



Climate change adaptation of major infrastructure projects

Country report for Romania

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Note for the readers of the printed version: the present country report links to a large number of resources via hyperlinks, which by nature are only active in the electronic version. In order to find the identified resources, an online search will usually deliver the right result; but otherwise it is also possible to make use of Annex II of the main report where all the identified resources and their hyperlinks are presented.

Disclaimer: The identified resources are non-exhaustive and present a snapshot of the readily available and accessible material during 2017. This information was collected through finite web-based desk research, and through questionnaires and interviews aimed at the relevant national competent authorities (ESIF managing authorities, research institutes, ministry officials, etc.). Further resources might be available but not accessible due to privacy restrictions, or a lack of mandate to share related material. Following the publication of the present report, more resources will continue to reach the public domain, including through Climate-ADAPT and the identified national websites.

1. INTRODUCTION

The [EU Strategy on Adaptation to Climate Change](#) of 2013 includes actions to enhance the resilience of infrastructure and mainstream climate adaptation into the European regional and cohesion policy. The [Common Provisions Regulation](#) (CPR) of 2013 states under article 8 that climate change mitigation and adaptation, and risk prevention shall be taken into consideration for investments made with the support of the European Structural and Investment Funds (ESI Funds). The regulation integrates climate change adaptation considerations into the preparation and approval of major projects¹ or other projects funded by the ESI Funds through the requirement to conduct climate change vulnerability and risk assessments. In coordination with the ESI Funds, and complimentary to them, the LIFE fund in addition assists in the realisation of the climate change adaptation objectives. Climate change analyses (such as vulnerability and risk assessments) are also sporadically found to be undertaken for infrastructure projects that are financed outside the framework of EU funds.

This report for Romania focuses on the adaptation to climate change of infrastructure projects supporting the requirement to undertake climate change vulnerability and risk assessments by presenting:

- **Legal, policy and institutional framework:** A schematic outline of national and regional policy and legal framework, and organizational structure to deal with adaptation;
- **Resources:** Offering the most important resources supporting the realization of climate change vulnerability and risk assessments for infrastructure projects. The available resources for data, methodologies, tools, guidance, design standards, system framework and institutional capacity are contextualized and listed in this section.
- **Sector overview:** Identifying the approach, main strengths and weaknesses for each of these sectors: Transport, Broadband, Urban development, Energy, Water and Waste;
- **Case studies:** Good practice in adaptation and resilience of infrastructure projects.

Country Overview

The [National Strategy on Climate Change \(2013-2020\)](#) (NAS), deals with mitigation (first part) and adaptation (second part). The implementation of the NAS is done through a 2-year [National Action Plan](#) (NAP). A [National Risk Assessment](#), was conducted in 2016, presenting key actions undertaken to develop a robust risk assessment process for climate change adaptation. [The Ministry of Environment, Water and Forestry](#) and the [National Agencies for Environmental Protection](#) are primarily responsible for the implementation of climate change adaptation agendas. The [National Administration for Meteorology](#) advises the Ministry of Environment, Water and Forestry during policy implementation and on legislation formulation.

Significant data is available through the [National Administration Romanian Waters](#) (NARW) and the [National Institute for Hydrology and Water Management](#) (NIHWM). The monitoring of climate-related parameters is executed by NARW and the [National Administration for Meteorology](#) (NAM). In the framework of the Opera-Clima project, the Ministry of the Environment, with the support of the World Bank, developed several [sectoral vulnerability assessments](#) to develop [Action Plan on Climate Change for 2016-](#)

¹ major project: an operation comprising a series of works, activities or services intended in itself to accomplish an indivisible task of a precise economic or technical nature which has clearly identified goals and for which the total eligible cost exceeds EUR 50 000 000 and in the case of operations contributing to the thematic objective under point (7) of the first paragraph of Article 9 of Regulation 1303/2013 where the total eligible cost exceeds EUR 75 000 000

2020. On the availability of guidance, the Ministry of the Environment and Sustainable Development published a [Guide on adaptation to climate change effects](#), which aims to facilitate the identification of adaptation measures and support decision making on climate change policy. The [National Administration for Meteorology](#) published the report [Climate change - from physical bases to risks and adaptation](#) (2015), with the objective to increase Romania's capacity to adapt to the impacts of climate change. Through the Opera-Clima project, the Ministry of the Environment, with the support of the World Bank has developed a [guidance document](#) to support the inclusion of the climate change impact in projects funded through ESI Funds. A series of projects has been planned for 2014 – 2020 under the programme '[2014 - 2020 INTERREG V-A Romania – Bulgaria](#),' which seeks to provide guidance and increase awareness on climate change adaptation throughout the country. Romania is collaborating with Bulgaria to develop local awareness regarding [Risk Management for Large Scale Infrastructures](#) in their cross-border area, which includes, amongst others, risk linked with climate change impact. The municipalities of Gradinari, Malu and Byala are collaborating across the border to develop a joint risk prevention and management system to address the effects of the climate change upon their environment. Design standards are implemented in legislation by the Government based on recommendations from organisations such as the [National Administration for Meteorology](#). This also includes good practice from other countries. Romania uses both Euro-codes and Romanian standards for infrastructure construction. Romanian design standards are based on [meteorological and seismic maps](#), since Romania is situated within an earthquake zone. EU resources are in use, such as the [Guide to Cost-Benefit Analysis of Investment Projects](#), the publication on [Climate Change and Major Projects](#) and the non-paper [Guidelines for Project Managers](#).

