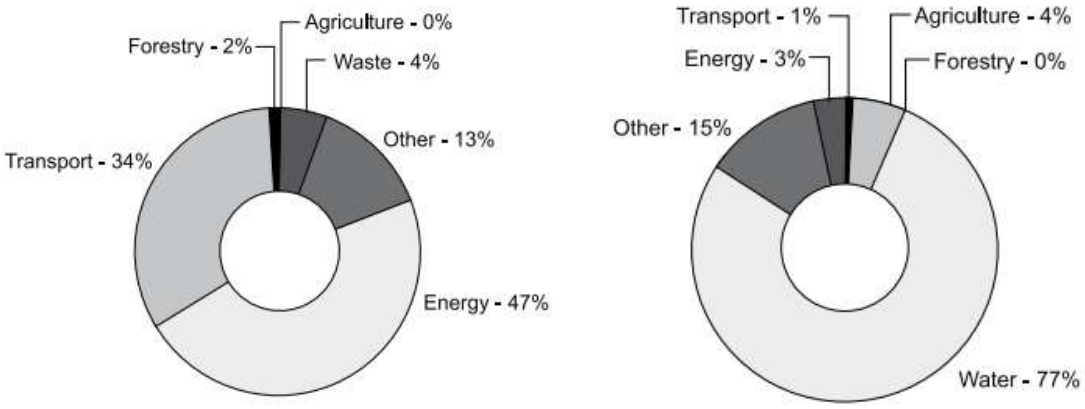
3 International funding sources available for Western Balkan Countries

3.1 Bilateral funding for climate change

Due to the increasing effects of climate change on infrastructure, a growing number of programmes and projects funded by international financial sources focus on addressing climate change in developing and emerging countries. They include multilateral and bilateral development banks, bilateral development cooperation agencies and the private sector. Bilateral financing refers to programmes and projects agreed on between two countries or between a specific financial institution and a country. Bilateral financial institutions have a long history financing development activity with a particular focus on financing for developing and emerging countries.

Bilateral financial institutions use a wide range of instruments (credit lines, grants, equities, debt, lending) to deliver climate proofing financing in developing and emerging countries.

Based on data from 2008, over 90 per cent of climate mitigation financing provided by bilateral financial institutions is targeted at the transport sector. On the other hand, only 1 per cent of climate adaptation financing is targeted at the transport sector.



a) Sectoral distribution of mitigation financing by bilateral financial institutions

b) Sectoral distribution of adaptation financing by bilateral financial institutions

Figure 1: Sectoral distribution of climate finance by bilateral financial institutions[102]

Traditional and already established mechanisms of bilateral financing are mostly used in the countries of the Western Balkans. Some of the most common are grants provided by GIZ and the Swedish International Development Agency (Sida). A complex political structure is often a major obstacle to obtaining funds from bilateral financial institutions.

The key bilateral financial institutions operating in the Western Balkans are presented below.

[102] Stockholm Environment Institute, Working Paper – Bilateral Finance Institutions and Climate Change: A Mapping of Climate Portfolios, 2009.

Table 2: EU bilateral climate change funding institutions

	Federal Ministry for Economic Cooperation and Development (BMZ)	German Development Agency (GIZ)	International Climate Initiative (IKI)	Swedish International Development Agency (Sida)
Background	The Federal Ministry for Economic Cooperation and Development is a cabinet level ministry of the German government. Through international cooperation, the Ministry implements programmes to reduce greenhouse gas (GHG) emissions and adapt to the consequences of climate change. **Climate change mitigation and adaptation** are a key focus of the Ministry. Between 2005 and 2020, the Ministry increased its budgetary funds for climate action by more than tenfold.[103] The Ministry primarily implements its assistance for developing countries through two agencies: GIZ and KfW.	The German Development Agency (GIZ) is Germany's main development agency that provides services in the field of international development coordination. The agency's areas of activity include **climate change, sustainable development and green recovery**. GIZ implements a wide range of programmes and projects for developing countries, which includes expanding the availability of green financing through targeted cooperation with the financial sector, for example through sustainable bonds and loans.[104]	The International Climate Initiative (IKI) is part of the German government's international climate finance commitment. IKI supports developing and emerging countries in **adapting to the impacts of climate change**, including project preparation advice for infrastructure development and **investment instruments for climate mitigation**. Within the *Adapting to the Impacts of Climate Change* funding programme, IKI supports vulnerable countries and regions in strengthening their adaptability to the consequences of climate change.[105]	The Swedish International Development Agency (Sida) collaborates with organisations, government agencies and the private sector with the aim of investing in sustainable development for all. One of the agency's areas of activity includes the **environment and climate change**. The agency's activities are divided into: (i) prevention of climate change, adaptation, emissions reduction and pollution, and (ii) environmentally sustainable development and the sustainable use of natural resources. In 2019, 19 per cent of Sida's total aid was earmarked for climate change and the environment.[106]

[103] https://www.bmz.de/en/development-policy/climate-change-and-development/climate-financing

[104] https://www.giz.de/en/ourservices/99580.html

[105] https://www.international-climate-initiative.com/en/about-iki/funding-area-adapting-to-the-impacts-of-climate-change/

[106] https://www.sida.se/en/sidas-international-work/environment-and-climate

	Federal Ministry for Economic Cooperation and Development (BMZ)	German Development Agency (GIZ)	International Climate Initiative (IKI)	Swedish International Development Agency (Sida)
Financing priorities[107]	> **Energy and climate** > Energy efficiency > **Low-carbon transportation** > Migration and climate > **Cities and climate** > Water and climate > Agriculture and climate > Forests and climate > Oceans and climate > **Climate risk management** > Climate risk insurance > **Climate finance**	> Rural development > **Sustainable infrastructure** > Emergency aid and **disaster risk management** > **Environment and climate change** > Economic development	> Mitigation of GHG emissions > **Adaptation to the impacts of climate change** > Conserving carbon sinks > Conserving biological diversity	> Democracy and human rights > **Environment and climate change** > Gender equality and women's role
Beneficiaries[108]	> Governments > NGOs > Private sector	> Governments > NGOs > Private sector	> Governments > Organisations and initiatives	> Governments > NGOs > Private sector
Funding conditions[109]	> Grants > Concessional loans	> Grants > Concessional loans (Note: An own contribution is usually expected)	> Grants	> Grants

[107] ACT Alliance Secretariat, A Resource Guide to Climate Finance: An Orientation to sources of Funds for Climate Change Programmes and Action, 2018

[108] Ibid.

[109] Ibid.

Table 3: Non-EU bilateral climate change funding institutions

	International Climate Fund (ICF)	United States Agency for International Development (USAID)	Abu Dhabi Fund for Development (ADFD)	Swiss Investment Fund for Emerging Markets (SIFEM)[110]
Background	The International Climate Fund (ICF) is a UK government agency that helps developing countries **adapt to climate change** and adopt low carbon growth. The UK government allocated GBP 2.9 billion to the IFC for the years 2011–2015. The UK plans to spend GBP 11.6 billion in the period 2021–2026, GBP 3 billion of which will contribute to protecting and restoring nature. ICF engages in international negotiations and drives innovation and novel ideas for action.[111]	The United States Agency for International Development (USAID) is an American agency seeking to strengthen the resilience of developing countries and vulnerable populations to the impacts of climate change. One of USAID's ten thematic priorities is the **environment and global climate change**. USAID helps communities prepare for climate change and manage its impacts. In 2021, USAID developed and published a new Agency Climate Strategy, which guides the Agency's efforts to target climate change resources and contribute to the integration of climate change considerations in international development.[112]	The Abu Dhabi Fund for Development (ADFD) is an autonomous national entity affiliated with the Abu Dhabi government. The Fund helps developing countries achieve **sustainable socio-economic growth**. In 2009, ADFD signed an agreement with the International Renewable Energy Agency (IRENA) to allocate USD 350 million to support renewable energy projects in developing countries.[113]	The Swiss Investment Fund for Emerging Markets (SIFEM) is the development finance institution of the Swiss Confederation that promotes long-term, sustainable and broad-based economic growth in developing end emerging countries. The Fund adheres to the basic principles of environmental sustainability in its investment activities. Some of SIFEM's strategic objectives for the period 2021–2024 are: (i) **strengthening the resilience** of developing and emerging countries and companies **with regard to global risks such as** pandemics and **the effects of climate change**, and (ii) contributing to the **achievement of international environmental goals,** in particular to the **mitigation of climate change** and its associated **negative consequences**.

[110] https://sifem.ch/

[111] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/48409/5539-uk-international-climate-fund-cmci.pdf

[112] https://www.usaid.gov/climate/strategy

[113] https://www.adfd.ae/english/ABOUTADFD/Pages/Home.aspx

	International Climate Fund (ICF)	United States Agency for International Development (USAID)	Abu Dhabi Fund for Development (ADFD)	Swiss Investment Fund for Emerging Markets (SIFEM)[110]
Financing priorities[114]	> **Supporting sustainable and inclusive economic growth** > Building resilience to manage risks > Improving stewardship of natural resource	> **Climate adaptation** > Clean energy > Sustainable landscapes > **Mainstreaming climate change in** development, food security, **infrastructure and disaster preparedness planning** > Low-emission development	> **All types of sustainable economic growth projects**	> Agribusiness, aquaculture and forestry > Business activities and services > Consumer goods > Education > Energy, water and resource efficiency > Financial services > Generalist > Healthcare > **Infrastructure** > Renewable energy > Small- and medium-sized enterprises (SMEs) development > Venture capital
Beneficiaries[115]	> Governments > NGOs > Private sector	> Governments > NGOs	> Governments > NGOs > Private sector	> Private sector
Funding conditions[116]	> Grants > Concessional loans	> Grants > Concessional loans	> Grants > Concessional loans > Equities	> Loans > Equities

[114] ACT Alliance Secretariat, A Resource Guide to Climate Finance: An Orientation to sources of Funds for Climate Change Programmes and Action, 2018.
[115] Ibid.
[116] Ibid.