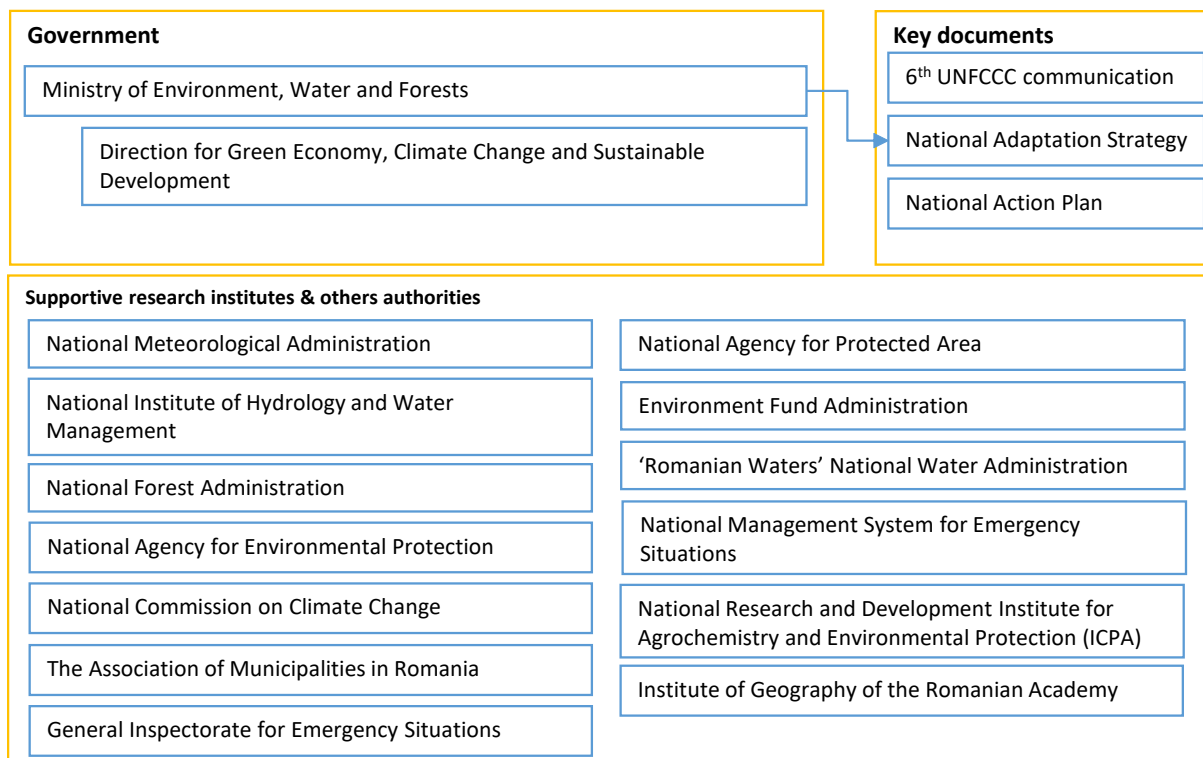
There are some ongoing adaptation efforts for infrastructure, but mainly in the water sector. Under the operational programme for Large Infrastructure Programme a number of major projects are planned in the transport for the programming period 2014 – 2020. One example is the highly anticipated [Sebes - Turda Highway](#), which includes hydraulic works, and the installation of drainage systems and culverts for channelling water underneath the road, designed for climate adaptation. In the framework of the Opera-Clima project, the Ministry of the Environment, with the support of the World Bank, developed several sectorial vulnerability assessments, including the [urban sector](#). For the energy sector, Romania's Sixth National Communication to the UN Framework Convention on Climate Change ([UNFCCC](#)) provides a national assessment of climate risk and vulnerability. The World Bank has published an [energy sector rapid assessment](#), modelling climate change impacts on hydropower under different scenarios. In the water sector, the publication on [Romania: Toward Low Carbon and Climate Resilient Economy](#) used adaptation models to assess the effectiveness of the proposed green policies and infrastructure investments in the sector. The [National Administration for Meteorology](#) also provides both [Guidance](#) for the preparation of drought management, and an [Action Plan](#) for Water Scarcity and Drought Prevention. The broadband and waste sectors are not involved in the national or regional authority climate change adaptation plans or initiatives organised by governmental bodies.

Case studies identified in Romania with application of the climate change adaptation include a [railway project](#), the Construction of [Sebes - Turda Motorway](#), and the weather-management tool [CLIMHYDEX](#) ("Changes in climate extremes and associated impact in hydrological events in Romania").

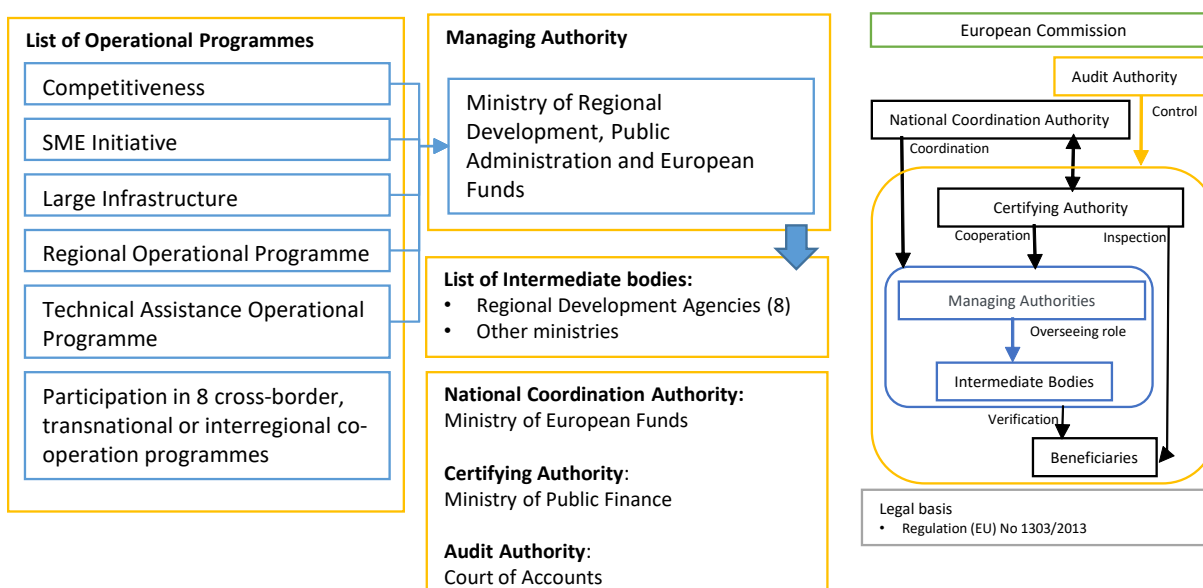
2. LEGAL, POLICY AND INSTITUTIONAL FRAMEWORK

The [Ministry of Environment, Water and Forests](#) is responsible for coordinating environmental policy, including Environmental planning, assessment, advising and policy making; representing Romania in European and international forums on environmental issues; managing funds meant for environmental programs and projects under its authority, other than those financed under ESIF funds; overseeing the integration of

environmental requirements in sectoral strategies; assisting other ministries and authorities in sectoral policies elaboration in order to tackle climate change risks; and raising public awareness, strengthening cooperation with environmental non-governmental associations.



Romania benefits of ERDF and CF allocations, which are managed through Operational Programmes the Ministry of Regional Development, Public Administration and European Funds. Major infrastructure investments are primarily made through the "Large Infrastructure" OP. Transport and environment projects are funded from the Cohesion Fund (CF).



3. RESOURCES

This country report has reviewed the currently available resources in Romania for adapting to the impacts of climate change across six key infrastructure sectors. Adaptation to climate change is integrated in the legal basis² for ESIF-funded projects, through the processes of vulnerability and risk assessments which are, broadly:

1. Vulnerability – evaluating the sensitivity and exposure of infrastructure to climate change
2. Risk – estimating the likelihood and impact of relevant climate hazards
3. Adaptation - consideration of adaptation options and integration into the project planning

The legal requirements for major projects also foresee climate change mitigation. This study however is focused on climate change adaptation and does not cover mitigation aspects.