There are also plans to establish new bilateral donors in the Western Balkans, mainly through multilateral projects. For example, under the WBIF, bilateral donors can support technical assistance projects and help with project preparation, institutional support, capacity development and alignment with the EU acquis. Bilateral donors and other international institutions will provide the main means to ensure rapid implementation of the investment package within the WBIF.

3.2 Multilateral climate change funding

The development of climate-resilient Western Balkan road networks, *increasing opportunities for the deployment of nature-based solutions to mitigate and adapt to climate change* and *supporting the development of smart transport infrastructure* are top priorities for all countries in the Action Plan of Green Agenda for the Western Balkans in the period 2021–2030. Expanding national legislation and adjusting to EU legislation, especially in the field of the environment and climate, is the foundation for further progress and planned withdrawal of investment funds. Given the low economic development and mostly poor road infrastructure in all Western Balkan countries, support in adjusting to EU legislation and withdrawing funds from multilateral financial institutions is of particular importance.

Multilateral climate change funding is provided by multilateral financial institutions including: (i) multilateral development banks (MDBs), and (ii) other multilateral financial institutions.

MDBs are international financial institutions chartered by at least two countries for the purpose of encouraging economic and social development in developing and emerging countries. The main activities MDBs finance include: (i) **infrastructure**, (ii) energy, (iii) education, **and** (iv) **environmental sustainability** in developing and emerging countries.[117] The major MDBs operating in the Western Balkans are:

- World Bank (WB)
- European Bank for Reconstruction and Development (EBRD)
- European Investment Bank (EIB), and
- Central European Bank (CEB).

In 2020, the MDBs committed a total of USD 66 billion in climate finance in all economies in which they operate, out of which USD 38 billion was set aside for low-income and middle-income economies. About 20 per cent of total investments were targeted at transport.

[117] https://www.investopedia.com/terms/m/multilateral_development_bank.asp

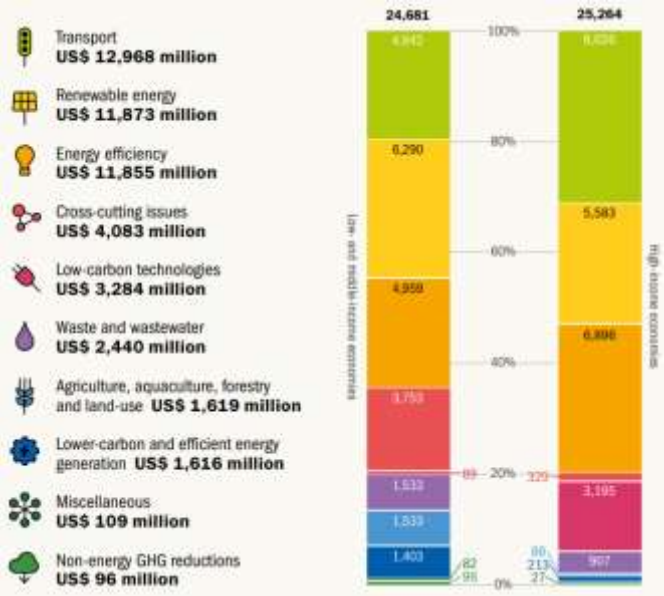


Figure 2: Total MDBs climate finance by activity in 2020[118]

More information on the programmes of these MDBs is presented in *Chapter 3.3 International financing institutions*. Programmes of other multilateral financial institutions (non-MDBs) are presented and described below.

[118] https://thedocs.worldbank.org/en/doc/9234bfc633439d0172f6a6eb8df1b881-0020012021/related/2020-Joint-MDB-report-on-climate-finance-Infographic-final-web.pdf

Table 4: Multilateral climate funds

	United Nations Environment Programme (UNEP)[119]	Western Balkan Investment Framework (WBIF)[120]	Green Climate Fund (GCF)[121]	Global Environment Facility (GEF)[122]
 **Background**	The United Nations Environment Programme (UNEP) is the leading environmental authority in the UN system that promotes coherent implementation of the environmental dimension of sustainable development. UNEP hosts the secretariats of critical multilateral environmental agreements and research bodies. UNEP provides countries with the necessary **tools and technologies to protect and restore the environment**. The Environmental Fund is UNEP's core financial fund. In 2021, UNEP launched the Programme Strategy for 2022–2025 to tackle **climate change**, loss of nature and pollution. The Strategy emphasises that UNEP supports countries in taking full advantage of the opportunities presented by decarbonisation, dematerialisation and resilience, with a focus on sectors with the highest emissions (including **transport**).	The Western Balkan Investment Framework (WBIF) is a joint initiative of the EU and international financial institutions, with the goal of uniting and coordinating various sources of funding for priority projects in the region. The WBIF consists of the Joint Grant Facility and the Joint Lending Facility. The funds of the Joint Grant Facility are intended for projects supported by loans of the partner international financial institutions. The WBIF provides **grants for** energy, environment, social, **transport** and digital **infrastructure**. Since 2009, the WBIF has allocated over EUR 1.4 billion in grants to strategic infrastructure projects. In the period 2015–2020, 937 km of new roads were built with WBIF funds. In the period 2022–2030, the building of an additional 625 km of motorway and the rehabilitation of 1,383 km of railway are planned.	The Green Climate Fund (GCF) is a UNFCCC climate fund, mandated to support developing countries in raising and realising their national ambitions towards low-emission and climate-resilient pathways. The aim of the GCF's investments is to support **climate change mitigation and adaptation** in developing countries. GCF invests across four economic transitions: (i) built environment, (ii) energy and industry, (iii) human security, livelihoods and well-being, and (iv) land use, forests and ecosystems. GCF was the leader in approving climate finance projects in 2020 (USD 2.2 billion out of a total of USD 3.4 billion). GCF approved nearly USD 3 billion in climate projects in 2021 and expects to reach a total of USD 15 billion in 2023.	The Global Environment Facility (GEF) is a multilateral trust fund that focuses on investments in nature, biodiversity, **climate change**, chemicals and desertification projects in developing countries and transition countries. Since its establishment, GEF has provided over USD 21.7 billion in grants and mobilised an additional USD 119 billion in co-financing. Through its Small Grants Programme, which is a corporate programme of GEF implemented by the United Nations Development Programme (UNDP), the GEF has provided support to over 26,000 civil society and community initiatives. Based on the primary focal area of each project, 19 per cent of investments within the Small Grants Programme targeted **climate change mitigation,** while 3 per cent focused on **climate change adaptation**.

	United Nations Environment Programme (UNEP)[119]	Western Balkan Investment Framework (WBIF)[120]	Green Climate Fund (GCF)[121]	Global Environment Facility (GEF)[122]
Financing priorities	> **Climate activities** > Chemicals and pollution activities > Nature activities > Science policy > **Environmental governance** > Finance and economic transformation > Digital transformation	> Economic and investment plan > **Sustainable transport** > Clean energy > **Environment and climate** > Private sector > Human capital > Digital future	> Health, food and water security > Livelihood of people and communities, energy generation and access > **Transport** > **Infrastructure and built environment** > Ecosystems and ecosystem services > Buildings, cities, industries and appliances > Forests and land use	> Low-emission energy access and power generation > **Low-emission transport** > Energy-efficient buildings, cities and industries > Sustainable land use and forest management > Enhanced livelihoods of the most vulnerable people, communities and regions > Increased health and well-being, food and water security > **Resilient infrastructure** > Resilient ecosystems
Beneficiaries	> Government > NGOs > Private sector	> Government > Private sector	> Regional, national and sub-national bodies > NGOs > Private sector	> Government > NGOs > Private sector > Research institutions

[119] https://www.unep.org/
[120] https://www.wbif.eu/
[121] https://www.greenclimate.fund/
[122] https://www.thegef.org/projects-operations/database

	United Nations Environment Programme (UNEP)[119]	Western Balkan Investment Framework (WBIF)[120]	Green Climate Fund (GCF)[121]	Global Environment Facility (GEF)[122]
Funding conditions	UNEP focuses on: > Public sector support for green finance (guidelines and case studies, interactive dialogue between the public and private sector) > Financing mechanism (green bonds, green insurance) > Micro-credits for sustainable development (community enterprises, pilot projects)	> Grants (technical assistance or investment grants)	> Grants > Concessional debts > Guarantees > Equities https://www.greenclimate.fund/document/gcf-brief-direct-access	> Grants > Concessional debts > Guarantees > Equities[123]

[123] https://climatefundsupdate.org/the-funds/global-environment-facility-gef/

The UNFCCC has also developed two funds to support the creation of strong, climate-resilient economies and communities by helping countries address a range of obstacles, including limited access to climate-resilient technologies and infrastructure, as well as low engagement of the private sector for developing and providing adaptation solutions:

- The **Special Climate Change Fund (SCCF)**, and
- The **Least Developed Countries Fund (LDCF)**.

The next four-year programming strategies of these two Funds are currently being developed. The focus will be on supporting innovative initiatives that facilitate private sector engagement in climate adaptation, climate risk management and climate-resilient technology and infrastructure.[124] The Funds are also trust funds of the GEF.

It is also important to mention the specialised agency of the UN organisation that promotes industrial development and environmental sustainability – the **United Nations Industrial Development Organization (UNIDO)**. UNIDO's focus is to promote and accelerate inclusive and sustainable industrial development. The programmes provided by UNIDO are primarily based on technical assistance, the transfer of expertise and policy development within specific industrial sectors.

3.3 International financing institutions

This chapter provides an overview of available international funding for the implementation of climate proofing and resilience measures. It also describes the role of development banks in providing funds for climate proofing in developing and emerging countries (e.g., in recent years, development banks have been at the forefront of support for the achievement of a low-carbon economy and the creation of a climate-resilient economy. In addition to providing financial resources for much more favourable terms than the market, development banks also provide technical assistance, grants for special purposes, support in modifying regulations, rules and in implementing reforms. The role of development banks in terms of climate finance is continuously being valorised and improved, and significant progress in the transparency and coordination of major development banks was made in 2011, marking the beginning of the development of joint annual reports on investing in climate proofing and resilience.