Information on the requirements for climate change adaptation is available in the 2016 publication [Climate Change and Major Projects](#), and details on the methodology of climate resilience analysis is provided in the 2017 JASPERS publication [The Basics of Climate Change Adaptation, Vulnerability and Risk Assessment](#). Further resources are being identified in the present publication and its references. Effective vulnerability and risk assessments for the adaptation of major projects to climate change require the resources explained in the following table:

Resources	Explanation
Data Availability	The availability, accessibility and applicability of data on climate projections and impacts, on geophysical parameters, on long-term scenarios, on economic, environmental and social impacts, etc.
Methodologies	The existence of quantitative or qualitative methodologies (a system of processes, a set of principles and rules) for integrating climate change adaptation in the development of infrastructure projects.
Tools	The availability of tools for planning, evaluation, impact estimation (i.e. software, maps, computer simulations, long term climate forecasts etc.) to assist with the adaptation of infrastructure to climate impacts
Guidance	The provision of guidance on how to use methodologies (i.e. for conducting climate change vulnerability and risk assessments) or develop the required infrastructure project documentation relating to climate adaptation.
Design Standards	The availability of published engineering design standards (i.e. by BSI, DIN, ISO) for infrastructure projects that include sections or appropriate provisions to ensure resilience to climate change impacts
System	The institutional and legal framework that the formal authorities work with to deliver their primary responsibilities for climate adaptation, infrastructure, and management of European Structural and Investment Funds

² Regulation (EU) No 1303/2013, Commission Delegated Regulation (EU) No 480/2014, Commission Implementing Regulation (EU) No 1011/2014, No 215/2014, 2015/207; and the Directives 2001/42/EC, 2011/92/EU and 2014/52/EU

Institutional Capacity	The human and technical capacity of institutions to carry out their functions. It depends on being adequately resourced, on having the appropriate expertise, and on collaborating effectively and enforcing laws and regulations
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3.1. Data Availability

Quantitative data are essential to understand the relevant risks and the requirements for any corresponding climate change adaptation in key sectors.

Data on adaptation to the effects of climate change can be obtained from a range of sources, including:

- The Ministry of Environment, which funded and published the study [Climate change scenarios for Romania \(2001-2030\)](#).
 - The [National Administration Romanian Waters](#) (NARW), which monitors the national hydrological network. The NARW also make available data on the economic valuation of assets at risk from climate change.
 - [The National Institute for Hydrology and Water Management](#) (NIHWM) provides short, medium and long-term hydrological forecasts and warnings, and also monthly hydrogeological forecasts and trend estimations.
- The monitoring of climate-related parameters are covered by NARW and the [National Meteorological Administration](#) (NAM). NAM is the main organization which performs systematic observations on atmospheric climate and, to a lesser extent, on parts of sea and terrestrial climate. These observations are gathered, validated and transferred in the National Meteorological Network (NMN). NAM has also provided downscaled results from global and regional climate models to identify the policy relevant risks related to climate change.

Institutions active in researching issues related to climate adaptation include [Terra Millenium III](#), an environmental protection organization that promotes sustainable development programs at national and international level in the field of energy, transport and climate change, as well as the [Lucian Blaga University of Sibiu](#) (ULBS), which contributed to the elaboration of the Best Practices Guide for the Vulnerable Sector Transport.

Romania's Sixth [National Communication](#) to the United Nations Framework Convention on Climate Change (UNFCCC) also provides long-term climate change assessments across a range of sectors, with scenarios on risk and vulnerability assessments by sector. It highlights the need of enhancement for research and innovation in order to provide a solid rationale for sectorial strategies.

A [National Risk Assessment](#) has been developed for 10 risks, including those affected by climate changes. Once the process has been completed, a country report, containing both the outcome of the risk assessment and the recommendations required to maintain an acceptable level of risk, has been published.

In the framework of the Opera-Clima project, the Ministry of Environment, with the support of the World Bank has developed several [sectoral vulnerability assessments](#) ([water](#) sector, [energy](#) sector) to inform the [National Action Plan on Climate Change for 2016-2020](#) (or "National Action Plan").

The [CarpatClim](#) project aimed to improve the basis of climate data in the Carpathian Region in order to investigate the temporal and spatial structure of the climate in the Carpathian Mountains and the Carpathian basin. CarpatClim has also provides users with a freely available high-resolution gridded [database](#) for the Larger Carpathian Region

(LCR).

[ECLISE](#) (2011-2013) was a collaborative FP7 research project under the Environment Programme of the European Commission. The project researchers, in close cooperation with users, developed and demonstrated local climate services to support climate adaptation policies. Specific climate services for climate-vulnerable regions in Romania, organised at a sectoral level, include:

- [Baia Mare](#) – an assessment of future temperature and precipitation statistics;
- [Somes River basin](#) - an ensemble of stream flow changes for overlapping 30 year periods into the future;
- [Vrancea region](#) – an assessment of climatic conditions impact on the hydrological regime in small catchments, and a further assessment of slope instability in build-up areas and landslide/flood risk assessment; and
- [Baragan Plain](#) – an assessment of climate change and its effects on land use and landscape in the Baragan Plain, and a study on the impact of climate change on the hydrological regime of Baragan Plain.

[Infobase](#) maintains a searchable European database of climate change adaptation projects. The Intergovernmental Panel on Climate Change ([IPCC](#)) also presents data on some impacts and vulnerabilities of climate change adaptation in Romania. Additionally, The [EURO4M](#) project has provided users with a freely available high-resolution gridded [database](#) for the Romanian territory (ROCADA) which has been updated.

The Romanian [National Institute of Statistics](#) (INSSE) is the national statistics authority and maintains a database of statistics relating to the economy, society and environment. The exact content of this database was not examined in the context of the present study.

Updates for a wide range of national adaptation actions, can be found in the [National adaptation actions deliveries database on EIONET](#), and on the [Climate-ADAPT](#) website.

3.2. Methodologies

Methodologies for integrating climate change adaptation into the development of infrastructure projects rely on the basic rules of risk assessment.

In 2008 The Ministry of Environment published a "[Guide on adaptation to climate change effects](#)", which aims to facilitate the identification of adaptation measures and support decision making on climate change policy. The guide supports the implementation of the measures articulated in the NAP in 2016. The purpose of the publication is to identify the measures necessary to limit the negative impacts predicted by climate scenarios, estimated over a medium and long time horizon. The identified measures are to be implemented through collaboration with local authorities and through providing appropriate technical assistance making use of:

- Monitoring the impact of climate change as well as associated socio-economic vulnerability;
- Integrating adaptation measures into strategies and policies for sectoral development and cross-sectoral harmonization; and
- Identifying adaptation measures for critical sectors for vulnerability to climate change.

The [National Meteorological Administration](#) published the report "[Climate change - from physical bases to risks and adaptation](#)" (2015), with the objective to increase Romania's capacity to adapt to the impacts of climate change. The report aims to provide a source of information on climate change and related risks and to serve as a guidance tool for users of climate products and decision makers involved in planning sustainable adaptation to climate change.

The requirements stipulated in the "[Guidelines for Project Managers: Making vulnerable investments climate resilient](#)", elaborated by the European Union Directorate-General for Climate Action (DG-CLIMA), are applied, in general, for the major projects financed through the Large Infrastructure Operational Programme (LIOP) 2014-2020, depending of the relevance and the availability of the data.

Both [Environmental Impact Assessments](#) (EIA) and [Strategic Environmental Assessments](#) (SEA) are transposed in [Romania](#). An EIA ensures that the environmental consequences of infrastructure projects are identified and assessed. An SEA is mandatory for programmes prepared which set the framework for future development consent of projects listed in the EIA Directive.

3.3. Tools

Tools are highly valuable for facilitating climate adaptation studies and planning for infrastructure. They can be public or private, numerical or descriptive, and be provided in many mediums, such as software, text documents, maps, and so on. Some tools are generic (such as in risk assessments) whilst others are specific to a certain set of circumstances.

The World Bank in their series of publications on '[Romania: Toward Low Carbon and Climate Resilient Economy](#)' used adaptation models which projected water availability, crop yields, and the hydropower impact of climate change. They assessed the effectiveness of the proposed green policies and investments. Adaptation modelling included three models:

- A water run-off model (CLIRUN) to estimate streamflow runoff;
- The AquaCrop model to assess crop yield and irrigation demand; and
- Water Evaluation and Planning (WEAP) model to evaluate the water storage, hydropower potential, and water availability.

[RO-RISK](#) aims to provide a unified framework for the risk assessment process in Romania, strengthening the risk prevention and management in the country and thus, contributing to the national planning of climate adaptation. The project has developed a unified set of tools to assess risk (including important climate-related risks in Romania such as drought, wild fires, floods, landslides), which can be used by authorities.

"[Green Path to Sustainable Development](#)" project had as main goals: (1) to reduce the human and ecosystem vulnerability to climate change and (2) to develop a set of good practices on adaptation to climate change (applied to the elaboration of adaptation plans for the municipalities of Brasov, Sibiu and Târgu Mures).

[IMPACT2C](#) has been initiated by the European Commission in order to provide information and evidence on the impacts of global warming for Europe and key vulnerable regions of the world. To examine the impact, several dedicated model chains are applied. In general these chains consist of General Circulation Models (GCMs), Regional Climate Models (RCMs), impact models and assessment models. This project also offers both a [Precipitation mapping tool](#) and [Extreme Floods mapping tool](#).

EIONET provides [Flood Maps](#) which are publically available, mapping areas of potential significant flood risk. EIONET also contains Flood Risk Management Plans.

For a continual update of available tools, the reader is referred to the European Climate Adaptation Platform [Climate-ADAPT](#), which has a dedicated tools section.

3.4. Guidance

Guidance is an essential requirement to ensure consistency in applying methodologies and tools. Romania primarily makes use of knowledge and guidance derived from the European level, such as the DG Clima Publications: [Climate Change and Major Projects](#) and the non-paper [Guidelines for Project Managers - Making vulnerable investments climate resilient](#); while it uses JASPERS Guidance and the soon to be finalised document: Basics of Climate Change Adaptation Vulnerability and Risk Assessment.

By means of the Opera-Clima project, the Ministry of Environment, with the support of the World Bank has developed a [guidance document](#) to support the inclusion of climate change impacts in projects funded through ESI Funds.

The [National Meteorological Administration](#) provides both [Guidance](#) for the preparation of drought management, and an [Action Plan](#) for Water Scarcity and Drought Prevention.

3.5. Design Standards

Design standards are critically important for all infrastructure projects to ensure stability and optimal functioning under the strain of natural phenomena. For civil works (including bridges, buildings, masts and towers for the mobile access networks), EN standards are available to address natural forces such as wind and snowfall, e.g. EN1991-1-4 (Eurocode 1) and EN1993 (Eurocode 3) for structures in steel. However, these standards might be outdated and not account for the impacts of climate change.

The [Romanian Standards Association](#) (ASRO), the national standards authority, is collaborating with the [European Standardization Organizations](#) in the context of the EU Regulation No 1025/2012 on European standardisation. The European Committee for Standardisation (CEN) and Electrotechnical Standardisation (CENELEC) established the [Adaptation to Climate Change Coordination Group \(ACC-CG\)](#) to coordinate standardisation work in the field of adaptation to climate change in support of the implementation of the EU Strategy on Adaptation to Climate Change. More information is available in the section on *Available resources at the EU level* in the Final Report of the present study (European Commission, 2018).

3.6. System

The institutional system for adapting to climate change requires a legal framework (laws and implementing regulations) and strategies and policies (with implementing action plans). The system is usually conflated with disaster management (and its various components, preparedness, reduction etc.) and more generally with resilience.

Institutional and legal framework

In July 2013 the government adopted Romania's [National Strategy on Climate Change \(2013-2020\)](#) through the Governmental Decision no. 529/2013. The document is divided in two parts, the second dealing with adaptation. During the development of the 2013-

2020 Climate Change Strategy a Working Group was established to carry out the [environmental assessment of the Strategy and Action Plan](#), comprising representatives from all relevant ministries. A 2-year [programme to operationalize the national climate change strategy](#) resulted in the development of a National Climate Change and Low Carbon Green Growth Strategy (2016-2030) and an associated [Action Plan on Climate Change \(2016-2020\)](#), adopted through Government Decision 739/2016. In October 2016, the government also adopted the National Climate Change and Low Carbon Green Growth and [National Climate Change Action Plan on 2016-2020](#), to further adopt practices to enhance the development of climate change adaptation in Romania. Review is not yet foreseen, evaluation of implementation of the NAS and the NAP will happen post 2020.

The NAS aims to provide an action framework and guidelines to enable each sector to develop an individual action plan in line with the national strategic principles. The [National Strategy](#) on recommends the following actions:

- Updating of climate scenarios;
- Supporting research activities in the field climate change and the creation of a national database on climate change;
- Estimation of the cost of climate change for each priority sector;
- Developing the national adaptation agenda to the effects of climate change and its integration into politics / legislation;
- Elaborate and implement a campaign to raise awareness of all actors involved, especially the population; and
- Monitoring the process of adaptation to the effects of climate change.

The Adaptation section of the National Climate Change aims to provide an action framework and guidelines that are enable each sector to develop an individual action plan in line with the national strategic principles.³

The government, with financial support from the EU and technical assistance from the World Bank, has implemented a programme on climate change which aims to develop and operationalise a comprehensive [National Action Plan on Climate Change for 2016-2020](#) (or "National Action Plan"). The Action Plan provides a concise summary of relevant information on each selected action includes details of the type of action (e.g., policy, investment, capacity building), start and completion dates, responsible bodies, suggested result indicators, funding sources and financing amounts.

The [National System for Emergency Situations](#) has in place mechanisms that implements prevention and response measures to the emergencies at different levels (national, county and local). For the coordination of response at the national level, the legal framework was recently updated and new structures and responsibilities were established (e.g. Emergencies Department under the Ministry of Internal Affairs). The short-term warning mechanism works well (intervention and warning measures for public safety), however, long-term decision management and active long-term prevention measures and strategies are still to be produced.

The national framework for Environmental Impact Assessments has not yet been revised to include considerations on adaptation. The transposition of the revised EIA Directive in Romanian law is currently underway and aspects on climate adaptation are considered in [the preparation of the new legislation](#).

³ The adaptation component addresses the following sectors: industry; agriculture and fisheries; tourism; public health; construction and infrastructure; transport; water resources and flood protection; forestry; energy; biodiversity; insurance; recreational activities; education

Responsible authorities

The [Ministry of Environment](#), the [Ministry of Waters and Forests](#) and the ["Romanian Waters" National Administration](#) are primarily responsible for the implementation of climate change adaptation agendas. To foster inter-ministerial coordination, the National Commission for Climate Change has been set up and reorganized (Government Decision no. 1026/2014) to involve representatives from different ministries. The [National Meteorological Administration](#) conducts research at National and European level, focusing on the evaluation of hazards within current and future climate conditions, associated climate risks, and adaptation in key economic sectors, which are vulnerable to climate change impacts (e.g. agriculture, forests, water resources, and tourism). It advises the Ministry of Environment during implementation and on legislation.