International financial institutions (primarily development banks) have proven to be reliable partners in financing climate change mitigation measures and climate change adaptation projects. Financing conditions offered by development banks are, as a rule, more attractive than those offered by commercial banks or other financial institutions. Favourable terms of financing tend to include: interest rates that are below market conditions, grace repayment periods, technical support in preparing and implementing projects and assistance in developing and implementing reforms and regulatory changes. Aside from technical assistance which may be included as a grant component in development banks' funding schemes, financing provided by these institutions often includes an investment grant component.

[124] https://www.thegef.org/what-we-do/topics/special-climate-change-fund-sccf

Developing country needs to finance major infrastructure projects are supported by multilateral and international development banks which serve as a mediator in collecting funds and distributing them to projects in developing countries.

3.3.1 World Bank (WB)

Background and funding sources

The World Bank (WB) serves as a global financing institution that collects funds from multiple sources: fees paid by member states, revenues from own investments and financial markets, contributions from members and revenues from loan repayments.

Sub-loan placement is made to low- and middle-income countries at interest rates lower than those offered by commercial banks (no interest is charged for development projects in the poorest countries). Additional benefits of financing obtained from the WB are longer repayment and grace periods of several years. The WB's presence in the Western Balkans is organised through its divisions forming the WB Group, including:

- International Bank for Reconstruction and Development (IBRD)
- International Development Association (IDA)
- International Finance Corporation (IFC).

WB support for the transportation and infrastructure sector is provided through IBRD and IDA financial products and IFC advisory services and analytics. The IFC has been actively working in the Western Balkans since the 1990s, with a presence in Albania, Bosnia and Herzegovina, Croatia, Kosovo*, North Macedonia, Montenegro and Serbia. The WB has provided over EUR 863 million in support to Western Balkan countries since 2010.[125]

- More information on the general financing services of the WB can be found here: http://www.worldbank.org/en/projects-operations/products-and-services#IPF

IFC advisory services

Among the advisory services offered, the IFC contributes to WB development projects through technical assistance (policy recommendations and implementation, administrative capacity development and overcoming regulatory barriers). The focus of the work is on infrastructure projects, particularly road construction and rehabilitation projects. Over the past 10 years, IFC has supported 23 projects, including: (i) road safety, improving road-sector performance capacity, (ii) assessment of road assets, (iii) transport and information and communications technology (ICT) sector dialogue, (iv) climate resilience in road transport management, (v) rail support for railway modernisation, (vi) transport – cross-cutting initiatives benchmarking corridor performance (Western Balkans), (vii) assessing options for establishing an automated exchange of data at border crossing points in Southeast Europe (Western Balkans), (viii) updating a regional transport study – REBIS (Western Balkans), (ix) green urban transport solutions for sub-national governments and capacity development for public-private partnerships.

[125] An overview of WB support to Western Balkans: https://www.europarl.europa.eu/RegData/etudes/BRIE/2018/628232/EPRS_BRI(2018)628232_EN.pdf

- More information on applying for financing from the IFC can be found here: https://www.ifc.org/wps/wcm/connect/corp_ext_content/ifc_external_corporate_site/solutions/how-to-apply-for-financing

Funding conditions

Funded from WB funds, the IFC cooperates with the private sector, governments and civil society organisations to provide advisory services and investment projects. IFC funding priorities in the Western Balkans include: (i) agribusiness, (ii) infrastructure development with a focus on climate proofing and resilience.[126]

3.3.2 European Bank for Reconstruction and Development (EBRD)

Background and funding sources

The European Bank for Reconstruction and Development (EBRD) is the single most important donor for Western Balkan countries. It is funded from its 60 founding countries' fees, contributions and capital market gains, which enables the EBRD to finance projects in both the private and public sector. EBRD financing is distributed among various sectors, with infrastructure covering 21 per cent of all investments. Aside from infrastructure, the EBRD finances energy projects, financial institutions and other sectors (agriculture, property, manufacturing, tourism).[127] The EBRD is either directly present in the Western Balkans or through financial intermediaries (local banks) and joint investment funds (WBIF).

Together with the EU, KfW and other donors, funds are pooled in the WBIF to finance projects: (i) energy, (ii) environment and social projects, (iii) transport, and (iv) digital transformation. The WBIF provides support in the form of technical assistance and advisory services on grants and project financing options with favourable conditions. Since its founding, the WBIF has provided grants in the amount of EUR 1.4 billion for key infrastructure projects in the Western Balkans.

- A guide to EBRD financing is available here: https://www.ebrd.com/downloads/research/factsheets/guidetofinancing.pdf

Funding conditions

The EBRD has funded numerous road infrastructure projects in the Western Balkans, which have resulted in over 800 km of roads (including local roads, regional roads and highways). The type of the projects supported by the EBRD have targeted:

- Road construction, repairs and upgrades and rehabilitation
- Construction of motorways
- Improving the road network's climate resilience.

[126] IFC official webpage: „IFC factsheet for Western Balkans": https://www.ifc.org/wps/wcm/connect/dbf5ac41-9981-4081-a64a-ab97fb99009e/Western+Balkans+Factsheet+FY15.pdf?MOD=AJPERES&CVID=kB6NKKf
[127] A guide to EBRD financing: https://www.ebrd.com/downloads/research/guides/finance.pdf
** This designation is without prejudice to positions on status, and is in line with UNSCR 1244 and the ICJ Opinion on the Kosovo Declaration of Independence.*

Infrastructure projects financed by the EBRD are generally funded through loans, particularly for projects amounting to EUR 3-250 million, fixed or floating interest rates, and a repayment period of up to 15 years. Grace periods are usually incorporated and can vary depending on the project details. EBRD-funded projects generally include a grant component of up to 20 per cent.

3.3.3 German Development Bank (KfW)

Background and funding sources

The KfW belongs to a German banking group that finances national development projects in Western Balkan countries. It cooperates with governments, public enterprises and commercial banks. The focus of its operations is on climate change mitigation measures, infrastructure development, the use of renewable energy sources and the transportation sector.

Funding conditions

Eligibility for KfW funding depends on the given programme and can vary from the government level to NGOs and the private sector. The programmes the KfW is engaged in are commonly implemented together with EU and EBRD funds, increasing the impact on development projects on the whole.

The regional focus related to transport:

- Early warning and disaster risk reduction
- Resilient infrastructure
- Adaptation to climate change in the transportation sector
- Climate risk insurance and risk financing
- Climate finance.

An access point for applicants is a KfW country or regional programme, while support can be obtained in the form of: (i) grants, (ii) concessional loans, And (iii) equity and guarantees.

3.3.4 European Investment Bank (EIB)

Background and funding sources

The European Investment Bank (EIB) is the EU's investment bank and is owned by the EU Member States. The EIB promotes the EU's objectives by providing long-term project funding, guarantees and advice. It supports projects both within and outside the EU. The EIB is not funded through the budget of the EU, and instead raises money through international capital markets by issuing bonds. The EIB is one of the world's biggest financiers of green finance and is planning to invest EUR 1 trillion in climate-related projects by 2030, including just transitions.

The EIB is committing at least 25 per cent of its investments to climate change mitigation and adaptation.

In the Western Balkans, the EIB offers loans, grants and expertise in four key areas:

- Innovation
- Small businesses
- Infrastructure
- Climate.

In 2021, the EIB invested a total of EUR 853 million across the Western Balkans for sustainable development, the green transition, digitalisation and support for small businesses. Throughout its 40-year presence in the Western Balkans, the EIB has supported the construction of safer roads, creating better regional connectivity, faster trade, economic development and new job opportunities.

- The EIB's funding services as well as further information on how to apply for the funding, see: https://www.eib.org/en/products/lending/loans/index.htm

Funding conditions

There is a substantial need for investment in transport infrastructure in the Western Balkans, and the EIB is using its financing to support the improvement of transport connections in the region. The EIB has provided a significant amount in loans for roads and motorways. To develop a more sustainable and diverse transport system in the region, several new rail operations have been agreed on or are being evaluated.[128]

To expand its local presence and boost financial and technical assistance for countries outside the EU, the EIB Group launched EIB Global with the aim of accelerating project planning and implementation through customised support provided by experts on the ground. The Western Balkans can benefit from EIB Global, which will also be one of the main partners of the European Commission in implementing the Global Gateway Initiative.

To be eligible for EIB funding, the relevant projects must contribute to EU economic policy objectives.[129] The EIB does not provide grants or venture capital.

3.3.5 Council of Europe Development Bank (CEB)

Background and funding sources

The Council of Europe Development Bank (CEB) is a multilateral development bank with an exclusively social mandate. It participates in the financing of social projects, responds to emergency situations and contributes to improving the living conditions of the most disadvantaged population groups. The Bank receives no aid, subsidy or budgetary contribution from Member States to finance its activities. The CEB's resources are therefore raised on international capital markets in the form of borrowings.

The CEB contributes to the implementation of socially-oriented investment projects through three sectoral lines of action, namely:

- Inclusive growth: working to guarantee access to economic opportunities to ensure a prosperous future for all.
- Support for vulnerable groups: helping to integrate the most vulnerable groups to foster a more diverse society.
- Environmental sustainability: supporting a liveable society that promotes environmental sustainability and mitigates and adapts to climate change.

[128] https://www.eib.org/attachments/country/the_eib_in_the_western_balkans_en.pdf
[129] https://www.eib.org/en/projects/cycle/appraisal/project-appraisal-eligibility.htm

The CEB is one of the founding members of the WBIF. The Bank has approved 19 projects supporting the objectives of the WBIF, with a loan value of close to EUR 500 million and a total project value of nearly EUR 1 billion.[130] An additional EUR 52 million in technical assistance and investment grants from the WBIF were blended with these loans.

Funding conditions

The CEB, in its capacity of a WBIF founding member and 2020 co-chair of the WBIF's Project Financiers' Group (PFG), provides support for the Economic and Investment Plan for the Western Balkans and investments in social, sustainable infrastructure and human capital.

Six of the CEB member states are beneficiaries of the WBIF: Albania, Bosnia and Herzegovina, Kosovo*, Montenegro, Serbia and North Macedonia. The CEB supports the countries' strategies and policies to promote European integration and social development.