The General Inspectorate for Emergency Situations (GIES), part of the Ministry of Internal Affairs is responsible for the coordination, prevention and management of emergency situations.

Management of the ESI Funds

There are five Operational Programmes in Romania, whose Managing Authority is the department of Public Administration and European Funds in the Ministry of Regional Development. Moreover, Romania participates in 8 cross-border, transnational or interregional co-operation programmes. The intermediary bodies consist of eight Regional Development Agencies, and other ministries. The Ministry of Transport is the Intermediate Body for Transport under the Large Infrastructure Operational Program. The Ministry of European Funds, through the Large Infrastructure Projects General Directorate is, according to GD 398/2015, the National Coordination Authority, with the Ministry of Public Finance functioning as the Certifying Authority, while the Audit Authority is the Court of Accounts.

3.7. Institutional Capacity

The institutional challenge for climate change adaptation is that climate policy is a cross-cutting issue, and requires co-operation across a large number of institutions. To be effective in delivering climate change adaptation a minimum level of capacity is needed on leadership, technical and human resources, analytical capabilities, and financial support.

Technical and human resources

According to the interviewed organisations in the context of this study, there are ambiguous estimations on whether the various involved institutions have qualified staff and expertise to cover functions that support climate adaptation. One interviewee mentioned that it is difficult to retain highly qualified personnel, who is offered more attractive salaries elsewhere. With regard to the [National Meteorological Administration](#); there is a National School of Meteorology which is active within conventions at universities in the relevant fields (meteorology, climate, agro-meteorology, etc.) The institute is actively trying to target expertise talents by offering bilateral project, fellowships, training opportunities abroad, as well as networks and development opportunities. The [2015 annual report](#) (most recent) includes a chapter on the School of Meteorology and its activities (p.159), and the [organisational structure](#).

Effective collaboration

The Government Decision no. 1026/2014 led to the reorganisation of the National Commission for Climate Change (NCCC) as a framework that enhances inter-ministerial coordination towards meeting Romania's climate objectives. However, interviewees for

the present report, mentioned that cooperation might be lacking because the ownership of the issued is not always clear.

The [National Management System for Emergency Situations](#) represents a network of permanent communication between the public authorities and organisations qualified for emergency management, built on levels and areas of expertise and available infrastructure and resources to reduce the loss of life and response to various types of emergencies through disaster risk management.

Across borders, Romania is collaborating with Bulgaria through the INTERREG V - A programme to develop local awareness regarding [Risk Management for Large Scale Infrastructures](#) in their cross-border area, which includes, amongst others, risk linked with climate change impact. The municipalities of Gradinari, Malu and Byala are collaborating across the border to develop a joint risk prevention and management system to address the effects of the climate change upon their environment.

Financial resources

The [ESI Funds are enabling the development of major projects](#) in the 2014 – 2020 programming period for Romania. Concerning major projects, by early 2018, there have been 3585 Million EUR approved for Network Infrastructures in Transport and Energy; 175 Million EUR for Research and Innovation; 54 Million EUR for Information and Communication technologies; 1445 Million EUR in Environment Protection & Resource Efficiency; and 2 Million EUR for Climate Change Adaptation & Risk Prevention. The [data set will be updated regularly](#) to reflect changes in the programme lists and major project notifications.

The National Climate Change Strategy (in Chapter five) describes the necessary resources for the implementation of climate adaptation measures: it comprises different budgets of ministries, funds for topic-related projects as well as established EU budget.

4. SECTOR OVERVIEW

4.1. Introduction

Since 2014, the requirements for major projects to obtain ESIF funding⁴ demand that project applications integrate climate change considerations⁵, such as a vulnerability and risk analysis and adaptation option appraisal. At EU-level, material is available to assist in fulfilling these requirements. Key websites and documents are:

- The [Climate-ADAPT](#) website containing many links to data and a [map viewer](#)
- EUROPEAN COMMISSION Directorate-General for Regional and Urban policy: The [Guide to Cost-benefit analysis of Investment projects](#) (also referred to as the 'CBA guide')
- EUROPEAN COMMISSION DIRECTORATE-GENERAL CLIMATE ACTION: [Non-paper of Guidelines for Project Managers: Making vulnerable investments climate resilient](#)
- JASPERS Guidance note: [The Basics of Climate Change Adaptation, Vulnerability and Risk Assessment](#)

⁴ http://ec.europa.eu/regional_policy/archive/projects/major_projects/index_en.cfm

⁵ For a compilation of the climate change requirements for major projects in 2014-2020, see: <http://www.jaspersnetwork.org/plugins/servlet/documentRepository/displayDocumentDetails?documentId=401>

- JASPERS Guidance note: [An overview of the most important sources for integrating climate change in \(major\) projects](#)

Additional relevant material can be found in the Final Report of the present study (European Commission, 2018) in the section *Available resources at the EU level* and in *Annex I*.⁶

4.2. Transport

Investments in the transport sector are very diverse, covering roads (including bridges and tunnels), inland waterways, rail, ports / airports, and public transport infrastructure. Any disruption caused in this sector can affect many other sectors (economic and societal) directly. Potential threats are extreme weather events such as extended heatwaves, flooding, heavy rainfall or storm, landslides and sea-level rise (limited to the coastal area) amongst others. Extreme weather events are a potential threat to both infrastructure and operation of the transport system.

In the context of the Opera-Clima project, the Ministry of Environment, with the support of the World Bank, developed several sectoral vulnerability assessments, including [transport](#). The project also included the identification of relevant adaptation measures for inclusion in projects funded through the ESI Funds.

Romania's Sixth National Communication on the UN Framework Convention on Climate Change ([UNFCCC](#)) provides a national assessment of climate risk and vulnerability. The report states how a key challenge for Romania is to increase the resilience of Romania's transport infrastructure and services. The infrastructure of road, railway, marine and air transport are vulnerable especially to extreme weather events. The direct impact of the climate change on the marine transport will be a result of the fluctuations on the flowing conditions of the rivers and streams. Indirectly, the climate change impact will be felt at the level of the road and railway transport by damage of infrastructure.

Under the Large Infrastructure Operational Programme a number of major projects are planned in the transport for the programming period 2014 – 2020:

- Road infrastructure: development / extension of motorways (Lugoj – Deva, Timisoara – Lugoj for instance), rehabilitation of national roads (DN 6, DN76 for instance), development of high-speed roads;
- Railway: Rehabilitation of existing lines (Radna-Gurasada-Simeria, Braşov – Simeria, Focşani – Roman, Predeal – Braşov for instance), modernisation of railway stations, electrification of existing lines (Cluj-Napoca – Episcopia Bihor for instance);
- Public transportation: development of Bucharest metro network; and
- Waterways: improvement of navigation conditions on the Danube and investments in port infrastructure.