All CEB loans are provided in accordance with the Bank's mandate. They must meet specific technical and social criteria, and be in strict conformity with the Bank's environmental, procurement and compliance guidelines and policies. Potential borrowers include governments, local/regional authorities, public/private financial institutions or any other public/private legal entity approved by a CEB member state.

3.3.6 European Investment Fund (EIF)

Background and funding sources

The European Investment Fund (EIF) is a risk financer for SMEs across Europe, including the Western Balkans. The EIF is part of the EIB Group, while the EU (represented by the European Commission) and a variety of banks and financial institutions are shareholders. The EIF's two main statutory objectives are:

- Promoting EU objectives, notably in the field of entrepreneurship, growth, innovation, research and development, employment and regional development;
- Generating an appropriate return for shareholders through a commercial pricing policy and a balance of fee and risk-based income.

To achieve these objectives, the EIF invests in venture capital and growth funds that support SMEs through equity-based financing. The EIF cooperates with a wide range of financial intermediaries such as banks, leasing companies, guarantee funds, mutual guarantee institutions, promotional banks or other institutions that provide financing to SMEs or guarantees for SME financing.

Funding conditions

[130] https://coebank.org/fr/news-and-publications/news/ceb-partner-organisations-kick-second-phase-western-balkans-investment-framework/#:~:text=Six%20of%20the%20CEB%20member,countries%20exceeds%20%E2%82%AC%20800%20million.

* *This designation is without prejudice to positions on status, and is in line with UNSCR 1244 and the ICJ Opinion on the Kosovo Declaration of Independence.*

The EIF does not invest in SMEs directly. It invests in fund management companies and offers guarantees and other products to financial intermediaries who extend loans and equity investments to SMEs that meet the eligibility and credit risk requirements.

Under the InvestEU Climate & Infrastructure programme, the EIF makes investments that aim to make a relevant contribution to the EU Green Deal by investing funds in greenfield/brownfield backbone infrastructure and industrial ecosystems in energy, transport, the environment, digital connectivity, space and social infrastructure. The EIF provides equity investments to, or alongside, climate and infrastructure funds, investing in one or more of the six thematic strategies:

- Clean energy transition and climate
- Sustainable transport
- Environment and resources
- Digital connectivity and data infrastructure
- Social infrastructure
- Space infrastructure.

In addition to these thematic strategies, InvestEU also requires the fulfilment of horizontal priorities: female representation and innovation cohesion. The call for expression of interests is open to investment funds, fund-of-funds (in any form), and special purpose vehicles (in any form).

3.3.7 International Finance Corporation (IFC)

Background and funding sources

The IFC is the largest global development institution focused on the private sector in developing and emerging countries. As a member of the WB Group, the IFC offers investment, advisory and asset-management services to encourage private sector development in less developed countries.

It provides an array of debt and equity financing services and helps companies deal with risk exposure while refraining from participating in a management capacity. The Corporation also offers advice to companies on decision-making, evaluating decisions' impact on the environment and society and assuming responsibility. It provides advice to governments on building infrastructure and partnerships to further support private sector development.

The IFC has been active in most of the Western Balkans (Albania, Bosnia and Herzegovina, Croatia, Kosovo*, North Macedonia, Montenegro and Serbia) since the early 1990s. Its priorities in the Western Balkans include:

- Agribusiness
- Infrastructure development with a focus on climate change
- Improvements in the investment climate.

Funding conditions

* *This designation is without prejudice to positions on status, and is in line with UNSCR 1244 and the ICJ Opinion on the Kosovo Declaration of Independence.*

The IFC does not provide direct loans to micro, small and medium enterprises or individual entrepreneurs, but many of the IFC's investment clients are financial intermediaries that give loans to smaller businesses.

To be eligible for IFC funding, a project must meet several criteria. The project must:

- Be located in a developing country that is a member of the IFC
- Operate in the private sector
- Be technically sound
- Have good prospects of being profitable
- Benefit the local economy
- Be environmentally and socially sound, meeting the IFC's environmental and social standards as well as those of the host country.

3.4 EU programmes

EU support to Western Balkan countries is provided through its financial institutions (EIB, EIF) and various programmes implemented in all the Western Balkan countries, and can be divided into two categories:

- Direct support at national level
- EU assistance at multilateral level.

Road infrastructure projects in the Federation of Bosnia and Herzegovina (BiH) have been funded through an EIB loan in the amount of EUR 109 million (Mediterranean Corridor (CVc)) and EUR 34.4 million (Mediterranean Corridor (R2a). EU assistance at the multilateral level is organised through the Instrument for Pre-accession Assistance (IPA) for Western Balkan countries. The IPA has dedicated funds in the amount of up to EUR 9 billion (IPA III 2021–2027), which have been distributed among different programmes:

- Interreg cross-border cooperation programme
- Interreg transnational cooperation programme
- Interreg programme of interregional cooperation
- Interreg-IPA cross-border cooperation programme
- ENPI / ENI cross-border cooperation programme
- IPA-IPA cross-border cooperation programme.

The partner organisations of the IPA programme are the EU, EIB, EBRD, CEB, KfW and WB.[131]

3.4.1 EU assistance at national level

The EU supports countries at the national level in the implementation of projects that contribute to meeting the goals of climate neutrality. One of the available EU programmes targeted at climate change mitigation and adaptation is the **Programme for Environment and Climate Change (LIFE).**[132]

[131] https://wbif.eu/
[132] https://cinea.ec.europa.eu/programmes/life_en

The LIFE programme aims to facilitate the shift towards a sustainable, circular, energy-efficient, renewable energy-based, climate-neutral and resilient economy. The financial envelope of the LIFE programme is implemented through four sub-programmes:

- Nature and biodiversity
- Circular economy and quality of life
- **Climate change mitigation and adaptation**
- Clean energy transition.

Projects that contribute to the implementation of climate mitigation goals can be financed through: (i) the 2030 energy and climate policy, (ii) the EU Member States' National Energy Climate and Action Plans, and (iii) the EU's mid-century and long-term climate and energy strategy. Climate adaptation projects that support the implementation of the new EU adaptation strategy and related national implementation will also be financed.

The **WeBalkans.eu**[133] platform is a one-stop shop for news, stories, funding opportunities and relevant information on cooperation between the EU and Western Balkans. The areas of EU support include:

- **Connectivity (transport, energy, digital)**
- Culture and youth
- Democracy and human rights
- Economy
- **Environment**
- Equality and society
- Innovation and skills
- Regional cooperation.

Between 2015 and 2020, the EU provided EUR 1 billion in grants to transport and energy projects. Ongoing national support and opportunities in the transport sector can be found on this website. The key contacts and partners are:

- European Commission – Directorate General for Mobility and Transport
- Council of Europe Development Bank
- European Bank for Reconstruction and Development
- European Investment Bank
- KfW Development Bank
- Regional Cooperation Council
- Transport Community
- Western Balkans Investment Framework
- Agence Française de Développement
- WB Group (including IFC).

[133] https://webalkans.eu/en/

3.4.2 EU assistance at multilateral level

Cross-Border Cooperation (CBC) is a key element of the EU's policy towards its neighbours. It supports sustainable development along the EU's external borders, helps reduce differences in living standards and addresses common challenges across these borders. CBC promotes cooperation between EU countries and neighbouring countries that share a land border or sea crossing. Funding can also be provided for a programme between several EU and neighbouring countries which, for example, are part of the same sea basin.

CBC is designed on the principles of the EU's territorial cooperation model, but has been adapted to the specificities of EU external cooperation.

CBC has three main objectives:

- Promoting economic and social development in border areas,
- Addressing common challenges (environment, public health, safety and security),
- Establishing better conditions for persons, goods and capital mobility.

Interreg

The European Territorial Cooperation (Interreg) is one of the EU's key instruments to support cooperation across borders through project funding. Its aim is to jointly address common challenges and find shared solutions in fields such as health, the environment, research, education, transport, sustainable energy and more.

Interreg is organised under multiple strands:

- Interreg A – cross-border cooperation between adjacent regions (which should in principle be located along land or sea borders separated by up to 150 km of sea) to address common challenges identified jointly in the border regions and to exploit the untapped growth potential in these areas;
- Interreg B – transnational cooperation over larger transnational territories or around sea basins with a view to achieving a higher degree of territorial integration;
- Interreg C – interregional cooperation through four specific programmes to boost the effectiveness of cohesion policy by promoting:
    - the exchange of experiences, innovative approaches and capacity development with a view to identifying and disseminating good practices and implementing them in regional development policies, including 'investment for jobs and growth goal' programmes (the Interreg Europe programme);
    - the exchange of experiences, innovative approaches and capacity development with a view to identifying, transferring and capitalising on good practices on integrated and sustainable urban development (the Urbact programme);
    - the exchange of experiences, innovative approaches and capacity development with a view to improving and simplifying the implementation of Interreg programmes and cooperation activities, along with the setting up and operation of European groupings of territorial cooperation* (the Interact programme);
    - the analysis of development trends in relation to territorial cohesion goals (the European Spatial Planning Observation Network (ESPON) programme);

- Interreg D – cooperation between the outermost regions to facilitate the development and integration of the outermost regions and Overseas Countries and Territories (OCTs) (for example, the Caribbean region) in their neighbouring environment.

The new cooperation programme for the period 2021–2027 has maintained key features of the previous programme (Figure 3), but includes novelties based on the new regulation, the experiences gleaned from the 258 projects selected for funding in 2014–2020, and a survey from partner states.