Major projects are required to include climate adaptation measures based on risk and vulnerability assessments.

Road infrastructure

An example of the risks and vulnerabilities taking into account the effects of climate

⁶ European Commission (2018) Climate change adaptation of major infrastructure projects. A stock-taking of available resources to assist the development of climate resilient infrastructure. Final report.

change within transport is the [Sebeş - Turda Highway](#). The Sebeş-Turda motorway is designed to link the Sibiu-Arad motorway (Pan-European Corridor IV) and the Bucharest-Brasov-Bors motorway. The section of highway Sebeş – Turda has a total length of 70 km, with Romania receiving EUR 622 million from the European Commission for construction of the project. See “Case Study” section for further information.

See section 4.1 for more information on other documents that can help in taking climate considerations into account.

Railway infrastructure

No railway specific guides or documents on climate adaptation have been retrieved from desk study or interviews. See section 4.1 for more general documents with guidance for all types of infrastructure.

Airport infrastructure

No specific strategy on making Romanian airports climate resilient was retrieved from desk study or interviews. But more general materials are available which apply to all types of projects, including airport infrastructure. See section 4.1 for more information.

4.3. Broadband

The International Telecommunication Union has issued the recommendation L.1502 “[Adapting information and communication technology infrastructure to the effects of climate change](#)” for the purpose of identifying climate threats and their impact. L.1502 supports Resilience by design in identified risky areas, and proposes changes to equipment installation standards to ensure protection from more frequent extreme weather phenomena and their impacts. The European broadband sector standardisation bodies have not prepared vulnerability assessment and risk management framework for dealing with climate change in broadband projects.

The broadband sector is not specifically addressed in the national climate change strategy. With regard to EU funding of Romania’s broadband infrastructure, there is comprehensive guidance provided in ‘[European Funding for Broadband 2014 – 2020](#)’. This report states that European Structural and Investment Funds are the largest EU public funding source that supports broadband investment. The report also states that the 2014 - 2020 total budget for broadband deployment in Romania is approximately €100 Million.

Under the operational programme ‘Competitiveness Operational Programme’, the following project is planned for 2014 – 2020: Building a national NGN infrastructure in disadvantaged areas, through the use of structural funds - [phase II](#).

It is a general best practice for operators to use flood mapping information from environmental agencies to safeguard new planned data centres from flooding. For civil works (e.g. masts and towers for the mobile access networks), EN standards are available to address wind and snowfall, e.g. EN1991-1-4 (Eurocode 1) and EN1993 (Eurocode 3) for structures in steel. But these standards don’t take climate change into account. CEN-CENELEC is currently working on adapting a number of EN standards to climate change. See Final Report of the present study (European Commission, 2018) for more information in the section on *Available resources at the EU level*.⁷

See section 4.1 for more information on other documents that can help in taking climate considerations into account.

⁷ European Commission (2018) Climate change adaptation of major infrastructure projects. A stock-taking of available resources to assist the development of climate resilient infrastructure. Final report.

4.4. Urban Development

Investments in the urban development sector include site developments (industrial and other), urban planning, local infrastructure, building projects (such as hospitals, schools), and much more diverse projects. Cities have a unique position to analyse and respond to local impacts and vulnerabilities, such as heat island effects, which depend on the specific layout of a city, its green spaces, and numerous other factors. Cities can actively support the uptake of climate change adaptation in infrastructure projects through, for instance pilot projects, and can initiate dedicated infrastructure projects to improve their resilience to climate change.

In the context of the Opera-Clima project, the Ministry of Environment, with the support of the World Bank, developed several sectoral vulnerability assessments, including the [urban sector](#), and identifying the relevant adaptation measures to be taken to ensure the inclusion of climate change in projects funded through the ESI Funds.

The National Strategy lists recommendations and actions which support holistic infrastructure and urban planning, in order to better integrate climate change considerations in the design and contents of the plans. The actions aim to strengthen local capacity in terms of professional training and public education.

Adaptation measures outlined by the government within the urban sector include:

- Elaboration of risk maps for heat wave in urban areas under present climate change conditions;
- Elaboration of Romania's [territorial development strategy and the elaboration of the local development strategies](#) have been identified and adopted;
- Elaboration of associated management plans for climate adaptation to heat waves on central and local levels of administrations; and
- Implementation of planned actions with the disaster management community and monitoring according to the National Strategy for Climate Change in Romania.

See section 4.1 for more information on other documents that can help in taking climate considerations into account.

4.5. Energy

Project investments in the energy sector are related to power and heat generation infrastructure and energy distribution networks. Potential impacts of climate change on energy infrastructure may include increased damage to power generation plants or problems with energy provision, leading to black-outs or other disruptions. Disruptions in the energy sector can have large impacts on different sectors due to the increasing dependency on (electric) power provision for all kind of operational systems such as water supply (pumping installations, ...), the food system (transport, cooling, ...), transport (electrified vehicles, dynamic traffic information, ...), etc.

In the context of the Opera-Clima project, the Ministry of Environment, with the support of the World Bank developed several sectoral vulnerability assessments, including the [energy sector](#), and identified the relevant adaptation measures to be taken to ensure the inclusion of climate change in projects funded through the ESI Funds. Major projects are required to include climate adaptation measures based on risk and vulnerability assessments. The World Bank has published an [energy sector rapid assessment](#), modelling

climate change impacts on hydropower under different scenarios.

Romania's Sixth National Communication on the UN Framework Convention on Climate Change ([UNFCCC](#)) provides a national assessment of climate risk and vulnerability. The report mentions problems in the energy sector especially during generation by hydropower plants, taking into account Romania's drought exposure lying on the Southern and the South-Eastern European coastline.

Energy system infrastructure is affected by extreme weather phenomena; there have been many situations in which thousands of houses remained without electricity. There are also occurrences of breakdowns of the transportation and distribution electricity lines, with damage of the electric transformers and long blackouts experienced.

The National Strategy on climate change and low carbon economic growth includes a section on adaptation in the energy sector.

Under the Large Infrastructure Operational Programme three major projects are planned in the energy sector for the programming period 2014 – 2020. According to the ESI Funding requirements, these would need to address the climate adaptation requirements.

- Rehabilitation of the district heating system in Bacău to comply with the environmental protection standards regarding air pollutant emissions and to increase efficiency in urban heating supply;
- Modernization of the thermal energy transport system in Bucharest;
- Development of NTS transport capacity in order to ensure natural gas flow towards Romania - Republic of Moldova (project components / gas compressor stations)

See section 4.1 for more information on other documents that can help in taking climate considerations into account.

4.6. Water

Investments in the water sector are linked to efficient water supply (including reduction of leakage), wastewater treatment and water reuse as well as the implementation of [River Basin Management Plans \(RBMP\)](#) to ensure integrated water management at the river basin scale. Important threats are linked to water quantity (droughts and floods) as well as quality (water pollution). Climate change can have an impact on both water quantity and quality.