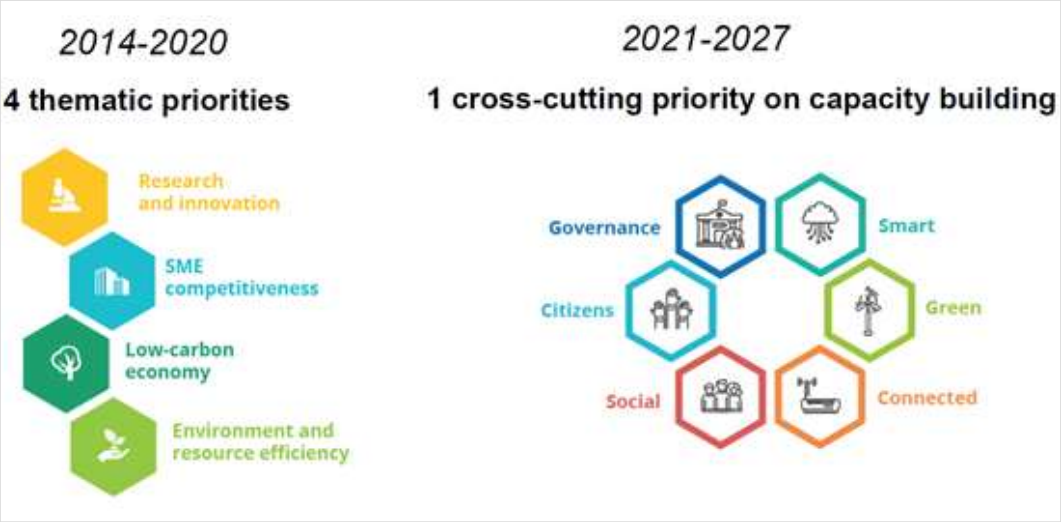


Figure 3: Comparison of Interreg priorities between two periods[134]

The 2021–2027 period has granted nearly EUR 10 billion for Interreg, with reinforced cooperation with partner states for Interreg IPA, Interreg NEXT and the integration of a dedicated strand for cooperation between the EU's outermost regions and neighbouring countries. The total amount is shared between over 100 Interreg programmes across the EU's borders, within and outside the EU, which will contribute to implementing the EU cohesion policy's main priorities:

- A more competitive and smarter Europe (PO1)
- A greener, low-carbon transition towards a net zero carbon economy and resilient Europe (PO2)
- A more connected Europe (PO3)
- A more social and inclusive Europe (PO4)
- A Europe closer to its citizens (PO5).

For the period 2021–2027, Interreg has two new specific objectives:

- Interreg Specific Objective (ISO) 1: Better cooperation governance;
- Interreg Specific Objective (ISO) 2: A safer and more secure Europe.

Resources and co-financing rates

[134] Excerpt from presentation *Public consultation: Interreg Europe 2021-2027*, held on 24 March 2021

Interreg is supported by the European Regional Development Fund (ERDF) and entails projects in which one or more Member States and their regions along with one or more Member States and non-EU countries and their regions cooperate across borders based on the EU's external financing instruments (i.e. IPA III and NDICI).

Over the period covered by the current multiannual financial framework (2021–2027), Interreg will receive an allocation of EUR 8.05 billion (2018 prices) from ERDF resources.[135]

The ERDF's resources for Interreg programmes will be allocated as follows:

- 72.2 per cent (a total of EUR 5,812,790,000 for land and maritime cross-border cooperation (Interreg A));
- 18.2 per cent (a total of EUR 1,466,000,000 for transnational cooperation (Interreg B));
- 6.1 per cent (a total of EUR 490,000,000 for interregional cooperation (Interreg C)); and
- 3.5 per cent (a total of EUR 281,210,000 for cooperation between the outermost regions (Interreg D)).

The co-financing rate at the level of each Interreg programme may not exceed 80 per cent.

Instrument for Pre-Accession Assistance (IPA)

The Instrument for Pre-accession Assistance (IPA) is the means by which the EU has been supporting reforms in the enlargement process with financial and technical assistance since 2007. IPA funds build up the capacities of the beneficiaries throughout the accession process, resulting in progressive, positive developments in the region. The pre-accession funds also help the EU reach its own objectives, including a sustainable economic situation, energy supply, transport, the environment, climate change and stability.

For the period 2007–2013, the IPA had a budget of EUR 11.5 billion. Its successor, IPA II, was allocated EUR 12.8 billion for the period 2014–2020. For the new multiannual financial framework period 2021–2027, the IPA III budgetary envelope amounts to EUR 14.162 billion.[136]

The current beneficiaries are Albania, Bosnia and Herzegovina, Kosovo*, Montenegro, North Macedonia, Serbia and Turkey.

The new instrument IPA III (2021–2027) is aligned with the flagship and priorities of the 'Economic and Investment Plan for the Western Balkans' (October 2020), the Western Balkan Strategy 'A credible enlargement perspective for and enhanced EU engagement with the Western Balkans (February 2018), and the Commission Communication 'Enhancing the accession process – a credible EU perspective for the Western Balkans (February 2020).

IPA III is a solid policy-driven approach, with strategic and dynamic deployment of assistance, placing the fundamental requirements for EU membership at the core of the instrument. By further focusing

[135] https://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=LEGISSUM:4536656
[136] https://ec.europa.eu/neighbourhood-enlargement/enlargement-policy/overview-instrument-pre-accession-assistance_en
* *This designation is without prejudice to positions on status, and is in line with UNSCR 1244 and the ICJ Opinion on the Kosovo Declaration of Independence.*

EU financial assistance on key priorities, IPA III will leverage support for reforms to foster sustainable socio-economic development and bringing the partners closer to the Union's values and standards.

3.4.3 Other EU programmes and projects

Other EU programmes and projects are not directly related to investments in climate-resilient road infrastructure but can indirectly contribute to the development of sustainable road transport. Some of these programmes and projects are:

- Investment in urban mobility transport
- Investment in clean and energy efficient vehicles
- Investment in renewable energy projects.

The most important international organisation operating in the field of mobility and transport is the **Transport Community**[137], consisting of 33 participants – all EU Member States and the six Western Balkan regional partners. The Transport Community is collaborating on the integration of Western Balkan transport markets in the EU by assisting the six Western Balkan partners in adopting and implementing EU legislation in the field of transport and by supporting projects that connect Western Balkan regional partners with each other and with the EU.

However, all the previously mentioned bilateral, multilateral and international donors also finance projects that indirectly contribute to increasing the climate resilience of road infrastructure.

[137] https://www.transport-community.org/

4 Financial sources for climate proofing measures in infrastructure projects (roads) in Western Balkan countries

4.1 The European Green Deal and Green Agenda for the Western Balkans

The European Green Deal delivers a set of proposals to make the EU's climate, energy, transport and taxation policies fit for reducing net GHG emissions by at least 55 per cent by 2030 compared to 1990 levels. As such, the majority of measures focus on climate change mitigation. They do, however, also include proposals that explicitly aim to adapt infrastructure to climate change. They include the building of safer and more sustainable infrastructure and seek innovative solutions to prevent and manage natural disasters.

As part of this effort, the EU has opened up financial sources for climate proofing measures for infrastructure projects in EU Member States. Some of these ''best practices'' include:

- The **Connecting Europe Facility (CEF)** – Transport: one of the instruments (best practice) used to channel resources for climate adaptation and resilience of road infrastructure in EU Member States. It aims both at supporting investments in building new infrastructure or rehabilitating and upgrading existing transport networks. The CEF's website provides an overview of projects funded in the previous period. It includes examples of initiatives that received funding and which targeted network-wide assessments of the TEN-T Core Road Network (for example, in Croatia) with the aim of leading to investment portfolios for upgrades of the network.
- Another interesting EU practice that will be utilised in the context of the Green Deal is the **InvestEU Programme**. By using guarantees from the EU budget to crowd in other private or public investors, it aims to stimulate investment in green infrastructure, amongst others. As such, one of its main targets is sustainable infrastructure, which includes transport, in particular clean and sustainable transport modes, multimodal transport, road safety, renewal and maintenance of rail and road infrastructure.

What the Green Deal is for the EU, the Green Agenda (and its Action Plan) is for the countries of the Western Balkans – a comprehensive strategic roadmap that aims to support the Western Balkan countries build a modern, climate-neutral and resource-efficient economy. The Green Agenda comes with a significant investment package – and also includes significant grant resources. The external instruments under the next EU Multiannual Financial Framework (2021–2027), the Instrument for Pre-Accession Assistance for Rural Development (IPARD) with its 11 measures and IPA III are the key funding instruments to implement the Green Agenda. Existing sources of financial support—for example, through the WBIF—will also be used to channel resources.

The significance of climate resilience of transport infrastructure has been recognised in the Green Agenda and its Action Plan, but none of the Western Balkan countries has thus far prepared or approved a targeted transport sector strategy for adaptation to climate change – let alone for road infrastructure. The Road Action Plan therefore envisages the preparation of a ''climate change assessment with guidelines at the regional level as a mechanism to increase the climate resilience of the transport network in the region.''

4.2 Other (global) financial sources

Many other (global) funds engaged in climate adaptations efforts prioritise countries that are at direct risk and are at a lower level of development, thus limiting the possibilities of Western Balkan countries to access finance. Nonetheless, certain possibilities can be explored further:

- Contact the National Designated Authority (NDA) for the Green Climate Fund in the respective country and explore possibilities (see information in links on developing a Concept Note and the Project Preparation Facility);
- Innovation in climate-proofing concepts for road infrastructure (disaster risk reduction, nature-based solutions, etc.) may provide access to specific grant funding. See, for example, the Innovation Facility of the Adaptation Fund.

4.3 Financial sources for the Western Balkans

All six Western Balkan countries can access funds from the following joint sources:

- IPA III/ multi-country assistance
- EU programmes of territorial cooperation
- TAIEX (Technical Assistance and Information Exchange instrument)
- Local Administration Facility (LAF) is a programme under the TAIEX instrument managed by the Directorate-General Enlargement of the European Commission
- Montenegro, North Macedonia and Serbia, as part of the IPA which supports reforms in countries that are in the process of joining the EU, IPARD focuses on the rural areas and the agri-food sector of those countries.

In the EU's policy context, sustainable financing is understood as finance to support economic growth while reducing pressures on the environment and taking social and governance aspects into account.

Environmental considerations may include climate change mitigation and adaptation, as well as environmental issues more broadly, for instance, the preservation of biodiversity, pollution prevention and the circular economy. Social considerations might refer to issues of inequality, inclusiveness, labour relations, investment in human capital and communities, as well as human rights issues. The governance of public and private institutions—including management structures, employee relations and executive remuneration—plays a fundamental role in ensuring the inclusion of social and environmental considerations in the decision-making process.

Sustainable finance plays a key role in delivering on the policy objectives under the European Green Deal as well as the EU's international commitments on climate and sustainability objectives. It channels private investment in the transition to a climate-neutral, climate-resilient, resource-efficient and fair economy to complement public funds. Sustainable finance will help ensure that investments support a resilient economy and a sustainable recovery from the impacts of the COVID-19 pandemic.

4.4 Western Balkan Investment Fund - WBIF

The current EU framework for the transport sector is the Memorandum of Understanding (MoU) on the Development of the South-east Europe Comprehensive Transport Network. The implementation of the MoU is supported by the South-east Europe Transport Observatory (SEETO).

The SEETO Comprehensive Network is aligned with the EU's TEN-T, and through its regular ministerial meetings and annual updates of the Five Year Multi-Annual Plan. Through this plan, SEETO provides

priority investments as defined by the Western Balkan countries themselves, in particular in road, rail and inland waterways, and supports work on various aspects of transport policy.

Due to its collaborative nature in line with the 'Team Europe' approach, the WBIF is the main vehicle for implementing the EU's ambitious Economic and Investment Plan for the Western Balkans.

All Western Balkan countries have prepared Single Project Pipeline documents (SPPs) which provides details about planned infrastructural projects, which will result in the full implementation of the Green Agenda.

Some of the available publicly announced SPPs include the following infrastructure projects to meet the Green Agenda obligations.

Table 5: Amount of investment in projects in EUR

Country	Sector	Number of projects	Amount of investment in EUR
Kosovo*	Transport sector	11	1,190,400,000
Montenegro	Transport sector	9	2,996,232,000
North Macedonia	Transport sector	54	4,506,373,000
Serbia	Transport sector	27	7,901,200,000

By the end of 2020, bilateral donor contributions through the WBIF amounted to EUR 107.31 million, including EUR 5.17 million transferred from the EBRD Western Balkan Fund at the inception of the WBIF. The largest individual cumulative pledges to date have been made by Norway, Sweden, Austria, Germany, Italy and the UK. Austria is the current WBIF co-chair.

The following projects have been implemented in the transport sector (including roads) in Western Balkans countries:

Table 6: Project implemented in the transport sector in Western Balkans countries

in 000 EUR	Albania		Bosnia and Herzegovina		Kosovo		Montenegro		North Macedonia		Serbia		TOTAL	
	WBIF grants 2009-2020	IPA II bilateral grants 2014-2020	WBIF grants 2009-2020	IPA II bilateral grants 2014-2020	WBIF grants 2009-2020	IPA II bilateral grants 2014-2020	WBIF grants 2009-2020	IPA II bilateral grants 2014-2020	WBIF grants 2009-2020	IPA II bilateral grants 2014-2020	WBIF grants 2009-2020	IPA II bilateral grants 2014-2020	WBIF grants 2009-2020	IPA II bilateral grants 2014-2020
Transport	125,200,00	24,000,00	232,800,00	31,800,00	101,900,00	0,00	110,500,00	13,500,00	139,700,00	107,600,00	154,100,00	56,000,00	864,200,00	232,900,00

According to the Guidelines for WBIF Technical Assistance Grants of July 2017, there are 7 eligible sectors for financing projects under the Green Agenda, including transport (railways, inland

* This designation is without prejudice to positions on status and is in line with UNSCR 1244 and the ICJ Opinion on the Kosovo Declaration of Independence.

waterways, river ports, roads, seaports, airports, border facilities, intermodal terminals and urban transport).

There are specific sectoral considerations when applying for funds from the WBIF. After verifying that the project meets the WBIF's overall objective in terms of supporting priority investments in line with EU accession objectives, the project must also comply with the adopted national strategy for that sector and with the relevant national and regional development plans and strategies (see Chapter 3).

4.4.1 WBIF grant application process:

As a rule, there are two calls (rounds) per year, i.e. grants are approved at the Steering Committee meetings in June and December.

When preparing applications, the applicants must take the project's relevance to the implementation of the following regional and national policies and strategies into consideration:

- Connectivity Agenda, which recognises that well-developed and interconnected infrastructure for transport and energy is a key driver for economic growth and jobs as well as for attracting new investments in the region;
- South East Europe 2020 Strategy;
- EU Strategy for the Danube Region;
- National development plans and country strategy papers;
- Climate change issues were introduced in the WBIF in June 2013, with the aim of assisting in identifying contributions to climate finance (mitigation and adaptation) from each project and to encourage an improved design of infrastructure projects so investments are made more resilient to current and future climate risks.

Assessments of project contributions to climate finance (mitigation and adaptation) are carried out by the Lead IFI in the assessment stage. They are based on the Rio markers' methodology which determines whether climate change is the principal objective of the project, one of the objectives (significant) or whether it is not an objective. Rio markers are used for statistical reporting on the amount of official development assistance dedicated to the themes of the 'Rio Conventions'.

- The Lead IFI may propose a specific percentage of the project budget that contributes to climate change based on its own methodology;
- Tracking climate finance commitments is the responsibility of the financiers, not of the beneficiary;
- The grant application must provide information on specific issues such as the project's potential contribution to GHG emission reduction, any assessment of climate risks, and measures to improve the project's climate resilience;
- The requirements in terms of the information provided and the level of detail for infrastructure, specifically roads, include a pre-feasibility and feasibility study, detailed design and procurement procedures, the construction and supervision of works;
- Project applicants must provide information related to climate change mitigation/adaptation in the grant application, such as:
    - Is the project's lifetime 20 years or more? (Climate change impacts will be increasingly felt over this timeline)
    - Does the project target areas most affected by climate change?

- Do the project's components depend on other supplies or services that are sensitive to climate conditions or weather events?
- Are the transport routes related to the project vulnerable to weather disruptions (e.g. by storms, floods, landslides, etc.)?
- Are the project facilities or operations negatively affected by higher temperatures? Can this lead to reduced productivity, higher costs or equipment failure?

Project activities that gather information on and increase the understanding of mitigation and adaptation measures qualify, even when they do not directly achieve mitigation or adaptation. Some of the examples of qualifying and non-qualifying mitigation and adaptation components in the transportation sector are as follows:

Table 7: Examples of qualifying and non-qualifying mitigation and adaptation elements[138]

Mitigation		
Component	**Non-qualifying component**	**Qualifying cost**
Improvements in traffic flow to reduce GHG emissions per unit transported (e.g. toll roads)	Road repair projects. Improvements in traffic flow in one area that could lead to increased congestion in another. Improvements in traffic flow where clear evidence of GHG savings cannot be provided	Cost of technology and infrastructure relating to traffic flow improvements
Traffic management to reduce GHG emissions per unit transported (e.g. speed limits, high occupancy vehicles, cars to buses)	Changes that lead to adverse consequences elsewhere that are not quantified. Changes in traffic management where clear evidence of GHG savings cannot be provided	Cost of planning, awareness raising initiatives, subsidies and incentives for road users and monitoring/ enforcing (but not the costs borne by road users)
Shift to lower-carbon modes of road and highway transport including research and development	Changes that lead to adverse consequences elsewhere that are not quantified. Shifts where clear evidence of GHG savings cannot be provided	Cost of making the shift, including research, planning and/ or construction of low carbon alternatives
High-efficiency, heavy-duty or light-duty vehicles retrofit (including the use of lower-carbon fuels, electric or hydrogen technologies, etc.).	Use of vehicles that are better than the existing ones, but that perform worse than standard practice benchmarks. Use of biofuels where emission reduction claims are made for the same emission reductions	Cost (to the project) of qualifying vehicles and fuel
Road freight logistics projects that streamline logistics and reduce empty running	Logistics projects that do not reduce fuel consumption	Cost of projects
Information campaigns and training to influence driver behaviour	Road safety campaigns or other campaigns that do not aim to reduce fuel consumption	Cost of campaigns
Shift from high-carbon to lower-carbon transport	Shifts where clear evidence of GHG savings cannot be provided	Cost of making the shift, including research, planning

[138] https://www.afdb.org/fileadmin/uploads/afdb/Documents/Policy-Documents/Climate_Finance_Tracking_Guidance_Manual_-_Transport_Sector.pdf

modes, such as from airplanes to trains, from cars to busses, from busses to trains and from trains to bicycles and walking		and/ or construction of low-carbon alternatives
Improve traffic flow to reduce carbon emissions per unit transported	Road repair projects. Improvements in traffic flow in one area that could lead to increased congestion in another. Improvements in traffic flow where clear evidence of GHG savings cannot be provided	Cost of technology and infrastructure relating to traffic flow improvements
Substitution of high-carbon by lower-carbon or non-fossil fuels, thereby reducing carbon intensity per kilometre travelled	Use of biofuels where emission reduction claims are made for same emission reductions. Use of non-fossil fuels where whole of life production- and combustion-related GHG emissions exceed whole of life production- and combustion-related GHG emissions for fossil fuels	Cost (to the project) of qualifying vehicles and fuel
Integration of transport and urban development planning (dense development, multiple land-use, walking communities, transit connectivity, etc.), leading to a reduction in the use of passenger cars	Integration where clear evidence of GHG savings cannot be provided	Costs of integration
Adaptation		
Component	**Non-qualifying component**	**Qualifying cost**
The development of flood-related contingency plans for road or rail traffic management	Normal traffic planning activities Contingency planning for non-climate-related scenarios Measures to improve traffic flows	Cost of flood-related contingency planning
Improvement in frequency of drain and culvert maintenance	Normal maintenance measures Reinstatement of normal maintenance measures after a period of neglect	Cost of maintenance measures that provide necessary climate resilience (normal plus additional)
Change in culvert and roadside drainage system design specifications	Roadside and rail drainage systems that have not been designed to cope with an increase in intensity or period of rainfall	Entire cost of climate-resilient works
Fortification of existing bridge supports	Bridge rehabilitation projects that do not involve the use of additional fortification for roads and railways	Cost of bridges that are strengthened to specifications that go beyond standard practice
Fortification of existing valley or coastal roads or railways (e.g. use of gabions, concrete walls)	Repair and rehabilitation projects that replace 'like with like'	Cost of sections of road/ railway that are strengthened to specifications that go beyond standard practice

Changes to road and railway design to increase stability and resilience to erosion (e.g. changing the composition of base materials, reduction in cut and fill slope angles, use of stabilisation)	Designs that have not been modified to take account of future rainfall conditions or river flows	Cost of sections of road/ railway that are strengthened to specifications that go beyond standard practice

- The proposals are submitted to the PFG
- All applications for grants must be submitted online through the Management Information System (MIS).
- The National IPA Coordinator (NIPAC) must be included in the application process.
- The grant requests presented by the beneficiaries are analysed under the lead of the Commission (DG NEAR) with the aim of drawing up a list of eligible projects ready for assessment.
- The screening results/ conclusions are considered in the Paris Group (PG) meeting, an informal meeting of the European Commission, CEB, EBRD, EIB, KfW and WBG, with the possible participation of bilateral donors, and the grants that have had a positive screening are selected for further consideration (assessment).
- Eligible grant requests are assessed online through MIS under the lead of the Lead IFI, against technical quality, compliance with environmental and social standards, including the promotion of gender equality and additionality of the grant, financial and economic sustainability, credit risks and legal aspects.
- The PFG considers the screening and assessment conclusions and recommends a list of projects to the Steering Committee for approval, which are eligible under the WBIF.
- Approval: grants recommended for approval by the PFG are submitted to the Steering Committee and are presented by applicants and participating financial institutions at the Steering Committee meeting.