According the Directive 2000/60/CE, River Basin Management Plans (for the 11 River Basins of Romania) were elaborated by National Administration "Apele Romane". Also, based on those Basin Management Plans, County Master Plans were elaborated. The investments in the water/waste water realized through LIOP are based on those Plans. Following the EU Floods Directive 2007/60/EC, Member States are obliged to perform flood risk assessment and to elaborate flood hazard and risk maps and flood risk management plans. Flood risk maps include the history of floods and climate scenarios and have been prepared for each river basin, with forthcoming technical studies identifying the measures required to further reduce the exposure to the flood risks of the vulnerable activities. The EIONET database provides [Flood Maps](#) and the Flood Risk Management Plans for Romania that are publically available. A [Guidance document on adaptation to climate change in water management](#) is available to ensure that the RBMP are climate-proofed. [Evaluations of the RBMP and FRMP](#) are also available on the EC website.

The National Strategy on Climate Change details measures for water infrastructure and measures for safe supply in Romania. Within the [National Institute of Hydrology and Water Management](#), research on the impact of climate change on national water resources is ongoing.

As a result of the catastrophic floods recorded in recent years, the [National Strategy of Flood Risk Management](#) set the duties that fall on each entity involved in flood risk management, structured on prevention actions and measures, of operational intervention as well as those for the rehabilitation and the return to operational normality. The strategy aims to reduce the impact of the floods on the population and on infrastructure by appropriate planning and by a policy that should correspond to the standards of environment protection.

Measuring risks and vulnerabilities to the effects of climate change has been assessed at the elaboration of the plan for the prevention and protection of floods in the [Arges - Vedea Hydrographic basin](#). The [World Bank](#) quantified the climate change impacts on mean annual flow for four river basins of Romania: Buzau, Ialomita, Arges and Mures. Another example of adaptive procedures in major infrastructure is a project to provide coastal protection for beaches along the Black Sea. This investment along this stretch of the Black Sea Coast will help adaptation to the effects of future coastal erosion in a way that will benefit visitors and local people. These measures will also further improve the attractiveness of the region for businesses and tourism.

Romania participates in [IRIDA](#) which is a project involving innovative remote and ground sensors, data and tools which are integrated into a decision support system for agriculture water management.

The Danube is of particular focus for the Romanian adaptation efforts. Romania is involved in the [DriDanube](#) project which aims to improve capacity of the Danube Macro region for drought emergency response and enhance preparedness for drought management by introducing recently developed monitoring and risk assessment tools. [CAMARO-D](#) - in which Romania is also involved - is a project within the Danube Transnational Programme aiming to provide advanced management routines for land use impacts on the water regime in the Danube river basin. [The Climate Change Adaptation in the Danube Delta](#) project supported the building of a basis for the adaptation of the Ukrainian, Moldovan and Romanian parts of the Danube Delta region to the changing climate conditions through integrated land and water management, increasing co-operation of the sub-basin countries.

The [Fast Danube](#) project was implemented to ensure safely conducting the transport activities on Danube. This involved:

- Investigating and developing technical solutions to be included in a feasibility study on the Romanian-Bulgarian common sector of the Danube;
- Identification and preliminary design of the necessary works to eliminate the existing difficult points;
- Carrying out the Environmental Impact Assessment and Appropriate Assessment for developing the documentation in order to obtain the Environmental Agreement; and
- Completion of technical specifications for carrying out the works on this sector of the Danube.

One of the objectives of this project is to develop at least two alternative scenarios to be tested using the mathematical model developed, to perform economic evaluation of the various identified scenarios and to select the preferred scenario that improves navigation, environmental protection and economic development. Benefits of this project include

avoiding further adverse impact on the river and the ecological system; improving the waterway infrastructure, and supporting sustainable transport through encouraging the use of inland waterways transport.

[SEERISK](#) contributed to improve coherence among risk assessments undertaken by the countries from the South East Europe Programme area at national and local level, especially in case of disasters intensified by climate change. The main aims of SEERISK were developing and testing a Common Risk Assessment Methodology for the Danube Macro region of which the most tangible outcomes are risk maps. Romanian team was involved in mapping the risk related to [heat waves in the municipality of Arad](#) (Western Romania).

The [National Meteorological Administration](#) also provides both [Guidance](#) for the preparation of drought management, and an [Action Plan](#) for Water Scarcity and Drought Prevention.

Major projects are required to include climate adaptation measures based on risk and vulnerability assessments. Under the 'Large Infrastructure' Operational Programme, there are 28 phased projects and 44 new major projects to develop regional water and wastewater systems planned for 2014 – 2020. There are projects already approved (Hunedoara – Valea Jiului and Vrancea counties) or under approval at the level of European Commission (Alba and Galati counties). Other projects include:

- Phased project for extension and modification of water and wastewater systems in Covasna County;
- Rehabilitation and modernisation of water and sewerage systems in Suceava County – Phase II; and
- Rehabilitation and Extension of Water supply and Sewerage Systems in Gorj County – Phase II.

Projects regarding climate change adaptation in which the National Institute of Hydrology and Water Management were a partner include:

- [FP6 Cecilia Project](#) - Central and Eastern Europe climate change impact and vulnerability assessment;
- [Carpathcc Project](#) - Carpathian in-depth assessment of vulnerability to climate change and ecosystem-based adaptation measures;
- [FP7 Eclise Project](#) - enabling climate information services for Europe; and
- [Climhydex Project](#) - changes in climate extremes and associated impact in hydrological events in Romania.

See section 4.1 for more information on other documents that can help in taking climate considerations into account.

4.7. Waste

Project investments in the waste sector are related to separate collection infrastructure, re-use and recycling infrastructure, energy recovery facilities and closure of landfills. Potential impacts of climate change on waste infrastructure may include increased rates of waste decomposition, odour and dust due to increased temperatures, flooding of landfills and waste treatment facilities, and reduced water availability for wet processes in waste treatment facilities. Also the impact on transport infrastructure should be

considered, as transport is a critical component of waste management (collection, transport to and from waste treatment facilities). The impact on transportation is discussed in the section on transport above.

In Romania, no specific examples, guides, tools or other instruments have been identified explicitly for the waste sector that could assist in addressing climate adaptation.

Under the operational programme for Large Infrastructure Programme the following major projects are planned for 2014 – 2020:

- Development of waste management infrastructure in Galați county.
- Development of a high energy efficiency cogeneration plant for municipal waste for the municipality of Bucharest.

The cogeneration plan will need to comply with the provisions of [Directive 2010/75/EU on industrial emissions](#) (IED), just like other large waste treatment plants. The IED requires as a general principle that necessary measures should be taken to prevent accidents which may have environmental consequences, and to limit those consequences. This requires that a structured management plan should be available that includes and mitigates hazards such as extreme weather conditions (e.g. flooding, very high winds). In the [BAT reference document \(BREF\) on Waste Treatments Industries](#), some information is provided on the impact of certain climatic conditions (e.g. the impact of higher temperature on biofilter performance, aerobic decomposition, etc.). Although climate change is not specifically addressed.

For landfills, [Directive 1999/31/EC on the landfill of waste](#) requires that landfills are situated and designed in such a way that pollution of the soil, groundwater or surface water is prevented. This requirement is translated into national design standards for the construction of landfills that include the consideration of temperature, precipitation extremes and flooding where relevant.

See section 4.1 for more information on other documents that can help in taking climate considerations into account.