Eligibility Criteria for the Sustainable Transport Sector ⇐ Transport projects shall relate to one of the three transport flagships (Connecting East to West, Connecting North to South, Connecting the Coastal Regions) suggested in the Annex of the Economic and Investment Plan and/or be located on the indicative extension of the TEN-T core network to the Western Balkans. Projects that match both criteria are prioritised.

For roads: the integration of sustainable and smart elements in road transport, such as multimodal transport nodes, electric charging stations or an ITS will be promoted.

For infrastructure projects, the feasibility study and preliminary design costs are usually about 1–2 per cent of the total investment (project) costs (i.e. works, supplies and contingencies), while the detailed design cost (with final cost estimates and tender documents) is typically around 4–5 per cent of the total estimated project costs. The TA for construction supervision normally adds another 4–5 per cent to the total estimated investment. For complex projects, the cost of an initial concept study must also be added. The total costs for preparatory and implementation activities of infrastructure projects may thus represent a significant share of the total project costs.

5 Case studies

This chapter presents case studies in the field of climate finance in the Western Balkans and the EU.

5.1 Western Balkans

Climate-resilient Road assets in Albania

Name of the project/ programme	Climate-resilient Road assets in Albania
Implementation area	Albania
Financing instruments/ sources	World Bank Financed through a grant provided by the Global Facility for Disaster Reduction and Recovery (GFDRR)
About the project/ programme	The main project objective was to inform the prioritisation of future climate- and seismic-resilient investments in primary road assets. The project included risk analyses by hazard (seismic, landslide, coastal flooding, pluvial flooding), loss analyses by hazard (road, road users and total losses), criticality analyses (taking into account international connections, industry, harbour, tourism, evacuation), and exposure and hazard maps as a final result.  a) Pluvial flooding hazard map  b) Landslide vulnerability map  c) Annual damages to road (repair costs) Risk assessments for floods, landslides and earthquakes were analysed, including annual expected damages by hazard and corridor. Subsequently, the highest and lowest critical corridors were determined. Part 2 of the project entailed mitigation measures and a CBA analysis focused on locations with the highest risk profile and provided suggestions on how to decrease the risk. It provided: • An overview of potential solutions • Selection of solutions based on a cost/ benefit ratio • Determined adaptive strategies.
Benefits	> Effective, site-specific mitigation measures were determined > Economically viable measures were defined > The significance of adequate maintenance of culverts for the performance of the road network was emphasised > Project results were used to improve the Road Asset Management System (RAMS)

Orient/East-Med Corridor: Kosovo*-Serbia R7 Road Interconnection, Pristina-Medare Section[139]

Name of the project/ programme	Kosovo*-Serbia R7 Road Interconnection, Pristina-Medare Section
Implementation area	Kosovo* and Serbia
Financing instruments/ sources	EIB, EBRD, WBIF
About the project/ programme	Although this project was not directly aimed at increasing climate adaptation, through the reduction of CO_2 emissions, it can indirectly be considered as contributing to an increase in the climate resilience of road infrastructure. The Orient/East-Med Corridor in Kosovo includes the Pristina to Merdare E80/R7 road section, which continues into Serbia and further to Albania. This road interconnection is of major importance for freight and passenger transport in the Western Balkans. The existing route is a two-lane road, is inconsistently maintained and prone to bottlenecks.  The EU, through the WBIF, has been instrumental in identifying investment needs as well as financing the preparation of the technical documentation for the expansion of the existing infrastructure into a 23 km-long dual carriageway from Pristina to the border crossing point in Merdare.
Benefits	> 3 km-long dual carriageway from Pristina to Merdare > Substantial decrease in travel time along the Pristina – Merdare route > Reduction in accident rate, road infrastructure maintenance costs and vehicle operating costs > Improved economic opportunities for residents that work and live along the new route > More efficient, multimodal transport route along the Orient/East-Med Corridor (Route 7) by eliminating bottlenecks and congestion, while ensuring connection with Adriatic Sea ports.

5.2 European Union

Name of the project/ programme	Adaptation of road infrastructure to climate change (AdSVIS)
Implementation area	Germany
Financing instruments/ sources	National funding Federal Ministry of Transport and Digital Infrastructure, Germany

[139] https://www.wbif.eu/project/PRJ-KOS-TRA-002

** This designation is without prejudice to positions on status, and is in line with UNSCR 1244 and the ICJ Opinion on the Kosovo Declaration of Independence.*

About the project/ programme	Lead partner: BASt: Federal Highway Research Institute, Germany Objective: the German highway network covers about 12,900 km of motorways and approximately 39,600 km of national roads (together approximately 53,000 km), around 39,000 bridges and over 240 tunnels. They provided a total asset of around EUR 360 billion. As roads have an expected functional life period of around 30 to 50 years and bridges and tunnels of around 80 to 100 years, the regulations for road and bridge constructions must be adjusted to take the consequences of projected climate change into account. Consequently, the research programme AdSVIS was initiated.[140] Researchers have combined the knowledge of the authorities involved (DWD, BSH, BfG, BAW, DZFS/EBA, BAG and BASt), merging information on climate development with knowledge on three transport modes: roads, railways and waterways. A strategy was developed by the Federal Highway Research Institute (Bundesanstalt für Straßenwesen) to adapt roads and engineering structures to the impacts of climate change. The strategy "Anpassung der Straßenverkehrsinfrastruktur an den Klimawandel/Adaptation of road traffic infrastructure to climate change (AdSVIS)" currently comprises around 15 projects. Adaptation measures will be developed for the identified risk areas and their effectiveness will have to consequently be assessed.
Benefits	• For the first time, the potential impacts of climate change were determined in a cross-modal approach for rail, roads and waterways by applying uniform concepts, methods and data. • Future projections show increasing impairments caused by floods, landslides and low water levels. • German-wide index maps were prepared illustrating the outcomes of high and low water levels, gravitational mass movements and storms, which can be used for climate impact analyses. • Availability restrictions of the transport infrastructure resulting from climate change and associated extreme weather events were investigated in a model case study focusing on a section of the crucial European "Rhine-Alpine" transport corridor. • Adaptation options were conceptually prepared for the transport sector and specific adaptation measures identified and assessed. • The planning and implementation of adaptation measures is a lengthy process and many infrastructures are planned and constructed for a long service life.

Name of the project/ program	Pluvial floods in the Netherlands
Implementation area	Germany
Financing instruments/ sources	National funding Federal Ministry of Transport and Digital Infrastructure, Germany
About the project/ program	Since current knowledge on urban pluvial flood impacts is limited, this study aimed to explore pluvial flood impacts in Dutch urban areas by analysing actors' interests and relevant additional data. The knowledge produced by this study provides inputs for the setup of a model (quantitative or qualitative) to estimate the impacts of pluvial flooding in a certain area.

[140] https://www.umweltbundesamt.de/en/topics/climate-energy/climate-change-adaptation/adaptation-tools/project-catalog/adsvis-adaptation-of-the-road-infrastructure-to

	This model aims to provide decision-makers with information about flood impacts, so they can properly weigh decisions on adequate measures to prevent or mitigate flood impacts. Selected measures • Additional maintenance of roadsides (after monitoring) • Additional maintenance of drainage systems • Additional maintenance of pavements • Construct piped drainage systems (where missing) • Improvement of existing drainage systems (where present) There is a clear economic rationale for increasing the climate resilience of The Netherland's road network • Monitoring and improved maintenance is a no-regret measure for the entire network <u>Financing of interventions for roads in The Netherlands</u> National highways • Financing through the road authority's (RWS) regular budget − Regular maintenance − Reinvestment • Financing through the national infrastructure investment fund (MIRT) for expansion and new roads • National government budget (general taxes, including excise on fuel) Provincial roads • Financing from the provincial road budget • Budget from road taxes (based on vehicle weight and fuel type) Municipal roads • Financing from the municipal budget • National government budget (general taxes) and local taxes Researchers have combined the knowledge of the authorities involved (DWD, BSH, BfG, BAW, DZFS/EBA, BAG and BASt), merging information on climate development with knowledge on three transport modes: roads, railways and waterways. A strategy was developed by the Federal Highway Research Institute (Bundesanstalt für Straßenwesen) to adapt roads and engineering structures to the impacts of climate change. The strategy "Anpassung der Straßenverkehrsinfrastruktur an den Klimawandel/Adaptation of road traffic infrastructure to climate change (AdSVIS)" currently comprises around 15 projects. Adaptation measures will be developed for the identified risk areas and their effectiveness must consequently be assessed.