5. CASE STUDIES

5.1. Case studies of climate adaptation projects

CLIMHYDEX	
Project description	The CLIMHYDEX ("Changes in climate extremes and associated impact in hydrological events in Romania") project is supported by the Executive Agency for Higher Education, Research, Development and Innovation Funding (UEFSCDI) as a 3 year Complex Exploratory Research Project (PCCE), cod PNII-ID-2011-2-0073), under the contract nr. 5/2012.05.11.
Photograph	n/a
Budget	Not available
Climate Change Vulnerability and Risks	The objective of this project is to improve knowledge in understanding the complex mechanisms controlling the variability of the most important weather/climate extremes occurring in Romania at various time scales, to estimate the

	uncertainty associated to their projections in the future perturbed climate and to quantify climate change impact on hydrological regime, focusing on extremes events.
Climate change adaptation measures	<p>More specific objectives cover the following:</p> <ul style="list-style-type: none"> • Identify the main observed variability features of a wide range of climate extremes in Romania mainly connected to hydrological extremes (flood and drought) at a spatial and temporal scale never used before; • Study in deep the large-scale/regional-scale mechanisms controlling the variability of selected extremes in Romania at various timescales; • Developing improved statistical downscaling models to estimate the local climate extremes and various parameters used in hydrological models; • Estimation of future changes in various climate parameters including extreme indices and associated uncertainty; • Developing of improved hydrological models (HDMs) for pilot hydrological basins at various spatial and temporal scale; • Estimation of future changes in selected hydrological extremes and estimation of the associated uncertainties; and • Quantification of the water resources vulnerability to climatic change and the establishment of the necessary adaptation measures in pilot river basins.
Good practice	SWAT is a watershed scale model, operating with daily steps, developed to evaluate and forecast (for long periods of time) the impact of land management practices on water, sediment and nutrients in ungauged river basins, with different soils, land use and management conditions. It is a physical model using freely available inputs which allows the analysis of changes in land use impacts on water resources. The major components of the model include: climate, hydrology, temperature, and soil properties, plant growth, nutrients, pesticides and land management.
Further information	http://climhydex.meteoromania.ro/sites/default/files/field/image/CLIMHYDEX-REPORT-ENGLEZ-2016-final_V2_0.pdf

5.2. Case studies of infrastructure projects which have addressed climate change adaptation

CFR-SA railway project: km 614 - Simeria

Project description	The projects consists of rehabilitation and modernisation works on section Km 614 – Simeria, part of the Pan-European railway Corridor IV. The overall objective of the project is to ensure maximum speeds of 160 km/h for passenger train traffic through the rehabilitation and modernisation of railway infrastructure and superstructure.
Photograph	n/a
Budget	2bn Euro - financed through the Large Infrastructure Operational Programme (LIOP) 2014-2020.
Climate Change Vulnerability and Risks	The objective is to assess the vulnerability of the Simeria-Km 614 Railway Project to climate change and weather extreme events and identification of adaptation measures.
Climate change adaptation measures	<p>A number of adaptation options have been proposed for identified risks, the latter being subsequently assessed in terms of approach within the project. Much of the proposed options (e.g. creating walls and other constructions to prevent stones from falling on the rail, use of geotextiles and geogrids for embankments, etc.) are already included in the works foreseen within the project. Another set of proposed options are subject to the operating costs associated with the project's operating phase. Further risks mitigation measures include:</p> <ul style="list-style-type: none"> • Taking into consideration record water flows in bridges design; • Construction / rehabilitation of dykes and riverside protection systems; and • Constant monitoring at regional and local level to record in time the effects of meteorological events and the risks to transport activities.
Good practice	In the design of this major infrastructure project, climate change has been taken into consideration. Extreme weather events resulting in for instance increased water flow of the river has been considered in the design of bridges, increased storms have been considered in the design of walls and other constructions to prevent stones falling on the rails, etc.
Further information	http://summit.railwaypro.com/eur-4-7-billion-for-rail-infrastructure-projects/

Construction of Sebes - Turda Motorway

Project description	The new motorway will provide a link between the existing motorway sections A1 Orastie-Sibiu and A3 Gilau - Campia Turzii and will thus offer a quick connection for transit traffic between two important urban agglomerations of Romania: Cluj-Napoca and Sibiu currently using the existing DN1 (E81).The new motorway will have a length of approx. 70 km with a design speed of 120 km/h and it will include 7 junctions, 4 service, 4 rest areas, 1 maintenance and control centre, 1 maintenance and monitoring centre and 66 structures.
Photograph	N/A
Budget	Total investment for the project "Construction of Lugoj-Deva Motorway lot 2, lot 3 and lot 4 (section Dumbrava – Deva) – phase 2" is EUR 469 580 351, with the EU's Cohesion Fund contributing EUR 336 063 762 through the "Large Infrastructure" Operational Programme for the 2014-2020 programming period.
Climate Change Vulnerability and Risks	<p>Sebes - Turda Motorway construction is framed according to Annex no. 1 to EU Regulation no. 215/2014 with a coefficient of 0% for climate change. Although, at the Feasibility Study stage (2007) and Revision (2013), there were done and revised the hydraulic Study, the Hydrology maps and index of water level increase, earthquake movements and other indicators that could involve instability in the project area.</p> <p>According to the guide, the following steps were taken during the assessment: identification of the climate change sensitivities of the project, assessment of the project's exposure to climate change hazards, vulnerability analysis, risk assessment, identification of adaptation options, appraise of the adaptation options.</p> <p>During the evaluation of the environmental impact (EIA) information were provided, in terms of climate issues (drought, floods, changes in watercourses, temperature changes, shifting and habitat changes, landslides, land crashes, fires) on how species and habitats are affected.</p> <p>The analysis of the existing data on climate change has shown an increasing trend for the average annual temperature, extreme temperatures and extreme rainfall, as well as a tendency to decrease for average annual rainfall and wind speeds, observed at project level. At the same time, it should be mentioned that the exposure to climate change in the project area is lower compared to other areas of the country.</p> <p>The vulnerability analysis, based on the sensitivity and exposure assessment analysis, revealed that climate variables that could generate a high vulnerability of the project under</p>

	current and future conditions are increased temperature extremes, changes in extreme rainfall, floods and ground instability / landslides. The identified risks associated with climate change are both natural risks - related to infrastructure elements(e.g. rail, embankments) as well as operational and maintenance risks - such as restrictions, disruptions or poor working conditions
Climate change adaptation measures	A number of adaptation options have been proposed for identified risks, the latter being subsequently assessed in terms of approach within the project. Much of the proposed options (e.g. creating walls and other constructions to prevent stones from falling on the motorway, use of geotextiles and geogrids for embankments, etc.) are already included in the works foreseen within the project. Another set of proposed options are subject to the operating costs associated with in operational phase.
Good practice	In the design of this major infrastructure project, climate change has been taken into consideration. Extreme weather events resulting in for instance increased storms have been considered in the design of walls and other constructions to prevent stones falling on the road, flood risk has been considered, etc.
Further information	http://ec.europa.eu/regional_policy/en/projects/major/romania/upgrades-made-to-motorway-links-in-western-romania

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