6 Key issues and challenges

The Western Balkans face enormous challenges in terms of understanding the risks climate change poses. Environmental and climate change management in the Western Balkans is hampered by institutional, political and legal frameworks that have not been optimised. The complex political structure is also the reason for the lower number of national funds and programmes focused on climate proofing projects. However, the process of harmonisation with EU standards is leading to environmental reforms, and the EU's pre-accession period has created opportunities for the Western Balkan countries to systematically start adapting their laws and accessing additional resources and technical assistance.

Membership in the Energy Community largely drives energy and climate policy in all Western Balkan countries. While sustainable energy issues will be a priority over time, energy and other natural resources are currently being used inefficiently in both the public and the private sector, and significant investments in energy efficiency and climate change adaptation are necessary. A climate proof path ensures that the Western Balkans will avoid the mistakes of the past and seize the opportunity to leapfrog to a better growth trajectory that can deliver on both development and climate goals. This will, however, require investments in climate proofing measures. Non-investment will cost even more in the long term.

Reforms in the countries of the Western Balkans are only progressing slowly, especially as regards purposeful spending of funds. Collected tolls and fuel taxes are not fully spent on highway construction. Also, the inclusion of funding for climate change recovery in the maintenance phase is often not planned at the level of annual activities of road infrastructure management companies.

An underdeveloped operating environment represents a key challenge for obtaining funds from bilateral, multilateral and international financial institutions. Some problems common to all Western Balkan countries are: underdeveloped institutions, low civil service capacities and a weak judiciary. Since the costs of fighting climate change in developing countries could reach hundreds of billions of USD annually in coming years, there is no doubt that appropriate reforms are needed to reduce administrative barriers for obtaining international funding.

In the transport sector, EU financial institutions want to fund projects that promote sustainable transport. These institutions have their own environmental requirements, including climate and climate change, which must be met for the project to be successfully funded. Infrastructure and public transport should be accessible, efficient, environmentally friendly and safe.

Non-EU financial institutions very often do not have established systems of measures and controls for environmental and climate risks, and thus no relevant credit policies. This may pose a risk because mainstreaming adaptation in the transport sector should take place at the national, sector and project (donor) levels.

Concerns about the influence of external actors in the Western Balkans from Russia, Turkey and China, for example, and the potential of these countries to seriously compete with the EU for influence has intensified in recent years. For instance, one non-EU player has become particularly active in the region's infrastructure development: China has initiated infrastructure projects of about EUR 7.8 billion in the Western Balkans. Most likely, not all of these projects will actually be implemented and they do not involved any grants, but only loans.[141]

[141] https://www.eib.org/attachments/efs/infrastructure_investment_in_the_western_balkans_en.pdf

A rise in climate finance from international funding sources is expected in the medium term. However, such funding remains under threat, not only because the entire world is facing a difficult situation, but also because the internal complexity of the countries' political structure and the poor investment climate are the main obstacles to investment.

Greenfield projects are not a challenge in terms of financing: climate proofing only constitutes a low percentage of total project costs and can be financed along with the entire project.

Brownfield projects may be a different story, as these are relatively small and dispersed investments typically not included in large greenfield projects.

If there is a financing gap for such brownfield climate proofing projects, project development is necessary and a dedicated facility might make sense.

Therefore, the key recommendations for the Western Balkans to increase climate resilience and proofing are:

	Full harmonisation of national legislation in the field of the environment and climate change with EU legislation
	Reduction of administrative barriers for the withdrawal of funds from international financial sources
	Development of own (national) strategies, guidelines and criteria for financing climate-resilient infrastructure
	Inclusion of funding for climate change recovery and proofing in the annual plan of road maintenance companies
	Purposeful spending of funds from collected tolls and excises on fuel
	Establishment of a **Regional Fundraising Mechanism in the Western Balkans**
	Continuous increase in the capacity of government institutions and the private sector on available funds for financing climate projects.

7 Paving the way to the establishment of a fundraising mechanism in the Western Balkans

This chapter provides an overview of the possibilities and recommendations for the potential establishment of a fundraising mechanism to finance climate resilience projects for road infrastructure in the Western Balkans.

The first section of this chapter presents an analysis of the financing needs for climate resilience projects in road infrastructure. The goal of this discussion is to clarify the required investment amount and how this relates to potential financing options. The second section of this chapter presents an overview of the advantages and disadvantages of setting up a separate fundraising/financing mechanism. The main question is to what extent a separate financing mechanism would make sense and is feasible. This chapter concludes with a section presenting a number of recommendations and potential measures for the way forward.

7.1 Understanding the financing needs for climate resilience projects in road infrastructure

Given the population size and the respective European average, infrastructure financing gaps exist for motorways in all Western Balkan countries (see, for example, data presented in the 2018 EIB report 'Infrastructure Investment in the Western Balkans'). Existing financing mechanisms—most importantly, the WBIF—respond to this need for financing for road infrastructure and prioritise sustainable transport investments.

It is important for financiers to understand the cost of a potential investment: what are the financing needs in terms of project scope, ticket size, etc.? This aspect raises an important question: is there also a specific financing gap for the climate proofing component of road infrastructure? To gain a better understanding, we need to look at the difference between greenfield and brownfield projects:

Table 8: Difference between greenfield and brownfield projects

Greenfield road infrastructure projects	Brownfield road infrastructure projects
• New construction or major upgrade/rehabilitation of road infrastructure	• Adaptation of existing road infrastructure
• Usually, a greenfield project is part of a larger (government-led) investment planning process	• Brownfield projects are often outside of typical investment cycles in road infrastructure
• Typically, they include large ticket sizes for projects	• Often, these include smaller ticket sizes for projects

Overall, greenfield projects (including major upgrades/ re-investments) do not pose such a major challenge in terms of accessing financing for climate proofing of road infrastructure because it only represents a small percentage of the total project costs and is financed along with the entire project.

Brownfield projects may be a different story, as they are relatively small and dispersed investments that are typically not included in large greenfield projects. These brownfield projects are likely to be carried out in the context of the ClimaProof programme and those that require additional efforts to attract finance. If there is indeed a clear financing gap for brownfield climate proofing projects, project development is necessary and a dedicated facility might make sense.

7.2 The advantages and disadvantages of setting up a separate financing mechanism

Designing and establishing a fund or facility is a way to ensure funds are allocated and used in line with certain targets, for example, climate adaptation. There is a range of options, depending on type of capital (debt/ equity/ guarantees), return requirements (market-based, concessional, grants) and ownership and decision-making frameworks (private or public capital and managed).

Criteria that guide the applicability of a certain fund or facility structure include, for example:

- Existence of other instruments offering financing
- Resources needed and available for setting up a mechanism.

Table 6 provides an overview of the advantages and disadvantages of setting up a separate financing mechanism.

Table 9: Overview of advantages and disadvantages of a separate financing mechanism

Advantages	Disadvantages
• Allows for a specialised mechanism that centralises expertise on financing aspects underlying climate-proofing of road infrastructure	• Limited additionality compared to existing facilities in the Western Balkans
• Provides a dedicated access point and incentive for developers (and governments) to include climate proofing in their infrastructure projects	• Requires additional resources and new and/ or a change in governance structure (including obtaining the political mandate)
• Can facilitate dedication of specific TA and grant resources to climate-proofing interventions	• Limited scope in the short run for private sector investments in climate-proofing of road infrastructure (and thus for potential participation/ contribution in a separate mechanism)
	• Limited use of economies of scale

The overview presented above leads us to conclude that setting up a separate financing mechanism might not be opportune in the context of the resources and efforts required. Are there any alternative of separate funding/ financing mechanisms?

The climate proof components of greenfield projects are likely to be covered by existing project and climate resilience requirements of financing institutions such as the WBIF/ EBRD/ EIB. The main challenge are interventions for existing brownfield infrastructure that are needed outside of standard

(green field) investment projects. An option would be to clearly map these brownfield road infrastructure climate adaptation interventions for the six Western Balkan countries, group them into a pool of projects to achieve a sufficient size for investment support, and create an additional regional add-on facility under the WBIF or a similar financier. This facility would, for example, allow specific access to dedicated technical assistance resources that are targeted at project preparation and development of climate adaptation projects.

Private sector participation in any financing mechanism should be considered, but is unlikely to be realistic in the short term. As already discussed, private sector investment in road infrastructure in the 6 non-EU Western Balkan countries has been very limited over the last decade. Countries such as Croatia offer potential examples with public-private partnerships in the development of road infrastructure (toll roads), but these will have limited applicability to climate adaptation interventions for roads.

There are additional ways to explore how the private sector can be involved in utilising existing or designing new funding mechanisms for climate proofing, for example:

- Through the integration of climate-proofing of road infrastructure with real estate or wider area development – such as national parks, tourist sights or other avenues;
- By exploiting links between climate-proofing of road infrastructure and other (private sector-led) infrastructure development – e.g. for small-scale energy producers.

7.3 Conclusions and potential way forward

One of the key questions of the review concerned the following: will the establishment of a separate financing mechanism for ClimaProof investments increase the likelihood of access to additional resources?

Financing for climate adaptation components of greenfield projects is likely to be covered by existing standards for new investments by financiers (such as the EBRD, EIB, etc.). Climate adaptation for the infrastructure of brownfield projects might require additional financing efforts/ resources and may justify the establishment of a facility. Establishing a new and separate financing mechanism would, however, offer limited additionality compared to existing facilities in the Western Balkans and requires additional resources and new and/or a change in governance structures (including obtaining a political mandate).

What then are the options going forward? Considering the above, three short-term measures seem feasible for exploring the design of a potential financing mechanism for climate proofing of road infrastructure in the Western Balkans. They are:

1. Address the capacity gap – strengthen the project development capacity in the region through dedicated TA to develop a project pipeline and attract potential financiers;

2. Consider the option of pooling the investments needed for different ClimaProof interventions in the six Western Balkan countries to ensure sufficient scale for potential financiers;
3. Explore the creation of an add-on facility within the WBIF (or other potential financiers such as GCF) for climate proofing of existing road infrastructure – which would provide access to (concessional) finance and technical assistance programmes for packages of projects in the Western Balkan region. With financing from the host fund, the add-on facility could take the form of dedicated project development and preparation facility, preparing projects for investment by existing financing windows (for example, WBIF or GCF).